SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA, LEGON

ECONOMIC BURDEN OF DENTAL DISEASES OF PATIENTS ATTENDING THE DENTAL UNIT OF UNIVERSITY HOSPITAL, LEGON

BY

SELI YAWA DEH

(10506908)

THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT FOR THE AWARD OF MASTERS IN PUBLIC HEALTH DEGREE

JULY, 2015

DECLARATION

I declare that all information produced from this project is a result of my own research. Other works cited have been duly acknowledged by means of referencing. No part of this research has been presented elsewhere for another degree.

Signature: ……..

Seli Yawa Deh

(Student)

Date: ……..

Signature: ……

Dr. Genevieve Cecilia Aryeetey

(Supervisor)

Date: ……

DEDICATION

This dissertation is dedicated to my parents Dr. Kodjo Deh and Mrs. Josephine Deh and my friend Kwadwo Agyapong for the care and support given me throughout the course of this programme.

ACKNOWLEDGMENT

This dissertation was made possible through the valuable contribution by many individuals.

First and foremost, I express my sincere gratitude to Dr. Genevieve Cecilia Aryeetey for your guidance and supervision throughout this project. My special thanks goes to Professor Moses Aikins, Dr. Justice Nonvignon, Dr. Reuben Esena and the staff of the Department of Health Policy, Planning and Management for your assistance.

I would also like to thank my siblings and friends for their support and encouragement.

Finally, I would like to thank Edward Asiedu who assisted me at the data collection stage of this project as well as the staff of the dental unit, University Hospital, Legon and the patients who participated in the study for their assistance and cooperation.

ABSTRACT

Introduction: Dental health is essential to the general well-being of an individual. The most common oral diseases are dental caries and periodontal diseases. Significant economic costs are incurred by dental patients however limited studies have been conducted on the economic burden dental diseases place on its patients. This study therefore aimed to, estimate the costs of dental diseases and determine the economic burden of dental diseases on patients.

Methods: Cross-sectional design was used in this study. Data was collected from 185 patients attending the dental unit of University Hospital, Legon. Direct cost was estimated from medical and non-medical costs. Indirect cost was estimated by valuing productivity time lost to patients and intangible cost such as pain was described using the Likert scale. The socioeconomic differences in the cost of dental diseases were determined using the wealth quintiles of patients.

Results: The estimated total cost of dental diseases was GHS 27,184.00 (US$ 6,614.11) with the direct cost constituting 94.5% and indirect cost constituting 5.5% of the total cost profile. The mean cost was GHS 146.94 (US$ 35.75). The richer socioeconomic group had the highest cost per quintile with a mean of GHS 191.89 (US$ 46.69). The intangible cost described was highest for pain (49.2%).

Conclusion: The costs of dental diseases are enormous hence dental health services should be made affordable for patients. Oral health intervention programmes should focus more on preventive than curative care in order to prevent dental diseases with its associated health expenditure, productivity losses and intangible costs.

Keywords: direct cost, indirect cost, intangible cost, socioeconomic status, dental diseases

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CDC	Center for Disease Control and Prevention
COI	Cost of Illness
DALY	Disability Adjusted Life Year
GBD	Global Burden of Disease
HCA	Human Capital Approach
NHIS	National Health Insurance Scheme
OECD	Organisation for Economic Co-operation and Development
WHO	World Health Organisation
WTP	Willingness to Pay
YLD	Years Lived with Disability
YLL	Years of Life Lost

DEFINITION OF TERMS

Oral Health	The state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking and psychosocial wellbeing.
Dental diseases	Disease conditions that affect the teeth, gums, other tissues and parts of the mouth.
Direct cost	The value of health care resources that are consumed with respect to the prevention, diagnosis and treatment of disease or injury, as well as the provision of an intervention, including costs related to side effects or other current and future consequences.
Indirect Cost	Indirect costs represent the value of output lost due to illness or premature death.
Intangible Cost	Intangible costs are defined as sufferings and discomfort borne by a patient because of a disease.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Oral health is essential to the overall wellbeing of an individual. Poor oral health occurs from poor oral hygiene and other oral health related problems. Some oral diseases include oral infections, trauma, injuries, hereditary lesions and oral cancer among others. The commonest types of oral diseases are dental diseases. Dental diseases are disease conditions that affect the teeth and surrounding tissues. In this study, the terms "oral diseases" and "dental diseases" are used interchangeably.

The most common dental disease conditions are dental caries and periodontal disease. Dental caries affects about 90% of the world's population and periodontal diseases affects about 20% of the world's population while the global burden of dental diseases increased by 21% in the last 20 years (Marcenes et al., 2013). Currently, it is estimated that about 3.9 billion people are affected by the disease worldwide. Dental diseases are common in both developed and developing countries. According to Patel (2012), the prevalence of dental caries is irregularly distributed in Europe and in the last 30 years, Western Europe observed marked improvements in the prevalence of dental caries while some improvements were also recorded in Eastern Europe however, the prevalence of dental caries in Eastern and Central European children is still significant.

In developing countries, prevalence of the disease is still increasing despite many interventions taken to reduce the incidence of the disease. For instance, India and Pakistan have prevalence rates of 50% and 55% respectively (Datta & Datta, 2013; Dawani et al., 2012). Some North African countries like Egypt and Tunisia have prevalence rates of about 70% (Hamila, 2013) and

43% respectively (Maatouk et al., 2006). There are few studies on the overall burden of the disease in Africa but the World Health Organisation (WHO) attributes the greatest burden due to dental diseases to Eastern, Central and sub-Saharan Africa (Marcenes et al., 2013). This is evident in studies conducted in Kenya and Nigeria which reported about 49% and 60% prevalence of dental disease respectively (Bashiru & Omotunde, 2014). Dental caries prevalence of 55% was also reported among Ghanaian school children (Addo-Yobo et al., 1991) and Korle-Bu Teaching Hospital in Ghana recorded an increase of 75% in dental infections from 2010 to 2011.

Dental diseases are associated with some economic cost. These include direct costs which includes cost of treatment, indirect cost which comprises lost wages due to dental diseases and intangible costs such as pain and reduced quality of life (Cunningham, 2000). Patients incur costs when they access dental healthcare. For instance, individual households in Kenya finance oral health care mainly from out-of-pocket payments (Kaimenyi, 2004).

There are other non-monetary impact of dental diseases on society through reducing productivity and participation in the workforce. In Canada, over 40 million hours were lost due to dental problems and treatment with subsequent productivity losses of over $1 billion in 2009 (Hayes et al., 2013). The Australian economy also made about $2 billion per annum in productivity losses as a result of dental diseases (Richardson & Richardson, 2011).

Despite these economic costs incurred by patients who have dental diseases very few studies have been conducted on the economic burden that dental diseases place on its patients hence the need to conduct cost of illness studies (COI) in this area to estimate such costs associated with the dental diseases.

1.2 Statement of the problem

Dental diseases are a major public health concern globally. The costs of treating dental conditions can be enormous and the World Health Organisation (WHO) identifies oral diseases to be among the most expensive diseases to treat (Hayes et al., 2013). In industrialised countries, dental treatment accounts for between 5% and 10% of total health care expenditures of the health sector of the countries (WHO, 2013).

Countries within the European Union spent €54 billion on dental healthcare in 2004 (Patel, 2012) and in the United States, dental healthcare expenditure continues to rise. For instance, total dental expenditure for children aged 5-17 years amounted to $20 billion in 2009 (Centers for Disease Control and Prevention, 2014). The situation is different in the developing world. There are unmet population needs for oral health care in countries like Tanzania where the government's oral healthcare budget was inadequate to meet the increasing oral health needs of the population (Astrøm & Kida, 2007). In 2014, the University Hospital recorded more than 7,800 dental cases (GHS, 2015). Basic dental treatments are covered by the National Health Insurance (NHIS) and other private insurance providers but dental patients are compelled to make out-of- pocket payments when more advanced dental treatments which are not covered by the NHIS are required.

Indeed the treatment of dental diseases places significant economic costs on individuals and the society yet the economic impact of dental interventions has received limited attention in Ghana. This study seeks to identify the types of dental treatments received by patients who attend the dental unit at the University Hospital, Legon which provides a wide range of dental services and has a patient population with diverse background from the university community and

surrounding areas, as well as also to estimate the costs and determine the economic burden of dental diseases on these patients.

1.3 Conceptual framework for the economic burden of dental diseases

Economic burden of a disease is the total cost of a disease or an illness that is borne by an individual who suffers from the disease or businesses or societies who are responsible for payment of healthcare for employees or citizens. This study focuses on the economic burden of dental diseases on the individual. The costs associated with dental diseases include direct costs, indirect costs and intangible costs.

According to a working paper on cost estimation published in 2009 by the Institute of Quality and Efficiency in Healthcare, direct costs refer to the resource consumption in the provision of health care interventions. Patients incur these costs in the form of medical and non-medical costs. The medical costs cater for the payments made for dental consultation, diagnostics, treatment and medication. Some costs are covered by the National Health Insurance Scheme (NHIS) and other private health insurance providers while out-of-pocket payments are made for dental services that are not covered by insurance. The non-medical costs include travelling costs, cost of food and other miscellaneous expenses made because of the disease.

Indirect costs denote the production losses due to incapacity for work (in the case of illness); occupational disability (in the case of long-term illness or disability) or premature death. They are incurred by the patients who attend the hospital for treatment. This results in productivity losses to the patient due to lost work hours and lost earnings.

Intangible costs are defined as the pain and suffering associated with a disease. Dental diseases such as dental caries, periodontal disease, and dentoalveolar abscess cause the individual to

experience excruciating pain and suffering. Also, patients may have poorly arranged or missing teeth or poorly formed facial bones or fractured teeth in trauma cases. These dental conditions may affect the patient's self-esteem which may result in reduced social interaction. The sum of these costs constitutes the economic burden of dental diseases.

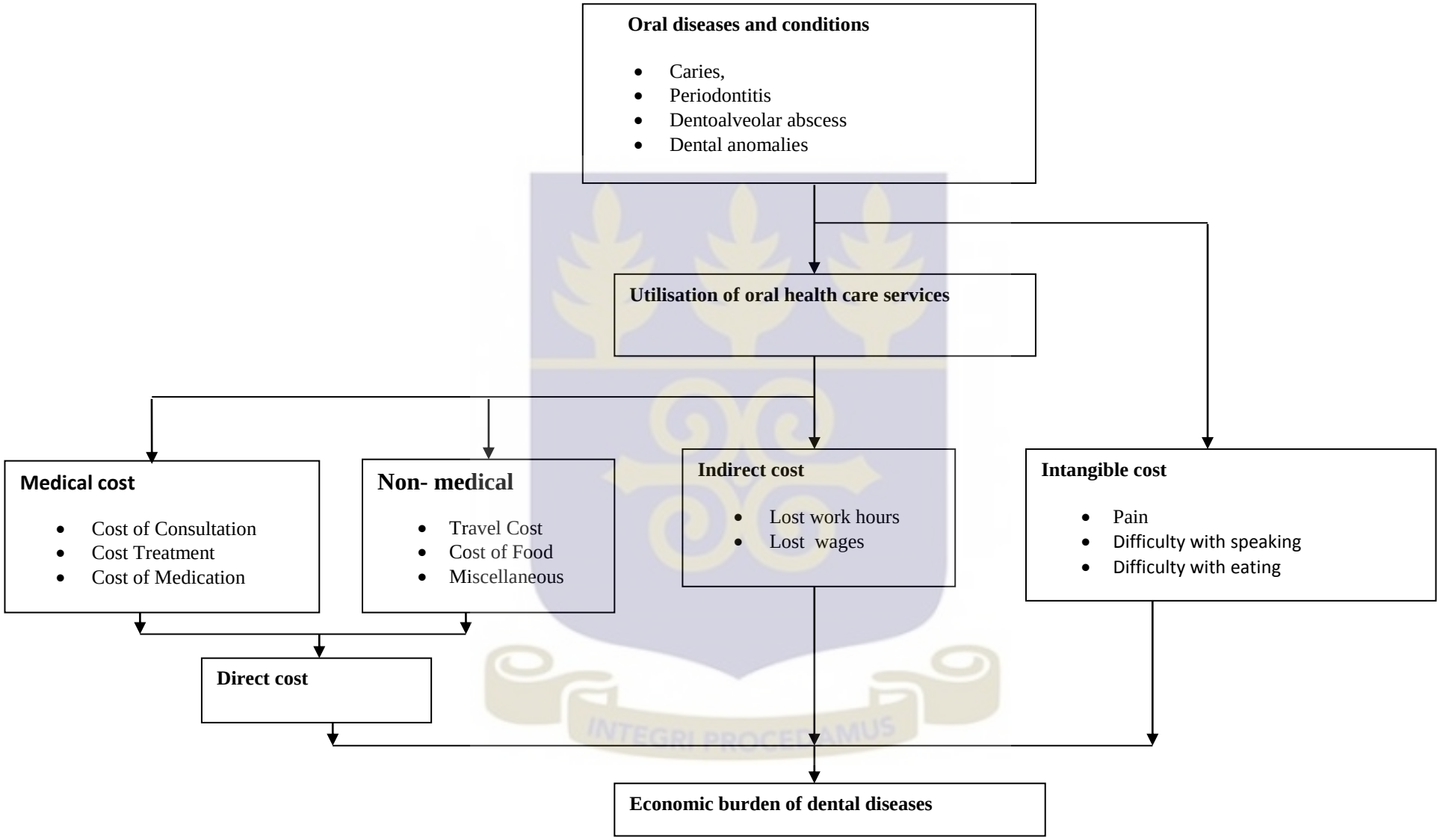

Figure 1: Conceptual framework for the economic burden of oral diseases

1.4 Justification

There is limited evidence on the economic burden of oral diseases on individuals and governments in Africa and Ghana in particular. As a result the country is unable to strategically organise and plan national and community oral health intervention programmes that can effectively address the oral health needs of communities in order to reduce the costs associated with dental diseases.

