University of Ghana http://ugspace.ug.edu.gh

SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

THE EFFECT OF MOBILE HEALTH COMMUNICATION INTERVENTION ON FEMALE TEACHERS' KNOWLEDGE ON CERVICAL CANCER AND CERVICAL SCREENING UPTAKE IN ACCRA METROPOLIS

BY

SAMIRA ALI MUSTAPHA

(10029717)

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN PUBLIC HEALTH

AUGUST, 2022

University of Ghana http://ugspace.ug.edu.gh

DECLARATION

I hereby declare that except for work done by others which has been duly acknowledged, this thesis is the result of my own original research carried out under the supervision of Prof. Aryeetey, Prof. Torpey and Dr Ganle. This thesis has not been submitted either in part or in whole to any other institution for the award of another degree

…… 23rd August, 2022

Samira Ali Mustapha (Student) Date

…….. 23rd August, 2022

Prof Richmond Aryeetey (Principal-Supervisor) Date

……. 23rd August, 2022

Prof Kwesi Torpey (Co-Supervisor) Date

…….. 23rd August, 2022

Dr John Ganle (Co-Supervisor) Date

University of Ghana http://ugspace.ug.edu.gh

ABSTRACT

Background:

Cervical cancer is the fourth most frequently diagnosed cancer and the fourth leading cause of cancer death among women. Without significant intervention, the global burden is expected to increase to nearly 700,000 cases and 400,000 deaths by 2030, Ninety percent of these occur in sub-Saharan Africa including Ghana.

Mobile health is an emerging technology around the world that can be effective in improving knowledge on cervical cancer and cervical cancer screening uptake. Because mobile phone adoption is growing at an exponential rate in low- and middle-income nations, employing mobile phones to promote cervical cancer services might reach a larger number of individuals in resource-constrained settings than traditional healthcare delivery methods.

Objective: This study sought to assess the effect of mhealth communication intervention on female teachers' knowledge on cervical cancer and cervical cancer screening uptake.

Methodology: The study employed a cluster randomized design with baseline and endline stages. Multistage cluster randomized sampling was used to select 237 teachers from 61 private and government schools in 4 sub-districts in Accra metropolis. Two cross sectional surveys were carried out at baseline and endline across all intervention arms with control. SMS only (40), WhatsApp (50), SMS+WhatsApp (80) and Control (67). Questionnaire was the main tool for data collection. Modified ordinary least square regression(OLS) with Difference in Difference analysis and robust standard error were used to determine the effect of the mhealth communication intervention on cervical cancer knowledge and cervical screening uptake

Results: The study assessed the effectiveness of WhatsApp only, SMS only, and WhatsApp + SMS with control on knowledge of cervical cancer and cervical cancer screening uptake. The results showed that, receiving at least one intervention, increased knowledge score on cervical cancer and overall knowledge of cervical screening by 11.5% and 19% respectively($p<0.001$). Among the three interventions, WhatsApp text yielded the largest improvement on knowledge. It

University of Ghana http://ugspace.ug.edu.gh

increased knowledge on cervical cancer by 17.34% ($p<0.001$), Knowledge on risk factors by 18.26% ($p<0.001$) and overall knowledge by 17.53% ($p<0.001$) and the three interventions had a significant effect on knowledge on cervical cancer but did not have significant effect on cervical screening uptake

Conclusion

This study concludes that SMS and WhatsApp interventions had an impact on knowledge of risk factors of cervical cancer and general knowledge of cervical cancer. However, WhatsApp was the most effective in terms of raising awareness on cervical cancer

University of Ghana http://ugspace.ug.edu.gh

DEDICATION

I dedicate this work to my parents and siblings

University of Ghana http://ugspace.ug.edu.gh

ACKNOWLEDGEMENT

I wish to acknowledge all who in diverse ways have helped with the write up of this thesis:

I give God all the glory for his enabling grace to write this thesis.

I wish to thank my supervisory team in the persons of Prof. Richmond Nii Aryeetey, Prof. Kwesi Torpey and Dr. John Ganle for taking time off their busy schedule to attend to my work, and for giving insightful comments and guidance. I also appreciate their patience throughout my writing of this thesis

I am most grateful to the past and present deans of School of Public Health (SPH): Prof. Richard Adanu, Prof Julius Fobil and Prof Kwesi Torpey For their instrumental roles and continuous concern throughout the period of my studies.

I wish to express my sincerest gratitude to all faculty members and staff of the Department of Population Family and Reproductive Health for the various assistance and expertise they contributed to this write up.

I am thankful to my former and current deans of School of Nursing and Midwifery (SONM), Dr Mary Opare, Prof. Ernestina Donkor and Prof. Lydia Aziato for their concern, and encouragement throughout My PhD studies. And I also thank all my colleagues in SONM for their support.

I am also indebted to the circuit supervisors overseeing the approved schools from Ghana Education Service (GES), and the Heads of all the selected schools; and all teachers who participated

I also acknowledge financial assistance from the faculty endowment fund from the College of Health Sciences, University of Ghana; under the leadership of Prof Ayeh-kumi, the former Provost of the College of Health Sciences.

I also thank the faculty and staff of Biostatistics Department and IT Department for their technical support and contribution to the writing of the thesis.

Finally, I thank my family for their unflinching support during the tough times of my studies. I cannot extend my gratitude enough. God bless us all.

University of Ghana http://ugspace.ug.edu.gh

TABLE OF CONTENTS

University of Ghana http://ugspace.ug.edu.gh

University of Ghana http://ugspace.ug.edu.gh

University of Ghana http://ugspace.ug.edu.gh

University of Ghana http://ugspace.ug.edu.gh

University of Ghana http://ugspace.ug.edu.gh

LIST OF TABLES

University of Ghana http://ugspace.ug.edu.gh

LIST OF FIGURES

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

LIST OF ACRONYMS

AIDS	-	Acquired Immune Deficiency Syndrome
CC	-	Cervical cancer
CI	-	Confidence Interval
CRUK	-	Cancer Research UK
GARH	-	Greater Accra Regional Hospital
GHS	-	Ghana Health Service
GSS	-	Ghana Statistics Service
GSM	-	Global System for Mobile communication
HIV	-	Human Papilloma Virus
MOH	-	Ministry of Health
SMS	-	Short Message Service
SSA	-	Sub-Saharan Africa
WHO	-	World Health Organization

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

DEFINITION OF TERMS

Client Barriers: Client barriers are individual factors that directly prevent women from participating in cervical screening programs.

Health System Factors: Health system factors are barriers related to policies, structural barriers such as limited screening facilities and inadequate supply of materials that prevent the health care provider from working effectively

Risk Factor: a risk factor is any feature (internal or environmental) that makes an individual more prone to developing a serious disease

Knowledge: How much is known about cervical cancer and cancer screening. This was scored over 100%

Prevalence of cervical screening: Refers to the proportion of female teachers who had screening done before the intervention. This was expressed in percentage

No consent: Schools that did not agree to participate in the study, instantly, end their participation

Consenting Schools: Schools that agree to participate in the study

Perceived Barrier: One's opinion as to what will stop them from adopting the new behaviour

Perceived susceptibility: One's belief regarding the chance of getting a condition

Perceived severity: One's conclusion of how serious a condition and its sequelae or consequences

Perceived benefits: One's belief in the efficacy of the advised action to reduce risk or seriousness

Self- efficacy: Personal belief in the ability to do something

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Cervical cancer (CC) presents a significant health problem to women globally. It is the fourth most common type of cancer impacting women worldwide (World health Organization(WHO), 2022). Approximately, 528,000 new cervical cancer cases and 266,000 deaths were identified in 2012 (GLOBOCAN, 2012). In 2018, an estimated 570,000 were diagnosed with cervical cancer worldwide and about 311,000 died from the disease, which accounts for 7.5% of all female cancer deaths with 70% of these occurring in developing countries (Bray et al, 2018; Ferlay et, al 2018). In 2020, over 600,000 new cases of cervical cancer were diagnosed with 340,000 deaths around the world. Majority(90%) of deaths occurred in Low- and middle-income countries(LMIC) (WHO, 2022). Cervical cancer is common in sub- Saharan Africa, where about 35 new cases are diagnosed per 100,000 women, annually. The rate of cervical cancer deaths in Sub- Saharan Africa is ten times the rate in North America (WHO, 2013). This is largely because of a higher rate of early cervical screening in North America, resulting in dramatic decline in morbidity and mortality (NIH, 2017 In Ghana, cervical cancer is the leading cause of cancer related death and an estimated 1,500 women die from cervical cancer, annually between ages 15 and 44 years and those above 65 years. (1CO/IARC, 2017; MOH. 2015)

Cervical cancer affects the cervix uteri in women (Small, Bacon, Bajaj et al., 2017). It is the result of abnormal cell growth around the cervical opening of the uterus, at the squamocolumnar junction. The cancerous cells then spread and affect surrounding tissues and organs causing severe illness and ultimately death. (Shepherd, Frampton, and Harris, 2014; Harrington et al., 2017: American Cancer Society, 2018).

A preponderance of evidence supports a causal link between cervical cancer (CC) and Human

University of Ghana http://ugspace.ug.edu.gh

Papilloma Virus (HPV). There are over a hundred species of the HPV, and about 15 of them are associated with a high risk of cervical cancer development (Denny, Quinn, Sakaranarayanan et al, 2006; Canavan & Doshi, 2000). In Ghana, cervical cancer is mostly caused by HPV types 16 and 18 (Wiredu & Armah, 2006).

There are two major types of cervical cancer that have been identified. Tumours which arise from the ectocervix (outerlining) most often lead to squamous cell carcinoma, which accounts for the majority (70%) of cervical cancers. Adenocarcinoma, which arises from the mucus-secreting cells (glandular cells) of the endocervical canal constitute nearly the entirety of the remaining 30%. At the early stages, cervical cancer has no signs or symptoms hence the need for healthy women to screen (Sankaranarayanan et al, 2013, American Cancer Society 2017; Adanu, 2010).

The prevention of cervical cancer depends on widespread screening and accurate diagnosis of precursor lesions, followed by appropriate triaging and implementation of therapy (Ferris et al, 2002). Regular cervical screening by women in reproductive age can reduce risk of cervical cancer incidence and mortality by 90% (WHO, 2015). Cervical screening enables early detection of pre-cancer lesions before symptoms of advanced cervical cancer are established (Stewart, 2016; Denny et al. 2013). World Health Organization recommend early screening for cervical cancer to reduce avoidable cervical cancer-related deaths and their recommendations have been adopted in many countries (WHO, 2022; Tokosi et al., 2017). However, women in sub-Saharan Africa often present with advanced stages of cervical cancer (McFarland et al., 2016; Rosser, Njoroge & Huchko, 2015). This is as a result of lack of early screening, lack of appropriate referral of women with cervical disease, HIV-HPV (human papillomavirus) co-infection, screening-related misconceptions, lack of infrastructure resources, medical, financial and a lack of awareness and education about cervical cancer among women, lack of adequate laboratory supplies, and treatment facilities (McFarland at al., 2016; Denny et al., 2013:

University of Ghana http://ugspace.ug.edu.gh

Nwobodo & Ba-Break, 2017; Rosser, Njoroge & Huchko, 2015).

In Ghana, cervical cancer screening is limited, and the screening uptake is poor due to lack of knowledge and awareness of the disease, religious and cultural belief, and financial challenges (Anaman-Torgbor, et al., 2020). These factors are contributing to the large cervical cancer burden in Ghana, and the disease is a public health concern with enormous social and economic impact (Quentin et al, 2015; Abotchie and Shokar, 2009).

Simple, inexpensive, and cost-effective methods that have the ability to prevent deaths from cervical cancer have been developed and validated through numerous large-scale scientific studies (Acera et al, 2017; Campos, Tsu, Jeronimo et al; 2015: Blumenthal, et al, 2007). Visual inspection with acetic acid (VIA) and visual inspection with Lugol's iodine (VILI) are examples of screening methods recommended for women in Low and Middle Income Countries (LMICs) (Phongsavan et al., 2014; sharma et al, 2011; Blumenthal, et al, 2007; Sankaranarayanan, Rajkumar, Cherian; et al, 2009). These methods are appealing because it is affordable, requires few resources, and can be performed by a wide range of health-care workers (physicians, nurses, midwives, local health-care workers among others). Again the results of this test are immediate, as such screening allows for a single appointment (Phongsavan et al, 2014; Solomon Lawson et al, 2012; Lynette et al, 2013; WHO, 2013).

A study in Accra, about a decade ago, revealed that cervical cancer screening uptake is very low (Adanu et al, 2010). Instead of screening healthy women, most women who were screened in Ghana already had symptoms (Adanu, 2002). Previous studies further confirmed that the main factor underpinning the problem of low screening uptake in Ghana is due to poor knowledge about cervical cancer and screening (Quentin et al, 2015; Abotchie & Shokar, 2009). An integrated review on barriers to cervical cancer screening in Sub-Saharan Africa from 10 different countries, including Ghana, also confirmed low knowledge and awareness about cervical cancer and cervical screening as the main barriers (Mc Farland, 2013).

University of Ghana http://ugspace.ug.edu.gh

Research findings suggest that introduction and implementation of mobile health (mhealth) technology could be considered as a strong influence to increase knowledge and uptake in cervical cancer screening in limited resource areas (Babirye et al, 2019; Hall et al, 2015) through awareness creation, providing information and education. (Marcolino et al, 2018; Bhatt et al, 2018; Ji et al, 2019; Babirye, et al, 2019). "MHealth communication intervention technologies play an important role in helping cancer patients to become active participants in their care. Given the ubiquity of mobile devices and the omnipresent wireless connectivity, mHealth solutions (SMS and WhatsApp) have the capability to provide just-in-time support that is both adaptive and targeted to user needs. mHealth solutions can be used to generate and share patient-centred care planning, manage late effects with cancer and its treatments, promote lifestyle and behavioral changes and assist survivors with communication with healthcare providers. Mobile applications afforded cancer patients the ability to engage with their health providers and their support networks" (Geng et al, 2015).

Various mhealth communication strategies "have been developed and used to increase knowledge and adherence to cervical cancer screening uptake. This involves the use of mass media (Fornos et al. 2014), videos (Tuong et al., 2014), print materials (Austin et al. 2002), phone calls (Broberg et al., 2013) and text messages (Rashid et al. 2014) have been used to communicate the information to women. Among these strategies, mobile phone-based mhealth communication intervention (SMS and WhatsApp) have shown to have many characteristics that makes them well suited for CC screening uptake due its ability to reach large groups of people at a low cost per person, as compared to more complex interventions which may have a higher per capita cost (Hall et al, 2015).

The use of phone-based mHealth provides the opportunity to improve health communication, exchange medical information, educate target populations and support data collection, even in rural and remote areas. The advantage of implementing phone-based mHealth applications in

University of Ghana http://ugspace.ug.edu.gh

cancer screening is its cost effectiveness and easy-to-use strategy that appears to be appreciated by patients and caregivers, and which could potentially improve the quality of healthcare" (Quercia et al, 2018). For the purpose of this study, mHealth was linked to interventions using mobile phone-based communication (SMS and WhatsApp messages) for the delivery of cervical cancer health services.

1.2 Problem statement

Across Sub-Saharan Africa, uptake of cervical cancer screening has been reported to be very low (Calys -Tagoe et al, 2020; Sankaranarayanan, 2014; Adanu, 2010). Recent studies suggest that the high incidence of cervical cancer in the sub- region is linked with low cervical screening uptake (Vander, 2014; Sankaranarayanan, 2014). For instance, contrary to the 70% screening coverage recommended by World Health Organization(WHO, 2021), studies among women in Accra reported that cervical screening utilization was below 3% (Calys -Tagoe et al, 2020; Ampofo, Adumatta, Owusu, Awuviry-Newton, 2019; Adanu et al, 2002). The attendance at Greater Accra Regional Hospital the national CERVICARE unit in Accra indicate that uptake of VIA has reduced from 906 in 2016 to 646 in 2021 among the young women and Pap smear uptake among older women has increase marginally from 1183 in 2016 to 1557 in 2020. The attendance at the military hospital for both Pap smear and VIA ranges between 117 - 325 in 2017 and 2021 respectively which is very low. This has resulted in "unnecessary" (Brenan et al, 2012) and "avoidable" (Sankaranarayanan, 2014) cancer-related deaths of women across all age groups (Domfeh, Wiredu, Adjei et al, 2008). Globally, there has been a decline in the incidence of mortality of cervical cancer as a result of cervical screening as compared to other cancers (Sankaranarayanan, 2014; WHO, 2013; Sankaranarayanan et al, 2013). Despite this, uptake of screening services remains very low in sub-Saharan Africa including Ghana.

University of Ghana http://ugspace.ug.edu.gh

In Ghana, and in some other African countries, a number of studies have examined the reasons for low cervical cancer screening uptake. From these studies, inadequate knowledge and awareness have been identified as the most common barriers to screening (Mc Farland et al, 2016; Quentin et al, 2015; Abotchie & Shokar, 2009). Other important barriers include cost, inadequate knowledge about available screening sites and lack of time and proximity to screening sites (Quentin et al, 2015; Abotchie & Shokar, 2009). Similarly, ignorance about the benefits of cervical screening has been identified as another barrier (Awua, et al, 2018; Quentin et al, 2015).

From literature, one outstanding problem is how to overcome the barriers to screening uptake among women (Calys -Tagoe et al, 2020; Linde et al, 2020). A few earlier studies have attempted to address the problem of low screening uptake and inadequate knowledge: employing education, invitation letters (Eaker, Adami, and Granath , 2004; de Jonge, Cloes, Op de Beeck, et al., 2008; Acera et al, 2017) and phone calls (Rashid, Mohammed, Hamid et al., 2013; Kiran, Davies et al 2018). However, letters and telephone are expensive and difficult to scale up even though they may enhance cervical cancer screening (CCS) participation. As a result, WHO recommend short message texting (SMS) and this has promoted its adoption since it is relatively cost effective (WHO, 2021; Uy et al., 2017; Huf et al., 2020). Nevertheless, many of such studies have reported mixed results in terms of success rates, (Stoffel, et al, 2021; Acera et al., 2017; Linde, et al., 2020; Lee et al., 2014; Albrow et al., 2014). Consequently, there is need for more innovative interventions to address the problem of inadequate knowledge and low cervical cancer screening uptake especially in low-income countries (Sabatini et al., 2016; Acera et al., 2017; Sakarayananan et al, 2014).

In particular, the use of innovative communication interventions such as social media (WhatsApp) and conventional text messaging have been identified as potential strategies that

University of Ghana http://ugspace.ug.edu.gh

could help disseminate information about cervical cancer, create awareness, and ultimately increase uptake of screening services among literate women (Osei, Appiah, Gaogli, 2021; Fortunato, et al. 2015). What is lacking at the moment however, are well designed studies that test the effects of these communication interventions (Stoffel et al., 2021; Albrow, et 2014).

In Ghana for instance, there are no studies that have tested the effects of communication interventions on knowledge and uptake of cervical cancer screening services among literate populations like female teachers. There is, therefore, a need to fill this gap in knowledge given the epidemiological and public health significance of cervical cancer in many African countries, including Ghana.

1.3 Study Justification

There is there is no available documented evidence of an intervention studies that has focused on SMS and WhatsApp to address the promotion of knowledge on cervical cancer and cervical screening uptake in literature in Ghana or elsewhere. This study will generate new evidence on the use of mobile health (mhealth) communication solutions specifically SMS and WhatsApp on cervical cancer screening uptake and knowledge on cervical cancer in Ghana

Likewise, the findings of this study will create space for further studies to be conducted to expand the evidence base on the effectiveness of SMS text and WhatsApp text in improving cervical screening utilization and knowledge on cervical cancer. It may also influence positively health education and promotion policies

Also, data on prevalence of cervical screening generated by this study will guide future public health research targeted at women and provide better understanding on the effect of communication intervention. This will enable public health researchers, scale up efforts to facilitate early diagnosis of cervical cancer to reduce mortality.

University of Ghana http://ugspace.ug.edu.gh

1.4 General Objective

To determine the effect of health communication intervention on knowledge of cervical cancer and screening uptake among female teachers in Accra Metropolis

1.4.1 Specific Objectives

1. To determine the prevalence of cervical cancer screening among female teachers in Accra Metropolis.
2. To determine factors associated with cervical cancer screening among female teachers in the Accra Metropolis.
3. To test the effect of communication intervention on knowledge of cervical cancer.
4. To determine the effect of communication intervention on cervical cancer screening uptake.

1.4.2 Research Question

1. What is the prevalence of cervical cancer screening uptake among female teachers in Accra Metropolis?
2. What are the factors associated with cervical cancer screening uptake among female teachers in Accra Metropolis?
3. What is the effect of communication intervention on knowledge of cervical cancer?
4. What is the impact of communication intervention on cervical cancer screening uptake?

1.4.3 Hypothesis

This study would seek to test four hypotheses:

1. The prevalence of cervical cancer screening uptake among female teachers in Accra Metropolis will be about 12.9%.

University of Ghana http://ugspace.ug.edu.gh

2. There is an association between the socio-demographic factors, knowledge and cervical cancer screening uptake
3. Mhealth Communication intervention will increase knowledge of cervical cancer among intervention participants compared to controls.
4. The cervical cancer screening uptake will increase significantly among teachers who received the communication intervention in comparison to controls

1.5 The Conceptual Framework

Conceptual framework is an analytic tool or structure, that shows the overall organization of ideas for the study. It also shows the relevant variables and concepts and maps out the relationship amongst them that needs to be measured (Swaen, 2022; Afribary, 2020). The conceptual framework for this study was adapted from the e Health Belief Model and findings from research. The Health Belief Model has been validated and used in many studies (Costa, 2020; Namdar, Azam, Bigizadeh et al, 2012; Pribadi & Devy, 2020).

The Health Belief Model was originally designed to explain failure of large numbers of eligible adults to participate in tuberculosis (TB) screening (preventive health behaviour). The Health Belief Model was considered most appropriate among other behavioural theories; because the reasons for the development of this theory in disease prevention then, is still relevant to the problem of low screening uptake which is the main exposure of interest in this study.

The HBM has provided a useful framework for investigating health behaviours. It advances that, the main determinant of behaviour is the individuals belief. Which include: individual's perception of their chances of getting a disease condition (perceived susceptibility), individual's judgment of the severity of the disease (perceived severity), individual's conclusion whether the new behaviour expected is better than what the he or she is already doing (perceived benefits), an individual's opinion as to what will stop them from adopting the

University of Ghana http://ugspace.ug.edu.gh

new behaviour (perceived barrier), factors that trigger behaviour change (cues for action) and personal belief in the ability to do something (self- efficacy). This conceptual framework shows that the constructs of the health belief model and an individual's socio-demographic characteristics such as age, religion, marital status, level of education and parity together could predict the effect on the communication intervention(female teachers' readiness to utilize cervical screening and vice versa (Pribadi and Devy, 2020 ; Aina, 2020; Nyangasi et al., 2018)

Linking the theory to cervical screening uptake which the primary outcome of this study, the Health Belief Model (HBM) which informs this communication intervention proposes that, the female teachers' likelihood to take up screening, depends on the level of awareness of their perceived susceptibility, and the seriousness (severity) of suffering from cervical cancer. Thus, if they think or believe they are at risk of developing cervical cancer and perceive cervical cancer is a severe disease with serious medical, social and economic consequences, then they are more likely to obtain cervical cancer screening test.

On the other hand, if the female teachers hold strong conviction that CCS is not effective, and it will not benefit them, then regardless of their age, marital status, educational level and knowledge about cervical cancer and screening, they will not utilize the screening services recommended by series of messages sent by this intervention. In a similar way, perceived barrier is the most significant determining factor in behaviour change (Conner and Norman, 2022). This may include health system factors, which may be tangible and psychological, may mitigate against cervical screening uptake. Examples include high cost of test, long waiting time and proximity to screening facilities. These characteristics may prevent the female teachers from utilising the cervical screening services as desired (Conner and Norman, 2022; Aina, 2020).

Evidence from studies have shown that, when the teachers(Respondents) are empowered

University of Ghana http://ugspace.ug.edu.gh

through the mhealth communication intervention which is a series of messages developed to adequately inform them about their risk of cervical cancer, benefits of screening, burden of cervical cancer and where to go for screening (cues for action). It could increase their knowledge and thus provide the driving force and increase the likelihood of cervical screening uptake among teachers (Lemos et al, 2017; Lee et al., 2014)

The health belief model has been criticized for over emphasizing on rational behaviour of clients does not consider habitual behaviours that may impact the decision-making process to accept a recommended action such as cervical screening uptake. It argues that individuals carefully weigh the barriers and benefits of behaviour. It ignores evidence from behavioural economics that stipulates that people act on impulse rather weighing the possible outcome before making a decision. In addition, individuals may not only take up screening to reduce the risk of the disease but will attend with the possibility of solving other problems. For examples, cervical screening utilization could be triggered by other factors such as accompanying a friend for screening or taking a child for consultation (Houghbaum, Becker, Rosenstock, et al., 2021; LaMorte, 2019; Gillam, 1991)

Another limitation of the health belief model is that, it presumes individuals have access to equal amounts of information on a disease or illness. It does not address individual differences that could affect attention and processing of health information as well as motivational value (Houghbaum, Becker, Rosenstock, et al., 2021; LaMorte, 2019).

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

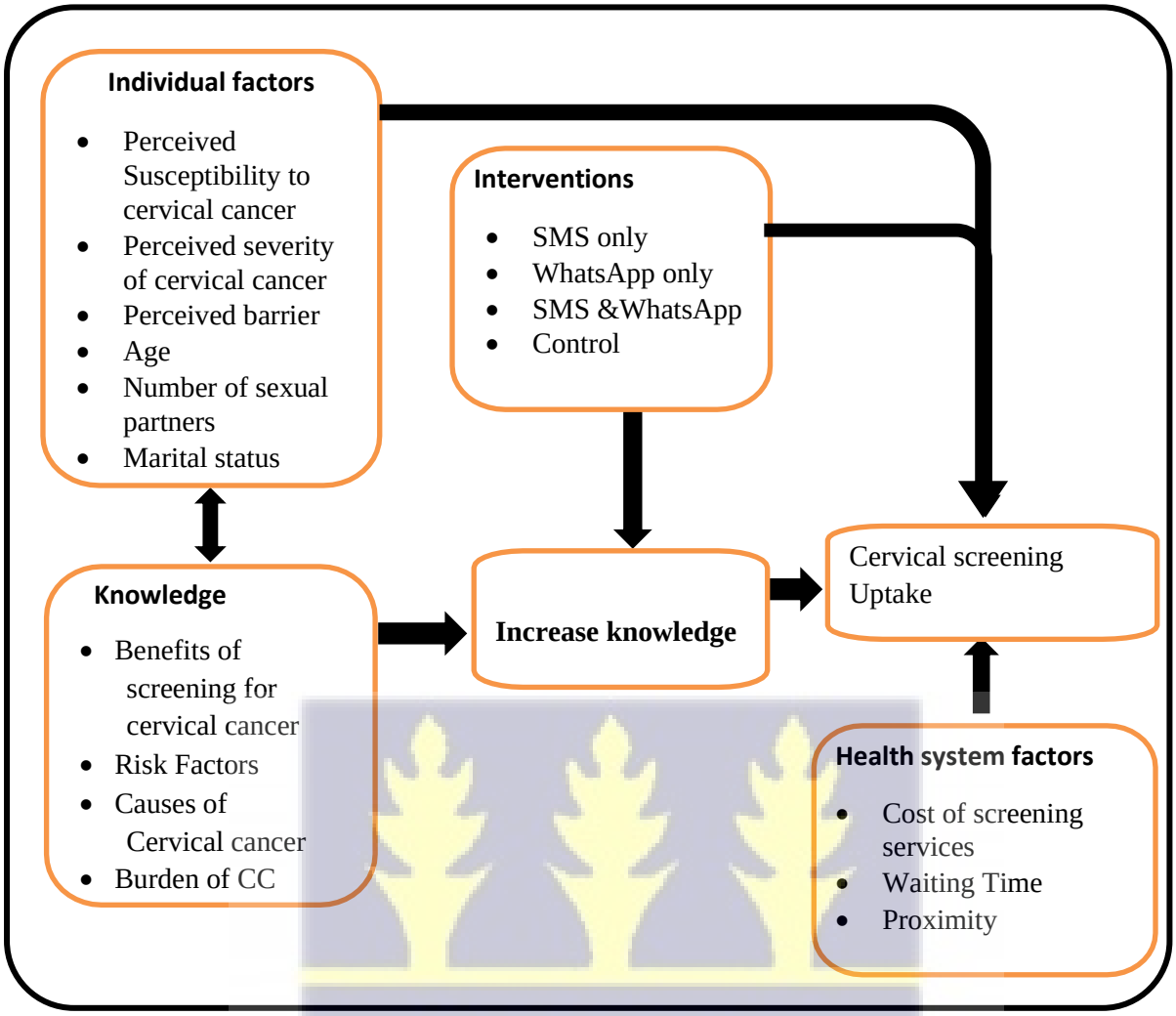

Figure 1.1: Conceptual Framework

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the existing literature relevant to the objectives of my study. It will include the overview of cervical cancer and current screening methodologies available to women living in developing nations. Then, an examination of the population knowledge and awareness of cervical cancer and its symptoms, screening, and treatment amongst women in Sub-Saharan Africa. This provides the context to understand factors which positively or negatively influence the uptake of cervical screening. Finally, I will present a review of existing literature on the implementation of mobile health (mHealth) in developed nations as a successful intervention to improve population knowledge and screening measures.

2.2 Overview of cervical cancer

Cervical cancer, a complication of persistent Human Papilloma Virus (HPV) infection is indisputably a common cause of cancer related morbidity and mortality among women worldwide. Accounting for 3.2% of all cancers in women (Bray et al, 2018) and about 80% of cancer deaths among women in developing countries (Ferlays et al., 2015). The human papillomavirus (HPV) is a sexually transmitted infection that is easily spread. At some point in live, 50% to 80% of sexually active women are exposed to at least one HPV type (Naber et al, 2016).

Cervical cancer is classified into two histological types. Adenocarcinoma and squamous cell carcinoma (SCC). SCC is more common and accounts for 70% of all cases. (Cancer Society of America, 2015). HPV has been discovered in 99.7% of cervical squamous cell cancer cases over the world (Burd, 2003; Walboomers et al, 1999). Cervical adenocarcinomas are also

University of Ghana http://ugspace.ug.edu.gh

linked to HPV and the link is also age-dependent (Anderson, Rylander, Larsson et al, 2001). HPV was found in 89 percent of adenocarcinomas in women under the age of 40, but only 43 percent of adenocarcinomas in women 60 and older. HPV is thought to be associated to the transformation areas of abnormal cells that cause cervical cancer (American Cancer Society, 2015; Anderson, Rylander, Larsson et al, 2001).

The process of developing cervical cancer starts with a risk factor. A risk factor is any attributes (individual or environmental) that makes an individual more prone to developing a serious disease (Cutler, 2002). Some risk factors cannot be controlled by the individual (exogenous/extrinsic) for example family history and age. However, with cervical cancer most identified risk factors are modifiable (lifestyle related) (Cutler, 2002). Some modifiable risk factors include: multiple sexual partners, smoking, obesity, low fruit and vegetables in-take. (Harrington et, al, 2017)

Early sexual intercourse with several partners, long-term use of oral contraceptives and obesity are all predisposing factors for cervical cancer (Satija, 2015). HPV is transmitted by skin-to-skin contact during sexual activity, including vaginal, anal, and even oral sex (American Cancer Society, 2015; Satija, 2015). Women between the ages of 25 and 49, are considered the sexually active age group prone to infection by the human papillomavirus, resulting in an infected cervix (Ferlay et al, 2015; WHO, 2013). In addition, women who use combined oral contraceptives and long-acting injectable steroid contraceptives over 5–10-year period are at a higher risk of developing cervical cancer than women who do not use such (Satija, 2015).

In relation to cervical cancer and precursor lesions, HPVs can also be categorized into high risk (16, 18, 31, 33, 34, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68, and 70), and low risk (6, 11, 42, 43, and 44) HPV types. A systematic review and meta- analysis conducted by Ogembo et al. (2015) on the predominance of Human Papillomavirus genotypes among African women excluding

University of Ghana http://ugspace.ug.edu.gh

women from Central Africa reveals that HPV 16, 52, 35, 18, 58, 51, 45, 31, 53 and 56 were the 10 most basic genotypes in women with atypical cervical cytology. There was a significant range of Human papillomavirus infection rates depending on location, with South Africa (57.3%) having the highest prevalence, followed by East Africa (42.8%), West Africa (27.2%), and North Africa (12.8 percent). HPV 16 and 18 were the specific strains that were found in large numbers among women with atypical cervical cytology from South Africa, with 9.9% and 5.8%, respectively, in different areas. According to the systematic review, 39 studies categorized eligible women who were tested for Human Papillomavirus infection into age categories. The group of 25–34 years old exhibited the highest HPV dominance, with 50.5 percent (95 % CI: 37.1–63.8) in these investigations. The group 15–24 years old came in second with 48.2 percent (95% CI: 14.7–81.6). HPV prevalence was 36.1 percent (95 % CI: 26.9–45.2) and 31.6 percent (95 percent CI: 14.9–48.3), respectively, in the 35–44 and 45–54-year-old groups. Data on the prevalence of HPV in Ghana's general population is currently unavailable. However, in Western Africa, where Ghana is located, roughly 4.3 percent of women in the general population are expected to have high-risk HPV-16/18 infection at any given time, and HPVs 16 and 18 are responsible for 55.6 percent of invasive cervical malignancies. (Ghana Fact Sheet on Human Papillomavirus and Related Cancers, 2018).

Carrageenan a polysaccharide compound derived from seaweed and used widely in food additives, has been identified to stop HPV infection in laboratory technology. In addition, two vaccines Gardasil and Cervarix have been approved and are in use among young girls, before exposure to HPV via sexual intercourse. However, the vaccinated girls need to continue to screen for cervical cancer. This is because the available vaccines do not protect against all species of HPV that cause cervical cancer (WHO, 2021). Furthermore Metformin, a classic first line hypoglycaemic agent (drug) for type 2 diabetes has been shown to disrupt cancer growth including cervical cancer proliferation by inducing cervical cancer apoptosis (cell

University of Ghana http://ugspace.ug.edu.gh

suicide) (Xia et al., 2020; Febbraro et al., 2014). A meta- analysis consisting of six studies reported a significant reduction in the risk of cancer death among Metformin users compared with non-users (Franciosi, 2013)

2.3. Cervical Cancer Burden

Cervical cancer is a significant public health issue which presents significant disease burden to women of reproductive and middle age, among citizens living in low-resource nations (LMICs) such as sub-Saharan Africa (WHO, 2022; Bray et al. 2018). Developing nations have the greatest disease burden of cervical cancer with rate of death ranging from 10 to 35 per 100,000 persons as linked to 2 to 4 mortalities per 100,000 persons in developed nations (Arbyn et al, 2011). This disparity is due to successful national cervical cytological testing (the Papanicolaou test), which detects cell abnormalities that may indicate or precede cervical cancer. (World Health Organization, 2013).

