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ORAL HEALTH CARE DURING PREGNANCY AND ITS RELATED OUTCOMES - A CASE OF EASTERN REGIONAL HOSPITAL, KOFORIDUA

BY

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DECLARATION

I, Ama Amaning-Darko (Dr), declare that except for other studies which have been duly acknowledged, this work is the result of my original research. This dissertation, either in whole or in part has not been presented elsewhere for another degree.

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DEDICATION

I dedicate this thesis to my lovely daughter, Nuna Yayra Kalitsi, who began this Masters of Public Health programme with me in my belly and is ending the programme with me as a curious and active study partner. I love you Nu.

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I thank God for his help throughout the years.

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ABSTRACT

Introduction: Most pregnant women worldwide experience several oral conditions due to hormonal and other systemic changes that accompany pregnancy. These oral conditions may either occur anew or be an exacerbation of a preexisting chronic oral disease. Examples of such oral conditions include gingivitis, periodontitis, pregnancy epulis amongst others.

Problem: Unfortunately, poor oral health in pregnancy is translated into serious effects on both mother and child like preterm birth, preeclampsia, gestational diabetes mellitus and low birth weight of a neonate. Despite these dire consequences, there are no obviously spelt out policies in Ghana requiring pregnant women to visit a dentist during their antenatal care to correct any such oral conditions.

Objectives: To determine the prevalence of reported oral health conditions amongst pregnant women, the prevalence of adverse pregnancy outcomes associated with poor oral health and to establish whether receipt of oral healthcare had a role to play in preventing adverse pregnancy outcomes.

Method: A retrospective cross-sectional study was done using secondary data from the Electronic Medical Records of Eastern Regional Hospital, Koforidua. Using MS Excel and Stata 16.1, this data was analysed with descriptive statistics and an odds ratio calculated to determine the strength of association between receipt of oral health care and adverse pregnancy outcomes.

Results: This data showed that only 0.8% of pregnant women visited the dental clinic from February 2018 to January 2020 most of whom presented with acute cases. The most prevalent reported poor oral health condition was dental caries. Although only 1.67% of pregnant women who received oral care during pregnancy had an adverse pregnancy outcome, 4.22% amongst those who did not receive oral care, had adverse pregnancy outcomes related to poor oral health. Receipt of oral healthcare was, however, not related to the prevention of adverse pregnancy outcomes (whilst controlling for age and NHIS status) [OR: 0.3791, p-value of 0.0522]

Conclusion: Dental attendance by pregnant women was low. Pregnant women who had oral healthcare mostly reported with acute oral conditions like dental caries. Although prevalence of adverse pregnancy outcomes amongst those who had no oral healthcare in pregnancy was more than those who had oral healthcare, the relationship between receipt of oral health care and occurrence of adverse pregnancy was not significant.

Recommendation: Further research ought to be done in the area of oral healthcare during pregnancy and its effect on maternal health. Pregnant women ought to be sensitized by midwives, dentists, obstetricians and nurses on the need to have oral healthcare during pregnancy.

TABLE OF CONTENTS

CONTENTS Pages

LIST OF TABLES

Table……..……Page

LIST OF FIGURES

LIST OF ABBREVIATIONS

COVID-19	-	Corona Virus Disease of 2019
EMR	-	Electronic Medical Records
ERHK	-	Eastern Regional Hospital Koforidua
HAMS	-	Health Administration and Management System
NHIS	-	National Health Insurance Scheme
TQMH	-	Tetteh Quarshie Memorial Hospital
WHO	-	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background

In the face of mounting evidence to support the health consequences and long-term risks associated with poor oral care in pregnancy, why oral health seem to be a derelict aspect of antenatal care remains a mystery. The fact, however, is that poor oral health in pregnancy has a negative systemic impact on both mother and foetus with potential long-term effects.

Pregnant women are reported to obtain less dental treatment than non-pregnant women due to the spread of various myths regarding the seeking of dental care during pregnancy (Yenen & Ataçağ, 2019). Indeed, internationally, dental visits by pregnant women is consistently low even in high-income countries such as United States of America (USA) (23–49%), United Kingdom (UK) (33–64%) and Greece (27%) (George, et al., 2016). Meanwhile, poor oral health in pregnancy can result in negative outcomes such as premature delivery, pre-eclampsia, delivering babies with low birth weight, pregnancy granuloma, gingival ulcers, gingivitis, mouth dryness, dental erosions and loose teeth. Hormonal fluctuations in pregnancy may have a direct impact on preexisting gum issues and, indirectly, on tooth decay (Yenen & Ataçağ, 2019). Mothers with dental caries left untreated are also more likely to pass on the bacteria that causes tooth decay to their child after birth, especially if they are sharing the same spoon while feeding the child, through the direct transmission of their infected saliva (Council on Clinical Afffairs, 2009).

The World Health Organisation Global Oral Health Programme developed policies and actions for the continuous improvement of oral health in the World Oral Health Report 2003. The idea is that as the risks to poor health outcomes are connected, oral disease prevention and promotion of oral health must be integrated with chronic disease prevention and general health promotion (Petersen,2010).

1.2 Problem Statement

In Ghana, pregnant women are not visiting the dentist in spite of the risks involved. Annan and Nuamah (2005) conducted a study by examining 100 pregnant women attending antenatal clinic in Ghana and noticed that most of them with poor oral health did not even know they had poor oral health. Over 76% of pregnant women in Ghana are said to have periodontal disease (Gocka et al., 2022). These women are thus having a high risk of gestational diabetes mellitus, preeclampsia, premature birth, and of having low birth weight babies all preventable by receiving dental care.

Unfortunately, health workers who attended to pregnant women in Ghana were not adequately informed about the role of oral health in the health status of expectant mothers and their babies. Only 3.8% of the Ghanaian nurses assessed were aware of the connection between oral disease and delivery status (Aikins & Eigbobo, 2014). Such clinicians are thus unlikely to refer pregnant women they attended to to see a dentist for a routine dental checkup for the sake of their overall health and that of their babies. This may be the unpredicted fuel of highly preventable poor pregnancy outcomes.

In view of this, some countries have begun to integrate oral health into their public health and primary health care systems (Boggess & Edelstein, 2006; Pakshir, 2004; Russell & Mayberry, 2008). Despite initiatives designed to improve dental attendance during pregnancy, pregnant women continue to use dental services in low numbers around the world (Gaffield et al., 2001; Hullah et al., 2008; Thomas, Middleton & Crowther, 2008; Pakshir, 2004; Shamsi et al., 2013; Vamos et al., 2015).

Developed countries like Germany have implemented preventive strategies to address the issue of oral health care in pregnancy, some even using non-dental professionals such as midwives and other antenatal care providers (Wagner & Heinrich-Weltzien, 2016). However, despite the positive international evidence, limited importance is being given to the oral health of pregnant women in Ghana. There is also inadequate evidence of dental service utilisation or non-utilisation amongst pregnant women in Ghana and its attendant sequelae. This study will add on the literature on oral health and pregnancy outcomes in Ghana.

1.3 Justification of the Study

Although pregnancy in itself is not a disease, the experience tends to be rather uncomfortable. Preventive oral care and oral treatments will lessen the discomfort associated with pregnancy whilst preventing adverse pregnancy outcomes.

Thus, this study will contribute to bringing this issue unto the agenda to potentially aid the formulation of a policy for pregnant women to visit their dentist for preventive care and

treatment of oral health conditions in order to have better pregnancy outcomes. It will put the issue of oral health care in pregnancy on the agenda for discussion so more research is conducted on the subject. It will be beneficial to the government, healthcare practitioners, pregnant women and scholars in many ways.

Governments have the responsibility to provide good and effective healthcare for the citizens in line with United Nation's Sustainable Development Goal 3 which focuses on ensuring healthy life and wellbeing of all people (including pregnant women). Thus, this study will provide first-hand data on dental unit attendance of pregnant women.

In the case of healthcare practitioners (including obstetricians, midwives, nurses and other cadres of health workers), the study will serve as evidence of the need to create awareness of link between oral health and pregnancy outcomes

Pregnant women also stand the chance of benefiting immensely from this study in that, the study will inform them of the health risk they may be putting themselves and their unborn babies to if they denied themselves dental services whilst pregnant. Knowing this will help them to seek dental services to ensure a safe and healthy delivery.

Recent scholarly materials on prevalence of oral health conditions among pregnant women in Ghana are inadequate. Thus, this study will contribute to the literature on oral health and pregnancy outcomes in the country. The gaps identified in the study will serve as an opportunity for future studies to be conducted.

1.4 Objectives

1.4.1 General objective

This study aims to assess the association between oral healthcare and adverse pregnancy outcomes amongst pregnant women attending Eastern Regional Hospital, Koforidua

1.4.2 Specific objectives

1. To determine the prevalence of oral conditions reported by pregnant women
2. To determine the prevalence of adverse pregnancy outcomes relevant to poor oral health amongst pregnant patients who had oral health care and who did not have oral health care respectively.
3. To explore whether the receipt of oral healthcare during pregnancy is associated with the occurrence of relevant adverse pregnancy outcomes such as Gestational Diabetes, Preeclampsia, Preterm birth and low birth weight.

1.4.3 Research Questions

- What is the prevalence of different oral conditions reported by pregnant women?
- What is the prevalence of adverse pregnancy outcomes amongst pregnant patients who had oral care and those who did not have oral care at Eastern Regional Hospital, Koforidua?

- What is the association between receipt of oral health care and pregnancy outcomes?

CHAPTER TWO

LITERATURE REVIEW

2.1 Oral health

Oral health is described as the absence of discomfort in the mouth and face, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss, and other diseases and disorders that restrict a person's ability to bite, chew, smile, communicate, and maintain psychosocial well-being (WHO, 2012). It entails being free of chronic oral-facial pain, oral and pharyngeal (throat) cancers, oral soft tissue lesions, birth defects like cleft lip and palate, and a slew of other diseases and disorders affecting the oral, dental, and craniofacial tissues (collectively known as the craniofacial complex) (National Institute of Dental and Craniofacial Research, 2014). The condition of health of the teeth, gums, tongue, and other tissues within the oral cavity is referred to as dental health. Although dental health is a subset of oral health, in this study, the two terms are used interchangeably. Proper dental health is accomplished by practicing good oral hygiene, which involves brushing teeth regularly and visiting the dentist regularly.

The state of one's mouth might be an indicator of one's overall health. Oral health is multi-faceted and encompasses the ability to talk, smile, smell, taste, touch, chew, swallow, and express a wide range of emotions with confidence and without pain, discomfort, or disease of the craniofacial complex (head, face, and oral cavity) (Glick et al., 2016).

Oral health refers to the state of one's mouth. Oral health, according to Yewe–Dyer (1993), is the state of the mouth and related tissues in which disease is contained, future disease is

inhibited, the occlusion is adequate for mastication, and the teeth have a socially acceptable appearance. This definition attempts to embrace the socio-environmental model. Meanwhile, oral health, according to Dolan (1993), is described as a comfortable and functional dentition that permits people to remain in their intended social role. Sheiham and Spencer (1997) stated that "oral health means being able to chew and eat the whole range of items in the diet, being able to speak properly, having a socially acceptable smile and dentofacial profile, being comfortable and free from pain, and having fresh breath."

For many pregnant women around the world, oral problems are a major health concern. Pregnancy brings about a slew of physical and hormonal changes that affect virtually every part of the body, including the mouth (Gajendra & Kumar, 2004).

2.2 Pregnancy

Pregnancy, also known as gestation, is the time during which one or more offspring develops inside a woman. Pregnancy occurs when a sperm fertilises an egg after it is released from the ovary during ovulation. The fertilised egg then travels down into the uterus, where implantation occurs. A successful implantation results in pregnancy.

Averagely, full-term pregnancy lasts 40 weeks, divided into first, second and third trimesters. Early diagnosis of pregnancy and antenatal care during pregnancy more often result in healthy pregnancy journeys and the birth of healthy babies.

Maternal mortality continues however, to be a worry with almost (99%) of them occurring in Low and Middle Income countries and more than half in sub-Saharan Africa. Maternal

mortality is defined as deaths occurring in women, while pregnant or within 42 days of termination of pregnancy irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. Seventy-five percent of maternal deaths occur as a result of complications due to pregnancy and child birth (WHO, 2016). Hypertensive disorders are the third highest cause of maternal mortality in Ghana (Der et al,.2013).

2.3 Normal Oral Changes in Pregnancy

Several systems in the body are affected by pregnancy. These include the haematological system, cardiovascular, respiratory, gastrointestinal, renal endocrinal, musculoskeletal systems amongst others. Indeed, the eyes, breasts and skin of the pregnant woman all go through physiological changes. Pregnancy also affects the oral environment in several ways.

It is thought that pregnancy has little effect on healthy pristine gingiva. Most gingival alterations in pregnancy are primarily in response to increasing plaque (American Academy of Pediatric Dentistry, 2011). The gum papillae may appear red, resembling a strawberry. Fissures can form on the gingiva's edges and on the papillae. It is possible to report bleeding and even discomfort. In some cases, the gingiva is hyperplastic and appears dull, and pale pink with a rough and dry surface. The gingiva may also turn dark red sometimes.

Pregnancy tumours may be noticed when gingiva growth is limited to one location. In most cases, the underlying cause is an irritation. Gingivitis simplex, gingivitis ulcerosa, gingivitis hypertrophicans, and pregnancy tumour are all names for gingival alterations. The reason for these alterations has been identified as a rise in progesterone levels in the bloodstream, which increases vascular permeability (Yenen & Ataçağ, 2019).

It is well known that tooth decay rises during pregnancy. The teeth feel uncomfortable, and tooth loss may occur. However, there is no factual foundation for the assumption that foetal calcium (Ca) requirements for intrauterine development are met by the mother's teeth and that tooth loss occurs during every pregnancy (American Academy of Pediatrics, 2017). Dentists can explain this phenomenon as follows: In 70% of pregnancies, nausea and vomiting occur. Vomiting can have a bad impact on dental hygiene and may promote degradation of the mother's enamel layer. During pregnancy, Calcium concentration decreases. However, there is no difference in the quantity of ionised Calcium compared to pre-pregnancy levels, despite the fact that bone turnover is increased during pregnancy (Yenen & Ataçağ, 2019).

