ENSIGN GLOBAL COLLEGE

FACTORS ASSOCIATED WITH HUMAN PAPILLOMAVIRUS VACCINE UPTAKE AMONG SELECTED UNIVERSITY STUDENTS IN THE GREATER ACCRA REGION OF GHANA

SUBMITTED BY

CYNTHIA AKESE-SARQUAH

(207100205)

A THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH, FACULTY OF PUBLIC HEALTH, ENSIGN GLOBAL COLLEGE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF PUBLIC HEALTH DEGREE

SEPTEMBER, ,2023

DECLARATION

I, Cynthia Akese-Sarquah, declare that this work is a result of my investigation except for materials from published sources that have been duly acknowledged. This work has not been submitted for any other degree elsewhere.

Cynthia Akese-Sarquah   …………………….   …………………….
(Student)   Signature   Date

Certified by:
Dr. Edward Kofi Sutherland   …………………….   ………………….
 (Supervisor)   Signature   Date

Dr. Stephen Manortey   .…………………….   …………………..
(Head of Academic Program)   Signature   Date

DEDICATION

To my sons, Kweku and Kofi

ACKNOWLEDGEMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FI0 GURES

ABBREVIATION/ACRONYM

Abbreviation	Meaning
ACIP	Advisory Committee on Immunization Practices
ANOVA	Analysis of Variance
CDC	Centre for Disease Control and Prevention
COVID	Coronavirus disease
GIMPA	Ghana Institute of Management and Public Administration
HBM	Health Belief Model
HPV	Human Papilloma Virus
hrHPV	High-Risk Human Papillomavirus
SD	Standard Deviation
WHO	World Health Organization
MUCG	Methodist University College Ghana
PUC	Pentecost University College
CUG	Central University Ghana
UPSA	University of Professional Studies Accra
OR	Odds Ratio
aOR	Adjusted Odds Ratio
IBM	Information Behavioral Model

ABSTRACT

Introduction: Cervical Cancer remains a major global health threat. However, there is paucity of information about help-seeking behaviour among tertiary students in Ghana. This study sought to examine the factors associated with human papillomavirus vaccine uptake among University Students in Ghana. **Method:** The study adopted an analytic cross-sectional design that involved 1050 university students. A multi-stage sampling technique was used. The data was analyzed using STATA version 15 (Stata Corporation, College Station, TX, USA). Statistical techniques used include the independent student t-test, one-way ANOVA and Pearson Chi-Square test with an alpha level of 0.05. The association between the dependent and independent variables were modelled using logistic regression with a 95% confidence interval. **Result:** The study result indicates that about 10% of the participants were vaccinated against the HPV virus. The participants with higher scores on the knowledge test were more likely to have been vaccinated (aOR:1.19; 95% CI: 1.08 to 2.13) compared to those who had low scores. Having an elevated perception of vulnerability (aOR:11.37; 95% CI: 7.09 to 11.28) to the HPV virus, perceiving infection as being severe (aOR: 4.92; 95% CI: 3.87 to 8.19), perceiving the vaccine as being beneficial (aOR: 5.87; 95% CI: 4.45 to 8.32) increased the odds that a participant will accept the vaccine. In contrast, the perception of a barrier (aOR: 0.25; 95% CI: 0.19 to 0.79) when accessing the vaccine reduced the odds of accepting it. Being 30 years and above was associated with higher odds for HPV vaccine uptake (aOR:2.43; 95% CI: 1.02 to 5.71), compared to being below 19 years of age. Also, the study participants who were married or cohabiting were 1.3(95% CI:1.02 to 3.22) times more likely to have received the vaccine compared to counterparts who were never married. The participants who belonged to the Health Science College (aOR: 2.31; 95% CI: 1.46 to 5.08) were more likely to vaccinate compared to those belonging to the Basic and Applied Science College. **Conclusion**: The HPV vaccine uptake among university students can be increased by improving perception and knowledge through education.

Keywords: Cervical Cancer, HPV Vaccine

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Cervical cancer remains a major global health threat. Globally, it is the fourth most common cancer in women (Gultekin *et al.*, 2020). In 2020, 342,000 cervical cancer-related deaths and 604,000 new cervical cancers were reported of which low-middle income countries bear approximately 90% of the burden (Sung *et al.*, 2021). About 20% of the newly diagnosed cases live in Africa and the number keeps rising in the sub-Saharan Africa region (Jedy-Agba *et al.*, 2020; Burt *et al.*, 2021).

Epidemiologic studies have shown that almost all (up to 99% for squamous cell carcinomas) cases of cervical cancer are caused by infection with high-risk human papillomavirus (hr-HPV)(Gultekin *et al.*, 2020). Factors associated with an increased risk of hr-HPV infection include smoking, early age at first sexual intercourse, a higher number of sexual partners and a history of sexually transmitted infections (Roset Bahmanyar *et al.*, 2012; Taku *et al.*, 2020).

To eliminate cervical cancer as a public health concern, the WHO adopted the 90-70-90 targets that would guide globally concerted efforts until 2030 (Gultekin *et al.*, 2020). These include ensuring that 90% of girls have received the full dose of HPV vaccine by the age of 15, 70% of women are screened with high-performance tests by age 35 and 45 years, and that 90% of women with the disease should be treated (Gultekin *et al.*, 2020).

The introduction of a vaccine against the Human Papilloma Virus (HPV) has led to a significant decline in cases of cervical cancer in many countries (Schottenfeld and Jennifer Beebe-Dimmer, 2015; Markowitz *et al.*, 2018). Several countries, mostly in Europe, North America, Australia and

Asia have introduced the vaccines into their national immunization program and other public and national health systems (Koulova *et al.*, 2008). In the United States of America, the vaccines were introduced about 13 years ago following advice from relevant health regulatory authorities including the Advisory Committee on Immunization Practices (ACIP) and the Center for Disease Control and Prevention (CDC) (Markowitz *et al.*, 2014).

In Ghana, cervical cancer is the leading cause of death among women and the number is expected to rise by 2025. Also, the WHO has predicted that the number of newly diagnosed cases will rise from 2797 to 7797 by the same period(Debrah *et al.*, 2021). Currently, three HPV vaccines (Quadrivalent Gardasil, Cervarix and a nonviolent Gardasil) have been approved for the Ghanaian market (Petrosky *et al.*, 2015; Debrah *et al.*, 2021).

The patronage of the vaccine among the general population is poor and the cost ($150.00) of the vaccine has been identified as one of the key reasons for the low acceptance. However, studies have shown that many other factors may account for the vaccine uptake among tertiary students that are yet to be explored in Ghana.

1.2 Problem Statement

The burden of infectious agent-related cancer cases continues to be a challenge worldwide. More than 80% of these cases were recorded in less developed countries in the world. This represents a significant contribution of infectious agents to the burden of cancer-related morbidity and mortality in these countries (Martel *et al.*, 2008). Cervical cancer is a leading cause of cancer-related death in Ghana and other sub-Saharan countries and more than 90% of the reported cases are strongly associated with the Human Papilloma Virus (HPV), (Denny *et al.*, 2014). Human

papillomavirus transmission is basically through contact with infected persons and has been recognized as a very common sexually transmitted infection.

Many developed countries have incorporated HPV vaccination into their health policies in addition to cervical cancer screening programs targeting girls and boys at ages 11 and 12 with a catch-up vaccination period up to age 26. These programs have resulted in a decline in HPV-related clinical diseases and the prevalence of early cervical cancer cells (Markowitz *et al.*, 2018). Several studies associate adolescence with risky sexual behaviour e.g. early sexual debut, multiple sexual partners, engaging in unprotected sexual intercourse and others (Doku, 2012; Menon *et al.*, 2016).

In Ghana, studies have been conducted to determine the proportion of HPV vaccination among the general population yet there is no published data on university students. Also, there is scant data about the awareness, perception and acceptance of HPV vaccine among university students. This makes it difficult to develop an intervention to improve HPV vaccine coverage of this population. Thus, this study sought to examine the factors associated with HPV vaccine uptake among selected university students in the Greater Accra Region in Ghana.

1.3 Rationale of Study

The association of an infectious agent i.e. HPV with cervical cancer, makes it crucial to use national health policies to facilitate the vaccination of the adolescent age group before their sexual debut. In an era of preventive medicine, much attention needs to be placed on the uptake and knowledge of the HPV vaccine among adolescents in Ghana at a stage in their lives where they are deemed vulnerable to HPV infection.

Studies done in the area of cervical cancer vaccines in our sub-region show a high level of willingness of participants to accept the vaccine but there is a lack of data to show uptake and

knowledge of the vaccine among the adolescent age group.

This study seeks to provide information on the proportion of female students at the Universities within the recommended age group that know about the HPV vaccine and the proportion who have been vaccinated. It will further address the perception of the students in their youth on the vaccine and the extent to which knowledge of the vaccine affects uptake.

This will help address the gap in knowledge and uptake of cervical cancer vaccine among this group which can help in policy formulation to help address the burden of cervical cancer in our sub-region.

1.4 Conceptual Framework

The conceptual framework shows the connectedness of socio-demographic characteristics, perception and knowledge in explaining HPV vaccine uptake. This relationship is sometimes mediated by a person's intention to engage in the activity. Studies have shown that participant socio-demographic characteristics such as age, marital status and level of education background are significantly associated with vaccine uptake. This relationship is moderated by the person's intention to vaccinate, sometimes.