This study was carried out to show the effect of dental diseases on patients who attend University Hospital, Legon, and to identify the costs of treatment associated with dental diseases. This is to contribute to knowledge in this area and may influence stakeholders to take more preventive than curative measures towards dental conditions in order to reduce economic costs associated with dental diseases in Ghana.

1.5 Objectives

1.5.1 General Objectives

The general objective of this study is to determine the economic burden of dental diseases on patients attending the dental unit of University Hospital, Legon.

1.5.2 Specific Objectives

The specific objectives of this study are

1. To estimate the direct cost of dental diseases.
2. To estimate the indirect cost of dental diseases.
3. To describe the intangible cost of dental diseases.

4. To determine the socioeconomic differences in the cost of dental diseases.

1.5.3 Research Questions

The research questions for this study are as follows.

1. What are the direct costs associated with dental diseases?
2. What are the indirect costs associated with dental diseases?
3. What are intangible costs associated with dental diseases?
4. What are the socioeconomic differences in the cost of dental diseases?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Oral and Dental Health: definition, prevalence and effects

Oral health is defined as a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking and psychosocial wellbeing (WHO, 2012). It means being free of chronic oral-facial pain conditions, oral and pharyngeal (throat) cancers, oral soft tissue lesions, birth defects such as cleft lip and palate, and scores of other diseases and disorders that affect the oral, dental, and craniofacial tissues, collectively known as the craniofacial complex (National Institute of Dental and Craniofacial Research, 2014).

Dental health is concerned with the state of health of teeth, gums, tongue and other tissues within the oral cavity. Dental health is a subset of oral health however these two terms are used interchangeably in this study. Good dental health is achieved by practicing good oral hygiene which includes regular tooth brushing and making regular dental visits. The health of the mouth can be an indicator of an individual's general health. Conditions such as anaemia, diabetes, human immunodeficiency virus (HIV) infections and some eating disorders like bulimia, show their first signs and symptoms in the mouth (Chapple, 2000).

2.2 Health and Dental Diseases

Oral health is known to be significantly linked to the general health of an individual. This is because the mouth is one of the entry points of bacteria and other disease causing agents to the body. Dental diseases share a common risk with the four leading chronic

diseases namely cardiovascular diseases, cancer, chronic respiratory diseases and diabetes (WHO, 2008). The two most common oral diseases are dental caries and periodontal disease. Some studies conducted in East Africa reported 37.5 % prevalence of dental caries (Gathecha et al., 2012) while those conducted in West Africa reported caries prevalence of about 49% (Faye et al., 2008).

Periodontal disease affects the gums, bone and other supporting tissues of the teeth. Globally, about 5% - 20% of the adult population suffer from the disease and it is estimated that about 50% of the European population suffer from periodontal disease (Patel, 2012). Similar findings of 47% prevalence of periodontal disease was reported among the United States adult population (Dye et al., 2012). Higher prevalence of periodontal disease was found in studies conducted in Africa. Most countries reported an average of 80% prevalence of periodontal disease (Godson & Mumghamba, 2009). The Korle-Bu Teaching Hospital in Ghana ranked periodontal disease as 3rd in the top ten causes of out-patient attendance at the dental clinic (Korle-bu Hospital, 2012). Saini, Saini, & Saini (2010) reported that periodontal disease may be linked to cardiovascular disease, stroke, bacterial pneumonia, preterm births and low-birth weight babies. Dhadse et al, (2010) also found that people with periodontal disease are nearly three times as likely to suffer from heart disease.

According to Li et al. (2000), poor oral health was more common in patients with cerebral infarction and dental and oral conditions are significantly associated with the diagnosis of a cerebral vascular accident. Also, Shanthi et al. (2012) found that periodontal disease may be a potential risk factor for preterm and low birth weight babies

while Ettaro et al. (2004) observed a link between diabetes and periodontal diseases which imposes a large economic burden of $100 billion per year in the United States.

2.3 Global Burden of Dental Disease

The Global Burden of Disease (GBD) Report (2010) estimates that 3.9 billion people worldwide suffer from dental problems and most do not get adequate treatment. In spite of significant achievements in oral health of populations globally, problems still remain in many communities especially among under-privileged groups in developed and developing countries (WHO, 2015). The burden of diseases is measured using the disability-adjusted life-years (DALYs) metric. This is the sum of years of life lost due to premature mortality (YLLs) and years lived with disability (YLDs). This provides a single standardized measure by which the effects of all fatal and non-fatal diseases and injuries is compared (Marcenes et al., 2013). Since death as a direct result of oral diseases is rare, DALYs due to oral conditions are usually estimated based on YLDs.

Marcenes et al. (2010) found that oral conditions accounted for 15 million DALYs globally. The largest increases in DALYs were observed in Eastern (51.7%) and Central Sub-Saharan Africa (50.5%) and Oceania (47.4%).

Dental health care imposes financial burden on patients. In 2010, an estimated $108 billion was spent on dental services in the United States. Pryor et al. (2009) found about 7% of respondents incurred an average debt of $1,108 that resulted from dental health expenditure. Most of these dental out-of-pocket expenses constituted more than 27% of overall health care out-of-pocket expenditure. In some cases, it exceeded the average amount of prescription out-of-pocket costs compelling 7% percent of respondents

delaying dental care because of cost (Pryor, Prottas, Lottero, Rukavina, & Knudson, 2009).

Similar studies in Australia revealed that dental health expenditure accounted for 10% of total health expenditure in 2004 (Thompson, Cooney, Lawrence, Ravaghi, & Quiñonez, 2014).

2.4 Cost of Illness

Cost of illness study is a type of economic study common in the medical literature, particularly in specialist clinical journals. The aim of a cost of illness study is to identify and measure all the costs associated with of a particular disease. There are significant costs associated with dental diseases and this remains a major public health issue for countries worldwide due to the effect it has on the individuals in particular and the society in general. The economic valuations of diseases are classified into three main categories namely direct costs, indirect costs and intangible costs (Institute for Quality and Efficiency in Health Care (IQWiG), 2012).

The COI studies can be conducted from a number of perspectives. Each perspective contains different cost items. These different cost items may lead to varying outcome for the same illness. The societal perspective measure costs to a society, health care system, third-party payers, business sectors, the government, and the participants and their families. The provider perspective measure cost to the facility or health provider and the patient perspective measure costs to the patient alone. Each perspective provides useful information about the costs to the particular group however cost of illness studies do not indicate where resources should be allocated in the short term and this is a limitation of the cost of illness studies.

2.5 Direct Costs

Economic costs are either determined from either the perspective of the patient, provider or the society.

The growing cost of dental health care has gained attention globally. Dental diseases can have varying effects on the consumption possibilities of individuals. Dental health care services employ both preventive and curative measures in treating dental health conditions. These have been identified as the direct cost of dental services which can be direct medical cost and direct non-medical cost. The cost of dental diseases generally results in increased expenditures on health goods and services. In some cases, individuals have to pay catastrophic proportions of their available income when they access such services (Xu et al., 2003). In order for the individual to adjust to the current change in both income and expenditure, he may reduce his consumption of non-health goods and liquidate his savings or assets. In some high-income countries, the expenditure for dental health care often exceeds that of other diseases such as cancer and heart disease (Patel, 2012) and it is estimated that the global cost of treating these diseases will exceed US$ 30 trillion thereby forcing many people into poverty (Patel, 2012).

2.5.1 Direct medical costs

Direct medical costs which are incurred in the prevention or treatment of dental diseases is an important component of the cost of dental diseases. These expenses include dentists' consultation, medication, dental insurance premiums and other forms of therapy related to dental health care. Costs of treatment are catered for either by insurance coverage or directly by the individuals who make out-of-pocket payment. This may result in enormous burden on the household income and on the national economy.

2.5.2 Direct medical costs on governments

The cost of dental health care accounted for 5% of total health expenditure and 16% of private health expenditure across the Organisation of Economic Co-operation and Development (OECD) countries in 2009 and the current European Union countries spent close to €79 billion on dental health care, and if the trends continue, this figure could be as high as €93 billion in 2020 (Patel, 2012). In the United States, spending for dental services increased to $110.9 billion in 2012. Out-of-pocket spending for dental services also increased by 3.0% in 2012 (Centers for Medicare & Medicaid Services, 2012). Australians spent approximately $7690 million on dental care annually, accounting for about 7% of total health expenditure with private funding accounting for 85% of the expenditure. In addition to dental care provided in the dental sector, it is estimated that general medical practitioner care for dental problems costs approximately $245–$350 million per year and the cost of treating dental problems in hospital is approximately $100 million (Harford & Chrisopoulos, 2012).

2.5.3 Direct medical costs on individuals

Dental treatment can be expensive. Given these high costs of payments for simple dental conditions, health shocks are likely to increase the tendency for such households to incur catastrophic health payments. Xu et al. (2003) found that 19% of households who access general health borrowed money or sold personal items to pay and 16% were unable to afford the medications prescribed. With limited insurance coverage, out-of-pocket spending is a common phenomenon in many low and middle income countries particularly Sub –Saharan Africa and some parts of Asia and South America. Some reports from Thailand indicated that the poor were more likely to pay for health services

from their own household income (Pannarunothai & Mills, 1997), while Kaimenyi (2004) found that households in Kenya finance oral health care mainly from out-of-pocket payment. Many people living in developing countries are poor live. These out-of-pocket-payments may result health 'shocks' which increases the tendency for such households to become poor (Xu et al., 2003).

2.5.4 Non-medical Costs

Sherman et al. (2001) defines non-medical costs simply as expenditures that are a result of an illness but are not involved in the direct purchasing of medical services. These may include expenditures such as travel, lodging and home services. Distance to a dental facility is a major non-medical cost incurred by patients especially if they have to travel a long distance to seek dental care. This will result in increases in non-medical costs associated with seeking dental treatment In the United States, there are an estimated 154,000 dental practices (Fargo Wells Bank, 2011) and 92% of Europeans living in countries like Sweden and Netherlands have easy access to a dental clinic thereby saving on travel costs when seeking dental care (European Dental Competent Autorities and Regulators, 2010).

On the contrary, people living in remote areas in most developing countries have to travel long distances to access dental healthcare as most dental clinics are located in the urban areas. This results in increases in non-medical costs associated with seeking dental treatment. Curtis et al. (2007) concluded in his study that perception of the impact of travel costs are major drivers restricting access to dental services for people living in remote locations.

Foster et al., (2013) proposed three approaches to estimating direct costs. These are top-down, bottom-up, and econometric approach. The top-down approach uses known total cost expenditures and apportions these costs to broad severity and categories. The bottom-up approach requires the estimation of costs associated with a treatment or service and utilisation. This approach is used in this study since the study is conducted from the patient's perspective. The costs are then estimated by multiplying unit costs and the number of units used. The econometric approach estimates the difference in costs in a cohort of individuals with and without a disease, but it is seldom used.

2.6 Indirect costs

Indirect costs are the costs of resources for which no payments are made, but for which there is an opportunity cost or foregone benefit. Production losses due to illness influence the wealth of society. Indirect costs are often substantial compared to direct costs (Roijen et al., 1995).

Indirect costs associated with treatment of dental disease include lost productivity or lost earnings resulting from time spent away from the workplace or school in order to access dental health services and lost days due to illness attributable to poor oral health. In Canada, the number of hours per worker either missed or in reduced activity is 3.5hrs. This translates into 40 million lost work hours resulting in productivity losses of over $1 billion (Roijen et al., 1995).

Indirect cost is estimated using several methods. The two most common methods are the human capital approach (HCA) and the willingness-to-pay (WTP) approach. The HCA views an individual as producing a stream of output over a period of time, and measures costs indirectly associated with illness which is lost output or earnings due to morbidity

and premature mortality. The WTP approach proposes that the value of health can be deduced from the amount of money an individual would be willing to pay to reduce the probability of an illness. A ‘‘linked’’ human capital and WTP approach embodies characteristics of both methods. An additional approach to estimating indirect costs is the friction cost method, which is similar to the HCA, but measures only the production losses incurred during the time it takes to replace a sick worker (Roijen et al., 1995).

WTP is a variable indicator that depends on the economic and social stratum in which the survey which is a limitation to this method.