Another normal oral manifestation of pregnancy is a reduction in saliva production or excessive production of saliva. Dehydration, gestational diabetes, oral thrush and difficulty sleeping can all cause reduced saliva production in a pregnant woman. To compound the discomfort of a dry mouth, the reduced salivation tends to make the teeth more susceptible to dental caries (Hersh, 2019).

However, some pregnant women have excessive salivation (also known as ptyalism). This can be induced by pregnancy sickness, since nausea causes women to attempt to swallow less, particularly those with hyperemesis gravidarum (extreme morning sickness). Other causes include pregnancy-related heartburn, as well as irritants such as tobacco, chemicals, and certain medical problems (NCT (National Childbirth Trust), 2019).

2.4 Routine oral checks that must be done in pregnancy and their significance

Enlisted below is the normal, internationally-accepted clinical practice as should be executed by a dentist to a pregnant patient.

1. Questions concerning Oral hygiene practices, exposure to fluoride, oral disorders (e.g., caries, gingivitis), and access to dental treatment should all be asked of every pregnant woman to provide relevant oral care advice.

2. The teeth, gums, tongue, palate, and mucosa ought to be thoroughly examined to pick up any unknown poor oral health conditions and have them treated accordingly.

4. Patients should be advised to clean and floss their teeth on a regular basis, to avoid sugary foods and drinks, and to see a dentist for oral prophylaxis to prevent and stop the progression of dental conditions like gingivitis and dental caries.

5. Oral health status, treatment plans and procedures done should be documented.

6. Dentists and obstetricians must have clear lines of communication and collaborative partnerships to provide best treatment options for pregnant women. Physicians can advise dental colleagues about the safety of dental therapy during pregnancy and provide clear referral recommendations (Silk et al., 2008).

2.5 Causes of Oral manifestations of Pregnancy

According to the American Academy of Pediatrics (2012), oral health is an important element of prenatal care, and a dental examination is suggested early in pregnancy. This is because amongst others: hormonal changes, dietary changes and vomiting exacerbate poor oral health during pregnancy thereby increasing the likelihood of pregnant women developing dental decay, gum disease, and dental erosion (Silk et al.,2008). Maintaining dental hygiene throughout pregnancy is critical as expectant mothers may notice a decline in their oral health due to a variety of causes.

2.5.1 Poor Oral Hygiene as a cause of oral manifestations of pregnancy

Pregnancy affects the oral cavity environment, making it more susceptible to colonisation by cariogenic flora and increasing the risk of dental illness. Pregnant women may clean and floss their teeth less frequently than they did before the pregnancy. This might be due to freshly discovered gum discomfort or (for some) nausea during brushing (March of Dimes, 2019).

Gingivitis and periodontal disease are caused by the presence of a biofilm matrix (plaque) that attaches to periodontal structures and acts as a bacterial reservoir (Nakaishi et al, 2006).

Plaque buildup and periodontal disease can be caused by colonising Gram negative bacteria like Actinobacillus actinomycetemcomitans and Porphyromonas gingivalis affecting the mouth. When these bacteria are spread through the bloodstream, they trigger a systemic immune response in both the mother and the child (Dasanayake et al. 2001).

Gum bleeds are an immunological reaction to the oral flora. The immune system monitors gums for harmful microorganisms in a healthy mouth. Bleeding gums indicate that the body is boosting blood flow in order to recruit immune cells to fight these harmful microbes. It is an inflammatory process. It leads to gum disease if left untreated over an extended period of time (Lin, 2018). Thus, changes in the oral microbiota during pregnancy explain bleeding gums

2.5.2 Hormonal changes as a cause of oral manifestations of pregnancy

Hormonal changes during pregnancy can alter preexisting gum disorders (including gingivitis and periodontal disease) and exacerbate preexisting tooth decay. Gingivitis ulcerosa, gingivitis hypertorpicans, gingivitis simplex, and pregnancy tumours are some of the other gingival abnormalities that can occur as a result of hormonal changes during pregnancy. Also, the increased level of the hormone progesterone in the bloodstream, which increases the permeability of blood vessels, has been blamed for these alterations (Jafri et al., 2015; Yenen & Ataçağ, 2019).

Estrogen and progesterone have a role in the collagen balance in your body. Estrogen stimulates the synthesis of collagen whilst its breakdown is triggered by progesterone. Both are necessary for healthy gum healing and maintenance (Lin, 2018).

Pregnancy raises your chances of having bleeding gums that lead to gum disease. It's a delicate balance of oral flora, sex hormones, and immunological reaction.

2.5.3 Dietary changes as a cause of oral manifestations of pregnancy

Sweet cravings may also have a role to play in poor oral manifestations of pregnancy (Kushtagi et al. 2008; Khader et al. 2009). During the first months of pregnancy, some women may have a strong desire for certain foods, particularly carbohydrates, and tooth brushing may be ignored afterwards. Increased sugar consumption and soda drinking were found to be substantially related during pregnancy (Vergnes et al., 2013). Constantly having sugar in the mouth also encourages caries formation or progression of preexisting carious lesions resulting in dental pain secondary to acute or acute-on-chronic dental caries.

2.5.4 Vomiting as a cause of oral manifestations of pregnancy

Hyperemesis may also have a role to play in poor oral manifestations of pregnancy (Kushtagi et al. 2008; Khader et al. 2009). Pregnancy hormones relax the gastric sphincter (a muscular ring that retains food in the stomach leading to morning sickness). Strong stomach acids can cover the teeth as a result of gastric reflux (regurgitating food or drink)

or morning sickness vomiting. Reflux and vomiting on a regular basis can erode the surface of the tooth (the enamel) leading to tooth sensitivity and increased risk of decay (Better Health Channel, 2020; Jauhal Dental, 2015).

2.6 Oral diseases that occur in Pregnancy

Tooth decay and gum disease, known as gingivitis or periodontitis, are quite frequent in pregnant women (35–100 percent) and are generally more severe until the 36th week of pregnancy (Onigbinde et al., 2014). Gingivitis and periodontal infection are the most common oral disorders connected with pregnancy (Gajendra & Kumar, 2004).

Gestational Diabetes Mellitus, premature delivery, pre-eclampsia, delivering babies with low birth weight are systemic effects of poor oral hygiene and systemic changes that occur during pregnancy whilst pregnancy granuloma, gingival ulcers, gingivitis, mouth dryness, dental erosions and mobile teeth are among the undesirable oral effects of pregnancy mentioned by Yenen and Ataçag (2019).

2.6.1 Dental Caries

Studies have shown that there is a higher prevalence of Dental Caries amongst pregnant women than amongst nonpregnant women (Kateeb & Momany, 2018). For caries to form, the non-desquamative surface of the tooth is required, as well as *S. sanguis*, *S. mutans* and other cariogenic bacteria, plaque, saliva, time and food. Risk factors for caries include high levels of cariogenic bacteria, frequent sugar consumption, insufficient salivary flow, insufficient fluoride exposure, poor dental hygiene, and poverty (Nowak et al., 2019). Since

most of the risk factors occur in pregnancy, pregnant women often present at the dental clinic with Dental caries.

Image 1: Dental Caries

Source:

https://casemasters.azureedge.net/posts/dcGrsQ3FmfhwwNsW5VJBORyHQft2/271930730c184816a594cf09bf87b545/59d7b1c2-258a-4b92-8b9b-90ce9eedc7d3-l

2.6.2 Gingivitis

Gingivitis is a term that refers to inflammation of the gum/gingiva.

Gingivitis in pregnancy can range from mild gingival erythema(redness), oedema(swelling) and hyperplasia (increased number of cells) to more severe cases with

discomfort and bleeding of the gingival tissue either spontaneously or with tooth brushing (Gajendra & Kumar, 2004; Christensen, Jeppe-Jensen & Petersen, 2003).

Sixty to seventy-five percent of pregnant women exhibit oral manifestations of pregnancy in the form of gingivitis according to a report by Zenk (2016). An earlier report by Silk et al. (2008), also indicated that gingivitis was identified in 40% of pregnant women, according to a study conducted.

Pregnancy gingivitis often begins in the second month of pregnancy, peaks in the eighth month, and cures spontaneously after birth (Yenen & Ataçağ, 2019).

Gingivitis may also progress into Periodontal disease. If Gingivitis is not treated, the bone that supports the teeth might become infected and degenerate. Teeth with insufficient bone support might then grow loose and may need to be extracted or may fall off spontaneously as classic manifestation of periodontitis (Centers for Disease Control and Prevention, 2019)

Image 2: Gingivitis

Source: https://en.wikipedia.org/wiki/Gingivitis#/media/File:Gingivitis_(crop).jpg

2.6.3 Periodontal disease

Periodontal diseases are a set of disorders that affect the supporting tissues of the teeth, causing inflammation and their destruction (Heather & Boggess, 2008). Periodontal disease usually manifests as mobile teeth.

Periodontal disease has an increased tendency of occurrence in pregnancy (Jeffcoat et al., 2001). Periodontal infections are linked to a variety of systemic conditions, including gestational complications.

Image 3: Periodontal disease

Source: https://www.nature.com/articles/s41407-020-0311-3?proof=tNature

2.6.3.1 Gestational Diabetes as a sequelae of Periodontal Disease

Gestational Diabetes Mellitus is a kind of glucose intolerance that develops during pregnancy and is connected with substantial maternal and foetal problems. The pathogenesis of Gestational Diabetes Mellitus is unknown, however systemic inflammation may have an impact on insulin signaling and glucose metabolism. Periodontal disease is a chronic inflammatory disorder that causes local and host immunological responses and has been linked to the development of Gestational Diabetes Mellitus (Abariga & Whitcomb, 2016).

2.6.3.2 Preterm Births as a sequelae of Periodontal Disease

Preterm birth is when a baby is born too early, before 37 weeks of pregnancy have been completed. The bacteria that cause periodontal disease can produce a wide range of inflammatory mediators, including prostaglandins and interleukins (Gajendra & Kumar, 2004, Madianos et al, 2001). Because these chemicals appear to be endogenous mediators of normal labour beginning, their enhanced synthesis has been linked to the induction of labour, even causing preterm labour in women with severe periodontal disease (Gajendra & Kumar, 2004; Madianos et al., 2001).

Periodontal disease is thus a risk factor for preterm birth. Periodontal disorders are responsible for 18% of all preterm births (Jeffcoat et al., 2001).

2.6.3.3 Preeclampsia as a sequelae of Periodontal Disease

A condition that develops in pregnant women, it is marked by high blood pressure and presence of proteins in urine.

According to a meta-analysis by Huang et al. (2014) maternal periodontal disease is an independent predictor of preeclampsia. From their research, women who had periodontal disease before 32 weeks of pregnancy were 3.69 times more likely to develop preeclampsia than their counterparts who did not have periodontal disease. Whilst those with Periodontal disease within 48 hours after birth was linked to a 2.68-fold increased incidence of preeclampsia. Pregnant women who had periodontal disease within 5 days of giving birth had a 2.22-fold increased risk of preeclampsia than women who did not have periodontal disease.

2.6.3.4 Low Birth Weight Babies as sequelae of Periodontal Disease

Low birth weight is defined by the World Health Organization(WHO) as a birth weight of an infant of 2,499 g or less, regardless of gestational age. Meanwhile, poor dental hygiene has been linked to poor pregnancy outcomes. There is microbiological evidence as well as clinical investigations that support the link between periodontal infection and low birth weight and preterm low birth weight (Lubon et al. 2018). Preterm birth and low birth weight outcomes have been linked to the accompanying inflammation of gum disease (Dasanayake & Naftolin, 2016; Papapanou, 2015).

2.6.4 Pregnancy Granuloma

Epulis gravidarum, often known as pregnancy tumours or pyogenic granuloma or pregnancy granuloma is a frequent occurrence during pregnancy (Yenen & Ataçağ, 2019).

Pregnancy gingivitis is a kind of periodontal (gum) disease caused by hormonal changes. This increases blood flow to the gum tissue, causing additional inflammation in reaction to the presence of plaque. The gums would seem swollen and easily bleed with this disease. Gingivitis can be complicated by the formation of an epulis in a small percentage of instances. Epulis gravidarum, described as a hyperplastic and inflammatory lesion that originates from the buccal mucosa and mostly from gingival tissues, affects roughly 5-10% of pregnant women. Inadequate dental hygiene, persistent gingivitis, the use of hormone treatments, hypertension medications antiepileptic, immunosuppressive drugs, and high active progesterone due to pregnancy are all risk factors (Cristi et al., 2019).

If they do not disappear on their own (usually after delivery) or if the discomfort is unbearable, surgical removal is advised. Surgical excision can be done using either traditional or laser procedures. Because pyogenic granulomas bleed, laser therapy may provide more pleasant outcomes for the patient.

Image 4: Pyogenic granuloma

Image source:https://www.icliniq.com/articles/dental-oral-health/oral-pyogenic-granuloma

2.6.5 Oral Thrush

Fungal species are also present in a healthy oral microbiome. The most well-known oral fungus species associated with oral thrush is Candida albicans. Candida infection may also raise the likelihood of having a premature baby. Both Candida albicans and Staphylococcus aureus are well-known opportunistic bacteria.

Candida levels are greater in pregnant women than in non-pregnant women during the middle and late stages of pregnancy (Lin,2018).

Changes in the immune system during pregnancy also have a role in candida infection. Oral thrush may also be a sign of an increased risk of gum disease (Lin,2018)

Image 5: Oral Candidiasis Source: https://www.healthline.com/health/thrush#pictures

It is interesting to consider how preventing and treating oral health issues before conception, in the course of pregnancy, or after delivery is a way to enhance women's oral and overall health, pregnancy outcomes, and the dental health of their children. However, given the link between dental health and overall health, oral health should be a goal in and of itself for everyone (Boggess & Edelstein, 2006).