Cervical cancer is the most often diagnosed cancer and a major cause of cancer-related death among women in most SSA nations (Bray et al, 2018; Fitzmaurice et al 2017). As a result, sub-Sahara African countries have high disease burden of CC, with the disease accounting for 84-88% percent of all deaths (Arbyn et al, 2020). It is often considered to be a disease of the poor and underprivileged (WHO, 2013; Anorlu, 2008; Nordquis & Chn 2017). Eastern and Southern Africa have one of the highest age-standardized incidence rates in the world.- Guinea with 50.9 cases per 100,000 women aged 15 to 44, Zambia with 53.7, Lesotho with 61.6, and Tanzania with 68.6 (ICO HPV Report, 2017).

In Ghana, the incidence rate of cervical cancer was 24.6 cases per 100,000 women (ICO/IARC, 2018). Cervical cancer ranks as the second most frequently occurring cancer amongst women in Ghana, and the second most frequently occurring cancer amongst women between 15 and

University of Ghana http://ugspace.ug.edu.gh

44 years of age (ICO/IARC, 2018). Adanu (2002) reported that, at the Korle–Bu Teaching Hospital, the largest teaching hospital in Ghana - 64% of all gynaecological cancers between 1995 and 1997 were cervical cancers. Additionally, Nkyekyer (2000) noted that cervical cancer was the most common form of gynaecological cancer in Ghana, constituting 57.8% of all cancers, followed by ovarian cancer. Current estimates indicate that Ghana has a population of 8.57 million women aged 15 years and older who are at risk of developing cervical cancer. In 2018 alone 3,151 women were diagnosed with cervical cancer with 2,119 resulting deaths (Bray et, al, 2018; Ghana Human Papillomavirus and Related Cancers, Fact Sheet 2018).

The incidence of cervical cancer peaks in the Ashanti and Greater Accra regions, where the majority of women die within 2 years of their diagnosis (Nartey et al, 2017). It is conceivable that exposure to HPV may be occurring at younger ages in the Greater Accra region (Nartey et al, 2017). The World Health Organization (WHO) has projected future estimates of cervical cancer in Ghana through 2025 reach over 5,000 new cases, resulting in at least 3,300 deaths each year. Cervical cancer cases in Ghana, and the Sub-Saharan region at large are often diagnosed late, at advanced stages, where very little can be done (MOH, 2014; Dennya et al, 2013; Denny & Anorlu, 2012). Therefore, cervical cancer is a significant cause of mortality and morbidity among women of childbearing age, in terms of years of life lost (YLL) and years lived with disability (YLD). It also makes the largest contribution to Disability Adjusted Life Years (DALY) (Yang, Bray, Parkin et al, 2004). Effective screening programs are key elements to overcoming the burden of disease in SSA. Cervical intraepithelial neoplasm grades 2 or 3, which are precancerous lesions that, if treated, can prevent women from getting invasive cervical cancer, can be detected with early cervical cancer screening.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

2.4 Cervical Cancer Screening

The purpose "of cervical cancer screening is to identify lesions that have the potential to become malignant and to start treatment as soon as possible (Duke et al., 2015). In developed countries, cervical screening has been demonstrated to effectively lower the incidence of cervical cancer, compared to developing nations where screening remains low, ranging from 2.0 percent to 20.2 percent in urban areas and 0.4 percent to 14.0 percent in rural areas (Karly, Silvia, & Philippe, 2009). Cervical cancer infection has a long dormant period over a decade. Once pre-cancerous lesions are found, they can be addressed on an outpatient basis, making screening important and effective. When compared to the cost of treating cervical cancer, screening is rather inexpensive (Sankaranarayanan, et al., 2013). Precancerous lesions can also be monitored in order to prevent morbidity and mortality.

In Ghana, despite the fact that screening for certain malignancies such as cervical cancer is accessible and many more nurses have been trained to provide the service. These attempts to reduce the incidence and mortality of the disease in Ghana have been or unsuccessful as cases of cervical cancer increase yearly (battorcervical.org; Adanu et al., 2010, Mc Farland, 2013). Cervical cancer screening rates in Ghana are extremely low, ranging from 3.2 percent to 2.2 percent in urban and rural areas, respectively (WHO, 2008; Ayanore et al., 2020; William & Amoateng, 2012). Cervical cancer screening can be done in a variety of ways. The most typical method (Pap smear) involves taking a tiny sample of cervical tissue during a pelvic examination, for cytological analysis (Duke et al., 2015). The paucity of cervical cancer screening programs and the inadequacy of cytology-based screening programs in poorer countries are largely to blame for the high disease burden." (Saxena, Sauvaget, & Sankaranarayanan, 2012).

Cervical cancer screening should begin at age 21, with women aged 21 to 29 "years receiving screening every three years, and women aged 30-65 years receiving a Pap smear test and HPV

University of Ghana http://ugspace.ug.edu.gh

DNA (co testing) every five years, according to new guidelines. Every three years is sufficient for a Pap smear (American College of Obstetricians and Gynecologists (ACOG), 2013). Furthermore, even if the Pap smear result is normal, the combination of Pap smear test and HPV DNA can indicate whether dysplasia will develop in the next few years in women aged 30-65.Women over 65years with no history of moderate or severe dysplasia or cervical cancer and with three negative Pap smear results in a succession are advised to stop the screening, or two negative co-test findings in a row during the last 10 years, with the most recent test completed within the last 5 years" (ACOG, 2013).

The effectiveness of cervical screening is dependent on its sensitivity and specificity. Sensitivity refers to the ability of a test to accurately identify people with the disease, whereas specificity indicates the accuracy of identifying those without the disease (normal population). Sankaranarayanan (2014), in his review on cancer screening in low-and middle- income countries (LMICs), reported the general sensitivity of over 60%, and specificity of 85% for visual inspection with acetic acid

2.4.1 Methods of Screening Test

The Papanicolaou (Pap) smear test, HPV DNA test, and visual inspection with acetic acid (especially in low-resource settings) are all screening tests for cervical cancer. Ablative treatments are used to treat pre-invasive cervical disease, such as burning or freezing abnormal tissue (cryotherapy) and surgical removal of aberrant tissue (WHO, 2013). However, in developing countries like Ghana, the main options of cervical cancer screening are Pap smear (cytological test), HPV DNA-based detection tests. visual inspection with acetic acid (VIA) and visual Lugol's iodine inspection (VILI) (Sherris et al., 2009). This section discusses how these tests are conducted:

University of Ghana http://ugspace.ug.edu.gh

2.4.2 Visual inspection with acetic acid (VIA)

Visual inspection with acetic acid (VIA) and seem to be satisfactory alternative screening to cytology (Pap smear). VIA and VILI has been in use since 1990s in many LMICs (Catarino, Petignant Dongui et al., 2015). This approach does not require high technology or infrastructure.

Visual inspection with acetic acid (VIA) involves the application of 3% -5% acetic acid (vinegar) to the squamocolumnar junction of the cervix. This is followed by the observation of the swabbed area under good light, preferably white light (For example, the halogen lamp). Viewing with a magnifying lens is also called visual inspection with magnifying lens/device (VIAM). This is usually performed by trained nurses and other trained paramedical staffs (WHO 2013). A positive result is given by a defined dense white patch with a rough margin which appears attached to the squamocolumnar junction. A negative test result is recorded when there is no reaction. VIA is easy, cheap and recommended for less developed countries. A new approach called "see and treat" promotes a combination of screening (VIA) and treatment (cryotherapy: Freezing precancer cells with carbon dioxide gas) for screen positive women without symptoms within a single visit (Sankaranarayanan, 2014; Sherris, 2009). Evidence from a seven (7) year VIA testing study in a rural Southern India confirmed that VIA is safe, effective and acceptable and can save lives from cervical cancer even in remote areas with few resources (Poli, et al., 2015).

2.4.3 Visual inspection with Lugol's iodine (VILI).

Visual inspection with Lugol's Iodine (VILI) involves examining the uterine cervix under good light source. After the application of Lugol's iodine, a positive result is ascertained by no reaction to the Lugol's Iodine giving rise to yellow colouration. (Sankaranarayanan, 2014). Lugol's iodine reacts with glycogen, resulting in a brown or black discoloration. Normal

University of Ghana http://ugspace.ug.edu.gh

mature squamous epithelium contains glycogen. When the glycogen in the normal cervical cells (at the squamocolumnar junction) are in contact with Lugol's iodine it turns black. Such a reaction is termed VILI negative. (Sankaranarayanan, 2014).

Table 2.1 Classification of VILLI results

VILLI Classification	**VILLI findings**	**Interpretation**
Test Positive	No reaction: Yellow discolouration of cervical cells	Abnormal cervical cells
Test Negative	Brown or black discolouration	Normal cervical cells

Arbyn et al (2008) assessed the accuracy of five cervical cancer screening tests in eleven studies in Africa and India. The results showed that VILI and VIA detected the presence of cervical cancer and precancer lesions with a better accuracy than Pap smear. The results further indicated that VIA had a high sensitivity (79-83%) that correlated with colposcopy and VILI was 10% more sensitive than Pap smear. The Pap smear on the other hand, showed the lowest sensitivity (57%) and a rather high specificity of 95% (Sankaranarayanan, 2014). This finding was also confirmed by a systematic review and meta-analysis conducted in Asia by Chanthavilay, Mayxay, Phongsavan, et al, (2015). In addition, Chanthavilay et al (2015), recommended additional colposcopy and biopsy for all screened positive women in developing countries to confirm the results because of the high sensitivity and low specificity of VIA and Pap smear. This is to avoid the problem of over treatment.

University of Ghana http://ugspace.ug.edu.gh

2.4.4 Papanicolaou smear (Pap smear)

Cytology screening (Pap smear) is the oldest and the most widespread. This technique has led to effective reduction in the incidence and mortality from CC in many developed countries **(**Catrino et al, 2015). Papanicolaou smear is a microscopic examination of cells scraped from the squamocolumnar (SCJ) junction of the cervix; and used to detect precancerous and cancerous conditions of the cervix (Mehta, 2009). The cervix consists of columnar epithelium which lines the endocervical canal medially and squamous epithelium covers the exocervix externally. The point at which these two epithelial cells meet is called the squamocolumnar junction. It is in this area that the sample is taken for Pap -smear test (Chanthavilay et al, 2015)

Pap- smear should not be performed when a woman is pregnant or menstruating. A day prior to the test, the woman taking the test must abstain from sex, vaginal medications and douching. (Mayo Clinic, 2020; Sherris, 2009). This is to avoid obscuring the epithelial cells with blood, inflammatory cells, or foreign materials such as foam or gel. During the test, the woman is placed in the lithotomy position with her legs supported. The cervix is then visualized with the aid of a speculum and a light source. The Ayre spatula is used to take the sample from the cervix, by rotating the spatula through a 360° turn for adequate sample of squamous epithelial cells and endo-cervical cells. (Chanthavilay et al, 2015) The sample is evenly distributed on a glass slide which is immediately fixed using 95% ethyl alcohol and ether to ensure appropriate preservation of the smear. There are two types of Pap- smear test kit. The traditional and the liquid based cytological kit. Pap- smear screening is indicated for sexually active women with history of at least three years of active sexual life irrespective of the age- for early screening. And stopped at age 70 years if no abnormal results is reported for the past 10 years. (Chanthavilay et al, 2015)

University of Ghana http://ugspace.ug.edu.gh

2.4.5 HPV DNA Test

HPV DNA test (HPV test) is an objective screening test which detects the presence of high risk (HR)HPV infection including HPV types 16 and 18 which cause most cases of cervical cancers. Currently, WHO recommends HPV test as first - choice screening test for women. This is because it has been proven to be more effective and efficient than Pap- smear and VIA (Mayo Clinic, 2022; WHO, 2022; WHO, 2021; Moarcas et al, 2014)

HPV DNA test involves taking samples of vaginal and cervical tissue with a brush during a pelvic examination. The sample is stored in a bottle containing a liquid preservative. The same sample of cells taken can be used for both the Pap smear and the HPV test (co-testing). Current international guidelines advocate the use of HPV DNA co-testing with Pap smear (cytology) (Saslow et al., 2012). Co-testing combines the benefit of high sensitivity of HPV DNA testing with better specificity of cytology. This has improved detection rates for glandular cervical cancer and extension of the screening interval in women who test negative. Negative cytology and HPV test means risk for precancerous cervical lesions is less than 1% (Gupta et al., 2017). Therefore, HPV DNA co-testing appears to be one of the most effective strategies that governs current practice with respect to both cost and outcomes (Skroumpelos et al., 2019)

DNA typing in clinical setting and the identification of HR-HPV genotypes is an important part of cervical cancer screening, as it provides the necessary evidence for the prevention and management of cervical cancer (Jamdar, et al., 2018). In studies to assess the effectiveness of HPV DNA test, Bhatla et al (2009) reported the sensitivity and specificity of HPV-DNA detection of CIN2+ disease for self-collected samples to be 82.5% and 93.6% respectively compared to 87.5% and 93.2% for physician-collected samples. Currently, the high cost of available HPV DNA test prevents the general utilization of this method of cervical cancer screening in LMICs (WHO, 2022; Martinez et al; 2020; Gupta et al, 2017)

University of Ghana http://ugspace.ug.edu.gh

At present, there are five FDA-approved assays for HPV DNA detection: Hybrid Capture 2 (13 HR-HPV types), Cervista HPV HR test (14 HR-HPV types), Cervista HPV 16/18, Cobas 4800 HPV test (PCR-based) and Aptima HPV (amplification-based) assay, (Stoler et al., 2011). In addition, a cost-effective HPV test kit, Care HPV (Qiagen) has been evaluated in low-resource settings. Field evaluation in rural China showed the accuracy of Care HPV to be higher than VIA (Qiao et al., 2008). A multi-country evaluation of this test in India, Nicaragua and Uganda also confirmed the high sensitivity (81.5%, 76.5-85.8) and specificity (91.6%) of this test (Jeronimo et al., 2014). The availability Care HPV is expected to allow wider usage of HPV DNA testing in resource-limited countries.

Furthermore, to address the problem of cost as a barrier to cervical screening utilization, a cluster randomized controlled trial in India evaluated the efficacy and cost-effectiveness of a single screening using VIA, cytology and HPV testing. The study reported that VIA was a useful alternative to HPV testing for low-resource settings, in reducing the incidence and mortality from invasive cervical cancer. Since it provided standardized testing and detection rates (Sankaranarayanan et al., 2005)

2.5 Factors contributing to low cervical screening uptake

Efforts to improve cervical cancer mortality through outreach to under-screened women require an understanding of challenges women experience. It is therefore imperative to identify barriers (factors) that lead to low attendance. Understanding these factors is crucial to changing behaviours that undermine successful cervical screening uptake. Barriers that have been found to contribute to low cervical screening attendance is presented under client and health system factors in the next sub section.

University of Ghana http://ugspace.ug.edu.gh

2.5.1 Inadequate Knowledge and Awareness

Knowledge on cervical cancer and attitude towards screening play a major role in its uptake. Since awareness is the first step towards uptake. It is worrying that reports from cross-sectional studies in Ghana and other countries in Sub-Saharan Africa have, commonly identified inadequate knowledge as the major challenge to successful cervical cancer screening programmes. As a matter of fact, this is common among educated women including teachers, health workers and University staffs and students (Abotchie & Shokar, 2009; Denny & Anorlu, 2012). Consequently, inadequate knowledge noted in Sub–Saharan Africa may be an important factor contributing to the high prevalence of cervical cancer (80% of global burden) observed (WHO, 2013). For example, Ebu, et al (2015) who studied a high-risk population of HIV positive women in southern Ghana, reiterated that, almost 65% of respondents had low knowledge about cervical cancer. Similarly, a cross-sectional survey among 256 secondary school teachers in Sagamu in Ogun State in Nigeria also confirmed low knowledge. Only 24% had good knowledge. A recent integrative review involving 15 cross sectional surveys from 10 countries in sub-Saharan Africa identified limited knowledge and awareness as the most common barrier to screening uptake. In spite of the benefits of cervical screening, when most women are ignorant of these benefits, it may influence their refusal to participate (Anorlu, 2012).

Previous studies demonstrate significant positive relationships between knowledge and uptake (Adanu et al., 2010; Mupepi, 2011; Emmanuel, Oluwafolahan, Moyosore, & Adebukola, 2016;). Also, Emmanuel, Oluwafolahan, Moyosore, and Sinat (2016) conducted a cross sectional study to identify the predictors and factors related to the uptake of cervical cancer screening test among female secondary school teachers in Nigeria, and reported that adequate knowledge of cervical cancer includes knowing the risk factors and signs and symptoms. An additional dimension of the commonly reported problem of inadequate knowledge of women,

University of Ghana http://ugspace.ug.edu.gh

from studies reviewed indicated that women are disenfranchised. Despite, World Health Organization's call to promote cervical screening uptake to reduce the burden of cervical cancer, most women in Sub-Saharan Africa including Ghana, lack awareness. Thus, they continue to report late with advanced cervical cancer (Anorlu, 2008). Among women who screen in Ghana, Adanu et al (2010) noted that, most already have symptoms suggestive of cervical cancer including abnormal vagina bleeding and painful sex This goes to show that, the first time these women hear of cervical cancer, is when they seek medical care, by which time the cancer is already advanced. This calls for intensified efforts to increase awareness and promote women in the communities, schools, market places, towns, districts and nationwide and not to assume that women will embark on cervical screening based on its immense benefits alone.

2.5.2 Perceived susceptibility

According to the Health Belief Model (Perceived susceptibility), a woman's perception about her vulnerability to contracting cervical cancer, predicts her chance of screening for cervical cancer. This was confirmed by psychological research which showed that people take up a cancer screening when they feel threatened or expect a favourable outcome (Cherry & Gans, 2018).

A study by Odukoya, Oyediram and Ujomu, (2012), assessed the perceived susceptibility of women and identified none of them thought they were at risk of developing cervical cancer therefore they did not utilize the cervical screening opportunity. In addition, three cross sectional surveys noted a sense of good health or the absence of symptoms as a factor for non-attendance of cervical screening programs. The participants in all the studies cited, explained they felt no need to have a cervical screening test, since they felt healthy. (Ebu et al, 2015; Eze et al, 2012; Mupepi et al, 2011). In addition, Lee, Fog, Menon et al (2008) found a wrongly

University of Ghana http://ugspace.ug.edu.gh

held belief among Korean American women, who thought screening was unnecessary in the absence of ill health.

Good health described above as a barrier to cervical screening uptake, can be described as a fatalistic belief. That is associated with inadequate knowledge about cervical cancer (Eze et al, 2012). Cervical cancer is asymptomatic. Therefore, there is the need to screen healthy women (Adanu, 2010.) For instance, if a woman should screen only when unwell, then the screening test will invariably diagnose the cancer instead of preventing it.

2.5.3 Attitude and perception towards screening uptake

Attitude has been described as the foundation of success and failure (Hasen, 2016). Attitude can affect behaviour positively or negatively (Cherry & Gans, 2018). According to the basic tenets of the health believe model, the individual's perception informs behavioural change. For instance, earlier studies have shown that positive changes in attitude and perception about the risks and benefits of screening are associated with a greater adherence rate to recommended preventive screening procedures (Chan & So, 2015). In addition, it is known that adequate knowledge on a subject increases the tendency to assume a positive attitude (Cherry &Gans, 2018). For example, Emmanuel et al. (2018) studied 265 Teachers in Nigeria and identified a correlation between knowledge and attitude. The study results showed that, those who had heard of cervical cancer screening had a better attitude and were willing to screen for cervical cancer. Also, there was a 4% increase in the uptake of cervical screening among the intervention group ($p = 0.038$); whereas the control group remained essentially the same. These results further buttress the importance of awareness campaigns. However, evidence of screening uptake associated with poor knowledge exist in many developing countries (Smith et al., 2017). In fact, Alliance for Cervical Cancer Prevention (ACCP) project in rural India attributed the problem of poor attitude towards cervical screening to ignorance. As it identified

University of Ghana http://ugspace.ug.edu.gh

that 99% of the 80,000 women recruited had never screened because their knowledge about cervical cancer and screening was generally poor (ACCP, 2014; Adageba et al., 2011).

Moreover, a community study by Awua et al. (2017) in Ghana reported poor attitude of women towards screening. He reiterated that, of the 156 participants recruited in the community for screening at the hospital, only 38.5% attended. Also in another study, 361 female staffs in three health facilities in Ghana were surveyed. Although, about 75% of the respondents knew that cervical cancer could be prevented through screening, yet only 11% had ever screened at least once (Adageba et al., 2011) Furthermore, Adanu (2010) discovered among four different groups of well-educated women at the University of Ghana's main and medical campuses in Accra, that although 39% of the respondents had sufficient knowledge about Pap smears, only about 18% had ever had a Pap smear done. In this regard, Hasahya, et, al (2016) explained from her exploratory study among women in Uganda, that even though participants had heard of cervical cancer they did not have sufficient understanding of the disease to improve their health seeking behaviour and called for the intensification of educational campaigns.

Nevertheless, several studies have identified the attitude of fear of positive cervical screening test results as a barrier to cervical screening uptake. This is because it decreased the likelihood of participating in screening (Kahesa et al, 2012; Mosavel et al, 2009; Ndikom & Ofi, 2012). For example, Ebu et al, (2015) reported fear of being diagnosed with cervical cancer, deterred many women from participating in cervical screening. A study at Mama Lucy Kibaki Hospital in Nairobi by Mbaka, Waihenya, Oisebe, and Lihana (2018), stated cervical screening was hampered by a fear of tests, a lack of understanding, and a lack of faith in the process though cervical cancer screening was free In addition, Hasahya (2016) attributed the state of fear and anxiety associated with anticipated positive screening, to wrong interpretation. Also, a systematic review validated the evidence of many misconceptions among women (Hussein, Hassan and Jarat, 2016).

University of Ghana http://ugspace.ug.edu.gh

2.5.4. Financial barriers

Several studies have found that financial hurdles to cervical cancer screening exist, with many under-screened groups. Financial worries, particularly among women with limited financial resources, such as those without health insurance, may be a barrier to cervical cancer screening. (Majid et al, 2019; Adunlin et al, 2019; McAlearney et al, 2010). Despite the fact that most cancer screenings are free or low-cost, pricing cancer screenings may pose challenge to some women. Women without any health insurance cover and low-income women are less likely than those with private insurance and a higher income to have had a Pap test in the previous year (Silvera et al., 2020; Bonafede et al., 2019), Furthermore, compared to women with medical insurance, a higher proportion of women without medical insurance have a 3.5 year or longer gap between Pap tests (Bonafede et al., 2019). It's worth noting that, while one challenge to low cancer screening is due to its cost factors, the out-of-pocket expense may be unknown to some women. In a survey of women living in Appalachian counties in Ohio, for example, 81 percent said they had no idea how much a Pap test cost, 42 percent of women overestimated the cost of a Pap test (McAlearney et al, 2010).

2.5.5 Cultural beliefs and values shame around cervical cancer

The cultural beliefs of some ethnic minority do not permit women to share their cervical cancer condition with each other. Because these women only talked about it with their closest friends or at home with their husbands and if someone in the immediate vicinity had been diagnosed with cancer or had died as a result of it (Lofters et al, 2017). This is because they feel that if cancer isn't discussed, it doesn't exist. It is not customary to discuss bad topics like disease or death. And if people are aware that they have a condition, they will be met with sympathy, which is unpleasant (Rimande-Joel and Ekenedo, 2019; Padela et al, 2014). Studies in Somalia of cervical cancer (CC) screening among woman revealed that, the women were not willing to

University of Ghana http://ugspace.ug.edu.gh

test for the cancer because they believed that having CC meant that a woman or her partner had multiple sexual relationships. Having history multiple partners is not acceptable in Islam. Consequently, these women were afraid of the judgement of others. Therefore, the fear of labeling and shaming prevents them from a screening program that will possibly diagnose them with CC. Thus, keeping the subject undiscussed to prevent questions from the community and family members (Ghebre et al, 2015).

2.6 Knowledge of cervical cancer and cervical cancer screening

Women's understanding of cervical cancer is quite low in many undeveloped nations (Amarin, Badria, & Obeidat, 2008). It has been shown that the vast majority of women in various nations had never heard of cervical cancer and even fewer had ever heard of cervical screening (Wong, 2009; Kidanto, Kilewo, & Moshiro, 2002). Cervical cancer can only be prevented and controlled if persons at risk are aware of the disease's risk factors, as this will allow them to avoid behaviors that increase their exposure to them. Furthermore, knowing the disease's symptoms and indicators would allow persons at risk to seek medical help earlier rather than later in the disease's progression in the less developed countries when only palliative care is possible. (WHO, 2013). Even at secondary health care centers, the long transition time from a premalignant lesion to frank cervical cancer allows for early detection and practically complete cure (Owoeye & Ibrahim 2013). However, this window of opportunity which has enabled the developed countries to reduce the incidence of cancer of the cervix would be wasted if the level of knowledge of CC screening is low (Owoeye & Ibrahim 2013). The increase cases of CC may be due to a lack of understanding about the disease, which often leads in a late detection at an advanced stage, making treatment extremely difficult (Wittet and Tsu, 2008). This is due to several reasons, "namely ignorance about the symptoms, fatalistic attitude such as readiness to attribute neoplastic disease to supernatural causes thereby resulting in delays in seeking help,

University of Ghana http://ugspace.ug.edu.gh

fear of confirmation of suspicion and of course the perennial problem of low coverage of the population by health centre services especially the rural areas" (Owoeye & Ibrahim 2013). A study by Gyamfua et al, (2019) on the level of knowledge and related factors on CC among women revealed a significant association between the occupation and educational background of women and their level of knowledge in relation to cervical cancer uptake. Women with low or medium level of education had low level of knowledge on cervical cancer uptake whiles women with high or tertiary level of education showed a high level of knowledge on cervical cancer uptake at Bogoro community. Also, this seems to imply that people with a higher level of education have in-depth knowledge about cervical cancer. As a result, it is reasonable to assume that the more literate a community is, the more informed they will be about cervical cancer. As a result, people in industrialized countries with high literacy levels are more likely to know a lot about cervical cancer.

A study of rural women in Zimbabwe found that they had little awareness of the causes, prevention, and treatment of cervical cancer. The majority of the women polled (95.78%) have never had a cervical cancer screening test (Tapera et al, 2019). Comparable research of Sudanese women found that they had little understanding of cervical cancer and how to prevent it. Despite the fact that the majority of them (78.8%) had a university degree and almost all of them (97.2%) lived in Khartoum state, Sudan, where the services are available, only a small percentage (15.8%) had had a Pap smear test (Almobarak et al, 2016). Cervical cancer risk factors, symptoms and indicators, and prevention were all poorly understood in studies conducted across Nigeria, as well as a considerably low Pap smear test uptake. 2013 (Owoeye & Ibrahim)

In Ghana, Opoku et al, (2016) "found that the majority of respondents 66.7% in their study have never heard of CC. Out of 100 women who had heard about cervix cancer, 23% said they

University of Ghana http://ugspace.ug.edu.gh

were aware of the risk factors, 17% said they were aware of the signs of cervical cancer, and 14% said they were aware of how to detect cervical cancer

A study was conducted in the United States to find out women's knowledge on HPV and cancer of the cervix. The study revealed that, knowledge about Human Papillomavirus among U.S women between the ages 18 to 75 years old was low with only 40% of women reporting having ever heard of HPV and even among those who had heard of it, less than half of the number knew that Human Papillomavirus causes cervical cancer. Their findings revealed that knowing about HPV does not predetermine one's knowledge about its relationship with cervical cancer. Therefore, researchers in health care have the tasks of designing messages to increase recognition of the name Human Papillomavirus Virus and the acronym HPV and increase the knowledge level of the potential effects of Human Papillomavirus infection" (Tiro, Meissner, Kobrin & Chollette, 2007).

2.7 Socio-demographic factors associated with cervical cancer screening uptake

Based on the literature reviewed, it is evident that demographic parameters such as level of education, age, place of residence, and marital status, among others, have a substantial impact on cervical cancer screening uptake. As a result, the current study believes it is important to look at the impact of these sociodemographic characteristics on the use of cervical cancer screening uptake in Ghana

2.7.1 Age

Age has been found to be one of the most important predictors of Pap test. (Astarian, Mirzabeigi, Khezeli, 2017). However, there are mixed findings when it comes to age (Aina et al., 2020; Ifemelumma, 2019; Petkeviciene, Ivanauskiene & Klumbiene, 2018) Some findings from research suggest that younger women are more likely to seek cervical screening services

University of Ghana http://ugspace.ug.edu.gh

than older women (Aina, Raul, Padilla, et al., 2020; Ifemelumma, 2019; Cerigo et al., 2013). While other, studies (Petkeviciene, Ivanauskiene and Klumbiene, 2018; Woldetsadik, et al, 2020; Ayanore, Adjuik, Ameko et al, 2020) present contrary view that non- attendance of cervical cancer screening was greater among young women than older women. Other studies have found no link between the age of the respondents and their use of cervix cancer screening services (Park et al 2011; Simou et al 2010). According to the study results of Park et al, (2011), age had no influence on the desire to receive CC screening. Similar findings were reported in a study conducted in Greece, which found no link between age and cervix cancer screening uptake (Simou et al., 2010).

A survey in Ethiopia found that women between the ages of 40 and 49 were more likely to screen than those between the ages 18 to 29 (Woldetsadik et al., 2020). Opposing evidence suggests that screening declines with old age (Balogus, et al., 2012; Woldetsadik, et al, 2020; Ayanore, Adjuik, Ameko et al, 2020 Eaker et al 2001). In a population –based study in Sweden, it was observed that, some women would not attend cervical cancer screening test after invitation because they felt they had reached menopause (Eaker et al., 2001). To confirm this, Aina, et al., (2020) in Swaziland showed that participants who were less than 30 years of age were less likely to receive a cervical exam compared to women aged 30 years and above. Similarly, Cerigo, (2013) in Quebec, Canada demonstrated that older women (45 and above) had higher odds of inappropriate screening compared to younger women (21-29). Furthermore, older women spoke of valuing the test (Pap smear) for their daughters but not themselves. Although they understood the Pap smear test and recognised its health maintenance role (Oscarsson et al., 2008). These findings are worrisome as, cervical cancer cases tend to occur in midlife among women between the ages of 35 and 44 (American Cancer Society, 2018).

Also, Cervical cancer mortality increases with age, cervical cancer is higher among women above age 40 (WHO, 2022). A population-based study in India, identified that, of the total of

University of Ghana http://ugspace.ug.edu.gh

18,869 women screened, 50% of the women screened were between the ages of 31-40. This study's finding is consistent with the age bracket (31-45) recommended by WHO as having the highest screening benefit.

2.7.2 Place of Residence: Rural versus Urban

Studies support that women who lived in urban areas were more likely to be tested than those who lived in rural areas (Spencer, et al., 2021; Nyangasi et al., 2018; Sözmen, Unal et al., 2016). A study conducted by Nyangasi et al. (2018) in Kenyan, identified women residing in urban areas had higher screening scores, than those living in rural areas. Also, Spencer, et al (2021) observed that mother-daughter pairs that failed to engage in either screening or vaccination were more likely to reside in deprive areas. Furthermore, Sözmen, Unal et al., (2016) confirmed that living in a rural area was associated with decrease possibility of getting Pap smear and mammography

2.7.3 Marital Status

According to Ebu (2018) and Tapera et al., (2019) respondents' marital status had no effect on cervical cancer screening uptake. However, a study by Sözmen, Unal et al., (2016) found being married was a strong determinant of participating in both Pap smear test and mammography compared to being single. This may be because married women have more social support and are more sexually active than single women (Acikgoz, & Ergor 2011This may be because, these group of women, have higher probability of having multiple sexual partners compared to married women. This may increase their risk of acquiring HPV infection which justify the need for them to utilize cervical screening service.

University of Ghana http://ugspace.ug.edu.gh

2.7.4 Educational Level

High educational level has been demonstrated as a strong predictor of cervical screening uptake (Aina, 2020; Nyangasi et al., 2018) A survey by Aina, (2020) among 300 women in Swaziland revealed that, women who had a tertiary education were more likely to receive a cervical screening than those with basic or no education. Also, two studies in Kenya confirmed higher education increased the likelihood to attend cervical screening (Nyangasi et al., 2018; Tiruneh, 2017). This includes a survey by Nyangasi et al., (2018) which reported, women with more formal education had higher probability to take up screening than ladies with less formal education. Also, Tiruneh, (2017) in Kenya, found that Pap smear screenings were higher in communities that had higher proportions of women with higher education

Likewise, Sözmen, Unal et al., (2016), confirmed that having university degree increased the probability of obtaining Pap smear test and mammography than having high school education. Ebu (2018) studied among HIV positive women in the central region of Ghana. The study findings revealed that respondents with a high degree of education utilized cervical screening than those with only a high school diploma. This is because education leads to a greater understanding of health-related concerns, which can lead to increased use of cervical cancer screening services. Women who are educated can assess risk factors for particular diseases and favorably affect health-care decision, such as cervix cancer screening programs (Ebu, 2018). On the Contrary, Tapera et al., (2019), found educational level has no association with cervical screening uptake

INTEGRI PROCEDAMUS

2.8 Prevalence of cervical cancer screening uptake

Cross-sectional survey involving 28,000 women of reproductive age from five SSA nations demonstrated significant variation and disparity in cervical cancer screening uptake throughout the region. (Ba et al, 2021). CC screening uptake was just 19.0 percent in SSA, as likened to

University of Ghana http://ugspace.ug.edu.gh

81.1 percent in HICs, the prevalence rate at 0.7 percent was recorded in Benin. According to (Ba et al, 2021) uptake of CC screening among reproductive age women in these low-resource countries is low which indicates an increase in the rate of CC in the near future. The low incidence of cervical cancer screening in Sub-Saharan Africa (SSA) may be due to reasons being that most nations in the region face conflicting health requirements, including a high case of infectious illnesses, maternal and child health issues, and resources constraints

As a result, cancer prevention strategies like HPV vaccinations and countrywide CC screening programs are given less priority (Stewart, Moodley & Walter, 2018; Gouda et, al 2019). Furthermore, a lack of knowledge about CC screening uptake may play a role, since most women in SSA postpone preventative treatment seeking medical help until they experience gynecological signs and symptoms like irregular bleeding in the vagina, discharges from the vagina (Arbyn et al, 2020). These clinical signs frequently signal advanced-stage cancer, which has a poor prognosis and a higher risk of death (Stewart, Moodley and Walter, 2018).

Low cervical screening uptake has been reported in other parts of Africa among women in their home countries. For example, a Zimbabwean study reported a cervical screening uptake of 9%. A prevalence of 10% and 8.4% were reported among female health workers and Public secondary school teachers respectively in Sokoto Nigeria (Ijezie and Johnson, 2019). Another Nigerian cross-sectional study reported a screening uptake of 17.6% among female teachers in Sagamu, Nigeria (Emmanuel, Oluwafolahans & Sinat, 2016). Mabelele et al, (2018) found only 14.3% of the women who attended reproductive and child health clinic at Magu district hospital, Lake Zone in Tanzania participated in cervical cancer screening and Kileo et al (2015) reported 21 % of female teachers in Dar es Salam, Tanzania, ever used cervical cancer screening services.