The HB Model has constructs that have been labelled as the perceived severity, susceptibility, benefits and risks that are capable of explaining HPV vaccine uptake. In the same, knowledge is a potential predictor of HPV vaccine uptake.
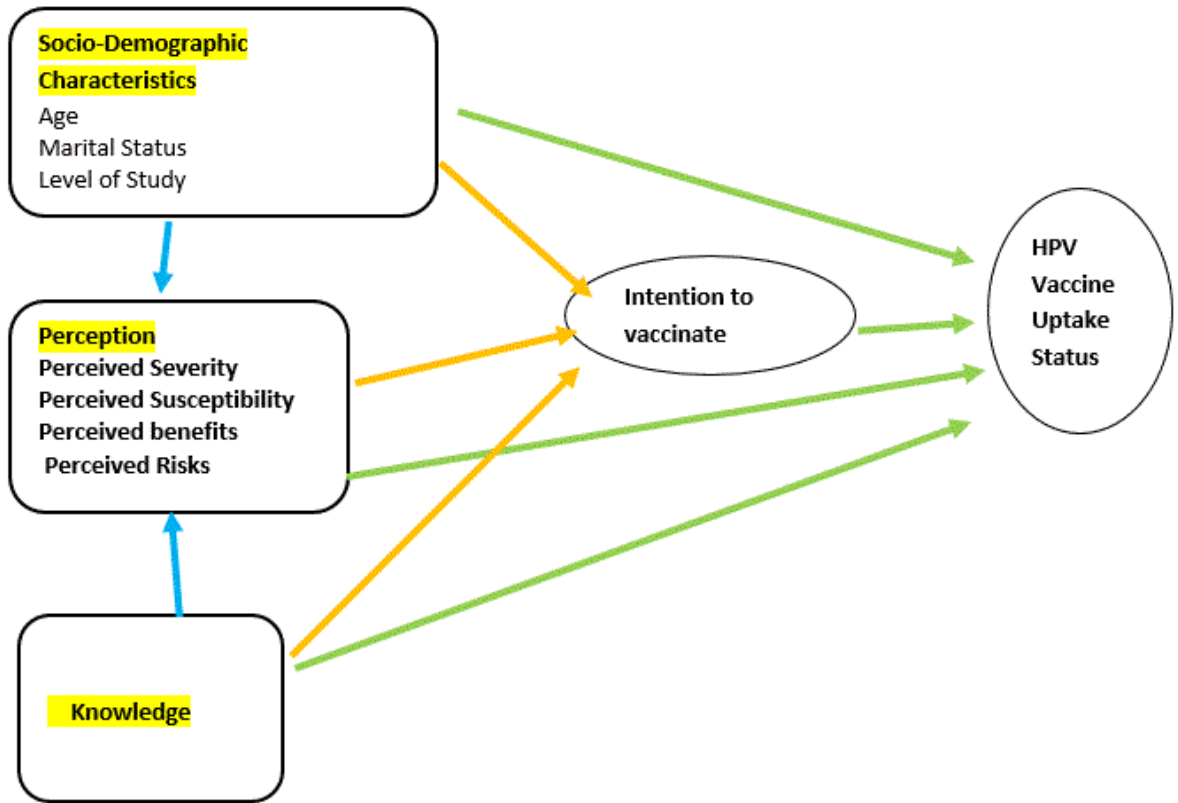
Figure 1.1: General Conceptual framework for knowledge, perception, socio-demographic, intention and HPV vaccine uptake.

Source: Author's construct, 2023

1.5 Research Questions

1. What proportion of university students have taken the human papillomavirus vaccine?

2. What are the student's knowledge and perceptions concerning the human papillomavirus vaccine uptake?

3. What is the relationship between participants' socio-demographic characteristics and the human papillomavirus vaccine uptake?

1.6 General Objectives

The overall aim of the study seeks to examine the factors associated with the human papillomavirus vaccine uptake among university students in the Greater Accra Region of Ghana.

1.7 Specific Objectives

1. To examine the proportion of university students who have taken the human papillomavirus vaccine

2. To assess students' knowledge and perception concerning the human papillomavirus vaccine uptake

3. To determine the relationship between participant socio-demographics characteristics and human papilloma vaccine uptake.

1.8 Profile of Study Area

The study involves students from universities namely Ghana Institute of Management and Public Administration, Methodist University College of Ghana, Pentecost University College, Central University Ghana and University of Ghana.

Ghana Institute of Management and Public Administration (GIMPA)

The Ghana Institute of Management and Public Administration (GIMPA) is a public university located in Accra, the capital city of Ghana, West Africa. Established in 1961, GIMPA is a renowned institution that focuses on providing education and training in the fields of management, public administration, governance, leadership, and related disciplines. It was initially founded as a joint project between the Government of Ghana and the United Nations Special Fund GIMPA's

primary goal is to contribute to the development of Ghana and the African continent by offering high-quality education, training, research, and consultancy services in various areas relevant to public administration, business management, leadership, law, social sciences, and more. The institution aims to equip individuals with the knowledge, skills, and expertise needed to excel in their respective fields and contribute to the advancement of their communities and countries.

The institute offers a wide range of academic programs, including undergraduate and postgraduate degrees, diploma programs, short courses, and professional training. GIMPA has several faculties and schools dedicated to different areas of study, such as the School of Business, School of Public Service and Governance, and School of Technology.

GIMPA is known for its commitment to excellence, research, and practical application of knowledge. It often collaborates with government agencies, private organizations, and international institutions to address real-world challenges and provide solutions that benefit society. Over the years, GIMPA has gained recognition both locally and internationally for its contributions to education, research, and capacity-building in various fields

In addition to its academic programs, GIMPA hosts seminars, workshops, conferences, and other events that bring together scholars, professionals, policymakers, and experts to discuss important issues and share insights. The institution's emphasis on academic rigor, ethical values, and societal impact has solidified its position as a leading educational and research institution in Ghana and beyond

Methodist University College Ghana (MUCG)

Methodist University College Ghana (MUCG), commonly referred to as Methodist University, is a private Christian university located in Accra, the capital city of Ghana, West Africa. Established in 2000, the university is affiliated with the Methodist Church Ghana and operates under its

auspices. The institution aims to provide quality education, promote Christian values, and contribute to the development of society through academic excellence and ethical leadership. Methodist University offers a variety of undergraduate and postgraduate programs in fields such as business administration, social sciences, theology, computer science, information technology, nursing, and more. The university places an emphasis on practical skills and real-world application.

Pentecost University College (PUC)

Pentecost University College (PUC) is a private Christian institution of higher learning located in Accra, the capital city of Ghana, West Africa. Established in 2003, the university college is affiliated with The Church of Pentecost, a prominent Christian denomination in Ghana. PUC's mission is to provide quality education within a Christian framework, fostering spiritual growth, academic excellence, and ethical leadership among its students.

PUC offers a range of undergraduate and postgraduate programs in various fields, including business administration, theology, information technology, nursing, and more. The programs are designed to equip students with practical skills and knowledge for their chosen careers.

Central University Ghana (CUG)

Central University Ghana is a private Christian university located in Accra, the capital city of Ghana, West Africa. Established in 1998, the university aims to provide quality education within a Christian framework, promoting academic excellence, moral values, and holistic development. Central University Ghana is accredited by the National Accreditation Board of Ghana and offers a range of undergraduate and postgraduate programs. Central University offers a diverse range of programs across various disciplines, including business administration, theology, communications, public health, pharmacy, law, and more. These programs are designed to provide

students with a strong academic foundation and practical skills.

University of Ghana

The University of Ghana, often referred to as UG, is a public research university located in Legon, a suburb of Accra, the capital city of Ghana, West Africa. Established in 1948 as the University College of the Gold Coast, it is one of the oldest and most prestigious universities in the region. The university is dedicated to providing quality higher education, conducting impactful research, and contributing to the development of Ghana and the African continent.

The university offers a wide range of undergraduate, postgraduate, and doctoral programs across various disciplines, including humanities, social sciences, natural sciences, business, law, medicine, engineering, and more. The University of Ghana is known for its research contributions in various fields. It conducts research that addresses local and global challenges, promotes sustainable development, and advances knowledge.

1.9 Scope of Study

The study adopted a cross-sectional study design using mainly primary data to describe the factors associated with the human papillomavirus vaccine among university students in the Greater Accra Region. The study was guided by the Health Belief Model and the data was collected using an online survey. The constructs involved in the study include participant knowledge, beliefs and socio-demographic characteristics.

1.10 Organization of Report

The study is organized into six (6) chapters. Chapter One provides an introduction to the study, which includes the background of the study, the problem statement, the objectives of the study, the rationale for the study, the research questions, and a description of the study area. Chapter Two deals with the literature review which links the research work to a body of knowledge. Chapter Three presents a detailed explanation of the research methodology used to achieve the research objectives. Chapter Four analyzes and presents findings in different formats. Chapter Five provides summary and analysis of the findings from an analysis of the data and a comparison of the findings with work done by other researchers. Lastly, Chapter Six presents the conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section consists of the literature that was reviewed for the study. It includes literature on the prevalence of HPV vaccine uptake and its determinants.

2.1 Prevalence and Uptake of Human Papilloma Virus Vaccine

Many factors affect the uptake of the HPV vaccine. The uptake rate of the vaccine among adolescents varies significantly worldwide with some countries showing as low as 2.4% and others as high as 94%. These variations in the uptake rate of the vaccine represent the level of awareness and knowledge of the Human papillomavirus and the vaccine among adolescents from different walks of life(Loke *et al.*, 2017). Awareness and knowledge inform the health-seeking behaviour of people. The health-seeking behaviour which includes recommendations from healthcare providers and the gynecological history of clients establishes the personal importance of the vaccine which affects uptake (Rosenthal *et al.*, 2011).

A cross-sectional study conducted in Nigeria involving 310 medical and paramedical students reported that 14% of the participants were vaccinated against HPV(Idowu *et al.*, 2019). The study used a stratified sampling technique and the questionnaires were self-administered, and semi-structured. A similar study that reported the correlates of HPV vaccine knowledge and acceptance in Northern Nigeria reported that only 5% of the 510 participants were vaccinated against HPV(Iliyasu *et al.*, 2022).

A cross-sectional study conducted in Oromia Ethiopia among 422 adolescents selected from Ambo town indicated that 44% of the participants were immunized against HPV(Beyen *et al.*, 2022). In a Ghanaian study that sought to examine the patterns of HPV genotypes, risk factors indicated that 8.2% of the female participants were vaccinated(Debrah *et al.*, 2021). The participants were selected from reproductive health facilities in Kumasi and the Greater Accra Region of Ghana.

Acceptability of the vaccine is demonstrated by the client's willingness to accept the vaccine which also contributes to the client's desire to get vaccinated. Women belonging to higher socioeconomic levels are likely to accept the vaccines (Jain *et al.*, 2009). Maternal education is tied to the socioeconomic background of families and this has a direct effect on the acceptability of the vaccines by adolescents as well.