2.7 Effect of poor oral health of pregnant women on children

In pregnant women, oral health is an important part of overall health that has an impact on their quality of life as well as foetal outcomes (George et al, 2011; Brown, 2006). Early childhood caries (ECC), with its consequences of premature tooth loss and subsequent development of malocclusion, has been linked to poor oral hygiene and a lack of oral health information among mothers during and after pregnancy (Jose & King, 2003; Szatko, Wierzbicka, Dybizbanska, Struzycka & Iwanicka-Frankowska, 2004). If proper oral health habits are instilled in pregnant women, early childhood caries can be greatly minimised. Mothers with untreated dental caries are also more likely to convey the bacteria that cause tooth decay to their child after birth, especially if they are feeding the newborn with the same spoon (Council on Clinical Affairs, 2009).

2.8 Other causes of poor pregnancy outcomes

Aside the association with poor Oral health, the above stated adverse pregnancy outcomes may also occur in a pregnant woman who may not have periodontitis.

2.8.1 Other causes of Gestational Diabetes

In contrast to type 1 diabetes, gestational diabetes is not caused by a lack of insulin. Instead, a hormone produced by the placenta prevents the body of a pregnant woman from properly using insulin. This is referred to as insulin resistance. It occurs such that instead of being absorbed by the cells in the pregnant woman's body, blood sugar (glucose) builds up in her blood.

The symptoms of gestational diabetes may fade away once the baby is born. Alternatively, the mother may be at a higher risk of getting type 2 diabetes later in life (UW Medicine, n.d).

2.8.2 Other causes of preterm birth

Preterm birth can be caused by a variety of factors, including maternal or foetal stress, infection or inflammation, uterine haemorrhage, and uterine overdistention (Overdistention usually happens to women who have twins or triplets or excess amniotic fluid during labor) (University of Utah, 2021)

2.8.3 Other causes of preeclampsia

The most credible hypotheses centre on the placenta and divide the illness into two phases. In the first stage, the initiating cause causes placenta-producing substances (e.g., particular proteins, placental "debris") to enter the maternal blood and are thought to be responsible for the following stage.

This is the second stage, which culminates in the outward manifestation of maternal "illness" (high blood pressure, kidney, liver and coagulation abnormalities). The presence of illness is determined not only by the impact of circulating substances from the placenta, but also by the mother's health, which includes disorders that may damage the vasculature (such as preexisting cardiovascular, renal, metabolic, and genetic conditions) (Preeclampsia Foundation, 2020).

2.8.4 Other causes of low birth weight babies

Premature delivery is the leading cause of low birthweight (being born before 37 weeks gestation). When a baby is born prematurely, he or she has less time in the mother's uterus to develop and build weight. The majority of a baby's weight is gained in the latter stages of pregnancy.

Intrauterine growth restriction is another reason of low birthweight (IUGR). This happens when a baby does not grow properly during pregnancy because to issues with the placenta, the mother's health, or the infant's condition. A baby with IUGR can be born at full term (37 to 41 weeks). Babies with IUGR that are born at term may be physically mature yet weak. Premature newborns with IUGR are both physically and mentally underdeveloped (The Children's Hospital of Philadelphia, 2014).

2.9 Existing data on oral health seeking behaviour of pregnant women

In a study conducted in Nigeria on dental service utilisation by pregnant women, only 8.7% of respondents sought dental consultations throughout the pregnancy for symptoms such as tooth discomfort and decay (66.7%), pain, and gum swelling (33.3%). The most prevalent explanation cited for not visiting a dentist during the index pregnancy was that the appointment was irrelevant to the outcome of the pregnancy (69.2%). Only 60.3% consented to undergo dental consultations during subsequent pregnancies after being counselled (Onwuka, et al., 2021).

2.10 Factors causing poor dental service utilisation amongst pregnant women

Poor pregnancy outcomes can result from poor oral health issues. Pregnancy has been associated with many changes in the oral cavity that predispose an individual to periodontal diseases and other oral lesions or worsen an already existing lesion. Dental consultations have, however, been poorly attended by pregnant women. A number of factors have accounted for this trend amongst which are: socioeconomic status, behavioural factors, demographic factors, psychological element and perceived need.

2.10.1 Socioeconomic status

Evidence shows that socioeconomic status is associated with oral health status. Such socioeconomic factors include educational level, income and health insurance. Studies have shown that socioeconomic status is negatively linked with oral health and disease (Bowling, 2005), which means the higher the status, the better the perception of oral health and the less record of clinically- diagnosed dental problems. Education and income remain the most common and important indicators used in epidemiology for socioeconomic status measurement (Tsakos et al.,2011; Watson & Nilam, 2017; Meija et al., 2014; Steele et al., 2015; Borell & Burt, 2004). Greater burdens of unattended oral health issues and poorer self-rated oral health are frequently identified amongst persons from lower income and education category.

2.10.2 Behavioural factors

A mother's oral health behaviour during pregnancy such as oral hygiene, dental clinic visits and sweet consumption habits have a significant effect on their oral health during pregnancy and on their children's oral health in the future (Adair et al., 2004; Corchuelo-Ojeda, 2013).

Pregnant women with good hygiene had higher odds of using dental services and receiving routine dental care than those with poor hygiene. Also, pregnant women who did not consume cariogenic foods and did not smoke were significantly more likely to assess dental services (Corchurlo-Ojeda, 2013; Timothé et al.,2005)

2.10.3 Demographic factors

Tribe, ethnicity, nationality, age, marital status and parity are among the demographic factors influencing frequency of dental visits by pregnant women. In a survey, done by Marchi et al. (2010), tribal minorities and those who spoke non-English languages at their places of residence had lower odds of receiving dental care in pregnancy. In addition to this, married women are seen as more likely to seek dental care whilst pregnant than their single or unmarried counterparts (Al Habashneth et al., 2005; Corchuelo-Ojeda 2013; Singhal et al., 2014). In an interesting turn of events, pregnant women with 2 or more children assess dental care more than those pregnant for the first time (Saddiki et al., 2010; Marchi et al., 2010; Dinas et al., 2007; Vergnes et al., 2013; suelo-Ojeda and Perez, 2014).

2.10.4 Psychological element

Psychological factors related to the utilisation of dental services in pregnancy include oral health beliefs, anxiety, dental insurance contentment, oral health education, oral health referrals and so on. Usually, women with adequate oral health knowledge visit dental clinics compared to those with poor knowledge (Corchuelo-Ojeda, 2013). In the same vein, those who had antenatal counselling on oral health are more likely to see a dental professional. Regarding the link between mother's oral health and pregnancy, most pregnant women believed the unborn child could be affected if there is poor maternal oral health (Saddki et al., 2010)

2.10.5 Perceived Need

Pregnant patients most likely to access dental care were those with pain, gingivitis or perceived dental issues (Dinas et al., 2007; Singhal et al., 2014; Vergnes et al., 2013).

Due to increased tooth sensitivity, gingival oedema, and a tendency of the gum to bleed, pregnant women may avoid dental visits or even abandon their oral health routines (Scannapieco et al. 2003; Radnai et al. 2006).

2.11 Effect of provision of good oral health care in pregnancy

On the other hand, healthy gingiva is unaffected by pregnancy (Council on Clinical Afffairs, 2009). There will be no oral issues and their systemic consequences during pregnancy if a healthy diet and sufficient oral health care practices are followed (Yenen &

Ataçağ, 2019). This entrenches how much preventive oral health care needs to be included in routine Antenatal care in Ghana.

Promoting oral health during pregnancy can enhance maternal oral health, minimise the risk of early caries development in children, and have a favourable impact on mothers' and children's oral health behaviours and attitudes (Ramos-Gomez, Weintraub, Gansky, Hoover & Featherstone, 2002). As such, the role of obstetricians and midwives in referring pregnant women to dentists is crucial. Given the direct access they have to pregnant women during antenatal care, they must create awareness of the benefits of seeking oral health care for the benefit of both mother and child. The goal of this research is to determine how often pregnant women use dental services.

According to Boggess and Edelstein (2006), public policies that promote complete dental services for underprivileged women of reproductive age should be expanded so that oral health can be included in the antenatal care of pregnant women. Again, professionals involved in prenatal care should talk to pregnant women about the importance of oral health and send them to a dentist if necessary (Al-Habashneh, Aljundi & Alwaeli, 2008).

2.12 Oral Health Policy in Ghana

Currently, Ghana does not have a national oral health policy, let alone a policy to effect mandatory oral health care in pregnancy. The available public communication on the need for a national oral health policy and the interest of the Ministry of Health in the development of such a policy dates back to July 2006. The then Chief Dental officer, Dr

David Oppong Mensah spoke of how the Ministry of Health of Ghana was developing a national oral health policy "to direct the provision of oral health services and oral health development in Ghana" (Ghana Web, 2006). The policy has since not materialized for unclear reasons.

Meanwhile, the only mention of oral health in the current National Health Policy (2020) addresses how oral health conditions are on the rise. These stand as evidence of the level of importance currently being given to oral health and its relation to general and maternal in Ghana.

2.13 The role of epidemiology in policy formulation

The purpose of epidemiology is to be the independent voice of science, consistently advancing understanding and revealing problems and risks whilst public health practice and public policy are concerned with putting what is known and practicable into action. Public health and policies use epidemiological findings within a political and societal context (Marks, 2009).

Using its specialization in population health data, epidemiology contributes to the conceptualization and assessment of health. It assesses health requirements and dangers, quantifies the impact of health problems on society, and investigates health inequities (Spasoff, 1999).

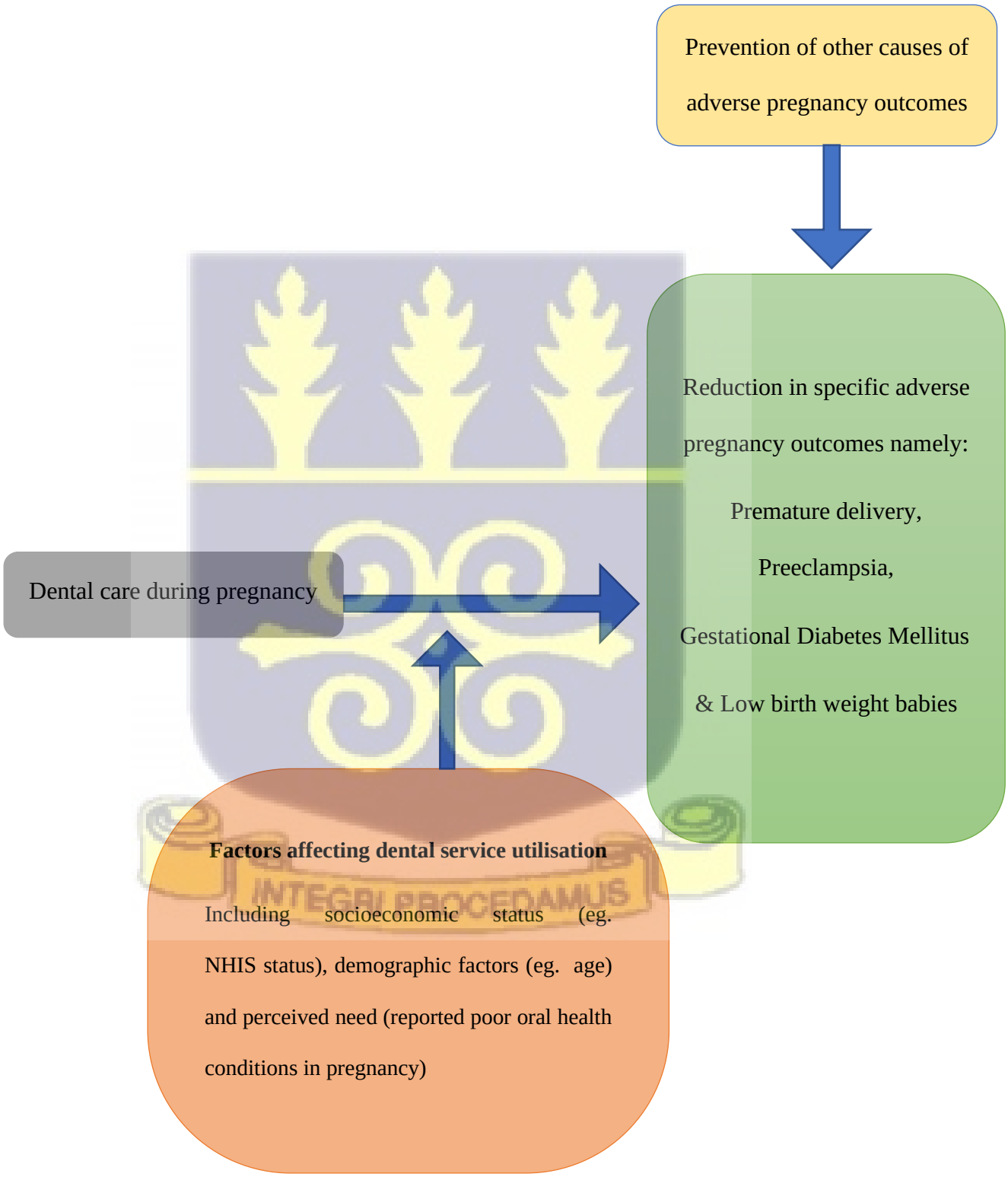
This study is focused on establishing the association between poor oral health in pregnant women and preventable adverse pregnancy outcomes in order to begin the formulation of an appropriate policy to include routine oral health care in antenatal care.

Indeed, epidemiology plays a role in both Need and Impact assessments of Public Health Policies.

2.14 Conceptual Framework

Figure 1: Conceptual Framework on the effect of oral health checkup in antenatal care

Source: Owner's Construct



2.15 Conceptual Review

The conceptual framework above is a depiction of the effect of not obtaining dental care during pregnancy.

From the framework above, "Dental care during pregnancy" stands as the exposure variable with "Reduction in specific adverse pregnancy outcomes namely: Premature delivery, Preeclampsia, Gestational Diabetes Mellitus & Low birth weight babies" being the outcome. In that, receipt of dental care during pregnancy causes a reduction in the adverse pregnancy outcomes outlines due to improved oral health.

"Factors affecting dental service utilisation" stands as the confounders. Confounders predict the outcome by interacting with the exposure. Indeed, these variables may either diminish, strengthen, negate, or otherwise alter the association between the independent and dependent variables.

Prevention of other causes of adverse pregnancy outcomes stands as the control variable in this conceptual framework.