University of Ghana http://ugspace.ug.edu.gh

Studies by Montgomery, Dune, Shettt and Shetty (2015) in India on prevalence of cervical cancer revealed that, the prevalence of cervical screening uptake reported was 13.4% which is in sharp difference to what pertains in high income countries like USA which report very high prevalence rates. For example, Johnson, Head, Scott and Zimet (2020) reported almost 77% among 630 women in The United States had had a Pap smear test in the last 5 years and among these 67.5 % had ever had HPV test.

Regarding the prevalence of cervical screening uptake in Ghana, ICO/IARC Report (2018) indicates that, only 2.8 % percent of women between the ages of 25- 64 years have screened for cervical cancer. A similar percentage was reported by a recent WHO survey among a nationwide representative sample in Ghana. This showed in both wave 1 and 2 of their studies, only 3.1% and 2.4% respectively had a Pap smear test (Calys- Tagoe, et al., 2020). Low patronage has been reported in previous publications in Ghana. For example, a study among 140 university of Ghana students between the ages of 20- 35 years reported a prevalence rate of 12% for cervical screening uptake (Abotchie and Shokar, 2009), Adanu (2010) reported a prevalence as low as 2.1% among women in Accra. A study in southern Ghana, Elmina reported a very low prevalence of 0.8% among 392 rural women (Ebu et al, 2015). The consonance of several studies in Ghana (ICO/IARC Report, 2018; Calys- Tagoe et al., 2020; Abotchie & Shokar, 2009; Adanu, 2010; Ebu et al, 2015) demonstrate that, though women in Ghana are at high risk of cervical cancer, the screening uptake is very low. As a result, there continue to be more deaths each year (Torode et al, 2021).

Additional reason for the low uptake is that Ghana has no systematic national cancer programme and the cancer registry is at underdeveloped stage with no national routine "screening programme. In the absence of national screening programme, most of the cervical cancer screening that take place in the country can be described as opportunistic screening. Where physicians request Pap smear or VIA for patients seen in clinics for either general

University of Ghana http://ugspace.ug.edu.gh

medical problems or for consultations related to vaginal bleeding among others (Adanu et al, 2010). World Health Organization (WHO) Director General's call to action to eradicate cervical cancer as a public health problem has not received the necessary attention. Despite having the knowledge and tool to prevent, screen and treat women with cervical cancer, the global health community has not tackled the disease in a coherent and consistent manner" (Torode, 2021)

2.9 Mhealth Interventions and their use in healthcare

Mobile Health (mhealth) is a new concept which was first reported in the 21st century. Various authors have given different definitions on mhealth, according to WHO (2011), "mobile health (mHealth) refers to the use of mobile telephones and other wireless technology in health promotion or disease prevention, WHO (2021) avers that "the use of mobile communication technologies to promote health by encouraging healthy behaviors is known as mHealth (e.g., delivery of healthcare information, health data collection or patient observation and provision of care). O'Leary (2016) also sees mobile health (m-Health) as a technology that have a good impact on patients and health services, through the use social media, Web, and mobile apps. Building on the definitions of mHealth by (WHO, 2011), and O'Leary (2016) the researcher defines mHealth as services that improve personal and medical healthcare using mobile technologies. Using mHealth applications is regarded to be good to society because it promotes public health, despite the personal benefits (Agarwal et al, 2016). Furthermore, mHealth is a new field with the potential to improve healthcare system efficiency, increase patient happiness, and reduce healthcare costs (Hussain et al., 2018).

Due to weak health systems, increases in tropical diseases, increases in infectious diseases, and increasing rate of mortality, a cheaper and easier way to improve the quality of healthcare services to patients in low- and middle-income countries (LMICs) is through Mhealth

University of Ghana http://ugspace.ug.edu.gh

technologies (WHO, 2016). Despite the fact that mHealth activities are mostly used to transform healthcare in high-income countries (HICs), there is an increase in the integration of mobile health into existing mhealth services in low- and middle-income countries (LMICs) (Sondaal, et al, 2016)

Mobile health technology is seen as a tool for achieving universal health coverage, especially in LMICs with limited resources (El-Sappagh et al, 2019; Palmer et al, 2018). According to a recent research, applications on mhealth is widely utilized in HICs to alter healthcare services and diagnosis of disease infectious and other diseases including Diabetes, HIV/AIDS, Tuberculosis, CC, and a variety of others (Sharma, et al, 2019; Alwashmi, 2020). Other research (El-Sappagh et al, 2019: Alwashmi, 2020) conducted in various HICs focused on mobile health applications to aid in medication adherence, appointment reminders, illness monitoring, emergency tracking, and other areas of patient care.

According to WHO (2016), the advantages of employing mobile health technology are numerous. For example, mHealth enables the creation of data on the health condition of individuals which is cost-effective. mHealth, for example, allows more individuals in distant places to obtain services related to their health conditions. Patients can communicate their health issues with their doctors or health sectors in charge in real time and as often as they need. On the one hand, this provides for more efficient personnel planning, and on the other, it allows for cost savings. Furthermore, the adoption of remote monitoring and counseling can help to improve the management of chronic health concerns. The use of mobile health to provide health services has the potential to decrease disparities, empower individuals to take charge of their health, and enhance the cost-effectiveness of health care (Sharma et al, 2019).

In the case of malignancies such as CC, it is recommended that regular screening, should be done every three or five years. Using mHealth methods will allow possible reach out to targeted audience and remind them of their appointments, which will help to increase screening rate.

University of Ghana http://ugspace.ug.edu.gh

These tactics have been shown to promote health promotion intervention attendance and adherence in a cost-effective and time-effective manner (Broberg et al, 2014). Again, providing cervical cancer screening through mHealth enables timely data collection, transmission, and storage as well as data analyses, sharing and reporting. (Broberg et al, 2014). Besides, mHealth applications contribute to improving cervical cancer through monitoring, diagnoses and treatment. (Tokosi et al, 2017).

2.9.1 Mobile phones and their use in healthcare

Mobile phones, according to the mHealth Alliance, can reach the unreachable, permit the community with knowledge, in addition assist distant health professionals in their operations (Coleman et al, 2011). A substantial amount of research documents the use and positive impact of mobile phone on health-care delivery in both advanced and emerging countries (Lester & Karanja, 2008; Lester et al., 2010). Through various scientific investigations, researchers have attempted to examine the efficiency and effectiveness of mobile phones in the delivery of health services to people, and health systems, and have shown a relatively positive influence on the population (Orr & King, 2015).

According to Adler, (2009), mhealth phone based communication refers to the integration of client's mobile phone communication into the process of health delivery to enhance health outcomes; by enhancing information or data flow. One significant feature of the phone based mhealth communication is the ability to deliver messages to a client phone via SMS, voice mail, and WhatsApp (Adler, 2009). Expanding health care to adopt phone based mhealth has become a huge potential that can transform health care delivery across the globe. This change is fuelled by a group of factors which include rapid growth in mobile technologies, increasing opportunities to integrate mhealth into existing health service and wide coverage of cellular network (WHO, 2011).

University of Ghana http://ugspace.ug.edu.gh

In low- and middle-income countries, mobile phone penetration and acceptance are rapidly expanding (GSMA, 2019). As a consequence, using mobile phones for healthcare may reach a larger number of people in resource-constrained regions than conventional disease management techniques. The conventional way of interacting with mobile phone text message components has evolved, and it is now being utilized to assist with healthcare services (Castelnuovo, 2015).

The short message service (SMS) and WhatsApp are two most widely used interpersonal mobile phone communication methods, with SMS including the production of fast conversation with alphanumeric messages of 160 typescripts or less and WhatsApp having an infinite word limit (International Telecommunications Union, 2014). Text and WhatsApp messaging are now widely used, with a valued three-quarters of all mobile handlers using them (International. Telecomm. Union, 2014). Short message service (SMS) and WhatsApp application on phone are simple technology which involves sending or receiving messages on the mobile phone (International. Telecommunication Union, 2014). SMS and WhatsApp messaging for services related to health can be regarded part of a greater mHealth strategy, which is the use of mobile phone technology such as phones, tablets, tele-monitoring, and tracking devices to support and improve health care and public health practice. (Tang, et al, 2014).

Mobile Short message service and WhatsApp are mostly commonly applied to social communication, it can be used in health promotion interventions to address health issues at the individual-level by proactively delivering timely relevant health information and support patient-provider communication, making it easier and prompt (Kohut, et al, 2011).

Apart from their broad usage and reach, text and WhatsApp messaging have a number of additional features that makes them suitable for health services. While text-messaging treatments is seen to be less costly, more sophisticated interventions has shown to be expensive

University of Ghana http://ugspace.ug.edu.gh

(Kohut, et al, 2011). SMS can also integrate traits that are generally linked with an effective health communication initiative, for instances, customizing, interaction, and individual centered (Ganasegeran, 2017). WhatsApp's group communication function allows users to send audio, text, video, or location messages, which is a unique tool for health communication (Ahiable, 2018; Ganasegeran, 2017).Contacts can see when other users are typing online, as well as when they last used the system. It is also the most downloaded software on the planet (Barhoumi, 2015). It is free, its user friendly and accounts for roughly 20 percent of overall smartphone usage (Barhoumi, 2015).

SMS and WhatsApp have been widely used in health care in a variety of methods to date. Some studies, for example, have employed technology to automate the message delivery process for providers, from fully automated clinical appointment reminders to personnel writing and delivering the messages themselves (Tamuzi, Muyaya, Tshimwanga and Zeng, 2017). Other studies have used a combination of SMS, phone calls, emails, and WhatsApp messages to enhance health-related results (Abaza et al, 2017). SMS and WhatsApp interventions also have enabled healthcare workers to communicate relevant information to patients to promote adherence (Tamuzi, Muyaya, Tshimwanga & Zeng, 2017).

Cervical cancer patients and providers can ‘‘interact" via two-way communication using SMS and WhatsApp interventions. Patients can also connect with providers via SMS and WhatsApp to confirm their adherence to any health interventions or outcomes (Zamberg et, al 2020). Engaging in supportive interactions through SMS and WhatsApp enables patient to not only access their doctors but also receive support which increases decisions when it comes to health choices, it improves their health self-efficacy (Oh, Lauckner, Boehmer, Fewins-Bliss, & Li, 2013) and increases their adherence to medical treatments (Bass et al., 2006). (Samal et al., 2011).

University of Ghana http://ugspace.ug.edu.gh

Firmino-Machado et al. (2019) avers that one impact of mhealth SMS and WhatsApp is it helps to increase information sharing by informing cancer patients on their attendance days, risk factors associated with the disease and the screening times. Seeking help is considered the "initial step" in the supportive communication process, and the rest of a helpful interaction is unlikely to happen unless people seek help first (MacGeorge et al., 2011). When users of SMS and WhatsApp divulge information about their health concerns or actively seek support from their doctors and others in their network, they reap the biggest benefits (Oh et al, 2013).

In Ghana, Mobile Technology Community Health (MoTeCH) has been applied to maternal and childcare, has proven to be efficient in rural and urban centres. It has led to improved maternal outcomes than in the traditional face to face education usually employed (Motech, 2015). This support that, Mobile health interventions could deliver timely information and support timely health care (LeFevre, et al, 2017). Integrating mobile phone into health care, enhances the ability to reach people wherever they are (Mbuagbaw et al., 2012). This makes mhealth phone based a useful alternative especially in underserved areas where there is a large population and widespread mobile phone usage. This is because these days, mobile phones are handy, personal and also affords the opportunity to connect with people irrespective of the distance (Mbuagbaw, et al., 2012)

2.9.2. Successful studies on the application of mhealth mobile phone in healthcare

This section highlights the application of mhealth mobile phone intervention in improving health outcomes. Success studies that concentrated on the efficacy of applying mhealth mobile phone technologies in improving health condition were identified and discoursed.

University of Ghana http://ugspace.ug.edu.gh

2.9.2.1 Maternal health

On prenatal attendance studies of pregnant women, the worth in the usage of cell phone in maternal health has proven to be effective. Community health professionals identify and register pregnant women with mobile phones who attend prenatal in the community for mHealth intervention. The majority of interventions were carried out via text messages and interactive phone conversations, as well as the distribution of SMS-sent coupons. During pregnancy, pregnant women who used phones had a greater uptake of suggested prenatal care visits (at least four). These also aided in the management of secondary care concerns such as: malaria treatment, and antepartum referrals (Awoonor-Williams, et al., 2012; Lund, 2012; Watterson, Walsh and Madeka, 2015). In conclusion, mHealth technology such as mobile phone had the potential to improve the quality of maternal care in general since prenatal visits are used to address both primary and secondary care outcomes.

2.9.2.2 Diabetic Self-Management and weight Management

Application of Mhealth technology has been used in the management of diabetic and weight management studies. A randomized control study by Ibrahim (2018) tested the effect of educational intervention using SMS text messaging on diabetes self-care. The randomized control trial involved 150 type 2 diabetic patients in Iran. The educational messages were based on the four main areas of diabetic- self- care tasks namely diet, exercise, blood glucose monitoring and taking medications. The results after a 12 weeks intervention, demonstrated SMS text messaging as an effective educational method that can improve glycaemic control, self-care and other aspects of diabetic care. This was evident by a significant decline in mean BMI, FBS in all the intervention groups. Mean Self Care Inventory -R scores (SCI-R) significantly increased. However, in the control group, mean SCI-R scores increased ($P < 0.001$). Another trial used text messaging to aid weight loss and prevented metabolic

University of Ghana http://ugspace.ug.edu.gh

deterioration in overweight and obese people who did not have clinical CVD or diabetes. The intervention group saw a statistically significant drop in weight (2.4 percent), body mass index (BMI), and waist circumference (4.8 percent), while the control group saw a statistically non-significant increase in weight, BMI, and waist circumference. The mean differences in glucose and cholesterol levels, on the other hand, were statistically insignificant (Ibrahim, 2018).

2.9.2.3 Management and control of HIV//AIDS

Mobile phones have been shown to be effective in managing and controlling communicable diseases like HIV/AIDS (Chi & Stringer, 2010) Treatment adherence and the usage of antiretroviral medication were two of the first uses of mobile health. Many mHealth research show that adherence by patients to the usage of antiretroviral medicines for the management and treatment of HIV/AIDS improved. SMS was the main tools for communication, with some being complemented by interactive phone calls (Devi et al., 2015). The use of mobile phones for treatment adherence has been discussed in several studies on the condition.

2.9.2.4 Health promotion

Studies by Lee, Koopmeiners, Rhee, Raveis, & Ahluwalia, (2014) on promoting health using mhealth service among Hispania's immigrant women who lives in Los Angeles and Korean women within Minnesota in American. According to the study, 58 percent of Hispanic immigrant women who visited a Los Angeles community health centre were naïve with internet usability whiles 64 percent were also naïve on the usage of emails, yet 70 percent had cell phones and 65 percent used text messaging on their mobile phones on a regular basis (Dang et al., 2013)

In the same survey, 46% of women said they would be willing to receive reminders via text messages on their phones. The study findings highlight the prevalence of mobile text

University of Ghana http://ugspace.ug.edu.gh

messaging as a communication tool among women. This suggests that it could be used to reach out to women and encourage them to adopt healthy habits. SMS is found to affect the promotion of health awareness, (Buis et, al 2013) health knowledge (Sharma et, al 2011) and changing unhealthy behaviour or improving therapy (Buchholz, et, al 2013).

2.10 Effect of mhealth (SMS and WhatsApp) intervention on improving knowledge

Mobile devices have become excellent instruments for planning, executing, and increasing information on a variety of health problems due to their broad availability and functionality. The following are the few studies that have demonstrated the efficacy of communication intervention using SMS and WhatsApp in improving knowledge on cervical cancer and cervical screening uptake.

Studies by Lee, et al. (2014) revealed that weekly administration of SMS significantly increased the general knowledge about cervical cancer, cervical cancer risk factors and knowledge about Pap smear testing. These findings were observed in a study which was carried out to assess the acceptability and feasibility of mobile phone text based message.

Pereira et al, (2020) conducted a three-week pre-post WhatsApp intervention research to improve awareness about early diagnosis and risk reduction of breast cancer among 35 women (aged 45-69 years). A total of 293 WhatsApp educational messages comprising audio, video, text, and images were shared in a WhatsApp group. The intervention improved women knowledge on subjects discussed, particularly "myths and facts," "concept of disease', "risk factors," and "protective factors." On knowledge about "concept of disease," before the intervention, more of the participants erroneously identified breast cancer as a benign tumor. After the intervention, there was a significant improvement in the perception of the disease. Regarding risk factors of breast cancer, pre- intervention, half of the respondents, cited family history of breast cancer, smoking and alcohol use. All the variables had a greater frequency of

University of Ghana http://ugspace.ug.edu.gh

response after the intervention . Additional risk factors such as high-fat food intake, first pregnancy after 30 years of age, reaching menopause after 55years of age were also mentioned. Furthermore, knowledge on early detection of breast cancer also improved significantly post-intervention compared to pre-intervention. All of the participants indicated after the intervention that doing a breast self-examination was necessary and being asymptomatic did not rule out the need for clinical breast examination and mammography. Nonetheless, after the intervention, majority of women said that they understood the proper use of clinical breast assessment and that they were aware of the recommended age range and frequency of the inspection.

Likewise, a Portuguese study by Lemos et al., (2017) analyzed the effect SMS interventions on cervical cancer prevention. One hundred and forty-four female undergraduate students were assessed on their knowledge in cervical cancer. The study employed pre and post study design with two intervention arms and control. However, participants were not randomly allocated into the intervention. A single video session was shown to participants in the video only intervention group. The same video and additional SMS text was presented to participants in the SMS + video intervention group. The control group received no intervention The results showed that both intervention formats (video only and SMS+video) were effective in improving knowledge on risk factors. However, the SMS+ video was more efficient because the SMS component provided an additional positive effect in increasing knowledge on the risk factors. The findings also indicate that mobile SMS messages coupled with video had an incremental impact on CC risk factors awareness. This was because of the SMS factor in the intervention, was found to be a necessary condition to increase knowledge on cervical cancer.

Also, Indracanti, Berhane, Minyamer, (2018) employed a pre and post intervention studies to assess the effect of mobile messages application on cervical cancer knowledge among 283 university students aged between 17 to 30 years in Ethiopia. The findings revealed that at baseline,

University of Ghana http://ugspace.ug.edu.gh

only 41% of the participants said they had heard of cervical cancer. This increased to 89% after the intervention. Also, level of awareness on the prevention of cervical cancer increased at post-intervention compared to pre- intervention (50% versus 13%). Again, there was a statistically significant improvement in general knowledge of CC (risk factors, symptoms, methods used in screening, and vaccine) among all students at post-intervention compared to baseline knowledge levels. Furthermore, it was identified that age, year of study, and family net income were significant explanatory factors for overall baseline knowledge levels, while the sole independent variable significant for overall increase in knowledge levels following education intervention was year of study

Findings of the above studies showed that SMS and WhatsApp made significant improvement in creating awareness about cervical cancer.as well as increased general knowledge about the cervical cancer risk factors, symptoms and methods of screening (Bhochhibhoya et al, 2021; Indracanti, Berhane, Minyamer, 2018; Lemos et al., 2017; Lee, et al. (2014). Therefore, it may be effective tool in increasing knowledge.

2.11 Effect on mhealth (SMS and WhatsApp) on cervical cancer screening uptake

The effect of MHealth interventions (SMS and WhatsApp) have been investigated by a couple of studies. However, these studies have reported varying results on the effect of SMS and WhatsApp on cervical screening uptake. While some studies reported that SMS and WhatsApp interventions improve cervical screening uptake, (Wanyaro and Kabiru,2017; Bhochhibhoya et al, 2021; Lee, et al. (2014). Others found that SMS and WhatsApp interventions did not enhance cervical screening uptake (Linde et al., 2020; Adamu, et al., 2012; Rossman et al., 2021). In addition, in settings where there was a national screening program, such as was found in UK, Sweden, and Kenya, SMS reminders were employed to prompt women of their impending screening appointment. (Kerrison et al., 2015; Eaker et al., 2004; Wanyaro and

University of Ghana http://ugspace.ug.edu.gh

Kabiru, 2017). This initiative was found to be effective in increasing screening uptake among hard-to-reach populations.

A randomized controlled trial with intervention and control group by Linde et al., (2020) assessed the effect of one-way text- messaging on follow up cervical screening attendance using HPV DNA testing among 705 HPV-positive women. The intervention group received one-way text messages, and the control group received no text messages. They reported an increase in cervical cancer uptake among the intervention group compared with control though it was extremely low within 14 months. From the results, it was evident that one-way text message did not improve follow up screening attendance. They recommended the use of phone calls or outreach services that involve HPV testing at home than the use of one-way text messages and repeat screenings at the clinic. In addition, a systematic review by Rossman et al., (2021), identified that technological challenges of connectivity and coverage issues reduced the success and reliability of text messages to women and phone calls which might have affected uptake.

A randomized control trial in Sweden that studied different methods of reminder to increase women's compliance for cervical screening program found that SMS reminder increased cervical screening uptake by 31.4% and the combinations of written reminder plus SMS reminder increased uptake by approximately 50% within 12 months (Eaker et al., 2004). Kerrison et. al. (2015) conducted a randomised control trial in a sample of 2240 women who were receiving their first breast screening. The intervention arm made of 1122 women reported a significantly higher first appointment screening uptake than the control group (1118) who received no sms reminders A similar observation was reported by Wanyaro and Kabiru(2017) who also used a randomised control trial in Kenya They also observed SMS reminders significantly increased CCS attendance compared to no reminders.

University of Ghana http://ugspace.ug.edu.gh

Mhealth intervention studies by Bhochhibhoya et al, (2021) which focused on the use mobile messages as reminders to increase knowledge and improve uptake on cervical screening by using text messages revealed that cervical cancer screening attendance among women in the intervention group, showed a significant increase as compared to the control group.

According to these findings, mHealth-based mobile phone interventions employing SMS may be a useful way to improve cervical cancer screening uptake. Though varying degrees of success rates were reported, it made a positive impact among hard-to-reach population of women.

2.12 Conclusion

This chapter sought to review literature relevant to the objectives of the study. It began with an overview of cervical cancer, looked at the burden of cervical cancer. It further looked at cervical cancer screening and methods available in LMIC specifically in Ghana. It also discussed mhealth applications in healthcare and reported on the effect of SMS intervention on cervical screening and knowledge.

From the literature, it can be deduced that, several studies have used SMS text message and demonstrated its feasibility on cervical cancer screening uptake and knowledge. However, the application of WhatsApp message on cervical cancer screening uptake and knowledge is scarce. Nevertheless, studies conducted on WhatsApp as a communication intervention concentrated on breast cancer screening has been identified in the literature. Also, the few studies identified on the application of SMS on cervical cancer screening uptake and knowledge were carried out in high income countries, but none has been conducted in Ghana. This is the Gap that this study can help fill in the setting of Accra Metropolis in Ghana. It is expected through this study, many teachers in Accra Metropolis who hitherto had not heard of cervical cancer and cervical screening will be equipped with the necessary knowledge and confidence to take up cervical screening.

University of Ghana http://ugspace.ug.edu.gh

CHAPTER THREE

METHODS

3.1 Study Area

The study was carried out (in two selected sub-metropolises) in Accra Metropolis in the Greater Accra Region. Accra is the capital town of Ghana. It is bordered in the north by the Ga West Municipality, in the south by the Gulf of Guinea, in the west by Ga South . La forms the eastern border (GSS, 2014) Accra Metropolitan Area is one of the most populated areas in the country Ghana. It has a total projected population of 4,613,637 people; females form more than 50% of the population in Accra and 2,264,791 of females were above age eleven years (GSS, 2014).

Accra is a large metropolis and the most urbanised city in Ghana. Over three decades, Ghana's urban population has more than tripled, increasing from 4 million to about 14million (The world Bank, 2015). The city is experiencing a rapid growth, estimated at 4.4% per annum (AMA Composite budget, 2019). This rate of urbanization in Accra Metropolitan Area is one of the fastest in West Africa (World Bank report 2010). As a result of urbanization, Ghana's annual Gross Domestic Product(GDP) (monetary value for finished goods and services) has grown rapidly, averaging 5.7 percent. On the other hand, urbanization in Accra has resulted in congestion, increasing slum settlements and increased inability of various institutions including health and education, to cope with the fast growth (The world Bank, 2015).

There are 11 sub-metropolitan areas in Accra: Ayawaso East, Ayawaso West, Ayawaso Central Ablekuma Central, Ablekuma North, Ablekuma South, Osu Klottey, Aseidu Keteke, La, Okaikoi North and Okaikoi South (Ayawaso West Municipal Report, 2019). However, some institutions still use the six major sub-metropolises in their day-to-day administrative work (World Bank report, 2010). Accra was selected for the study because it has high incidence of cervical cancer cases compared with the remaining regions in Ghana (Nartey et al, 2017).

University of Ghana http://ugspace.ug.edu.gh

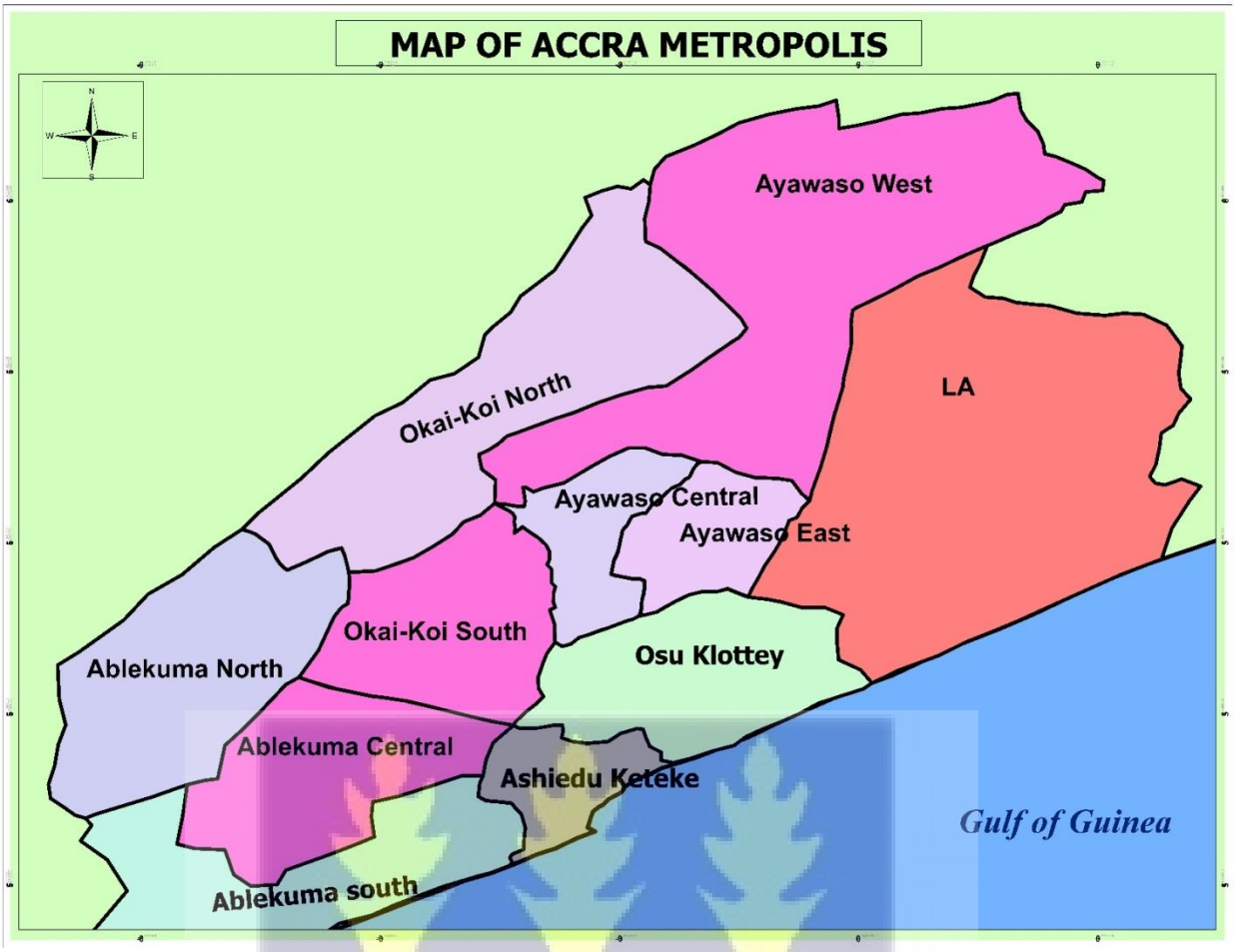

Figure 3.1: Map of Accra Metropolis

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

3.1.1 Osu Klottey

The study was conducted in two randomly selected sub-metropolitan areas, namely: Osu Klottey and Ayawaso. Osu Klottey encompasses three communities. Namely, Adjaben, Osu and Adabraka. Osu Klottey "is one of the Ga communities in Accra, with people from different ethnic group in Ghana present. It has a population of about 124,000 people. The sub-metropolis is bounded on the north by the Odo Bridge and the Ring Way East and Central highways. The south is bounded by the Atlantic Ocean and the Graphic Road, and the east is bounded by La and Ring Way East respectively."

Health care is provided by a number of hospitals. These include polyclinics and regional hospitals. Notable among these are the Trust Hospital, Greater Accra Regional Hospital, Osu Maternity Home, and Accra Mental Hospitals. These also serve as geographical landmarks. For the year 2017, about 15 Junior High Schools and 15 primary schools in Osu Klottey participated in School Health Services under the Ghana Health Service (Osu Klottey Sub metropolis Heath directorate, 2017).

3.1.2 Ayawaso

The Ayawaso sub- metropolis (sub- district) has the largest land area and population in Accra. It consists of three sub– districts namely Ayawaso Central, Ayawaso West, and Ayawaso East. It is bounded in the north by Ga District and GIMPA and in the South by Osu Klottey sub district, Ako- Adjei Interchange down to Kwame Nkrumah Circle. It shares border in the east with Kpeshie sub district and in the west with Okaikoi south (Ayawaso sub- municipal directorate report, 2018).

Ayawaso is densely populated. Ghana Statistical Survey (2016), projected the population of

University of Ghana http://ugspace.ug.edu.gh

Ayawaso to 527,331. The occupation of the people in Ayawaso varies widely. Most of the women are traders whilst majority of the men are artisans (e.g., masons and auto-mechanics among others). The settlements in Ayawaso are influenced by the socio- economic status of the people. For example, Civil servants with low income live in places like Nima–Maamobi, Alajo and Kotobabi, while high income earners (Private and government workers) live in suburbs including Roman ridge, Airport residential area, Kanda and Legon. (Ayawaso sub- municipal directorate report, 2018)

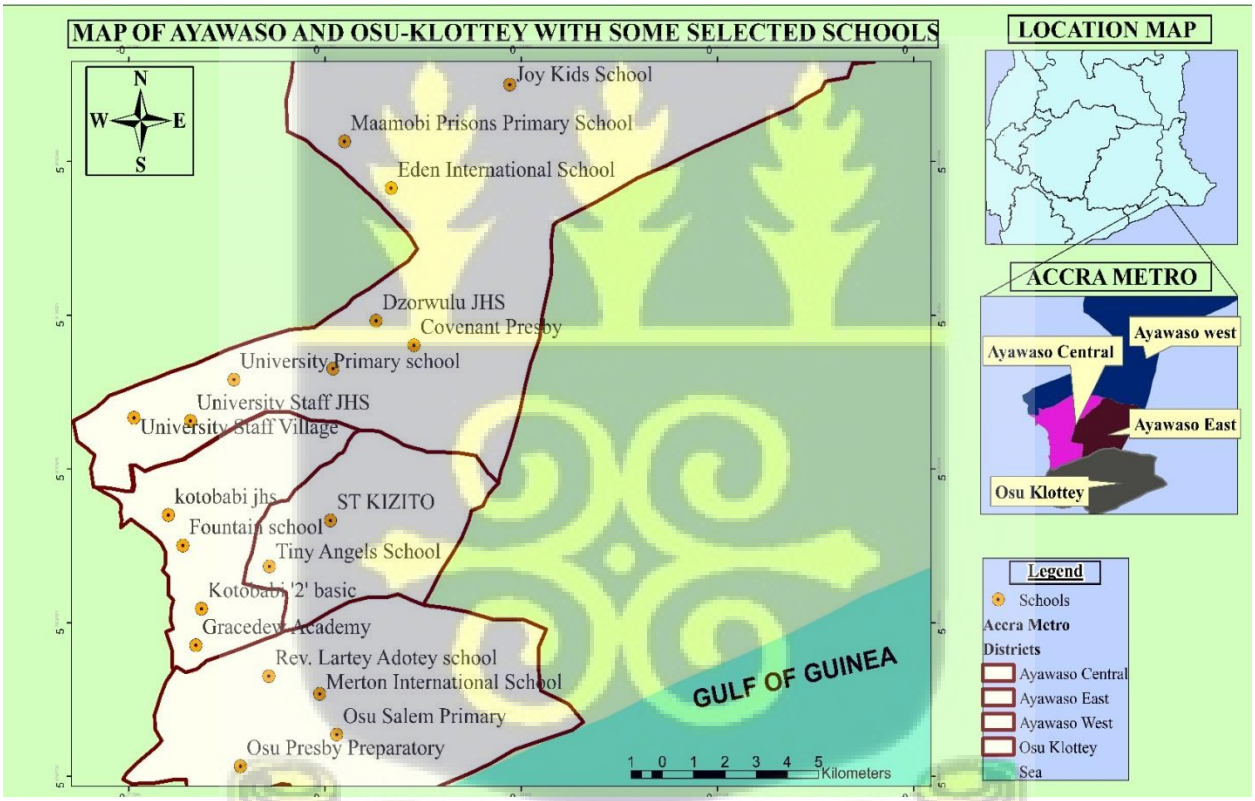

Figure 3.2: Map of Ayawaso and Osu- Klottey with some selected schools

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

3.2. Study Design

This study employed cluster randomised design with baseline and endline stages (Zhang, Xu, Ouyang, 2021; Creswell, 2004), in which schools (cluster-naturally existing groups), were assigned into intervention and control groups. The choice of this design was informed by the main outcome of the study (cervical screening) and by the nature of the intervention under investigation. This was followed by two cross- sectional surveys. One at baseline and the other at endline in both the intervention and control groups. The baseline survey was conducted between September and November 2018. The endline cross- sectional survey was conducted between March and August 2019. Whilst the SMS and WhatsApp messages (interventions) were conveyed between December and February 2019. Each intervention arm was compared with control to ascertain the impact of the intervention. This study had three intervention arms with control as shown in the following diagram:

Diagram of Study Design

Group A: CR ——— O ——— X ——— O

Group B: CR ——— O ——— X ——— O

Group C: CR ——— O ——— X ——— O

Group D CR ——— O ——————— O

Key: CR represents cluster randomization

O represents measurement

X represents the treatment of a group to intervention

(Diagram: Adapted from Creswell, 2004)

University of Ghana http://ugspace.ug.edu.gh

In addition, it has been reported that to change complex behaviour such as non- attendance of screening, individual assignment was not adequate. Therefore, cluster randomization was preferred (Crespi, 2016).

The limitation of cluster randomized design is that participants within anyone one cluster (schools) are more likely to respond in a similar way and thus do not act independently. This lack of independence leads to loss of statistical power in comparison to individual randomized trial (Hans, et al., 2005). However, the sample size calculation of this study increased the sample size by an inflation factor called the design effect (20%) to address this defect.