2.7 Intangible costs

Intangible costs capture the psychological dimensions of illness including pain, anxiety, discomfort and suffering. They are difficult to measure and are not usually included in cost of illness (COI) studies. Intangible cost is often measured by the Contingent Valuation Method (CVM). This method is used to estimate cost on the basis of the individual's willingness to pay to avoid the risk of damage to health. Pain, discomfort, sleepless nights, limitation in eating function leading to poor nutrition and time off school or work as a result of dental problems are common effects of dental diseases (Watt, 2005). In a study conducted in England, 47.5% of children experienced toothache and this was the primary reason for seeking dental care (Shepherd, Nadanovsky, & Sheiham, 1999). In the United States, the cost of chronic pain due to different diseases is estimated to be about $80 billion per year, with as much as 40% associated with orofacial pain and 90% of pre-adolescents reported an impact related to oral health. Prevalence of dental pain was found to be about 33% among Brazilian teenagers, of whom 9% reported distressing, excruciating pain. In Thailand, 74% of 35–44-year olds had daily

performances affected by their oral state and 46% reported their emotional stability was affected (Sheiham, 2005). Adequate dentition is necessary to improve a person's quality of life. However, there is a greater tendency to become edentate as one advances in life. Despite the improvement in oral health care services, edentulism still remains a public health concern in the world. Edentulism is irreversible and is described as the "final marker of disease burden for oral health". The prevalence of edentulism amongst adults over 60 years of age was 25% and 21.7% in the United States and Canada respectively (Emami et al., 2013). Edentulism reduces masticating efficiency and affects food taste, food preferences, and food consumption patterns with suboptimal intakes of various nutrients which prevents edentate individuals from meeting current dietary recommendations (Lee et al., 2004) therefore edentulism affects the quality of life of an individual and comes as a cost to sufferers.

2.8 Sensitivity Analysis

Sensitivity analysis is a way of determining how certain values of an independent variable will affect an outcome variable when some assumptions are made. The assumptions used in this studies was that al the respondents earned the current minimum wage. The challenge of this assumption is that some respondents may earn above or below the minimum wage. This technique which is used within specific limits depends on a number of independent variables. This is used to test the robustness of the results obtained by repeating the comparison between the independent variable and the outcome variable while changing the assumptions used**.** Sensitivity analysis aids in determining robustness of the conclusions of an economic evaluation. This is because there are uncertainties about elements of a given economic evaluation. Sensitivity analysis

involves the use of several methods. One way sensitivity analysis determines the effect of variations in one independent variable on the outcome variable while keeping other variables constant at their baseline value. Two way sensitivity analysis involves varying two independent variables at the same time to determine the effect it will have on the outcome variable (Briggs, 1999). This test is performed because most elements in an economic valuation vary simultaneously. The third method is probabilistic sensitivity analysis. This method involves Monte Carlo simulations. It determines the extent to which the value of an outcome variable is impacted by a range of independent variables which are varied simultaneously with specified distributions. These simulations may result in a more practical outcome (Briggs, 1999).

2.9 Effect of cost on dental health services utilisation

The utilisation of dental services is essential to promoting and maintaining optimum health and well-being. Utilisation is the actual attendance by the members of the public at health care facilities to receive care. Utilisation, which measures the number of visits per year or the number of people with at least one visit during the previous year, serves as an important tool for oral health policy and decision-making (Poudyal et al., 2010).

Patients who attend dental clinics regularly are more likely to have dental diseases diagnosed in their early stages which results in the provision of more accurate and timely dental treatments. Lack of regular utilisation of dental health services may result in delayed diagnosis which leads to untreated dental diseases and sometimes death. Gender, age, education level, income level, geographic location, health insurance status and other factors are tied to household economic conditions and their ability to utilise dental health services (Wall, Vujicic, & Nasseh, 2012).

The affordability of dental care is a major issue of concern to policy makers in several countries. According to Locker, Matear & Lawrence (2002), 26% of adults agreed that dental care is costly. Also, 35% of them mentioned that they could not afford the preventive and restorative treatments they required. They also noted that 30% of Canadian adults were unable to afford dental care in the past, with about 13% of them reporting a competing need, having to sacrifice other spending like buying food to pay for dental care. Again, 30% reported avoiding or delaying dental visits and 32% were unable to afford the recommended treatment.

Some studies have highlighted the effect of high dental health expenditure on the well-being of individuals. Thompson et al. (2014) reported that more than a third of Canadians require dental treatment and those who have financial difficulties are more likely to have unmet dental care need. According to Chrisopoulos, Beckwith, & Harford (2011), the cost of dental care may be a barrier to Australians making regular dental visits and complying with recommended dental treatments. They observed that the percentage of adults who delayed dental visits due to cost increased from about 27% in 1994 to about 34% in 2008.

In India, the cost of dental treatment was a barrier for 6.9% of the people who participated in a study (Devaraj & Eswar, 2012). Another study conducted in South West Nigeria also ranked the cost of treatment as the second major barrier to dental health care utilisation (Ajayi & Arigbede, 2012). This finding was similar to that of Kemuto (2010) who also found that 28% of patients who participated in a study at the University of Nairobi Dental Hospital cited the high cost of dental treatment as the reason for delaying dental health utilisation.

2.10 Effect of Socio-economic Status on Dental Health

Socioeconomic status (SES) provides a way of looking at how individuals or families fit into society using economic and social measures that have been shown to impact individuals' health and well-being. Socioeconomic status and health are closely related, and SES can often have profound effects on a person's health due to differences in ability to access health care as well as dietary and other lifestyle choices that are associated with both finances and education (Borskey, 2014). It is generally expected that people with low SES experience greater levels of oral disease compared to those within the higher SES.

According to O'Reilly & Boyd-Boland (2006) profound disparities exist across socio-economic groups in Australia and the incidence of caries and periodontal disease increased as socio-economic status decreased. Again, socioeconomically disadvantaged groups rate their oral health poorer than more advantaged groups and report more tooth loss and more problems with their teeth, mouth or dentures.

Celeste et al. (2011) in their study of trends in socioeconomic disparities in the utilisation of dental care in Brazil and Sweden concluded that a higher proportion of people of higher socioeconomic status visit the dentist more frequently than those in lower socioeconomic status due to relevant and persistent disparities in the utilisation of dental care in both countries.

2.11 Conclusion

In conclusion, it can be seen that the consequences of dental diseases places economic burden on individuals and affects the quality of life of dental patients. From the review, I found that limited studies exist on the burden of dental diseases (prevention and

treatment) on individuals and government as a whole in many developing countries. The studies cited in this review were mainly from developed countries. This cost of illness study conducted from the patients' perspective therefore becomes relevant as it will not only bridge the knowledge gap in this field but also provide useful information for individuals and policy makers in the health sector on the burden of dental diseases in Ghana.

CHAPTER THREE

3.0 METHODS

3.1 Type of study

This study is a cross sectional cost –of –illness study from the perspective of the patient in a university hospital from May to July 2015.

3.2 Study area

The study was conducted in University Hospital, Legon, one of the public hospitals in the Greater Accra region of Ghana. It is located at Legon in the Ayawaso West Wuogon district and Accra Metro Sub-District. The Ayawaso West Wuogon district is located in the Accra Metropolitan Area of the Greater Accra region of Ghana. It serves the University of Ghana community and the surrounding areas. It was built in 1957 to cater for the health needs of the university community. It is a 130 bed capacity hospital. It has four main departments namely Pediatrics Unit, Obstetrics and Gynaecology Unit, Medical Unit and Surgical Unit. University Hospital, Legon also has several clinics including the dental clinic which has 2 dental surgery units. The dental clinic has 6 dentists, 6 dental surgeon assistants and 2 non-medical staff. It attends to approximately 30-35 clients a day who present with various types of dental diseases.

3.3 Study variables

The variables analysed in this study are direct cost, indirect cost and intangible cost of dental diseases.

Table 1: Table of variables

Cost type	Cost variables	Cost description
Direct cost	Medical	1. Cost of consultation 2. Cost of diagnostics 3. Cost of treatment 4. Cost of medication
	Non-medical	1. Travel Costs 2. Cost of Food 3. Miscellaneous expenses
Indirect cost	Productivity losses	1. Work hours lost 2. Lost wages
Intangible cost	Intangible Cost	1. Pain 2. Difficulty with eating 3. Difficulty with speaking 4. Difficulty with smiling 5. Avoiding the company of others

3.4 Study population

Data collection was undertaken from 11th May, 2015 to 22nd May, 2015. The study population was made up of patients with dental diseases who attend the dental unit of the University Hospital, Legon. In 2014, 7,884 patients attended the dental unit. Currently, the unit attends to an estimated average of 30 patients daily. For the given period of the study which was 10 days, the population of the study was estimated to be 300 patients.

3.5 Sample size

The sample size (n) was calculated using the Cochrane Formula (Israel, 2013) .

$$n = \frac{z^2\, p\, q}{d^2}$$

where z = 1.96, p = 0.5, (prevalence of 50% is assumed since the prevalence of dental diseases in Ghana is not known), q = (1-p) = (1-0.5) = 0.5. Therefore, q = 0.5, d (precision) = 5% (0.05).

therefore,

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

$$n = 384$$

This formula only takes into consideration the precision and not the size of the population therefore the sample size of 384 was obtained regardless of the size of the population.

The dental clinic at the University Hospital, Legon, attends to about 30 patients a day. It was estimated that about 300 patients will attend the unit during the period of the study. The finite population correction factor was used to adjust for the finite population (N). The sample size was calculated to be

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where n=sample size, n_0 = 384, N=population=300

$$n = \frac{384}{1 + \frac{(384-1)}{25}}$$

$$\frac{}{300}$$

$$n = \frac{384}{(1+1.2767)}$$

$$n = 168.6$$

Adjusting for 10% non-response rate,

$$= 168.6 \times \frac{10}{100}$$

$$= 16.9 \quad \text{approximately} \quad 17$$

Sample size n = Adjusted sample size +10% non-response rate

$$=168.6+17= 185$$

Therefore, the sample size determined for this study was 185.

3.6 Sampling Method

Non probability purposive sampling method was used in this study.

3.6.1. Sampling procedure

The average number of patients who visited the dental clinic of the University Hospital, Legon, was estimated to be 30 patients per day. The number of patients expected to visit the dental clinic over the data collection period of 10 days was estimated to be 300 patients. The patients were recruited to participate in the study after they were registered by the receptionist at the unit. These patients were selected from the attendance book and those who satisfied the inclusion criteria and consented to participate in the study were interviewed. This procedure was repeated every day until the desired sample size of 185 was achieved.

Inclusion Criteria

Patients who were 18 years and above and who received dental treatment within the study period were included in the study.

Exclusion criteria

Patients who are less than 18years and patients who did not have dental treatment during the period of study were excluded from the study. Patients who received only consultation and patients who were reviewed were also excluded from the study.

3.7 Data collection techniques

Data was collected by the Principal Investigator and one research assistant each recruiting approximately 10 study participants daily. This resulted in the recruitment of approximately 20 study participants in a day. The questionnaires were administered at the out-patient department of the dental clinic of the University Hospital every weekday between 8am and 2pm. Data was collected by interviewer administered structured questionnaires. It consisted of open and closed ended questions on the respondents' demographic information, employment status, insurance status and household assets. The questionnaire also contained questions on type of dental illness, direct medical cost (costs of consultation, diagnostics, treatment and medication), non-medical cost (travel costs, food costs and miscellaneous expenses) indirect cost (productivity days lost, travelling time, and waiting time) and intangible cost (pain, difficulty with speech, difficulty with eating, difficulty with smiling and avoiding the company of others).

3.8 Quality control

In order to ensure that complete and accurate data was obtained, some measures were instituted during the pre-data collection stage, the data collection stage and the data entry and processing stage.

3.8.1 Pre-data collection stage

Training of research assistants

An individual with requisite background in dental health care and who could speak two of the common local dialects (Twi and Ga) spoken in the study area was recruited to serve as research assistant for the study. The assistant was trained for two days. The assistant was trained in the explanation and administration of the questionnaire and ethical issues such as the need to obtain informed consent before interviewing the study participants to ensure that he recruits and relates with the participants in the appropriate manner.

3.8.2 Pretesting of questionnaire

The questionnaire was pretested on patients who attended the dental unit of the Ridge Hospital, Accra. This was performed by the Principal Investigator and the trained research assistant. The questionnaire was pretested to identify ambiguity and other difficulties that the participants may encounter in responding to the questions and the questionnaire was revised and restructured accordingly. The pretesting was also done to assess the research assistant's administration of the questionnaires in order to prevent interviewer bias.

3.8.3 Data collection stage

The Principal Investigator ensured that the assistant adhered to the research guidelines. The questionnaires were given special codes which was indicative of the day on which a set of questionnaires were administered. Meetings were held at the end of every day to examine the completed questionnaires and discuss the challenges encountered in order to improve the method of collecting data. Also, measures were instituted to ensure that a study participant was not interviewed twice.

3.8.4 Data entry and processing

Data entry controls were put in place to serve as checks in order to prevent wrong entries and other errors. Completed questionnaires were coded and double entered into Epi Info 7. Data were entered on the day it was collected by the Principal Investigator. Data were cross checked for errors, cleaned and exported to Microsoft Excel 2007 and STATA Version 12 for analysis.

3.9 Data Analysis

The costs estimated in this study were costs incurred by the patients who attended the dental clinic of the University Hospital during the study period.

3.9.1 Estimation of direct costs

Direct costs were estimated as costs incurred by the study participant in direct relation to the dental disease. This was obtained by estimating both the medical and non-medical costs incurred by the study participant.

3.9.2 Estimation of direct medical cost

Total medical costs were estimated by adding all the costs incurred by the consumption of medical goods and services by the study participant. These included the cost of consultation, cost of treatment, cost of diagnostic tests and cost of medication. The estimation approaches are shown in Table 2.

Table 2: Estimation of direct medical costs

Type of Costs	Costs Estimation approach
Consultation	This is the summation of the costs of consultation and registration of the patients during the study period.
Diagnostics	This is the summation of the cost of diagnostic tests requested for the patients during the study period.
Treatment	This is the summation of the costs of the treatments like extractions and fillings received by the patients during the study period.
Medication	This is the summation of the medications prescribed for the patients during the study period.
Total medical cost	This is the summation of the total costs of consultation, diagnostics, treatment and medication for received by the patients during the study period.

3.9.3 Estimation of direct non-medical cost

Direct non-medical cost was estimated by summing up the travelling cost, food cost and other miscellaneous expenses. The estimation approaches are shown in Table 3.

Table 3: Estimation of direct non- medical costs

Type of cost	Estimation approach
Travel	This is the summation of all travel costs like taxi fares and bus fares incurred by the patient when travelling to the dental unit and from the dental unit to their homes during the study period.
Food	This is the summation of all costs incurred by the patients on food items purchased due to their dental disease during the study period.
Miscellaneous	This is the summation of all costs incurred by the patients on other items such as telephone calls or other pain reliving agents purchased because of their dental diseases.
Total direct non-medical cost	This is the summation of all travel costs, all food costs and all miscellaneous expenses incurred by the patients due to their dental diseases.

3.10 Estimation of indirect cost

Total indirect cost was estimated by using the human capital approach (HCA) which measures output losses by lost earnings (Addo, Nonvignon, & Aikins, 2013). Productivity losses were estimated by calculating the total work hours lost and total lost earnings using the minimum daily wage in Ghana at the time of the study.

3.10.1 Productivity losses

Table 4: Estimation of indirect costs

Category	Estimation Approach
Total travel time	This is the summation of the hours spent travelling to the hospital and hours spent travelling from the hospital to the house.
Valued travel time	This was estimated by multiplying the total travel time spent by patients who are employed by the hourly rate of the daily minimum wage.
Total waiting and treatment time	This is the summation of the hours spent on waiting and treatment at the hospital.
Valued waiting and treatment	This was estimated by multiplying the total hours spent on waiting and treatment at the hospital by employed patients by the hourly rate of the daily minimum wage.
Productivity days lost	This is the summation of the total number of days lost by patients who are employed.
Valued productivity days lost	This was estimated by multiplying the total number of days lost by patients who are employed by the daily minimum wage.
School days lost	This is the summation of the number of days lost by patients who are students.
Total indirect cost	This is the summation of valued travel time, valued waiting and treatment time and valued productivity days lost by the patients.

3.11 Description of intangible cost

Intangible costs in this study were not estimated but described using the likert scale. Five likert items were used. They were "strongly disagree", "disagree", "neutral", "agree" and "strongly agree". "Strongly disagree" and "disagree" were collapsed into "disagree". "Strongly agree" and "agree" were collapsed into "agree". The five likert items assessed the patients' ratings for pain, difficulty with chewing, difficulty with speaking, difficulty with smiling and avoiding the company of others due to dental disease. These are shown in Table 5. The responses were presented graphically using MS Excel 2007.

Table 5: Description of intangible cost

Category	Description
Pain	Percentage of patients who agreed that they experienced pain
Difficulty with chewing	Percentage of patients who agreed that they experienced difficulty with chewing
Difficulty with speech	Percentage of patients who agreed that they experienced difficulty with speech
Difficulty with smiling	Percentage of patients who agreed that they experienced difficulty with smiling
Avoiding the company of others	Percentage of patients who agreed that they avoided the company of others due to their dental disease

The responses were scored and the percentages of the responses were used in the description of the effect of dental diseases on the items being assessed. The results were presented graphically using Microsoft Excel 2007.

3.12 Sensitivity Analysis

Sensitivity Analysis was performed to assess the robustness of the cost estimates. This was done by varying the cost of medication and the minimum wage by 5%, 10% and 25%.

3.13 Estimation of socio-economic status

Socio-economic status of the respondents was estimated by using the Principal Component Analysis to generate wealth quintiles in STATA Version 12 from asset ownership of study participants by grouping them into richest, richer, middle, poorer and poorest groups.

3.14 Assumptions

The assumption that was made in this study is that the national daily minimum wage for the country is reflective of the average income earned per day by the respondent.

3.15 Proposal and funding information

This research was self-financed.

3.16 Study limitations

The limitations of this study are as follows.

1. The intangible costs were not valued in monetary terms but were described as no real market exists for such costs (Xie et al., 2008).
2. The accuracy of the number of days or hours lost by the patients as a result of dental diseases was based on the recall of the patient which may not be accurate.

3.17 Ethical considerations

The following were observed during the study.

Ethical clearance

Ethical clearance for the study was obtained from Ethical Review Committee of the Research and Development Division of the Ghana Health Service.

Permission from study site

Permission was obtained from the Head of the dental unit of University Hospital, Legon and School of Public Health, University of Ghana, Legon before the research is conducted.

Description of subjects involved in the study

The study population was made up of patients attending the dental unit of University Hospital, Legon who received dental treatment during the period of the study in May 2015.

Informed consent

The participants were allowed to give their informed consent by either signing or thumb-printing the consent form after the information required for their consent was read and duly explained to them before they were recruited to participate in the study. No patient was forced or coerced to take part in the study. The patients were made to know that participation was voluntary. The participants were also informed that they had the right to refuse or withdraw from the study at anytime without it affecting their ability to access dental health care at the facility in the future. A written consent was sought from study participants before data was collected from them.

Privacy/Confidentiality/Anonymity

The study was conducted in a manner that ensured the privacy of the respondents. All patients who gave consent were assured of anonymity. Data was also reported in a manner that prevented the use of the patient's names which ensured confidentiality of information that was collected from participants.

Potential Risks and Benefits

The study population and other stakeholders in dental health care benefitted from this study. In the study population, the estimation showed the burden of dental disease on patients who attended University Hospital, Legon, and it identified the costs involved in treating such diseases and the loss of productivity due to the disease so that stakeholders will be informed to take more preventive than curative measures towards managing dental conditions in Ghana. There were no risks associated with study.

Data storage and usage

The questionnaires were coded and kept under lock and key in a cupboard, and the key was kept by the Principal Investigator. Data collected was coded and entered within 24 hours of collection, and was saved under a password known to only to the principal investigator. The soft copy of data was stored on a CD-ROM and external hard drive as well. The data collected will be kept by the Principal Investigator for 3-4 years to allow for publication of the research after which questionnaires will be destroyed.

Conflict of interest

I declare no competing interest.

CHAPTER FOUR

4.0 RESULTS

4.1 Background characteristics of respondents

A total of 185 questionnaires were administered to patients attending the dental unit of the University Hospital, Legon with 100% response rate. The highest age of the respondents was 90 years (1) and the lowest age of respondents was 18 years (1) with the mean age being 29 years. There were 82 male respondents and 103 female respondents. This constituted 44.3% and 55.7 % respectively of the total respondents. Majority (143) which represented 80% of the respondents had tertiary education while the rest had SSS/SHS/Vocational education (9.7%), middle school/JSS/JHS education (10) and 9 respondents had primary or no education.

About 80% (147) of the respondents are single while 18.4% (34) are married and 2.2% (4) are either separated or divorced. The employment status of the respondents showed 36.2% (67) employed and 9.7% (18) unemployed with 54.1% (100) being students. More than half (53.5%) of the respondents were insured with the National Health Insurance Scheme (NHIS) and the rest were either insured with a private health insurance (10.3%) or uninsured (36.2%). The study population was evenly distributed among the wealth quintiles with 20% being poorest and 20 % being poorer. The middle richer and richest wealth quintiles were constituted by 21%, 19% and 20 % of the respondents respectively. The background characteristics of the respondents are shown in Table 6.

Table 6: Background characteristics of respondents

Characteristics	Number	(%)
Sex:		
Male	82	(44.3)
Female	103	(55.7)
Age:		
<20	11	(5.9)
20-29	118	(63.8)
30-39	21	(11.4)
40-49	14	(7.6)
50-59	10	(5.4)
60+	11	(5.9)
Marital Status:		
Married	34	(18.4)
Separated/Divorced	4	(2.2)
Single	147	(79.5)
Educational Status:		
No education /Primary	9	(4.9)
Middle school/JSS/JHS	10	(5.4)
SSS/SHS/Vocational	18	(9.7)
Tertiary	148	(80.0)
Employment Status:		
Employed	67	(36.2)
Students	100	(54.1)
Unemployed	18	(9.7)
Insurance:		
Insured (NHIS)	99	(53.5)
Insured (Private)****	19	(10.3)
Uninsured	67	(36.2)

*JSS/JHS means Junior Secondary School/Junior High School
**SSS/SHS means Senior Secondary School/Senior High School
***NHIS means National Health Insurance Scheme
****Private means other private insurance schemes (First fidelity, Profiler and Premium Mutual Health)

4.2 Dental condition of respondents

4.2.1 Previous dental treatment of respondents

A greater number of the respondents 69.2% (128) had a previous dental condition for which they have received treatment however 30.8% (57) of respondents reported of never having a dental condition for which they have received treatment.

4.2.2 Current dental condition of respondents

Toothache was the highest reported dental condition accounting for 54.6% (101) of dental conditions reported by the respondents at the dental clinic. This was followed by gum disease which was reported by 27.0% (50) of the respondents. Swollen jaw (dento-alveolar abscess) was reported by 8 respondents. Broken tooth, mouth sores and other dental conditions including tooth sensitivity, pericoronitis and impacted lower third molar was also reported by 23 respondents. The current dental conditions of respondents are shown in table 7.

4.2.3 Dental condition and socioeconomic status (SES)

Toothache was the most reported dental condition across all the socioeconomic groups. The highest percentage of 11.9% (22) was reported by the richest group followed by the poorest group who reported a percentage of 11.4% (21). The lowest percentage of 10.3% (19) was reported by both the poorer and the richer groups. Again, the richest group had the highest percentage of 6.5% (12) of those who reported with gum disease. This was followed 5.9% (11) who belonged to the poorest group. The rest of the dental conditions reported by the different socioeconomic groups are shown in Table 8.

4.2.4 Duration of dental condition of respondents

The respondents had their dental conditions for different durations before seeking dental treatment with 39.5% (75) having their dental condition for less than a week. The dental conditions which lasted for less than a month and less than a year were reported by 25.4% (47) and 35.1% (65) of the respondents respectively.

4.2.5 Type of treatment received by respondents

The respondents received different kinds of treatment at the dental unit with 43.8% (81) of the respondents receiving medication followed by 21.6% (40) who had their teeth extracted. About 8% (15) received a restorative treatment (filling) while 21.1% (40) and 2.2% (4) of the respondents received preventive treatment in the form of scaling and polishing of their teeth (cleaning) and dentures respectively. Other treatments received by the respondents included root canal treatment and excision of Epulis among others. There were small differences in the type of treatment received by respondents in the different socioeconomic groups and these are shown in Table 9.

About 50% (95) of the respondents paid cash for treatment received while 20.5% (38) and 28.1% (52) paid with the National Health Insurance Scheme (NHIS) and other forms of private health insurance respectively. The mode of payment for treatment received by the respondents is shown in Table 10.

Table 7: Dental conditions as reported by the respondents

Current dental condition:	N	(%)
Bad Breath	3	(1.6)
Broken Tooth	15	(8.1)
Gum Disease	50	(27.0)
Mouth sores	5	(2.7)
Swollen Jaw	8	(4.3)
Toothache	101	(54.6)
Other*	3	(1.6)
Duration of condition:		
<Week	73	(39.5)
<Month	47	(25.4)
<Year	65	(35.1)
Type of treatment:		
Cleaning	39	(21.1)
Dentures	4	(2.2)
Extraction	40	(21.6)
Filling	15	(8.1)
Medication	81	(43.8)
Other**	6	(3.2)

*Other dental conditions include dentoalveolar abscess, tooth sensitivity and pericoronitis

**Other treatments include root canal treatment and excision of epulis

Table 8: Dental condition by wealth quintile

Current Dental Condition	Wealth Quintile					
	Poorest	**Poorer**	**Middle**	**Richer**	**Richest**	**Total**
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Toothache	21 (11.4)	19 (10.3)	20 (10.9)	19 (10.3)	22 (11.9)	101 (54.6)
Gum Disease	11 (5.9)	9 (4.9)	8 (4.3)	10 (5.4)	12 (6.5)	50 (27.0)
Swollen jaw	2 (1.1)	3 (1.6)	1 (0.5)	2 (1.1)	0 (0.0)	8 (4.3)
Broken tooth	0 (0.0)	4 (2.2)	6 (3.2)	3 (1.6)	2 (1.1)	15 (8.1)
Bad breath	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)	3 (1.6)
Mouth sores	2 (1.1)	1 (0.5)	2 (1.1)	0 (0.0)	0 (0.0)	5 (2.7)
Other	0 (0.0)	1 (0.5)	1 (0.5)	1 (0.5)	0 (0.0)	3 (1.6)
Total	**37 (20)**	**37 (20)**	**38 (20.5)**	**36 (19.5)**	**37 (20)**	**185 (100)**

Table 9: Type of treatment by wealth quintile

Type of Treatment	Wealth quintile					
	Poorest	**Poorer**	**Middle**	**Richer**	**Richest**	**Total**
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Medication	20 (10.9)	16 (8.6)	14 (7.6)	14 (7.6)	17 (9.2)	81 (43.8)
Extraction	5 (2.7)	8 (4.3)	10 (5.4)	8 (4.3)	9 (4.9)	40 (21.6)
Filling	3 (1.6)	4 (2.2)	4 (2.2)	2 (1.1)	2 (1.10	15 (8.1)
Cleaning	7 (3.8)	8 (4.3)	8 (4.3)	12 (6.5)	4 (2.2)	39 (21.1)
Dentures	1 (0.5)	1 (0.5)	1 (0.5)	0 (0.0)	1 (0.5)	4 (2.2)
Other	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	4 (2.2)	6 (3.2)
Total	**37 (20)**	**37 (20)**	**38 (20.5)**	**36 (19.5)**	**37 (20)**	**185 (100)**

Table 10: Mode of payment for treatment received by respondents

Mode of payment	Number	(%)
Cash	95	(51.4)
NHIS*	38	(20.5)
Private Health Insurance	52	(28.1)

*NHIS means National Health Insurance Scheme

4.2.6 Travel time spent by respondents

Total travelling time spent by the respondents was 275.4 hours. This was the time spent travelling from their homes to the hospital and time spent travelling from the hospital to their homes after they had received treatment for their dental conditions. The mean travelling time was 1.49 hours.

4.2.7 Waiting and treatment time spent by respondents

Total waiting and treatment time spent by the respondents at the hospital was 281 hours.. The mean waiting and treatment time was 1.52 hours. The time spent by the respondents is shown in Table 11 below.

Table 11: Travel time, waiting and treatment time spent by respondents

Category	Time(hrs)	Mean
Travel time	275.4	1.49
Waiting and treatment time	281	1.52

4.2.8 Total productive days lost by respondents

The total number of productive days lost by the respondents who were employed and students was 260. This was the sum of the number of days absent from either school or work due to dental diseases and the number of extra days to be spent by the respondents in order to recover from their diseases after receiving dental treatment. The average days lost by patients who were employed was 1.9 days and the average days lost by students was 1.3 days.

Table 12: Total days lost to respondents

Category	n	Days lost	Mean
Employed	67	124	1.9
Students	100	136	1.3
Total	**167**	**260**	

4.3 Direct cost of dental diseases

The total direct cost of dental disease was GHS 25,681.70 (US$ 6,248.59). This accounted for 94.5% of the cost profile of dental disease. This was made up of direct medical costs and non-direct medical costs. The average direct cost of dental diseases was GHS 138.82 (US$ 33.78) per patient.

4.3.1 Direct medical cost

The total direct medical cost estimated was GHS 22,305.00 (US$ 5,427.01). This accounted for 82.1% of the cost profile. This cost was made up of four main cost categories. The highest cost category was cost of treatment which contributed GHS 10,010.00 (US$ 2,435.52). The second highest cost category was cost of consultation which contributed GHS 7,295.00 (US$ 1,774.94). The cost of medication and cost of diagnostic tests contributed GHS 3,775.00 (US$ 918.49) and GHS 1,225.00 (US$ 298.05) respectively. The average direct medical cost was GHS 120.57 (US$ 29.34).

4.3.2 Direct non-medical cost

The total direct non-medical cost estimated was GHS 3,376.70 (US$ 821.58). This accounted for 12.4% of total cost profile. The cost categories included travel cost, food cost and miscellaneous expenses. The highest cost category was travel which contributed GHS 2,098.60 (US$ 510.61) and the least contributing category was miscellaneous

expenses which contributed GHS 319.50 (US$ 77.74). The average direct non- medical cost was GHS 18.25 (US$ 4.44).

4.4 Indirect cost of dental diseases

The total indirect cost of dental diseases estimated was GHS 1,502.30 (US$ 365.52). This was 5.5% of the total cost profile. The average indirect cost of dental diseases was GHS 8.1 (US$ 1.97). Table 13 shows the cost profile of dental diseases.

Table 13: Total cost of dental diseases

Cost component	Cost (GHS)	(US$)*	Cost profile (%)
Direct cost			
Medical Cost			
Consultation	7,295.00	1,774.94	26.8
Diagnostics	1,225.00	298.05	4.5
Treatment	10,010.00	2,435.52	36.8
Medication	3,775.00	918.49	13.9
Sub-total	**22,305.00**	5,427.01	82.1
Non-medical costs			0.0
Travel	2,098.60	510.61	7.7
Food	958.60	233.24	3.5
Miscellaneous	319.50	77.74	1.2
Sub-total	**3,376.70**	821.58	12.4
Total direct cost	**25,681.70**	6,248.59	94.5
Indirect costs*			0.0
Valued productive days lost by patients	868.00	211.19	3.2
Valued travelling time	313.96	76.39	1.2
Valued waiting time	320.34	77.94	1.2
Total indirect	**1,502.30**	**365.52**	5.5
Total cost	**27,184.00**	**6,614.11**	100.0

* Daily interbank US$ forex rate on 10th June, 2015 used was GHS 4.11.
*****The national minimum wage per day (GHS 7) as at June, 2015 was used to value productivity days and time lost to patients.

4.5 Direct cost per dental condition

The highest direct medical cost per condition was associated with toothache and this was estimated to be GHS 10,190.00 (US$ 2,479.32) while the lowest direct cost per condition which amounted to GHS 285.00 (US$ 69.34) was associated with bad breath. The means of direct medical cost per condition is shown in the Table 14.

Table 14: Direct medical cost per reported dental condition

		Cost		Mean		
Dental condition	**N**	**(GHS)**	**(US$)***	**(GHS)**	**(US$)***	**%**
Bad breath	3	285.00	69.34	95.00	23.11	1.3
Broken tooth	15	3,485.00	847.93	232.33	56.53	15.6
Gum disease	50	5,875.00	1,429.44	117.50	28.59	26.3
Mouth sores	5	490.00	119.22	98.00	23.84	2.2
Swollen jaw	8	745.00	181.27	93.13	22.66	3.3
Toothache	101	10,190.00	2,479.32	100.89	24.55	45.7
Other	3	1,235.00	300.49	411.67	100.16	5.5
Total	**185**	**22,305.00**	**5,427.01**			**100.0**

***Daily interbank US$ forex rate on 10th June, 2015 used was GHS 4.11**

4.6 Total cost of dental diseases

The total cost of dental diseases was estimated to be GHS 27,184.00 (US$ 6,614.11). The estimated direct cost of GHS 25,681.70 (US$ 6,248.59) constituted a greater proportion of the total cost of dental diseases. Of the direct cost, medical cost contributed GHS 22,305.00 (US$ 5,427.01) while the non-medical costs contributed GHS 3,376.70 (US$ 821.58). The indirect cost contributed only GHS 1,502.30 (US$ 365.52) to the total cost

of dental diseases. The percentage contribution of direct costs and indirect costs to the total costs of dental diseases are shown in Figure 2.

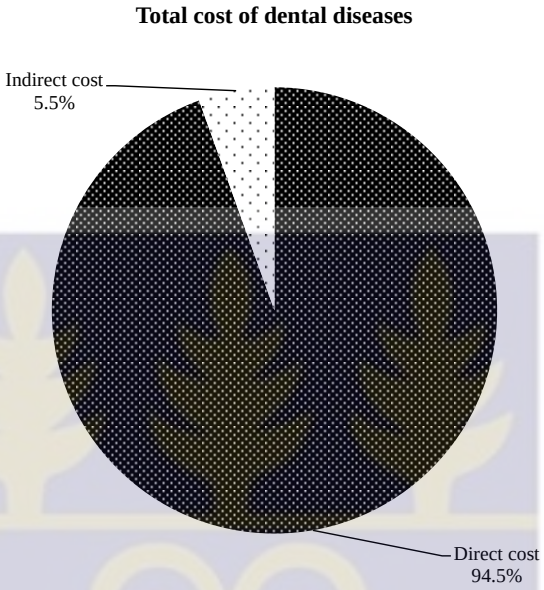

Figure 2: Total cost of dental diseases

4.7 Direct cost of dental healthcare by wealth quintile

The respondents in different socio-economic groups incurred different costs with the respondents in the richer wealth quintile incurring the highest direct cost per quintile which amounted to GHS 6,908.10 (US$ 1,680.80) and those in the poorer wealth quintile incurring lowest cost per quintile which amounted to GHS 4,170.40 (US$ 1,014.70). The socio-economic status of the respondents, the total cost per quintile and the mean cost per quintile are shown in Table 15.

Table 15: Direct cost of dental healthcare by wealth quintile

Wealth quintile	Number	Direct cost (GHS)	Direct cost (US$)*	Mean (GHS)	Mean (US$)*
Poorest	37	4,271.20	1,039.22	115.44	28.09
Poorer	37	4,933.80	1,200.44	133.35	32.44
Middle	38	5,398.20	1,313.43	142.06	34.56
Richer	36	6,908.10	1,680.80	191.89	46.69
Richest	37	4,170.40	1,014.70	112.71	27.42
Total	**185**	**25,681.70**	**6,248.59**		

* Daily interbank US$ forex rate on 10th June, 2015 used was GHS 4.11

4.8 Sensitivity analysis of the cost of dental diseases

Sensitivity analysis was performed to determine the robustness of the study. The components on which the sensitivity tests were conducted were the wage rate and the costs of medication. One-way and two-way sensitivity tests were performed. These tests were performed by varying the minimum wage for the indirect costs and by increasing the amount of the cost of medication by 5% and 10%.

A variation of 5%, 10% and 25% of the cost of medication produced a percentage change of 0.7 and 1.4 respectively in the total cost. A variation of 25% of the cost of medication produced the highest percentage change of 3.5 in the total cost and 0.2 in the percentage change in the proportion of the direct cost. No change was produced in the proportion of indirect cost by the variations of the cost of medication. A variation of 5% and 10% in the wage rate both produced 0.1% change in the total cost, -0.1% change in the proportion of direct cost and 1.8% change in the proportion of indirect cost. A variation of 25% in the wage rate produced 0.3% change in the total cost and -0.3% and 5.5% change in the proportions of the direct and indirect costs respectively. A two-way sensitivity test was performed with multi-variation of the cost of medication and the wage rate. The results of the tests are shown in Table 16.

Table 16: Sensitivity analysis of total cost of dental diseases

Scenario	Cost component	Percentage change in parameter	Total cost		Percentage change in total cost	Proportions of total cost		Percentage change in proportions of cost	
			(GHS)	(US$)***		Direct	Indirect	Direct	Indirect
Base scenario		**0**	**2,7184.00**	**6,614.11**	**0**	**94.5**	**5.5**	**0**	**0**
Variation*	Medication	5	27,372.75	6,660.04	0.7	94.5	5.5	0.0	0.0
		10	27,561.50	6,705.96	1.4	94.5	5.5	0.0	0.0
		25	28,127.75	6,843.73	3.5	94.7	5.3	0.2	0.0
Variation*	Wage rate**	5	27,199.58	6,617.90	0.1	94.4	5.6	-0.1	1.8
		10	27,215.58	6,621.80	0.1	94.4	5.6	-0.1	1.8
		25	27,273.02	6,635.77	0.3	94.2	5.8	-0.3	5.5
Multi-variation	Medication and wage rate	5	27,388.33	6,663.83	0.8	94.5	5.5	0.0	0.0
		10	27,592.66	6,713.54	1.5	94.4	5.6	-0.1	1.8
		25	28,216.77	6,865.39	3.8	94.4	5.6	-0.1	1.8

***** The cost of medication and the wage rate was varied by 5%, 10% and 25% increment respectively.
****** The national minimum wage per day (GHS 7) as at June, 2015 was used to value productivity days lost to patients.
*** Daily interbank US$ forex rate on 10th June, 2015 used was GHS 4.11.

4.9 Intangible cost of dental diseases

Five dimensions were used in describing the intangible cost of dental diseases. These were pain, difficulty with smiling, difficulty with speaking, difficulty with eating and avoiding the company others. The dimension with the highest percentage was pain which was reported by 49.2% (91) of the respondents. This was followed by difficulty with eating 43.2% (80) and difficulty with speaking 18.9% (35). The percentages of all the dimensions are presented in figure 3 below.