Many studies have demonstrated that the various socio-demographic factors of the client can influence both positively and negatively the determinants of HPV vaccine uptake(Jain *et al.*, 2009; Henry *et al.*, 2016; Loke *et al.*, 2017).

2.2 Factors Associated with HPV Vaccine Uptake

The determinants of the HPV vaccine uptake follow a scientifically approved approach to conceptualize the many factors that can predict and promote healthy behaviour performance. The concept adapted for the study which is based on the IMB model focuses on the information, motivation and behaviour skills which impact healthy behaviour adoption. The natures of these constructs are specified empirically by the model which identifies the causal relationship between them. This association can be utilized to translate the approach into achieving a scientifically targeted HPV vaccine promotion intervention and uptake.

2.2.1 Socio-demographic Factors and HPV Vaccine Uptake

Available studies have shown a strong relationship between socio-demographic characteristics and HPV vaccine uptake. For example, the recommended ages for the vaccines are 11 and 12 years but can be given as early as age 9 based on the risk of acquiring HPV infection. Younger people are more likely to receive the HPV vaccines and students in tertiary institutions have 3 times the odds of vaccinating against HPV (Rosenthal *et al.*, 2011). Student status in most of tertiary institutions is linked with single marital status, which is a predictor of vaccination (Jain *et al.*, 2009; Amponsah and Owolabi, 2011). Girls from communities with high levels of poverty in the United States had higher HPV vaccination as compared with those from low-poverty communities but the reverse is likely to be the case in Sub-Saharan African countries including Ghana (Coleman, Levison and Sangi-haghpeykar, 2011; Henry *et al.*, 2016).

The vaccine is equally recommended for males and females from ages 13 to 26 (Meites *et al.*, 2019).

2.2.2 HPV Knowledge and HPV Vaccine Uptake

Knowledge on the human papillomavirus and the vaccine is low in most countries in sub-Saharan Africa (Kane *et al.*, 2006; Abotchie and Shokar, 2009; Becker-Dreps *et al.*, 2010).

Ghana's health service has a strong advocacy program on adolescent health. This project aims at capacity building in the area of advocacy and peer education in matters concerning reproductive health education among the youth(Bayram, Beji and Gokyildiz, 2011). If a similar concept is adopted for cervical cancer screening and management of precancerous conditions, there could be a reduction in the burden of the disease(WHO, 2019).

2.1.3 Intention to take up HPV Vaccine

Acceptability of the HPV vaccine serves as a proxy for assessing the willingness of women toward the uptake of the vaccine. Factors mostly associated with the acceptability of the HPV vaccine include individual's belief system and perceived risk of the infection. Others are perception of effectiveness and side effects of vaccines, care giver's health attitude, sexual and immediate societal environment as well as health care providers factors including cost and availability of vaccines(Zimet *et al.*, 2006; Katz *et al.*, 2010). A study in Kenya showed that 95% of the mothers were willing to vaccinate their daughters to help prevent cervical cancer if available (Becker-Dreps *et al.*, 2010). In Ghana, about 94% are willing to vaccinate themselves and their daughter when the opportunity arises (Coleman, Levison and Sangi-haghpeykar, 2011). Acceptability is further determined by adequate education of all stakeholders. Other parameters that needed to be addressed and were considered barriers were the cost of vaccine and other sociocultural factors (Kane *et al.*, 2006).

2.3 Health Belief Model

The HBM posits that a person's beliefs namely perceived severity and susceptibility of the disease and the perceived benefits and risks influences a person's health seeking behaviour (Arimbawa, Hita and Wardhana, 2021). This model has been useful for studies that sought to understand factors accounting for vaccine uptake (Zampetakis and Melas, 2021; Limbu, Gautam and Pham, 2022).

Perceived severity refers to the belief that the consequences resulting from experiencing a disease poses serious harm to oneself and others (Arimbawa et al., 2021)) The students are likely to vaccinate against cervical cancer when they perceive that their refusal to accept a vaccine is deleterious.

Perceived susceptibility refers to the belief that there is high risk of experiencing a negative health outcome(Arimbawa, Hita and Wardhana, 2021). This implies that students would opt for a vaccine when they realise they are at increased risk of infection.

Another construct within the HBM is perceived benefits. This suggests that the person will carry out an action when the person thinks it is beneficial (Arimbawa, Hita and Wardhana, 2021). This implies, students who perceive that the vaccination attracts benefits are more likely to vaccinate than counterparts who do not see the benefit in vaccinating.

Another component is perceived barrier. The proponents argue that a person is less likely to carry out an action when he/she faces setbacks(Arimbawa, Hita and Wardhana, 2021). In this case, students may not vaccinate when they have to miss class or pay for the service or when the vaccinate is unavailable sometimes.

Cue to action is a component of the model that a person has to be stimulated to act, beyond his or her perception(Arimbawa, Hita and Wardhana, 2021). This could be internal or external factors. The internal factor could be a previous experience with an infection. The external cues could stem from a healthcare worker, mandatory, and fear for the unknown.

The last construct of the HBM is the self-efficacy. This refers to the person's confidence of his or her ability to implement the action successfully(Arimbawa, Hita and Wardhana, 2021). Relating it to this study, students with who believe that they can access the vaccine on their own are more likely to vaccinate compared to their colleagues who are limited by disability.

CHAPTER THREE

METHODS

3.0 Introduction

This chapter elaborates on the study design, study site, target population, source of data, the sampling technique, the sample size, the data collection, data analysis and ethical consideration

3.1 Study Design

An analytic cross-sectional design was adopted for the study. This design provided a snapshot of the population at a particular time (Grimes & Schulz, 2002). It required less time and money to conduct, compared to a case-control, cohort study or randomized control trial. However, it could not establish the temporality of causation. This design was selected because it allowed for the collection of predictor and outcome variables at the same time.

3.2 Data Collection Techniques and Tools

An online-administered questionnaire was used as a tool for the collection of data. The questions were adapted from previously published peer-reviewed studies(Becker-Dreps *et al.*, 2010; Coleman, Levison and Sangi-haghpeykar, 2011; Bancroft *et al.*, 2014; Cunningham, Davison and Aronson, 2014; Beyen *et al.*, 2022). The questionnaire was in three parts, the first part consisted of questions regarding participant demographic characteristics such as participant age, education, marital status, occupation and parity. The second section was made up of questions regarding human papilloma virus, vaccine and prevention. The third part contain questions regarding students' perceptions concerning the human papilloma virus vaccine.

3.3 Study Population

The study population was university students enrolled in accredited tertiary institutions in the Greater Accra Region of Ghana.

3.3.1 Eligibility Criteria

Inclusion Criteria

i.   The study involved all university students in the Greater Accra with access to electronic platforms that support online survey forms (Google Forms)

ii.   It included students with verified student identity numbers

Exclusion Criteria

i.   The study excluded all students in the selected school without access to social media and electronic platforms that support online survey forms (Google Forms)

ii.   The study excluded university students outside the Greater Accra Region

iii. Data of students without valid student identity was removed

3.4 Study Variables

3.4.1 Dependent Variable

The primary outcome was the Human Papilloma Virus Vaccine Uptake status.

3.4.1 Independent variables

Table 1: Independent Variables

Variables	Measurement
Age	Continuous
Age Sexual Debut	Continuous
Age at Menarche	Continuous
Marital Status	Categorical
Religion	Categorical
College	Categorical
Residence	Categorical
Educational Background	Categorical
Occupation of Guardians	Categorical
Beliefs	Categorical

3.5 Sampling Methods

3.5.1 Sampling Techniques

A multi-stage sampling technique was used. A simple random sampling technique was used in selecting the universities and a snow ball sampling approach was used to identify student participants to fill the online questionnaire. In terms of the selection of universities, a list of all universities in the Greater Accra Region in Ghana was prepared and 5 of them were selected using a simple random sampling technique. This approach was used because most schools were on vacation during the study time period.

3.5.2 Sampling Size Determination

The sample size was arrived at by using Cochran's sample size formula: $n = \frac{z^2 p(1-P)}{d^2}$

Where n was the sample size?

Z was the statistic corresponding to the level of confidence which was aimed at 95%, Z=1.96

P was the prevalence. In this study the proportion used for sample size calculation was 50%,

d, was the precision which is 5%; d = 0.0025

This implied that Z^2 P (1-P) = (3.8416*0.09) / 0.0025 = 384.2

39 (10% of the 385) was added to the minimum sample size of 385 to account for non-response, making a total sample size of 424.

Since this was an internet-based survey, the researcher considered all eligible respondents at the end of the survey, 1050 respondents to increase statistical power.

3.6 Pre-testing

A pilot study was conducted with participants from the University of Professional Studies Accra (UPSA). This was done to test for the validity and reliability of the data collection instrument. The reliability assessment produced a Cronbach Alpha reliability index of 0.88.

3.7 Data Handling

Data was captured in a Microsoft excel spreadsheet for cleaning and coding. The original entry on the online questionnaire was used as the data source. The principal investigator was used for data cleaning and coding. Soft copies of the dataset were saved on an external drive and Google drive. After which it was transferred to STATA statistical software 15 for analysis

3.8 Data Analysis

The data were entered into Microsoft Excel for cleaning and then exported to STATA version 15 (Stata Corporation, College Station, TX, USA) for analysis. Descriptive statistics such as frequencies, mean, median and standard deviation were used.

The first objective sought to assess the proportion of university students who have taken the human papillomavirus vaccine. This was described using a bar chart.

The second objective examined students' knowledge and perceptions concerning the human papillomavirus vaccine uptake. In terms of knowledge, percentages, frequencies and 95% confidence interval were used to describe the participants' performance on each question asked. The overall knowledge score was handled as a continuous variable. Participant perception was assessed using mean and standard deviation (SD±); questions asked were on a 5-point Likert scale. The bivariate analysis was carried out using an independent student t-test and a one-way ANOVA using an alpha level of 0.05. The backward selection technique was used to select variables for a multivariate logistic regression using a 0.25 cut-off. Multivariate logistic regression was used to model the relationship between the participant beliefs and vaccine uptake using a 95% confidence interval.