3.2.1 Study Population

The study population included all female teachers in public and private schools aged in Osu-Klottey and Ayawaso. Female teachers were chosen for this study because, they were educated could read and understand the messages used in the intervention in this study, the prevalence of cervical screening uptake among female teachers is very low (Adogu, et al., 2015). Also teachers formed an established group that could be followed up throughout the stipulated period of study with minimal disturbance to their work. Further, Female teachers in most of the schools, as part of their job schedule are involved in guidance and counselling, sex education, and support the overall well-being of students.

3.2.2. Inclusion Criteria

Any female teacher between 24 to 65 years who was sexually active, teaching in any public or private schools in Osu Klottey and Ayawaso sub metropolises during the period of the study, who had daily access to a mobile phone with a charger and was able to receive and read SMS text-message or WhatsApp

University of Ghana http://ugspace.ug.edu.gh

and was willing to participate was eligible for the study. The age range of 24 to 63 years falls within the age group for cervical screening in Ghana (Ghana Health Service Report, 2011).

3.2.3. Exclusion Criteria:

Any female teacher who qualifies to be part of the study but at the time of interview was not feeling well or absent from school was excluded

3.2.4. Sample size calculation

To estimate percentage of teachers who undertook cervical cancer screening (CCS)

as stipulated by objective 1. The number of schools required was given by sample for comparing difference in proportion

Equation 1

$$n = \frac{(r+1)Z^2_{1-\frac{\alpha}{2}}P(1-P)}{V^2} \times def$$

Where n = The number of female teachers to be sampled, $p =$ 12.9% is the anticipated proportion of female teachers in the schools that have previously been reported to undertake cervical screening (Adogu, et al, 2015),

$deff =$ 1.7 is the design effect. The design effect reflects the effects of stratification and degree of clustering used in the school survey (teachers clustered within school).

$Z_{1-\frac{\alpha}{2}} = 1.96$ is the standard normal estimate at the 95 % level of confidence.

$V =$ 0.05 Assumed margin of error of 5%,

r =0.20 Individual teacher non-response rate (r) of 20.0%,

University of Ghana http://ugspace.ug.edu.gh

The estimated number of female teachers required for the study is **354**. (Control arm=89 teachers, SMS=89 teachers, WhatsApp=89 teachers, both WhatsApp and SMS=89 teachers).

Assuming that the average number of teachers in the schools is 10, and 50% of the population of teachers are females, the total number of schools required is 71 that is

$[\mathbf{354}/(\mathbf{10} \times \mathbf{0.5})]$= **71**

The second was based on sample size estimation procedure required for evaluating impact of health intervention (specific objective 3 and 4). To verify whether the integrated communication intervention (both SMS and WhatsApp) is more effective from statistical and programmatic point view compared to a standard communication intervention which uses only SMS or WhatsApp, or a scenario where there is no intervention at all, sample estimation for superiority trial used.

The sample size needed to quantify the impact of communication strategy on CCS uptake (binary outcome) is as follows

$$n = \frac{1}{2}\left(\frac{Z_{\alpha/2} + Z_{\beta}}{arcsin\sqrt{p} - arcsin\sqrt{P_0}}\right)^2 \times deff \cdots\cdots (2)$$

Substituting the parameters above, resulted in a final sample size was 280.

To evaluate the effect of communication strategy on knowledge of cervical cancer (quantitative continuous outcome measure) the sample size is given by:

$$n = 2\left(\frac{Z_{1-\alpha} + Z_{1-\beta}}{d}\right)^2 \times S^2 \times deff \cdots\cdots (3)$$

Final sample size was 260

University of Ghana http://ugspace.ug.edu.gh

n is the number of teachers to be enrolled for each intervention arm; p is the proportion of screening uptake via SMS, WhatsApp, or control arm group; P_0 is the proportion of screening uptake among the integrated communication group (both SMS and WhatsApp); $Z_ß$ is the power of the study, d is the real difference in cervical cancer knowledge score between teachers who received the integrated intervention and the comparison group; S is polled standard deviation of both groups. Sample size for equations 2 and 3 were not used because they were both smaller than the sample size estimate from equation 1. This explains why the study used the final sample size obtained from equation 1.

3.2.5. Sampling technique

Multistage stratified-cluster random sampling technique was employed. "The first stage involved random selection of two sub-metropolises, namely Ayawaso and Osu-Klottey in six sub-metropolises in Accra. After writing the names of all the six sub-metropolises on pieces of paper, two were picked at random based on limited budget."

Secondly, there were four strata from which schools were randomly selected. These strata were: Public schools in Ayawaso, Private schools in Ayawaso, Public schools in Osu-Klottey and Private schools in Osu-Klottey (From Kindergarten to Junior High schools within the two communities under Ghana Education Service). Each school was assigned a random number. Schools with odd random numbers were selected. A total of 71 schools were selected but 61 participated. The selection of the schools was done in collaboration with the Statistics Department of Ghana Education Service.

The 61 participating schools were in four sub-metropolises namely: Ayawaso Central (17 schools) Ayawaso East (14 schools) Ayawaso West (15 schools) and Osu Klottey (15 schools).

University of Ghana http://ugspace.ug.edu.gh

The names of the four sub- metropolises were written on pieces of paper and picked blindly at random. The first to be selected was assigned to control. The second to be selected was assigned to SMS only. The third to be selected was assigned whatsApp only. The fourth draw was assigned to SMS + WhatsApp arm. Finally, the three arms with control were: No intervention(Ayawaso West), SMS only(Ayawaso East) , WhatsApp only(Osu Klottey) and integrated (WhatsApp + SMS)(Ayawaso Central). Five teachers were supposed to be selected per school but in some cases only one female teacher consented and in others cases some teachers did not meet the inclusion criteria so were exempted. In total 340 teachers were contacted in the 61 consenting schools. 41 declined participation, 27 gave no phone contacts, 10 gave wrong phone contacts, 8 were missed due to internet connectivity. and 17 did not meet the inclusion criteria of the study accounting for 29 % non-response rate.

3.2.6. Data collection Technique

The data for the study was collected with a structured questionnaire

3.2.6.1 Data Collection Tool

The questionnaire was developed based on literature review in the absence of a validated tool for cervical cancer (Ombech. Muigai, Wanzala 2012; Denny-Smith, Bairan, Page 2006). It consists of 61 closed ended and open-ended questions. The items were divided into four sections. Section A assessed the socio-demographic and reproductive health characteristics of participants. Section B measured the knowledge on risk factors for cervical cancer (CC). Section C assessed knowledge on CC and CCS. Section D calculated the attitude based on the health belief model. This assessed perceived susceptibility, perceived severity, perceived barrier and self-efficacy with a number of questions under each subset. The questionnaire was developed following existing practices.

University of Ghana http://ugspace.ug.edu.gh

Including reviewed literature review and review by subject expects (Linde et al, 2017; Ombech. Muigai, Wanzala 2012).to ensure all the variables and issues of interest to this study was appropriately addressed.

3.3 Pre-data Collection Activities

3.3.1 Pre - testing

A pre-test was conducted to assess the clarity, systematic flow of questions, and correct any ambiguity in the questionnaires. Ten (10) teachers in 2 selected schools in La Nkwatanang municipality (5 teachers per school). La Nkwatanang was chosen because the teachers had similar characteristics with the intended study participants. Feedback was used to review the tool before implementation. Also, all the educational messages were pretested via SMS text messages and WhatsApp for feasibility.

3.3.2 Training of Research Assistants (Field staff)

A two-day training was carried out for the field staff (research assistants) on data collection processes involved in the study. The data collection team consisted of 10 university graduates with experience in data collection. The training covered general knowledge in research field work, background of the study, the study area, aim, objectives, the research design, sampling issues, and ethics of research.

The research assistants were taken through administration of the questionnaires. All sub-sections of the questionnaire were explained. The field staffs were paired and given opportunity to administer the questionnaire to each other. Importance of working in pairs was explained. Also, the importance of administering questionnaires only after respondents have accepted voluntary

University of Ghana http://ugspace.ug.edu.gh

participation and given written informed consent was emphasized. Number of schools to be captured by each pair was finalised.

3.3.3 School Entry

First, permission was obtained from the Accra Metropolis Directorate of Ghana Education Service (GES). At the school level, permission was obtained through the administrative heads of the schools. Authorization to administer questionnaire in the 71selected schools was obtained through the administrative heads, namely: the circuit supervisors before the head teachers were contacted. In their absence of the head teacher, the research team postponed their visit to the school.

In few instances, visit to the circuit supervisors coincided with meeting of the circuit supervisor and head teachers in the circuit. This offered the research team the opportunity to meet a cross-section of head teachers. In all the meetings, the principal investigator (PI) or research team gave an overview of the study, sampling method, voluntary participation, risk and benefits and confidentiality issues were clearly explained. Questions and concerns raised by any head teacher or any teacher was addressed satisfactorily. However, 10 schools out of the 71 refused participation in the study.

3.4. Baseline cross-sectional survey

Baseline survey was conducted between September and November 2018. Before the onset of the survey, relevant information on the study was communicated to all teachers and head teachers in all 71 selected schools, however 10 headteachers did not consent. In the 61 participating schools the paper- based questionnaire was self-administered by the respondents. The questionnaire was administered in english language which is the preferred medium of teaching and communication

University of Ghana http://ugspace.ug.edu.gh

in Ghana.

Data collected at baseline consisted of the socio-demographic data, level of awareness, knowledge on cervical cancer and screening, CC risk factors and perception of female teachers. It generated primary data on the prevalence of cervical screening uptake and factors associated with cervical screening uptake among teachers in Accra Metropolis**.**

3.4.1. SMS and WhatsApp Messaging Intervention

After baseline survey, the phone numbers of teachers in the intervention arms were extracted from and questionnaire and verified through phone calls. The confirmed phone numbers of teachers in the SMS only and the SMS +WhatsApp arms were extracted into excel and uploaded into the Hubtell Ghana Platform. Two WhatsApp groups were created on the PI's personal phone. Namely the WhatsApp only group and the SMS +WhatsApp group.

Beginning from 2nd December to 2nd February, 2019, three separate WhatsApp and Short message service (SMS) messages were sent every week for 12 weeks (3 months) to the personal phones of female teachers. The messages were sent from Wednesday to Friday to all three intervention arms: SMS only arm, WhatsApp only arm and SMS + WhatsApp arm. The same messages were deployed in each arm except the control. The messages were delivered at the morning break period for schools (9am). Over, 6,000 text messages were sent to the personal phone numbers of female teachers in the intervention arms SMS only, WhatsApp only and SMS + whatsApp. To prevent contamination, ground rules were set at beginning of the intervention to discourage sharing of the messages across platforms. This was to prevent the possibility of messages reaching the teachers in the control schools

The principal investigator (PI) with the help of Hubtel Ghana, scheduled the delivery of the text

University of Ghana http://ugspace.ug.edu.gh

messages at predefined intervals to the female teachers' personal phones. Subsequently, the Hubtel Ghana platform generated transmission reports which displayed the number sent and rejected messages. Transmission rate was presented in a pie chart and it recorded 20% rejection in the 8th week which increased to 60 % in the 10th week However, the WhatsApp platform showed all participants received messages sent. A follow up by the principal investigator to Hubtel Ghana revealed that, the high rejection rate was due to internet connectivity of some telcos company in Ghana and switched off phones. However, it was confirmed that the Hubtel Ghana platform would automatically resend the messages.

All participants stayed in the intervention till the end of the study. Except one who voluntarily opted out. Customized notebooks with the displayed picture (dp -Campaign message) on the WhatsApp platforms was given to the participants in the control arm at the end of the study, during endline survey. This was to sensitize them to take up cervical cancer screening. This was necessary because all the teachers; in the intervention and control, were equally at risk of cervical cancer

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

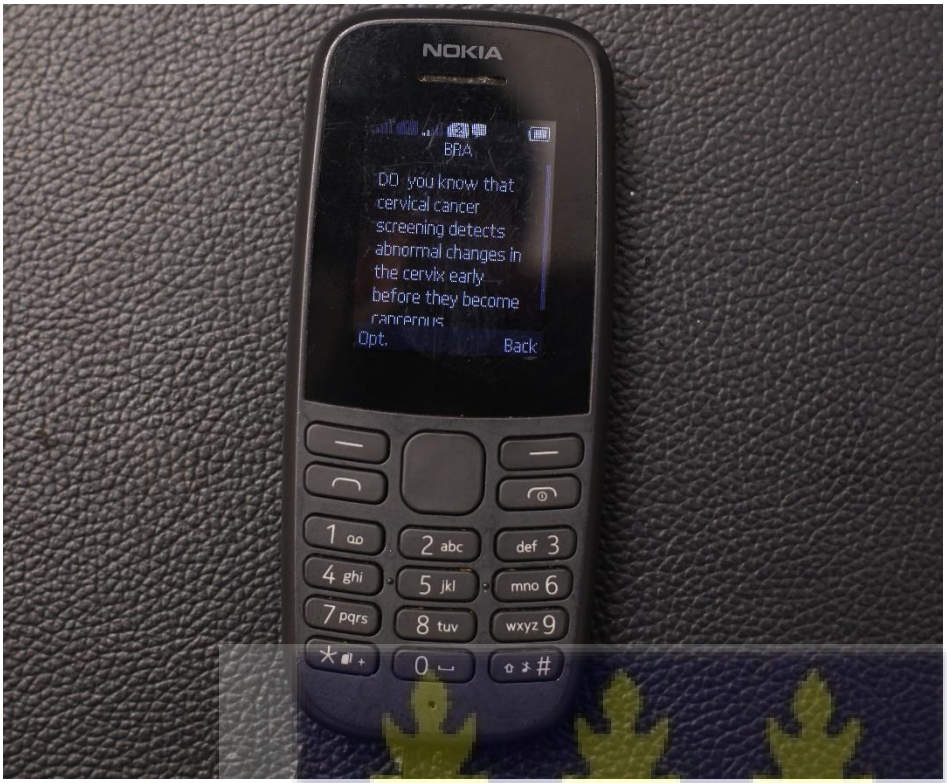

Figure 3.2: Picture of a phone with SMS messages

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

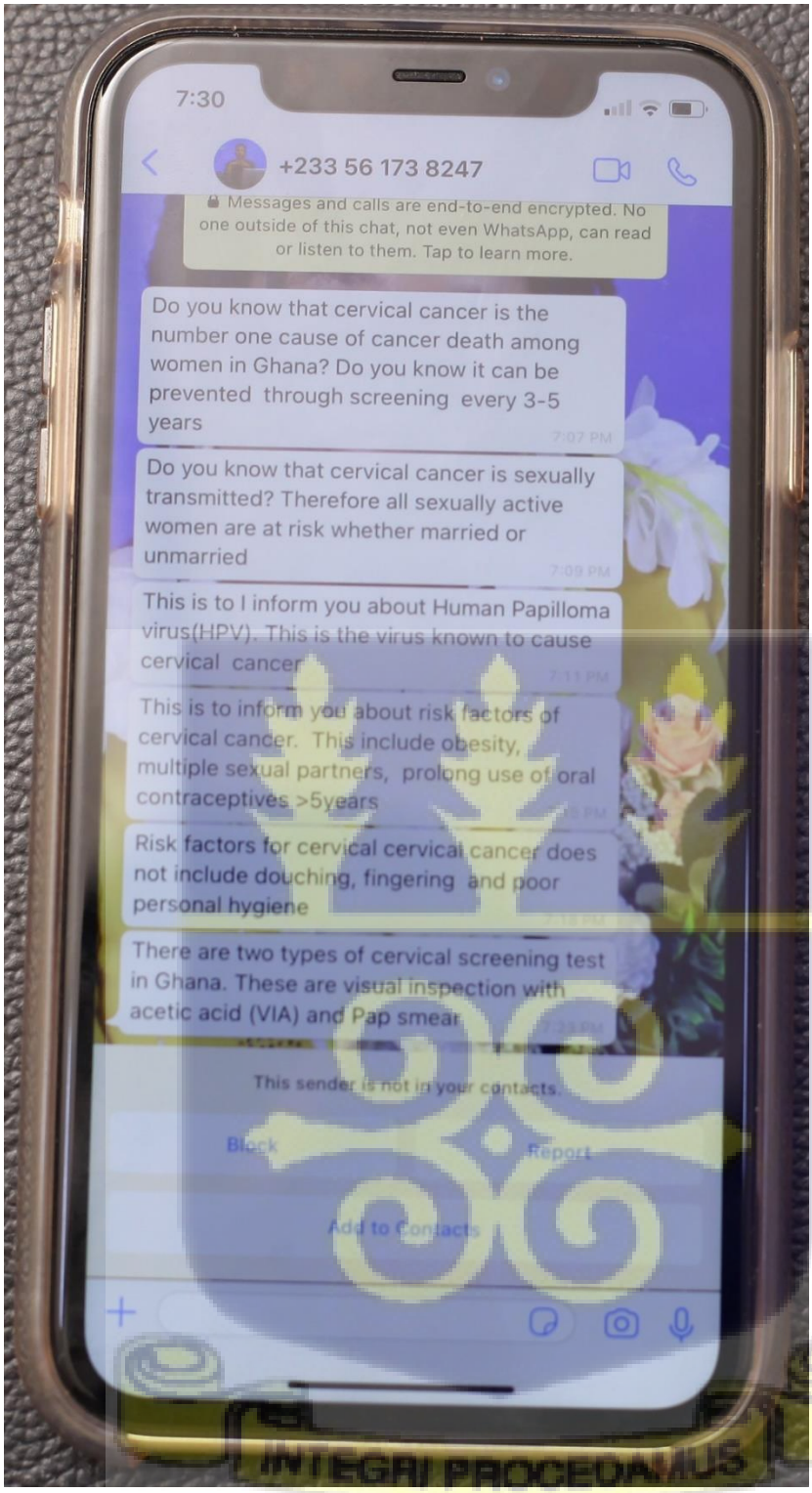

Figure 3.3: Picture of a phone with WhatsApp messages

University of Ghana http://ugspace.ug.edu.gh

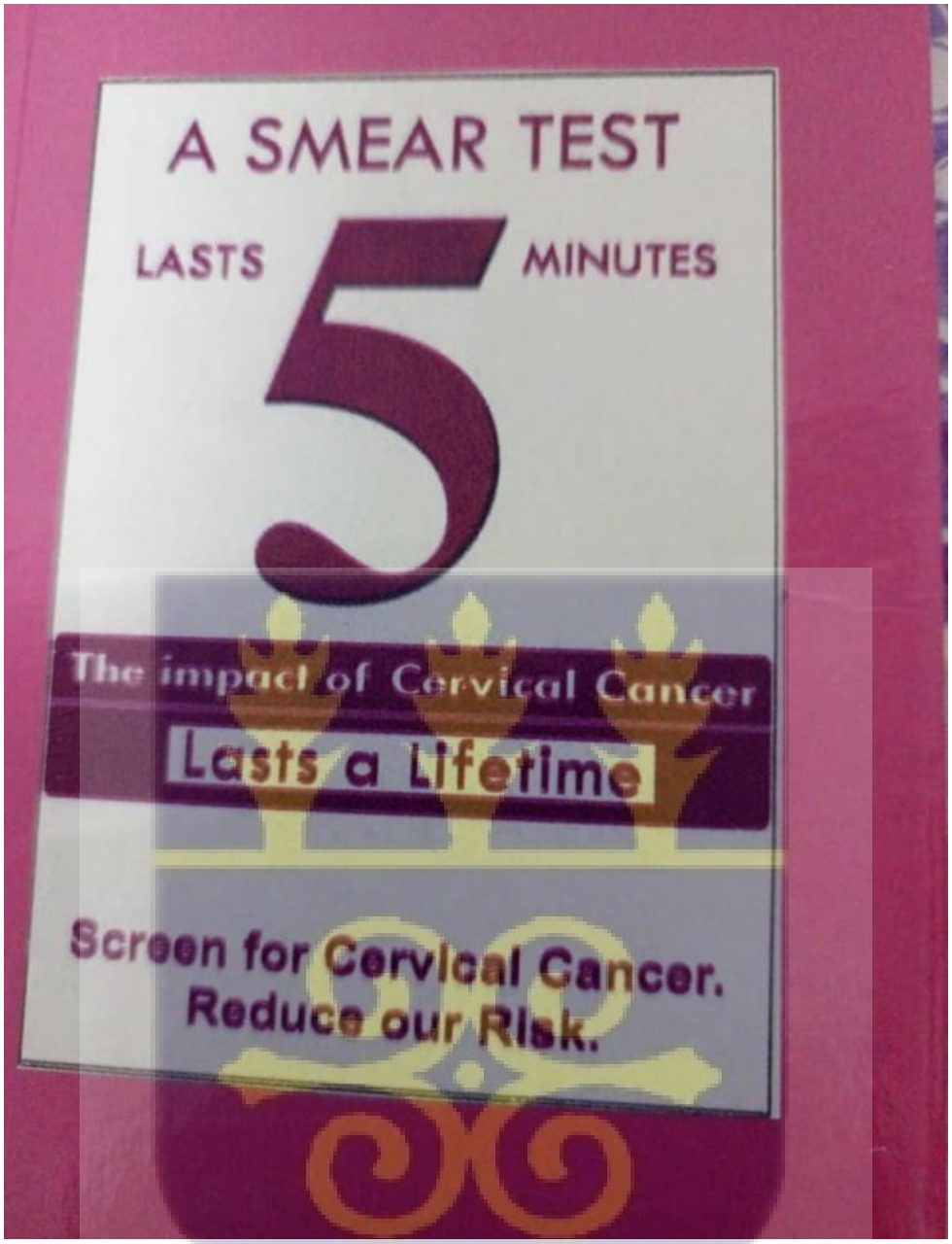

Figure 3.4: Picture of a book given at the end of survey to teachers in control group

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

3.4.2 End line cross- sectional survey

Post intervention survey was conducted between March and August, 2019.This lasted longer (6months) than the baseline and intervention phase, though, it followed immediately after the 12 weeks of communication intervention. This was because some of the female teachers who were in the study were on leave and a few others were attending short courses. The same questionnaire was used in baseline and endline cross- sectional surveys.

Those who took screening in various hospitals communicated to participants and tested positive during screening I believe received treatment as stipulated by the Ministry of health policy for the management of positive cervical cancer screening test.

3.5. Description of the SMS and WhatsApp Program

The text message program was created on the whatsApp and a local bulk messaging company called Hubtel Ghana in Accra. The goal of sending messages was to improve female teachers' knowledge on cervical cancer and cervical cancer screening as well as promote cervical cancer screening uptake. Sixteen (16) messages were developed in English language. The program was designed to disseminate three (3) messages every week from Wednesday to Friday at 9am for twelve weeks.

3.5.1. The Development of Messages

The messages were adapted from UK cervical screening programme, American CDC programme and some constructs of the health belief model. Before the development of messages, baseline survey was carried out to assess the knowledge and factors affecting screening uptake. This was found to be inadequate. Educational messages developed centred around the burden of cervical

University of Ghana http://ugspace.ug.edu.gh

cancer, risk factors, HPV infection, types of cervical screening in Ghana, symptoms of cervical cancer, location of screening centres and benefits of cervical screening. To ensure content, construct validity and creation of a strong health promotion message, the developed messages were reviewed by my subject experts who have carried out numerous studies in cervical cancer in Ghana. It was further reviewed by a psychologist and a clinician who made inputs for alternate wording and identified messages that were not clear. The psychologist and clinician confirmed message's ability to capture participants' attention and promote participants' willingness to stay throughout the 12 weeks intervention as well as promote screening uptake.

The draft of 16 messages were pretested among 10 female teachers in La Nkwatanang municipality. Five from private and five from a public school. For clarity, systematic flow of messages and correct any ambiguity. Their inputs were used to revise the messages before the main study.

3.5.2 Messages Disseminated

Number	Messages Broadcasted
1	You have been selected for the cervical cancer study among teachers in Accra. This will involve receiving messages every Wednesday to Friday for 12weeks. Please read the messages and take action. Do not inform non-participants
2	Do you know that cervical cancer is the number one cause of cancer death among women in Ghana? Do you know it can be prevented through screening every 3-5 years?

University of Ghana http://ugspace.ug.edu.gh

3	Do you know that cervical cancer is sexually transmitted? Therefore, all sexually active women are at risk whether married or unmarried?
4	Do you know that having cervical cancer screening every 3-5 years decrease your chance of getting cervical cancer?
5	This is to inform you about Human Papilloma Virus (HPV). This is the virus known to cause cervical cancer
6	This is to inform you about risk factors of cervical cancer. This includes obesity, having multiple sexual partners, prolong use of oral contraceptives (>5 years)
7	Additional risk factors for cervical cancer include HIV infection, Human Papilloma Virus smoking and many children (> 4)
8	Do you know risk factor for cervical cancer does not include douching, fingering and poor personal hygiene?
9	Do you know that cervical cancer screening detects abnormal changes in the cervix early before they become cancerous?
10	There are 2 types of screening test in Ghana. These are visual inspection with acetic acid (VIA) and Pap smear
11	VIA also called vinegar test is good for women under 45 years and Pap smear test is also recommended for women above 45 years.
12	Visual inspection with acetic acid (VIA) test results are instant but and Pap smear test may take 2 -6 weeks. This because Pap smear require a laboratory analysis

University of Ghana http://ugspace.ug.edu.gh

13	You may have your screening test at the University Hospital Legon, 37 Military Hospital, Greater Accra Regional Hospital, SSNIT Hospital and Marie Stopes
14	It is recommended that you refrain from douching and sexual intercourse the night before your test. It is best to screening at the end of your menses
15	It is advised that healthy women with no symptoms screen for cervical cancer. When symptoms like painful sexual intercourse, bleeding after sex and menopause show up, it may be too late
16	Cervical screening takes only a few minutes it can save your life. Make an appointment for your screening today.

3.6. Data Sources

Data was collected from female teachers between the ages of 24 to 63 years in selected schools approved by GES. Data was collected using structured questionnaire which contained closed ended and open-ended questions.

3.7 Field Work

Regular meetings were held daily at close of day during pre-intervention survey and bi-weekly at post intervention survey to discuss progress of work. Further strategies and good field work practices were championed to maximize contact hours with teachers without disrupting teaching

University of Ghana http://ugspace.ug.edu.gh

sessions. This includes, scheduling all follow up visits and picking up of questionnaires, at the convenient time to the teachers. Either before morning school assembly, at morning or lunch break and after schools

Quality control checks were made by researcher to include follow up visits and cross checking some responses on the questionnaire to enhance internal validity. Data collected were kept locked a computer with a password.

3.8 Data Set

Two sets of data were generated in this study. The first set of data was collected at baseline and the second was generated at the end-line survey from both the control and the three intervention groups. A time variable was introduced to differentiate baseline data at time one (T1) from endline data at time two (T2). In addition, three sets of codes were assigned. The first code was assigned to ensure that data of a particular participant in the baseline study was linked to the same participant at endline. The second code was assigned to separate the three arms of the intervention and the control. Likewise, the third code was assigned to differentiate those who took the screening services from those who did not. Then, the two data sets were merged.

3.8.1 Data Management

Data from self-administered paper-based questionnaire was used in the surveys, this was first captured in Excel after successful completion of the surveys. Afterwards, it was imported into STATA version 16 for analysis. The data set was cleaned by running summaries of totals for number of observations, reviewing range of values for all 61 questions. Frequencies were ran to

University of Ghana http://ugspace.ug.edu.gh

identify outliers. Variable such as age of participants was entered with the date of birth to estimate the correct age at the time of survey."

3.9 Statistical Methods

3.9.1 Dependent Variables (Primary and Secondary Outcome Measures)

This study had two main outcome measures. These were cervical cancer screening (CCS) uptake and knowledge on cervical cancer (CC). The primary outcome measure was cervical cancer screening (CCS) uptake. This variable was a binary outcome variable. Participants were asked *"Have you ever been screened for cervical cancer"*. The response *"Yes=1"* and *"No=2"* was recoded as "*Yes=1"* and "*No=0"* due to the objective of the study.

The secondary outcome measure was knowledge of cervical cancer and screening. This was a quantitative continuous variable measured on a scale of 0-100%. The higher the score the higher the level of knowledge on cervical cancer and cervical cancer screening.

Knowledge on CC and screening had two sub-domains; knowledge on cervical cancer and knowledge on cervical cancer risk factors. For knowledge assessment on cervical cancer risk factors, participants were asked to choose the correct answer from 12 items that increases a woman risk to CC namely: *abortion, smoking, douching and fingering; poor personal hygiene, HPV infection, obesity, oral contraceptives, having large number of children (>4), multiple sexual partners, HIV/AIDS infection, and a family history of cervical cancer*. A correct answer carried 1 mark and wrong response scored 0. The scores for this variable were converted to percentages and it ranged from 0-100% (Mean±Standard deviation=45.9±20.2).

Also, knowledge assessment on CC was assessed by asking participants; *Have you heard of cervical cancer; Cervical cancer is sexually transmitted; HPV is necessary for cervical cancer*

University of Ghana http://ugspace.ug.edu.gh

development; HPV infection affects only women; Cervical cancer can affect young women; Cervical cancer affects mostly women after 50; Women can die from untreated cervical cancer; Screening is done to diagnose cervical cancer; I need to screen every year; Screening to diagnose cervical cancer; screen to diagnose cervical changes before they become cancerous; Screening informs women about their health status and Screening is not necessary. A mark of 1 point was given to a correct answer using the 12 items. The scores for this variable were converted to percentages and it ranges from 0-91.7% (Mean±Standard deviation=61.3±13.1).

A composite knowledge variable was generated by combining the knowledge assessment on cervical cancer risk factors and screening. This was deemed appropriate to have a holistic understanding of the overall knowledge on cervical cancer (CC) and screening, among the participants**.** The composite score ranged from 0-87.5% and Mean±Standard deviation was 53.7±14.1. The intervention was a nominal categorical variable measured as: No intervention, SMS only, WhatsApp only, SMS+ WhatsApp**.**

3.9.2 Independent Variables (Other covariates)

Demographic factors considered in this study were age, marital status (married, single and divorced, separated, and widowed), educational level (JHS/SHS, training college and university), religion (Christian and Others (Islam and traditional)), parity was an open-ended question. Responses were recoded as none=0: 1-2 and 3+), condom use (yes or no), age at first sex (recoded as ≤ 24 and 25+) and number of sexual partners (recoded as ≤1, 2-3 and 4+).

University of Ghana http://ugspace.ug.edu.gh

3.9.3 Statistical Analysis

Two approaches to data analysis were carried out; namely descriptive with independence test of association and inferential analysis. Descriptive statistics was performed for the baseline data and chi-square test of proportional independence and Kruskal Wallis rank test was performed for all independent categorical and discrete variables respectively by the arms of the intervention (Control, Whatsapp only, SMS only and Whatsapp+SMS).

Before inferential analysis was performed, the study checked for continuous variables (knowledge assessment variable scores) normality and was recognized that, all the knowledge assessment variables were normally distributed. For this reason, the study employed ordinary least square (OLS) regression to assess all independent variables significantly influencing knowledge assessment scores and Poisson regression analysis on cervical cancer screening (CCS) uptake.

Since the outcome measures were binary, sensitivity analyses were conducted using Poisson, logistic probit regression models to determine how the effect size estimate varies with different estimation techniques. This study used the OLS, and Poisson regression analysis with difference in differences estimate and robust standard errors to quantify the impact of the intervention on knowledge and CCS uptake.

3.10 Quality Control

The following quality assurance processes were implemented to safeguard validity and reliability of information generated.

University of Ghana http://ugspace.ug.edu.gh

3.10.1 Expert Review of Question

The set of developed questionnaires were developed following existing practices including review by subject expects. The necessary amendments were made to ensure internal validity, correct flow of questions and right responses from the potential participants.

Further checks from various academic data bases were made to confirm non-availability of validated questionnaire for this study.

3.10.2 Pre-testing

The questionnaire was pre-tested among 10 participants in La- Nkwatanang municipality. First the headteacher's consent was sought. Next, the participants were contacted one-on-one in their respective classrooms and sometimes in the teachers 'common room for their consent. This was followed by administration of self- explanatory questionnaire. Data gathered confirmed knowledge deficit on cervical cancer and cervical cancer screening. The intervention was also tested for feasibility.

3.10.3 Training of Research Assistants

Before the start of data collection, research assistants were given a 2- day comprehensive training. To ensure the research assistants collected the accurate information in the private space of the participants. See section 3.3.2 for more detailed description.

3.10.4 Ethical considerations

The Study proceeded after obtaining ethical approval from the ethical review board of Ghana Health Service (GHS-ERC 004/08/18). Permission was sought from all institutions involved in the

University of Ghana http://ugspace.ug.edu.gh

study. These include The Ministry of Health Regional Director for Greater Accra, Ghana Education Service, Accra Metropolis Director, The Director of GARH and the Deputy Director of Nursing at GARH. The Director and The Deputy Director of Nursing, Military Hospital, The Director and The Director of Nursing, University Hospital, The Director and The Deputy Director of Nursing, SSNIT Hospital, and The Director of Nursing, Marie Stopes, Also Permission was taken from the heads of the 71 selected schools and their circuit supervisors before any contacts was made with teachers. Only respondents who consented to participate were enrolled after signing written consent form.

The ethical issues emphasized during the study included the following:

- *Confidentiality*: The questionnaires were self- administered at the convenience and in the private space of participants. All data were handled anonymously, codes were assigned to the questionnaires and all information were kept confidential. Extracted data were saved on a computer locked with password known only to the principal investigator. No names were mentioned in any report.
- *Voluntary participation/withdrawal*: Participation was voluntary. All participants were at liberty to withdraw at any stage of the research if they were no longer interested. There was no penalty for withdrawal from the study nor was explanation was required. This made was known. Also, each participant's written informed consent was mandatory before enrolment.
- *Interference with daily schedule*

  All meetings to collect filled questionnaire were scheduled and conducted at a time convenient to the teachers. This was either before morning school assembly, at morning or lunch break and after schools.

University of Ghana http://ugspace.ug.edu.gh

- *Potential Risks***:** There was no risk for participating in this study. However, participants might have felt uncomfortable answering some of the questions which may be a bit sensitive. Nevertheless, they had a choice not to answer any question that they felt uncomfortable with.

- *Compensation:* No renumeration (cash) was given to participants**.** As cash compensation would influence the responses and introduce bias.

- However Active participation required the purchase of 1,200 megabytes of data at 30 Ghana cedis for the 12 weeks intervention (3months). Eight hundred (800) megabytes of data was provided by the principal investigator. Four hundred (400) at the beginning and additional 400 megabytes at the end of the study (Information sheet, Appendix).
- *Benefits*: Participants benefited directly from this communication intervention because this study gave current information on cervical cancer and reproductive health issues. As well as inform them about the benefits of cervical screening and where to go for screening. In addition, they will receive SMS text or WhatsApp messages that will prompt them to go for screening. Findings from this intervention could serve as evidence for scale up among women with similar background**.**

University of Ghana http://ugspace.ug.edu.gh

CHAPTER FOUR

RESULTS

4.0 Introduction

This finding of the study is presented in this chapter. Primary data was collected from female teachers in Accra Metropolis to determine the effect of a communication intervention on knowledge of cervical cancer and cervical cancer screening uptake among female teachers in Accra Metropolis.