In summary, receipt of oral healthcare leads to reduction in particular adverse pregnancy outcomes namely: Premature delivery, Preeclampsia, Gestational Diabetes Mellitus & Low birth weight babies. Meanwhile factors affecting dental service utilisation influence this causal association.

CHAPTER THREE

METHOD

3.1 Research paradigm

The knowledge paradigm applied in this study was positivism with the aim of understanding a theory and its applicability to our country, so as to bring this issue unto the agenda. Positivism was also applied because my study is deductive. My study was driven by the use of archival (hospital) data records. Quantitative data was collected. In positivism studies, the role of the researcher is limited to data collection and interpretation.

The purpose of this study is exploratory because there is a dearth of literature on oral health among pregnant women in Ghana and its attendant pregnancy outcomes.

3.2 Study Design

This study was a retrospective cross-sectional study adopting quantitative research methods to assess prevalence of poor oral health conditions in pregnant women and its attendant sequelae amongst pregnant women attending dental clinic at Eastern Regional Hospital, Koforidua**.**

3.3 Study location

Founded in 1926, the Eastern Regional Hospital, Koforidua (ERHK) serves as the Municipal Hospital for the New Juaben Municipality, which has a population of

approximately 180,000 people as well as a secondary referral institution for the entire Eastern Region of Ghana. The 356-bed hospital currently serves as a referral hub for about sixteen (16) district hospitals in the region.

The following departments amongst others in the facility work together to offer curative services: Obstetrics and Gynecology, Internal Medicine, Paediatrics, Surgery, Ophthalmology, Ear Nose Throat, Physiotherapy and Dentistry. As a result, the hospital treats general disorders such malaria, anaemia, respiratory ailments, hernia, fractures, gynaecological ailments, pregnancy and associated diseases, and dental diseases. It is a not-for-profit Ghana Health Service Facility (Eastern Regional Hospital, 2017). The facility has an average monthly attendance of pregnant women of 309.

The regional hospital is the referral centre in the region and has a large patient population so it was chosen on the basis of availability of relevant data from their EMR.

3.4 Study population

Electronic Medical Records of pregnant women who attended the Dental and Obstetrics departments of the Eastern Regional Hospital, Koforidua, from February 2018 to January 2020 were used for this study. This constitutes a 2-year period of study in the pre-COVID-19 era.

Inclusion criteria:

1. Main participants are pregnant Dental patients of the Eastern Regional Hospital, Koforidua within the stipulated 2-year period
2. Participants also include all obstetric patients visiting the obstetrics department within the stipulated 2-year period

Exclusion criteria:

1. Non-pregnant patients visiting the ERHK for treatment

3.5 Study Variables

Independent variables:

- Number of pregnant patients who had antenatal care at the Eastern Regional Hospital, Koforidua over the 2-year period
- Number of pregnant patients who visited dental department for oral health care at Eastern Regional Hospital, Koforidua

Dependent variables:

- Number of cases of Preeclampsia, Low birth weight, Preterm birth and Gestational Diabetes amongst pregnant women who visited the antenatal clinic at Eastern Regional Hospital, Koforidua

- Number of cases of Preeclampsia, Low birth weight, Preterm birth and Gestational Diabetes amongst pregnant women who visited the dental clinic at Eastern Regional Hospital, Koforidua

3.6 Sample Size

Secondary Data from the Health Administration Management System (HAMS) was utilized such that all dental and obstetrics cases within the 2 years pre-COVID-19 (from February 2018 to January 2020) were included in the study. A total of 7,409 pregnant women visited ERHK for antenatal care and /or dental care.

3.7 Data Collection

Data of pregnant women attending both dental and obstetrics departments was extracted from the electronic medical records software in use (known as the Health Administration and Management System (HAMS))

Dental records of all pregnant patients seen within the specified period were extracted from the Electronic Medical Records of the University Hospital by personnel from the records department. The Obstetric records of these pregnant dental patients were then traced for any related adverse pregnancy outcomes namely: Premature delivery, Preeclampsia, Gestational Diabetes Mellitus and Low birth weight babies.

These outcomes were also retrieved from the obstetric records within the indicated timeframe and analysed accordingly.

3.8 Data analysis

The data extracted was captured unto a spreadsheet (MS Excel) for data cleaning. The cleaned data was transferred to STATA 16 statistical software for analysis.

For the first objective which seeks to determine the prevalence of oral conditions reported by pregnant women, this was analysed using frequencies, and percentages.

For the second objective which seeks to assess the prevalence of adverse pregnancy outcomes in pregnant patients. Frequencies and percentages were used for the analysis.

The third objective sought to explore whether the receipt of oral healthcare during pregnancy was associated with the occurrence of relevant adverse pregnancy outcomes, namely Gestational Diabetes, Preeclampsia, Preterm birth and low birth weight. An odds ratio was thus used to quantify the relationship between the exposure (oral health care in pregnancy) and a disease (i.e. the adverse pregnancy outcomes in question, namely Gestational Diabetes, Preeclampsia, Preterm birth and low birth weight).

3.9 Quality control

One field worker from the Record Department of the Eastern Regional Hospital, Koforidua was engaged in the collation of the necessary secondary data. As such, no training was needed for this field worker. The person was, however, reminded of the strict

confidentiality of the participants to be observed. COVID-19 protocols were all duly observed.

3.10 Ethical considerations, Confidentiality and Data Management

Ethical clearance was obtained from Ghana Health Service Ethics Review Committee (GHSERC) under reference number GHSERC: 032/12/21. Once ethical clearance was received, it was submitted to the Eastern Regional Hospital, Koforidua for approval and continuation of the study.

Utmost anonymity and confidentiality of patients' data assessed was maintained while reviewing the secondary data from the software by employing the help of only one worker from the records department and training him to maintain patient confidentiality as required. The Ghana Health Service as well as the hospital in question granted permission by proxy to assess the needed data.

Data collected was carefully stored on a personal password-protected computer assessed by only the researcher. This data was meant to be used for academic and publication purposes only.

No conflict of interest arose from undertaking this study.

3.11 Financial considerations

Study subjects did not incur any form of financial costs by being included in this study. No study subjects were compensated in anyway. Other miscellaneous costs were financed by the principal investigator.

3.12 Risks involved in the study

There was only a minimal amount of risk involved in this study. Although the study subjects were not exposed to any physical or emotional harm, there was a potential of health data exposure. This was addressed by the training of the records personnel who retrieved the data on the ethics of the role and the use of a password protected computer to analyse the data.

Another risk encountered in the execution of this study were the potential risk of exposure to COVID-19 from visiting the hospital and interacting with the personnel from the records department of Eastern Regional Hospital, Koforidua. There was also the risk of road traffic accidents occurring from travelling from Accra to my study location in Koforidua. As such, all COVID-19 protocols and motor-traffic regulations were duly observed.

3.13 Benefits of the study

Study participants did not benefit directly from this study. However, evidence obtained from the study can potentially improve the management of pregnant women in the health

facility This study could also to inform the need for a policy to include routine oral healthcare in antenatal care for better health of mothers and their babies.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

4.1 Overview

This chapter presents a data analysis and results of relevant data collected from the electronic medical records of all pregnant women who visited the Eastern Regional Hospital, Koforidua from February 2018 and January 2020. The data analysis was done using STATA version 16 software and edited using Microsoft Excel.

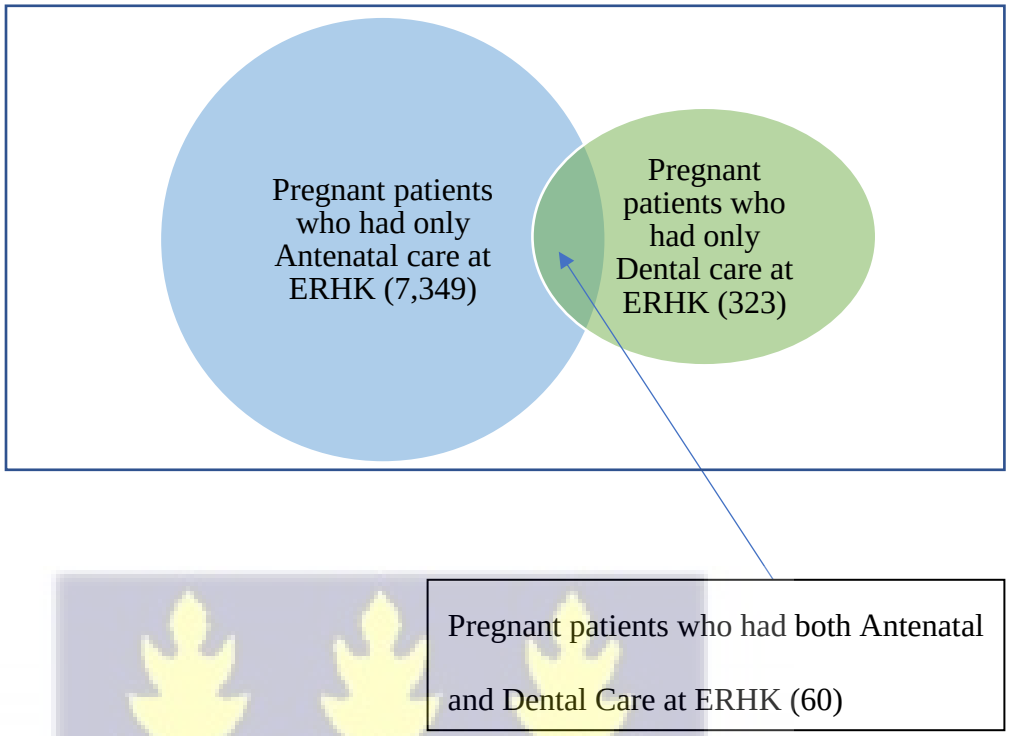
4.2 Data Disposition

The study collected data which was categorised as follows;

i. Number of pregnant women who visited Eastern Regional Hospital, Koforidua for antenatal care in the 2 year period=7,409.
ii. Number of Pregnant patients who had dental care at Eastern Regional Hospital, Koforidua in the 2 year period= 383.
iii. Number of Pregnant Patients who had both dental and antenatal care at ERHK= 60

Figure 2 displays the graphical view of the data disposition.

Figure 2: Pregnant patients who visited ERHK from February 2018 to January 2020



4.3 Sociodemographic characteristics of the participants

The sociodemographic characteristics of the participants of this study consist of age Distribution and National Health Insurance Authority (NHIS) status of pregnant women who visited ERHK for Antenatal Care, Dental care and both Antenatal & Dental Care.

The study categorised the age Distribution of participants into participants less than 20 years, from 20 to 29 years, from 30 to 39 years and above 40 years.

The NHIS statuses of pregnant women were categorised into those with and without NHIS sponsorship.

Table 1: Sociodemographic characteristics of pregnant women who visited ERHK for Antenatal Care, Dental care and both Antenatal & Dental Care

	Antenatal care Freq. (%)	Dental care Freq. (%)	Both Antenatal & Dental Care Freq. (%)
Age			
< 20 years	395 (5.33%)	74 (19.32%)	2 (3.33%)
20-29 years	3,198 (43.16%)	140 (36.55%)	22 (36.67%)
30-39 years	3,696 (49.89%)	169 (44.13%)	36 (60%)
> 40 years	120 (1.62%)	-	-
NHIS Use			
No	98 (1.32%)	44 (11.49%)	2 (3.33%)
Yes	7,311 (98.68%)	339 (88.51%)	58 (96.67%)
Total	7,409(100%)	383 (100%)	60(100%)

Source: ERHK (2018-2020)

Almost 50% of women who visited ERHK for Antenatal care fell between the 30-39 age group, 44% of women who visited ERHK for Dental care were between 30 and 39 years and 60% of women who visited ERHK for both Antenatal and Dental care were between 30 and 39 years. However, the study revealed that pregnant women above the age of 40 years failed to attend dental care.

A vast majority of women (almost 99%) who had Antenatal care at ERHK had the National Health Insurance. Similarly, a great percentage of pregnant women who had Dental care at ERHK had the National Health Insurance as did pregnant women who had both Antenatal & Dental care

4.4 Prevalence of reported oral health conditions amongst pregnant women at Eastern Regional Hospital, Koforidua

The study investigated the prevalence of reported oral health conditions amongst pregnant women at Eastern Regional Hospital, Koforidua. Based on the data extracted, pregnant women who reported for some oral health care were diagnosed with Gingivitis, Dental Caries, Periodontal Disease, Epulis Gravidarum, Oral Thrush, Dentoalveolar Abscess, Fractured Tooth, Fractured Restoration, Impacted tooth, Malocclusion, Retained Primary tooth, and Tooth Erosion.

Table 2: Table showing the prevalence of oral health conditions amongst pregnant women at Eastern Regional Hospital, Koforidua (N=383)

Prevalence	Frequency	Percent of cases
Gingivitis	64	16.71
Dental Caries	96	25.07
Periodontal Disease	31	8.09
Epulis Gravidarum	3	0.78
Oral Thrush	1	0.26
Dentoalveolar Abscess	40	10.44
Fractured Tooth	21	5.48
Fractured Restoration	1	0.26
Impacted Tooth	13	3.39
Malocclusion	3	0.78
Retained Primary tooth	6	1.57
Tooth Erosion	1	0.26
Total	280	73.1
Valid cases:	383	

Source: ERHK Dental Department (2018-2020)

Out of 383 pregnant dental patients who reported at the Dental department within the specified time frame, 280 cases of thirteen diagnoses (namely: Gingivitis, Dental Caries,

Periodontal Disease, Epulis Gravidarum, Oral thrush, Dentialveolar Abscess, Tooth Erosion, Fractured Tooth, Fractured Restoration, Impacted Tooth, Malocclusion and Retained Primary tooth) were reported by the pregnant patients. About 103 patients did not have diagnoses attached to their records either from not following through with the consultation or otherwise.

Dental caries stood as the most prevalent reported dental case accounting for over 25.07% (N = 96) of relevant dental diagnoses followed by Gingivitis (N =64; 16.71%), Dentoalveolar Abscess (N = 40; 10.44%), Periodontal disease (N =31; 8.09%) and Fractured tooth (N=21; 5.48%). The outcome indicates that pregnant women who report to the dental department are likely to have at least of the one of the following: Dental caries, Gingivitis, Dentialveolar Abscess, Periodontal Disease or Fractured tooth.