The third objective sought to assess the relationship between participant socio-demographic characteristics and uptake of the human papilloma vaccine. This variable was described as the HPV vaccine Uptake with "Yes" and "No" categories. Bivariate analysis was conducted to assess the association between the HPV vaccine uptake and characteristics using both Fisher's exact test and Pearson Chi-square analysis depending on minimum cell counts. The alpha level of 0.05 was used. A multivariate analysis was then carried out to model the relationship between the participant characteristics and the willingness to accept HPV using 95% Confidence Interval.

3.9 Ethical Considerations

This research sought the consent of participants by asking them to provide their consent on the online platform before proceeding to the survey. Participants were aware of the objectives of the research project, and were assured of anonymity and confidentiality for all information they provided. Participants were also assured that at any point during the data collection, they had every right to withdraw without any consequences to their person, image or self-esteem.

Ethical clearance was obtained from the Ethical committee of the Ensign Global College before the study begun.

3.10 Limitations to the study

1. The study was limited to only six universities in the greater Accra region.

2. Participants were likely to give personal or social desirable responses as they might be aware of expectations of the study.

3. The study used a non-random sampling technique in selecting the study participants so care should be taken when generalizing the findings.

3.11 Assumptions of Study

1. The study assumed that students had some level of knowledge Human Papilloma Virus and were expected to demonstrate good prevention protocols.

2. The study assumed that the knowledge level of students or study participants would directly affect their Human Papilloma Virus Vaccine Uptake attitudes and practices levels as shown in the general conceptual framework for knowledge and perception.

3. The study assumed that knowledge, individual and external forces could explain HPV vaccine uptake among university students in Ghana as observed in previous studies

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter consists of the study findings. The study results were organized using tables, pie and bar charts. The findings have been arranged according to the study objectives.

4.1 Socio-Demographic Characteristics

Seven of the 1057 records belonging to the university students who filled the online questionnaires were deleted because values for some of the respondents were missing. The average age of the study participants was 23(SD ± 3.9) years. The majority of the participants belonged to age group "20-24" years (n=676/1050; 64.4%). Approximately 71% (n=400/567) indicated they first had sexual intercourse when they were between 17 to 21 years of age.

Table 2: Socio-Demographic Characteristics of Study Participants

Characteristic	Frequency (n=1050)	Percentage (%)	Mean (SD)
Age (Years)			22.9 (3.9)
≤19	136	12.9	
20-24	676	64.4	
25-29	138	13.1	
≥30	100	9.5	
Sexual Debut Age (Years);n=567			19.5(3.4)
<16	50	8.8	
17-21	400	70.6	
≥22	117	20.6	
Age at Menarche (Years)			
≤9	54	5.1	
10-14	706	67.2	
>14	290	27.6	
Marital Status			
Single	668	64.1	
In a relationship	299	28.5	
Married/Cohabiting	83	7.9	

SD= Standard Deviation

Contd…Socio-Demographic Characteristics

Most of the participants professed faith in Christianity (n=985/1050; 93.7). Only 4 of the 1050 participants belonged to other religious groups such as the African Traditional Religion and Atheism.

Characteristics	Frequency	Percentage (%)
Religion		
Christian	985	93.7
Muslim	61	5.9
Other	4	0.4
Level of Study		
Bachelor	830	79.0
Masters-Doctorate	220	21.0

Area of Study

About 45% (n=465/1050), 26% (n=273/1050) and 19% (n=197/1050) of the participants studied humanity, basic and applied science and health sciences related courses respectively.

Figure 4.1: area of study
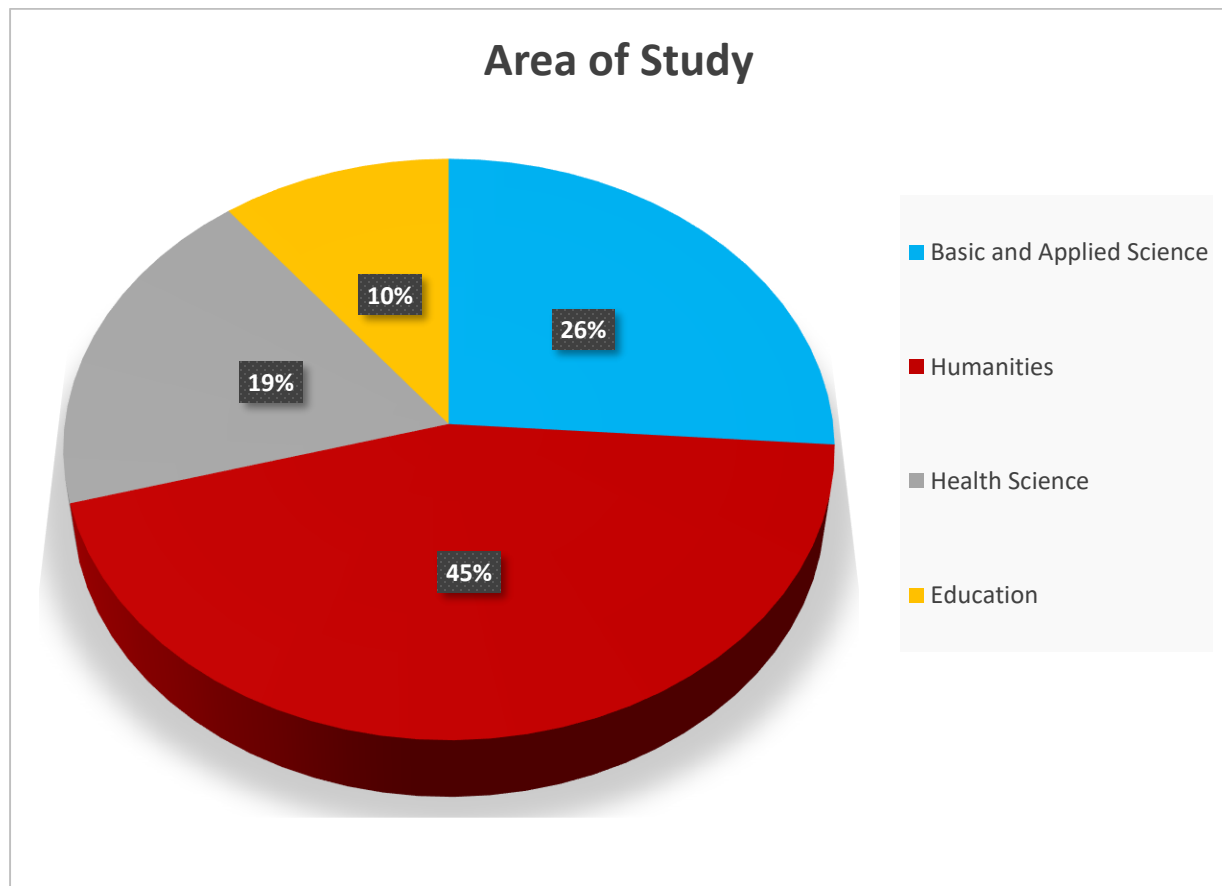
4.2 The proportion of students who have taken the human papilloma virus vaccine

The participants were asked if they have received the human papilloma virus vaccine.

Approximately 90% (n=949) of the participants had not taken a human papilloma virus vaccine.
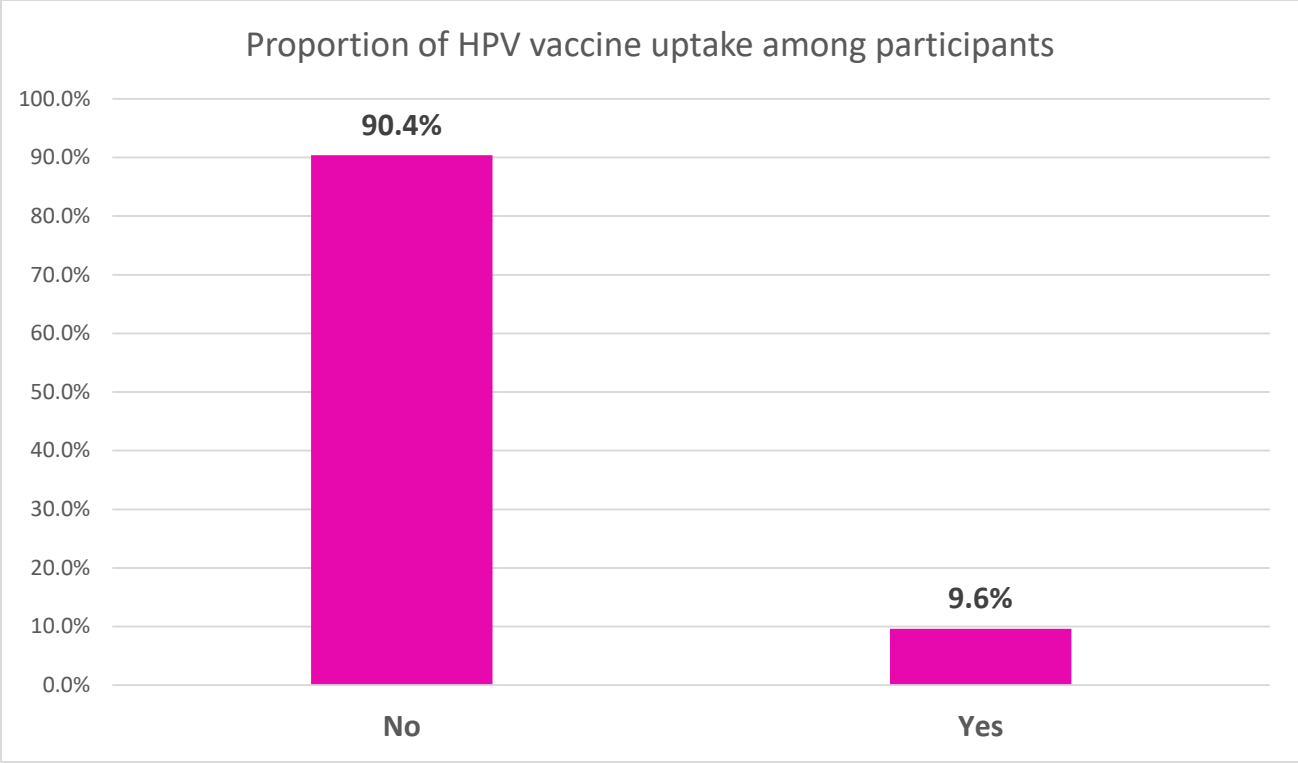
Figure 4.2: proportion of HPV vaccine uptake among participants

4.3 Students' knowledge and perceptions concerning the human papilloma virus vaccine uptake

4.3.1 Knowledge of HPV and the vaccine

The knowledge of the participants was assessed by asking them questions related to HPV, cervical cancer and the vaccine. They performed poorly on question 4. Out of the 1,050 participants, 1,039 responded to this questions (46.3%; 95% CI=43.9 to 54.7) and 5(37.8%; 95% CI=28.6 to 57.5).