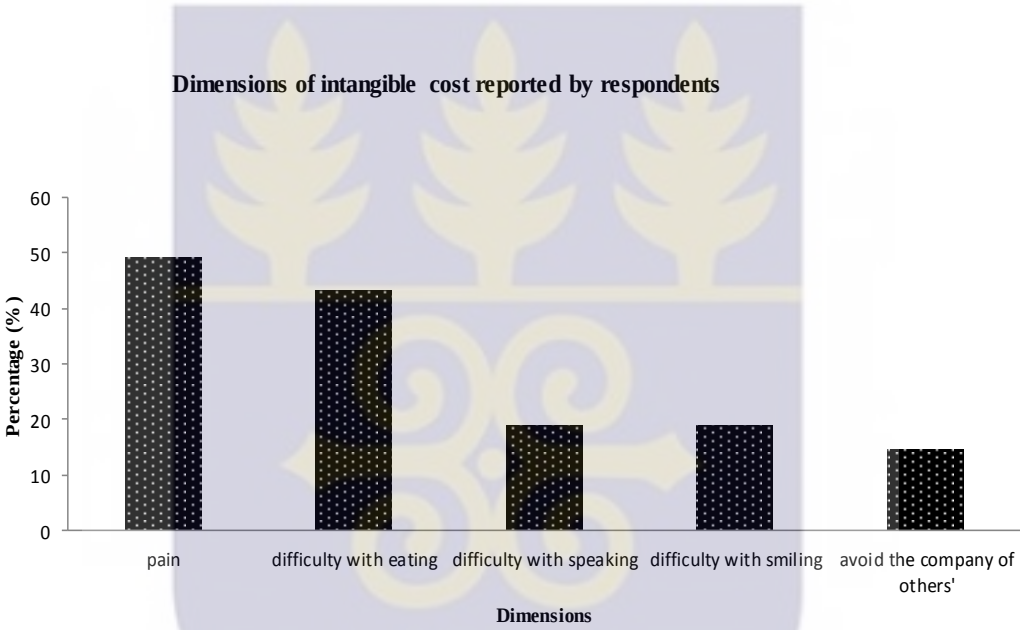

Figure 3: Patients intangible cost

CHAPTER FIVE

5.0 DISCUSSION

The total cost of dental diseases was estimated to be GHS 27,184.00 (US$ 6,614.11) with an average of GHS 146.94 (US$ 35.75) per patient. The direct cost constituted 94.5% of the total cost profile while the indirect cost constituted 5.5% of the total cost profile. Medical cost constituted 86.9% of the direct cost and non-medical costs constituted 13.1% of the direct cost. The percentages of intangible cost borne by responds was highest for pain (49.2%) and lowest (14.6%) avoiding the company of others.

5.1 Direct cost of dental diseases

This study revealed that the direct cost of dental diseases is high. This was evident in the proportions of the direct and indirect cost estimated which are comparable to costs estimated in some studies in other countries. This finding is similar to the direct cost estimated in Malaysia by Mohd-Dom et al. (2014) who found that the direct cost constituted about 94% of the total cost. Even though the proportion (90%) of direct cost estimated by Warmerdam et al. (2014) was similar to that reported this study, it was higher in monetary terms which was US$ 127million as compared to the direct cost (US$ 6,614.11) estimated in this study. This can be attributed to the perspective and the period of the two studies. Whilst this study estimated the cost of study from the patients perspective, Warmerdam et al. (2014) estimated cost from the societal perspective which considers costs incurred by both the patient and the health care provider. Also, costs estimated in this study was for a ten (10) day period while that estimated by Warmerdam et al. (2014) was an annual cost. Both studies however used similar cost components like diagnostic tests, treatment, food and travel costs.

Direct medical cost constituted 86.9% while non-medical costs constituted 13.1% respectively of the direct cost. The difference in the proportions can be explained by the contribution of the high cost of treatment component of the direct cost which confirms the findings of Masood et al. (2015) that dental treatments are associated with high costs. More patients (78.9%) had curative treatments (medication, extraction, filling) than preventive treatments (cleaning). This confirms the finding by Mohd-Dom et al. (2014) where 76.4% of patients received curative treatment and it suggests that more curative than preventive treatments are received by dental patients. This results in patients making high dental health care expenditure since curative treatments are more costly than preventive treatment.

On the contrary, Nazaradden, Francisco, & Clare (2015) reported direct medical costs and direct non-medical costs as 45% and 51% respectively showing that the direct non-medical cost constituted more than half of the total direct cost however, the cost of the health services consumed in that study was subsidized resulting in patients making low health care expenditure thereby reducing the proportion of direct medical cost. Meanwhile, the non-direct medical cost estimated in this study constituted 13.1% of the total direct cost. This is similar to findings by Hahn et al. (2008) who reported non-direct medical costs as 15% of the total direct cost.

Furthermore, the mean direct cost is GHS 133.46 (US$ 32.47) which is less than the mean direct cost (US$ 386) reported by Mawardi et al. (2014) who conducted a cost analysis of dental services needed before hematopoietic cell transplantation in the United States. Even though both studies were conducted from the patients' perspective, the contrast in the costs can be attributed to the difference in the sample size used in both studies. The number of participants used in the study conducted by Mawardi et al. (2014) was 403 while 185 participants were used in this study.

5.2 Indirect cost of dental diseases

The indirect cost estimated was GHS 1,502.30 (US$ 365.52). This was contrary to that of Harford & Chrisopoulos (2012) who estimated the maximum indirect cost to be US$ 604 million in their study conducted in Australia and this can be attributed to the large sample size (6,284) that was used in the study as compared to the sample size (185) that was used in this study. The productivity losses estimated in this study constituted a lower proportion (5.5%) of the total cost and was comparable to the proportion (4%) estimated by Mohd-Dom et al. (2014). This is contrary to the findings by Addo et al. (2013) and López et al.(2002) who reported a higher indirect cost proportion of 74% and 38% respectively. The participants in those studies suffered from mental illness and diabetes respectively. These are chronic illnesses and it presupposes that dental diseases usually lacked the chronic nature of other diseases like mental illness and diabetes which require regular hospital visits thus, patients with dental diseases incur lower productivity losses when compared to patient with other chronic illnesses.

The actual income of the respondents was not used in this study due to the difficulty in obtaining such information therefore the daily minimum wage was used for all respondents. This may result in the underestimation or over estimation of the indirect cost as some respondents may earned above or below the minimum wage. Also, the productivity days and work hours lost were based on the recall of the patients and some respondents may earn more than the minimum daily wage of GHS 7 (US$ 1.7) that was used to value the productivity time lost which would have resulted in higher productivity losses however, this limitation may be overcome in future studies if employees are able to give their accurate hourly wage rate and productivity time lost.

5.3 Cost of dental disease and socio-economic status

The total cost of dental diseases estimated was GHS 27,184.00 (US$ 6,614.11). The cost for diseases was estimated for different socioeconomic groups which were categorized into richest, richer, middle, poorer and poorest groups. There were small differences in the cost incurred by the different socio-economic groups however the highest mean cost was incurred by the richer group which amounted to GHS 191.89 (US$ 46.69). This was higher than the mean cost incurred by the middle and the poorer socioeconomic groups and it compares with the findings of Brown (2006) who reported that children in a high income family incurred higher average dental costs (US$ 567) than those in middle and poorer income families. This may be explained by the ability of the richer group to pay for more expensive treatment options than those from the middle and low socioeconomic groups. This findings also confirms that of Masood, Sheiham, & Bernabé (2015) which revealed that that dental health expenditure was more common in wealthier, urban and larger households in low and middle income countries (LMICs).

The lowest mean cost was incurred by the richest group which amounted to GHS 112.71 (US$ 27.42). This may be due to the ability of the richest group to afford regular dental visits thereby receiving preventive dental treatment which prevents them from developing dental diseases which would have caused them to incur high dental health expenditure.

5.4 Intangible costs of patients

The findings of this study revealed that patients experienced pain as a result of their dental diseases. This was evident in the number of patients (91) who agreed that they experienced pain due to their dental condition. This represented almost half (49.2%) of the respondents. This finding however differs from that of Duncan et al. (2003) which showed that 31.2% of patients reported dental pain from a baseline of 11.5% and Okunseri et al. (2005) who also reported 34%

dental pain prevalence. Pau, Croucher, & Marcenes (2007) also noticed that 28% of their subjects reported varying degrees of dental pain. However, these differences may result from the different dental conditions reported by the subjects in the different studies as some dental conditions do not produce pain.

Some of the respondents agreed that they had difficulty with chewing. This was reported by 43.2% of the respondents. This condition is usually reported by patients who have lost multiple teeth or patients who have some form of dental prostheses like dentures. Peek et al. (2002) made a contrary finding which revealed that 34% of study subjects complained of having difficulty with chewing. Locker et al.(2002) also reported that 26% of their subjects complained of having difficulty with chewing and concluded that there was an increase in the prevalence of chewing problems related with dental diseases however having difficulty with chewing may depend on the severity of tooth loss and patients employ several means of adapting to this difficulty hence the difference in the results. Meanwhile, dental patients who are denture wearers or who have multiple missing teeth also complain of having difficulty with speech however most of the respondents (61.6%) in this study disagreed that they had difficulty with speech which confirms the findings of Turgut et al. (2012) who reported that tooth loss did not influence articulation and that their study subjects had the ability to compensate for the differences and articulated speech sounds correctly. Furthermore, Artjomenko, Vidzis, & Broka (2012) noted that dental diseases that result in tooth loss can produce changes in speech quality however well designed dental prostheses could improve a patient's speech function.

Few respondents constituting 18.9% (35) of the respondents agreed that they had difficulty with smiling due to their dental condition. Ibiyemi & Taiwo (2011) on the other hand reported that 50% of their subjects had difficulty with smiling due to discolouration of their anterior teeth.

They also reported that about 70% of their subjects had difficulty answering questions and another 40% interacted with their colleagues with some form of difficulty due to their dental conditions. This difference may be explained by the fact that the subjects in their study were adolescents and they fall within the age group where there is increased awareness of aesthetic aspects of their facial features which further confirms their finding that 24.5% of the adolescents perceived that their anterior teeth were discolored with 69.1% disliking the discolouration of their teeth. Also, about a tenth (27) of the subjects in this study agreed that they avoided the company of others because of their dental diseases. This is contrary to the findings of Settineri et al., (2010) who reported that about 19.4% self-reported cases of halitosis and concluded that it leads to avoidance behaviours and limits relationships. The difference may be due to the low rate of awareness of the condition among subjects in this study (Hammad, Darwazeh, Al-Waeli, Tarakji, & Alhadithy, 2014). The total cost of dental diseases in this study did not include intangible costs in monetary terms. Xie et al.(2008) showed that intangible costs forms the greatest proportion of total costs of illness however intangible cost was not estimated in this study. This means that the estimated total cost of dental diseases in this study is not the actual cost of dental disease therefore the intangible cost must be estimated in monetary term in future studies in order to overcome this limitation.

5.5 Sensitivity analysis

The cost of medication and the wage rate were varied by 5%, 10% and 25% in order to test the robustness of the costs estimated in this study. The 5%, 10% and 25% variation in cost of medication produced 0.7%, 1.4% and 3.5% change respectively in the total cost whereas the 5%, 10% and 25% variation in the wage rate resulted in 0.1%, 0.1% and 0.3% change respectively in the total cost. The high percentage changes produced by variations in the cost of medication

shows that the total cost is more sensitive to variations in the cost of medication when compared to variations in the wage rate which produced lower percentage changes. However, whereas 10% variations in the cost of medication produced twice the percentage change in the total cost as produced by 5% variation, 10% variation in the wage rate produced the same 0.1% change in the total cost as produced by 5% variation in wage rate. The total cost is most sensitive to 25% variation in both the cost of medication and the wage rate. The 25% variation in cost of medication also produced 0.2% change in the proportion of the direct cost and 0.0% in the proportion of the indirect cost which means that the proportion of the direct cost is more sensitive to variations in the cost of medication whereas the proportion of indirect cost is not sensitive to variations in the cost of medication. This is because the cost of medication is a component of the direct cost but not a component of the indirect cost therefore changes in the cost of medication will produce more changes in the proportions of the direct cost than in the proportions of the indirect costs. Both proportions of direct and indirect costs are sensitive to variations in wage rate however, indirect costs are more sensitive to the variations in the wage rate. Also, direct costs have negative changes of -0.1%, -0.1% and -0.3% which means that the proportions of direct cost decrease with increase in the variations of wage rate. This may be explained by the fact that the wage rate is one of the most important components of indirect cost hence the indirect cost being most affected by variations in the wage rate.

The multi-variation of cost of medication and wage rate produced the highest percentage change in the total cost (0.8%, 1.5% and 3.8%) and this makes the total cost most sensitive to the multi-variation of cost of medication and wage rate. The proportions of the direct and indirect costs were not sensitive to 5% multi-variation of cost of medication and wage rate. They were however sensitive to 10% and 25% multi-variations. Also, the proportions of the indirect costs

were more sensitive to the multi-variations than the proportions of the direct cost and the proportions of the direct cost decreased as the multi-variations increased however since the changes produced by the variations were close to the initial proportions of the direct cost (94.5%) and indirect cost (5.5%) it shows that the cost estimates are robust.

Limitations of the study are as follows

1. The intangible costs were not estimated in the study which led to the underestimation of the total cost.
2. The study did not indicate whether out-of-pocket payments were higher for insured or uninsured respondents.
3. Productivity losses were not disaggregated into those employed and those not employed to establish the proportion of costs for absenteeism from school and from work.
4. Majority (50%) of the respondents in the study were students who mainly walked to the facility and that could have affected the cost of travel.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The costs of dental diseases are important and cannot be overlooked. The direct costs are high and constitutes more than two-thirds (94.5%) of the total costs with the cost of treatment significantly contributing (44.9%) to direct medical cost while output losses by patients made up about half (57.8%) of the indirect cost. Patients in poor socioeconomic groups incur higher costs of dental healthcare than those in the richest group. Furthermore, patients suffer pain and have difficulty with chewing due to their dental conditions however their ability to interact with others is least affected by their dental conditions.

6.2 Recommendations

The recommendations of the study are as follows:

1. Stakeholders such as the Ministry of Health (MOH) and the Ghana health Service (GHS) should ensure that dental health services are subsidised for patients in order to reduce high dental health care costs.
2. Further studies must be conducted by researchers to estimate the intangible cost of dental diseases.
3. Further studies must be conducted by researchers to estimate the total costs of dental diseases from societal perspective in order to add to the pool of knowledge in this area.

REFERENCES

Addo, R., Nonvignon, J., & Aikins, M. (2013). Household costs of mental health care in Ghana. *The Journal of Mental Health Policy and Economics*, *16*(4), 151–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24526584

Addo-Yobo, C., Williams, S. A., & Curzon, M. E. (1991). Dental caries experience in Ghana among 12-year-old urban and rural schoolchildren. *Caries Research*, *25*(4), 311–4. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/1913771

Ajayi, D. M., & Arigbede, A. O. (2012). Barriers to oral health care utilization in Ibadan, South West Nigeria. *African Health Sciences*, *12*(4), 507–13. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3598293&tool=pmcentrez&rendertype=abstract

Artjomenko, V., Vidzis, A., & Broka, K. (2012). The assessment of speech quality and intellibility after replacement of lost teeth with removable dentures: review of literature. *Acta Chirurgica Latviensis*, *12*(1), 72–77.

Astrøm, A. N., & Kida, I. A. (2007). Perceived dental treatment need among older Tanzanian adults - a cross-sectional study. *BMC Oral Health*, *7*, 9.

Bashiru, B., & Omotunde, S. (2014). Burden of oral diseases and dental treatment needs of an urban population in Port Harcourt, Rivers State, Nigeria. *European Journal of General Dentistry*, *3*(2), 125.

Borskey, E. (2014). Definition of socioeconomic status (SES). Retrieved May 28, 2015, from http://std.about.com/od/glossary/g/sesgloss.htm

Briggs, A. (1999). Economics notes: handling uncertainty in economic evaluation. *BMJ (Clinical Research Ed.)*, *319*(7202), 120. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1116199&tool=pmcentrez&rendertype=abstract

Brown, E. (2006). Children's visits and expenses,United States, 2003. Retrieved July 1, 2015, from http://meps.ahrq.gov/mepsweb/data_files/publications/st117/stat117.pdf

Celeste, R. K., Nadanovsky, P., & Fritzell, J. (2011). Trends in socioeconomic disparities in the utilization of dental care in Brazil and Sweden. *Scandinavian Journal of Public Health*, *39*(6), 640–648.

Centers for Disease Control and Prevention. (2014). *Use of selected clinical preventive services to improve the health of infants, children, and adolescents — United States, 1999–2011*. Retrieved from http://www.cdc.gov/mmwr/pdf/other/su6302.pdf

Centers for Medicare & Medicaid Services. (2012). *National health expenditures 2012 highlights*. Retrieved from https://kaiserhealthnews.files.wordpress.com/2014/04/highlights.pdf

Chapple, I. L. C. (2000). The significance of oral health in HIV disease. *Sexually Transmitted Infections*, *76*(4), 236–243.

Chrisopoulos, S., Beckwith, K., & Harford, J. (2011). Oral health and dental care in Australia: Key facts and figures,2011. Retrieved July 13, 2015, from http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737420706

Cunningham, S. J. (2000). Economics: Economic evaluation of healthcare – is it important to us? *British Dental Journal*, *188*(5), 250–254.

Curtis, B., Evans, R., Sbaraini, a., & Schwarz, E. (2007). Geographic location and indirect costs as a barrier to dental treatment: a patient perspective. *Australian Dental Journal*, *52*(4), 271–275. doi:10.1111/j.1834-7819.2007.tb00501.x

Datta, P., & Datta, P. (2013). Prevalence of dental caries among school children in Sundarban, India. *Epidemiology: Open Access*. Retrieved from http://www.omicsonline.org/prevalence-of-dental-caries-among-school-children-in-sundarban-india-2161-1165.1000135.php&&aid=20304

Dawani, N., Nisar, N., Khan, N., Syed, S., & Tanweer, N. (2012). Prevalence and factors related to dental caries among pre-school children of Saddar town, Karachi, Pakistan: a cross-sectional study. *BMC Oral Health*, *12*(1), 59.

Devaraj, C., & Eswar, P. (2012). Reasons for use and non-use of dental services among people visiting a dental college hospital in India: A descriptive cross-sectional study. *European Journal of Dentistry*, *6*(4), 422–7. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3474558&tool=pmcentrez&rendertype=abstract

Dhadse, P., Gattani, D., & Mishra, R. (2010). The link between periodontal disease and cardiovascular disease: How far we have come in last two decades ? *Journal of Indian Society of Periodontology*, *14*(3), 148–54. doi:10.4103/0972-124X.75908

Duncan, R. P., Gilbert, G. H., Peek, C. W., & Heft, M. W. (2003). The dynamics of toothache pain and dental services utilization: 24-month incidence. *Journal of Public Health Dentistry*, *63*(4), 227–34. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14682646

Dye, B., Eke, P., Wei, L., Thornton-Evans, G., & Genco, R. (2012, October). Prevalence of periodontitis in adults in the United States: 2009 and 2010. *Journal of Dental Research*.

Emami, E., de Souza, R. F., Kabawat, M., & Feine, J. S. (2013). The impact of edentulism on oral and general health. *International Journal of Dentistry*, *2013*, 498305.

Ettaro, L., Songer, T. J., Zhang, P., & Engelgau, M. M. (2004). Cost-of-illness studies in diabetes mellitus. *PharmacoEconomics*, *22*(3), 149–64. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14871163

European Dental Competent Autorities and Regulators. (2010). *European survey on oral health (Eurobarometer)*. Retrieved from http://www.fedcar.eu/index.php?option=com_content&view=article&id=41:le-systeme-imi-integre-la-profession-dentaire&catid=1:latest-news&Itemid=50&lang=en

Fargo Wells Bank. (2011). *Industry perspective: U.S. dental practices*. Retrieved from http://www.burkhartdental.com/sites/default/files/files/news/dental_offices_9_2011.pdf

Faye, M., Diawara, C. K., Ndiaye, K. R., & Yam, A. A. (2008).Dental fluorosis and dental caries prevalence in Senegalese children living in a high-fluoride area and consuming a poor fluoridated drinking water. *Dakar Médical*, *53*(3), 162–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19626786

Foster, R., Blakely, T., Wilson, N., & O'Dea, D. (2013). *Protocol for Direct Costing of Health Sector Interventions for Economic Modelling (Including Event Pathways)*. Retrieved from http://www.otago.ac.nz/wellington/otago042728.pdf

Gathecha, G., Makokha, A., Wanzala, P., Omolo, J., & Smith, P. (2012). Dental caries and oral health practices among 12 year old children in Nairobi West and Mathira West Districts, Kenya. *The Pan African Medical Journal*, *12*, 42. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3415062&tool=pmcentrez&rendertype=abstract

Godson, E., & Mumghamba, S. (2009). Periondontal diseases in Tanzania. *Medica-Odontologica*, *84*(7). Retrieved from https://www.doria.fi/bitstream/handle/10024/44888/AnnalesD847Mumghamba.pdf?sequence=1

Hahn, S. G., Jacobs, G., Heck, H., Kremers, S., Brase, H., Jungling, B., … Lutz, M. P. (2008). Cost analysis of non-medical vs. treatment-related costs in patients with chemotherapy for colorectal cancer. *ASCO Meeting Abstracts*, *26*(15_suppl), 6619. Retrieved from http://hwmaint.meeting.ascopubs.org/cgi/content/abstract/26/15_suppl/6619

Hamila, N. (2013). Early childhood caries and certain risk factors in a sample of children 1-3.5 years in Tanta. *Dentistry*. Retrieved from http://www.omicsonline.org/early-childhood-caries-and-certain-risk-factors-in-a-sample-of-children-years-in-tanta-2161-1122.1000180.php&&aid=21749

Hammad, M. M., Darwazeh, A. M., Al-Waeli, H., Tarakji, B., & Alhadithy, T. T. (2014). Prevalence and awareness of halitosis in a sample of Jordanian population. *Journal of International Society of Preventive & Community Dentistry*, *4*(Suppl 3), S178–86.

Harford, J., & Chrisopoulos, S. (2012). Productivity losses from dental problems. *Australian Dental Journal*, *57*(3), 393–7.

Hayes, A., Azarpazhooh, A., Dempster, L., Ravaghi, V., & Quiñonez, C. (2013). Time loss due to dental problems and treatment in the Canadian population: analysis of a nationwide cross-sectional survey. *BMC Oral Health*, *13*(1), 17.

Ibiyemi, O., & Taiwo, J. O. (2011). Psychosocial aspect of anterior tooth discoloration among adolescents in igbo-ora, southwestern Nigeria. *Annals of Ibadan Postgraduate Medicine*, *9*(2), 94–9. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4111029&tool=pmcentrez&rendertype=abstract

Institute for Quality and Efficiency in Health Care (IQWiG). (2012). *Cost estimation*. Retrieved from https://www.iqwig.de/download/Working_Paper_Cost_Estimation.pdf

Israel, G. (2013). Determining sample size. Retrieved July 13, 2015, from https://edis.ifas.ufl.edu/pdffiles/PD/PD00600.pdf

Kaimenyi, J. T. (2004). Oral health in Kenya. *International Dental Journal*, *237*(54), 378–382.

Kemuto, M. (2010). Oral treatment seeking behaviour among patients visiting the University of Nairobi Dental Hospital. Retrieved May 28, 2015, from http://periodontology.uonbi.ac.ke/sites/default/files/chs/dentalschool/periodontology/MAUBI GODRIVER.pdf

Korle-Bu Teaching Hospital. (2012). *AnnualReport.* Retrieved from Korle-Bu Teaching Hospital, Accra.

Lee, J. S., Weyant, R. J., Corby, P., Kritchevsky, S. B., Harris, T. B., Rooks, R., … Newman, A. B. (2004). Edentulism and nutritional status in a biracial sample of well-functioning, community-dwelling elderly: the health, aging, and body composition study. *Am J Clin Nutr*, *79*(2), 295–302. Retrieved from http://ajcn.nutrition.org/content/79/2/295.full

Li, X., Kolltveit, K. M., Tronstad, L., & Olsen, I. (2000). Systemic diseases caused by oral infection. *Clinical Microbiology Reviews*, *13*(4), 547–58. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=88948&tool=pmcentrez&rendertype=abstract

Locker, D., Matear, D., & Lawrence, H. (2002). General health status and changes in chewing ability in older Canadians over seven years. *Journal of Public Health Dentistry*, *62*(2), 70–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11989209

López Bastida, J., Serrano Aguilar, P., & Duque González, B. (2002). The social and economic cost of diabetes mellitus. *Atencion Primaria / Sociedad Española de Medicina de Familia Y*

Comunitaria, *29*(3), 145–50. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11879600

Maatouk, F., Maatouk, W., Ghedira, H., & Ben Minoun, S. (2006). Effect of 5 years of dental studies on the oral health of Tunisian ___ - - NCBI. *PubMed*, *12*(5).

Marcenes W, Kassebaum NJ, Bernabé E, Flaxman A, Naghavi M, Lopez A, M. C. (2013). Global burden of oral conditions in 1990-2010: a systematic analysis. *Journal of Dental Research*, *92*(7), 592–7.

Masood, M., Sheiham, A., & Bernabé, E. (2015). Household expenditure for dental care in low and middle income countries. *PloS One*, *10*(4), e0123075. doi:10.1371/journal.pone.0123075

Mawardi, H., Manlove, A. E., Elting, L. S., Marty, F. M., Treister, N. S., & Woo, S.-B. (2014). Cost analysis of dental services needed before hematopoietic cell transplantation. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, *117*(1), 59–66.

Mohd-Dom, T., Ayob, R., Mohd-Nur, A., Abdul-Manaf, M. R., Ishak, N., Abdul-Muttalib, K., … Mohd-Asari, A. S. (2014). Cost analysis of periodontitis management in public sector specialist dental clinics. *BMC Oral Health*, *14*, 56.

Nazaradden, I., Francisco, P.-M., & Clare, G. (2015). Direct non-medical costs double the total direct costs to patients undergoing cataract surgery in Zamfara state, Northern Nigeria: a case series. *BMC Health Services Research*, *15*(1), 163.

National Institute of Dental and Craniofacial Research. (2014). *The meaning of oral health*. Retrieved from http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/sgr/chap1.htm

O'Reilly, B., & Boyd-Boland, R. (2006). National Dental Update. Retrieved May 28, 2015, from http://www.ada.org.au/app_cmslib/media/lib/0702/m44818_v1_socioeconomic status and oral healthsep_06.pdf

Okunseri, C., Hodges, J. S., & Born, D. (2005). Self-reported toothache experience in an adult population in Benin City, Edo State, Nigeria. *Oral Health & Preventive Dentistry*, *3*(2), 119–25. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16173389

Pannarunothai, S., & Mills, A. (1997). The poor pay more: health-related inequality in Thailand. *Social Science & Medicine (1982)*, *44*(12), 1781–90. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9194240

Patel, R. (2012). The state of oral health in Europe. *Better Oral Health European Platform*. Retrieved from http://www.mah.se/PageFiles/49503/Report - the State of Oral Health in Europe.pdf

Pau, A., Croucher, R. E., & Marcenes, W. (2007). Demographic and socio-economic correlates of dental pain among adults in the United Kingdom, 1998. *British Dental Journal*, *202*(9), E21; discussion 548–9.

Peek, C. W., Gilbert, G. H., & Duncan, R. P. (2002). Predictors of chewing difficulty onset among dentate adults: 24-month incidence. *Journal of Public Health Dentistry*, *62*(4), 214–21. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12474625

Poudyal, S., Rao, A., Shenoy, R., & Priya, H. (2010). Utilization of dental services in a field practice area in mangalore, karnataka. *Indian Journal of Community Medicine : Official Publication of Indian Association of Preventive & Social Medicine*, *35*(3), 424–5.

Pryor, C., Prottas, J., Lottero, B., Rukavina, M., & Knudson, A. (2009). The costs of dental care and the impact of dental insurance coverage - *Robert Wood Johnson Foundation*. Retrieved May 28, 2015, from http://www.rwjf.org/en/library/research/2009/04/the-costs-of-dental-care-and-the-impact-of-dental-insurance-cove.html

Richardson, B., & Richardson, J. (2011). *The cost of poor dental health and what should be done about it*. Retrieved from www.bsl.org.au/pdfs/Richardson_End_the_decay_2011.pdf

Roijen, L. Van, Koopnanschagavb, M. A., Ruttena, F. F. H., & Maas, P. J. Van Der. (1995). Indirect costs of disease ; an international comparison, *33*, 15–29.

Saini, R., Saini, S., & Saini, S. R. (2010). Periodontitis: a risk for delivery of premature labor and low-birth-weight infants. *Journal of Natural Science, Biology, and Medicine*, *1*(1), 40–2.

Saunders, E. (2014). Cost of Tooth Extraction - Consumer Information. Retrieved from http://health.costhelper.com/tooth-extraction.html

Settineri, S., Mento, C., Gugliotta, S. C., Saitta, A., Terranova, A., Trimarchi, G., & Mallamace, D. (2010). Self-reported halitosis and emotional state: impact on oral conditions and treatments. *Health and Quality of Life Outcomes*, *8*, 34.

Shanthi, V., Vanka, A., Bhambal, A., Saxena, V., Saxena, S., & Kumar, S. S. (2012). Association of pregnant women periodontal status to preterm and low-birth weight babies: A systematic and evidence-based review. *Dental Research Journal*, *9*(4), 368–80. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3491321&tool=pmcentrez&rendertype=abstract

Sheiham, A. (2005). WHO | Oral health, general health and quality of life. *Bulletin of World Health Organ*, *83*(9), 641–720. Retrieved from http://www.who.int/bulletin/volumes/83/9/editorial30905html/en/

Shepherd, M. A., Nadanovsky, P., & Sheiham, A. (1999). Dental public health: the prevalence and impact of dental pain in 8-year-old school children in Harrow, England. *British Dental Journal*, *187*(1), 38–41.

Sherman, E. J., Pfister, D. G., Ruchlin, H. S., Ph, D., Rubin, D. M., Radzyner, M. H., … Scher, H. I. (2001). The collection of indirect and nonmedical direct costs (COIN) Form Carcinoma, *91*(4), 841–853.

Thompson, B., Cooney, P., Lawrence, H., Ravaghi, V., & Quiñonez, C. (2014). The potential oral health impact of cost barriers to dental care: findings from a Canadian population-based study. *BMC Oral Health*, *14*(1), 78. doi:10.1186/1472-6831-14-78

Turgut, M. D., Genc, G. A., Basar, F., & Tekciceki, M. U. (2012). The effect of early loss of anterior primary tooth on speech production in preschool children. Retrieved July 3, 2015, from http://journals.tubitak.gov.tr/medical/issues/sag-12-42-5/sag-42-5-18-1104-41.pdf

Wall, T. P., Vujicic, M., & Nasseh, K. (2012). Recent trends in the utilization of dental care in the United States. *Journal of Dental Education*, *76*(8), 1020–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22855587

Warmerdam, S., Caldewey, P., & Willert, P. (2014). *The cost of dental disease and prevention strategies in Sonoma county*. Retrieved from http://www.sonoma-county.org/health/meetings/pdf/fac/dental-costs.pdf

Watt, R. G. (2005). Public health reviews strategies and approaches in oral disease prevention and health promotion, *020370*(04), 711–718.

WHO. (2012). WHO | Oral health. Retrieved from http://www.who.int/mediacentre/factsheets/fs318/en/

WHO. (2008). Action plan for the global strategy for the prevention and control of noncommunicable diseases. Retrieved July 13, 2015, from http://www.who.int/nmh/publications/ncd_action_plan_en.pdf

WHO. (2015). WHO | What is the burden of oral disease? Retrieved from http://www.who.int/oral_health/disease_burden/global/en/

Xie, F., Thumboo, J., Fong, K.-Y., Lo, N.-N., Yeo, S.-J., Yang, K.-Y., & Li, S.-C. (2008). A study on indirect and intangible costs for patients with knee osteoarthritis in Singapore. *Value in Health : The Journal of the International Society for Pharmacoeconomics and Outcomes Research*, *11 Suppl 1*, S84–90.

Xu, K., Evans, D. B., Kawabata, K., Zeramdini, R., Klavus, J., & Murray, C. J. L. (2003). Household catastrophic health expenditure : a multicountry analysis, *362*, 111–117.

APPENDICES

Appendix I Informed Consent Form

Project Title: Economic burden of dental disease of patients attending the Dental Unit of Ridge Hospital, Accra.

Background

My name is Seli Yawa Deh, a student from the University of Ghana, Legon. I am conducting a study on the economic burden of dental disease of patients attending the dental unit of Ridge Hospital, Accra. The main objective of this study is to determine the economic burden of dental disease of patients attending the dental unit of Ridge Hospital.

Procedures

The study will involve answering questions from a structured questionnaire about the cost incurred by a patient in seeking dental healthcare. No coercion will be used to obtain repose from participants. It will be appreciated if you could participate in this study. This is an academic research which forms part of my work for the award of Masters Degree in Public Health.

Risks and Benefits

The study population and other stakeholders in dental health care will benefit from this study. The study population the estimation will show the effect of dental disease on patients who attend Ridge hospital especially to identify the costs involved in treating such diseases and the loss of productivity due to the disease in order to influence stakeholders to take more preventive than curative measures towards dental conditions, contribute to oral health policy dialogue.

There are no risks associated with study.

Right to Refuse

Participation in this study is voluntary. You are allowed to answer any individual question or all the questions. You can withdraw from the study at anytime however, you are encouraged to fully participate in the study.

Anonymity and confidentiality

The information obtained in this study will be kept confidential and will not be accessed by an unauthorised person.

Dissemination of Results

A durbar will be held at the dental unit of Ridge Hospital to disseminate the findings of the study. A copy of the study will be kept at the hospital as reference.

Before taking the Consent

Do you have any concerns about the study that you wish to be addressed?

Yes ☐ No ☐

If yes, please indicate your concern below.

……

……

If you have any questions later please, contact Seli Yawa Deh (**Tel: 0507655166**, or **selideh@gmail.com**) or The Ghana Health Service Ethical Review Committee administrator Hannah Frimpong (**0243235225** or **0507041223**).

Voluntary Consent

I have read the information given or the given information has been read and duly explained to me. My concerns about this study have been duly addressed. I now voluntarily agree to participate in this study knowing that I have the right to withdraw from the study at anytime without it affecting my ability to access dental health care at this facility in the future.

……	……	……	……
(Name of participant)	(Signature)	(Thumbprint)	(Date)
……	……..	……..	……
(Name of Researcher)	(Signature)	(Thumbprint)	(Date)

Interviewer's Statement

I, the undersigned, have explained this consent to the subject in English/Ga/Twi/Ewe/Hausa and that he/she understands the purpose of this study, procedures to be followed as well as the risks and benefits of this study.

The participant has agreed to fully participate in this study.

Signature of Research Assistant …….

Date……...

Address…….

Appendix II Questionnaire

QUESTIONNAIRE

A STUDY ON ECONOMIC BURDEN OF DENTAL DISEASES ON PATIENTS ATTENDING THE DENTAL CLINIC OF UNIVERSITY HOSPITAL, LEGON, ACCRA

Dear Respondent,

My name is Seli Yawa Deh, a Master of Public Health student from the University of Ghana, Legon. I am conducting a study on the Economic Burden of Dental Disease of patients attending the University Hospital, Legon, Accra You are assured that the answers you give will be kept strictly confidential. There are no risks associated with this study. The findings of this study will be disseminated to the hospital and will also contribute to the oral health policy in Ghana. Participation in this study is voluntary however I would be grateful if you would consent to voluntarily participate in this study by responding to the questions below. Thank you.

Do you have any concerns about the study that you wish to be addressed? Please Tick the boxes below

Yes ☐ No ☐

If yes, please indicate your concern below.

……

……

If you have any questions later please, contact Seli Yawa Deh (Tel: 0507655166, or selideh@gmail.com) or The Ghana Health Service Ethical Review Committee administrator Hannah Frimpong (0243235225 or 0507041223).

Informed Consent

I have read the information given or the given information has been read and duly explained to me. My concerns about this study have been duly addressed. I now voluntarily agree to participate in this study knowing that I have the right to withdraw from the study at any time without it affecting my ability to access dental health care at this facility in the future.

…… …… …… ……

(Name of participant) (Signature) (Thumbprint) (Date)

Interviewer's Statement

I, the undersigned, have explained this consent to the subject in English/Ga/Twi/Ewe/Hausa and that he/she understands the purpose of this study, procedures to be followed as well as the risks and benefits of this study.

The participant has agreed to fully participate in this study.

Name of Researcher/Assistant……..

Signature of Research/ Assistant …….

Date……...

Please provide the appropriate responses to the questions below.

	Questions	Response
	Respondents ID	☐☐☐
	Folder Number	
	Demographic Information	
1.	Age	☐
2.	Sex 1. Male 2. Female	☐
3.	What is your current level of education? 1. No education 2. Primary 3. Middle school/JSS/JHS 4. SSS/SHS/Vocational 5. Tertiary	☐
4..	What is your marital status? 1. Single 2. Married 3. Separated 4. Divorced	☐
5.	What is your employment status?	☐

	1. Employed 2. Self –employed 3. Unemployed	
6.	What is your current insurance status 1. Insured (NHIS) 2. Insured (Private Health Insurance) 3. Uninsured	☐
SECTION TWO(HOUSEHOLD ASSETS)		
7.	Wall Clock 1. Yes 2. No	☐
8.	Television 1. Yes 2. No	☐
9.	Fridge/Freezer 1. Yes 2. No	☐
10.	Washing Machine 1. Yes 2. No	☐
11.	Home Theatre 1. Yes 2. No	☐
12.	Bed/ Table/ Chair 1. Yes 2. No	☐
13.	Bicycle 1. Yes 2. No	☐
14.	Car/Truck 1. Yes 2. No	☐
15.	House 1. Yes 2. No	☐
16.	Radio 1. Yes 2. No	☐
17.	Computer/Laptop	

	1. Yes 2. No	☐
18.	VCD/DVD player 1. Yes 2. No	☐
19.	Sewing Machine 1. Yes 2. No	☐
20.	Cabinet/Cupboard 1. Yes 2. No	☐
21.	Motor Cycle/Scooter 1. Yes 2. No	☐
22.	Generator 1. Yes 2. No	☐
23.	Land 1. Yes 2. No	☐
SECTION THREE (DENTAL CONDITION)		
24.	Have you ever had a dental condition for which you received treatment? 1. Yes 2. No	☐
25.	What dental condition do you have now? 1. Toothache 2. Gum disease 3. Swollen jaw 4. Broken tooth 5. Bad breath 6. Mouth sores 7. Other	☐ (Specify if other)……
26.	How long have you had this condition?	☐ Days ☐ Weeks ☐ Months ☐ Years

27.	What treatment did you receive? 1. Medication 2. Extraction (removal of tooth) 3. Filling 4. Cleaning 5. Dentures 6. Other	☐ (specify if other)…….
28.	How did you pay for the treatment? 1. Cash 2. NHIS 3. Private Health Insurance	☐

SECTION FOUR (DIRECT COST)

Medical cost

If you paid cash, Please fill the column below by indicating the amount you spent on the following.

29.

Cost category	Amount of money spent (GHS)
Consultation	
Diagnostics (eg. X-ray)	
Treatment	
Drugs	
TOTAL COST	

30. Non- medical cost

Cost category	Amount of money spent (GHS)
Travel cost	
Food cost	
Miscellaneous eg. Phone calls	

SECTION FIVE (Indirect Cost)		
	Question	Response
31.	How many days have you been absent from work (if applicable) because of this dental condition?	☐☐ days
32.	How many days have you absent from school (if applicable) because of this illness?	☐☐ days
33.	How many extra days do you intend to spend at home after the treatment in order to recover from the dental condition before resuming work?	☐☐ days
34.	How many extra days do you intend to spend at home after the treatment in order to recover from the dental condition before resuming school?	☐☐ days
35.	How many minutes or hours did you spend travelling to and from the dental clinic?	☐ mins/hrs
36.	How many minutes or hours did you spend at the dental clinic	☐ mins/hrs

SECTION SIX (INTANGIBLE COST)

Below are statements I want you to respond to on a five-point scale from strongly agree (5) to strongly disagree (1). Kindly indicate your preference for each of the statements.

37.	I have severe pain because of my dental condition 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
38.	I have sleepless nights because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
39.	I have low self confidence because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
40.	I avoid the company of others because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
	I have difficulty in speaking because of my dental	

41.	condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
42.	I have difficulty smiling because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
43.	I have difficulty eating because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐
44.	I have to change my diet because of my dental condition. 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree	☐

THANK YOU.