Meanwhile, Oral thrush, Fractured restoration and Dental Erosion were reported by only one dental patient each in the 2-year period, implying that these conditions constitute a small percentage of oral health conditions reported by pregnant women to the dental department over the study period.

4.5 Prevalence of adverse pregnancy outcomes amongst pregnant patients

The study assessed the prevalence of adverse pregnancy outcomes amongst pregnant patients

Table 3: Prevalence of relevant adverse pregnancy outcomes amongst pregnant patients who had oral health care and who did not have oral health care respectively.

Adverse pregnancy outcome	Pregnant patients who had oral health care at ERHK Frequency (%)	Pregnant patients who had antenatal care but no oral health care at ERHK Frequency (%)
Gestational Diabetes	1 (1.67%)	105 (1.43%)
Preeclampsia	0 (0%)	175 (2.38%)
*Preterm Birth	0 (0%)	30 (0.41%)
Total	1 (1.67%)	310 (4.22%)
Valid cases:	60 (100%)	7349 (100%)

Source: ERHK (2018-2020)

Out of 383 pregnant patients who visited the dental clinic for some oral health care, only 60 pregnant patients had antenatal care at Eastern Regional Hospital, Koforidua out of which only 1 patient who had had some oral care presented with an adverse pregnancy outcome (Gestational Diabetes).

Out of 7349 pregnant patients who attended ERHK for antenatal care but no dental care within the specified 2-year period, 310 patients representing 4.22% presented with either Gestational Diabetes, Preeclampsia or Preterm birth. Preeclampsia was the most prevalent adverse pregnancy outcome, affecting 2.38% of the people whilst Preterm Birth occurred in 0.41% of the pregnant patients who had Antenatal care at ERHK.

Thirteen (13) newborns also presented with Low birth Weight. However, it was impossible to trace the pediatric records to the related antenatal and dental records of the mother. This diagnosis thus could not be included in the analysis.

4.6 Association of Receipt of Oral Healthcare with adverse pregnancy outcomes

The study investigated the association of receipt of oral healthcare with adverse pregnancy outcomes using logistic regression model.

The dependent variables were the number of adverse pregnancy outcomes whilst the independent variables were the number of pregnant women who had antenatal care but may or may not have received oral healthcare with the socio-demographic characteristics (age distribution and NHIS status) standing as confounders.

Pregnant patients' ages were grouped into less than 20 years, from 20 years to 29 years, from 30 years to 39 years, and 40 and beyond. Their NHIS status also categorized them into those accessing healthcare using National Health Insurance and those without it.

The exposure is thus the receipt or oral healthcare whilst the outcome is the prevalence of related adverse pregnancy outcomes namely: Gestational Diabetes, Preeclampsia and Preterm birth.

Table 4: Association between Socio-demographic characteristics and Receipt of oral Healthcare on adverse pregnancy outcome

Variable	Crude Odds ratio [95% CI]	P-value	Adjusted Odds ratio [95% CI]	P-value
Age				
ref(<20 years)				
20-29 years	1.7965 [0.7213-4.4745]	0.2080	1.7963 [0.7216-4.4766]	0.2080
30-39 years	**4.9213[2.0121-11.9949]**	**0.0000**	**4.9268[2.0178-12.0294]**	**0.0000**
40+	**4.1052[1.2302-13.6986]**	**0.0220**	**4.0845[1.2240-13.6297]**	**0.0220**
NHIS use				
No (Ref)				
Yes	1.3503[0.4253-4.2864]	0.6100	1.3628[0.4275-4.3445]	0.6010
Exposure (Receipt of oral health care)				
No (Ref)				
Yes	0.3969[0.0548-2.8740]	0.3600	0.3791[0.5007-2.6436]	0.0522

N=7409 LRCHi2 = 73.62 P-value = 0.00 Log-likelihood = -12225.359 Pseudo R2 = 00292

The results revealed that the age distribution of ANC visits (from 30 years to 39 years and 40 and above) of respondents was statistically significant since their p values were less than 5% (p<0.05). The results indicated that using p-value of 5%, there existed a statistically significant association between the age distribution of pregnant patients (from 30 years to 39 years and 40 and above) and occurrences of adverse pregnancy outcomes (p-value=0.0000, COR= 4.9213, CI= 2.0121-11.9949; p-value=0.000, AOR = 1.7963, CI= 2.0178-12.0294: p-value =0.0220, COR=4.1052, CI=1.2302-13.6986, p-value= 0.022, AOR=4.0845, CI=1.2240-13.6297)

Thus, pregnant patients from 30 years to 39 years had an increased tendency to develop adverse pregnancy outcomes by approximately 5 times using less than 20 years as

reference. Similarly, pregnant patients (40 and beyond) had an increased tendency to developing adverse pregnancy outcomes by approximately 5 times using less than 20 years as reference.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter presents a discussion of the findings of the study, which closely linked oral health care during pregnancy with adverse pregnancy outcomes at the Eastern Regional Hospital, Koforidua within New Juabeng Municipality. These findings have been related to recent literature as well.

5.2 Sociodemographic characteristics of participants

Only 60 out of the 7,409 pregnant women who visited ERHK for antenatal care had dental care in the facility during their period of pregnancy representing 0.8% of the pregnant population. In comparison to a study done in Nigeria, this result obtained was significantly lower than Nigeria with a dental service utilization of 27.9% (Braimoh & Ilochonwu, 2014) and 8.7% (Onwukwa et al.,2021).

A possible cause of this disparity between Ghana and a similar African country in the same sub region is the presence of a National Oral Health Policy in Nigeria. Nigeria had a draft Oral health policy from 2012 to 2015. This implied that the nation placed some importance to providing oral health care for its citizens, thus creating the necessary awareness amongst the people on their need for oral care (pregnant women inclusive). After the expiry of the draft oral health policy in Nigeria, there was an obvious decline in utilisation of oral health care services by pregnant women as seen in the 2021 study. There is thus a need for

appropriate oral health policies for people of all walks of life especially for a vulnerable group as pregnant women. Nigeria is currently working on re-implementation of the Oral health policy and Ghana ought to take a cue from that (NAN,2019).

Most pregnant women who visit the health facility fall between the age group of 30-39 years. This is consistent with findings that women in their 30s and beyond are giving birth more than ever before, while their younger counterparts are seeing a decrease in birth rates. For the first time in over 30 years, the 25- to 29-year-olds are being moved out of the top birth rate as a result of this development (Muza, 2022).

Most pregnant women who visit ERHK are under the NHIS. Although almost 99% of women who visited antenatal clinic at ERHK used the NHIS as sponsorship, roughly 88% of pregnant women who had dental care at ERHK used the NHIS card. This disparity may have occurred because pregnant women who sought oral health care at ERHK may have used another hospital for antenatal care or perhaps used alternative care providers including traditional birth attendants, herbalists, and spiritualists for their antenatal care and births (Aryeetey, et al.,2015).

5.3 Prevalence of oral conditions reported by pregnant women

Unlike in other countries where oral health care is included in antenatal care, pregnant women in Ghana only visit the dentist at will. It is thus prudent to find out what oral health conditions such women were diagnosed with. In this study, these expectant mothers were diagnosed with Dental Caries, Gingivitis, Periodontal Disease, Epulis Gravidarum, Oral thrush, Dentialveolar Abscess, Tooth Erosion, Fractured Tooth, Fractured Restoration,

Impacted Tooth, Malocclusion and Retained Primary tooth. Data collected revealed that the most predominant oral health conditions reported by pregnant women included Dental caries, Gingivitis, Dentoalveolar Abscess, Periodontal Disease and Fractured tooth in order of magnitude.

According to a study done in Iran, dental attendance by pregnant women was mainly limited to acute dental needs (Shamsi et al., 2013). It is thus no surprise that 25.07% of reported dental conditions were Dental Caries as seen in Table 3. This implies that about 1 out of 4 women reporting to dental clinic during pregnancy may present with conditions like Chronic apical periodontitis secondary to Dental caries (a dormant form of caries) which flared up during pregnancy or a newly developed carious lesion. Such women would have thus been driven by the excruciating pain of dental caries to report to the dental clinic.

Possible causes of dental caries in pregnant women would include poor oral hygiene (March of dimes, 2019) and increased sugar consumption as a result of the pregnancy cravings (Vergnes et al., 2013). Unfortunately, mothers who have dental caries tend to pass on the bacteria which cause dental caries to their babies resulting in early childhood caries or Rampant caries in their offspring through innocuous kissing and feeding of the child (Damle et al., 2016). This may also result in premature loss of primary teeth even resulting in malocclusion in the child.

The second most prevalent reported poor oral health condition at 16.71% was gingivitis, a precursor of periodontal disease. Gingivitis may lead to Periodontal disease and its sequelae if left untreated. In spite of its prevalence in pregnancy, pregnant women are

unlikely to report to dental clinics on account of occasional bleeding on brushing. When compared to nonpregnant women, pregnant women had worse oral hygiene and thus higher gingival inflammation and more periodontal disease. Women in their 3rd trimester saw an increase in the severity of gingivitis (Kashetty et al., 2018). These disorders, as well as their sequelae, can be avoided with proper dental hygiene.

Periodontal disease in itself was the 4th most prevalent dental condition at 8.04% prevalence. This is less than findings that the prevalence of Periodontal Disease ranges from 10 to 60% (Vogt et al., 2012). Pregnant women with periodontal disease are less likely to report it to the Dental clinic since it does not typically present with pain except when it leads to spontaneous tooth loss in its most severe forms. Periodontal disease is linked to advanced gestational age and obesity. It has been suggested that antenatal care for early pregnancy should include an oral health care programme, especially for low-income communities (Vogt et al., 2012).

Untreated periodontal disease has been linked to adverse pregnancy outcomes such as Gestational Diabetes Mellitus (Abariga & Whitcomb, 2016), Preeclampsia (Huang et al., 2014), Preterm births and Low birth weight (Lubon et al. 2018).

The third most prevalent diagnosis amongst pregnant dental patients was dentoalveolar abscess. Dentoalveolar abscess is a collection of pus that forms in an affected tooth and its supporting bone. It may be caused by dental caries, periodontal disease or injury to a tooth or even a suppressed immune system as occurs in pregnancy in the presence of poor oral

hygiene (Lin,2018; NHS,2019). As such it may have occurred as a sequela to any of the above-named oral health conditions.

Only one pregnant woman each reported to the dental clinic with Oral Thrush, Dental erosions and Fractured tooth restoration representing 0.26% each. Oral thrush may occur in pregnancy due to somewhat reduced immunity where Candida albicans takes advantage of and colonises the mouth, manifesting as Oral thrush (Lin,2018). Dental erosion may also occur due to frequent vomiting in pregnancy either from the normal physiological morning sickness or from hyperemesis gravidarum which is a disease condition in pregnancy characterized by frequent vomiting. In both cases, the acid contents of vomitus erode the enamel of the teeth, resulting in dental erosion. There is however little literature on the prevalence of tooth restoration fracture in pregnant women. This issue of tooth restoration fracture in a pregnant patient ought to be considered as an isolated occurrence.

5.4 Prevalence of relevant adverse pregnancy outcomes amongst pregnant patients who had oral health care and who did not have oral health care respectively.

This section discusses that the prevalence of relevant adverse pregnancy outcomes amongst pregnant patients who had oral health care and who did not have oral health care at ERHK.

Amongst the pregnant women who received oral care during pregnancy, only 1 out of 60 patients (1.67%) presented with an adverse pregnancy outcome associated with poor oral hygiene in the form of Gestational Diabetes Mellitus as seen in the Table 4.

Ideally, it is expected that since this patient had oral health care, she should have good oral hygiene and not be susceptible to any of the adverse pregnancy outcomes in question. However, since there are other established risk factors of Gestational Diabetes Mellitus, this isolated case may have occurred as a result of a previous history of gestational diabetes, being overweight, an age more than 25 years, a family history of type 2 diabetes, having another condition known as polycystic ovarian syndrome or being a person of African descent. Gestational diabetes may result in preterm birth, macrosomia resulting in difficult delivery, hypoglycemia in pregnancy and a higher chance of developing Type 2 Diabetes later in life (Center for Disease Control and Prevention, 2021).

Of pregnant patients who had some oral care during pregnancy only 1 person presented with an adverse pregnancy outcome associated with poor oral health which is insufficient to draw a model and is thus negligible.

Meanwhile, 4.22% of pregnant patients who had only antenatal care at ERHK presented with adverse pregnancy outcomes. It is thus possible that the oral health care in pregnancy has a protective effect on the gestational health of a pregnant woman. Therefore, pregnant women should be encouraged to have routine oral health care incorporated into their antenatal care.

5.5 Association of the receipt of oral healthcare during pregnancy with the occurrence of relevant adverse pregnancy outcomes

Unfortunately, solely depending on the analysis of the descriptive statistics from the prevalence of relevant adverse pregnancy outcomes amongst pregnant patients who had oral health care and who did not have oral health care may lead into error considering the low numbers of pregnant patients who had some oral health care in this study. There is therefore the need for the execution of the third objective which was "To explore whether the receipt of oral healthcare during pregnancy had an association with the occurrence of relevant adverse pregnancy outcomes namely; Gestational Diabetes, Preeclampsia, Preterm birth and low birth weight."

Since the p-values of the odds of occurrence of adverse pregnancy outcome with exposure to oral healthcare were greater than 0.05, it implied that there was a probability that the null hypothesis is true and no effect of the exposure (receipt of oral healthcare) was observed. This means that receipt of oral health care was insignificant the occurrence of the adverse pregnancy outcomes in question.

This was inconsistent with numerous studies showing that receipt of oral health care had a positive effect on reducing adverse pregnancy outcomes such as preterm births by 18% (Jeffcoat et al., 2001), Gestational Diabetes Mellitus (Abariga & Whitcomb, 2016) and low birth weight (Lubon et al., 2018). According to Huang et al. (2014) women who had periodontal disease before 32 weeks of pregnancy were almost 4 times likely to develop

preeclampsia than their counterparts who did not have periodontal disease. All these could not be established in this study.