.

Table 3: Knowledge of Human Papilloma Virus and the Vaccine

Item	Questions	Frequency (n=1050)	Percentage of correct responses (%)	95 % Confidence Interval
1	Is HPV sexually transmitted?	1037	66.5	49.6 to 78.3
2	Are sexually active individuals at risk of HPV infection?	1050	50.1	44.5 to 55.3
3	Do you think HPV infection can cause Cervical Cancer?	1048	68.6	47.9 to 72.7
4	Do you know HPV can cause genital warts (rashes)?	1039	46.3	43.9 to 54.7
5	Do you know of any other disease that is caused by HPV?	1050	37.8	28.6 to 57.5
6	Can HPV infection affect your Pap smear results?	1050	54.1	55.4 to 69.9

4.3.2 Perceptions concerning the human papilloma virus, cervical cancer and vaccine uptake

The health beliefs of participants were described. Majority of the participants felt they are susceptible (X=1.49; SD±1.2). Specifically, they held the opinion that they were at high risk for HPV (X=1.32; SD±1.1), genital warts (X=1.62; SD±1.0) and having cervical/vulvar disease (X=1.52; SD±1.3). Barriers such as **:** high cost of HPV vaccination (X=1.59; SD±1.1) and fear of severe side effect (X=1.63; SD±1.0)

Table 4: Perceptions concerning the Human Papilloma Virus, Cervical Cancer and Vaccine Uptake

Beliefs	Mean	SD±
Perceived Susceptibility (Aggregate)	**1.49**	**1.2**
Women are at high risk for HPV	1.32	1.1
Women are at high risk for having genital warts	1.62	1.0
Women are at high risk for having cervical/vulvar cancer	1.52	1.3
Perceived Severity (Aggregate)	**1.50**	**1.2**
HPV infection is severe	1.73	1.1
Genital warts are severe in women	1.49	1.4
Cervical cancer/vulvar cancer is life threatening	1.58	1.0
Perceived Benefit (Aggregate)	**1.55**	**1.2**
HPV vaccines is highly effective for the prevention of HPV infections	1.32	0.9
HPV vaccines is highly effective to prevent genital warts	1.81	1.0
HPV vaccine is highly effect for the prevention of cervical/vulvar cancer	1.48	1.1
Perceived Barrier (Aggregate)	**1.61**	**1.2**
High cost of HPV vaccination	1.59	1.1
Fear of severe side effects	1.63	1.0

SD=Standard Deviation

4.3.3 Bivariate analysis showing association between HPV vaccine uptake and participant knowledge and beliefs

A bivariate analysis was conducted using the independent t-test with an alpha level of 0.05. There was significant association between the perception that the participants were susceptible (t-test= -71.28; $p < 0.001$), infection was severe (t-test= -54.65; $p < 0.001$), (t-test= -46.2; $p < 0.001$) and other variables in the category such as such as Barriers (high cost of HPV vaccination and fear of severe side effect) with (t-test= -41.67; $p < 0.001$)

Table 5:Bivariate analysis showing association between HPV vaccine uptake and participant knowledge and beliefs

Item	HPV Vaccine Uptake		T-test(df)	p-Value
	No	Yes		
	Mean (SD±)	Mean (SD±)		
Perceived Susceptibility	1.15(0.42)	4.76(0.83)	-71.28(1048)	0.000
Perceived Severity	1.18(0.52)	4.60(1.02)	-54.65(1048)	0.000
Perceived Benefit	1.25(0.64)	4.60(1.02)	-46.21(1048)	0.000
Perceived Barrier	1.30(0.02)	4.60(1.02)	-41.67(1048)	0.000
Overall, Knowledge Score in Percentage	26.72(14.82)	92.04(20.46)	-39.89(1048)	0.000

4.3.4 Multivariate Analysis showing association of HPV vaccine uptake and participant knowledge and perceptions using logistic regression

The multivariate logistic regression analysis shows that perceived susceptibility, severity, benefit, barrier and overall knowledge score were significantly associated with HPV vaccine uptake. A unit increase in the perception that the participant susceptible increased the odds that the participant will accept the vaccine by 11.4 (95% CI= 7.09 to 11.28) times. The perception that HPV infection, genital warts or cervical cancer is severe elevates the odds that a participant would receive the vaccine (aOR= 4.92; 95% CI=3.87 to 8.19).

Multivariate Analysis showing association between HPV vaccine uptake and participant knowledge and perceptions using logistic regression

Table 6: Multivariate analysis showing association between HPV vaccine uptake and participant knowledge and perceptions using logistic regression

Items	Unadjusted			Adjusted		
	OR	95% CI	p-Value	OR	95% CI	p-Value
Perceived Susceptibility	10.36	6.99 to 15.38	0.000	11.37	7.09 to 11.28	0.000
Perceived Severity	6.84	5.17 to 9.04	0.000	4.92	3.87 to 8.19	0.000
Perceived Benefit	6.40	4.87 to 8.41	0.000	5.87	4.45 to 8.32	0.000
Perceived Barrier	0.51	0.49 to 0.86	0.000	0.25	0.19 to 0.79	0.000
Overall, Knowledge Score in Percentage	1.09	1.08 to 1.11	0.000	1.19	1.08 to 2.13	0.000

OR=Odds Ratio;   *CI=Confidence Interval*

4.4.1 To determine the association between participant socio-demographic characteristics and human papilloma vaccine uptake

A bivariate analysis was conducted to examine the association between participant characteristics and HPV vaccine uptake using Pearson Chi-square test with an alpha level of 0.05. The participant area of study (X^2=10.76; p=0.013) were significantly associated with HPV vaccine uptake status.

Table 7: Bivariate analysis showing the association between participant socio-demographic characteristics and HPV vaccine uptake

Characteristic	HPV Vaccine Uptake		X^2	p-Value
	No (%)	Yes (%)		
Age (Years)			5.255	0.154
≤19	127(93.4)	9(6.6)		
20-24	616(91.1)	60(8.9)		
25-29	124(89.9)	14(10.1)		
≥30	85(85.0)	15(15.0)		
Sexual Debut Age (Years)			0.677	0.713
<16	43(86.0)	7(14.0)		
17-21	359(89.8)	41(10.2)		
≥22	105(89.7)	12(10.3)		
Age at Menarche (Years)			1.380	0.501
≤9	49(90.7)	5(9.3)		
10-14	633(90.0)	73(10.3)		
>14	267(92.1)	23(7.9)		
Marital Status			6.094	0.048
Single	601(90.0)	67(10.0)		
In a relationship	280(93.6)	19(6.4)		
Married/Cohabiting	71(85.5)	12(14.5)		

Contd… Table 8: Bivariate analysis showing the relationship between participant socio-demographic characteristics and HPV vaccine uptake

Religion			**0.518**	**0.772**
Christian	892(90.6)	93(9.4)		
Muslim	56(91.8)	5(8.2)		
Other	4(100.0)	0		
Area of Study			10.758	0.013
Basic and Applied Science	254(93.0)	19(7.0)		
Humanities	421(90.5)	44(9.5)		
Health Science	182(92.4)	15(7.6)		
Education	91(82.7)	19(17.3)		

4.4.2 Multivariate analysis showing association between participant socio-demographic characteristics and HPV Vaccine Uptake

The multivariate analysis using logistic regression shows that participant age, marital status and area of study were associated with HPV vaccine uptake. Holding other variables constant, the study participants who were 30 years or above were 2.4 (95% CI=1.02 to 5.71) times more likely to receive the HPV vaccine, compared to those who were below 20 years of age. Being married or cohabiting increased the odds that a person would receive HPV vaccine (aOR=1.23; 95% CI=1.02 to 3.22), compared to being single. The study participants who pursued health science related programmes were more likely to accept the vaccine compared to those with basic and applied science background (aOR=2.3; 95% CI=1.46 to 5.08)

Multivariate analysis showing association between participant characteristics and HPV Vaccine Uptake

Table 8: Multivariate analysis showing association between participant characteristics and HPV vaccine uptake

Items	Unadjusted			Adjusted		
	OR	95% CI	p-Value	OR	95% CI	p-Value
Age (Years)						
≤19	Ref			Ref		
20-24	1.27	0.61 to 2.63	0.526	1.32	0.72 to 2.65	0.521
25-29	1.58	0.66 to 3.78	0.304	1.52	0.62 to 3.59	0.298
≥30	2.47	1.03 to 5.90	0.042	2.43	1.02 to 5.71	0.039
Marital Status						
Single	Ref			Ref		
In a relationship	0.66	0.39 to 1.13	0.134	0.63	0.37 to 1.21	0.132
Married/Cohabiting	1.63	1.04 to 3.16	0.041	1.23	1.02 to 3.22	0.027
Area of Study						
Basic and Applied Science	Ref			Ref		
Humanities	1.34	0.76 to 2.36	0.306	1.30	0.66 to 2.86	0.306
Health Science	2.36	1.16 to 4.78	0.017	2.31	1.46 to 5.08	0.011
Education	1.09	0.54 to 2.21	0.804	1.12	0.54 to 3.15	0.804
OR=Odds Ratio;		*CI=Confidence Interval*				

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter discusses the study results for the current study. The overall aim of the study was to assess the determinants of HPV virus vaccine uptake among university students in the Greater Accra Region of Ghana.