The chapter is organized into four main sections with sub-sections based on study objectives as follows:

1. Description of demographic characteristics of study participants (female teachers) in Accra Metropolis
    a. Prevalence of cervical cancer screening uptake among female teachers in Accra metropolis
2. Factors associated with cervical screening uptake
3. Effect of communication intervention on knowledge
4. Effect of communication intervention on cervical screening

4.1 Description of the study participants, cervical cancer screening practices, knowledge and assessment of the balance test at baseline

The baseline study involved 237 female teachers with an average age of 41.9 years in some selected educational institutions in the Greater Accra Metropolis. Three-fourths of the female teachers were married and approximately 72% of the teachers did do not use condoms currently and 47% reported having two to three sexual partners in life. Approximately 84% had university education. About 64% of the study participants had initiated sex on or before age 24. A detailed

University of Ghana http://ugspace.ug.edu.gh

frequency distribution of the study participants can be found in Table 4.1. The results from the Chi-square test of independence and analysis of variance showed that, baseline characteristics such as religion, number of sexual partners, knowledge on cervical cancer and overall knowledge were significantly different among study participants in the three arms of intervention (Table 4.1). Because of these differences that were observed during baseline, all the multivariable regression analysis adjusted for these differences in the estimation of the impact of the intervention. For all the other variables, the test of independence analyses did not show significant associations across the arms of the study, at baseline (p-value>0.05) (Table 4.1).

The overall knowledge of risk factors of cervical cancer among participants was low at 42.0%. But knowledge on risk factors did not differ among the three arms of the study at baseline (p=0.133; Table 4.1). The average knowledge score on cervical cancer was 57.9% at baseline but scores differed significantly across the study arms (p=0.005; Table 4.1). The overall knowledge score that combines the knowledge scores obtained from cervical cancer and the scores on risk factors was 50.1% and there was a statistically significant difference in the overall knowledge score across the study arms (p=0.006; Table 4.1**).** Approximately 17% of all participants had history of cervical cancer screening at baseline; there was no significant difference in cervical cancer screening across the study arms (p=0.127; Table 4. 1).

Table 4.1: Baseline characteristics of female teachers and assessment of the balance test

	Overall	**Arms of intervention**				
Variable		**Control**	**Whats App**	**SMS**	**WhatsApp +SMS**	**Test statistic(p-value)**
	n(%)	n(%)	n(%)	n(%)	n(%)	
Marital status						**11.26(0.081)$^{\chi 2}$**
Married	174(73.42)	55(82.09)	30(60.0)	30(75.0)	59(73.75)	
Single	49(20.68)	11(16.42)	17(34.0)	6(15.0)	15(18.75)	
DSW	14(5.91)	1(1.49)	3(6.0)	4(10.0)	6(7.50)	

University of Ghana http://ugspace.ug.edu.gh

Highest Educational level						**5.42(0.490)$^{\chi 2}$**
JHS/SHS	12(5.08)	5(7.46)	4(8.16)	1(2.50)	2(5.08)	
Training college	28(11.86)	10(14.93)	5(10.20)	6(15.0)	7(8.75)	
University	196(83.05)	52(77.61)	40(81.63)	33(82.50)	71(88.75)	
Religion						**9.85(0.020)$^{\chi 2}$**
Christian	213(90.64)	64(98.46)	47(94.0)	34(85.0)	68(85.0)	
Others	22(9.36)	1(1.54)	3(6.0)	6(15.0)	12(15.0)	
Parity						**12.08(0.060)$^{\chi 2}$**
None	35(15.28)	12(19.05)	12(24.0)	2(5.130	9(11.69)	
1-2	100(43.67)	21(33.33)	22(44.0)	23(58.97)	34(44.16)	
3+	94(41.05)	30(47.62)	16(32.0)	14(35.90)	34(44.16)	
Condom use						**1.03(0.793)$^{\chi 2}$**
Yes	65(28.14)	21(31.82)	15(30.0)	9(24.32)	20(28.14)	
No	166(71.86)	45(68.18)	35(70.0)	28(75.68)	166(71.86)	
Age at first sex						**4.73(0.193)$^{\chi 2}$**
≤ 24	146(63.76)	42(64.62)	37(74.0)	25(65.79)	42(55.26)	
25+	83 (36.24)	23(35.38)	13(26.0)	13(34.21)	34(36.24)	
Number of sexual partners in life						
Median(IQR)	2(1)	2(1)	2(2)	2(2)	1(1)	**12.96(0.005)^{H}**
≤1	98(44.55)	27(45.76)	13(28.26)	13(35.14)	45(57.69)	**14.79(0.022)$^{\chi 2}$**
2-3	103(46.82)	26(44.07)	26(56.52)	20(54.05)	31(39.74)	
4+	19(8.64)	6(10.17)	7(15.22)	4(10.81)	2(2.56)	
Ever screened for cervical cancer						
No	197(83.12)	57(85.07)	46(92.0)	33(82.50)	61(76.25)	**5.69(0.127)$^{\chi 2}$**
Yes	40(16.88)	10(14.93)	4(8.0)	7(17.50)	19(23.75)	
Knowledge on risk factors						
Mean±SD	42.02±(20.93)	42.30(21.54)	35.99(21.39)	44.37(21.79)	44.41(19.23)	1.88(0.133) $^{\mu}$
Knowledge on cervical cancer						
Mean(±SD)	57.93(13.53)	59.84(13.47)	51.50(16.12)	62.37(11.95)	58.65(10.95)	4.45(0.005) $^{\mu}$

University of Ghana http://ugspace.ug.edu.gh

Overall knowledge (knowledge score on cervical cancer + knowledge score on risk factors)						
Mean(±SD)	50.06(13.90)	51.07(13.62	43.75(15.25	53.76(13.36	51.79(12.34)	4.20(0.006) $^{\mu}$

NOTE: μ denote F-test statistic from analysis of equal variance; χ^2 denote chi-square test statistic from independence test of equal proportion and H denote Kruskal-Wallis test statistic from one-way analysis of variance. SD and IQR represent Standard deviation and Inter-quartile range respectively. DSW represent Divorced, Separated or Widowed. JHS represent Junior High School. SHS represent Senior High School. Others: Islam and Traditional religion. Overall knowledge: knowledge score on cervical cancer + risk factors

4.2 Factors associated with cervical cancer uptake among female teachers in Greater Accra

At baseline survey, the analysis showed that**, age and perceived barrier**s from the health belief model scores were associated with cervical cancer screening (CCS) uptake. A unit increase in age was significantly associated with probability of CCS uptake [Poisson model: adjusted prevalence ratio aPR(95%CI) = 1.09(1.05-1.14); p<0.001; Table 4.2]. In addition, a unit increase of perceived barriers' score predicted less probability of CCS uptake among the teachers at baseline [Poisson model: aPR(95%CI) = 0.85(0.79-0.91 <0.001] (Table 4.2A). The results from the sensitivity analysis from logistic and probit regression models in Table 4.2 B in the Appendix showed similar findings.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

Table 4.2: Factors associated with cervical cancer uptake among female teachers in Greater Accra at baseline study showing adjusted Poisson

	Poisson
Variable	**aPR[95%CI]**
Age	1.09[1.05-1.14]***
Age at first sex	
≤ 24	**Ref**
25+	1.28[0.63-2.57]
Parity	
3+	**Ref**
None	1.59[0.37-6.71]
1-2	0.82[0.44-1.55]
Number of sexual partners	
≤1	**Ref**
2-3	1.23[0.66-2.28]
4+	1.64[0.49-5.48]
Perceived susceptibility	0.89[0.72-1.11]
Perceived severity	1.09[0.93-1.27]
Perceived benefit	1.01[0.86-1.19]
Perceived barriers	0.85[0.79-0.91]***
Self-efficacy	1.12[0.89-1.40]

NOTE: The mean±standard deviation for Perceived susceptibility, severity, benefit, barriers and self-efficacy were; 3.72±1.47, 9.71±2.85, 13.81±2.05, 16.13±4.54 and 4.73±1.44 respectively. aIRR denote adjusted incidence rate ratio from Poisson regression analysis; CI represent Confidence Interval respectively. P-value notation: ***p-value<0.001

4.3 Pre and post assessment of knowledge on cervical cancer

At baseline survey, the overall knowledge score was not statistically significantly different among the control and the intervention groups (p=0.901; Table 4.3) but the overall knowledge score on risk factors of cervical cancer increased significantly from 39.3% among the controls to 53.9% among those who benefitted from at least one of the interventions (p<0.001; Table 4.3).

Details on the improvement in knowledge scores on each of the domains studied can be found in Table 4.3. There was no statistically significant difference in the overall average knowledge of cervical cancer between the control group and test group at baseline (p=0.169; Table 4.3). However, after the implementation of the interventions, the mean knowledge score on cervical cancer increased from 58.3% among the controls to 67% among the intervention group (p<0.001;

University of Ghana http://ugspace.ug.edu.gh

Table 4.3). The composite mean knowledge score (Risk factor knowledge + General knowledge on cervical cancer) also increased significantly from 49.0% among the controls to 60.5% among the intervention group after the implementation of the intervention compared to baseline ($p<0.001$; Table 4.3). A detailed analysis of the individual domain scores between the control and the intervention groups before and after the implementation of the intervention can be found in Table 4.3.

University of Ghana http://ugspace.ug.edu.gh

Table 4.3: Knowledge assessment on cervical cancer, risk factors and screening among female teachers in Greater Accra

Knowledge assessment on	**Baseline**			**End line**		
	Control	**Intervention**	**P-value**	**Control**	**Intervention**	**P-value**
Knowledge on risk factors of cervical cancer	%	%		%	%	
Abortion	43.94	43.19	0.917	32.14	37.73	0.454
Smoking	46.97	61.18	0.048	45.61	59.75	0.065
Douching and fingering	31.19	32.94	0.868	19.30	28.30	0.183
Poor Personal Hygiene	28.79	30.00	0.855	36.84	45.28	0.269
HPV infection	57.58	53.53	0.575	59.64	80.50	0.002
Obesity increase risk	21.21	13.53	0.145	14.03	23.90	0.119
Oral contraceptives	36.36	27.65	0.190	24.56	46.54	0.004
Sexual activity put a woman art risk of cervical cancer	43.94	46.47	0.726	43.86	71.69	<0.001
Having large number of children>4.	19.69	20.59	0.879	14.03	44.03	<0.001
Multiple sexual partners put a woman at risk	77.27	76.47	0.896	77.19	88.68	0.034
HIV/AIDS infection increases risk	45.45	45.29	0.982	50.87	59.11	0.281
A family history of cervical cancer increases a woman risk	54.54	51.18	0.641	45.61	61.01	0.044
Overall mean knowledge score on the risk of cervical cancer: mean±SD	42.30±21.54	41.91±20.74	0.901	39.28±19.44	53.87±16.84	<0.001
Knowledge on cervical cancer						
Have you heard of cervical cancer	96.97	88.24	0.038	96.49	95.60	0.772
Cervical cancer is sexually transmitted	40.91	33.33	0.277	31.58	53.46	0.005
HPV is necessary for cervical cancer development	56.06	58.89	0.693	63.16	90.57	<0.001
HPV infection affects only women	39.39	23.46	0.015	33.33	18.24	0.019
Cervical cancer can affect young women	80.30	83.13	0.610	87.72	93.08	0.209
Cervical cancer affects mostly women after 50	33.33	26.22	0.278	24.56	25.16	0.929
Women can die from untreated cervical cancer	86.36	92.26	0.164	89.47	96.86	0.029
Screening is done to diagnose cervical cancer	15.15	10.12	0.278	7.02	19.50	0.028

University of Ghana http://ugspace.ug.edu.gh

I need to screen every year	16.67	17.96	0.814	10.53	28.30	0.006
Screening diagnose cervical changes before they become cancerous	75.76	77.11	0.826	87.72	91.19	0.447
Screening informs women about their health status	89.39	87.50	0.688	85.96	97.48	0.001
Screening is not necessary.	87.88	87.35	0.912	82.45	94.97	0.003
Overall mean knowledge on cervical cancer (*mean±SD)*	59.85±13.47	57.13±13.52	0.169	58.33±8.07	67.03±10.78	<0.001
Composite mean knowledge score (Risk factor knowledge + General knowledge on cervical cancer) (*mean±SD)*	51.07±13.62	49.63±14.04	0.475	49.03±13.05	60.45±11.94	<0.001

SD: Standard deviation. HPV denote Human papilloma virus. HIV denote Human immunodeficiency virus. AIDS represent acquired immunodeficiency syndrome

University of Ghana http://ugspace.ug.edu.gh

4.4 Impact evaluation of the intervention on the four outcome measures (cervical cancer screening uptake, knowledge on cervical cancer, knowledge on risk factors of cervical cancer and overall knowledge): a multivariable analysis that adjust for time fixed effect

The results from the multi-variable modified Poisson regression analysis showed that participants who received SMS only and those who received both WhatsApp and SMS had a higher prevalence of cervical cancer screening uptake within the study period compared to the control group, although the impact was not statistically significant ($p>0.05$; Table 4.4). The results from the ordinary least square regression analysis showed that the knowledge score on risk factors of cervical cancer increased by 5.7% [95% CI: 0.13-11.24; $p<0.05$; Table 4.4] among those who were in the WhatsApp group compared to those in the control group. Those who benefitted from SMS alone had their knowledge score increased by 7.8% [95%CI: 2.85-12.68; $p<0.01$; Table 4.4] compared to the control group. Among those who benefitted from WhatsApp+ SMS, the level of knowledge on the risk factors of cervical cancer screening increased by 9.8% [95%CI: 5.17-14.41; $p<0.001$; Table 4.4]. Sending SMS alone increased the knowledge score on cervical cancer by 5.8% [95% CI: 1.18-10.39] compared to the control group. The overall knowledge score increased significantly in both the SMS alone group by 6.7% [95% CI: 2.32-11.06; $p<0.01$; Table 4.4] and the WhatsApp+SMS group by 6.7% [95%CI: 23.39-10.03; $p<0.001$; Table 4.4] compared to the control group.

University of Ghana http://ugspace.ug.edu.gh

Table 4.4: Impact evaluation of the three communication interventions on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting demographic characteristics and time of study among female teachers in Greater Accra

Variable	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge	Cervical Cancer screening uptake
	aβ[95%CI]	aβ[95%CI]	aβ[95%CI]	aIRR[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
WhatsApp	5.69[0.13-11.24]*	-0.08[-5.01-4.83]	2.75[-1.75-7.25]	0.85[0.35-2.11]
SMS	7.77[2.85-12.68]**	5.79[1.18-10.39]*	6.69[2.32-11.06]**	1.29[0.60-2.78]
WhatsApp+SMS	9.79[5.17-14.41]***	3.52[-0.25-7.29]	6.71[3.39-10.03]***	1.56[0.83-2.93]
Age	-0.6[-0.34-0.21]	0.04[-0.12-0.20]	-0.02[-0.19-0.15]	1.07[1.05-1.09]***
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	-4.29[-10.61-2.02]	0.92[-3.74-5.59]	-1.14[-5.61-3.31]	4.15[1.18-14.69]*
DSW	-12.21[-23.81--0.61]*	-6.91[-14.95-1.11]	-9.57[-18-72--0.42]*	2.45[0.48-12.36]
Educational level				
JHS/SHS	**Ref**	**Ref**	**Ref**	**Ref**
Training college	8.54[-4.19-21.27]	6.18[-4.60-16.97]	7.28[-3.16-17.72]	1.35[0.15-12.51]
University	8.69[-2.28-19.67]	7.04[-1.84-15.93]	7.21[-1.75-16.17]	2.31[0.28-18.91]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	-1.52[-10.68-7.64]	1.37[-2.98-5.72]	0.60[-5.44-6.64]	2.70[0.91-7.97]
1-2	-2.32[-7.06-2.42]	0.37[-3.14-3.87]	-0.78[-4.40-2.83]	0.89[0.54-1.46]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	-1.56[-6.49-3.38]	-1.32[-4.22-1.56]	-1.53[-4.65-1.57]	0.97[0.47-1.96]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	0.72[-4.01-5.44]	-2.54[-5.38-0.30]	-0.82[-3.99-2.35]	0.87[0.53-1.44]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	2.09[-2.45-6.65]	-0.45[-3.89-2.97]	0.65[-2.65-3.96]	0.97[0.66-1.44]
4+	1.81[-6.07-9.71]	-1.19[-5.44-3.05]	0.22[-4.67-5.11]	1.30[0.63-2.70]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	8.99[4.84-13.15]***	7.33[[4.26-10.41]***	8.25[5.06-11.45]***	1.69[1.23-2.33]***

NOTE: Ref: reference category; **aIRR** denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CC and CI represent cervical cancer and Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001. SMS: Short message services. JHS: Junior high school. SHS: Senior high school. Three communication interventions: WhatsApp only, SMS only and SMS+ WhatsApp

University of Ghana http://ugspace.ug.edu.gh

4.5 Impact evaluation of the combined intervention versus control: multivariable analysis adjusting for time fixed effect

Comparing the three interventions combined with control showed that receiving at least one of the interventions increased the prevalence of cervical cancer screening uptake by 1.3% although the effect was not statistically significant ($p>0.05$; Table 4.5). The knowledge score on the risk factors of cervical cancer increased by 8.0% [95%CI: 3.99-12.06; $p<0.001$; Table 4.5] compared to the control group. The knowledge level on cervical cancer increased by 2.8% although the effect was not found to be statistically significant. The overall knowledge increased by 5.4% [95%CI: 2.15-8.67; $p<0.001$; Table 4.5].

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

Table 4.5: Impact of intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR[95%CI]	aβ[95%CI]	aβ[95%CI]	aβ[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
Intervention	1.29[0.69-2.39]	8.03[3.99-12.06]***	2.83[-1.02-6.67]	5.42[2.15-8.67]***
Age	1.07[1.05-1.10]***	-0.05[-0.33-0.24]	0.06[-0.10-0.22]	-0.002[-0.18-0.18]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	4.33[1.25-15.01]*	-0.96[-10.13-2.22]	1.63[-2.94-6.20]	-0.63[-5.01-3.74]
DSW	2.47[0.52-11.88]	-11.80[-23.29--0.331]*	-6.44[-14.62-1.74]	-9.07[-18.28-0.14]
Educational level				
JHS/SHS	**Ref**	**Ref**	**Ref**	**Ref**
Training college	1.55[0.16-14.91]	8.61[-4.20-21.43]	6.66[-4.10-17.43]	7.53[-2.98-18.04]
University	2.75[0.32-23.21]	9.06[-2.20-20.33]	7.81[-1.22-16.84]	7.77[-1.51-17.06]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	2.77[0.95-8.07]	-1.52[-10.66-7.63]	1.31[-3.15-5.77]	0.57[-5.49-6.64]
1-2	0.90[0.54-1.49]	-2.35[-7.03-2.34]	0.68[-2.92-4.28]	-0.66[-4.28-2.95]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	0.96[0.48-1.89]	1.63[-6.61-3.35]	-1.39[-4.36-1.57]	-1.59[-4.78-1.59]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	0.84[0.51-1.37]	0.96[-3.77-5.68]	-2.46[-5.19-0.28]	-0.65[-3.79-2.48]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	0.96[0.64-1.44]	1.69[-2.74-6.12]	-0.58[-3.98-2.80]	0.37[-2.86-3.60]
4+	1.10[0.55-2.18]	0.77[-7.22-8.77]	-1.92[-6.24-2.39]	-0.69[-5.76-4.36]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	1.65[1.18-2.30]**	8.90[4.75-13.04]***	7.38[4.29-10.45]***	8.22[5.02-11.42]***

NOTE: **aIRR** denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CC and CI represent cervical cancer and Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

4.6 Impact evaluation of mHealth communication intervention: Difference in differences analysis

The difference in difference analysis provides a more robust impact estimate of the intervention. On impact evaluation of the combined intervention versus control, the ordinary least square regression analysis with difference in differences analysis showed that knowledge on cervical cancer and the overall knowledge increased in the intervention group compared to the control group by approximately 11.5% [95% CI: 4.02-18.8, p<0.01; Table 4.6A] and 10.4% [95% CI: 3.29-17.59, p<0.01; Table 4.6A] respectively. Although, cervical cancer screening uptake increased after the implementation of the intervention, the effect was not statistically significant (p>0.05; Table 4.6A).

The analysis of the impact evaluation of WhatsApp only versus control, with difference in differences analysis showed that the knowledge score on the risk factors of cervical cancer and knowledge on cervical cancer increased by 18.3% [95% CI: 6.06-30.46, p<0.001; Table 4.6B] and 17.3% [95% CI: 8.69-25.98, p<0.001; Table 6B] respectively, compared to the control group. The overall knowledge score increased by 17.5% [95% CI: 8.74-26.33, p<0.001; Table 4.6B] among those who received education through WhatsApp compared to the control group.

The impact evaluation of SMS only versus control, a difference in differences analysis showed that the cervical cancer screening uptake, knowledge score on the risk factors of cervical cancer, general knowledge on cervical cancer and the overall knowledge increased among participants who received education through SMS compared to the control group, but the effect was not statistically significant (p>0.05, Table 4.6C).

University of Ghana http://ugspace.ug.edu.gh

The impact evaluation of WhatsApp plus SMS using the ordinary least square regression analysis with difference in differences analysis showed that the knowledge on cervical cancer increased by 9.3% [95% CI: 1.19-17.42; p<0.05; Table 4.6D] among those who received both SMS and WhatsApp compared to the control group.. Education through combined SMS plus WhatsApp did not significantly improve cervical cancer screening uptake.

In analyzing the impact evaluation of SMS only versus WhatsApp only using the ordinary least square regression analysis with difference in differences analysis showed that the knowledge score on the risk factors of cervical cancer and general knowledge on cervical cancer among the WhatsApp group increased by 13.6% [95% CI: 1.70-25.46, p<0.05; Table 4.6E] and 10.0% [95% CI: 3.30-16.59, p<0.001; Table 4.6E] respectively when WhatsApp only was compared to the SMS group. The overall knowledge score increased by 11.4% [95% CI: 2.89-19.95, p<0.01; Table 4.6E] among those who received education through WhatsApp compared to the SMS group.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

Table 4.6A: Impact of intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR[95%CI]	aβ[95%CI]	aβ[95%CI]	aβ[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
Intervention	1.32[0.53-3.33]	3.39[-3.60-10.38]	-2.64[-8.66-3.37]	0.47[-5.03-5.98]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	1.71[0.75-3.77]	1.56[-7.09-10.22]	-1.07[-7.69-5.54]	0.53[-5.68-6.75]
Interaction effect				
Intervention				
End line	**0.96[0.39-2.32]**	**9.89[0.09-19.69]**	**11.49[4.02-18.79]****	**10.44 [3.29-17.59]****
Age	1.07[1.05-1.10]***	-0.04[-0.32-0.24]	0.07[-0.10-0.24]	0.01[-0.17-0.19]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	4.33[1.25-14.96]*	-.75[-9.84-2.35]	1.89[-2.64-6.42]	-0.45[-4.74-3.83]
DSW	2.47[0.52-11.84]	-11.69[-23.04--0.34]*	-6.46[-14.39-1.47]	-9.11[-18.14--0.09]*
Educational level				
JHS/SHS	**Ref**	**Ref**	**Ref**	**Ref**
Training college	1.56[0.16-14.86]	8.22[-4.50-20.94]	6.23[-4.39-16.85]	7.13[-3.26-17.52]
University	2.75[0.32-23.19]	8.99[-2.07-20.05]	7.83[-14.39-1.47]	7.78[-1.20-16.77]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	2.76[0.95-8.07]	-1.27[-10.12-7.58]	1.76[-2.67-6.18]	0.86[-4.93-6.64]
1-2	0.90[0.54-1.49]	-2.26[-6.98-2.45]	0.84[-2.86-4.53]	-0.52[-4.21-3.16]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	0.96[0.48-1.89]	-1.71[-6.61-3.20]	-1.42[-4.39-1.56]	-1.65[-4.79-1.48]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	0.84[0.51-1.37]	0.91[-3.89-5.71]	-2.51[-5.17-0.16]	-0.73[-3.90-2.45]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	0.96[0.64-1.44]	1.61[-2.82-6.02]	-0.65[-3.85-2.55]	0.27[-2.87-3.41]
4+	1.10[0.55-2.21]	0.23[-7.64-8.09]	-2.53[-6.89-1.83]	-1.27[-6.22-3.68]

NOTE: **aIRR** denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CI represent Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

University of Ghana http://ugspace.ug.edu.gh

Table 4.6B: Impact of WhatsApp intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR [95%CI]	aβ[95%CI]	aβ[95%CI]	aβ[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
Whats only	0.95[0.27-3.32]	-3.49[-12.77-5.79]	-8.88[-16.42--1.33]*	-6.17[-13.34-1.01]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	1.90[0.82-4.38]	1.83[-6.97-10.64]	-0.85[-7.50-5.79]	0.74[-5.50-6.98]
Interaction effect				
Intervention				
End line	0.77[0.22-2.67]	18.26[6.06-30.46]***	17.34[8.69-25.98]***	17.53[8.74-26.33]***
Age	1.06[1.02-1.11]**	0.08[-0.32-0.49]	0.13[-0.13-0.38]	0.11[-0.14-0.35]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	6.43[0.83-49.90]	-2.65[-11.34-6.03]	-1.92[-7.69-3.86]	-1.96[-7.55-3.64]
DSW	3.92[0.23-67.85]	-12.79[-39.26-13.68]	-14.10[-36.65-8.45]	-13.40[-36.01-9.21]
Educational level				
JHS/SHS		**Ref**	**Ref**	**Ref**
Training college		8.70[-6.16-23.57]	10.90[-2.29-24.09]	9.91[-1.63-21.45]
University		4.08[-7.47-15.63]	8.73[-1.46-8.45]	6.52[-2.92-15.96]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	1.11[0.33-1.21]	0.26[-12.12-12.64]	1.96[-4.77-8.70]	1.82[-6.07-9.70]
1-2	0.68[0.33-1.35]	0.10[-7.40-7.61]	0.07[-6.39-6.52]	0.18[-5.91-6.28]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	1.17[0.33-4.21]	-3.57[-10.77-3.63]	0.01[-4.46-4.48]	-1.54[-6.29-3.21]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	0.75[0.28-2.01]	1.40[-5.07-7.89]	-2.56[-7.58-2.45]	-0.06[-5.15-4.43]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	0.98[0.48-2.01]	3.39[-3.91-10.68]	0.20[-4.68-5.08]	2.06[-3.10-7.22]
4+	1.76[0.69-4.49]	2.33[-7.78-12.43]	-2.84[-8.53-2.85]	-0.06[-6.17-6.04]

NOTE: **aIRR** denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CI represent Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

University of Ghana http://ugspace.ug.edu.gh

Table 4.6C : Impact of SMS intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR[95%CI]	β[95%CI]	β[95%CI]	β[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
SMS only	1.22[0.39-3.84]	5.31[-2.87-13.50]	2.40[-5.08-9.88]	4.81[-2.24-11.86]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	1.81[0.74-4.42]	1.97[-7.07-11.01]	-1.07[-7.92-5.78]	0.80[-5.78-7.37]
Interaction effect				
Intervention				
End line	1.10[0.38-3.20]	5.04[-7.48-17.55]	6.02[-2.34-14.37]	4.97[-4.06-13.99]
Age	1.07[1.03-1.11]***	0.28[-0.07-0.62]	0.07[-0.19-0.32]	0.16[-0.06-0.39]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	3.15[0.38-26.42]	-1.91[-15.38-11.57]	2.05[-8.90-13.01]	1.61[-8.90-12.11]
DSW	2.17[0.08-56.57]	-4.80[-19.15-9.55]	0.63[-12.49-13.76]	-1.89[-15.41-11.64]
Educational level				
JHS/SHS		**Ref**	**Ref**	**Ref**
Training college		-2.08[-18.07-13.91]	8.06[-12.14-28.26]	1.18[-15.41-11.64]
University		-6.09[-19.57-7.38]	5.18[-11.99-22.35]	-3.36[-14.30-7.57]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	1.73[0.57-4.29]	4.64[-8.18-17.46]	3.60[-3.37-10.58]	5.61[-2.83-14.04]
1-2	0.55[0.27-1.14]	0.12[-6.80-7.04]	2.04[-4.65-8.73]	0.82[-5.42-7.05]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	1.56[0.57-4.29]	-3.47[-11.42-4.48]	-0.02[-4.92-4.88]	-2.16[-7.47-3.15]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	1.05[0.47-2.31]	-1.04[-8.91-6.84]	-1.64[-5.63-2.35]	-1.14[-6.17-3.89]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	0.92[0.48-1.75]	3.20[-3.94-10.33]	2.17[-2.87-7.21]	2.12[-7.47-3.15]
4+	1.59[0.58-4.31]	3.78[-5.48-13.04]	-4.05[-12.64-4.54]	-0.82[-8.76-7.12]

NOTE: **aIRR** denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CI represent Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

University of Ghana http://ugspace.ug.edu.gh

Table 4.6D: Impact of WhatsApp and SMS intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR[95%CI]	β[95%CI]	β[95%CI]	β[95%CI]
Arm				
Control	**Ref**	**Ref**	**Ref**	**Ref**
WhatsApp+SMS	1.64[0.58-4.59]	7.80[-0.38-15.98]	-1.49[-7.10-4.12]	3.33[-2.29-8.96]
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	1.89[0.80-4.48]	2.07[-6.87-11.00]	-0.93[-7.44-5.59]	0.85[-5.48-7.17]
Interaction effect				
Intervention				
End line	**0.83[0.29-2.38]**	**5.54[-5.50-16.57]**	**9.31[1.19-17.42]***	**7.03[-0.95-15.01]**
Age	1.09[1.06-1.12]***	0.01[-0.38-0.40]	0.06[-0.19-0.31]	0.03[-0.24-0.29]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	2.52[0.45-14.23]	-7.12[-17.70-3.46]	-4.71[-10.07-0.65]	-5.43[-12.37-1.51]
DSW	0.95[0.11-8.29]	-17.84[-37.03-1.36]	-13.09[-20.57-5.61]***	-15.00[-27-33--2.66]**
Educational level				
JHS/SHS	**Ref**	**Ref**	**Ref**	**Ref**
Training college	0.81[0.09-7.59]	2.28[-16.95-21.50]	4.57[-11.97-21.11]	3.89[-12.25-20.04]
University	1.23[0.15-10.43]	-0.18[-14.26-13.90]	4.37[-8.56-17.30]	2.08[-9.86-14.01]
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	1.08[0.18-6.30]	-2.73[-15.17-9.71]	-3.00[-8.80-2.80]	-2.40[-10.55-5.76]
1-2	1.09[0.59-1.99]	-4.50[-11.03-2.03]	-2.76[-7.10-1.59]	-3.51[-8.31-1.30]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	1.08[0.54-2.15]	-1.00[-7.56-5.55]	1.03[-2.05-4.11]	-0.09[-4.12-3.93]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	0.67[0.35-1.31]	2.27[-4.32-8.87]	0.55[-2.48-3.59]	1.66[-2.50-5.82]
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	1.05[0.68-1.60]	4.01[-2.15-10.18]	1.40[-2.87-5.66]	2.81[-1.44-7.07]
4+	1.67[0.55-5.04]	7.46[-3.02-17.94]	-3.37[-10.23-3.50]	2.10[-4.96-9.16]

NOTE: aIRR denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CI represent Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

University of Ghana http://ugspace.ug.edu.gh

Table 4.6E: Impact of WhatsApp compared with SMS intervention on cervical cancer uptake, knowledge on cervical cancer and risk factors adjusting for time of study among female teachers in Greater Accra

Variable	Cervical Cancer screening uptake	Knowledge score on risk factors of cervical cancer	Knowledge score on cervical cancer	Overall knowledge
	aIRR[95%CI]	β[95%CI]	β[95%CI]	β[95%CI]
Arm				
SMS	**Ref**	**Ref**	**Ref**	**Ref**
WhatsApp	0.59[0.18-1.95]	-6.96[-15.59-1.68]	-9.86[-15.04--4.67]***	-8.17[-14.19--2.16]**
Time				
Baseline	**Ref**	**Ref**	**Ref**	**Ref**
End line	2.15[1.13-4.08]*	7.24[-0.97-15.45]	6.84[3.05-10.64]***	7.38[134-13.41]*
Interaction effect				
Intervention				
End line	0.81[0.23-2.81]	13.58[1.70-25.46]*	9.95[3.30-16.59]***	11.42[2.89-19.95]**
Age	1.04[1.01-1.08]*	-0.15[-0.56-0.27]	0.18[-0.59-0.42]	0.005[-0.22-0.23]
Marital status				
Single	**Ref**	**Ref**	**Ref**	**Ref**
Married	5.12[1.02-25.62]*	-4.34[-13.29-4.61]	7.51[0.18-14.85]*	1.83[-4.61-8.26]
DSW	4.42[0.60-32.38]	-4.53[-19.65-10.60]	-0.11[-13.56-13.33]	-2.45[-16.46-11.55]
Educational level				
JHS/SHS		**Ref**	**Ref**	**Ref**
Training college		16.08[0.57-31.58]*	9.12[-2.67-20.92]	12.18[2.34-22.02]*
University		21.39[12.23-30.55]***	12.07[3.64-20.51]**	15.80[9.10-22.51]***
Parity				
3+	**Ref**	**Ref**	**Ref**	**Ref**
None	4.57[1.33-15.61]*	-2.52[-15.68-10.63]	7.96[0.88-15.04]*	3.25[-5.15-11.65]
1-2	0.58[0.23-1.46]	1.15[-6.03-8.33]	3.61[-1.77-8.99]	2.72[-2.76-8.20]
Condom use				
Yes	**Ref**	**Ref**	**Ref**	**Ref**
No	1.58[0.71-3.50]	-1.81[-8.11-4.49]	-5.42[-11.24-0.39]	-3.65[-7.89-0.59]
Age at first sex				
≤ 24	**Ref**	**Ref**	**Ref**	**Ref**
25+	1.58[0.72-3.50]	-2.95[-10.00-4.10]	-8.03[-12.30--3.76]***	-5.52[-10.31--0.73]*
Number of sexual partners				
≤1	**Ref**	**Ref**	**Ref**	**Ref**
2-3	1.19[0.49-2.89]	-4.39[-11.94-3.16]	-3.40[-9.01-2.21]	-4.55[-10.28-1.18]
4+	1.89[0.63-5.66]	-8.86[-18.70-0.98]	-2.57[-8.13-2.99]	-6.11[-11.95--0.27]*

NOTE: aIRR denote adjusted incidence rate ratio from Poisson regression analysis; β denote normalized coefficient from ordinary least square regression analysis. CI represent Confidence Interval respectively. P-value notation: *p-value<0.05, **p-value≤0.01 and ***p-value≤0.001

University of Ghana http://ugspace.ug.edu.gh

CHAPTER FIVE

DISCUSSION

5.0 Introduction

The study assessed the effect of mHealth communication intervention on knowledge of cervical cancer and screening uptake among female teachers in Accra Metropolis. This chapter presents discussion of the results based on the objectives of the study as follows.

- The prevalence of cervical cancer screening uptake.
- Factors associated with cervical cancer screening uptake among female teachers in the Accra Metropolis.
- The effect of mHealth communication intervention on knowledge of cervical cancer among female teachers in Accra Metropolis.
- The effect of mHealth communication intervention on cervical cancer screening uptake among female teachers in Accra Metropolis.

5.1 The prevalence of cervical cancer screening uptake

Cervical cancer screening is an important strategy for reducing the risk of cervical cancer incidence and mortality among women (Thaxton and Waxman, 2015; WHO, 2013). It enables early detection of pre-cancer lesions before symptoms of cervical cancer are occur (Stewart, 2016; Denny et al, 2013). In this study, the prevalence of cervical cancer screening uptake was 16.9% among 237 female teachers at baseline. This finding supports the hypothesis that the prevalence of cervical cancer screening uptake among female teachers in Accra Metropolis will be about 12.9%. This prevalence is slightly higher than the prevalence of 12% reported among University of Ghana students in Accra (Abotchie & Shokar, 2009), and much higher than the prevalence of 2.1% and

University of Ghana http://ugspace.ug.edu.gh

0.8% and, 2.4% reported in Accra (Adanu, 2010), Elmina (Ebu et al, 2014), and Ghana (Calys - Tagoe et al, 2020) respectively. Furthermore, this prevalence is higher than estimates from other studies reported in some African countries such as 12.2% in Ethiopia (Woldetsadik et al, 2020) and 0.7% in Benin (Ba et al., 2021). Similarly, the prevalence of this study is higher than the prevalence reported in other countries outside Africa such as India (13.4%) (Montgomery et al, 2015), which bears one fourth of the of the world's cervical cancer burden (GLOBOCAN, 2018). The difference observed may be due to the literate population of female teachers studied in this current study as over 80% of participants had tertiary education. High educational level has been demonstrated to be a strong predictor of cervical screening uptake (Aina, 2020; Nyangasi et al., 2018). This is because education leads to a greater understanding of health-related concerns, as well as give women the autonomy to access healthcare services which can lead to increased use of cervical cancer screening services (Doctor, Nkhana and Abdulsalam,2018). Also, women with high level of education can assess the risk factors for certain diseases and positively affect health care decision-making (Ebu, 2019).

The prevalence of 16.9% observed in this study, is consistent with the findings from three other studies among teachers from neighbouring developing countries in Nigeria and Tanzania (Kane et al., 2015; Adamu, Abiola and Ibrahim, 2012; Kileo et al, 2015; Ijezie and Johnson, 2015). Adamu et al., (2012) reported a prevalence of 4.9% among female teachers in Birnin-Kebbi, North-Western Nigeria. Ijezie et al. (2015) found 8.4% among 226 public school teachers in Akwa Ibom State, Nigeria, while Kileo et al. (2015), reported 21% among primary school teachers in Tanzania. Likewise, the prevalence reported by this study was lower than the prevalence in Portland in Jamaica (66.0%) (Ncube et al, 2015) and in United States of America (77.0%) (Johnson et al, 2020). The explanation for disparity in cervical screening uptake among study participants

University of Ghana http://ugspace.ug.edu.gh

compared to developed countries is because of, absence of national screening programs in Ghana, inadequate knowledge, financial challenges compared to the supposedly high-income countries where free routine cervical screening is occurs (Adanu,2010; Bloch and Vavrus, 2000; Denny et al., 2013; WHO, 2013). Moreover, countries in Africa, such as Ghana and Nigeria practice physician lead cervical cancer screening, where the test is carried out in women, when there is abnormal gynecological symptoms (Adanu et al., 2010; Handlogten et al, 2014). The lack of national screening program indicates the need for interventions into ensuring that asymptomatic women are screened for cervical cancer while awaiting government support towards routine screening program in health care (Rosser, Njoroge & Huchko, 2015; Adanu et al., 2010).

Furthermore, the cervical cancer screening prevalence identified by this study can be attributed to ignorance of the causes and effects of cervical cancer. This study found Knowledge on cervical cancer risk factors was low at 42% although 84% of participants have tertiary education. This has been confirmed by other studies in Ethiopia and Kenya (Birhanu et al, 2012; Morema et al, 2014). As a result of deficient awareness about cervical cancer screening most women in SSA only seek medical assistance after noticing gynaecological signs and symptoms such as abnormal vaginal bleeding, foul-smelling vaginal discharge which signify advanced stage malignancy with consequent poor prognosis and increased risk (Arbyn et al.,2020; Sankarayananan et al, 2014)

Low prevalence of cervical screening uptake could also due to the perceptions and attitudes of women based on cultural and religious beliefs (Anaman-Torgbor et al, 2017; Fentie et al, 2020) as well as the poor health infrastructure (Calys-Tagoe et al, 2020). Furthermore, most African countries have competing health needs with high burden of infectious diseases, maternal and child health problems, coupled with limited health resources, thereby limiting prioritization on cancer

University of Ghana http://ugspace.ug.edu.gh

prevention methods such as HPV vaccinations and national cervical cancer screening programs" (Stewart et al, 2018; Gouda et al, 2019).

5.2 Factors associated with cervical cancer screening uptake among female teachers in the Accra Metropolis

This study found that age has an association with cervical cancer screening uptake. From this study, an increase in unit of age of female teachers increased the probability of cervical cancer screening uptake by 15%. This is consistent with studies by Astarian et al (2017) in Iran, Huf et al (2020) in London, and Woldetsadik et al (2020) in Ethiopia, who found that older women have higher likelihood of participating in cervical cancer screening. On the other hand, other studies have also shown that cervical cancer screening uptake declines with higher age (Woldetsadik et al, 2020; Ayanore et al, 2020; Ifemelumma, 2019). Ifemelumma (2019) demonstrated that young women aged <30 years are less likely to partake in cervical cancer screening compared to the older ones. This is of public health importance, because young women are sexually active and have higher risk of HPV infection coupled with early coital debut and highs risk sexual behaviours. Ghana's National Reproductive Health Policy on cervical cancer prevention recommend visual inspection with acetic acid (VIA) screening with the treatment of pre-cancerous lesions with cryotherapy for women aged 25–45 and Pap smear for women aged 45 years and above (Ministry of Health (MOH), 2015). Thus, there is the need for higher rate of cervical cancer screening among young women (Ncube et al, 2015). Studies by Oscarsson et al (2008) revealed that older women mostly discuss cervical cancer screening test with their daughters who encourage them to partake in the screening, but they cervical cancer screening test even when they are invited. They gave reasons of matured age and menopause for their refusal (Eaker et al, 2001).

University of Ghana http://ugspace.ug.edu.gh

Successful cervical screening programs depend on the degree of coverage and the rate of attendance. Individuals may consider attending cervical screening test if barriers are identified and subsequently addressed (Julinawati *et al.* 2013. This study found "perceived barrier" was negatively associated with cervical cancer screening uptake. Thus, a unit increase of "perceived barriers" decreased the probability of cervical cancer screening uptake by 15%. This finding is consistent with studies by Abdullah et al (2011), Bayu et al (2016), Ilaboya et al., (2018), Nwabichie et al (2018), and Abiodun et al (2014) who confirmed that barriers associated with women's perception decreased the likelihood to uptake cervical cancer screening. Prominent barriers hindering the involvement of women in cervical cancer screening services include unsuitable clinic hours, distance, fear of getting an abnormal cervical cancer screening result, poor knowledge of the cervical cancer screening procedure, poor health seeking behaviour feeling of shame, comorbid conditions and physical disability, the pain and discomfort associated with cervical cancer screening test and a need for additional information (McFarland, 2013; Agurto et al; 2004, Gamarra et al, 2005; Bessler et al, 2007; Lovell et al., 2007; Mupepi 2011; Liu et al., 2014; Ilaboya et al., 2018; Chandrupatla et al, 2019).

According to Ilaboya et al. (2018) women are very fearful of breast cancer diagnosis as well as any other cancer. This is because cancer is generally perceived as a life threatening and the dread of an impending death induce negative responses of fear and depression. Such negative emotions force women to avoid participation in cancer screening interventions. This affects the effectiveness of efforts to reduce the incidence, morbidity and mortality (NIH, n.d, ; Broni et al., 2014; Ilaboya et al., 2018).Therefore women less likely to participate need extra motivation through effective educational campaigns to teach them about the benefits of early screening and available screening site (Broni et al., 2014).

University of Ghana http://ugspace.ug.edu.gh

Barrier perceived by women has reduced their attendance rates at cervical cancer screening globally which has proportionate impact on mortality, morbidity, and fiscal spending. Cervical screening attendance can be improved by the provision of information and consideration of women's health beliefs (Abdullah et al, 2011). There is a need of policy advancement of cervical cancer screening programmes by focusing on cervical cancer education, affordability, accessibility, and the necessity of screening uptake to control the cervical cancer morbidity and mortality rates. Thus, addressing the perceived barrier will help reconcile negative attitude towards attending cervical cancer screening test which will have a positive impact on women's health and well-being (Julinawati *et al*, 2013; Ilaboya et al., 2018).

5.3 The effect of mHealth communication intervention on knowledge of cervical cancer among female teachers in Accra Metropolis

This study assessed the effectiveness of three different mhealth communication intervention such as WhatsApp only, SMS only, and WhatsApp plus SMS with control on knowledge of cervical cancer among female teachers in Accra Metropolis.

From the Impact assessment of receiving at least one intervention (Either SMS only, WhatsApp only or SMS plus WhatsApp) in this study, the results showed the impact of receiving at least one intervention increased knowledge on CC and overall knowledge increased significantly about 11.5% and 10% respectively compared to control. The possible explanation for this finding may be that phone-based mHealth intervention provided the opportunity to give comprehensive information on cervical cancer and cervical screening through SMS and WhatsApp which effectively improved the knowledge of female teachers in the intervention group compared to

University of Ghana http://ugspace.ug.edu.gh

control. This emphasizes the importance of SMS and WhatsApp as an effective tool for awareness creation and knowledge building.

This is consistent with literature which discussed the effectiveness of SMS and WhatsAPP. SMS especially has been applied to diverse studies and found to be effective, It has been applied to drug adherence, cessation of smoking, Maternal and child health, management of diabetes and hypertension, cervical cancer, colorectal cancer and breast cancer among others (Lee et al., 2014; Lemos et al., 2017; Indracanti et al., 2018; Bhochhibhoya et al., 2021), For example the findings from Iranian study which used which used SMS text on diabetic self-care, demonstrated SMS text messaging as an effective educational method. It improved knowledge on glycaemic control, self-care and other aspects of diabetic care after a 12-week intervention (Ibrahim; 2018).

In the application to cervical cancer, similar findings were observed. A health promotion in which Hispanic immigrant women in Los Angeles and Korea participated, found a significant improvement in knowledge about cervical cancer risk factors, symptoms and prevention. Again pretest and posttest intervention studies by Indracanti, Berhane, Minyamer, (2018) assessed the effect of mobile messages application on cervical cancer knowledge among university students in Ethiopia. The findings strongly suggest there was improvement in awareness about cervical cancer as a preventive illness and there was also improvement in general knowledge of CC (risk factors, symptoms, methods used in screening, and vaccine) among all the students at post intervention compared at baseline. These studies highlight the important position of SMS and WhatsApp in shaping knowledge and supporting health promotion in a cost-effective and timely manner (Broberg et al, 2014). Further it has a rippling effect of promoting public health by enhancing the opportunity to reach people wherever they are (Mbuagbaw et al., 2012). This makes mhealth (SMS text and WhatsApp messages) a useful alternative to traditional health talks.

University of Ghana http://ugspace.ug.edu.gh

Again, the impact evaluation of receiving WhatsApp only on knowledge on cervical cancer and risk factors compared with control among female teachers demonstrated that effect of receiving WhatsApp only significantly increased knowledge score on cervical cancer risk factors and improved overall knowledge score on cervical cancer by 18.3% (P<0.001) and 17.3% (p< 0,001) respectively. The overall knowledge score on cervical cancer by 17'5% (p<0.001) among those who received education through WhatsApp compared to the control group.

Also, Impact of SMS only intervention on knowledge on cervical cancer and risk factors among female teachers in Greater Accra showed an increase in knowledge score on general cervical cancer, cervical risk factors and the overall knowledge on cervical cancer but the effect was not statistically significant (p>0.05)

The impact assessment of receiving WhatsApp plus SMS showed that the knowledge score on cervical cancer increased significantly by 9.3% (p<0.05), among those who received both SMS and WhatsApp compared to the control group. Education through combined SMS plus WhatsApp did not significantly knowledge on risk factor and overall knowledge compared with control.

In analyzing the impact of receiving SMS only versus WhatsApp showed that the knowledge score on the risk factors of cervical cancer and general knowledge on cervical cancer among the WhatsApp group compared to the SMS group increased by 13.6% (p<0.05) and 10.0% (p<0.001); respectively. The overall knowledge score increased by 11.4% (p<0.01) among those who received education through WhatsApp compared to the SMS group. This is because, WhatsApp is very popular among women with higher education including teachers.

The results showed that WhatsApp text yielded the largest improvements in knowledge. This support WhatsApp as the most effective communication strategy for increasing knowledge compared to SMS. This is probably because WhatsApp is very popular and it is the most

University of Ghana http://ugspace.ug.edu.gh

downloaded software on the planet (Barhoumi, 2015). In Ghana, WhatsApp is undeniably one of the most popular forms of communication. It is estimated that about 90% of informations about politics, finances, economics, are all circulating on whatsApp platform so most people are addicted. This makes WhatsApp stand out among other services such as SMS text, Viber, Skype, Facebook Messenger among others. It is also faster and more user friendly compared to SMS (Ahiable,2018)

5.4 The effect of mHealth communication intervention on cervical cancer screening uptake among female teachers in Accra Metropolis

This study found that female teachers who received SMS only and those who received WhatsApp plus SMS had a higher incidence of cervical cancer screening uptake compared to the control group. However, the results were not significant. Comparing the effect of the three interventions (SMS only, WhatsApp only and SMS plus WhatsApp) with control, this current study noted that though there was a marginal increase with the intervention this was not statistically, significant. This finding failed to support the hypothesis that cervical cancer screening uptake will increase significantly among teachers who received the communication intervention in comparison to control These results is very surprising, for despite improvement in knowledge, female teachers (86% had tertiary education) in Accra metropolis (urban area) were reluctant to utilize cervical screening. Although a significant number of participants have had exposure to HPV through sexual intercourse and were consequently at risk of developing cervical cancer. This increases possibility of increasing cervical cancer cases in future, as precancerous cervical lesions are asymptomatic, therefore it is preferred for women without symptoms to screen (Adanu et al., 2010). The inadequate utilization observed is contrary to 70% coverage recommended by WHO for the

University of Ghana http://ugspace.ug.edu.gh

eradication of cervical cancer (WHO, 2021). The health believe model employed in this study explains that one of the major reasons why people do not change their health behaviors is because they think doing so would be difficult (perceived barrier) (Boskey et al, 2022). This study found Perceived barrier was significantly associated with cervical cancer screening (CCS) uptake which predicted low screening uptake. Nevertheless, this current result is consistent with the findings reported by Linde et al. (2020) and Lemos et al. (2017) who identified in their studies that SMS text did not improve cervical screening utilization among university students and HPV positive women elsewhere although knowledge on cervical cancer increased. On the contrary studies by Bhochhibhoya et al (2021), Lee et al (2014) in Korea, Kerrison, (2015), demonstrated that SMS and WhatsApp improve cervical screening participation.

Contextually, the findings highlight the fact that inability of female teachers to screen was not merely the outcome of awareness, knowledge, and availability of screening sites but complex factors including, cost, unsuitable working hours and invasive nature of cervical screening as was elicited by this study under perceived barriers.

During the study, it was observed that not all participants in the study received the messages sent as evident by Hubtel Ghana transmission report recording 20% rejection in the 8th week which increased to 60 % in the 10th week. This is consistent with Rossman et al., (2021) findings of technological glitch of connectivity and coverage issues in their systematic review which was supported by three studies in their review. This they said could reduce the success and reliability of text messages to women which may have negative effect on CCS uptake. In addition, Somera et al (2020) identified, the was a time lag as some SMS messages were not delivered as scheduled. They delayed consistently, while other messages were truncated, and this feature also affected the effectiveness of the intervention.

University of Ghana http://ugspace.ug.edu.gh

Also, the cost of cervical screening (which is preventive) is not covered by National health insurance scheme (NHIS). But the NHIS covers the cost of breast and cervical cancer patients in the hospital (NHIA, 2016) Women seeking screening have to pay-out -of- pocket. Evidence from screening centers (Greater Accra Regional Hospital, 37 military hospital, Marie stopes Kokomlemle and Marie stopes Malata) recommended to teachers in this study indicate that, VIA test cost between 30($3.3) to 40($4.4) Ghana cedis, Pap smear cost 140 cedis ($15) while, HPV DNA test cost between 265 to 355Ghana cedis ($40). Not to mention transportation cost. The professional basic schoolteacher in Ghana (such as was recruited in this current study) earns between GHC 800.00 ($86) – GHC 2,083.00 ($226) per month depending on years of service and educational background (Ghana insider, 2022). Therefore, the cost of screening may force a female teacher faced with other compelling family responsibilities to attend to her family's needs rather than take up screening. This current study found about 85% of participants had children and 73% were married. Also, several studies have identified financial challenges as barrier to cervical cancer screen among many under-screened groups (Majid et al, 2019; Adunlin et al, 2019; McAlearney et al, 2010). This has policy implications. NHIS should cover the cost of cervical screening which is preventive, rather than the care of breast and cervical cancer patients in hospital as it is being practiced currently (NHIA, 2016). For literature is explicit on the importance cervical screening in cervical cancer prevention. In fact, the introduction of Pap smear in North America five decades ago, plummeted their morbidity and mortality rates (Denny et al., 2013; WHO, 2013). Also developed countries that have adopted routine cervical screening for women have also seen drastic dip in cases of cervical cancer. Whilst developing countries (mostly SSA) where implementation has been unsuccessful bear about 90% of the global burden of cervical cancer (WHO, 2022).

University of Ghana http://ugspace.ug.edu.gh

Therefore, when NHIS covers cervical screening, it will be more accessible and cost effective as it could result in decline in cervical cancer mortality and morbidity.

Also unsuitable working hours could account for the low screening uptake observed after intervention. Since the reproductive health clinics open at the time that teachers are in school with children. The clinics do not open on weekends when the teachers are free to utilize screening services. This has policy implication. It is recommended that Policy makers and implementers such as Ministry of health and Ghana health service and other private organizations such as Marie Stopes to consider revising their clinic hours to include weekends. This will allow working women who cannot make time during weekdays to attend on week--ends

Another factor is the invasive nature of cervical screening which may have may have contributed to low screening uptake observed because it challenges one's self-respect. Therefore, it requires a lot of internal motivation and certainty for a woman to subject herself and expose her genitals to another especially where there are no symptoms. In some cases, it could be perceived as wishing oneself the disease and one could just say "God forbid" and simply forget about screening (Yimer et al, 2021)

The evidence from this study suggests that high educational level does not influence screening uptake as demonstrated elsewhere (Aina, 2020; Nyangasi et al., 2018; Tiruneh, 2017; Adanu, 2010). However, this study's finding is congruent with Tapera et al., (2019), Who found educational level has no association with cervical screening uptake. It further confirms Adanu (2002), report that the use of Pap smear was very low among well educated women in Accra, in spite of high level of education and knowledge about cervical cancer. In order to reduce the incidence of cervical cancer in Ghana, there is the need for the establishment of routine CCS at the national level by the Ministry of health and Ghana health service, covered by NHIS. However,

University of Ghana http://ugspace.ug.edu.gh

until this occurs, there is the need for deliberate efforts to team with the telcos to create awareness on cervical cancer through WhatsApp and SMS. Otherwise, cervical cancer will remain one of the most common genital cancers in Ghana for decades to come.

5.5 Strengths of the study

1. This study shows how mHealth communication intervention (SMS and WhatsApp) can increase the knowledge on cervical cancer risk factors and general knowledge of cervical cancer.
2. At the time of this study, there were no intervention studies among women with regards to their uptake of cervical cancer screening and knowledge on cervical cancer in Ghana.
3. This is the first longitudinal studies conducted in Ghana on mHealth communication (SMS and WhatsApp) intervention related to female teachers' uptake of cervical cancer screening and knowledge on cervical cancer
4. The SMS and WhatsApp platforms used to disseminate information sustained the interest of the female teachers throughout the study. Only one person dropped out after the intervention

5.6 Limitations of the study

1. The "current study recruited female teachers from basic schools in urban areas in Accra Metropolis. The sample may not be a good representation of women in the country. This group of teachers may be more literate and more health conscious than other female teachers in rural parts of Ghana, or other groups of women elsewhere in Ghana, who are unemployed, less educated or have unstable employment." Future research should be more diverse to include

University of Ghana http://ugspace.ug.edu.gh

all group of women, which helps to ensure that the results will have an impact on all women in Ghana

2. The minimum sample size of 354 calculated for objectives 1& 2 were not met and this can affect the power. That is the ability of the study to detect the effect of the communication intervention on knowledge on cervical cancer and cervical screening uptake was reduced. Nonetheless, the robust statistical analysis used was able control defects of reduced statistical power.

3. There was inadequate literature on the effect of WhatsApp intervention on cervical knowledge and screening uptake. This limited the scope of discussion on the use of WhatsApp intervention on cervical cancer knowledge and screening uptake.

5.7 Contribution to Knowledge

Apart from contributing to literature on intervention on cervical cancer in Ghana, this study also lends credence to the fact that WhatsApp and SMS are effective platform for improving knowledge, and creating awareness on cervical cancer

This study systematically tested the effect of SMS only, WhatsApp only and SMS plus WhatsApp on female teachers' knowledge and cervical screening uptake. However, most previous studies conducted employed only SMS. This study design is an improvement over the SMS only or WhatsApp only designs.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study used a cluster randomized design with pre and post stages to assess the impact of mHealth communication intervention on knowledge of cervical cancer and screening uptake among female teachers in Accra Metropolis. The study sampled 237 female teachers. It examined their knowledge of cervical cancer and screening before using mHealth communication intervention (SMS and WhatsApp) for three months. SMS and whatsApp platforms were used give education on cervical cancer and cervical screening. Descriptive and inferential statistics were used to analyze the data.

The study concludes that there was a low prevalence of cervical cancer screening uptake among female teachers in Accra Metropolis. Significant predictors associated with cervical screening uptake were age and perceived barrier among female teachers in Accra Metropolis.

Teachers in both the intervention and control groups had some knowledge about cervical cancer. However, the teachers in the WhatsApp only group intervention achieved the highest increase in Knowledge after the communication intervention comparing SMS only versus control, WhatsApp only versus control, Whatsapp plus SMS versus control and SMS versus WhatsApp. This study concludes that mHealth communication interventions such as SMS and WhatsApp had an impact on knowledge of risk factors of cervical cancer and cervical cancer screening. However, WhatsApp was the most effective in terms of raising awareness on cervical cancer.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

6.2 Recommendations

The study proposes a number of recommendations based on study findings.

Ghana Education Service (GES)

- GES should adopt the findings revealed by this study in providing regular educational programs through SMS and whatsApp in the schools on cervical cancer

The Media

- Ministry of Information, Media Commission, Media houses promote the use of WhatsApp in awareness creation about cervical cancer

National Health Insurance Authority (NHIA)

- NHIA to revise existing policy on cancer care of women to allow NHIS to cover the cost of cervical screening which is preventive, rather than the care of breast and cervical cancer patients in hospital

Other Stakeholders

- Funding agencies interested in women's health should provide funding to support the cervical screening program of women in Ghana

Future Research: Considering the invaluable benefits, a study like this bestows to women, it is recommended that this study be replicated in several other regions and towns of the country in future.

University of Ghana http://ugspace.ug.edu.gh

REFERENCES

Abaza, H., & Marschollek, M. (2017). mHealth application areas and technology combinations. *Methods of information in medicine*, *56*(S 01), e105-e122

Abdullah, F., Aziz, N. A., & Tin, T. S. (2011). Factors related to poor practice of pap smear screening among secondary school teachers in Malaysia. *Asian Pacific journal of cancer prevention*, *12*(5), 1347-1352.

Abiodun, O. A., Olu-Abiodun, O. O., Sotunsa, J. O., & Oluwole, F. A. (2014). Impact of health education intervention on knowledge and perception of cervical cancer and cervical screening uptake among adult women in rural communities in Nigeria. *BMC public health*, *14*(1), 1-9.

Abotchie, P. N., & Shokar, N. K. (2009). Cervical cancer screening among college students in Ghana: knowledge and health beliefs. *International Journal of Gynecologic Cancer*, *19*(3).

Acera, A., Manresa, J. M., Rodriguez, D., Rodriguez, A., Bonet, J. M., Trapero-Bertran, M., ... & De Sanjosé, S. (2017). Increasing cervical cancer screening coverage: a randomised, community-based clinical trial. *PloS one*, *12*(1), e0170371.

Adageba, R. K., Danso, K. A., Ankobea, F. K., Kolbilla, D. Z., & Opoku, P. (2011). Knowledge of cervical cancer and patronage of cervical cancer screening services among female health workers in Kumasi, Ghana. *African Journal of Haematology and Oncology*, *2*(1).

Adanu, R. M.K., (2002). Cervical cancer knowledge and screening in Accra, Ghana. *Journal of women's health & gender-based medicine*, *11*(6), 487-488.

Adanu, R. M. K., Seffah, J. D., Duda, R., Darko, R., Hill, A., & Anarfi, J. (2010). Clinic visits and cervical cancer screening in Accra. *Ghana medical journal*, *44*(2).

Adanu, R., Mbizvo, M. T., Baguiya, A., Adam, V., Ademe, B. W., Ankomah, A.,. & Temmerman, M. (2015). Sexual and reproductive health research and research capacity strengthening in Africa: perspectives from the region. *Reproductive health*, *12*(1), 1-3.

Adetola, V., & Guay, M. (2011). Robust adaptive MPC for constrained uncertain nonlinear systems. *International Journal of Adaptive Control and Signal Processing*, *25*(2), 155-167.

Adler, N. J., & Harzing, A. W. (2009). When knowledge wins: Transcending the sense and nonsense of academic rankings. *Academy of Management Learning & Education*, *8*(1), 72-95.

Adogu, P.O., Njelita, I. A., Chimah, V. C., (2014). Cervical cancer: Knowledge of risk factors and practice of preventive measures among female primary school teachers in urban Anambra State, Nigeria. International journal of Tropical Medicine and Public Health. 5(1): 14-18:

Afam, N. H., & Ba-Break, M. (2017). Analysis of Interventions for Improving Cervical-Cancer Screening Uptake among Nigerian Women. *Public Health Open Access*, *1*(2).

Afribary (2020). Conceptual Framework- Meaning, Importance and How to Write it. Available at: https://afribary.com/knowledge/conceptual-framework/. Retrieved in July, 2022

University of Ghana http://ugspace.ug.edu.gh

Agarwal, S., LeFevre, A. E., Lee, J., L'engle, K., Mehl, G., Sinha, C., & Labrique, A. (2016). Guidelines for reporting of health interventions using mobile phones: mobile health (mHealth) evidence reporting and assessment (mERA) checklist. *bmj*, *352*

Alexander, S., (2018) How to interpret statistically insignificant results? Retrieved from: https://www.researchgate.net/post/How_to_interpret_statistically

AlMubarak, H. A., Stanley, J., Guo, P., Long, R., Antani, S., Thoma, G., ... & Stoecker, W. (2019). A hybrid deep learning and handcrafted feature approach for cervical cancer digital histology image classification. *International Journal of Healthcare Information Systems and Informatics (IJHISI)*, *14*(2), 66-87.

Alwashmi, M. F., Fitzpatrick, B., Farrell, J., Gamble, J. M., Davis, E., Van Nguyen, H., ... & Hawboldt, J. (2020). Perceptions of patients regarding mobile health interventions for the management of chronic obstructive pulmonary disease: mixed methods study. JMIR mHealth and uHealth, 8(7), e17409.

AMA composite budget (2019). Republic of Ghana. Composite budget for 2019-2022. Retrieved from: https://mofep.gov.gh/sites/default/files/composite-budget/2019/GR/Accra-Metropolitan.pdf

Amarin, Z. O., Badria, L. F., & Obeidat, B. R. (2008). Attitudes and beliefs about cervical smear testing in ever-married Jordanian women. *EMHJ-Eastern Mediterranean Health Journal, 14 (2), 389-397, 2008*.

American Cancer Society. (2015, February 26). Cancer Facts and Figures 2015.

Ampofo, A. G., Adumatta, A. D., Owusu, E., & Awuviry-Newton, K. (2020). A cross-sectional study of barriers to cervical cancer screening uptake in Ghana: An application of the health belief model. *PloS one*, *15*(4), e0231459.

Anaman-Torgbor, J. A., King, J., & Correa-Velez, I. (2017). Barriers and facilitators of cervical cancer screening practices among African immigrant women living in Brisbane, Australia. *European Journal of Oncology Nursing*, *31*, 22-29.

Anaman-Torgbor, J., Angmorterh, S. K., Dordunoo, D., & Ofori, E. K. (2020). Cervical cancer screening behaviours and challenges: a sub-Saharan Africa perspective. *The Pan African Medical Journal*, *36*.

Andersson, S., Rylander, E., Larsson, B., Strand, A., Silfversvärd, C., & Wilander, E. (2001). The role of human papillomavirus in cervical adenocarcinoma carcinogenesis. *European Journal of Cancer*, *37*(2), 246-250.

Andreas, J., Klein, D., & Levine, S. (2017, July). Modular multitask reinforcement learning with policy sketches. In *International Conference on Machine Learning* (pp. 166-175). PMLR.

Anorlu, R. I. (2008). Cervical cancer: the sub-Saharan African perspective. *Reproductive health matters*, *16*(32), 41-49.

Anorlu., R., Adegbesan, R., Adaramewa., T., (2010), Knowledge of HPV and cervical cancer among HIV-positive women in Lagos, Nigeria. 5(Suppl 1): A46.

University of Ghana http://ugspace.ug.edu.gh

Arbyn, M., Castellsagué, X., de Sanjosé, S., Bruni, L., Saraiya, M., Bray, F., & Ferlay, J. (2011). Worldwide burden of cervical cancer in 2008. *Annals of oncology*, *22*(12), 2675-2686.

Arbyn, M., Weiderpass, E., Bruni, L., de Sanjosé, S., Saraiya, M., Ferlay, J., & Bray, F. (2020). Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *The Lancet Global Health*, *8*(2), e191-e203.

Ashtarian, H., Mirzabeigi, E., Mahmoodi, E., & Khezeli, M. (2017). Knowledge about cervical cancer and pap smear and the factors influencing the pap test screening among women. *International journal of community based nursing and midwifery*, *5*(2), 188.

Austin, L.T., Ahmed, F., Mc Nally, N.J., (2002). Breast and cervical cancer screening in Hispanic women: a literature review using the health belief model. Women's Health Issues. 12(3): 122-128

Awoonor-Williams, J. K., Bawah, A. A., Nyonator, F. K., Asuru, R., Oduro, A., Ofosu, A., & Phillips, J. F. (2013). The Ghana essential health interventions program: a plausibility trial of the impact of health systems strengthening on maternal & child survival. *BMC health services research*, *13*(2), 1-12.

Awua, A. K., Wiredu, E. K., Afari, E. A., Tijani, A. S., Djanmah, G., & Adanu, R. M. (2018). A tailored within-community specimen collection strategy increased uptake of cervical cancer screening in a cross-sectional study in Ghana. *BMC public health*, *18*(1), 1-11.

Awua, A.K., Adanu, R.M.K., Wiredu, E.K., Afari E., &Saverini, A., (2017). Differences in age-specific HPV prevalence between self-collected and health personnel collected specimen in a cross-sectional study in Ghana. *Infectious agents and cancer,12(26),* 1-13

Ayanore, M. A., Adjuik, M., Ameko, A., Kugbey, N., Asampong, R., Mensah, D. & Zotor, F. (2020). Self-reported breast and cervical cancer screening practices among women in Ghana: predictive factors and reproductive health policy implications from the WHO study on global AGEing and adult health. *BMC Women's Health*, *20*(1), 1-10.

Ba, D. M., Ssentongo, P., Musa, J., Agbese, E., Diakite, B., Traore, C. B., ... & Maiga, M. (2021). Prevalence and determinants of cervical cancer screening in five sub-Saharan African countries: A population-based study. *Cancer Epidemiology*, *72*, 101930.

Babirye, D., Shete, P. B., Farr, K., Nalugwa, T., Ojok, C., Nantale, M., ... & Cattamanchi, A. (2019). Feasibility of a short message service (SMS) intervention to deliver tuberculosis testing results in peri-urban and rural Uganda. *Journal of clinical tuberculosis and other mycobacterial diseases*, *16*, 100110.

Barhoumi, C. (2015). The Effectiveness of WhatsApp Mobile Learning Activities Guided by Activity Theory on Students' Knowledge Management. *Contemporary educational technology*, *6*(3), 221-238.

Bass, M., Rosen, K. D., Gerend, M. A., Wakschlag, L. S., Madkins, K., Crosby, S. T., ... & Smith, J. D. (2021). Development and feasibility of a Configurable Assessment Messaging Platform for Interventions (CAMPI). *Families, Systems, & Health*, *39*(1), 19.

University of Ghana http://ugspace.ug.edu.gh

Basu, P., Sarkar, S., Mukherjee,S., Ghoshal, M., Mittal, S.,et al., (2016). Women's perceptions and and social barriers determine compliance to cervical screening: results from a population based study in India. *Cancer detect Prev 30(4): 369-74*

Bayu, H., Berhe, Y., Mulat, A., & Alemu, A. (2016). Cervical cancer screening service uptake and associated factors among age eligible women in Mekelle Zone, Northern Ethiopia, 2015: a community based study using health belief model. *PloS one*, *11*(3), e0149908

Bessler, M., Stevens, P. D., Milone, L., Parikh, M., & Fowler, D. (2007). Transvaginal laparoscopically assisted endoscopic cholecystectomy: a hybrid approach to natural orifice surgery. *Gastrointestinal endoscopy*, *66*(6), 1243-1245.

Bhatt, D. L , Schwartz, G. G., Steg, P. G., Szarek, M., Bittner, V. A., Diaz, R., ... & Zeiher, A. M. (2018). Alirocumab and cardiovascular outcomes after acute coronary syndrome. *New England Journal of Medicine*, *379*(22), 2097-2107.

Bhochhibhoya S, Dobbs PD, Maness SB. (2021). Interventions using mHealth strategies to improve screening rates of cervical cancer: A scoping review

Bhochhibhoya, S. Dobb,D.P. and Manes, S.B. (2020). Interventions using mhealth strategies to improve screening rates of cervical cancer: a scoping review. *Journal of preventive medicine* Doi 10.106/j.ypmed.2020.106387

Birhanu, Z., Abdissa, A., Belachew, T., Deribew, A., Segni, H., Tsu, V., ... & Russell, F. M. (2012). Health seeking behavior for cervical cancer in Ethiopia: a qualitative study. *International journal for Equity in health*, *11*(1), 1-8

Bloch, M., Beoku-Betts, J.A., &Tabachnick,B. R., (2000). Power, Opportunities and Constraints. Lynne Rienner Publication. London

Bloch,M., & Vavrus,F., (2000). Gender and educational research, policy and practice in Sub-Saharan Africa: Theoretical prospects in Power, Opportunities and Constraints. Lynne Rienner Publication. London

Blumenthal, J. A., Babyak, M. A., Doraiswamy, P. M., Watkins, L., Hoffman, B. M., Barbour, K. A., ... & Sherwood, A. (2007). Exercise and pharmacotherapy in the treatment of major depressive disorder. *Psychosomatic medicine*, *69*(7), 587.

Bonafede, M. M., Miller, J. D., Pohlman, S. K., Troeger, K. A., Sprague, B. L., Herschorn, S. D., & Winer, I. H. (2019). Breast, cervical, and colorectal cancer screening: patterns among women with Medicaid and commercial insurance. *American journal of preventive medicine*, *57*(3), 394-402.

Boskey, E. et al 2022. What is Health Belief Model? Retrieved from: https://www.verywellmind.com/health-belief-model-3132721. Retrieved in July, 2022

Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, *68*(6), 394-424.

Brazzaville, Republic of Congo: WHO Regional Office for Africa. Available from:

University of Ghana http://ugspace.ug.edu.gh

http://www.who.int/countryfocus/cooperation_strategy/ccs_gha_en.pdf

Brinton L.A., Figueroa, J.D., Awuah, B,, Yarney, J., Wiafe, S., Wood, S.N., Ansong, D., Nyarko, K., Wiafe-Addai, B., Clegg-Lamptey, J. N.(2014). Breast cancer in subSaharan Africa: opportunities for prevention. *Breast Cancer Res Treat*;144(3):467–78

Broberg, G., Gyrd-Hansen, D., Miao Jonasson, J., Ryd, M. L., Holtenman, M., Milsom, I., & Strander, B. (2014). Increasing participation in cervical cancer screening: offering a HPV self-test to long-term non-attendees as part of RACOMIP, a Swedish randomized controlled trial. *International journal of cancer*, *134*(9), 2223-2230.

Burd, E. M. (2003). Human papillomavirus and cervical cancer. *Clinical microbiology reviews*, *16*(1), 1-17.

Calys-Tagoe, B. N., Aheto, J. M., Mensah, G., Biritwum, R. B., & Yawson, A. E. (2020). Cervical cancer screening practices among women in Ghana: evidence from wave 2 of the WHO study on global AGEing and adult health. *BMC women's health*, *20*(1), 1-9.

Campos, N. G., Tsu, V., Jeronimo, J., Mvundura, M., Lee, K., & Kim, J. J. (2015). When and how often to screen for cervical cancer in three low-and middle-income countries: a cost-effectiveness analysis. *Papillomavirus Research*, *1*, 38-58.

Canavan, T. P., & Doshi, N. R. (2000). Cervical cancer. *American family physician*, *61*(5), 1369-1376.

Cancer Research UK (2017) Cervical cancer. Retrieved from: https://www.cancerresearchuk.org/about-cancer/cervical-cancer

Cervical cancer training and prevention. http://www.battorcervicalcentre.org/

Chan, A. H., Stewart, A. W., Harrison, J., Camargo Jr, C. A., Black, P. N., & Mitchell, E. A. (2015). The effect of an electronic monitoring device with audiovisual reminder function on adherence to inhaled corticosteroids and school attendance in children with asthma: a randomised controlled trial. *The Lancet Respiratory Medicine*, *3*(3), 210-219.

Chandrupatla, S. G., Khalid, I., & Tavares, M. (2019). Oral HPV prevalence and HPV vaccination among special needs population in the US. *Papillomavirus Research*, *8*, 100182.

Chanthavilay, P., Mayxay, M., Phongsavan, K., Marsden, D. E., White, L. J., Moore, L., & Reinharz, D. (2015). Accuracy of combined visual Inspection with Acetic Acid and cervical cytology testing as a primary screening tool for cervical cancer: a systematic review and meta-analysis. *Asian Pacific Journal of Cancer Prevention*, *16*(14), 5889-5897.

Cherry, K., & Gans, S. (2018). How social support contributes to psychological health. *Verywell Mind*.

Chi, B. H., & Stringer, J. S. (2010). Mobile phones to improve HIV treatment adherence.

Coleman, M. P., Forman, D., Bryant, H., Butler, J., Rachet, B., Maringe, C.. & ICBP Module 1 Working Group. (2011). Cancer survival in Australia, Canada, Denmark, Norway,

University of Ghana http://ugspace.ug.edu.gh

Sweden, and the UK, 1995–2007 (the International Cancer Benchmarking Partnership): an analysis of population-based cancer registry data. *The Lancet*, *377*(9760), 127-138.

Collins, M., (2022). Educational and health issues affecting women and girls in Africa. https://www.fpri.org/article/2022/04/educational-and-health-issues-affecting-women-and-girls-in-africa/

Conner, M., & Norman, P. (2022). Health Psychology in comprehensive clinical psychology 2nd Edition. Retrieved from; https://www.sciencedirect.com/topics/medicine-and-dentistry/health-belief-model

Costa, M. F. (2020). Health belief model for coronavirus infection risk determinants. *Revista de Saúde Pública*, *54*.

Creswell, J.W.(2004) Research Design Qualitative and Quantitative Approaches. Sage Publications. United States of America

Crespi, M.,(2016) Improved decisions for cluster randomized Trials.Annual review of public health. Retrieved from: https://www.annualreviews.org/doi/pdf/10.1146/annurev-publhealth-032315-021702

Crompton, K., van Goozen, S., van den Bree, M., Bunney, J., & Lydall, E. (2013). A feasibility study of short message service text messaging as a surveillance tool for alcohol consumption and vehicle for interventions in university students. *BMC public health*, *13*(1), 1-14.

Cutler, D. M. (2002). Equality, efficiency, and market fundamentals: the dynamics of international medical-care reform. *Journal of economic literature*, *40*(3), 881-906.

de Jonge E., Cloes, E., Op de Beeck, L., Adriaen,B., et al., (2008). A quasi-randomized trial on the effectiveness of invitation letter to improve participation in setting of Opportunistic screening for cervical cancer. *European Journal of Cancer Prevention*, 17(3): 238-242

Denny, J. C., Bastarache, L., Ritchie, M. D., Carroll, R. J., Zink, R., Mosley, J. D., ... & Roden, D. M. (2013). Systematic comparison of phenome-wide association study of electronic medical record data and genome-wide association study data. *Nature biotechnology*, *31*(12), 1102-1111.

Denny, L., & Anorlu, R. (2012). Cervical cancer in Africa. *Cancer Epidemiology and Prevention Biomarkers*, *21*(9), 1434-1438.

Denny, L., Quinn, M., Sankaranararayan (2006). Chapter 8: Screening for cervical cancer in developing countries. Vaccine. 24(3): S71-77.

Denny, SK, Denny, A., & Paul, T. (2013). Distribution, prevalence and intensity of Anguillicoloides crassus in the American eel, Anguilla rostrata, in the Bras d'Or Lakes, Nova Scotia. *BioInvasions Record* , *2* (1).

Devi, R., Singh, S. J., Powell, J., Fulton, E. A., Igbinedion, E., & Rees, K. (2015). Internet-based interventions for the secondary prevention of coronary heart disease. *Cochrane Database of Systematic Reviews*, (12).

University of Ghana http://ugspace.ug.edu.gh

Diop, M., (2015) How empowering women can help end poverty in Africa. https://blogs.worldbank.org/nasikiliza/how-empowering-women-can-help-end-poverty-africa#

Doctor, H.V., Nkhana -Salimu, S, Abdulsalam-Anibilowo, M. (2018). Health facility delivery in sub-Saharan Africa: Success, Challenges and implications for 2030 development agenda. BMC Public Health 18(765):1-12

Domfeh, A. B., Wiredu, E. K., Adjei, A. A., Ayeh-Kumi, P. F. K., Adiku, T. K., Tettey, Y., ... & Armah, H. B. (2008). Cervical human papillomavirus infection in Accra, Ghana. *Ghana medical journal*, *42*(2).

Duke, P., Godwin, M., Ratnam, S., Dawson, L., Fontaine, D., Lear, A., ... & Peach, M. (2015). Effect of vaginal self-sampling on cervical cancer screening rates: a community-based study in Newfoundland. *BMC women's health*, *15*(1), 1-9.

Eaker, S., Adami,H. O., & Granath,F., (2004). A Large Population- Based Randomized Controlled Trial to Increase Attendance at Screening for Cervical Cancer. *Cancer Epidemiol Biomakers Prev.* 13(3): 346-54.

Eaker, S., Adami, H. O., & Sparén, P. (2001). Attitudes to screening for cervical cancer: a population-based study in Sweden. *Cancer Causes & Control*, *12*(6), 519-528.

Eaker, S., Adami, H. O., & Sparén, P. (2001). Reasons women do not attend screening for cervical cancer: a population-based study in Sweden. *Preventive medicine*, *32*(6), 482-491.

Ebu, N. I., Mupepi, S. C., Siakwa, M. P., & Sampselle, C. M. (2015). Knowledge, practice, and barriers toward cervical cancer screening in Elmina, Southern Ghana. *International journal of women's health*, *7*, 31.

Ebu, N. I., Amissah-Essel,S., Aseidu, C., (2019). Impact of health education intervention on knowledge and perception of cervical cancer and screening for women in Ghana. *BMC public health*, 19,1505

El-Sappagh, S., Ali, F., Hendawi, A., Jang, J. H., & Kwak, K. S. (2019). A mobile health monitoring-and-treatment system based on integration of the SSN sensor ontology and the HL7 FHIR standard. *BMC medical informatics and decision making*, *19*(1), 97.

Emmanuel, T. A., Oluwafolahan, S., & Adebukola Sinat, B. M. (2016). Predictors and factors related to the uptake of cervical cancer screening test among female secondary school teachers in Sagamu, Ogun State, Nigeria. *Annals of Tropical Medicine & Public Health*, *9*(4).

Eze, J. N., Umeora, O. U., Obuna, J. A., Egwuatu, V. E., & Ejikeme, B. N. (2012). Cervical cancer awareness and cervical screening uptake at the Mater Misericordiae Hospital, Afikpo, Southeast Nigeria. *Annals of African medicine*, *11*(4), 238.

Fentie, A. M., Tadesse, T. B., & Gebretekle, G. B. (2020). Factors affecting cervical cancer screening uptake, visual inspection with acetic acid positivity and its predictors among women attending cervical cancer screening service in Addis Ababa, Ethiopia. *BMC women's health*, *20*(1), 1-10

University of Ghana http://ugspace.ug.edu.gh

Bray, F., Ferlay,J., Soerjomataram, L., et al.,(2018) Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries, CA Cancer J. Clin. 68: 394–424, https://doi.org/10.3322/caac.21492.

Ferlay, J., Colombet, M., Soerjomataram, I., Dyba, T., Randi, G., Bettio, M., ... & Bray, F. (2018). Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018. *European journal of cancer*, *103*, 356-387.

Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., ... & Bray, F. (2015). Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *International journal of cancer*, *136*(5), E359-E386

Ferris, G. R., Adams, G., Kolodinsky, R. W., Hochwarter, W. A., & Ammeter, A. P. (2002). Perceptions of organizational politics: Theory and research directions.

Fitzmaurice, C., Allen, C., Barber, R. M., Barregard, L., Bhutta, Z. A., Brenner, H., ... & Satpathy, M. (2017). Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 32 cancer groups, 1990 to 2015: a systematic analysis for the global burden of disease study. *JAMA oncology*, *3*(4), 524-548.

Fornos, A., Guinand, N., van de Berg, R., Stokroos, R., Micera, S., Kingma, H., ... & Guyot, J. P. (2014). Artificial balance: restoration of the vestibulo-ocular reflex in humans with a prototype vestibular neuroprosthesis. *Frontiers in neurology*, *5*, 66.

Fortunato, C., Barbarino, P., Boveri, S., Caroli, S., Del Mistro, A., ... & Altobelli, E. (2015). Self-sampling to increase participation in cervical cancer screening: an RCT comparing home mailing, distribution in pharmacies, and recall letter. *British journal of cancer*, *112*(4), 667-675.

Franciosi M, Lucisano G, Lapice E, Strippoli GF, Pellegrini F, Nicolucci A. Metformin therapy and risk of cancer in patients with type 2 diabetes: Systematic review. PLoS One. 2013; 8:e71583

Gamarra, C. J., Paz, E. P. A., & Griep, R. H. (2005). Knowledge, attitudes and practice related to Papanicolaou smear test among Argentina's women. *Revista de saúde pública*, *39*, 270-276.

Ganasegeran, K., Renganathan, P., Rashid, A., & Al-Dubai, S. A. R. (2017). The m-Health revolution: Exploring perceived benefits of WhatsApp use in clinical practice. *International journal of medical informatics*, *97*, 145-151.

Geng, J., Sun, Y., Zhang, M., Li, C., Yang, Y., Liu, Z., & Li, S. (2015). Long-term effects of controlled release urea application on crop yields and soil fertility under rice-oilseed rape rotation system. *Field Crops Research*, *184*, 65-73.

Ghana insider, 2022. https://ghanainsider.com/teachers-salary/

Ghebre, R. G., Grover, S., Xu, M. J., Chuang, L. T., & Simonds, H. (2017). Cervical cancer control in HIV-infected women: past, present and future. *Gynecologic oncology reports*, *21*, 101-108.

University of Ghana http://ugspace.ug.edu.gh

GLOBOCAN, IARC. (2012) GLOBOCAN 2012: estimated cancer incidence, mortality and prevalence worldwide in 2012; Fact Sheets

Gouda, H. N., Charlson, F., Sorsdahl, K., Ahmadzada, S., Ferrari, A. J., Erskine, H., & Whiteford, H. (2019). Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. *The Lancet Global Health*, *7*(10), e1375-e1387.

Gouda, M. K., Hassan, M. S., & Alieldin, N. H. Knowledge of Hepatitis, Hepatocellular Carcinoma and Hepatocellular Carcinoma Screening Guidelines among Cirrhotic Patients at El-Ragehy Hospital, Assiut University.

Gran, M., (2019). THE GLOBAL ROLE OF WOMEN – CARETAKERS, CONSCIENCE, FARMERS, EDUCATORS AND ENTREPRENEURS. Global volunteers. Retrieved from: https://globalvolunteers.org/global-role-of-women/

Gsm Association. (2019). The mobile economy 2018. *Recuperado de https://www. gsmaintelligence. com/research*.

Gyamfua, A. A., Nkrumah, I., Ibitoye, B. M., Agyemang, B. A., Ofosu, E. S., Tsoka-Gwegweni, J. M., & Cumber, S. N. (2019). The level of knowledge and associated socio-demographic factors on cervical cancer among women: a cross-sectional study at Kenyase Bosore community, Ghana. *The Pan African Medical Journal*, *34*.

Hall, I. J. Tangka, F. K., Howard, D. H., Royalty, J., Dalzell, L. P., Miller, J., & O'Hara, B. J., (2015). Cervical cancer screening of underserved women in the United States: results from the National Breast and Cervical Cancer Early Detection Program, 1997–2012. *Cancer Causes & Control*, *26*(5), 671-686.

Handlogten, K. S., Molitor, R. J., Roeker, L. E., Narla, N. P., Bachman, M. J., Quayson, S., ... & Ansong, D. (2014). Cervical cancer screening in Ghana, west Africa: prevalence of abnormal cytology and challenges for expanding screening. *International Journal of Gynecological Pathology*, *33*(2), 197-202

Harrington, K., Hall, E., Hawkins, M., Henry, A., MacKay, R., Maughan, T., ... & Faivre-Finn, C. (2017). Introducing the cancer research uk advanced radiotherapy technologies network (ART-NET). *Clinical Oncology*, *29*(11), 707-710.

Hasahya, O. T., Berggren, V., Sematimba, D., Nabirye, R. C., & Kumakech, E. (2016). Beliefs, perceptions and health-seeking behaviours in relation to cervical cancer: a qualitative study among women in Uganda following completion of an HPV vaccination campaign. *Global health action*, *9*(1), 29336.

Hasen, M. A., & Ammar, A. (2016). P. 123 Assessing level of awareness, attitudes and believes toward pediatric congenital neurosurgical conditions. *Canadian Journal of Neurological Sciences*, *43*(S2), S48-S48.

Hassan, M., Awosan, K. J., Nasir, S., Tunau, K., Burodo, A., Yakubu, A., & Oche, M. O. (2016). Knowledge, risk perception and hepatitis B vaccination status of healthcare workers in

University of Ghana http://ugspace.ug.edu.gh

Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. *Journal of Public Health and Epidemiology*, *8*(4), 53-59.

Head, K. J., Johnson, N. L., Scott, S. F., & Zimet, G. D. (2020). Communicating cervical cancer screening results in light of new guidelines: clinical practices at federally qualified health centers. *Health communication*, *35*(7), 815-821.

Houghbaum, G.M., Becker, M.H., Rosenstock, I.M., Stretcher, V.J. (2021). https://www.orau.gov/hsc/theorypicker/hbm.html# Retrieved in July, 2022

Huf, S., Kerrison, R. S., King, D., Chadborn, T., Richmond, A., Cunningham, D., ... & Vlaev, I. (2020). Behavioral economics informed message content in text message reminders to improve cervical screening participation: Two pragmatic randomized controlled trials. *Preventive medicine*, *139*, 106170.

Huf, S., King, D., Kerrison, R., Chadborn, T., Richmond, A., Cunningham, D., & Darzi, A. (2017). Behavioural text message reminders to improve participation in cervical screening: a randomised controlled trial. *The Lancet*, *390*, S46.

Hussain, M., Zaidan, A. A., Zidan, B. B., Iqbal, S., Ahmed, M. M., Albahri, O. S., & Albahri, A. S. (2018). Conceptual framework for the security of mobile health applications on android platform. *Telematics and Informatics*, *35*(5), 1335-1354.

Ibrahim, F. M. (2018). *The Effect of Self-Management Telecare Educational Program on Knowledge, Attitude and Practice among Saudi Type-2 Diabetic Patients at Sultan Bin Abdulaziz Humanitarian City Kindom of Sudia Arabia (2015-2017)* (Doctoral dissertation, University of Gezira).

ICO/IARC (2018). Information Centre on HPV and Cancer. Ghana Human Papillomavirus and Related Cancers, Fact Sheet 2018.

Ifemelumma, C. C., Anikwe, C. C., Okorochukwu, B. C., Onu, F. A., Obuna, J. A., Ejikeme, B. N., & Ezeonu, O. P. (2019). Cervical cancer screening: assessment of perception and utilization of services among health workers in low resource setting. *International journal of reproductive medicine*, *2019*.

Ijezie, A. E., & Johnson, O. E. (2019). Knowledge of cervical cancer and the uptake of the Papanicolaou smear test among public secondary school teachers in Akwa Ibom State, Nigeria. *Nigerian medical journal: journal of the Nigeria Medical Association*, *60*(5), 245.

Indracanti, M., Berhane, N., & Minyamer, T. (2018). Role of pre and post interventions on cervical cancer knowledge levels among women students at the University of Gondar, Gondar, Ethiopia. *bioRxiv*, 492611

Ilaboya D, GibsonL, Musoke,D., (2018) Perceived barriers to early detection of breast cancer in Wakiso District Uganda Using socio ecological approach Globalization and health 14(9);1-10

Ji, X., Guo, H., Yin, S., & Du, H. (2019). miR-139-5p functions as a tumor suppressor in cervical cancer by targeting TCF4 and inhibiting Wnt/β-catenin signaling. *OncoTargets and therapy*, *12*, 7739.

University of Ghana http://ugspace.ug.edu.gh

Julinawati, S., Cawley, D., Domegan, C., Brenner, M., & Rowan, N. J. (2013). A review of the perceived barriers within the Health Belief Model on pap smear screening as a cervical cancer prevention measure. *Journal of Asian Scientific Research*.

Kahesa, C., Kjaer, S., Mwaiselage, J., Ngoma, T., Tersbol, B., Dartell, M., & Rasch, V. (2012). Determinants of acceptance of cervical cancer screening in Dar es Salaam, Tanzania. *BMC public health*, *12*(1), 1-8.

Karly S, Silvia de sanjose and Philippe M. (2009). *Epidemiology and prevention of human papillomavirus and cervical cancer in sub-saharan Africa*:. Tropical medicine and International Health, 14 (10), 1287-1302.

Kerrison, R. S., Shukla, H., Cunninghan, D., et al.,(2015). Text – message reminders increase uptake of routine breast breast appointments: A randomized controlled trial in hard a hard to reach to reach population. *British Journal* of cancer 112: 1005-1010

Kidanto, H. L., Kilewo, C. D., & Moshiro, C. (2002). Cancer of the cervix: knowledge and attitudes of female patients admitted at Muhimbili National Hospital, Dar-es-Salaam. *East African medical journal*, *79*(9), 467-475.

Kileo, N. M., Michael, D., Neke, N. M., & Moshiro, C. (2015). Utilization of cervical cancer screening services and its associated factors among primary school teachers in Ilala Municipality, Dar es Salaam, Tanzania. *BMC Health Services Research*, *15*(1), 1-9.

Kohut, A., Wike, R., Horowitz, J. M., Simmons, K., Poushter, J., Barker, C.,. & Gross, E. M. (2011). *Global digital communication: Texting, social networking popular worldwide*. Washington, DC: Pew Research Centre.

Kiran, T., Davies, S., Moineddin, R., Lofters, A., (2018). Mailed Letters Versus Phone Call to Increase Uptake of Cancer Screening. A Pragmatic Randomized Trial. *Journal of American Board of Family Medicine.* 31(6): 857-868

Kurt, G., and Ayuz, A., (2019). Evaluating the Effectiveness of Interventions on Increasing Participation in Cervical Cancer Screening. The Journal of Nursing Research. 27 (5): 1-11.

LaMorte, W. (2019). The Health Belief Model. Available at: https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/behavioralchangetheories2.html Retrieved July, 2022

Lee, E. E., Fogg, L., & Menon, U. (2008). Knowledge and beliefs related to cervical cancer and screening among Korean American women. *Western Journal of Nursing Research*, *30*(8), 960-974.

Lee, H. Y., Koopmeiners, J. S., Rhee, T. G., Raveis, V. H., & Ahluwalia, J. S. (2014). Mobile phone text messaging intervention for cervical cancer screening: changes in knowledge and behavior pre-post intervention. *Journal of medical Internet research*, *16*(8), e3576.

LeFevre, A. E., Mohan, D., Hutchful, D., Jennings, L., Mehl, G., Labrique, A., ... & Moorthy, A. (2017). Mobile Technology for Community Health in Ghana: what happens when technical

University of Ghana http://ugspace.ug.edu.gh

functionality threatens the effectiveness of digital health programs?. *BMC medical informatics and decision making*, *17*(1), 1-17.

Lemos, M. S., Rothesa, I. A., Oliveiraa, F., et al., (2017). Raising cervical cancer awareness: Analysing the incremental efficacy of Short Message Service. Health Education Journal. 1-15

Lester, R. T., Ritvo, P., Mills, E. J., Kariri, A., Karanja, S., Chung, M. H., ... & Plummer, F. A. (2010). Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial. *The Lancet*, *376*(9755), 1838-1845.

Lester, R. T., Ritvo, P., Mills, E. J., Kariri, A., Karanja, S., Chung, M. H., & Plummer, F. A. (2010). Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial. *The Lancet*, *376*(9755), 1838-1845.

Lester, R., & Karanja, S. (2008). Mobile phones: exceptional tools for HIV/AIDS, health, and crisis management. *The Lancet. Infectious diseases*, *8*(12), 738-739.

Lofters, A. K., Vahabi, M., Kim, E., Ellison, L., Graves, E., & Glazier, R. H. (2017). Cervical cancer screening among women from Muslim-majority countries in Ontario, Canada. *Cancer Epidemiology and Prevention Biomarkers*, *26*(10), 1493-1499.

Lovell, M. R., Pardini, J. E., Welling, J., Collins, M. W., Bakal, J., Lazar, N., ... & Becker, J. T. (2007). Functional brain abnormalities are related to clinical recovery and time to return-to-play in athletes. *Neurosurgery*, *61*(2), 352-360.

Lund, S., Hemed, M., Nielsen, B. B., Said, A., Said, K., Makungu, M. H., & Rasch, V. (2012). Mobile phones as a health communication tool to improve skilled attendance at delivery in Zanzibar: a cluster-randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*, *119*(10), 1256-1264.

Lynette, D., Adewole, I., Anorlu, R., et al (2014). Human Papillomavirus Prevalence and type distribution in invasive cervical cancer in sub-Saharan Africa. International Journal of Cancer. 13(6): 1389-98

Mabelele, M. M., Materu, J., Ng'ida, F. D., & Mahande, M. J. (2018). Knowledge towards cervical cancer prevention and screening practices among women who attended reproductive and child health clinic at Magu district hospital, Lake Zone Tanzania: a cross-sectional study. *BMC cancer*, *18*(1), 1-8.

MacGeorge, E. L., Feng, B., & Burleson, B. R. (2011). Supportive communication. *Handbook of interpersonal communication*, *4*, 317-354.

Machado, T., Gopstein, D., Wang, A., Nov, O., Nealen, A., & Togelius, J. (2019, October). Evaluation of a recommender system for assisting novice game designers. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment* (Vol. 15, No. 1, pp. 167-173).

University of Ghana http://ugspace.ug.edu.gh

Majid, B., Khan, R., Junaid, Z., Khurshid, O., Rehman, S. H., Jaffri, S. N., ... & Safina, F. (2019). Assessment of knowledge about the risk Factors of chronic liver disease in patients admitted in Civil Hospital Karachi. *Cureus*, *11*(10).

Marcolino, M. S., Oliveira, J. A. Q., D'Agostino, M., Ribeiro, A. L., Alkmim, M. B. M., & Novillo-Ortiz, D. (2018). The impact of mHealth interventions: systematic review of systematic reviews. *JMIR mHealth and uHealth*, *6*(1), e23.

Mayo Clinic (n.d.) Pap smear. Retrieved from: https://www.mayoclinic.org/tests-procedures/pap-smear/about/pac-20394841

Mayo clinic (n.d.) HPV Test. Retrieved from: https://www.mayoclinic.org/tests-procedures/hpv-test/about/pac-20394355

Mbaka, P., Waihenya, R., Oisebe, C., & Lihana, R. (2018). Factors affecting the uptake of cervical cancer screening in Mama Lucy Kibaki Hospital, Nairobi, Kenya. *Cancer Res J*, *6*, 106.

Mbuagbaw, L., Thabane, L., Ongolo-Zogo, P., Lester, R. T., Mills, E. J., Smieja, M., ... & Kouanfack, C. (2012). The Cameroon Mobile Phone SMS (CAMPS) trial: a randomized trial of text messaging versus usual care for adherence to antiretroviral therapy. *PloS one*, *7*(12), e46909.

McAlearney, A. S., Song, P. H., Rhoda, D. A., Tatum, C., Lemeshow, S., Ruffin, M., ... & Paskett, E. D. (2010). Ohio Appalachian women's perceptions of the cost of cervical cancer screening. *Cancer*, *116*(20), 4727-4734.

McFarland, D. H., Martin-Harris, B., Fortin, A. J., Humphries, K., Hill, E., & Armeson, K. (2016). Respiratory-swallowing coordination in normal subjects: lung volume at swallowing initiation. *Respiratory physiology & neurobiology*, *234*, 89-96.

Mehta, R., & Zhu, R. J. (2009). Blue or red? Exploring the effect of color on cognitive task performances. *Science*, *323*(5918), 1226-1229.

Ministry of Health. National strategy for cancer control in Ghana 2016–2020. Ghana: Ministry of Health; 2015, 1–8

Moarcas, M., Georgescu, I.C., Bratila,E., et al. (2014). Clinical significance of HPV-DNA testing for precancerous cervical lesions. Journal of Medicine and Life. 7(3):1-3.

Montgomery, M. P., Dune, T., Shetty, P. K., & Shetty, A. K. (2015). Knowledge and acceptability of human papillomavirus vaccination and cervical cancer screening among women in Karnataka, India. *Journal of Cancer Education*, *30*(1), 130-137.

Morema, E. N., Atieli, H. E., Onyango, R.O. (2014) Determinants of Cervical screening services uptake among 18–49 year old women seeking services at the Jaramogi Oginga Odinga Teaching and Referral Hospital, Kisumu, Kenya. *BMC Health Services Research*, 14(335):1-7

Mosavel, M., Simon, C., Oakar, C., & Meyer, S. (2009). Cervical cancer attitudes and beliefs—a Cape Town community responds on World Cancer Day. *Journal of Cancer Education*, *24*(2), 114-119.

University of Ghana http://ugspace.ug.edu.gh

Mupepi, S. C., Sampselle, C. M., & Johnson, T. R. (2011). Knowledge, attitudes, and demographic factors influencing cervical cancer screening behavior of Zimbabwean women. *Journal of Women's Health*, *20*(6), 943-952.

Naber, S. K, Knudsen, A. B., Zauber, A. G., Rutter, C. M.,., Doria-Rose, V. P., Pabiniak, C., ... & Kuntz, K. M. (2016). Estimation of benefits, burden, and harms of colorectal cancer screening strategies: modeling study for the US Preventive Services Task Force. *Jama*, *315*(23), 2595-2609.

Namdar, A., Bigizadeh, S., & Naghizadeh, M. M. (2012). Measuring Health Belief Model components in adopting preventive behaviors of cervical cancer. *Journal of Fasa University of Medical Sciences*, *2*(1), 34-44.

Nartey, Yvonne, Philip C. Hill, Kwabena Amo-Antwi, Kofi M. Nyarko, Joel Yarney, and Brian Cox. "Cervical cancer in the Greater Accra and Ashanti regions of Ghana." *Journal of global oncology* 3, no. 6 (2017): 782-790.

Ncube, B., Bey, A., Knight, J., Bessler, P., Jolly, P.E., (2015). Factors associated with the uptake of cervical cancer screening among women in Portland, Jamaica. North American Journal of Medical Science. 7(3):104-13.

Ndikom, C. M., & Ofi, B. A. (2012). Awareness, perception and factors affecting utilization of cervical cancer screening services among women in Ibadan, Nigeria: a qualitative study. *Reproductive health*, *9*(1), 1-8.

NHIA, (2016) NHIS covers cervical and breast cancers. Retrieved from: http://www.nhis,gov,gh

Nkyekyer, K. (2000). Pattern of gynaecological cancers in Ghana. *East African medical journal*, *77*(10).

Nordquist, J., Hall, J., Caverzagie, K., Snell, L., Chan, M. K., Thoma, B., ... & Philibert, I. (2019). The clinical learning environment. *Medical teacher*, *41*(4), 366-372.

Nwabichie, C. C., Manaf, R. A., & Ismail, S. B. (2018). Factors affecting uptake of cervical cancer screening among African women in Klang Valley, Malaysia. *Asian Pacific journal of cancer prevention: APJCP*, *19*(3), 825.

Nwobodo, H. A., and Ba-Break, M., (2017). Analysis of Interventions for Improving Cervical-Cancer Screening Uptake among Nigerian Women. Public Health Open Access. 1(2): 1-14

Nyangasi, M., Nkonge, N. G., Gathitu, E., Kibachio, J., Gichangi, P., Wamai, R. G., & Kyobutungi, C. (2018). Predictors of cervical cancer screening among Kenyan women: results of a nested case-control study in a nationally representative survey. *BMC public health*, *18*(3), 1-10.

O'Leary, D. P., Zaheer, A., Redmond, H. P., & Corrigan, M. A. (2016). Integration of advances in social media and mHealth technology are pivotal to successful cancer prevention and control. *Mhealth*, *2*.

Odukoya, O. O., Oyediran, M. A., & Ujomu, P. I. (2012). Cervical cancer awareness and preventive practices: a challenge for female urban slum dwellers in Lagos, Nigeria. *African Journal of Reproductive Health*, *16*(1).

University of Ghana http://ugspace.ug.edu.gh

Ogembo, R. K., Gona, P. N., Seymour, A. J., Park, H. S. M., Bain, P. A., Maranda, L., & Ogembo, J. G. (2015). Prevalence of human papillomavirus genotypes among African women with normal cervical cytology and neoplasia: a systematic review and meta-analysis. *PloS one*, *10*(4), e0122488

Oh, H. J., Lauckner, C., Boehmer, J., Fewins-Bliss, R., & Li, K. (2013). Facebooking for health: An examination into the solicitation and effects of health-related social support on social networking sites. *Computers in human behavior*, *29*(5), 2072-2080.

Orr, J. A., & King, R. J. (2015). Mobile phone SMS messages can enhance healthy behaviour: a meta-analysis of randomised controlled trials. *Health psychology review*, *9*(4), 397-416

Oscarsson, M. G., Wijma, B. E., & Benzein, E. G. (2008). 'I do not need to… I do not want to… I do not give it priority…'–why women choose not to attend cervical cancer screening. *Health Expectations*, *11*(1), 26-34.

Oscarsson, M. G., Wijma, B. E., & Benzein, E. G. (2008). 'I do not need to… I do not want to… I do not give it priority…'–why women choose not to attend cervical cancer screening. *Health Expectations*, *11*(1), 26-34.

Osei, E. A., Ninon, A. P., Gaogli, J. E., & Boadi, E. O. (2021). "I Just Went for the Screening, But I Did Not Go for the Results". Utilization of Cervical Cancer Screening and Vaccination among Females at Oyibi Community. *Asian Pacific Journal of Cancer Prevention: APJCP*, *22*(6), 1789.

Owoeye, I. O. G., & Ibrahim, I. A. (2013). Knowledge and attitude towards cervical cancer screening among female students and staff in a tertiary institution in the Niger Delta. *International Journal of Medicine and Biomedical Research*, *2*(1), 48-56.

Owoeye, I. O. G., & Ibrahim, I. A. (2013). Knowledge and attitude towards cervical cancer screening among female students and staff in a tertiary institution in the Niger Delta. *International Journal of Medicine and Biomedical Research*, *2*(1), 48-56.

Padela, A. I., Peek, M., Johnson-Agbakwu, C. E., Hosseinian, Z., & Curlin, F. (2014). Associations between religion-related factors and cervical cancer screening among Muslims in greater Chicago. *Journal of lower genital tract disease*, *18*(4), 326.

Palmer, V. S., Birchfield, K. I., & Spencer, P. S. (2018). Health of Vulnerable Populations. *Academic medicine: journal of the Association of American Medical Colleges*, *93*(9), 1263

Park, M. J., Park, E. C., Choi, K. S., Jun, J. K., & Lee, H. Y. (2011). Sociodemographic gradients in breast and cervical cancer screening in Korea: the Korean National Cancer Screening Survey (KNCSS) 2005-2009. *BMC cancer*, *11*(1), 1-8.

Pearman, T. (2003). Quality of life and psychosocial adjustment in gynecologic cancer survivor. Health and quality of life outcomes 1(3):1-6.

Pereira, A. A. C., Destro, J. R., Picinin- Bernuci M, et al. (2020) Effects of a WhatsApp-Delivered Education Intervention to Enhance Breast Cancer Knowledge in Women: Mixed-Methods Study. JMIR Mhealth Uhealth 2020;8(7): e17430.

University of Ghana http://ugspace.ug.edu.gh

Petkeviciene, J., Ivanauskiene, R., & Klumbiene, J. (2018). Sociodemographic and lifestyle determinants of non-attendance for cervical cancer screening in Lithuania, 2006–2014. *Public Health*, *156*, 79-86.

Phongsavan, P., Gebel, K., Banovic, D., Buffett, K. M., & Bauman, A. E. (2014). Longer term impact of the mass media campaign to promote the Get Healthy Information and Coaching Service®: increasing the saliency of a new public health program. *Health promotion practice*, *15*(6), 828-838.

Poli, C., Bellec, M., Kuhl, U., Mortessagne, F., & Schomerus, H. (2015). Selective enhancement of topologically induced interface states in a dielectric resonator chain. *Nature communications*, *6*(1), 1-5.

Prempeh, E. A. K. (2015). *Factors affecting the utilization of cervical cancer screening services among women aged 18 to 55 years, within the Ejisu Juaben Municipality* (Doctoral dissertation).

Pribadi, E. T., & Devy, S. R. (2020). Application of the Health Belief Model on the intention to stop smoking behavior among young adult women. *Journal of Public Health Research*, *9*(2): 1-6

Quentin, R., Chanes, L., Vernet, M., & Valero-Cabré, A. (2015). Fronto-parietal anatomical connections influence the modulation of conscious visual perception by high-beta frontal oscillatory activity. *Cerebral cortex*, *25*(8), 2095-2101.

Quercia, R., Perno, C. F., Koteff, J., Moore, K., McCoig, C., Clair, M. S., & Kuritzkes, D. (2018). Twenty-five years of lamivudine: current and future use for the treatment of HIV-1 infection. *Journal of acquired immune deficiency syndromes (1999)*, *78*(2), 125.

Rashid, B., Damaraju, E., Pearlson, G. D., & Calhoun, V. D. (2014). Dynamic connectivity states estimated from resting fMRI Identify differences among Schizophrenia, bipolar disorder, and healthy control subjects. *Frontiers in human neuroscience*, *8*, 897.

Rashid, R.M.A., Mohammed, M., Hamid Z.A., et al., (2013). Is the Phone Call the most Effective Method for Recall in Cervical Screening?Results from Randomized Control Trial. *Asian Pacific Journal of Cancer Prevention: APJCP*, 14(10): 5901-4.

Rimande-Joel, R., & Ekenedo, G. O. (2019). Knowledge, Belief and practice of cervical cancer screening and prevention among women of Taraba, North-East Nigeria. *Asian Pacific journal of cancer prevention: APJCP*, *20*(11), 3291.

Rosser, J. I., Njoroge, B., & Huchko, M. J. (2015). Cervical cancer screening knowledge and behavior among women attending an urban hiv clinic in Western Kenya. *Journal of Cancer Education*, *30*(3), 567-572.

Rosser, J. I., Njoroge, B., & Huchko, M. J. (2015). Changing knowledge, attitudes, and behaviours regarding cervical cancer screening: The effects of an educational intervention in rural Kenya. *Patient Education and Counseling*. https://doi.org/10.1016/j.pec.2015.03.017

University of Ghana http://ugspace.ug.edu.gh

Rossi, P. G., Fortunato, C., Barbarino, P., Boveri, S., Caroli, S., Del Mistro, A.,. & Altobelli, E. (2015). Self-sampling to increase participation in cervical cancer screening: an RCT comparing home mailing, distribution in pharmacies, and recall letter. *British journal of cancer*, *112*(4), 667-675.

Sabatini, M. E., & Chiocca, S. (2020). Human papillomavirus as a driver of head and neck cancers. *British journal of cancer*, *122*(3), 306-314.

Sankaranarayanan, R. (2014). Screening for cancer in low-and middle-income countries. *Annals of global health*, *80*(5), 412-417.

Sankaranarayanan, R., Esmy, P. O., Rajkumar, R., Muwonge, R., Swaminathan, R., Shanthakumari, S., ... & Cherian, J. (2007). Effect of visual screening on cervical cancer incidence and mortality in Tamil Nadu, India: a cluster-randomised trial. *The Lancet*, *370*(9585), 398-406.

Sankaranarayanan, R., Ramadas, K., Thara, S., Muwonge, R., Thomas, G., Anju, G., & Mathew, B. (2013). Long term effect of visual screening on oral cancer incidence and mortality in a randomized trial in Kerala, India. *Oral oncology*, *49*(4), 314-321.

Satija, R., Farrell, J. A., Gennert, D., Schier, A. F., & Regev, A. (2015). Spatial reconstruction of single-cell gene expression data. *Nature biotechnology*, *33*(5), 495-502.

Saxena, U., Sauvaget, C., & Sankaranarayanan, R. (2012). Evidence-based screening, early diagnosis and treatment strategy of cervical cancer for national policy in low-resource countries: example of India. *Asian Pacific Journal of Cancer Prevention*, *13*(4), 1699-1703.

Sharma, A., Mentz, R. J., Granger, B. B., Heitner, J. F., Cooper, L. B., Banerjee, D., ... & Felker, G. M. (2019). Utilizing mobile technologies to improve physical activity and medication adherence in patients with heart failure and diabetes mellitus: Rationale and design of the TARGET-HF-DM Trial. *American heart journal*, *211*, 22-33.

Sharma, S. K., Arogya, S. M., Bhaskarmurthy, D. H., Agarwal, A., & Velusami, C. C. (2011). Hepatoprotective activity of the Phyllanthus species on tert-butyl hydroperoxide (t-BH)-induced cytotoxicity in HepG2 cells. *Pharmacognosy magazine*, *7*(27), 229.

Sherris, J., Wittet, S., Kleine, A., Sellors, J., Luciani, S., Sankaranarayanan, R., & Barone, M. A. (2009). Evidence-based, alternative cervical cancer screening approaches in low-resource settings. *International perspectives on sexual and reproductive health*, *35*(3), 147-152.

Sibanda, E. L., d'Elbée, M., Maringwa, G., Ruhode, N., Tumushime, M., Madanhire, C., & Terris-Prestholt, F. (2019). Applying user preferences to optimize the contribution of HIV self-testing to reaching the "first 90" target of UNAIDS Fast-track strategy: results from discrete choice experiments in Zimbabwe. *Journal of the International AIDS Society*, *22*, e25245.

Silvera, S. A. N., Bandera, E. V., Jones, B. A., Kaplan, A. M., & Demisse, K. (2020). Knowledge of, and beliefs about, access to screening facilities and cervical cancer screening behaviors among low-income women in New Jersey. *Cancer Causes & Control*, *31*(1), 43-49.

University of Ghana http://ugspace.ug.edu.gh

Simou, E., Maniadakis, N., Pallis, A., Foundoulakis, E., & Kourlaba, G. (2010). Factors associated with the use of pap smear testing in Greece. *Journal of Women's Health*, *19*(8), 1577-1585.

Small Jr, W., Bacon, M. A., Bajaj, A., Chuang, L. T., Fisher, B. J., Harkenrider, M. M., ... & Gaffney, D. K. (2017). Cervical cancer: a global health crisis. *Cancer*, *123*(13), 2404-2412.

Smith, R. A., Andrews, K. S., Brooks, D., Fedewa, S. A., Manassaram-Baptiste, D., Saslow, D., ... & Wender, R. C. (2017). Cancer screening in the United States, 2017: a review of current American Cancer Society guidelines and current issues in cancer screening. *CA: a cancer journal for clinicians*, *67*(2), 100-121.

Solomon, D., Lawson, H.W., et al. (2012) American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology Screening Guidelines for Prevention and Early Detection of Cervical Cancer. CA: A Cancer Journal for Clinicians

Sondaal, S. F. V., Browne, J. L., Amoakoh-Coleman, M., Borgstein, A., Miltenburg, A. S., Verwijs, M., & Klipstein-Grobusch, K. (2016). Assessing the effect of mHealth interventions in improving maternal and neonatal care in low-and middle-income countries: a systematic review. *PloS one*, *11*(5), e0154664

Spencer, Jennifer C., Noel T. Brewer, Tamera Coyne-Beasley, Justin G. Trogdon, Morris Weinberger, and Stephanie B. Wheeler. "Reducing Poverty-Related Disparities in Cervical Cancer: The Role of HPV Vaccination." *Cancer Epidemiology and Prevention Biomarkers* (2021).

Stewart, F. (Ed.). (2016). *Horizontal inequalities and conflict: Understanding group violence in multiethnic societies*. Springer.

Stewart, T. S., Moodley, J., & Walter, F. M. (2018). Population risk factors for late-stage presentation of cervical cancer in sub-Saharan Africa. *Cancer epidemiology*, *53*, 81-92.

Stoffel, S., Kioupi,S., Ioannou,D., (2021). Testing messages from behavioural economics to improve participation in a population -based colorectal cancer screening program in Cyprus: Results from two randomized control trials. *Preventive medicine reports*, 24, 101499

Stringer, E. M., Ekouevi, D. K., Coetzee, D., Tih, P. M., Creek, T. L., Stinson, K., ... & PEARL Study Team. (2010). Coverage of nevirapine-based services to prevent mother-to-child HIV transmission in 4 African countries. *Jama*, *304*(3), 293-302.

Stuart, A., Obiri-Yeboah, D., Adu-Sarkodie, Y., Hayfron-Benjamin, A., Akorsu, A. D., & Mayaud, P. (2019). Knowledge and experience of a cohort of HIV-positive and HIV-negative Ghanaian women after undergoing human papillomavirus and cervical cancer screening. *BMC women's health*, *19*(1), 1-11.

Sudenga, S. L., Rositch, A. F., Otieno, W. A., & Smith, J. S. (2013). Knowledge, attitudes, practices, and perceived risk of cervical cancer among Kenyan women: brief report. *International Journal of Gynecologic Cancer*, *23*(5).

University of Ghana http://ugspace.ug.edu.gh

Surajudeen,B. (2022). Re: How to interpret statistically insignificant results?. Retrieved from: https://www.researchgate.net/post/How_to_interpret_statistically_insignificant_results5/628696d2559aca2bf91bef0c

Swaen, B. (2022). Developing a conceptual framework for research. Available at: https://www.scribbr.com/methodology/conceptual-framework/ Retrieved in July, 2022

Tamuzi, J. L., Muyaya, L. M., Tshimwanga, J. L., & Zeng, L. (2017). Effectiveness of mHealth to increase cervical cancer screening: systematic review of interventions. *Int J Pul & Res Scie*, *2*, 555586.

Tang, D., Wei, F., Qin, B., Liu, T., & Zhou, M. (2014, August). Coooolll: A deep learning system for twitter sentiment classification. In *Proceedings of the 8th international workshop on semantic evaluation (SemEval 2014)* (pp. 208-212).

Tapera, O., Kadzatsa, W., Nyakabau, A. M., Mavhu, W., Dreyer, G., Stray-Pedersen, B., & Hendricks, S. J. H. (2019). Sociodemographic inequities in cervical cancer screening, treatment and care amongst women aged at least 25 years: evidence from surveys in Harare, Zimbabwe. *BMC public health*, *19*(1), 1-12.

Thaxton, L., & Waxman, A. G. (2015). Cervical cancer prevention: immunization and screening 2015. *Medical Clinics*, *99*(3), 469-477.

Tiro, J. A., Meissner, H. I., Kobrin, S., & Chollette, V. (2007). What do women in the US know about human papillomavirus and cervical cancer?. *Cancer Epidemiology and Prevention Biomarkers*, *16*(2), 288-294.

Tokosi, T. O., Fortuin, J., & Douglas, T. S. (2017). The impact of mHealth interventions on breast cancer awareness and screening: systematic review protocol. *JMIR research protocols*, *6*(12), e8043

Torode, J., Kithaka, B., Chowdhury, R., Simelela, N., Cruz, J. L., & Tsu, V. D. (2021). National action towards a world free of cervical cancer for all women. *Preventive Medicine*, *144*, 106313.

Tuong, W., Larsen, E. R., & Armstrong, A. W. (2014). Videos to influence: a systematic review of effectiveness of video-based education in modifying health behaviors. *Journal of behavioral medicine*, *37*(2), 218-233.

Uy, C., Lopez, J., Trinh-Shevrin, C., Kwon, S. C., Sherman, S. E., & Liang, P. S. (2017). Text messaging interventions on cancer screening rates: a systematic review. *Journal of medical Internet research*, *19*(8), e296.

Walboomers, J. M., Jacobs, M. V., Manos, M. M., Bosch, F. X., Kummer, J. A., Shah, K. V., ... & Muñoz, N. (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *The Journal of pathology*, *189*(1), 12-19.

Wanyoro, A. K., and Kabiru, W., (2017) Use of mobile phone short text message service to enhance cervical cancer screening at Thika Level 5 Hospital, Kiambu County, Kenya: A randomised control trial. *Research in Obstetrics and Gynecology* 5(1): 10-20

University of Ghana http://ugspace.ug.edu.gh

Watterson, J. L., Walsh, J., & Madeka, I. (2015). Using mHealth to improve usage of antenatal care, postnatal care, and immunization: a systematic review of the literature. *BioMed research international*, *2015*.

Williams, M. S., & Amoateng, P. (2012). Knowledge and beliefs about cervical cancer screening among men in Kumasi, Ghana. *Ghana medical journal*, *46*(3), 147.

Williams, M. S., & Amoateng, P. (2012). Knowledge and beliefs about cervical cancer screening among men in Kumasi, Ghana. *Ghana medical journal*, *46*(3), 147.

Wiredu, E. K., & Armah, H. B. (2006). Cancer mortality patterns in Ghana: a 10-year review of autopsies and hospital mortality. *BMC public health*, *6*(1), 1-7.

Wittet, S., & Tsu, V. (2008). Cervical cancer prevention and the Millennium Development Goals. *Bulletin of the World Health Organization*, *86*, 488-490.

Woldetsadik, A. B., Amhare, A. F., Bitew, S. T., Pei, L., Lei, J., & Han, J. (2020). Socio-demographic characteristics and associated factors influencing cervical cancer screening among women attending in St. Paul's Teaching and Referral Hospital, Ethiopia. *BMC women's health*, *20*(1), 1-9.

World Bank (2015) Rising through Cities in Ghana: The time for action is now to fully benefit from the gains of urbanization. Retrieved from: https://www.worldbank.org/en/news/opinion/2015/05/14/rising-through-cities-in-ghana-the-time-for-action-is-now-to-fully-benefit-from-the-gains-of-urbanization

World Health Organization (2022) Cervical cancer fact sheet. Available @ : who.int/news-room/fact-sheet/cervical cancer. Retrieved on June 30th, 2022

World Health Organization (2017) Affordable vaccines key to scale up HPV vaccination and prevent thousands of avoidable cervical cancers International agency for research: Press release No. 250 available @ http://www.iarc.fr/en/media-centre/pr/2017/pdfs/pr250_E.pdf

World Health Organisation (2016) Cervical cancer amongst African women. Retrieved from: http: www.afro.who.int/en/media-centre/afro-feature/item/7557. Retrieved on 26/4/2017

World Health Organization. (2015). *WHO guidelines for screening and treatment of precancerous lesions for cervical cancer prevention*. World Health Organization.

World Health Organization (2013). Latest World Cancer Statistics. Press Release No. 223. Internal Agency for Research on Cancer. Retrieved from: http:// ww.iarc/fr/en/media- centre/

World Health Organization, (2010) Country Cooperation Strategy: 2008–2011: Ghana.

World Health Organization. (2008). mHealth: new horizons for health through mobile technologies. *mHealth: new horizons for health through mobile technologies.*

University of Ghana http://ugspace.ug.edu.gh

Xiac, C., Liu, C., He, Z., et al., (2020) Merformin inhibits cervical cancer cell proliferation by modulating P13K/Akt induced major histocompatibility complex class 1-related chain a gene expression. Journal of experimental and clinical cancer research 39(127): 1-12

Yang, L., Parkin, D. M., Li, L. D., Chen, Y. D., & Bray, F. (2004). Estimation and projection of the national profile of cancer mortality in China: 1991–2005. *British journal of cancer*, *90*(11), 2157-2166.

Yimer,N.B., N.B., Mohammed, M.A., Solomon, K., et al.,(2021). Cervical cancer screening uptake in Sub-Saharan Africa. A systematic review and meta-analysis. Public Health195: 105-111

Zamberg, I., Manzano, S., Posfay-Barbe, K., Windisch, O., Agoritsas, T., & Schiffer, E. (2020). A mobile health platform to disseminate validated institutional measurements during the COVID-19 outbreak: utilization-focused evaluation study. *JMIR public health and surveillance*, *6*(2), e18668**.**

Zhang, D., Xu, L., Ouyang, Y et al (2021) Methods for dealing with unequal cluster size in cluster randomized trials: a scoping review. Plos one 16(7): e0255389. http//doi.org/10.1371/journal pone.0255389

Zhang, Y., Xu, C., Li, H., Yang, K., Cheng, N., & Shen, X. (2020). PROTECT: efficient password-based threshold single-sign-on authentication for mobile users against perpetual leakage. *IEEE Transactions on Mobile Computing*, *20*(6), 2297-2312.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

APPENDICES

APPENDIX A: INFORMATION SHEET

Title of Study: The effect of mobile health communication intervention on female teachers knowledge on cervical cancer and cervical cancer screening uptake in Accra Metropolis

Principal Investigator: Samira Ali Mustapha

Contact of Principal Investigator: 0244088874; samira.alimustapha@gmail.

Institution of Affiliation: Department of Population, Family and Reproductive Health, School of Public Health, College of Health Sciences, University of Ghana, Legon.

Introduction: I am a PhD candidate from the School of Public Health, University of Ghana. As part of my PhD research work, I am conducting a study to assess the effect of mobile health communication intervention (SMS TEXT and WHATSAPP) on female teachers' knowledge and uptake of cervical cancer screening in Accra Metropolis

Background of Research:

Cervical cancer is the commonest cancer and the leading cause of cancer death among women in Ghana. More women in Accra metropolis are reported to be affected than other regions in Ghana and majority die within two years of diagnosis. In addition low knowledge has been established as a major factor fueling low cervical screening uptake. However, Mobile technology is an innovative way of delivering health care and improving health outcomes. Therefore, I intend to employ SMS text and WHATSAPP as educational strategies to promote knowledge among female teachers because cervical cancer screening uptake is reported in studies to be low among teachers.

Nature of research: This study is a three-arm communication intervention (SMS=89, WhatsApp= 89, both WhatsApp and SMS=89, Control arm=89), involving a total of 345 teachers in 71 randomly selected schools under Ghana Education Service. Each teacher enrolled (24-63 years)

University of Ghana http://ugspace.ug.edu.gh

will receive educational messages for 3 months. At the end of the three months intervention. You will be required to answer questionnaires to assess your knowledge gained and your ability to go for cervical screening.

Participants' involvement:

- **Duration /what is involved:** You were randomly selected to participate in this study, and if you agree to participate, it will take between 15-20 minutes to complete the questionnaire. In addition**,** each participant is required to read the messages sent to learn about cervical cancer as well as take the appropriate required action to prevent yourself form future infection from cervical cancer.
- **Potential Risks:** There is no foreseeable risk for participating in this study. However, you may feel uncomfortable answering some of the questions which may be a bit sensitive. Nevertheless you may choose not to answer any question that you do not feel comfortable with
- **Benefits**: You will benefit directly from this communication intervention because it will give current information on cervical cancer and reproductive health issues, as well as inform you about the benefits of cervical screening and where to go for screening. In addition the SMS text or WhatsApp messages will prompt you to go for screening. Findings from this intervention could serve as evidence for scale up among women with similar background**.**
- **Costs:** Active participation require you purchase a total of 1,200 megabytes of internet bundle (data costing 30 Ghana cedis). At 10 cedis a month for 400 megabytes of data bundle. 800 megabytes of internet bundle will be provided by the researcher**.**
- **Compensation**: No remuneration (CASH) will be given for participation. The nature of the study design is such that a cash compensation may influence the responses and bias the

University of Ghana http://ugspace.ug.edu.gh

study finding.

- **Declaration of Conflict of Interest:** This is purely an academic work and there are no conflict of Interests
- **Confidentiality:** All information you share during the course of this study will be kept confidential, and used only for the intended academic purpose. The information will be accessible only to my supervisory team. Your name will not be mentioned in any report
- **Voluntary participation/withdrawal**: Participation in the research is voluntary and you are free to withdraw at any time (if you are no longer interested). There will be no penalty for withdrawal from the study. And no explanation will be required. However you can only participate in the study if you consent to participate
- **Outcome and Feedback:** This study has two outcome measures. The primary outcome measure is a cervical cancer screening uptake in recommended health facilities within the study period. This variable will be measured within the study period. The second outcome measure is knowledge of cervical cancer and cervical cancer screening. This variable will be measured on a scale of 0-100%. The higher the score the higher the level of knowledge on cervical cancer and cervical cancer screening.
- The study will be conducted in Ayawaso and Osu –Klottey sub Metropolises. The Study findings will be disseminated in all the 61 participating schools. Further dissemination will be carried out through public seminars, presentations at conferences, general awareness programmes in collaboration with the Media, and academic/research institutions in print.
- **Quality Assurance**

  SMS text will be monitored via transmission reports from Hubtel Ghana platform and WhatsApp broadcast pages. This will be done weekly to track the percentage of messages

University of Ghana http://ugspace.ug.edu.gh

sent, percentage delays and percentage failed.

- **Appropriate alternative Procedures and Treatment**: The proportion of teachers who have screen positive results, for cervical screening in all the intervention arms will be given the appropriate treatment for the prevention of cervical cancer. Those who test negative will be encouraged to test every positive three to five years
- **Funding information:** The Principal Investigator is the sole funder of this project.
- **Conflict of interest:** All data generated in the cause of this study will be owned by the Principal investigator only.

Who to Contact for Clarification:

If you would like to find out more about the study, you may contact the Principal Investigator, Samira Ali Mustapha on phone number 0244088874

For additional information, you may contact Dr Aryeetey the lead supervisor of this study on phone number 0244129669

If you have any further questions about your rights as a participant, you can contact the administrator of Ghana health service ethical review committee Hannah Frimpong 0243235225

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

APPENDIX B: CONSENT FORMS

Pre- Intervention Consent form

Study Title: The effect of mobile health communication intervention on female teachers' knowledge on cervical cancer and cervical screening uptake in Accra Metropolis

I have been adequately informed of the nature of this study, procedures, potential risks, benefits and cost involved. I understand that I am at liberty to withdraw my consent for participation at any time in the course of the study. I understand that the information obtained as a result of my participation will be treated as confidential and used for academic purpose by the investigator and her supervisors in School of Public Health, College of Health Sciences, University of Ghana. All my concerns have been addressed.

I certify that I voluntarily agree to participate in this study. I understand that, when enrolled into the study, I will be given some messages on cervical cancer and cervical screening by SMS text or WhatsApp text or SMS+Whatspp or None for 3months. Then, there will be a follow up.

I understand that I will be given a copy of the participant's information sheet before administration of the research questionnaire. I hereby agree to enroll in this study

Signature…….. Date……

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

Post- Intervention Consent form

Study Title: The effect of mobile health communication intervention on female teachers' knowledge on cervical cancer and cervical screening uptake in Accra Metropolis

I have been adequately informed of the nature of this study, procedures, potential risks, benefits and cost involved. I understand that I am at liberty to withdraw my consent for participation at any time in the course of the study. I understand that the information obtained as a result of my participation will be treated as confidential and used for academic purpose by the investigator and her supervisors in School of Public Health, College of Health Sciences, University of Ghana. All my concerns have been addressed.

I certify that I voluntarily agree to participate in this study. I understand that, when enrolled into the study, I will be given some messages on cervical cancer and cervical screening by SMS text or WhatsApp text or SMS+Whatspp or None for 3months. Then, there will be a follow up.

I understand that I will be given a copy of the participant's information sheet before administration of the research questionnaire. I hereby agree to enroll in this study

Signature…….. Date……

University of Ghana http://ugspace.ug.edu.gh

APPENDIX C: QUESTIONAIRE

TOPIC: THE EFFECT OF A MOBILE HEALTH COMMUNICATION INTERVENTION ON FEMALE TEACHERS' KNOWLEDGE AND CERVICAL SCREENING UPTAKE AMONG TEACHERS IN ACCRA METROPOLIS.

Instruction for completion of questionnaire

Please you have been selected to participate in this study, entitled " The effect of a mobile health intervention on female teachers knowledge on cervical cancer and cervical screening uptake in Accra Metropolis" We would be very grateful if you would spare few minutes of to answer these questions on cervical cancer and cervical screening.

Please ensure that, you have read attached information sheet and signed the consent form before completing the questionnaire. When completing this questionnaire, you are expected to provide the most appropriate answer to the questions asked. Upon completion of the survey, please submit the research to the research team present in your school.

Any information provided will be kept confidential and aggregated so individuals cannot be identified

1. Date of interview (dd/mm/yy):_____/____/_____

2.District……

3.Community……

4. Name of school ……

5. Type of School: Public…… or Private ……..

6. Respondent's Telephone Number ……

University of Ghana http://ugspace.ug.edu.gh

SECTION A: SOCIO-DEMOGRAPHIC AND REPRODUCTIVE HEALTH CHARACTERISTICS.

Instruction: Provide the most appropriate answers to the questions below

No.	QUESTIONS	REPONSES
1	Date of Birth	……..……
2	What is your current Marital Status?	1. Married [ ] 4.. Single [ ] 5. Cohabitation . [ ] 6.Divorced/Separated [ ]
3	Educational level:	1. JHS [ ] 2. SHS [ ] 3. Training college [ ] 4. University . [ ]
4	Religious Affiliation:	1.Moslem [ ] 2.Christian [ ] 3.Traditionalist / Spiritualist [ ] 4.4.Others (specify) [ ]
5	How many children have you given birth to?	Exact Number……..
6	Do you use condom?	1.Yes…….. .[ ] 2.No……...[ ]
7	How often do you use condom with your partner?	.Always [ ] 2.Sometimes [ ] 3.Never [ ]

University of Ghana http://ugspace.ug.edu.gh

8	Age at first sex in years	1. Less than 15years . [ ] 2. 15-24years [ ] 3. 25-34years [ ] 4. Other ……. [ ]
9	How many sexual partners have you had in life	……
10	Have you ever screened for cervical cancer?	1. Yes [ ] 2. No [ ]
11	How long ago?	Indicate in years...……..
12	How many times	

University of Ghana http://ugspace.ug.edu.gh

SECTION B: KNOWLEDGE ON RISK FACTORS FOR CERVICAL CANCER

From Ques 13 to 24. Tick the most appropriate factors that increase women's risk to cervical cancer

Number	Risk Factors	TICK (□)
13	Abortion	
14	smoking	
15	Douching and inserting of fingers in Vagina	
16	Poor Personal Hygiene	
17	Human papilloma Virus (HPV) infection	
18	Obesity increase a woman's risk	
19	Oral Contraceptives	
20	Sexual activity put a woman at risk of cervical cancer	
21	Having large number of children > 4	
22	Having multiple sexual partner put a woman at risk	
23	HIV/AIDS infection increases risk of cervical cancer	
24	A family history of cervical cancer increase risk of a woman	

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

SECTION C: KNOWLEDGE ON CERVICAL CANCER (CC) AND CERVICAL SCREENING

From Question 25 to 36 tick (□) either yes or no

Number	Item	Yes	No
25	Have you heard of cervical cancer?		
26	Cervical cancer is sexually transmitted		
27	Human Papilloma Virus (HPV) is the virus associated with cervical cancer development		
28	HPV affects only women		
29	Cervical cancer can affect young women		
30	Cervical cancer affect mostly women over 50		
31	Women can die from untreated cervical cancer		
32	The purpose of cervical screening can diagnose cervical cancer		
33	I need to have screening every year		
34	Cervical screening diagnose cervical changes before they become cancerous		
35	Cervical screening informs a woman about her health status		
36	Cervical screening is not necessary. There is no cure for cervical cancer		

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

SECTION D: ATTITUDE BASED HEALTH BELIEF MODEL

Instruction: from question 37 to 61
tick (□) State whether you agree or disagree or neutral

NO.	Perceived Susceptibility	Disagree	Neutral	Agree
37	I believe I am at risk of getting cervical cancer.			
38	I believe am more likely than the average woman to get cervical cancer			
	Perceived Severity	**Disagree**	**Neutral**	**Agree**
39	Cervical cancer will threaten the relationship with my husband/partner.			
40	Most women who develop cervical cancer die from it.			
41	My whole life will change if I have cervical cancer			
42	It is embarrassing to have cervical cancer			
43	It is too expensive to have cervical screening			
	Perceived Benefits	**Disagree**	**Neutral**	**Agree**
44	When I undergo screening test, I will not worry too much about cervical cancer			
45	Getting a cervical screening test is the best way to detect abnormal changes in the cervix			
46	Having cervical screening test will help detect cervical cancer in its early stages.			
47	Regular screening will help me to stay healthy.			
48	Having a cervical screening test regularly will decrease my chances of dying from cervical cancer			
	Perceived Barriers	**Disagree**	**Neutral**	**Agree**
49	I don't know where to go for and have cervical screening test.			

University of Ghana http://ugspace.ug.edu.gh

50	My partner is uncomfortable with me being examined by a male doctor.			
51	Having a cervical screening will only leave me with fear of dying			
52	I do not know where to go or who to ask to get a cervical screening			
53	I do not need to get a cervical screening if I feel well			
54	Having a cervical screening test will be painful and unpleasant			
55	Having a cervical screening test will take too much of my time.			
56	Having a cervical screening would be expensive for me.			
57	Since I do not have enough information on cervical screening test. It makes hard to decide.			
58	I have no means of transportation to the health clinic for a cervical screening test.			
59	I am scared to have a cervical screening test because I may learn that I have cancer			
	Self-efficacy	**Disagree**	**Neutral**	**Agree**
60	I am capable of getting a cervical screening test			
61	I am capable of managing any emotional distress caused by cervical screening test			

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

APPENDIX D: LIST OF SCHOOLS

AYAWASO WEST

MAAMOBI 10

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	DZORWULU A & B PRIMARY /KG	COVENANT PRESBY
2	MAAMOBI PRISONS 1 BASIC	KING OF KINGS
3	BETHANY METHODIST BASIC	JOY KIDS
4	DZOWULU JHS	LITTLE FLOWER MONTESSORI
5	ABELENKPE "2" BASIC	

ABELENKPE

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	UNIVERSITY STAFF VILLAGE PRI/KG	GOLDEN AGE SCHOOL
2	UNIVERSITY STAFF JHS	UNIVERSITY PRIMARY SCHOOL
3	ACCRA COLLEGE OF EDUCATION DEMONSTRATION	EDEN INTERNATIONAL SCHOOL
4	LA BAWALESHIE PRESBY A & C JHS	
5	LA BAWALESHIE PRESBY B KG	

AYAWASO EAST

KANDA 6

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	ISLAMIC TRAINING INSTITUTE	
2	KANDA ESTATE 1 BASIC	TINY ANGELS SCHOOL
3	RING ROAD EAST 1 BASIC	
4	KANDA '1' PRIM '3' &5 JHS	
5	KANDA ESTATE '5' PRIM & KANDA AMA JHS	

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

NIMA 7

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	ST KIZITO	
2	INSTITUTE OF ISLAMIC STUDIES	
3	37 MILITARY HOSPITAL BASIC	
4	FLAGSTAFF HOUSE BASIC	
5	ST FRANCIS XAVIER	
6	NIMA '1' BASIC SCHOOL	
7	NIMA '2' BASIC SCHOOL	
8	AL-WALEED COMP BASIC	
9	AYEBENG MEMORIAL	

AYAWASO CENTRAL

ABAVANNA 9

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	PIGFARM BASIC SCHOOL	GRACEDEW ACADEMY
2	KOTOBABI '2' JHS	DADDY'S PRIDE
3	KOTOBABI '3' BASIC	GLOBAL EVANGELICAL
4	ABAVANA JHS	
5	ABAVANA DOWN BASIC	
6.	Kotobabi 4 JHS	

KOKOMLEMLE

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	RASHAD ISLAMIC BASIC	
2	ALAJO '1' BASIC	
3	ALAJO '3' PRIMARY & COMMUNITY	
4	KPEHE R/C BASIC SCHOOL	
5	KOTOBABI 7 JHS	

New Zion Grant

NEWTOWN

Kokomlemle

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	KOKOMLEMLE 2 &4 BASIC	CJ MODERN
2	ST JOHN'S JHS	FOUNTAIN SCHOOL
3	KOKOMLEMLE '1' BASIC	
4	KOTOBABI 15 JHS	
5	~~KOTOBABI 4 JHS~~	

University of Ghana http://ugspace.ug.edu.gh

OSU KLOTTEY

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	OSU SALEM '5' BASIC	OSU PRESBY PREP. SCH.
2	OSU RINGWAY BASIC	LEARNING CENTRE
3	CALVARY METHODIST '1' BASIC	RINGWAY PREP. SCH.
4	CALVARY METHODIST '2' BASIC	TINY FLOWERS
5	ALL SAINTS ANGLICAN	CHILDREN'S CENTRE
6		MOTHERS PRIDE
7		REV. LARTEY ADOTEY MEM. SCH.
8		MERTON SCHOOL

ADJEBENG & ADABRAKA

S/N	PUBLIC SCHOOLS	PRIVATE SCHOOLS
1	LIBERTY AVENUE	
2	GES MODEL NURSERY	
3	GRAY MEMORIAL	
4	KHARIYAH ISLAMIC	
5	ST. JOSEPH'S RC	
6	ADABRAKA PRESBY	

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

APPENDIX E: SENSITIVITY ANALYSIS

Table 1: Factors associated with cervical cancer uptake among female teachers in Greater Accra at baseline study showing adjusted Poisson, Logistic and Probit analysis

	Sensitivity analysis	
Variable	**Logistic**	**Probit**
	aOR[95%CI]	**aβ[95%CI]**
Age	1.14[1.06-1.22]***	0.08[0.04-0.11]***
Age at first sex		
≤ 24	**Ref**	**Ref**
25+	1.45[0.50-4.13]	0.22[-0.31-0.76]
Parity		
3+	**Ref**	**Ref**
None	1.82[0.23-14.24]	0.43[-0.55-1.42]
1-2	0.69[0.26-1.79]	-0.23[-0.74-0.27]
Number of sexual partners		
≤1	**Ref**	**Ref**
2-3	1.35[0.52-3.54]	0.16[-0.35-0.67]
4+	1.70[0.24-12.07]	0.28[-0.76-1.32]
Perceived susceptibility	0.85[0.63-1.14]	-0.09[-0.26-0.07]
Perceived severity	1.18[0.94-1.49]	0.09[-0.03-0.20]
Perceived benefit	1.04[0.82-1.30]	0.03[-0.09-0.15]
Perceived barriers	0.77[0.68-0.87]***	-0.14[-0.20--0.08]***
Self-efficacy	1.05[0.77-1.43]	0.02[-0.14-0.18]

NOTE: The mean±standard deviation for Perceived susceptibility, severity, benefit, barriers and self-efficacy were; 3.72±1.47, 9.71±2.85, 13.81±2.05, 16.13±4.54 and 4.73±1.44 respectively. aOR represent adjusted Odd Ratio from Logistic regression; aβ denote adjusted normalized coefficient from Probit regression analysis. CI represent Confidence Interval respectively. P-value notation: ***p-value<0.001

INTEGRI PROCEDAMUS