The highlighted disparity may be as a result of insufficient sociodemographic factors to be adjusted or controlled in this study due to the limited data made available from the secondary data or due to insufficient (low) numbers of pregnant women who had antenatal care.

The findings from this study, however, revealed that the age distribution of ANC visits (from 30 years to 39 years and 40 and above) of respondents was statistically significant. The results indicated that using p-value of 5% for Crude Odds Ratio and Adjusted Odds Ratio, there existed a statistically significant association between the age distribution of pregnant patients (from 30 years to 39 years and 40 and above) and occurrences of adverse pregnancy outcomes for both Crude and Adjusted Odds Ratios. As such, there was an association between these particular age ranges and development of adverse pregnancy outcomes.

Thus, pregnant patients from 30 years to 39 years had an increased tendency to develop adverse pregnancy outcomes using less than 20 years as reference. Similarly, pregnant patients (40 and beyond) had an increased tendency to developing adverse pregnancy outcomes using less than 20 years as reference.

Although thousands of records were reviewed, the very low dental utilisation within the specified 2-year period made it impossible to adequately establish the association through statistical analysis. The quality of electronic records collected in health facilities ought to

be structured not just for diagnosis and treatment but with future research prospects too. Perhaps the availability of more sociodemographic parameters may have unveiled relevant associations which could impact local healthcare delivery for the better.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

This chapter presents the conclusion of the findings and makes recommendations for policy implementation.

6.2 Summary of the study

In spite of overwhelming evidence about the association between poor oral health and associated adverse pregnancy outcomes, there is no policy in Ghana to include oral health care in antenatal care in order to reduce the prevalence of adverse pregnancy outcomes such as Gestational diabetes, Preeclampsia, Low birth weight and Preterm birth as well as other oral manifestations of pregnancy.

Indeed, although publications on similar topics in Ghana showed that most pregnant Ghanaian women had some form of periodontal disease, they were neither aware of their conditions nor sought professional treatment for them (Goka et al., 2022, Annan & Nuamah,2005). Very few nurses knew of the association between poor oral health and adverse pregnancy outcomes and were also unlikely to refer pregnant women for routine oral care to safeguard their health and that of their babies (Aikins & Eigbobo, 2014).

In fact, as at now, Ghana neither has an oral health policy or any other policy to include oral health care in antenatal care.

In this study, records of all pregnant women who attended Eastern Regional Hospital, Koforidua from February 2018 to January 2020 were reviewed in a bid to answer questions such as: "What is the prevalence of different oral conditions reported by pregnant women?", "What is the prevalence of adverse pregnancy outcomes amongst pregnant patients who had oral care as well as in those who did not have oral care at Eastern Regional Hospital, Koforidua?" and "What effect does receipt of oral health care have on pregnancy outcomes?"

6.3 Conclusion

In this study, we can conclude that Dental attendance by pregnant women was very low compared to another sub-Saharan African country with a national oral health policy.

Those who reported to the dental department came in for acute reasons predominantly Dental Caries (a painful disease that is highly preventable by the receipt of routine oral health care). Percentage of pregnant women who had adverse pregnancy outcomes associated with poor oral health was less in those who had oral healthcare than in those who did not have oral healthcare. However, the protective effect of the receipt of oral healthcare on the occurrence of related adverse pregnancy outcomes was statistically insignificant.

The study, however, revealed that the age distribution of ANC visits (from 30 years to 39 years and 40 and above) of respondents was statistically significant with a strong association.

This study may however move the issue of pregnant women requiring dental services for their wellbeing as well as that of their babies from the agenda universe (all ideas that could possibly be brought up and discussed in a society or a political system) into at least the systemic agenda (all public issues that are viewed as requiring governmental attention).

6.4 Recommendations

- More research ought to be done into pregnancy outcomes after oral care during pregnancy.
- Ministry of Health of Ghana ought to formulate a national oral health policy to help provide wholistic health care in line with Sustainable Development Goal 3.
- More so, Dentists should continually educate people on how safe it is for pregnant women to seek oral care and the associated benefits as dictated by literature.
- Obstetricians and midwives must actively refer pregnant women to the dental department for oral healthcare.
- From the results obtained, the NHIS has given pregnant women access to antenatal care at lower costs and should be sustained.

6.5 Limitations of the Study

The study was limited in certain aspects. One constraint was that the study's scope was limited to only one public health facility out of the numerous public and private health facilities in the New Juabeng Municipality in particular and Eastern Region as a whole.

This limited the opportunity to compare the findings with other health institutions outside this municipality.

The information on the Electronic Medical Records Software (Health Administration and Management System) was inputted by clinicians, as such, it is possible that a human error could occur in inputting the details.

Scarcity of information provided in secondary data use was another limitation. For instance, the only sociodemographic factors available for my analysis were age and NHIS status, restricting the number of possible trends that could have been unveiled in this research. Notwithstanding the limitations of secondary source of data collection, great efforts were made to ensure that the methods and responses were valid and reliable by applying robust strategies to minimise biases.

Also, the likelihood that a pregnant woman attending antenatal care in the hospital under study is also obtaining a dental care service in a different hospital or vice versa was not explored.

Last but not least, not all adverse pregnancy outcomes were traceable given the nature if the data provided. The diagnosis "Low birth weight" was recorded in the neonates' folders which could not be linked to the antenatal and dental records of their mothers.

6.4 Future Studies

The above discussed limitations to the study should be resolved in future research endeavours. Researchers should try and include more district, municipal and metropolitan Assemblies to increase the number of health facilities and the sample size of participants. Since this study applied quantitative methods on secondary data, it was difficult to discover the reasons behind the results generated. This could be explored in future studies by applying qualitative methods to ensure clarity of the findings. If future studies will adopt mixed methods, then efforts should be made to apply probability sampling methods to ensure that the selection of participants is vigorous.

Additionally, future studies must identify the characteristics of women least likely to receive dental care during pregnancy.

References

Abariga, S. A. & Whitcomb, B. W. (2016). Periodontitis and Gestational Diabetes Mellitus: A Systematic Review and Meta-analysis of Observational Studies. *Biostatistics and Epidemiology Faculty Publications Series*, 16(344). https://doi.org/10.1186/s12884-016-1145-z

Adair, P. M., Pine, C. M., Burnside, G., Nicoll, A. D., Gillett, A., Anwar, S., Broukal, Z., Chestnutt, I. G., Declerck, D., Ping, F. X., Ferro, R., Freeman, R., Grant-Mills, D., Gugushe, T., Hunsrisakhun, J., Irigoyen-Camacho, M., Lo, E. C. M., Moola, M. H., Naidoo, S., ... Young, D. W. (2004). Familial and cultural perceptions and beliefs of oral hygiene and dietary practices among ethnically and socio-economically diverse groups. Community Dental Health, 21(1 SUPPL.), 102-111.

Adesina, K. T., Ernest, M. A., Tobin, A. O., Isiaka-Lawal, S. A., Adeyemi, M. F., Olarinoye, A. O., & Ezeoke, G. G. (2018). Oral health status of pregnant women in Ilorin, Nigeria. *Journal of Obstetrics and Gynaecology*, *38*(8), 1093-1098.

Agbaje, M. O. (2013). Dental caries in children- an assessment of the knowledge of Nigerian Paediatricians. *African journal of medicine and medical sciences*, *42*(2), 157-163.

Aikins, E. A., & Eigbobo, J. O. (2014). Child and maternal oral healthcare: An assessment of the knowledge of Nigerian and Ghanaian nurses. *East African medical journal*, *91*(2), 37-43.

Al Habashneh, R., Guthmiller, J. M., Levy, S., Johnson, G. K., Squier, C., Dawson, D. V., & Fang, Q. (2005). Factors related to utilization of dental services during pregnancy. *Journal of clinical periodontology*, *32*(7), 815–821. https://doi.org/10.1111/j.1600-051X.2005.00739.x

Al-Habashneh, R., Aljundi, S. H., & Alwaeli, H. A. (2008). Survey of medical doctors' attitudes and knowledge of the association between oral health and pregnancy outcomes. *International journal of dental hygiene*, *6*(3), 214-220.

American Academy of Pediatric Dentistry. (2011). Guideline on perinatal oral health care. *Reference Manual*, *33*(11/12), 118-123.

American Academy of Pediatrics. (2017, January 30). Pregnancy and Oral Health: Truth or Fiction? HealthyChildren.org. Retrieved March 14, 2022, from

https://www.healthychildren.org/English/ages-stages/prenatal/Pages/Pregnancy-and-Oral-Health-Truth-or-Fiction.aspx

Annan, B. D. R. T., & Nuamah, K. (2005). Oral pathologies seen in pregnant and non-pregnant women. *Ghana medical journal*, *39*(1), 24-27.

Aryeetey, R., Aikins, M., Dako-Gyeke, P., & Adongo, P. B. (2015). Pathways Utilized for Antenatal Health Seeking Among Women in the Ga East District, Ghana. Ghana medical journal, 49(1), 44–49. https://doi.org/10.4314/gmj.v49i1.8

Braimoh, O. B., & Ilochonwu, N. A. (2014). Oral health awareness and experience among pregnant women in a Nigerian tertiary health institution. *Journal of Dental Research and Review*, *1*(2), 66–69. https://www.jdrr.org/article.asp?issn=2348-2915;year=2014;volume=1;issue=2;spage=66;epage=69;aulast=Bashiru;aid=JDentResRev_2014_1_2_66_133936

Boggess, K. A., & Edelstein, B. L. (2006). Oral health in women during preconception and pregnancy: implications for birth outcomes and infant oral health. Maternal and child health journal, 10(5 Suppl), S169–S174. https://doi.org/10.1007/s10995-006-0095-x

Borrell, L. N., Burt, B. A., Neighbors, H. W., & Taylor, G. W. (2004). Social factors and periodontitis in an older population. *American journal of public health*, *94*(5), 748–754. https://doi.org/10.2105/ajph.94.5.748

Bowling, A. (2005) Concepts of functioning, health, well-being and quality of life. In: Measuring health. A review of quality of life measurement scales. 3rd ed. Maidenhead: Open University Press; P. 1-9.

Centers for Disease Control and Prevention. (2019, February 19). *Pregnancy and oral health feature*. Centers for Disease Control and Prevention. Retrieved November 9, 2021, from https://www.cdc.gov/oralhealth/publications/features/pregnancy-and-oral-health.html.

Centers for Disease Control and Prevention. (2021, August 10). *Gestational diabetes*. Centers for Disease Control and Prevention. Retrieved June 8, 2022, from https://www.cdc.gov/diabetes/basics/gestational.html

Christensen, L. B., Jeppe-Jensen, D., & Petersen, P. E. (2003). Self-reported gingival conditions and self-care in the oral health of Danish women during pregnancy. *Journal of clinical periodontology*, *30*(11), 949-953.

Corchuelo-Ojeda, J. (2013) Social determinants and lifestyle on oral health in access to dental calendar pregnant in 2012 (in Spanish). *Rev Fac Nac Salud Pública* 31: 170-180.

Corchuelo-Ojeda, J., Perez, G. J. (2014) Socioeconomic determinants of dental care during pregnancy in Cali, Colombia(in Spanish*). Cad Saude Punlica* 30: 2209-2218.

Council on Clinical Affairs, (2009). Guideline on Perinatal Oral Health Care. *American Academy of Pediatric Dentistry*,135-140.

Cristi, M. C., Gambacorta, V., Di Giovann, A., Pindozzi, S., Tassi, L., Daniele, P., & Ricci, G. (2019). Increased Epulis gravidarum prevalence in women with both nasal and oral symptoms. *Otolaryngology – Open Journal, 5*(1), 18-21. doi:10.17140/otloj-5-154

Damle, S. G., Yadav, R., Garg, S., Dhindsa, A., Beniwal, V., Loomba, A., & Chatterjee, S. (2016). Transmission of mutans streptococci in mother-child pairs. The Indian journal of medical research, 144(2), 264–270. https://doi.org/10.4103/0971-5916.195042

Dasanayake, A. P., & Naftolin, F. (2016). The association between periodontitis and preterm labor (PTL). In A clinician's guide to systemic effects of periodontal diseases (pp. 67-79). Springer, Berlin, Heidelberg.

Datta, S., Kodali, B. & Segal, S. (2010). Maternal Physiological Changes During Pregnancy, Labor, and the Postpartum Period. 10.1007/978-0-387-88602-2_1.

Der, E. M., Moyer, C., Gyasi, R. K., Akosa, A. B., Tettey, Y., Akakpo, P. K., Blankson, A., & Anim, J. T. (2013). Pregnancy related causes of deaths in Ghana: a 5-year retrospective study. *Ghana medical journal*, *47*(4), 158–163.

Dinas, K., Achyropoulos, V., Hatzipantelis, E., Mavromatidis, G., Zepiridis, L., Theodoridis, T., Dovas, D., Tantanasis, T., Goutzioulis, F., & Bontis, J. (2007). Pregnancy and oral health: utilisation of dental services during pregnancy in northern Greece. *Acta obstetricia et gynecologica Scandinavica*, *86*(8), 938–944. https://doi.org/10.1080/00016340701371413

Dülgergil, O., Dalli, M., Hamidi, M., & ÇOlak, H. (2013). Early childhood caries update: A review of causes, diagnoses, and treatments. *Journal of Natural Science, Biology and Medicine*, *4*(1), 29. https://doi.org/10.4103/0976-9668.107257

Eastern Regional Hospital, 2017. *About Us*. [online] Erhk.org. Available at: <http://erhk.org/aboutus.html#info2-5j> [Accessed 4 May 2022].

Gaffield, M. L., Gilbert, B. J. C., Malvitz, D. M., & Romaguera, R. (2001). Oral health during pregnancy: an analysis of information collected by the pregnancy risk assessment monitoring system. *The Journal of the American Dental Association*, *132*(7), 1009-1016.

Gajendra, S., & Kumar, J. V. (2004). Oral health and pregnancy: a review. *New York State Dental Journal*, *70*(1), 40.