5.1 The proportion of students who have taken the human papilloma virus vaccine

The first objective of the study sought to examine the proportion of students who had taken the human papilloma virus vaccine. Approximately10% of the participants were vaccinated against HPV virus. This is relatively higher than the 8.2% reported by a previously published study among the general population in Ghana (Debrah *et al.*, 2021). A similar study conducted among medical and paramedical students disclosed that 14% the participants were vaccinated against HPV (Idowu et al., 2019). A recently published study in the Northern Nigeria reported that only 5% were vaccinated against HPV (Iliyasu et al., 2022).

Previously published studies have attributed the variations in HPV virus vaccine coverage to differences in access to the vaccine and socio-demographic factors (Jain *et al.*, 2009; Henry *et al.*, 2016; Loke *et al.*, 2017). The 10% HPV vaccine coverage reported by the current is significantly lower than the 90% coverage rate recommended by WHO for the elimination of cervical cancer by 2030(Gultekin *et al.*, 2020). This implies that a lot of efforts must be implemented to improve vaccine coverage towards 2030.

5.2 Students' knowledge and perceptions concerning the human papilloma virus vaccine uptake

Available studies have shown strong relationship between participant knowledge, perceptions and HPV virus vaccine uptake. The second objective of the current of the current study was to examine the knowledge and perceptions concerning the human papilloma virus vaccine uptake.

We found that a unit increase in the perception that they are vulnerable to HPV virus infection and cervical cancer increased the person odds for accepting HPV virus vaccine. This confirms the health belief model that perceived vulnerability was positively associated with a behavior that seeks to avert negative health outcome(Arimbawa, Hita and Wardhana, 2021). This means that it will be helpful when the vulnerability of women are highlited during interventions such as social marketing and education campaigns.

The study results show that participants with the perception that acquiring the virus or cervical cancer is severe were more likely to vaccinate. Perceived severity according to the HBM refers to the belief that the consequences resulting from experiencing as disease poses serious harm to oneself and others (Arimbawa et al., 2021). The model predicts that students who held the view that a disease is servere were likely to accept the intervention prescribed (Rosenstock, Strecher and Becker, 1988).

Holding the view that it is beneficial to vaccinate against HPV virus increases the odds that a student will vaccinate. This corroborates the theory and study that students who perceive that the vaccination attracts benefits are more likely to vaccinate than counterparts who do not see the benefit in vaccinating (Rosenstock, Strecher and Becker, 1988; Arimbawa, Hita and Wardhana, 2021).

Perceived barriers were associated with HPV vaccine acceptance. Clearly participants with higher perception of barriers regarding the vaccine were less likely to accept it. The barriers mentioned included high cost of HPV vaccination and fear of severe side effects. Addressing these barriers could yield high uptake of the vaccine (Cunningham, Davison and Aronson, 2014). This will go a long way to slow down the rate of HPV infection and cervical cancer diseases among the populace.

The Information—Motivation— Behavioral Skills (IMB) model asserts that, knowledge could be a well validated approach to predict and promote healthy behavior attitude that can influence HPV vaccine uptake (Fisher, 2012). In the current study we observed that a unit increase in knowledge elevated the odds that the participant will accept the vaccine. Many studies have attributed the low level of knowledge on the Human papilloma virus to lack of education and advocacy for awareness on Human papilloma virus and vaccine on a national scale as compared to the audience given to HIV/ AIDS (Adanu, 2007; Perlman *et al.*, 2014; Dönmez *et al.*, 2018, 2019).

The concept of the IMB model underscores the need for improved knowledge on the HPV and cervical cancer as well as the vaccine. The low level of the knowledge on the Human papilloma virus and the vaccine among the students gives a gloomy prospect about the disease that needs urgent attention. It equally reflects the low little coverage given to HPV and the vaccine. Most studies acknowledge the importance of the knowledge of the virus and the vaccine in preventing cervical cancer (Vaidakis et al.,2017; Zimet ae al.,2006). It is out of the knowledge that students gain from health education that can drive the quest to adapt preventive and healthy lifestyles including vaccine use.

5.3 To determine the relationship between participant socio-demographic characteristics and human papilloma vaccine uptake

The study examined the association between participant socio-demographic characteristics and human papilloma vaccine uptake using a multivariate logistic regression model. The results identified the participant age, marital status and study area as the predicting variables.

The study found that the participants who were 30 years of age or older were more likely to have vaccinated, compared to those who were 19 years of age. This was accounted for by the high level of overall knowledge score exhibited by students in this age group. Most studies cited strong association of willingness to vaccinate with age of respondents(Zimet *et al.*, 2000; Sundström *et al.*, 2010; Perlman *et al.*, 2014). This means even with the low uptake of the vaccines among the current students there is still a glimmer of hope that they will recommend the HPV vaccine to their young relatives or future children when the opportunity arises. There are other studies that the findings on age and acceptability were contrary to what was seen in Africa, as women younger than 30 years and of good social economic level in the United State were more likely to receive the vaccine (Jain *et al.*, 2009).

The current study also observed that the participants who were married or cohabiting were more likely to accept the HPV vaccine compared to those who were single or never married. This suggests that the participants might have received some form of support from the husbands to vaccinate. Another reason could be that those who are married or cohabiting are more sexually active than the single ones and thus felt more vulnerable and at risk of getting the disease should their partners prove to be unfaithful. Further research needs to be done to confirm this assumption.

The students pursuing courses in Health Science were more likely to accept the vaccine compared to those who pursued courses in the Basic and Applied Sciences. This contradicts a similar study

conducted in Morocco that found no significant association between students who read science

and non-science related courses(Yacouti *et al.*, 2022).

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

About one-tenth of the participants were vaccinated against the HPV virus. The participants with higher scores in the knowledge test were more likely to have been vaccinated (aOR:1.19; 95% CI: 1.08 to 2.13), compared to those who had low scores. Having an elevated perception of vulnerability (aOR:11.37; 95% CI: 7.09 to 11.28) to HPV virus, perceiving infection as severe (aOR: 4.92; 95% CI: 3.87 to 8.19), perceiving the vaccine as beneficial (aOR: 5.87; 95% CI: 4.45 to 8.32) increased the odds that a participant will accept the vaccine. In contrast, the perception of a barrier (aOR: 0.25; 95% CI: 0.19 to 0.79) when accessing the vaccine reduced the odds for accepting it.

The socio-demographic factors associated with HPV vaccine uptake among the participants were age, marital status and area of study. Being 30 years and above was associated with higher odds for HPV vaccine uptake (aOR:2.43; 95% CI: 1.02 to 5.71), compared to being below 19 years of age. Also, the study participants who were married or cohabiting were 1.3(95% CI:1.02 to 3.22) times more likely to have received the vaccine compared to counterparts who were never married. The participants who belonged to the Health Science College (aOR: 2.31; 95% CI: 1.46 to 5.08) were more likely to vaccinate compared to those belonging to the Basic and Applied Science College.

6.2 Recommendations

Practice

Considering that participant knowledge and perception predicted HPV vaccine uptake, the Ministry of Education (MOE), National Commission for Civic Education (NCCE), Ministry of Health (MOH) and Ministry of Communication and Digitalization (MOCD) should develop educational interventions that ground cervical cancer and HPV prevention knowledge into university curriculum.

Aspects of the HBM such as perceived vulnerability, severity of disease, benefits of vaccine uptake and so on should be elaborately engrained in television and social media adverts around cervical cancer.

Given that some participants below 19 years of age were less likely to vaccinate, more efforts should be directed towards female belonging to that category. This can be done by educating parents or guardians about the importance of vaccination.

Policy

Since participant perception of barriers when accessing the vaccine reduced the odds for vaccine uptake, government should consider subsidizing the cost of the vaccines since high cost of vaccination is a barrier to the participants.

REFERENCES

Abotchie, P.N. and Shokar, N.K. (2009) 'Cervical Cancer Screening Among College Students in Ghana: Knowledge and Health Beliefs', 19(3), pp. 412–416. Available at: https://doi.org/10.1111/IGC.0b013e3181a1d6de.

Adanu, R.M.K. (2007) 'Letter To The Editor: "Letter to the Editor"', *International Journal of Phytoremediation*, 20(1), pp. 135–136. Available at: https://doi.org/10.1080/13518040701205365.

Amponsah, M. and Owolabi, H.O. (2011) 'Perceived Stress Levels of Fresh University Students in Ghana: A Case Study', *British Journal of Educational Research*, 1(12), pp. 153–169.

Arimbawa, P.E., Hita, I.P.G.A.P. and Wardhana, Z.F. (2021) 'Health belief model and the understanding of rational use of medicines', *International Journal of Public Health Science*, 10(2). Available at: https://doi.org/10.11591/ijphs.v10i2.20737.

