SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

ORAL HEALTH LITERACY AND BEHAVIORS AMONG STUDENTS OF KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

BY

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THIS DISSERTATION IS SUBMITTED TO THE KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI IN PARTIAL FULFILMENT OF REQUIREMENTS FOR THE AWARD OF THE MASTER'S DEGREE IN PUBLIC HEALTH: HEALTH SERVICES PLANNING AND MANAGEMENT.

SEPTEMBER 2019

DECLARATION

I declare that all information produced in this dissertation is a result of my own research. All cited works have been duly acknowledged by means of referencing. No part of this work has been presented anywhere else for another degree.

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DEDICATION

This dissertation is dedicated to my parents, Dr. Evans Dawoe and Mrs. Cecilia Dawoe. You have been my great inspiration and motivation.

ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude to my Dr. Yeetey Enuameh, for the support and stepwise guidance he provided throughout the writing of this dissertation.

I would also like to thank Stella Kabuja, Victor Morgan, Victory Anaba, Charlotte Paintsil and Ellen Tetteh for the help in the data collection.

Finally, I would like to express my gratitude to all my friends and classmates who have supported and encouraged me. God bless you all.

ABSTRACT

Introduction: Oral health is a major determinant in the overall quality of life of all individuals. Oral health literacy, which is the ability of an individual to obtain, understand and use oral health information needed to make informed choices concerning oral health, has been put forth as one of the main influencers of oral health outcomes. This study is to relate oral health literacy (OHL) to certain selected variables.

Method: A cross-sectional design was used for this survey. A sample size of 381 was determined by EpiInfo. An interviewer-administered questionnaire was used to collect data among KNUST students. REALD-30 toolkit was used to assess OHL and OHL levels. Multiple linear and multivariate regression analysis was used to determine the predictive associations between OHL and other variables such as college, gender, age, dental visit status and frequency of toothbrushing.

Results: Social media was the most preferred medium of oral health education among students (67.65%) while the most preferred medium for the general population was television and radio (49.47%). 33.96% of the population had no prior exposure to any form of oral health knowledge, while 33.18% had never visited a dentist. The mean OHL score was 12.10, with 88.50% having low OHL levels, 8.82% having moderate OHL levels and 2.67% having high OHL levels. Gender (C=-0.116, p=0.005), age (C=-0.025, p=0.003), college (C=-0.071, p=0.000) and exposure to education (C=0.132, p=0.002) significantly predicted OHL levels. Dental visit status (C=-0.15, p=0.013), frequency of visit (-0.29, p=0.008) and toothbrushing frequency (C=-0.199, p=0.006) were also significantly predicted by OHL levels.

Conclusion: About a third of the population had neither been exposed to oral health education nor visited a dentist. There is the need for further studies and further education of students and the general population to be carried out through their preferred media.

Keywords: Oral health, Oral health literacy, regression

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LIST OF ABBREVIATIONS

OHL:	Oral Health Literacy
WHO:	World Health Organization
USA:	United States of America
NCDs:	Non-Communicable Diseases
KNUST:	Kwame Nkrumah University of Science and Technology
REALD:	Rapid Estimate of Adult Literacy in Dentistry

DEFINITION OF TERMS

Oral Health	A multifaceted dynamic state which includes the ability to smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex.
Literacy	The ability to read and write.
Oral Health Literacy	The capability of a person to acquire, process and appreciate basic oral health information and services needed to make appropriate choices regarding their oral health.
Oral health behavior	Any action that is performed by an individual for the promotion, protection and/or maintenance of oral hygiene regardless of perceived or actual oral health status, whether such activity was effective towards the intent or not.
Social media	Websites and applications that enable users to create and share content or to participate in social networking.
Oral health education	The definition and transmission of messages which are intended to empower individuals to take greater control over and improve their oral health

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND.

"Literacy is Knowledge" is the bold heading of Robert Pondiscio's 2014 article in which he makes a case for literacy as a vehicle for the acquisition of knowledge, and that they should, therefore, be understood as one being entrenched in the other. The teachers of Greycaps try to make a counter-argument, defining literacy as the ability to read and write (some add listening and comprehension) and knowledge as the practical understanding of facts, data, and skills concerning a certain subject. The difference is, however, a very thin line, and this author wishes to side with the school of thought that considers knowledge a part of literacy.

According to Firmino *et al.*, 2018, Oral Health Literacy (OHL) is "*the capability of a person to acquire, process and appreciate basic oral health information (knowledge)- and services needed to make appropriate choices regarding their oral health"*.

The idea of Oral health literacy was modeled after the concepts of health literacy and has been used to explain the roles of education, culture and health systems in determining health outcomes through the transmission of knowledge (Institute Of Medicine, 2013). This will be demonstrated into further detail in the Conceptual Framework section below.

Several studies have shown that better health outcomes are related to higher levels of health literacy. In the domain of oral health literacy in particular, which has been gaining more prominence over the past decade, it has been shown that individuals with higher levels of OHL utilize dental care services more, report better self-efficacy, and generally have superior oral health outcomes to their less 'literate' counterparts (Baskaradoss, 2018). People who are more health literate are empowered to take better care of their health as a result of what they know, giving life to the quote by Sir Francis Bacon, "knowledge itself is power". If lower

literacy is related to less knowledge which results in worse health outcomes, then the words of the Prophet Hosea, “My people are destroyed for lack of knowledge” are rendered true. The government’s knowledge of health literacy in a population has policy implications to countries. This is because man-hours of production and school time for children are lost, while there are higher costs incurred for more emergency room visits and treatment of chronic conditions. Investigation health literacy allows for the formulation of policies that help raise awareness and enforce preventive health, as has been done in some states in the USA (Johnson and Goodwin, 2016).

The connection between OHL and oral health outcomes underscores the necessity for interventions and efforts to increase health literacy rates in order to have better well-being for individuals in the population.

1.2 STATEMENT OF THE PROBLEM

Oral diseases are the most common non-communicable diseases and affect over 90% of the world population in different manifestations at various points in a person’s lifetime. Oral health inequities exist between and among populations and different socioeconomic classes, with social determinants having a large impact. Inadequate numbers of qualified oral health workers and specialists and high treatment costs only worsen the matter. There is however general neglect of the issue and the general well-being of persons are continually affected negatively due to pain and illness caused by oral diseases (WHO, 2018).

The usage of service will be determined by the awareness of

- the type of problem one has,
- the interventions that exist for the problem, and
- the availability and accessibility of such interventions.

Generally, oral health awareness in developing countries are low relative to developed countries, and service utilization is largely symptomatic, not preventive (Mohd-Dom *et al.*,

2015). Ajayi and Arigbede in their 2012 study reported low levels of knowledge concerning oral health conditions and care as a major determinant affecting oral health care utilization in the sub-Saharan Africa region. The major reasons for non-use of oral health services are due to the lack of knowledge of the existence of such services, and lesser severity of the condition; people usually report for treatment only when the pain becomes severe or when there are other complications such as swellings and abscess formations (Rambabu and Koneru, 2018).

Oral health literacy has been proposed as one effective way of reducing oral health inequities globally. Being literate (having knowledge and comprehension) of the magnitude of the oral health problem and its impact on economies will stimulate policy processes and developments at institutional and governmental level towards reducing its burden. On individual and interpersonal levels oral health literacy will also urge individuals to make more use of oral health services through an understanding of how their general quality of life can be improved through enhanced oral health (Horowitz *et al.*, 2012; Guo *et al.*, 2014). Unfortunately, oral health literacy in Ghana and sub-Saharan Africa is very low and is clearly affecting interest in oral health as well as the usage of oral health services, leading to lower quality of life, loss of school and work hours, as well as increased costs due to late presentation (Johnson and Goodwin, 2016). These problems must be addressed as a matter of urgency, starting with awareness and literacy efforts, if primary prevention is an area of priority for reducing the NCDs burden across the continent and the globe.

1.3 CONCEPTUAL FRAMEWORK FOR ORAL HEALTH LITERACY

The conceptual framework for Oral Health Literacy developed by (Kleinman, 2013), is an adaptation of the Health Literacy framework for in the Institute Of Medicine Health Literacy

report of 2004. OHL exists within the context of the educational system, as well as culture and society in which individuals live, and their interactions with the health system affect and/or complement oral health status, oral health outcomes, and costs.

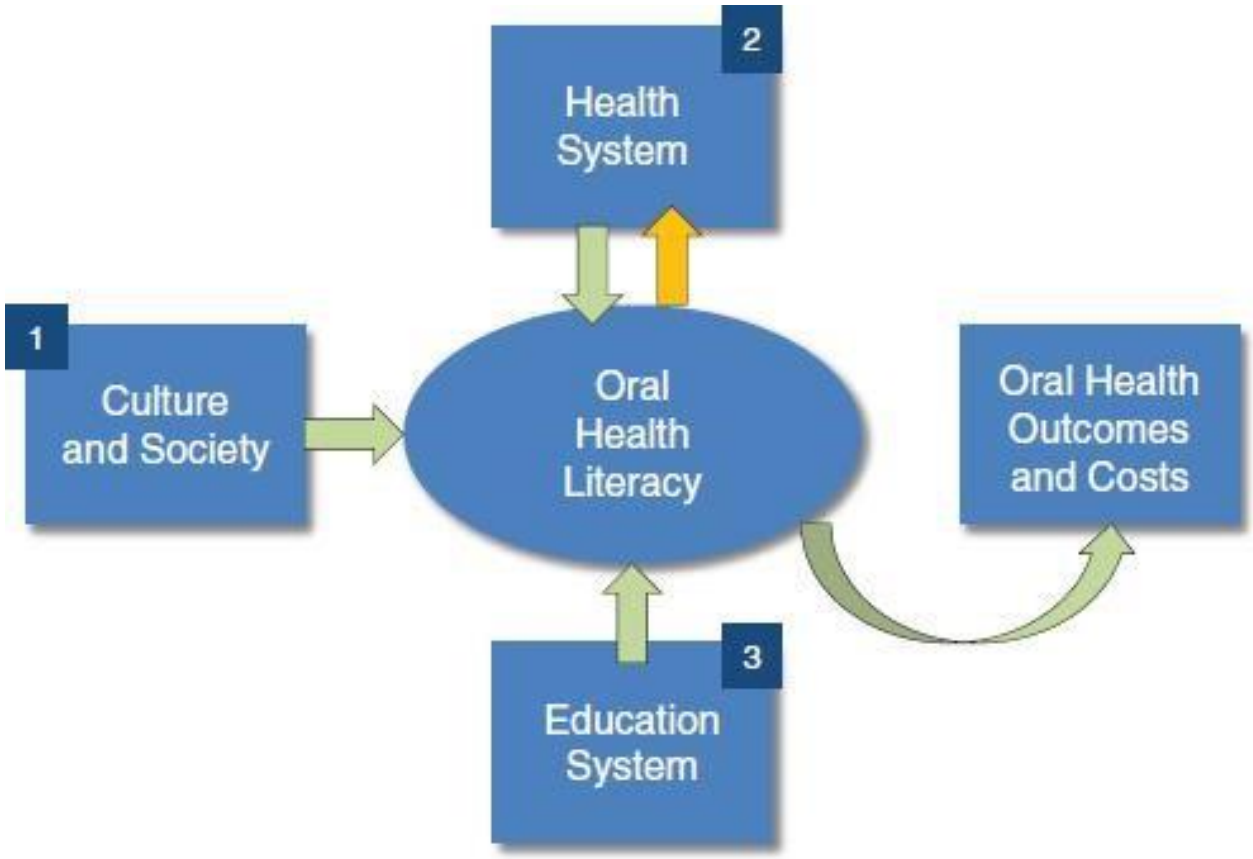
The educational system of a nation is tasked with the development of literacy skills (reading, writing, listening and understanding) and equips individuals who pass through it with capabilities to acquire, understand and act upon information on various differing subjects in order to yield specific outcomes. The cultural system describes the shared beliefs, values and norms of people as members of society. The beliefs and attitudes of an individual are shaped by family, social and cultural influences. These conditions that affect the individual's ability to fully participate in a health-literate environment are called the social determinants of health. Culture is not only about customs, ethnicity, native language, and socioeconomic status, but has evolved to include the effects of mass media, publications and health information sources. Culture is very vital in thinking about, understanding and responding to humans and events.

Health systems have many component functions: planning and crafting health services and education messages, shaping rights and responsibilities, developing and supporting health promotion activities, monitoring access and enforcing regulations. Health systems is a term used to refer to all the people involved in performing these functions.

Oral health literacy, therefore, becomes that setting within which an individual's education, culture, and interaction with the educational system act together to produce specific outcomes related to their oral health and general well-being.

(Institute Of Medicine, 2004).

FIGURE 1: ORAL HEALTH LITERACY CONCEPTUAL FRAMEWORK



SOURCE: Institute Of Medicine, 2013

1.4 JUSTIFICATION

Comprehensive searches by the author on HINARI, PubMed and Google Scholar databases produced no results of significance with respect to Oral Health Literacy in Ghana or Africa. There were however several studies in African populations on oral health awareness, behaviors, and service utilization, with those deemed as relevant being referenced in this work. Only two of these (Deh, 2015) and (Nimako-Boateng *et.al*, 2016) were conducted in a University community.

The lack of research in this area renders the government through the Ministry of Health unable to plan and focus efforts on improving upon the literacy and awareness state of the citizenry. It is this author's hope that this research will serve as a springboard for further

research into this and related areas concerning oral health, in order to improve the country's lot in this important but neglected health dimension.

1.5 OBJECTIVES

1.5.1 Main Objective

The main objective of this study is to assess the oral health literacy levels, its relationship with oral health behaviors of students of the Kwame Nkrumah University of Science and Technology and use these considerations to make recommendations for integration of oral health into the school's health policy for students.

1.5.2 Specific Objectives

For specific objectives this study seeks to:

1. Establish the students' preferred medium/media of oral health education and information.
2. Assess the oral health literacy levels of KNUST students and its possible predictors.
3. Evaluate the oral health behaviors of KNUST students and the presence of associations between OHL and oral health behaviors.
4. Generate recommendations based on study findings to inform oral health policy for KNUST students.

1.5.3 Research questions

1. Which medium/media do KNUST students prefer to use to access oral health care information and education?

2. What are the practices and oral health behaviors of students of KNUST?
3. What are the levels of oral health literacy among KNUST students?
4. Is there a relationship between exposure to oral health education, and Oral Health Literacy?
5. Is there a relationship between Oral Health Literacy and certain important oral health behaviors among KNUST students?
6. What are some of the recommendations that can be made in considering an oral health policy for students of the university?

CHAPTER 2

LITERATURE REVIEW

2.1 ORAL HEALTH

2.1.1 Definition and Relationship with general health

The mouth has been compartmentalized and separated from the body by lay and professionals alike, though there is evidence that shows a relevant reduction in quality of life, bodily function and normal performance of everyday activities such as chewing and speech, due to oral disease (Sheiham, 2005). Oral disease affects "the ability to live a socially and economically productive life".

Oral health has been defined as "multifaceted and includes the ability to smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex" (Glick, 2016). It exists as a central constituent of physical and mental well-being and is affected by a continuous evolution of an individual's experiences, perceptions, expectations and adaptive

abilities. Oral health is hereby reflected in the individual's conceptions, decisions, and actions that define the psychological, physiological and social qualities crucial to the quality of life.

As mentioned before, oral health is a major contributing factor to general well-being and several studies have proven that several conditions are impacted by oral health. Considering oral health in pregnancy, it is known that pregnant women are more susceptible to gum diseases (gingivitis and periodontitis) due to the elevation in hormone levels. Studies have also reported an association between maternal periodontitis and decreases in birth weight (Hartnett *et al.*, 2016). Long term thumb-sucking habits of the babies they bare do not have only dental but ear-nose-throat implications as well (Ferreira *et al.*, 2018). A complex interplay of dependence has been observed with diabetic patients, where improvements in their periodontal health lead to an improvement in the management of diabetes, and vice versa (Kudiyirickal and Pappachan, 2015). Mental health and oral health have also shown an interdependence. For starters, the pain oral disease and wrong metal models cause anxiety and fear of dental treatment. Bad breath, tooth discoloration or loss causes loss of confidence and is detrimental to the social well-being of an individual. Patients with anorexia due to frequent vomiting have erosion of the enamel on the teeth, while depression and anxiety disorders can lead to attrition, secondary to bruxism. There is also a growing body of evidence which suggests that more lost teeth increase a person's risk of developing dementia (Kisely, 2016).

Activities and habits such as smoking and alcohol consumption serve as overlapping risk factors for both oral as well as systemic diseases. Smoking and chewing of tobacco lead to tooth discolorations, various forms of cancer including oral cancer, respiratory diseases and an increased risk of gum disease. Alcohol consumption predisposes one to oral cancers, liver cirrhosis, and cardiovascular diseases. The bacteria that build up in the mouths of people with very poor oral hygiene may also have a link with pneumonia (Vassallo, 2016).

While there is no evidence to support the necessity to treat dentistry as separate from general medical practice, it has been so from the very beginning when dentistry was being proposed as an area of study at the Maryland School of Medicine in 1840. The proposal was waved off as dental conditions were thought to be of little consequence. The dentists went their way and so it has been ever since (McCredie, 2019). Despite the great evidence of interdependence between oral health and general health, most doctors will prescribe painkillers and antibiotics as first-line drugs to treat dental illnesses without appropriately referring the patient to a dentist/dental facility.

The importance of oral health to the overall health of individuals will only be realized with the integration of oral health into various aspects of care and education, with various players in the service delivery process all involved in bringing about better health outcomes. A study by Kuipers *et al.*, 2018 showed that an integrated approach to oral health care in mental health patients, with the involvement of the patients, parents, general practitioners, dentists and hygienists, insurance providers and policymakers all lead to better and more desirable outcomes.

Efforts towards the integration of oral care with general healthcare and other important domains have begun with more focus being given to NCDs (of which oral diseases have the highest burden) in the Sustainable Development Goals (SDGs), in contrast to the era of the Millennium Development Goals (MDGs) where there was no place for NCDs. The goals and objectives for lessening the burden of NCDs are not only under the SDG 3 (Good Health) but have been incorporated into others such as No Hunger (SDG 2) and Quality Education (SDG 4). This integrated focus, therefore, helps in shaping policy by international organizations and national governments to the benefit of the world population at large (FDI-NCD Alliance, 2017).

The Institute of Medicine, 2013 Roundtable on Health Literacy expressed the need for integration past just the health systems to the educational systems, in child education as well as professional school curriculum and board exams. Television programs have also served as an effective tool for integrated oral health messages as has been done in Hispanic soap operas by Colgate (Institute Of Medicine, 2013).

2.1.2 Epidemiology of oral health and disease

More than 90% of people all over the world at some point in their lifetime suffer from one form of oral disease. The Global Burden of Disease (GBD) 2016 study found more than 3.58 billion people worldwide suffering from oral diseases, with dental caries alone claiming about 2.4 billion of that figure, making it the ailment with the highest prevalence in adults in the world, while periodontitis (severe gum disease, causing a weakening of the toothsupporting tissue), causing tooth loss, was projected to be the 11th most prevalent condition. About 486 million children also suffer from dental caries in primary teeth. Oral cancers that affect the lip, tongue and oral cavity are estimated at around 4 cases per 100,000 people. Cleft lip and palate affect more than 1 in 1000 newborns worldwide (WHO, 2018).

The combined Disability Adjusted Life Years (DALYs) for oral diseases stood at a staggering 18,814,000 in the GBD 2010 report. In 2015, the figure stood at 16.9 million DALYs, with tooth loss accounting for 7.6 million and untreated caries, 3.5 million DALYs (Kassebaum *et al.*, 2017).

High prevalence and the recurring aggregate nature of oral diseases make them very costly to treat. The latest work found on the global economic impact of oral diseases (Listl *et al.*, 2015) estimated that about $297.67 billion (bn) was spent in 2010 on the treatment of oral conditions. $244.40bn of this amount was spent in high-income countries. North Africa and the Middle East together contributed $8.33bn, while sub-Saharan Africa contributed just

$2.96bn. Spending on oral health in the West African sub-region was a mere $0.04bn, and this is likely due to lack of awareness, low motivation to utilize dental services due to high costs and high poverty rates.

In Africa, the major risk factors of oral health include poverty, malnutrition, sanitation, tobacco use, and inadequate oral health systems which encompass the sheer inadequacy of oral health services and professionals, as well as low oral health awareness. The top-ranking oral diseases in Africa are Noma, necrotizing ulcerative gingivitis, oral cancer, oral manifestations of HIV and AIDS, dental caries, fluorosis, and oro-dental trauma (Josefczyk, 2015).

2.2 ORAL HEALTH LITERACY (OHL)

2.2.1 Definition of OHL

Oral health literacy is "*the capability of a person to acquire, process and appreciate basic oral health information and services needed to make appropriate choices regarding their oral health"* (Firmino *et al.*, 2018), adapted from (Institute Of Medicine, 2004).

2.2.2 Dimensions and levels of OHL

OHL has been demonstrated to exist within the context of interactions between the individual and his/her culture and society, educational and health systems. Hongal *et al.*, 2013 referenced work by Kickbusch *et.al* which identified 5 main dimensions affected by the individuals OHL within the aforementioned context, namely:

- Basic knowledge of oral health,
- Knowledge and utilization of the oral health care system,
- Workplace competencies in oral health,

- Market and consumer behavior, and
- Political participation (policy development).

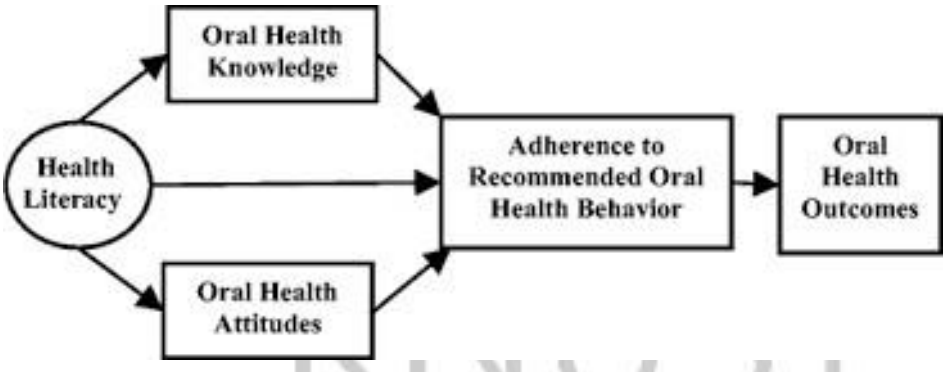
These dimensions are affected on various tiers, which Hongal, referencing Nutbeam D., explained as "what OHL helps us to do". OHL helps the individual on the:

- Functional tier, where one acquires appropriate skills of reading and writing, to perform effectually in routine circumstances relating to a health context,
- Interactive (communication) tier, where the individual makes use of cognitive, literacy and social skills to actively participate in everyday activities linked to oral health. Information is extracted from and understood through different forms of communication, and
- Critical tier, in which the individual critically analyses information relating to different contexts, and uses the information to exert more control over life events and situations with a specific desired outcome in mind.

2.2.3 OHL outcomes

Kleinman's conceptual model referred to in Chapter 1 of this paper generalizes the end result of OHL as "oral health outcomes and costs". Brega *et al.*, 2016 goes on to further explain these outcomes as the results of better adherence to recommended oral health behavior, due to changed attitudes and increased knowledge developed through health literacy efforts.

FIGURE 2: BREGA'S THEORETICAL FRAMEWORK



SOURCE: Brega *et al.*, 2016

Oral health knowledge, oral health attitudes and adherence to recommended behaviors may be considered outcomes in themselves. The final oral health outcomes, however, expected through improved health literacy are further explained in terms of 3 domains: oral and general health status as *perceived by the individual*, oral health-related *quality of life*, and *clinical health status*, measured generally by the established clinical presence/absence of dental caries and periodontal disease through objective examination. The domain of Quality of life is established by a validated measure of adult oral health functioning known as the General Oral Health Assessment Index (GOHAI). The National Health Interview Survey provides Likert-scale items for the Perceived Oral Health status domain (Macek *et al.*, 2016).

2.2.4 Assessing OHL

It is important to measure oral health literacy as it will inform decisions and developments on the levels of policies and performance towards improving the oral health status of populations of interest (Dickson-Swift et al., 2014). Due to the complex nature of OHL and its characteristic levels, it has been a challenge to adequately quantify oral health literacy. There

however exist several tools that have been used to attempt to measure individuals' capacity to acquire, comprehend and act upon oral health information.

The tools used to quantify oral health literacy have largely been based on reading and numeracy skills. The Rapid Estimate of Adult Literacy in Dentistry (REALD) and the Test of Functional Health Literacy in Dentistry (ToFHLiD) are the most widely used tools for measuring OHL. The REALD toolkit is a word recognition tool developed from the Rapid Estimate of Adult Literacy in Medicine (REALM) (Richman et al., 2007) while the ToFHLiD is an adaptation from the Test of Functional Health Literacy in Adults (ToFHLA) (Gong et al., 2007). These toolkits have been proven to have high validity and reliability, and have been adapted to suit the contexts of several nations (Tadakamadla et al., 2014; Junkes et al., 2015). With the REALD, the subject is required to identify and read aloud the words s/he recognizes and is scored from low (0) to high (total) according to the number of recognized words as against the total number of words found in the toolkit. Several variants exist depending on the number of words (e.g. REALD-30, REALD-66, REALD-99). The ToFHLiD tests more functional literacy and numeracy skills (Dickson-Swift et al., 2014).

Although these toolkits (the REALD in particular) are easy to understand and use with proven reliability and validity, they are not without flaws, as they only measure OHL based on word recognition and not the comprehension or function, though there is an established good correlation with other comprehension and functional oral health literacy tools (Haridas et al., 2014). Wong *et al.*, 2012 concluded in their Hong Kong-based study that the REALD is a valid tool which can be used as part of the basic screening of clinical patients and research participants.

Other measures for OHL include Comprehensive Measure of Oral Health Knowledge (CMOKH) developed by Macek et.al in 2010, as well as the Short Assessment of Health

Literacy – Spanish and English (SAHLS&E) by Lee et.al and the Rapid Estimate of Adult Literacy in Medicine and Dentistry (REALM-D) by Atchison et.al, all in the same year (Macek, 2014).

2.2.5 Oral health literacy and oral health outcomes

Oral health literacy has been prescribed as a remedy to disparities in oral health status across the globe, with several studies amongst various populations in diverse cultures (albeit none in Africa) establishing an association between OHL and oral health behaviors and status (Berkman *et al.*, 2011; Horowitz *et al.*, 2012; Haridas *et al.*, 2014; Kanupuru, Fareed and Sudhir, 2015; Calvasina *et al.*, 2016; Messadi *et al.*, 2018; VanWormer, Tambe and Acharya, 2019).

Berkman's study associated low health literacy with poorer health outcomes and lower usage of services, as did Calvasina's. In Haridas' population, better periodontal health was correlated substantially to higher OHL levels, and poorer OHL levels jeopardized selfefficacy and oral health behaviors. Fewer dentist visits, lower oral health-related quality of life, and more emergency room (ER) visit for non-traumatic dental conditions were associated with lower OHL levels.

Resource persons at the Third Leadership Colloquium of the U.S. National Oral Health Alliance under the theme "Oral Health literacy as a pathway to Health Equity" shared knowledge and experience on how OHL had become a way to reduce health disparities, as is the focus of *Healthy People 2020*. Professor A. Horowitz of the Maryland University School of Public Health spoke on how low oral health knowledge reduced frequency of dental clinic visits, which increased the risk of developing dental caries and periodontitis. OHL will, therefore, help to increase access to dental services. Dr. David Reznig, Director of Oral

Health at Grady Health Systems gave evidence as to how lower OHL resulted in higher patient anxiety, frustration, and dissatisfaction (Horowitz *et al.*, 2012).

Among student populations, some studies on the link between OHL and its outcomes have been conducted. Vozikis, Drivas and Milioris, 2014 conducted their study in Greece, which correlated better preventive behavior and health status among students to higher health literacy levels. Clinical parameters of lower dental caries rates, better periodontal health, and better oral hygiene status were associated with higher levels of OHL amongst students in a study conducted across 9 Indian Universities (Kanupuru, Fareed and Sudhir, 2015). In Malaysia, students of the Health Sciences University generally showed adequate levels of oral health literacy, though it was much higher amongst the dental students than medical and allied health science students, likely due to the non-inclusion of oral health education in the medical and allied health curriculum. Higher usage of dental services, better preventive behavior, and better self-reported efficacy among dental students also suggests a positive correlation with higher levels of OHL (Mohd-Dom *et al.*, 2015). Again, no such studies exist within the African context.

A few contrary studies concluded that oral health outcomes have no association with OHL. Burgette *et al.*, 2016 suggested that health literacy is fixed in nature, and does not affect a person's attitude or impact on health-seeking behavior and health status. Firmino *et al.*, 2018 on the other hand conducted a systematic review of 25 studies and found that while dental anxiety, night bottle feeding and oral health knowledge related outcomes (e.g. comprehension of health information, self-efficacy in prevention of dental caries and periodontitis, retention of dental knowledge, etc.) were associated with OHL, there was no association with toothbrushing habits, and there was inconclusive data on the relationship between OHL and oral health perceptions and behaviors, or dental treatment results.

Macek *et al.*, 2016 using data from the federally funded Multi-site Oral Health Literacy Research Study (MOHLRS) discovered a relationship between word recognition and/or confidence filling out forms and self-efficacy in periodontal health and functional abilities in maintaining oral health. There was however no association between any OHL measures and dental visits or dental caries self-efficiency.

2.3 ORAL HEALTH EDUCATION AND INFORMATION TRANSMISSION

The definition and transmission of messages which are intended to empower individuals to take greater control over and improve their oral health is the process of oral health education.

To properly educate the intended target group on their oral health, one must:

- First, gain a scientific understanding of the cause of the diseases pertinent to their socio-cultural and socioeconomic context. E.g. bacteria in the plaque biofilm on teeth convert sugars to acids, leading to dental caries;
- Secondly, isolate relevant factors contributing to the disease process. E.g. consuming large amounts of sugary foods, inadequate toothbrushing, lack of fluoride and calcium in diets and toothpaste;
- Thirdly, agree on science-based and socially acceptable messages that will encourage good behavior change amongst the public. E.g. reduce high amounts of dietary sugar, rinse mouth after taking a sugary diet, engage in twice-daily toothbrushing using a fluoride-containing toothpaste
- Finally, communicate the message. This step is the most demanding and most complicated step which involves conveying a comprehensible message to the right people in the right context or setting at the right time.

The setting may be clinically based (at the dental surgery, or during community dental screening programs) or community-based (media, internet, schools, workplace, hospitals, institutions for special needs and the aged).

The oral health information carried within the messages will help shape oral health behaviors. (Levine and Stillman-Lowe, 2019)

2.4 ORAL HEALTH BEHAVIORS

Adapting the WHO 1998 definition of health behavior, oral health behavior may be defined as any action that is performed by an individual for the promotion, protection and/or maintenance of oral hygiene regardless of perceived or actual oral health status, whether or not such activity was effective towards the intent.

Oral health behaviors are influenced by individual, interpersonal, institutional, communal and public policy factors, and these form a complex interplay with the cultural, societal, educational and health system interactions with oral health literacy (Manoj Sharma, 2016).

All oral health behaviors focus on the maintenance, restoration, and improvement of oral health, corresponding with the primary, secondary and tertiary levels of prevention,

Beneficial oral health behaviors include preventive dental check-ups, professional dental prophylaxis, twice-daily toothbrushing habits, flossing, reduction of sugary food intake, use of miswak (chewing stick) and general utilization of dental services for fillings, extractions, prosthesis, surgeries, etc. (Al-Batayneh, Owais and Khader, 2014)

2.5 ACCESS TO ORAL HEALTH CARE SERVICES

The Institute Of Medicine defines access to care as “the timely use of services personally to achieve better health outcomes”. Access is a product of the availability of the service as well

as the willingness of the individual to seek care (Almutlaqah *et al.*, 2017). Gulliford *et al.*, (2002) categorized access under four components namely:

i. The physical availability of the service and service provider (dentist or oral health worker in this case),

ii. The patient's utilization of the service and barriers to access – personal, organizational and financial barriers, iii. The significance and efficacy of available services, and iv. Equity in access.

While access to basic dental and oral healthcare remains a paramount and basic human right, research provides evidence that it is not being adequately satisfied in developing countries having a higher need of dental care (Naseem, 2016). The distribution of dentists is inequitable in these countries with dentists preferring urban areas to rural areas where the burden of oral disease is higher. In Ghana, the last study of its kind showed that out of the 120 dentists in the country, more than 70% were found in Kumasi and Accra alone, with only 3 dentists serving the 3 Northern regions (Donkor, 2006). The numbers since then are reported to have changed slightly, but no study proving that assertion is available in Ghana presently.

Dental care is expensive and in developed countries accounts for almost 10% of the total healthcare outlay, while in middle and low-income countries, the oral health care needs fare to outweigh the capabilities of their health systems(WHO, 2018). This represents the financial barrier to access. On a personal level, individuals do not visit dentists due to discouraging comments about dental care from others, lack of time, lack of transport and fear of dental instruments (Ajayi and Arigbede, 2012).

Organizations (e.g. clinics, hospitals, ministries of health) also contribute to access barriers in their own way through long waiting hours, unfavorable siting of service centers, lack of necessary equipment and medication, improper and inadequate recruitment and training of

staff and low worker motivation. Efforts to educate the public on services provided also falls on the organization through inefficient doctor-patient communication, as well as the absence of or failure to enforce or abide by guidelines entrenched within oral health policy (de Castro *et al.*, 2016).

2.6 ORAL HEALTH POLICY

Health policy is a set of non-contradictory guidelines and courses of action involving institutions, services, organizations and funding arrangements aimed towards the achievement of predetermined distinct goals concerning the people's health in the medium to long term. The policy process and policy development look at how these goals will be achieved in a well-defined time-bound manner, and the various inputs needed at every stage (World Health Organization, 2005).

The vicious cycle of ill-health and poverty has been established. Oral diseases, as has already been stated, cause the loss of large amounts of man-hours in workplaces and learning time in schools. Reduction in productivity leads to loss of revenue which tends to poverty which tends to inability to maintain good health, and thus continues the cycle (Sorsha, 2017). Oral health policy will only be developed and implemented if the evidence-based figures of the burden and effects of poor oral health, as well as the predicted economic gains through improved oral health, are demonstrated to policymakers.

Only 14 out of the 46 countries monitored by the WHO Regional Office of Africa are known to have oral health plans. It is known that dental officers favor urban areas and private practices. Findings of the survey also revealed that dental assistants and workers neglected to adequately instruct patients on preventive measures and only focus on curative treatment

(Josefczyk, 2015). Many African countries have reached out to the WHO for a guide on how to formulate oral health policies, which have led to the publication of the "*Promoting Oral Health in Africa"* manual by the World Health Organization, 2016. It remains to be seen how African countries will adopt this manual and respond to the growing burden of oral disease on the continent with robust policy directions.

The Oral health policy environment in Ghana has been promised and expected, yet has been absent for many years. On the 4th of July 2006, a news item by the Ghana News Agency was published on the GhanaWeb website captioned "*Health Ministry developing National Oral Health Policy*". In it, Dr. David Oppong Mensah, the then Chief Dental Officer with the Ministry of Health, Ghana indicated that the policy will among other things address issues of oral health education and information, and direct the development of oral health in the country. Dorothy Ankomah for Ghana News Agency, on the 3rd of July 2008 covered a story on the Ministry of Health's intention to focus on Oral health in its 5-year policy that will help intensify in-service training for mid-level oral health workers and orient oral health specialists to be in the capacity to educate rural communities.

5 years later, another news item by the Ghana News Agency on the 29th of July 2013 titled "*Ghana needs Dental Health Policy*" made it evident that the promises of developing an Oral Health Policy for Ghana have not materialized. The then President of the Ghana Dental Association (GDA), Dr. Gilbert Ankrah, complained about the lack of dental clinics in the rural areas, with only 40 functional clinics in the 240 districts in Ghana. The WHO recommends a dentist to population ratio of 1:10,000, but Ghana is in excess of 1:100,000.

2.7 CONCLUSION

There is a clear need for policy development to move oral health in a positive direction for the country in the areas of oral health education and information, with the integration of oral health messages into the culture, education and everyday life to build oral health literacy of Ghanaians. It is the aim of this dissertation to make recommendations for the integration of oral health policy guidelines into the KNUST Health and Safety Policy document. This can serve as a starting point for the integration of oral health policies at school, institutional and national levels. This will serve well the purposes of strengthening efforts towards primary health care.

CHAPTER 3

METHODOLOGY

3.1 STUDY TYPE

This study is an analytical cross-sectional study examining OHL and other variables from the student perspective.

3.2 AREA OF STUDY

The study was conducted in the Kwame Nkrumah University of Science and Technology (KNUST). KNUST is an institution of higher learning which is located within the newly created Oforikrom municipality, one of 5 new municipalities formerly under the Kumasi metropolis. It is the largest university within the Ashanti region of Ghana.

KNUST has generally, the teaching and non-teaching staff, as well as the student population for which the university exists.

3.3 POPULATION

The population of interest in this study is the student population of KNUST, which is estimated at about 45,000. These fall under 6 colleges, namely the College of Science (COS), College of Health Sciences (CHS), College of Humanities and Social Sciences (CHASS), College of Engineering (COE), College of Arts and Built Environment (CABE), and the College of Agriculture and Natural Resources (CANR).

3.4 STUDY VARIABLES

The study variables examined are Access to Oral health information/education, Oral Health Literacy, and Oral health behaviors.

TABLE 1: STUDY VARIABLES

VARIABLE	VARIABLE DESCRIPTION
Demographics	- Age - Gender - College
Access	- Exposure to oral health education/oral health information - Medium of exposure - Preferred medium of oral health education/oral health information (Student) - Preferred oral health education/oral health information (General population)
Oral Health Literacy (OHL)	OHL levels as determined by REALD-30 toolkit (0-19 – low, 20-25 – moderate, 26-30 – high)

Oral Health Behaviors	- Dental visit frequency - Toothbrushing frequency - Tooth cleaning materials - Most likely reason for seeking dental care - Intake of sugary foods

3.5 SAMPLE SIZE DETERMINATION

The sample size of 381 was determined using the StatCalc function in the EpiInfo 7 software. The inputs were as follows: Population: 45,000; Confidence level: 95%; Margin of error: 5%; expected frequency: 50%

3.6 METHOD OF SAMPLING

Simple random sampling of study participants was done.

3.6.1 Inclusion criteria

Only students of KNUST were included in this study.

3.6.2 Exclusion criteria

Students of any other institution did not qualify for this study. Unwillingness on the part of prospective participants also excluded them from the study.

3.7 DATA COLLECTION PROCESS

A structured questionnaire was designed for the collection of data. This was to be administered by the Principal investigator or research assistant to a willing prospective participant who qualified for the study.

3.7.1 Pretest

A pretest of the study was done using 10 students from the University of Cape Coast (UCC). This was performed by the principal investigator to identify any difficulties or ambiguities within the questionnaire and to determine whether the data collection tool was easily understandable by the participants.

3.7.2 Data collection

Data for the study were collected within the period of 16TH May 2019 to 15TH July 2019 by the principal investigator and research assistants using interviewer-administered questionnaires, which were structured to obtain information on demographics, access to oral health care services, education and information, oral health literacy, and oral health practices or behaviors.

3.7.3 Data entry and organization

The data entry tool was designed in Microsoft excel 365. Completed questionnaires were coded and recorded in the predesigned input tool. Questionnaires were cross-checked to avoid

mistakes and double entries. After checking for errors data was exported to STATA for analysis.

3.8 ANALYSIS OF DATA

Data analysis was performed using STATA Version 14.

Demographics and oral education exposure status were assessed. The relationship between the variables within these categories and OHL scores and levels were assessed.

The percentage preferred media of oral health education amongst students and the general population were also measured.

Specific oral health behaviors amongst study participants were evaluated and OHL levels were then assessed in its ability to predict these oral health behaviors.

3.8.1 Demographics

The basic demographic information that was taken included the gender, age, and College of affiliation of study participants.

3.8.2 Determination of preferred medium of oral health education

This section was analyzed based on multiple choice questions. The percentages of number of times each answer was chosen were used to express the most to the least preferred medium of oral health education amongst students and the perceived favorite choice of oral health education medium for the general population. The most common medium by which students who had a positive exposure status to oral health education also fell under this section of analysis.

3.8.3 Assessment of oral health literacy levels of KNUST students and possible predictors.

Oral health literacy was measured using the REALD-30 toolkit, with participants scoring between 0 (lowest) and 30 (highest). The scores were then categorized based on the REALD-30 categories of OHL levels, namely low (0-19), moderate (20-24) and high (25-30). Gender, age, college of affiliation and exposure to oral health education were selected as possible predicators of OHL scores and levels, and multivariate linear regression was performed to ascertain the presence and statistical significance of such associations.

3.8.4 Evaluation of oral health behaviors of KNUST students, and associations with OHL levels.

Specific oral health behaviors were selected for analysis: dental visits (whether participant had ever visited dentist or not), frequency of dental visits, toothbrushing frequency, intake of sugary foods, knowledge of the effects of sugars on dental health, most likely reason for visiting the dentist, perception of whether it is better to prevent or treat dental disease, personal evaluation of adequacy of oral health practices, and if the participant would like to know more about oral health.

The relationships between these oral health behavior variables were assessed for statistical significance and ability to predict OHL levels by multivariate linear regression models.

3.8.5 Assumptions

It was assumed that the data gathered in this study was very robust due to the educational status of the target population.

CHAPTER 4

RESULTS

4.1 BASIC DEMOGRAPHICS

A total of 381 questionnaires were administered to students of KNUST in various departments and halls or hostels of residence, with 374 respondents, representing a response rate of 98.16%. Male respondents numbered 204 (54.55%), while females were 170 (45.55%).

The lowest age among participants was 17 year, and the oldest was 44. The age with the highest number of respondents was 20 years, representing 24.60% of study partakers. When grouped, those less than 20 years of age constituted 18.18% (68 persons). Persons aged 20-25 were 295 in number (78.88%), while those above 25 were 11 persons (2.94%). The mean age was 21.27 years.

All 6 colleges were represented in the constitution of study participants. CHASS had the largest representation, with 120 students, representing 32.17% of study participants, while the representation from CANR was the lowest at 28 (7.51%). The other colleges were represented as follows: CHS (63 persons, 16.89%), CABE (53 persons, 14.21%), COE (61 persons, 16.35%), and COS (48 persons, 12.87%).

Below is Table 2 summarizing the information on the basic demographics of study participants.

TABLE 2: BASIC DEMOGRAPHICS

Characteristic	Frequency (Persons) N=374	Percentage (%)
Gender		
Male	204	54.55
Female	170	45.45
Age group		
<20	68	18.18
20-25	295	78.88
>25	11	2.94
College		
CANR	28	7.49
CHS	64	17.11
CHASS	120	32.09
CABE	53	14.17
COE	61	16.31
COS	48	12.83

CANR means the College of Agriculture and Natural Resources

CHS means College of Health Sciences

CHASS means College of Humanities and Social Sciences

CABE means the College of Architecture and Built Environment

COE means College of Engineering

COS means College of Science

4.2 STUDENTS' PREFERRED MEDIUM OF ORAL HEALTH EDUCATION

AND INFORMATION

Out of the total number of respondents (374), 66.04% (247 persons) had been exposed to some form of oral health education or information while 33.96% were not. Out of this number, questions were asked on what medium this information took, and what medium/media they would prefer as students. They were also asked which media would be most effective for educating the general population. Participants could choose more than one answer in this set of questions.

When participants who had been exposed to oral health education were asked what form it took, Television and radio were selected 113 (45.75%) times, social media was chosen 83 (33.60%) times while 66 (26.72%) indicated they had been educated by a dentist. Only 18 (7.29%) people had been educated about oral health by other health practitioners.

The most preferred medium for oral health education that was perceived as most effective for educating the student population was social media (chosen 253 times [67.65%]). The health outreaches option was the next after social media, chosen 101 times (27.01%). Oral health education as a part of the school curriculum was chosen 57 (15.24%) times while only 12 students perceived that other health practitioners have a role to play in oral health education. When asked which medium will be most effective for reaching the general public, students chose television and radio 185 times (49.47%), social media 148 times (39.04%) and health outreaches 117 times (31.28%). Other health workers were considered only 27 times. The following are tables depicting the status of study participants' exposure to oral health education, and the various media employed in oral health education, as well as a bar chart representing the latter.

TABLE 3: EXPOSURE TO ORAL HEALTH EDUCATION

Exposure	Freq (N)	Percentage (%)

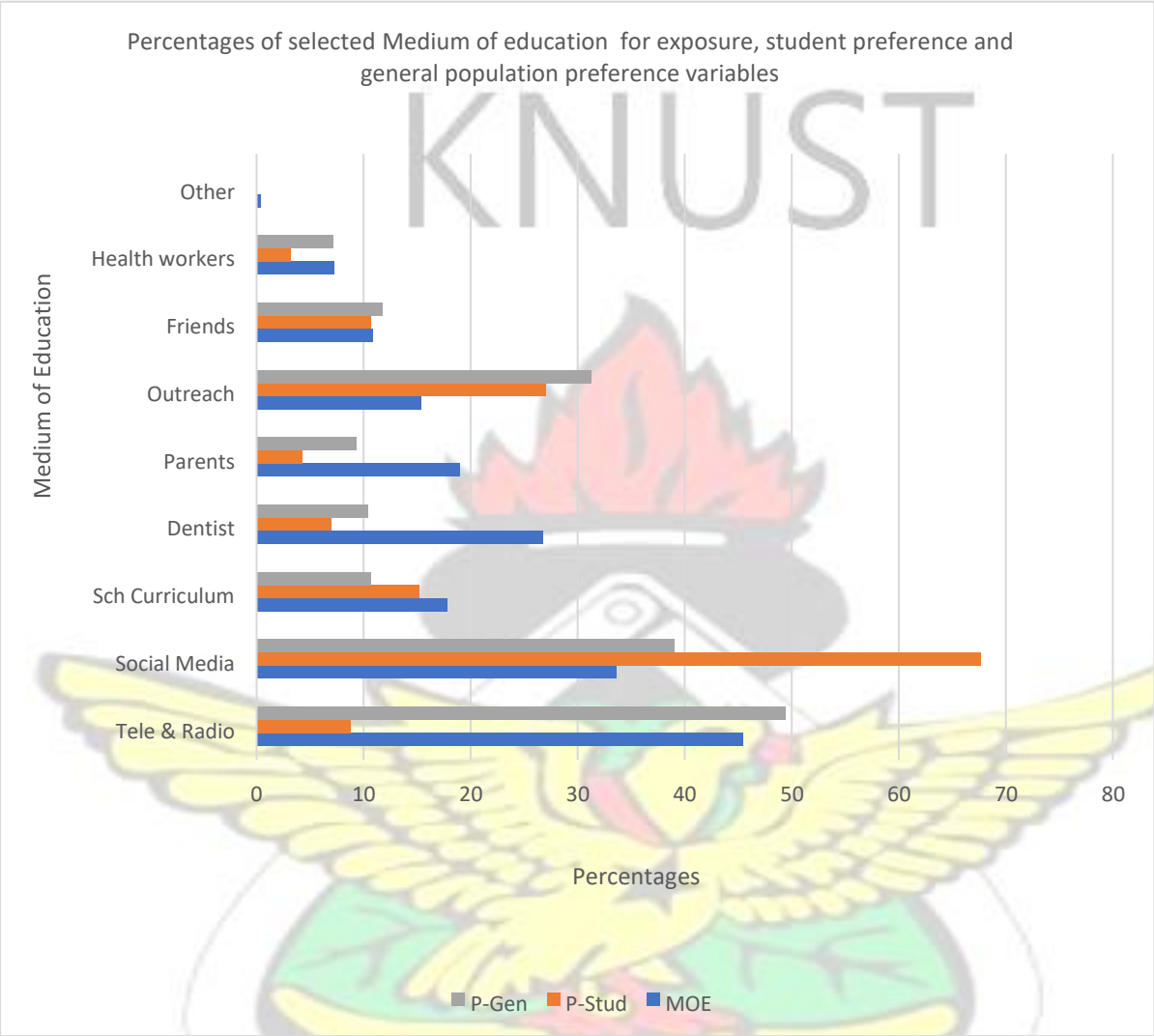
Yes	247	66.04
No	127	33.96
Total	374	100

TABLE 4: VARIOUS MEDIA EMPLOYED FOR ORAL HEALTH EDUCATION

MEDIA	**Medium of exposure (MOE) N=247 (%)**	**Preferred medium of education for students (P-Stud) N=374 (%)**	**Preferred medium of education for the general population (PGen) N=374 (%)**
Television and Radio	113 (45.75)	33 (8.82)	185 (49.47)
Social Media	83 (33.60)	253 (67.65)	146 (39.04)
School Curriculum	44 (17.81)	57 (15.24)	40 (10.70)
Dentist	66 (26.72)	26 (6.95)	39 (10.43)
Parents	47 (19.03)	16 (4.28)	35 (9.36)
Health Outreach	38 (15.38)	101 (27.01)	117 (31.28)
Friends	27 (10.93)	40 (10.70)	44 (11.76)
Other health practitioners	18 (7.29)	12 (3.21)	27 (7.22)
Other (Partner)	1 (0.40)	-	-

FIGURE 3: A BAR CHART SHOWING THE PERCENTAGES OF PEOPLE WHO CHOSE A

MEDIUM OF EDUCATION FOR EXPOSURE, STUDENT PREFERENCE, AND GENERAL POPULATION PREFERENCE VARIABLES.



*P-Gen is Preferred medium of education for general population

**P-Stud is Preferred medium of education for students

***MOE is Medium of Education

4.3 ORAL HEALTH LITERACY LEVELS

Using the Rapid Estimate of Adult Literacy in Dentistry-30 (REALD-30) toolkit for the quantification of OHL, participants were scored from 0-30 and grouped into categories of low (0-19), moderate (20-24) and high (25-30) OHL levels. The mean OHL score was 12.10, with a modal score of 10. 20 students scored 0 and 1 person had a perfect score of 30. A low OHL

level was seen in 88.50% of respondents (331 students); 8.82% had a moderate OHL level, while only 2.67% (10 students) had scores which translate to a high OHL level.

The table below summarizes the OHL levels in the study population.

TABLE 5: SUMMARY OF OHL LEVELS

OHL Level	Frequency (N=374)	Percentage (%)
Low	331	88.5027
Moderate	33	8.8235
High	10	2.6738

Of the respondents who scored a moderate and high OHL level, 81.82% and 90% respectively were students of CHS. All respondents from CANR scored 19 or less (low) for the REALD-30. Other colleges also recorded large percentages of low OHL levels for REALD-30, as depicted in Table 6 below.

TABLE 6: COMPARING OHL LEVELS AMONGST THE VARIOUS COLLEGES IN KNUST

OHL LEVEL	COLLEGE						Total Freq [N (%)]
	CANR	CHS	CHASS	CABE	COE	COS	
Low	28	27	119	51	59	47	331 (88.5027)
Moderate	0	27	2	2	2	0	33 (8.8235)
High	0	9	0	0	0	1	10 (2.6738)
Total	28	63	121	53	61	48	**374**

4.4 PREDICTORS OF OHL SCORES AND OHL LEVELS 4.4.1 Multiple linear regression analysis on predictors of OHL scores and OHL levels

Multiple linear regression was performed to assess if one's college of affiliation, gender, age and exposure status to oral health education can significantly predict one's OHL score and level. The results showed that the models could significantly predict OHL [F (4, 369) = 6.66, p = 0.000], and OHL levels [F (4, 369) = 13.90, p = 0.000], and account for 6.73% and 13.09% of the variance respectively. Multivariate linear regression analysis for the same variables was performed, giving the same results, and is shown in table 4.6.

4.4.2 Gender as a predictor of OHL scores and OHL levels

A higher proportion (0.13) of males had moderate to high OHL levels as compared to that of females (0.09).

The independent variable gender was coded in as 1 for Male and 2 for Female. Gender did not contribute significantly to the OHL score obtained (*C = -1.158, p = 0.061), but was a significant predictor of the OHL level of students (C = -0.116, p = 0.005). The result suggests that being male is significantly related to having a higher OHL level. Table 7 is a representation of the results of the multivariate regression model, while Table 8 is a representation of the relationship between gender and OHL levels.

*Let C represent Coefficient.

TABLE 7: MULTIVARIATE REGRESSION ON PREDICTORS OF OHL SCORES AND LEVELS

mvreg OHL OHLL = gender age college edu_expo

Equation	Obs	Parms	RMSE	"R-Sq"	F	P
OHL	374	5	5.827951	0.0673	6.655753	0.0000
OHLL	374	5	0.3927353	0.1309	13.89771	0.0000
OHL	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
Gender	-1.158	0.616	-1.88	0.061	-2.369	0.053
Age	-0.309	0.129	-2.40	0.017	-0.562	-0.056
College	-0.385	0.213	-1.81	0.071	-0.803	0.034
Edu_expo	-2.217	0.639	-3.47	0.001	-3.474	-0.961
_Cons	24.68	3.052	8.09	0.000	18.678	30.681
OHLL	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
Gender	-0.116	.041	-2.80	0.005	-0.1978548	-0.0346719
Age	-0.025	.009	-2.94	0.003	-0.0425184	-0.0084589
College	-0.071	.014	-4.97	0.000	-0.0993651	-0.0430091
Edu_expo	-0.132	.043	-3.08	0.002	-0.2170836	-0.0477372
_Cons	2.282	0.206	11.09	0.000	1.877305	2.686115

TABLE 8: RELATIONSHIP BETWEEN GENDER AND OHL LEVEL

GENDER	OHL LEVEL			Total
	Low	Moderate	High	
Male	177 (0.87)	19 (0.09)	8 (0.04)	204

Female	154 (0.91)	14 (0.08)	2 (0.01)	170
Total	331	33	10	374

4.4.3 Age as a predictor of OHL scores and OHL levels

Age was a significant predictor for both OHL score obtained and OHL level, (C = -0.309, p = 0.017) and (C = -0.025, p = 0.003) respectively. This weak negative relation suggests that younger students may have higher OHL scores and OHL levels as compared to older students.

4.4.4 College of affiliation as a predictor of OHL scores and OHL levels

The college variable was coded 1-6 in the order of CANR, CHS, CHASS, CABE, COE, and COS. As shown in Table 4.3.1, 90% of students with high OHL level were affiliated to the CHS, as well as 81.82% of students with moderate OHL levels. OHL levels were significantly predicted by the college of affiliation (C = -0.071, p = 0.000) but OHL scores were not (C = -0.385, p = 0.071).

4.4.5 Exposure to Oral health education as a predictor of OHL scores and OHL levels

The proportion of respondents with moderate to high OHL Levels who responded “Yes” to the question “Have you been exposed to any form of dental/oral health education/ information?” (0.15) was higher than that of those responding with “No” (0.04). regression showed that the association was significant for both OHL scores obtained (C = -2.217, p = 0.001) and OHL Level (C = -0.132, p = 0.002).

The responses were coded 1 for “Yes” and 2 for “No”.

The relationship between Exposure to oral health education and OHL Level is described in table 9.

TABLE 9: RELATIONSHIP BETWEEN EXPOSURE TO ORAL HEALTH EDUCATION AND OHL LEVEL (WITH PROPORTIONS)

Exposure	OHL LEVEL			Total
	Low	Moderate	High	
Yes	209 (0.85)	28 (0.11)	10 (0.04)	247 (1.00)
No	122 (0.96)	5 (0.04)	0 (0.00)	127 (1.00)
Total	331	33	10	**374**

4.5 RELATIONSHIP BETWEEN VARIABLES REPRESENTING ORAL HEALTH BEHAVIOR AND OHL LEVELS

The association under study here was the ability of OHL levels to act as a predictor for certain common oral health-enhancing behaviors and knowledge. A multivariate linear regression analysis was performed to assess the ability of OHL levels as the independent variable to significantly predict oral health-related behaviors such as dental visits (whether respondents use dental and oral health services or not), frequency of dental visits, reasons for using dental services, toothbrushing frequency, frequency of high sugar diet intake, knowledge of effects of sugar on oral health, preference between preventive care and treatment of disease, and personal oral hygiene practice adequacy.

The multivariate regression model could significantly relate usage of dental or oral health facilities [F (1, 363) = 6.20, p = 0.0132], frequency of dental visits [F (1, 363) = 7.21, p =

0.0076] and tooth brushing frequency [F (1, 363) = 7.26, p = 0.0059] to OHL scores, with 1.68%, 1.95% and 2.07% of the respective variances accounted for. The models proved insignificant for the other selected variables.

The summary of the multivariate linear regression carried out is represented by the table below.

TABLE 10: SUMMARY OF THE RELATIONSHIP BETWEEN VARIABLES REPRESENTING ORAL HEALTH BEHAVIOR AND OHL LEVELS

mvreg DV FOV TBF Sugar SE Reason PrevRx PrAdequacy L2Know = OHLL						
Equation	**Obs**	**Parms**	**RMSE**	**"R-sq"**	**F**	**P**
DV	365	2	.4871046	0.0168	6.198222	0.0132
FOV	365	2	.8756624	0.0195	7.213463	0.0076
TBF	365	2	.5812148	0.0207	7.670467	0.0059
Sugar	365	2	.4977727	0.0004	.1625755	0.6870
SE	365	2	.5499605	0.0000	.0001231	0.9912
Reason	365	2	.6137931	0.0011	.389571	0.5329
PrevRx	365	2	.2572904	0.0049	1.781745	0.1828
PrAdequacy	365	2	.4925997	0.0031	1.123381	0.2899
L2Know	365	2	.1375279	0.0000	.0002188	0.9882

4.5.1 OHL level as a predictor of Dental visit status

The dental visit status (whether a respondent had ever used dental or oral health care services) was coded as 1 for "No" and 2 as "Yes". 66.82% of respondents had ever used or visited a dental care facility. 81.63% of those who had ever visited a dental care facility, however, had

a low OHL level. 60% of respondents who had a high OHL level had never visited a dentist before. Table 11 shows the relationship between OHL level and dental visit status.

TABLE 11: COMPARISON OF OHL LEVEL AND DENTAL VISIT STATUS

OHL Level	Dental visit status		Total
	Yes	No	
Low	120 {81.63%}	204	324
Moderate	23	10	33
High	4	6 (60%)	10
Total	147 (66.82%)	220	**367 (100%)**

*{} represents vertical percentages, () represents horizontal percentages

According to the regression model, higher OHL levels were significantly associated with the positive dental visit status (answer of "Yes") as shown by the regression model (C = -0.15, p = 0.013).

4.5.2 OHL level as a predictor of Frequency of dental service utilization

Only 5 respondents (1.36%) visit a dentist every 3 months. 4.63% (17 respondents) visit a dentist every 6 months while 5.45% (20 respondents) visit a dentist on a yearly basis. All other respondents either answered as rarely (at least once in their lifetime) or never.

The regression model determined that OHL levels could significantly predict the frequency of dental visits of respondents (C = -0.29, p = 0.008). A higher OHL level was significantly associated with a higher frequency of dental visits.

4.5.3 OHL level as a predictor of toothbrushing frequency

The regression model was significant for predicting toothbrushing frequency (C = -0.199, p = 0.006. This statistical relationship suggests that respondents with higher OHL levels are likely to brush their teeth fewer times in a day.

The table below summarizes subsections 4.5.1, 4.5.2 and 4.5.3.

TABLE 12: STATISTICALLY SIGNIFICANT RELATIONSHIPS BETWEEN ORAL HEALTH BEHAVIOR VARIABLES AND OHL LEVELS

	Coef.	Std. Err	t	P> |t|	[95% Conf. Interval]
DV					
OHL Level	-.1500671	.0602771	-2.49	0.013	-.2686032 -0.0315
_cons	1.771858	.0735877	24.08	0.000	1.627146 1.9166
FOV					
OHL Level	-.2910304	.1083594	-2.69	0.008	-.5041213 -0.0779
_cons	4.673016	.1322877	35.32	0.000	4.412869 4.933
TBF					
OHL Level	-.1991945	.0719228	-2.77	0.006	-.3406321 -0.0578
_cons	2.737708	.087805	31.18	0.000	2.565037 2.91

4.5.4 Additional findings

All but 10 study participants use at least toothbrush to clean their teeth. Those who did not indicated oral wipes (1), charcoal (1), toothpick (1), chewing stick (1), a combination of

chewing sttck, charcoal and toothpaste (4) and mouthwash (2) as their preferred tooth cleaning materials.

While 92.92% of study participants believe that it is better to prevent oral disease, 61.85% still said they will visit a dental clinic only in cases of emergency.

Concerning self reported adequacy of oral hygiene practices, 58.90% of respondents said they were satisfied. When asked “would you like to know about your oral health and how to improve it?” however, 98.09% answered “Yes”.

CHAPTER 5

DISCUSSION

Oral health literacy in this study proved to have some significant relationships and predictive ability on certain oral health behaviors.

5.1 DETERMINATION OF THE PREFERRED MEDIUM OF ORAL HEALTH EDUCATION

The study determined that students who had been exposed to oral health information chose television and radio as the most common medium of education they were exposed to, followed by social media and all other internet-based media of education. Students were of the view that the general population would rather benefit more from television and radio, while the student population would be most likely to learn about oral health through social media. Interestingly, respondents did not regard dentists as an important source of oral health information.

This is in contrast to Taniguchi-tabata *et al.*'s 2017 study in Japan which revealed the dentists as the most important source of oral health education followed by school curriculum. Television only contributed to 30% of the population's oral health knowledge, which social media and the internet represented 22.6% of affirmative responses. School children in a Qatari study reported parents as the most popular source of oral health information, followed by dentists and school teachers (Al-Darwish *et al.*, 2015).

Considering the theoretical framework adopted, we realize that the role of culture and society in oral health education was largely defined by our traditional mass media (television and radio) as well as social media and internet-based media. The roles of parents and friends in our cultural and societal context are very minimal juxtaposed to the findings of the Qatari study that had so many students reporting parental influence in oral health education.

Khodadadi *et al.* in their 2016 study determined that low parental OHL was significantly associated with higher dental caries indices in school children. The lack of parental influence in oral health education may be due to their low levels of oral health literacy. Further studies must be conducted to ascertain this assumption.

There is also a considerable failing in our health systems with respect to oral health education. The Japanese study cited in the above paragraph showed more than half of the study population mentioning dentists as the source of their knowledge in oral health.

In the context of this study, this failing in the health system may be attributed to these 3 observations:

i. A large percentage of the population has never visited a dentist (55.59%).

ii. Other health workers and practitioners not playing a role in encouraging patients to take interest in their oral health (only 7.29% of study participants had been influenced by a health worker or practitioner who was not a dentist).

iii. The low dentist to patient ratio, which might make it difficult for dentists to cope with numbers of patients, and therefore will be forced to spend less time with each client in educating them (the total number of dentists in Ghana is estimated to be just about 500, with more than 80% off that number concentrated within the Greater Accra and Ashanti regions (Ghana News Agency, 2018)).

The educational system, as noted in the theoretical framework adopted has a definite role to play in oral health education, and to this end, the WHO in 2004 prepared a manual titled "Local Action: Creating health-promoting schools, as a guide to encourage the integration of health education into school curriculum across all levels. School-based interventions have succeeded in improving oral health knowledge, attitudes and status, as in the case of a study

conducted by Haque *et al.*, 2016 in Bangladesh. A 2015 review of 7 school-based interventional studies in India by Preethi showed positive results with improvements in oral health knowledge, attitudes, and status not only among students but among the teachers and parents as well. The reality and perception in the Ghanaian context, however, are not reflective of the WHO position and the practice in other countries. The study found that only 17.81% of the study population exposed to oral health education had their exposure from school (One tenth of the total population). Furthermore, just about a tenth of the population felt that school curriculum had a part to play in the oral health education of students and the general population respectively, rather opting for social media and Institute Of Medicineass media as the most effective ways of educating the respective groups.

Massive efforts need to be put into emphasizing and equalizing roles of the different systems that influence oral health literacy, as described by the theoretical framework used.

5.2 ASSESSMENT OF ORAL HEALTH LITERACY LEVELS OF KNUST STUDENTS AND POSSIBLE PREDICTORS.

The mean oral health literacy score from the REALD-30 toolkit in the study population was 12.10. Four out of five study participants had low levels of OHL. Sandhu *et al.*, 2017 recorded a fairly equal distribution of low, moderate and high OHL levels amongst undergraduate students. A similar study in the University of Kebangsaan, Malaysia by MohdDom *et al.*, 2015 indicated a mean OHL score of 10.27, with just 28.2% of the study population having low or inadequate OHL. OHL levels in this study are much lower than in these other cited studies, a further testament to the need for better efforts towards oral health education.

Slight differences were found in relating age and gender to OHL levels. It was suggested that being a male, and younger in age gave study participants a slightly better chance of having a

higher OHL level then being female and older. Age in this study was a statistically significant determinant of OHL, as was gender. Both Baskaradoss, 2018, and Noor *et al.*, 2019 identified females as having slightly higher average OHL scores and OHL levels than makes, but these relationships were not statistically significant. For Baskaradoss, age was insignificant in predicting OHL levels.

Colleges had a statistically significant effect on participants' OHL. Health science students generally had higher levels of OHL than their counterparts in other colleges, forming 81.82% of those who had moderate OHL levels, and 90% of participants with high OHL levels. Similarly, Sandhu *et al.*, 2017 found out that health science students had higher OHL levels than other students, though the difference was not a vast one. Mohd-Dom *et al.*'s 2015 study was conducted amongst health students only and determined that dental students had higher OHL levels than medical, pharmacy and allied health science students. These findings are expected since health science student are more exposed to information concerning general health and possibly oral health. Efforts must be put in to bridge the knowledge gap which exists between health students and other non-health related areas of study.

Another Malaysian study by Noor *et al.*, 2019 considered socioeconomic status as a determinant of OHL and found a significant relationship: higher OHL levels were related to being in a higher socioeconomic tier. It also significantly impacted on the oral health status and oral health-related behaviors. It will be beneficial to reproduce such studies in the Ghanaian context.

5.3 EVALUATION OF ORAL HEALTH BEHAVIORS OF KNUST STUDENTS, AND ASSOCIATIONS WITH OHL LEVELS.

Oral health-related behaviors evaluated in this study which were found to be significantly related to OHL levels included dental visit status, tooth-brushing frequency, and frequency of

dental visits. Other variables like intake of sugary foods, and reason for dental visits were not found to be significantly related to OHL levels in this study and will therefore not be included in this discussion.

A study by Naghibi Sistani *et al.*, 2017 in Tehran, Iran showed a significant relationship between higher OHL levels and improvements in oral health-related behaviours such as tooth-brushing frequency (more than once daily), consumption of sugary foods and snacks (less than one sugary snack a day) and frequency of dental visits (at least every 6 months).

Batista *et al.*, 2017 identified OHL as a significant predictor of specific oral health-related behaviors such as dental flossing, tooth-brushing frequency of more than once, and more regular use of dental health services. It was also noted that people with higher OHL levels tend to appreciate the services more than those who do not.

Though this study does not cover the full scope of oral health behaviours and their possible relations to OHL, it is worthy to note that there are positive signs of the possibility of improving oral health behaviors, attitudes and status of people as long as effort is invested in improving the oral health literacy levels of people through the various preferred media that have been highlighted within the study.

5.4 STUDY LIMITATIONS.

The main limitations of this study are as follows:

1. The non-existence of studies in Africa on the topic of Oral health literacy made it impossible to make comparisons within the African context.

2. A wider scope of oral health behaviors was not used.
3. Possible predictors of oral health literacy such as ethnicity and socioeconomic classes were not considered, as this could possibly give a more wholesome idea about the topic under study.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

The importance of oral health in determining the general quality of life of individuals cannot be overlooked. Oral health literacy has a large and very significant role to play in shaping oral health-promoting attitudes and behaviors. About a third of the study population have never been exposed to any form of oral health education, and a similar fraction of the population have never attended a dental clinic. Even though an overwhelming majority agreed that prevention was better than treatment, three out of five respondents still said they would only visit a dental clinic in cases of emergency.

These are clear indications of the need for remodeling of perceptions and behaviors in students and the general population at large, beginning from the basics through education in schools and at home.

Further studies in the field would support and serve as a springboard for large scale activities towards the improvement of the oral health of the populace.

6.2 RECOMMENDATIONS

Based on the findings of this study, my recommendations are as follows:

6.2.1 Recommendations for the University community

1. University authorities and stakeholders must include oral health examinations in the mandatory medical examination routine for new entrants of the university student body, as well as for staff.

2. Periodic oral health messages tailored by dentists for the university community and student body should be disseminated across student social media platforms and fora to improve upon oral health knowledge and literacy levels.

3. As part of their training, dental students and other relevant affiliated health science academics must be required to organize and carry out oral health screening and education programs to the other non-health colleges, to improve both literacy levels, and oral health status.

4. The University health services, in association with Dental school and school authorities ought to take advantage of the numerous events that take place on campus, including hall week celebrations to push through the message of improved oral health as an essential part of general health and wellbeing.

5. The university community is largely responsible for the undertaking of studies. Interest must be generated on conducting more studies about oral health. A larger knowledge base will always serve as a good foundation for policy formulation.

6.2.2 Recommendations for the general population.

1. The role of parents as oral health educators of households should be emphasized and adequate oral health information given during health programs on television and radio.

2. The mass and social media, which are seen to be the most effective channels of communication and education in our social systems should be empowered and motivated to transfer oral health knowledge to the general population through tailored messages which are understandable and attractive to everyone.

6.2.3 Recommendations for the Health and educational System.

1. Dentists ought to take advantage of social and mass media to organize oral health advocacy programs for the education of the populace.
2. Other health workers should as part of training be taught the importance of oral health in their patients. Better communication skills for both dental and general health practitioners should be built for more effective education of patients who visit clinics and hospitals.
3. Stakeholders such as the Ministry of Health (MOH) and Ministry of Education (MOE) ought to integrate oral health messages into the curriculum at Primary school, Junior and Senior High levels to improve literacy levels and consequently oral health status amongst the pupils who will eventually be making up the student population in the universities.
4. Health outreaches should incorporate oral health screenings and education as a means of achieving wider coverage.

More studies will be needed in the area of Oral health (all facets, including oral health status, knowledge, literacy, advocacy, service utilization and so on) in Ghana, to build a much richer base of knowledge from which informed decisions can be made on policy direction for better oral health of the good people of Ghana.

CHAPTER 7

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APPENDICES

APPENDIX I: INFORMED CONSENT FORM

Participant Information Leaflet and Consent Form

<u>This leaflet must be given to all prospective participants to enable them to know enough about the research before deciding to or not to participate</u>

Title of Research:

ORAL HEALTH LITERACY AND BEHAVIOURS AMONG STUDENTS OF KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Name(s) and affiliation(s) of researcher(s):

This study is being conducted by Dr. Makafui Dawoe of the Kwame Nkrumah University of Science and Technology School of Public Health, Kumasi.

Background (Please explain simply and briefly what the study is about):

There is an evident lack of studies on Oral Health literacy on Ghana, and Africa in general. Oral health service uptake is relatively poor in Ghana, as compared to other countries, and this may be attributed to the lack of adequate basic oral health knowledge.

Purpose(s) of research:

This study seeks to assess Oral health literacy and related oral health behaviours as well as oral health service utilization among students of the Kwame Nkrumah University of Science and Technology.

Procedure of the research, what shall be required of each participant and approximate total number of participants that would be involved in the research:

This is a cross sectional population survey. Participants will be selected by simple random sampling. Each participant will be required to answer a questionnaire which will be addressing the areas of Access to oral health information and services, Oral health literacy, and Oral health behaviours. An estimated 381 participants will be required to take part in this study.

Risk(s):

There are no known risks involved in this study, as there is no testing of a new drug, and sensitive personal details are not disclosed.

Benefit(s):

The goal of this study is to find the best ways and media of reaching the student population (firstly) and the general public with basic oral health information that is needed for individuals to make decisions and positive changes concerning their oral health. Again, it will serve as a springboard for the development of further studies on oral health literacy, education, promotion and interventions in Ghana, West Africa and beyond.

Confidentiality:

No name will be recorded. Data collected cannot be linked to you in anyway. No name or identifier will be used in any publication or reports from this study. However, as part of our responsibility to conduct this research properly, we may allow officials from the ethics committees to have access to your records.

Voluntariness:

Taking part in this study should be out of your own free will. You are not under obligation to. Research is entirely voluntary.

Alternatives to participation:

You have the choice not to take part in this research.

Withdrawal from the research:

You may choose to withdraw from the research at any time without having to explain yourself. You may also choose not to answer any question you find uncomfortable or private.

Consequence of Withdrawal:

There will be no consequence, loss of benefit or care to you if you choose to withdraw from the study.

Costs/Compensation:

No monetary compensation was given.

Contacts:
If you have any question concerning this study, please do not hesitate to contact Dr. Makafui Dawoe on 0552565694.

Further, if you have any concern about the conduct of this study, your welfare or your rights as a research participant, you may contact:

The Office of the Chairman Committee on Human Research and Publication Ethics Kumasi
Tel: 03220 63248 or 020 5453785

APPENDIX II: CONSENT FORM

Statement of person obtaining informed consent:

I have fully explained this research to _____ and have given sufficient information about the study, including that on procedures, risks and benefits, to enable the prospective participant make an informed decision to or not to participate.

DATE: _____ NAME: _____

Statement of person giving consent:

I have read the information on this study/research or have had it translated into a language I understand. I have also talked it over with the interviewer to my satisfaction.

I understand that my participation is voluntary (not compulsory).

I know enough about the purpose, methods, risks and benefits of the research study to decide that I want to take part in it.

I understand that I may freely stop being part of this study at any time without having to explain myself.

I have received a copy of this information leaflet and consent form to keep for myself.

NAME: _____

DATE: _____ SIGNATURE/THUMB PRINT: _____ **Statement of person witnessing consent (Process for Non-Literate Participants):**

I _____(Name of Witness) certify that information given to

_____ (Name of Participant), in the local language, is a true reflection of what l have read from the study Participant Information Leaflet, attached.

WITNESS' SIGNATURE (maintain if participant is non-literate): _____

MOTHER'S SIGNATURE (maintain if participant is under 18 years): _____

MOTHER'S NAME: _____

FATHER'S SIGNATURE (maintain if participant is under 18 years): _____

FATHER'S NAME: _____

APPENDIX III: QUESTIONNAIRE

ORAL HEALTH LITERACY AMONG STUDENTS OF KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY.

A QUESTIONNAIRE ASSESSING ORAL HEALTH LITERACY AND ITS ASSOCIATION WITH ORAL HEALTH BEHAVIOURS AND SERVICE UTILIZATION, AS PART OF A DISSERTATION IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE AWARD OF MASTER'S DEGREE IN PUBLIC HEALTH, HEALTH SERVICES PLANNING AND MANAGEMENT.

PLEASE NOTE THAT PARTAKING IN THIS RESEARCH IS VOLUNTARY. NO PERSONAL INFORMATION WILL BE DIVULGED TO THE PUBLIC.

TO PARTICIPATE ONE MUST BE A STUDENT OF KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY.

PERSONAL DETAILS ARE NOT REQUIRED.

PLEASE ANSWER THE QUESTIONS OR TICK THE ANSWERS AS REQUIRED.

A. DEMOGRAPHIC CHARACTERISTICS (PLEASE TICK ✓ AGAINST CHOICE)

1. GENDER: Male ___ Female ___
2. AGE: ____
3. COLLEGE:
   - ☐ College of Agriculture and Natural Resources
   - ☐ College of Health Sciences
   - ☐ College of Humanities and Social Sciences
   - ☐ College of Arts and Built Environment
   - ☐ College of Engineering
   - ☐ College of Science

B. ACCESS TO ORAL HEALTH CARE SERVICES, INFORMATION AND EDUCATION

4. In KNUST/Ghana, how easy/difficult is it to access dental/oral health services?
   - Very easy ___
   - Easy ___
   - Moderate ___
   - Difficult ___
   - Very difficult ___

5. Which of the following do you consider as the most prominent challenge to accessing dental treatment?
    Limited availability dental/oral health care facilities ___
    Cost ___
    Time constraints ___
    Fear of dentists ___
    Treatment not needed immediately ___
    Lack of confidence in skill of dentists and oral health workers ___
    Distance to dental clinic/facility ___
    I want to access dental care but do not know where to go ___
    Other (please specify) _____
    None ___

6. In terms of financial access, what are your thoughts about the cost of dental/oral health services and treatment?
    Very cheap ___
    Cheap ___
    Moderate ___
    Expensive ___
    Very expensive ___

7. Have you been exposed to any form of dental/oral health education/information?
    YES___ NO___

8. If YES, what form/media did it take/employ?
    Television/Radio show___
    Social media___
    Health outreaches___
    Dentist___
    Other health practitioners___
    Friends___
    Parents___
    School curriculum ___
    Other (please specify) _____

9. Is it common to hear/read/be exposed to oral health education/information in KNUST/Ghana?
    Very common ___
    Common ___
    Moderate ___
    Rarely ___
    Very rarely ___
    Never ___

10. Concerning Oral Health Education and Information, which medium/media would the **student population** most likely respond to, in your opinion?
    Television/Radio show___
    Social media___
    Health outreaches___
    Dentist___
    Other health practitioners___
    Friends___
    Parents___
    School curriculum ___
    Other (please specify) _____

11. Concerning Oral Health Education and Information, which medium/media would the **general population** most likely respond to, in your opinion?
    Television/Radio show___
    Social media___
    Health outreaches___
    Dentist___
    Other health practitioners___
    Friends___
    Parents___
    School curriculum ___
    Other (please specify) _____

C. ORAL HEALTH LITERACY

THE FOLLOWING TOOL IS THE RAPID ESTIMATE FOR ADULT LITERACY IN DENTISTRY - 30 (REALD-30).
PLEASE TICK ✓ AGAINST THOSE WORDS YOU **RECOGNIZE.**
PLEASE LEAVE THE WORDS YOU DO NOT RECOGNIZE AS BLANKS.

Sugar	Abscess	Periodontal

Smoking	Extraction	Sealant
Floss	Denture	Hypoplasia
Brush	Enamel	Halitosis
Pulp	Dentition	Analgesia
Fluoride	Plaque	Cellulitis
Braces	Gingivae	Fistula
Genetics	Malocclusion	Temporomandibular
Restoration	Incipient	Hyperaemia
Bruxism	Caries	Apicoectomy

D. ORAL HEALTH BEHAVIOURS AND SERVICE UTILISATION

12. How many times do you brush your teeth daily?
    Once___ Twice___ More than twice___

13. Which of these do you use in cleaning your teeth? (you can tick more than one where applicable)
    Toothbrush ___ Chewing stick/miswak ___
    Oral wipes ___ Toothpaste ___ Mouthwash ___
    Charcoal ___ Baking soda ___ Floss ___
    Toothpick ___

14. i. Do you take a lot of sugary drinks, foods and sweets? Yes ___ No ___
    ii. What effects do sugary foods, drinks and sweets have on your oral/dental health and hygiene? Positive ___ Negative ___

15. Have you ever visited a dentist? YES ___ NO ___

16. How often do you seek dental/oral health care?
    Once every 3 months ___
    Once every 6 months ___
    Once a year ___
    Rarely ___
    Never ___

17. Which of the following is a more likely reason for you to seek dental advice/treatment?
    Long-standing/chronic condition ___

Emergency (e.g. Toothache, broken tooth, bleeding, etc.) ___
Routine check-up (preventive consultation) ___

18. Which of the following do you think is better to pursue?
Prevention ___
Treatment ___

19. Do you think your oral hygiene practices are adequate as of now?
YES ___ NO ___

Would you like to know more about your oral health and how to improve it?
YES ___ NO ___

APPENDIX IV: ETHICAL CLEARANCE

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/287/19 — 15th May, 2019.

Dr. Makafui Dawoe
c/o University Post Office
KNUST-KUMASI.

Dear Sir,

LETTER OF APPROVAL

Protocol Title: ***"Oral Health Literacy and Behaviours among Students of Kwame Nkrumah University of Science and Technology."***

Proposed Site: ***Kwame Nkrumah University of Science and Technology.***

Sponsor: ***Principal Investigator.***

Your submission to the Committee on Human Research, Publications and Ethics on the above-named protocol refers.

The Committee reviewed the following documents:

- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning 15th May, 2019 to 14th May, 2020 renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Yours faithfully,

Osomfo Prof. Sir J. W. Acheampong MD, FWACP
Chairman

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