George, A., Dahlen, H., Reath, J. *et al.* What do antenatal care providers understand and do about oral health care during pregnancy: a cross-sectional survey in New South Wales, Australia. *BMC Pregnancy Childbirth* **16,** 382 (2016). https://doi.org/10.1186/s12884-016-1163-x

George, A., Johnson, M., Duff, M., Blinkhorn, A., Ajwani, S., Bhole, S., & Ellis, S. (2011). Maintaining oral health during pregnancy: perceptions of midwives in Southwest Sydney. *Collegian*, *18*(2), 71-79.

Ghana Web. (2006, July 4). Health Ministry developing National Oral Health Policy. Retrieved December 1, 2021, from https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Health-Ministry-developing-National-Oral-Health-Policy-106837

Goka, R.Y., Nyako, E., Sackeyfio, J., Hewlett, S., Ndanu, T., Konadu, A. and Ankoh, S., 2022. Periodontal health status of pregnant women attending three ante-natal clinics in Accra,Ghana. *Post Graduate Medical Journal of Ghana*, [online] 11, pp.63-68. Available at: <https://www.researchgate.net/publication/359300556_Periodontal_health_status_of_pregnant_women_attending_three_ante-natal_clinics_in_AccraGhana/citation/download> [Accessed 9 April 2022].

Gupta, R., & Acharya, A. K. (2016). Oral Health Status and Treatment Needs among Pregnant Women of Raichur District, India: A Population Based Cross-Sectional Study. *Scientifica*, *2016*, 1–8. https://doi.org/10.1155/2016/9860387

Hersh, E. (2019). Dry mouth in pregnancy: Causes, symptoms, and treatments. Retrieved November 09, 2021, from https://www.healthline.com/health/dry-mouth-pregnancy

Huang, X., Wang, J., Liu, J., Hua, L., Zhang, D., Hu, T., & Ge, Z. L. (2014). Maternal periodontal disease and risk of preeclampsia: a meta-analysis. *Journal of Huazhong University of Science and Technology. Medical sciences = Hua zhong ke ji da xue*

xue bao. Yi xue Ying De wen ban = Huazhong keji daxue xuebao. Yixue Yingdewen ban, *34*(5), 729–735. https://doi.org/10.1007/s11596-014-1343-8

Hullah, E., Turok, Y., Nauta, M., & Yoong, W. (2008). Self-reported oral hygiene habits, dental attendance and attitudes to dentistry during pregnancy in a sample of immigrant women in North London. *Archives of gynecology and obstetrics*, *277*(5), 405-409.

Jauhal Dental. (2015, May 08). Acid reflux and oral health. Retrieved November 09, 2021, from https://jauhaldental.com/acid-reflux-and-oral-health/

Jafri, Z., Bhardwaj, A., Sawai, M., & Sultan, N. (2015). Influence of female sex hormones on periodontium: A case series. *Journal of natural science, biology, and medicine*, *6*(Suppl 1), S146–S149. https://doi.org/10.4103/0976-9668.166124

Jeffcoat, M. K., Geurs, N. C., Reddy, M. S., Goldenberg, R. L., & Hauth, J. C. (2001). Current evidence regarding periodontal disease as a risk factor in preterm birth. *Annals of Periodontology*, *6*(1), 183-188.

Jose, B., & King, N. M. (2003). Early childhood caries lesions in preschool children in Kerala, India. *Pediatric dentistry*, *25*(6).

Kashetty, M., Kumbhar, S., Patil, S., & Patil, P. (2018). Oral hygiene status, gingival status, periodontal status, and treatment needs among pregnant and nonpregnant women: A comparative study. Journal of Indian Society of Periodontology, 22(2), 164–170. https://doi.org/10.4103/jisp.jisp_319_17

Khader, Y. S., Bawadi, H. A., Haroun, T. F., Alomari, M., & Tayyem, R. F. (2009). The association between periodontal disease and obesity among adults in Jordan. *Journal of clinical periodontology*, *36*(1), 18-24.

Kushtagi, P., Kaur, G., Kukkamalla, M. A., & Thomas, B. (2008). Periodontal infection in women with low birth weight neonates. *International Journal of Gynecology & Obstetrics*, *101*(3), 296-298.

Lin, S. (2018) Normal Mouth Changes During Pregnancy *The functional Dentist* https://www.drstevenlin.com/mouth-changes-during-pregnancy/

Madianos, P. N., Lieff, S., Murtha, A. P., Boggess, K. A., Auten Jr, R. L., Beck, J. D., & Offenbacher, S. (2001). Maternal periodontitis and prematurity. Part II: Maternal infection and fetal exposure. *Annals of Periodontology*, *6*(1), 175-182.

Marchi, K. S., Fisher-Owens, S. A., Weintraub, J. A., Yu, Z., & Braveman, P. A. (2010). Most pregnant women in California do not receive dental care: findings from a population-based study. *Public health reports (Washington, D.C. : 1974)*, *125*(6), 831–842. https://doi.org/10.1177/003335491012500610

March of Dimes (Ed.). (2019, June). Dental Health during pregnancy. Retrieved November 09, 2021, from https://www.marchofdimes.org/pregnancy/dental-health-during-pregnancy.aspx

Marks J. S. (2009). Epidemiology, public health, and public policy. *Preventing chronic disease*, *6*(4), A134.

Meija, G., Jameson, L. M., Ha, D., Spencer, A. J. (2014) Greater inequalities in dental treatment than in disease experience. *J Dent Res.* 93:966-71.

Meyer, F., & Enax, J. (2018). Early Childhood Caries: Epidemiology, Aetiology, and Prevention. *International Journal of Dentistry*, *2018*, 1–7. https://doi.org/10.1155/2018/1415873

Ministry of Health Republic of Ghana. (2020, January). National Health Policy: Ensuring healthy lives for all (Revised Edition). https://www.moh.gov.gh/wp-content/uploads/2020/07/NHP_12.07.2020.pdf-13072020-FINAL.pdf

Muza, S., L. C. C. E. (2022, May 9). How to have a healthy pregnancy after 30. Verywell Family. Retrieved June 9, 2022, from https://www.verywellfamily.com/pregnancy-in-your-thirties-4147320

Nowak, A. J., Christensen, J. R., & Mabry, T. R. (2019). Dental Caries (M. H. Wells, Ed.). In Pediatric dentistry: Infancy through adolescence (Sixth ed., pp. 169-179). Philadelphia: Elsevier. doi:https://doi.org/10.1016/B978-0-323-60826-8.00012-2.

NCT (National Childbirth Trust). (2019, July 11). Excessive saliva in pregnancy. Retrieved November 09, 2021, from https://www.nct.org.uk/pregnancy/worries-and-discomforts/common-discomforts/excessive-saliva-pregnancy

NHS. (2019, February 5). Dental Abscess. NHS choices. Retrieved June 1, 2022, from https://www.nhs.uk/conditions/dental-abscess/

Onigbinde, O. O., Sorunke, M. E., Braimoh, M. O., & Adeniyi, A. O. (2014). Periodontal status and some variables among pregnant women in a Nigeria tertiary institution. *Annals of medical and health sciences research*, *4*(6), 852-857.

Onwuka, C., Onwuka, C.I., Iloghalu, E.I. *et al.* Pregnant women utilization of dental services: still a challenge in low resource setting. *BMC Oral Health* **21,** 384 (2021). https://doi.org/10.1186/s12903-021-01746-2

Papapanou, P. N. (2015). Systemic effects of periodontitis: lessons learned from research on atherosclerotic vascular disease and adverse pregnancy outcomes. *International dental journal*, *65*(6), 283-291.

Petersen, P. E. (2010) Improvement of global oral health - the leadership role of the World Health Organization *Community Dental Health* 27, 194–199 doi:10.1922/CDH_2760Petersen05 Poul Erik Petersen

Preeclampsia Foundation. (2020). Preeclampsia - cause of preeclampsia. Retrieved November 10, 2021, from https://www.preeclampsia.org/cause-of-preeclampsia

Radnai, M., Gorzó, I., Urbán, E., Eller, J., Novák, T., & Pál, A. (2006). Possible association between mother's periodontal status and preterm delivery. *Journal of Clinical Periodontology*, *33*(11), 791-796.

Ramos-Gomez, F., Weintraub, J., Gansky, S., Hoover, C., & Featherstone, J. (2003). Bacterial, behavioral and environmental factors associated with early childhood caries. *Journal of clinical pediatric dentistry*, *26*(2), 165-173.

Romero, R., Gotsch, F., Pineles, B., & Kusanovic, J. P. (2007). Inflammation in pregnancy: its roles in reproductive physiology, obstetrical complications, and fetal injury. *Nutrition reviews*, *65*(suppl_3), S194-S202.

Russell, S. L., & Mayberry, L. J. (2008). Pregnancy and oral health: a review and recommendations to reduce gaps in practice and research. *MCN: The American Journal of Maternal/Child Nursing*, *33*(1), 32-37.

Scannapieco, F. A., Bush, R. B., & Paju, S. (2003). Associations between periodontal disease and risk for atherosclerosis, cardiovascular disease, and stroke. A systematic review. *Annals of Periodontology*, *8*(1), 38-53.

Shamsi, M., Hidarnia, A., Niknami, S., Rafiee, M., & Karimi, M. (2013). Oral health during pregnancy: A study from women with pregnancy. *Dental research journal*, *10*(3), 409.

Silk, H., Douglass, A. B., Douglass, J. M., & Silk, L. (2008). Oral health during pregnancy. *American family physician*, *77*(8), 1139-1144.

Singhal, A., Chattopadhyay, A., Garcia, A.I. *et al.* (2014) Disparities in Unmet Dental Need and Dental Care Received by Pregnant Women in Maryland. *Matern Child Health J* 18, 1658–1666. https://doi.org/10.1007/s10995-013-1406-7

Spasoff R. (1999) *Epidemiologic Methods for Health Policy* Oxford University Press

Steele, J., Shen, J., Tsakos, G., Fuller, E., Morris, S., Watt, R., Guarnizo-Herreño, C., & Wildman, J. (2015). The Interplay between Socioeconomic Inequalities and Clinical Oral Health. *Journal of Dental Research*, *94*(1), 19–26. https://doi.org/10.1177/0022034514553978

Szatko, F., Wierzbicka, M., Dybizbanska, E., Struzycka, I., & Iwanicka-Frankowska, E. (2004). Oral health of Polish three-year-olds and mothers' oral health-related knowledge. *Community dental health*, *21*(2), 175-180.

The Children's Hospital of Philadelphia. (2014, August 24). *Low birthweight.* Retrieved November 10, 2021, from https://www.chop.edu/conditions-diseases/low-birthweight

Thomas, N. J., Middleton, P. F., & Crowther, C. A. (2008). Oral and dental health care practices in pregnant women in Australia: a postnatal survey. *BMC pregnancy and childbirth*, *8*(1), 1-6.

Timothé, P., Eke, P. I., Presson, S. M., & Malvitz, D. M. (2005). Dental care use among pregnant women in the United States reported in 1999 and 2002. *Preventing chronic disease*, *2*(1), A10.

Tsakos, G., Demakakos, P., Breeze, E., Watt, R. G. (2011). Social gradients in oral health in older adults: findings fro the English longitudinal survey of aging. *Am J Public Health*. 101:1892-9.

University of Utah. (2021). Preterm labor: What are the causes & symptoms? Retrieved November 10, 2021, from https://healthcare.utah.edu/womenshealth/pregnancy-birth/preterm-birth/preterm-labor-causes-symptoms.php

UW Medicine. (n.d). Gestational diabetes: Causes, symptoms & treatment. Retrieved November 10, 2021, from https://www.uwmedicine.org/conditions-symptoms/pregnancy-postpartum/gestational-diabetes

Vamos, C. A., Thompson, E. L., Avendano, M., Daley, E. M., Quinonez, R. B., & Boggess, K. (2015). Oral health promotion interventions during pregnancy: a systematic review. *Community dentistry and oral epidemiology*, *43*(5), 385-396.

Vergnes, J. N., Pastor-Harper, D., Constantin, D., Bedos, C., Kaminski, M., Nabet, C., Sixou, M., & Rouillon, F. (2013). Santé bucco-dentaire perçue et recours aux soins pendant la grossesse : étude MaterniDent [Perceived oral health and use of dental services during pregnancy: the MaterniDent study]. *Sante publique (Vandoeuvre-les-Nancy, France)*, *25*(3), 281–292.

Vogt, M., Sallum, A. W., Cecatti, J. G., & Morais, S. S. (2012). Factors associated with the prevalence of periodontal disease in low-risk pregnant women. Reproductive health, 9, 3. https://doi.org/10.1186/1742-4755-9-3

Watson, C. A., Nilam, S. (2017) Educational level as a social determinant of health and its relationship to periodontal disease as a health outcome. *J Dent Sci Ther.* 1:8-11.

Wagner, Y., Heinrich-Weltzien, R. Midwives' oral health recommendations for pregnant women, infants and young children: results of a nationwide survey in Germany. *BMC Oral Health* **16**, 36 (2016). https://doi.org/10.1186/s12903-016-0192-1

Wooten, K. T., Lee, J., Jared, H., Boggess, K., & Wilder, R. S. (2011). Nurse practitioner's and certified nurse midwives' knowledge, opinions and practice behaviors regarding periodontal disease and adverse pregnancy outcomes. *American Dental Hygienists' Association*, *85*(2), 122-131.

World Health Organization *Maternal Mortality*. (2016). Available from: http://www.who.int/mediacentre/factsheets/fs348/en/ (Accessed: October 7, 2021).

Yenen, Z., & Ataçağ, T. (2019). Oral care in pregnancy. *Journal of the Turkish German Gynecological Association*, *20*(4), 264–268.

Zechmeister, E. B., Shaughnessy, J. J., & Zechmeister, J. S. (1997). *A practical introduction to research methods in psychology*. McGraw-Hill Humanities, Social Sciences & World Languages.

Zenk J. K. (2016). The ADA Council on Access, Prevention, and Interprofessional Relations. *Northwest Dentistry*, *95*(3), 7–8.

Appendix

I. Curriculum Vitae of Principal Investigator

Personal information

NAME: Ama Amaning-Darko (Dr.)