Bancroft, E.K., Page, E.C., Castro, E., Lilja, H., Vickers, A., Sjoberg, D., Assel, M., Foster, C.S., Mitchell, G., Drew, K., Mæhle, L., Axcrona, K., Evans, D.G., Bulman, B., Eccles, D., McBride, D., Van Asperen, C., Vasen, H., Kiemeney, L.A., Ringelberg, J., Cybulski, C., Wokolorczyk, D., Selkirk, C., Hulick, P.J., Bojesen, A., Skytte, A.B., Lam, J., Taylor, L., Oldenburg, R., Cremers, R., Verhaegh, G., Van Zelst-Stams, W.A., Oosterwijk, J.C., Blanco, I., Salinas, M., Cook, J., Rosario, D.J., Buys, S., Conner, T., Ausems, M.G., Ong, K.R., Hoffman, J., Domchek, S., Powers, J., Teixeira, M.R., Maia, S., Foulkes, W.D., Taherian, N., Ruijs, M., Den Enden, A.T.H. Van, Izatt, L., Davidson, R., Adank, M.A., Walker, L., Schmutzler, R., Tucker, K., Kirk, J., Hodgson, S., Harris, M., Douglas, F., Lindeman, G.J., Zgajnar, J., Tischkowitz, M., Clowes, V.E., Susman, R., Ramón Y Cajal, T., Patcher, N., Gadea, N., Spigelman, A., Van Os, T., Liljegren, A., Side, L., Brewer, C., Brady, A.F., Donaldson, A., Stefansdottir, V., Friedman, E., Chen-Shtoyerman, R., Amor, D.J., Copakova, L., Barwell, J., Giri, V.N., Murthy, V., Nicolai, N., Teo, S.H., Greenhalgh, L., Strom, S., Henderson, A., McGrath, J., Gallagher, D., Aaronson, N., Ardern-Jones, A., Bangma, C., Dearnaley, D., Costello, P., Eyfjord, J., Rothwell, J., Falconer, A., Gronberg, H., Hamdy, F.C., Johannsson,

O., Khoo, V., Kote-Jarai, Z., Lubinski, J., Axcrona, U., Melia, J., McKinley, J., Mitra, A. V., Moynihan, C., Rennert, G., Suri, M., Wilson, P., Killick, E., Moss, S. and Eeles, R.A. (2014) 'Targeted prostate cancer screening in BRCA1 and BRCA2 mutation carriers: Results from the initial screening round of the IMPACT study', *European Urology* [Preprint]. Available at: https://doi.org/10.1016/j.eururo.2014.01.003.

Bayram, G.O., Beji, M.K. and Gokyildiz, S. (2011) 'Reproductive health', *Reproductive Health*, (April 2007), pp. 1–173. Available at: https://doi.org/10.1007/978-94-009-2693-6_5.

Becker-Dreps, S., Otieno, W.A., Brewer, N.T., Agot, K. and Smith, J.S. (2010) 'HPV vaccine acceptability among Kenyan women', *Vaccine*, 28(31), pp. 4864–4867. Available at: https://doi.org/10.1016/j.vaccine.2010.05.034.

Beyen, M.W., Bulto, G.A., Chaka, E.E., Debelo, B.T., Roga, E.Y., Wakgari, N., Danusa, K.T. and Fekene, D.B. (2022) 'Human papillomavirus vaccination uptake and its associated factors among adolescent school girls in Ambo town, Oromia region, Ethiopia, 2020', *PLoS ONE*, 17(7 July), pp. 1–15. Available at: https://doi.org/10.1371/journal.pone.0271237.

Burt, L.M., McCormak, M., Lecuru, F., Kanyike, D.M., Bvochora-Nsingo, M., Ndlovu, N., Scott, A.A., Anorlu, R.I., Sharma, V., Plante, M., Nyongesa, C., Tigeneh, W., Fakie, N., Suneja, G. and Gaffney, D.K. (2021) 'Cervix Cancer in Sub-Saharan Africa: An Assessment of Cervical Cancer Management', *JCO Global Oncology*, (7), pp. 173–182. Available at: https://doi.org/10.1200/go.20.00079.

Coleman, M.A., Levison, J. and Sangi-haghpeykar, H. (2011) 'HPV vaccine acceptability in Ghana , West Africa', *Vaccine*, 29(23), pp. 3945–3950. Available at: https://doi.org/10.1016/j.vaccine.2011.03.093.

Cunningham, M.S., Davison, C. and Aronson, K.J. (2014) 'HPV vaccine acceptability in Africa: A systematic review', *Preventive Medicine*, 69, pp. 274–279. Available at: https://doi.org/10.1016/j.ypmed.2014.08.035.

Debrah, O., Agyemang-Yeboah, F., Donkoh, E.T. and Asmah, R.H. (2021) 'Prevalence of vaccine and non-

vaccine human papillomavirus types among women in Accra and Kumasi, Ghana: a cross-sectional study', *BMC Women's Health*, 21(1). Available at: https://doi.org/10.1186/s12905-021-01511-1.

Denny, L., Adewole, I., Anorlu, R., Dreyer, G., Moodley, M., Smith, T., Snyman, L., Wiredu, E., Molijn, A., Quint, W., Ramakrishnan, G. and Schmidt, J. (2014) 'Human papillomavirus prevalence and type distribution in invasive cervical cancer in sub-Saharan Africa', *International Journal of Cancer*, 134(6), pp. 1389–1398. Available at: https://doi.org/10.1002/ijc.28425.

Doku, D. (2012) 'Substance use and risky sexual behaviours among sexually experienced Ghanaian youth'.

Dönmez, S., Öztürk, R., Kısa, S., Karaoz Weller, B. and Zeyneloğlu, S. (2019) 'Knowledge and perception of female nursing students about human papillomavirus (HPV), cervical cancer, and attitudes toward HPV vaccination', *Journal of American College Health*, 67(5), pp. 410–417. Available at: https://doi.org/10.1080/07448481.2018.1484364.

Dönmez, S., Öztürk, R., Kısa, S. and Weller, B.K. (2018) 'Knowledge And Perception Of Female Nursing Students About Human Papilloma Virus (Hpv), Cervical Cancer And Attitudes Towards Hpv Vaccination', *Journal of American College Health*, 8481. Available at: https://doi.org/10.1080/07448481.2018.1484364.

Fisher, W.A. (2012) 'Understanding Human Papillomavirus Vaccine Uptake', *Vaccine*, 30, pp. F149–F156. Available at: https://doi.org/10.1016/j.vaccine.2012.04.107.

Gultekin, M., Ramirez, P.T., Broutet, N. and Hutubessy, R. (2020) 'World Health Organization call for action to eliminate cervical cancer globally', *International Journal of Gynecological Cancer*. Available at: https://doi.org/10.1136/ijgc-2020-001285.

Henry, K.A., Stroup, A.M., Warner, E.L. and Kepka, D. (2016) 'Geographic factors and human papillomavirus (HPV) vaccination initiation among adolescent girls in the United States', *Cancer Epidemiology Biomarkers and Prevention*, 25(2), pp. 309–317. Available at: https://doi.org/10.1158/1055-

9965.EPI-15-0658.

Idowu, A., Olowookere, S.A., Israel, O.K. and Akinwumi, A.F. (2019) 'Human Papillomavirus Vaccine Acceptability and Uptake among Medical and Paramedical Students of a Nigerian Tertiary Health Institution', *American Journal of Public Health Research, Vol. 7, 2019, Pages 143-150*, 7(4), pp. 143–150. Available at: https://doi.org/10.12691/ajphr-7-4-3.

Iliyasu, Z., Galadanci, H.S., Muhammad, A., Iliyasu, B.Z., Umar, A.A. and Aliyu, M.H. (2022) 'Correlates of human papillomavirus vaccine knowledge and acceptability among medical and allied health students in Northern Nigeria', *Journal of Obstetrics and Gynaecology*, 42(3). Available at: https://doi.org/10.1080/01443615.2021.1910639.

Jain, N., Euler, G.L., Shefer, A., Lu, P., Yankey, D. and Markowitz, L. (2009) 'Human papillomavirus (HPV) awareness and vaccination initiation among women in the United States, National Immunization Survey-Adult 2007', *Preventive Medicine*, 48(5), pp. 426–431. Available at: https://doi.org/10.1016/j.ypmed.2008.11.010.

Jedy-Agba, E., Joko, W.Y., Liu, B., Buziba, N.G., Borok, M., Korir, A., Masamba, L., Manraj, S.S., Finesse, A., Wabinga, H., Somdyala, N. and Parkin, D.M. (2020) 'Trends in cervical cancer incidence in sub-Saharan Africa', *British Journal of Cancer*, 123(1), pp. 148–154. Available at: https://doi.org/10.1038/s41416-020-0831-9.

Kane, M.A., Sherris, J., Coursaget, P., Aguado, T. and Cutts, F. (2006) 'Chapter 15: HPV vaccine use in the developing world', *Vaccine*, 24(SUPPL. 3), pp. 132–139. Available at: https://doi.org/10.1016/j.vaccine.2006.05.128.

Katz, I.T., Ware, N.C., Gray, G., Haberer, J.E., Mellins, C.A. and Bangsberg, D.R. (2010) 'Scaling up human papillomavirus vaccination: A conceptual framework of vaccine adherence', *Sexual Health*, 7(3), pp. 279–286. Available at: https://doi.org/10.1071/SH09130.

Koulova, A., Tsui, J., Irwin, K., Van Damme, P., Biellik, R. and Aguado, M.T. (2008) 'Country recommendations on the inclusion of HPV vaccines in national immunization programmes among high-income countries, June 2006-January 2008', *Vaccine*, 26(51), pp. 6529–6541. Available at: https://doi.org/10.1016/j.vaccine.2008.08.067.

Limbu, Y.B., Gautam, R.K. and Pham, L. (2022) 'The Health Belief Model Applied to COVID-19 Vaccine Hesitancy: A Systematic Review', *Vaccines*, 10(6), p. 973. Available at: https://doi.org/10.3390/vaccines10060973.

Loke, A.Y., Kwan, M.L., Wong, Y.T. and Wong, A.K.Y. (2017) 'The uptake of human papillomavirus vaccination and its associated factors among adolescents: A systematic review', *Journal of Primary Care and Community Health*, 8(4), pp. 349–362. Available at: https://doi.org/10.1177/2150131917742299.

Markowitz, L.E., Dunne, E.F., Saraiya, M., Chesson, H.W., Curtis, C.R., Gee, J., Bocchini, J.A. and Unger, E.R. (2014) 'Human Papillomavirus Vaccination Recommendations of the Advisory Committee on Immunization Practices (ACIP)', *MMWR Recommendations and Reports* [Preprint]. Available at: https://doi.org/10.15585/mmwr.mm6832a3.

Markowitz, L.E., Gee, J., Chesson, H. and Stokley, S. (2018) 'Ten Years of Human Papillomavirus Vaccination in the United States', *Academic Pediatrics*, 18(2), pp. S3–S10. Available at: https://doi.org/10.1016/j.acap.2017.09.014.

Martel, C. De, Ferlay, J., Franceschi, S., Vignat, J., Bray, F., Forman, D. and Plummer, M. (2008) 'Global burden of cancers attributable to infections in 2008 ':, *Lancet Oncology*, 13(6), pp. 607–615. Available at: https://doi.org/10.1016/S1470-2045(12)70137-7.

Meites, E., Szilagyi, P.G., Chesson, H.W., Unger, E.R. and Romero, J.R. (2019) 'Human Papillomavirus Vaccination for Adults : Updated Recommendations of the Advisory Committee on Immunization Practices', 68(32), pp. 698–702.

Menon, J.A., Mwaba, S.O.C., Thankian, K. and Lwatula, C. (2016) 'Risky Sexual Behaviour among University Students', 4(1), pp. 1–7. Available at: https://doi.org/10.9734/ISRR/2016/25462.

Perlman, S., Wamai, R.G., Bain, P.A., Welty, T., Welty, E. and Ogembo, G. (2014) 'Knowledge and Awareness of HPV Vaccine and Acceptability to Vaccinate in Sub-Saharan Africa : A Systematic Review', 9(3). Available at: https://doi.org/10.1371/journal.pone.0090912.

Petrosky, E., Bocchini, J.A., Hariri, S., Chesson, H., Curtis, C.R., Saraiya, M., Unger, E.R., Markowitz, L.E. and Centers for Disease Control and Prevention (CDC) (2015) 'Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices.', *MMWR. Morbidity and mortality weekly report*, 64(11).

Rosenstock, I.M., Strecher, V.J. and Becker, M.H. (1988) 'Social Learning Theory and the Health Belief Model', *Health Education & Behavior*, 15(2). Available at: https://doi.org/10.1177/109019818801500203.

Rosenthal, S.L., Weiss, T.W., Zimet, G.D., Ma, L., Good, M.B. and Vichnin, M.D. (2011) 'Predictors of HPV vaccine uptake among women aged 19-26: Importance of a physician's recommendation', *Vaccine*, 29(5), pp. 890–895. Available at: https://doi.org/10.1016/j.vaccine.2009.12.063.

Roset Bahmanyar, E., Paavonen, J., Naud, P., Salmerón, J., Chow, S.N., Apter, D., Kitchener, H., Castellsagué, X., Teixeira, J.C., Skinner, S.R., Jaisamrarn, U., Limson, G.A., Garland, S.M., Szarewski, A., Romanowski, B., Aoki, F., Schwarz, T.F., Poppe, W.A.J., De Carvalho, N.S., Harper, D.M., Bosch, F.X., Raillard, A., Descamps, D., Struyf, F., Lehtinen, M. and Dubin, G. (2012) 'Prevalence and risk factors for cervical HPV infection and abnormalities in young adult women at enrolment in the multinational PATRICIA trial', *Gynecologic Oncology*, 127(3). Available at: https://doi.org/10.1016/j.ygyno.2012.08.033.

Schottenfeld, D. and Jennifer Beebe-Dimmer (2015) 'Annals of Epidemiology The cancer burden attributable to biologic agents', *Annals of Epidemiology*, 25(3), pp. 183–187. Available at:

https://doi.org/10.1016/j.annepidem.2014.11.016.

Sundström, K., Tran, T.N., Lundholm, C., Young, C., Sparén, P. and Dahlström, L.A. (2010) 'Acceptability of HPV vaccination among young adults aged 18-30 years-a population based survey in Sweden', *Vaccine*, 28(47), pp. 7492–7500. Available at: https://doi.org/10.1016/j.vaccine.2010.09.007.

Sung, H., Ferlay, J., Siegel, R.L., Laversanne, M., Soerjomataram, I., Jemal, A. and Bray, F. (2021) 'Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries', *CA: A Cancer Journal for Clinicians*, 71(3). Available at: https://doi.org/10.3322/caac.21660.

Taku, O., Businge, C.B., Mdaka, M.L., Phohlo, K., Basera, W., Garcia-Jardon, M., Meiring, T.L., Gyllensten, U., Williamson, A.L. and Mbulawa, Z.Z.A. (2020) 'Human papillomavirus prevalence and risk factors among HIV-negative and HIV-positive women residing in rural Eastern Cape, South Africa', *International Journal of Infectious Diseases*, 95. Available at: https://doi.org/10.1016/j.ijid.2020.02.051.

WHO (2019) 'Global Strategy Towards the Elimination of Cervical Cancer As A Public Health Problem', *Who*, (December), p.

Yacouti, A., Elkhoudri, N., El, A., Benider, A., Hadrya, F., Id, R.B. and Forster, A. (2022) 'Awareness, attitudes and acceptability of the HPV vaccine among female university students in Morocco', pp. 1–10. Available at: https://doi.org/10.1371/journal.pone.0266081.

Zampetakis, L.A. and Melas, C. (2021) 'The health belief model predicts vaccination intentions against COVID-19: A survey experiment approach', *Applied Psychology: Health and Well-Being*, 13(2). Available at: https://doi.org/10.1111/aphw.12262.

Zimet, G.D., Liddon, N., Rosenthal, S.L., Lazcano-Ponce, E. and Allen, B. (2006) 'Chapter 24: Psychosocial aspects of vaccine acceptability', *Vaccine*, 24(SUPPL. 3). Available at: https://doi.org/10.1016/j.vaccine.2006.06.017.

Zimet, G.D., Mays, R.M., Winston, Y., Kee, R., Dickes, J. and Su, L. (2000) 'Acceptability of human papillomavirus immunization', *Journal of Women's Health and Gender-Based Medicine*, 9(1), pp. 47–50. Available at: https://doi.org/10.1089/152460900318957.

APPENDIX I: QUESTIONNAIRE

STUDY ID: _____

Section I: DEMOGRAPHICS

1. Age…   (DOB)……………

2. Marital Status: 1. Married [   ]   2. Cohabiting [   ] 3. Single [   ]   4. In a Relationship [   ]

3. Hall of residence, specify…………

4. Hostel (if outside campus) specify …………..

5. College ………..

6. Educational level of Guardian:

1. No Basic Education [   ]

2. Basic / Primary [   ]

3. Junior High School [   ]

4. Senior High School [   ]

5. Tertiary education [   ]

7. Occupation of Guardians: 1. Unemployed [   ] 2. Professional [   ] 3. Semi-professionals [   ] 4. Artisans 5. Traders [   ]   6. Others ……………………………..

8. Place of permanent residence: 1. Accra [   ] 2. Outside Accra [   ]

9. Religion: 1. Christianity [   ]   2. Islam [   ]   3. Traditional [   ]

Section II: Health Seeking Behaviour and Gynaecological History

1. Age at Menarche (first menses) ………..

2. Sexual experience 1. Sexually Active [ ] 0. Never had sex before [   ]

3. **If Yes to question** 2, age at first sexual intercourse ……..

4. Number of life time sexual partners ………

5. Have you used contraception before (including morning after pill)? 1 Yes [   ] 0. No [   ]

6. If Yes specify. 1. Condom [   ] 2. Combined oral contraceptive [   ] 3. Emergency Pill[   ]

Others [   ]

7. Ever heard about Pap smear? 1 Yes [   ] 0. No [   ]

8. Have you done a Pap smear before? 1. Yes [   ] 0. No [   ]

9. Do you know where to get it done? 1.Yes[   ] 0. No [   ]

10. Have you had a talk on sexual health education? 1. Yes [   ] 0. No [   ]

11. Source of information on sexual health education

1. Care giver/ parents [   ]

2. Siblings/Cousins [   ]

3. Friends [   ]

4. Media [   ]

5. Organised by the University [   ]

6. Other specify………

12. History of induced abortion 1. Yes [   ] 0. No [   ]

13. Will you recommend a program on sexual health education at the university?

1. Yes [   ] 0. No [   ]

Section III: Knowledge of Human Papilloma Virus (HPV) and HPV Vaccine

1. Do you know of HPV? 1. Yes [   ] 0.NO [   ]

2. Have you heard of the HPV vaccine? 1. Yes [   ] 0. No [   ]

3. Is HPV sexually transmitted? 1. Yes [   ] 0. No [   ]

4. Are sexually active individuals at risk of HPV infection? 1. Yes [   ] 0. [   ]

5. Have you heard about Cervical cancer 1. Yes [   ] 0. No [   ]

6. Do you think HPV infection can cause Cervical Cancer? 1. Yes [   ] 0. No [   ] 2. Not Sure [   ]

7. Do you know HPV can cause genital warts (rashes)? 1. Yes [   ] 0.No [   ]

8. Do you know of any other disease that is caused by HPV? 1. Yes [   ] 0. No [   ]

9. Do you know of Pap smear? 1.Yes [   ] 2. No [   ]

10. Can HPV infection affect your Pap smear results? 1. Yes [   ] 0. No [   ]

Section IV: Uptake of HPV Vaccine

1. Have you received HPV vaccine? 1. Yes [   ] 0. No [   ]

a. If Yes to **question 1 section IV**,

Who recommended the vaccine?

    a. Health care provider [   ]

    b. Care giver/ Parent [   ]

    c. Friends [   ]

    d. Media [   ]

    e. Other, specify………….

2. If No to **question 1 section IV,**

Why haven't you received the HPV vaccine?

    a. I don't know where to get the vaccine? [   ]

    b. It is only for people with multiple sexual partners [   ]

    c. Fear of Side effect [   ]

    d. I will need the consent of my Parental [   ]

    e. Other, specify………..

Section IV: HPV VACCINE ACCEPTABILITY (intention to vaccinate)

If No to question 1, section IV

1. Would you want to receive an HPV vaccine? 1.Yes [   ] 0. No [   ]

Beliefs	SA	A	N	D	SD
Perceived Susceptibility(Aggregate)					
Women are at high risk for HPV					
Women are at high risk for having genital warts					
Women are at high risk for having cervical/vulvar cancer					
Perceived Severity(Aggregate)					
HPV infection is severe					
Genital warts are severe in women					
Cervical cancer/vulvar cancer is life threatening					
Perceived Benefit(Aggregate)					
HPV vaccines is highly effective for the prevention of HPV infections					
HPV vaccines is highly effective to prevent genital warts					
HPV vaccine is highly effect for the prevention of cervical/vulvar cancer					
Perceived Barrier(Aggregate)					
High cost of HPV vaccination					
Fear of severe side effects					