ADDRESS: P. O. BOX AN 6880, Accra-North

RESIDENTIAL ADDRESS: Dome Pillar 2, Asafo Adjei, Kwasi Oppong Street, DNT/B/027A

DATE OF BIRTH: 25th May, 1991

NATIONALITY: Ghanaian

MARITAL STATUS: Married

CHILDREN: 1

MOBILE NUMBER: +233 (0) 243 419 788

EMAIL ADDRESS: amaadarko@yahoo.com ; amaadarko@gmail.com

Educational Background

INSTITUTION	DURATION	QUALIFICATION
University of Ghana School of Public Health (WEEKEND)	Ongoing	Masters in Public Health

Alliance Francaise d'Accra	April - June 2018	French Certificate (Level B1)
University of Glasgow Dental School, Scotland	October 2016	Clinical Elective Programme
University of Ghana School of Medicine and Dentistry	September 2010 - September 2017	Bachelor of Medical Sciences &Bachelor of Dental Surgery
Wesley Girls High School	September 2006 – May 2009	West African Certificate Examination
God's Grace International School	September 1993 – April 2006	Basic Education Certificate Examination

Work Experience

INSTITUTION	DURATION	POSITION
Tetteh Quarshie Memorial Hospital	April 2021 till date	Medical Officer
Ridge Hospital	Oct 2019 to Oct 2020	Senior House Officer
37 Military Hospital	Sept 2018 to Sept 2019	House Officer
Excel Dental Clinic	June to July 2018	Observership
Blessmay Ventures (Import)	March to April 2018	Bookkeeper
Holy Trinity Medical Medical Centre (Dental department)	June 2011 to July 2011 (Vacation period)	Observership
New Horizon Special School	March 2010 to July 2010	Teacher

New Horizon Special School	November 2009 to February 2010	Volunteer

Extracurricular Activities

In 2018, I was chosen by the Ghana Dental Association in advertising material to represent the association in the new educational advertising campaign on tooth sensitivity being run by Unilever.

I occasionally write to educate the general public on Oral Health Issues through:

- Newspaper articles
- My blog at talkdentistrygh.wordpress.com
- Facebook under the hashtag : #DrAmaTalksDentistry

I have given Public Health Education talks at:

- Pepsodent Ghana's Facebook page on 4th and 5th September, 2020
- The Ghana National Police Training School organized by the University of Ghana Dental School at on June 21, 2017 (Oral Health Education Programme)

- Pure Fire Ministries organized on April 6, 2017. (Oral Health Education Programme)
- Agricultural Development Bank Head office on October 28, 2020 (Breast Cancer Awareness Programme)

I am currently the Vice President of my basic school alumni group (God's Grace International School 2006 alumni).

My hobbies are drawing, reading and writing.

Referees

1. Dr Emma Vasco
Head of Dental Department
Consultant Periodontologist
Ridge Hospital, Accra
+233 (0) 244 699 781

2. Dr Frederick Arhin
37 Military Hospital
Consultant Oral & Maxillofacial Surgeon
Neghelli barracks, Accra
+233 (0) 244 858 952

II. Curriculum Vitae of Supervisor

FRANCES BAABA da-COSTA VROOM

P.O. Box LG13, School of Public Health, University of Ghana, Legon,

Tel: (026) 7338320, fbvroom@ug.edu.gh

Profile: Baaba is a Health Informatics Specialist and Lecturer with approximately 11 years experience. She has engaged in research on topics such as mHealth, technology acceptance and health informatics education. She has also worked and consulted on projects on digital health capacity building, digital health competency frameworks and curriculum development. Baaba enjoys reading, cooking and sharing knowledge. She constantly seeks to engage in productive activities that can impact people.

EDUCATION

- PhD Public Health, **University of Ghana, Legon,** July 2017
- MSc. Health Informatics, **University of Ghana, Legon, Ghana,** September 2008
- Bachelor of Information Systems, **St. Francis Xavier University, Antigonish NS, Canada,** May 2002

AWARDS

- Queen Elisabeth Scholar, Early Career Researcher, **University of Ghana & McGill University**, November 2019 - March 2021
- Short-term Postdoctoral Visiting Scholar, **University of South Florida**, June - 8August 2019

RESEARCH INTERESTS

- Mobile Health (mHealth)
- Digital Health Capacity Building
- Health data quality improvement
- Technology acceptance in Health
- Workflow and process engineering

PROJECTS

Co-ordinator : Rapid review to determine viable interventions which would promote increased consumption of protein and micronutrient-rich foods, improve health outcomes and household incomes within farming communities. Commissioned by Global Alliance

for Improved Nutrition. PI: Prof. Richmond Aryeetey. Completed November 2018.

Principal Investigator: Feasibility of Mobile Health for Treatment Coverage Reporting: Lymphatic Filariasis Control Programme in Ghana, PhD research 2013 - 2017.

Co-PI : Review of Master of Health Informatics Programme at the School of Public, Co-PIs: Alfred Yawson, Samuel Dery, Seth Afagbedzi. Ongoing

Co-PI: Knowledge, Attitudes and Use of ICT Tools and E-Health by Students of the College of Health Sciences, University of Ghana, Co-PIs: Samuel Dery, Seth Afagbedzi, Duah Dwomoh. Completed, 2014

CONSULTANCIES / WORKSHOPS

Consultant for Health Information Systems Programme (HISP)- South Africa. Curriculum Development Writer Services. December 2020

Consultant International Telecommunication Union. Conversion of digital health training material into an online self-paced course. December 2020

Consultant World Health Organisation Africa Regional Office, Development of a digital health curriculum based on the WHO AFRO and ITU digital training materials, May 2020

Consultant for World Health Organisation Africa Regional Office, Rapid Review and Policy options for Open Data Sharing in Francophone and Lusophone Member States, February 2020

Consultant for World Health Organisation Africa Regional Office, Rapid Review and Policy options for Open Data Sharing in Anglophone Member States, March 2019

Consultant, Global Fund LFA Spot Check on Key Population Service Delivery, Nigeria, November 2018

Facilitator, Capacity Building workshop for Managers of Routine Health Information Systems in the ECOWAS Region, organised by the School of Public Health, University of Ghana, July 2017

Consultant for MEASURE Evaluation, Review of capability maturity model for Health Information Systems interoperability and mHealth data security guidelines, July 2017

Facilitator, Medical Informatics Continuous Professional Development for health professionals, organised by the School of Medical Sciences, University of Cape Coast, April 2016

PEER-REVIEWED PUBLICATIONS

Nti, J., Afagbedzi, S., **Da-Costa Vroom, F. B.**, Ibrahim, N. A., & Guure, C. (2021). Variations and Determinants of Anemia among Reproductive Age Women in Five Sub-Saharan Africa Countries. *BioMed Research International*, *2021*. https://doi.org/10.1155/2021/9957160

Guure, C., Owusu, S., Dery, S., **da-Costa Vroom, F. B.**, & Afagbedzi, S. (2020). Comprehensive Knowledge of HIV and AIDS among Ghanaian Adults from 1998 to 2014: A Multilevel Logistic Regression Model Approach. Scientifica, 2020, 1-10. doi:10.1155/2020/7313497

Were, M. C., Kimutai, S., **da-Costa Vroom, F. B.**, Twizere, C., & Wright, G. (2019). Harmonizing Minimum Competencies for Masters in Health Informatics Programs in Africa Leveraging University Accreditation Bodies and Professional Societies. Paper presented at the 12th Health Informatics in Africa Conference (HELINA 2019), Gaborone, Botswana. https://conf.helina-online.org/public/2019_Helina_Proceedings_Part1.pdf

Nangsangna, R. D., & **da-Costa Vroom, F**. (2019). Factors influencing online health information seeking behaviour among patients in Kwahu West Municipal, Nkawkaw, Ghana. Online J Public Health Inform, 11(2), e13. doi:10.5210/ojphi.v11i2.10141

Guure, C., Maya, E. T., Dery, S., **da-Costa Vroom, B**., Alotaibi, R. M., Rezk, H. R., & Yawson, A. (2019). Factors influencing unmet need for family planning among Ghanaian married/union women: a multinomial mixed effects logistic regression modelling approach. Archives of Public Health, 77(1). doi:10.1186/s13690-019-0340-6

Gyapong, J. O., Owusu, I. O., **da-Costa Vroom, F. B.**, Mensah, E. O., & Gyapong, M. (2018). Elimination of lymphatic filariasis: current perspectives on mass drug administration. Research and Reports in Tropical Medicine, Volume 9, 25-33. doi:10.2147/rrtm.s125204

da-Costa Vroom, F., Godi, A., Dery, S., & Afagbedzi, S. (2017). Perceptions of EMR usage by health sciences students in Ghana. J Health Inform Afr., 4(1), 58-67. doi:10.12856/JHIA-2017-v4-i1-166

Dery, S., **da-Costa Vroom, F.**, Godi, A., Afagbedzi, S., & Dwomoh, D. (2016). Knowledge and use of information and communication technology by health science students of the University of Ghana. Ghana Medical Journal, 50(3), 180-188.

Nonvignon, J., Mensah, E., **da-Costa Vroom, B. F.**, Adjei, S., & Gyapong, J. O. (2016). The Role of Health Systems in the Control of Neglected Tropical Diseases in Sub-Saharan Africa. In J. Gyapong & B. Boatin (Eds.), Neglected Tropical Diseases - Sub-Saharan Africa (1 ed.): Springer International Publishing.

da-Costa Vroom, F. B., Aryeetey, R., Boateng, R., Anto, F., Aikins, M., Gyapong, M., & Gyapong, J. (2015). Data reporting constraints for the lymphatic filariasis mass drug administration activities in two districts in Ghana: A qualitative study. SAGE Open Medicine, 3. doi: 10.1177/2050312115594083

Aikins, M., **da-Costa Vroom, B.**, & Dery, S. K. K. (2014). Human Resource for eHealth care delivery: The State of the Ghanaian Health Sector. In Prof. C. Charles Mate-Kole (Ed.), Public Health Issues in Ghana: Practice, Interventions and Control Strategies (pp. 33-48). Tema: Digibooks Ghana Ltd.

SELECTED EXTENSION SERVICES

July 2021, **Presenter**, Ghana Health Service Better eHealth Regional Hub

June 2021, **Moderator**, WHO's Workshop on Data Revolution, Health Status Transformation and Artificial Intelligence for Health and Pandemic Preparedness in the African Context

December 2020, **Panelist,** Discussion on developing a digital health competency framework.

August 2020, **Webinar Panelist**, Global Digital Health Network August Meeting

August 2020 **Chair**, Panel of Assessors for National Accreditation Board

December 2019 **Chair**, Panel of Assessors for National Accreditation Board

February 2019 **Chair**, Panel of Assessors for National Accreditation Board

December 2018 **Chair**, Panel of Assessors for National Accreditation Board

PROFESSIONAL ASSOCIATION MEMBERSHIP

Ghana Health Informatics Association, **Full Member** 2011- Present

Health Informatics in Africa, **Board Member** 2014 - Present

EMPLOYMENT HISTORY

Senior Lecturer Department of Biostatistics, School of Public Health

August 2020 - Present

Lecturer Department of Biostatistics, School of Public Health

August 2017 - July 2020

Tutor Department of Biostatistics, School of Public Health

January 2011 - July 2017

IT Specialist Ghana-Canada Medical Centre, Adjiringanor, Ghana September 2008 – March 2011

- Coordinated development of a Hospital Management System
- Evaluated new hardware and software to meet company requirements. Made purchase recommendations, including helping users assess needs and providing justification for equipment and services.
- Trained staff to upgrade computer literacy and use of hardware and software

applications as needed to perform job functions.

- Setup and maintained network systems and related peripheral equipment; performed basic network administration and security functions ensuring system integrity and security.

Assistant Information Systems Manager, FutureGen Int'l Computers & Software Ltd, Port Hawkesbury, Canada June 2002-July 2005

- Managed inventory in store to ensure optimum levels at all times
- Responsible for accounts payable and receivables
- Resolved client computer hardware and software problems in store, on site and over the telephone
- Programmed and setup Point-of-Sale Systems (POS)
- Provided training for employees and other clients on POS systems
- Assisted manager on several networking installation assignments

Personal Profile:

Marital Status: Married

Date of birth: 3rd April, 1980

Hobbies: reading, cooking

III. Ethical clearance documents for initial study site (TQMH)

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted

My Ref. GHS/RDD/ERC/Admin/App 122/039
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Email: ethics.research@ghsmail.org
15th February 2022

Dr. Ama Amaning-Darko
University of Ghana, Legon School of Public Health
P. O. Box AN 6880, Accra- North

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 032/12/21**
Study Title	Prevalence of Reported Poor Oral Health Conditions in Pregnant Women and its Attendant Sequelae - A Case of Tetteh Quarshie Memorial Hospital
Approval Date	15th February, 2022
Expiry Date	14th February, 2023
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. James Akazili
(Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

IV. Ethical clearance for Amended Study site (ERHK)

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Divisi
Ghana Health Service
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Tel: +233-0302681109
Email: ethics.research@ghsmai

My Ref.ghs/rdd/erc/Admin/amend/app/22
Your Ref. No.

8th June, 2022

Dr Ama Amaning-Darko
P. O. Box AN 6880
Accra North.

RE: Request for Ethical Approval to Amended Protocol

Reference is made to your letter dated 4th May, 2022 on the above subject matter.

The Ghana Health Service Ethics Review Committee (GHS-ERC) has reviewed the documents submitted, and the rationale for the request for amendment. The GHS-ERC has given approval for the amendment to be implemented.

GHS-ERC Number	**GHSERC: 032/12/21**
Study Title	Oral Health Care During Pregnancy and Related Outcomes- A Case of Eastern Regional Hospital, Koforidua
Effective Date for Approval of Amendment	8th June, 2022
Expiry Date	14th February, 2023
GHS-ERC Decision	**Amendment Version** 1 final **dated**: 14th May, 2022 **Approved**

The approval covers the following only:

- **See attached appendix for details of the amendment.**

The following applies:

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC).
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.

- Submission of a final report **after completion** of the study.
- Informing ERC if study is discontinued and reasons why.
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol.

SIGNED.....

Mr. Kofi Wellington
(GHS-ERC Vice Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra