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# Determinants of Cervical Cancer Screening in HIV-Positive Young Women in Swaziland

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

In Swaziland, cases of cervical cancer among Human Immunodeficiency Virus (HIV)-positive adolescent girls and young women (AGYW) are increasing, but there is low uptake of cervical cancer screening. This study was conducted using the systems thinking theory to explore the relationships between the uptake of cervical cancer screening among HIV-positive AGYW in Swaziland and the availability of trained health providers, cervical screening services, and the provision of referrals for cervical screening. The study also investigated any differences in uptake of cervical screening based on age group. For this quantitative cross-sectional study, secondary HIV program data that were collected routinely between January 2016 and March 2018 were accessed. Data were described with univariate analysis while relationships were tested using bivariate analysis and logistic regression. Most facilities (97%) had staff who had been trained; facilities with greater numbers of trained staff were more likely to have a higher uptake (*OR*: 30.3, $p = 0.000$). Facilities with cervical screening services were also more likely to have a higher uptake ($x^2 = 16.94$, $p = 0.000$), and facilities with all the core components for screening had the highest uptake ($p = 0.002$). AGYW who had a positive screen were referred equally but the referral rate was low (20.45%). There was no difference in uptake by age group. The results of the study can increase knowledge of the institutional factors that contribute to the low uptake of cervical cancer screening among HIV-positive AGYW and has implications for social change by informing interventions for improving cervical cancer screening uptake in HIV-positive AGYW in similar settings, ultimately reducing the high costs, morbidity, and mortality related to cervical cancer in this population.

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## Introduction

HIV-infected women are affected with cervical cancer because HIV accelerates the progression of cervical dysplasia and cancer if they are infected with human papilloma virus (HPV; Mbulaiteye, Bhatia, Adebamowo, & Sasco, 2011). In Swaziland, cervical cancer is the leading cause of cancer related deaths and fourth leading cause of all deaths among women regardless of HIV status (Bruni et al., 2016). The high mortality rate for women with cervical cancer in Swaziland is associated with advanced disease at diagnosis (Bruni et al., 2016), which is partly due to low rates of early detection (Gyenwali, Pariyar, & Onta, 2013). Cervical cancer is classified as an AIDS defining illness and therefore cervical cancer screening is recommended within basic HIV care for women and screening uptake is a proxy indicator for HIV program performance among women (Franceschi & Jaffe, 2007; Ports, Haffejee, Mosavel, & Rameshbabu, 2015). The most recent World Health Organization (WHO) guidelines on cervical cancer screening recommend screening from the age of 21 and every 3 years after that except in special populations like women infected with HIV (WHO, 2013b). The guidelines recommend screening at first HIV diagnosis in those with non-perinatally acquired HIV and every year after that regardless of age (WHO, 2013b).

Despite the importance of cervical cancer screening to prevent the morbidity and mortality related to cervical cancer, the uptake of cervical cancer screening among HIV-infected AGYW remains very low in Swaziland (Jolly et al., 2017). Studies that have been conducted in other sub-Saharan countries provide multiple reasons for the low uptake of cervical cancer screening among women but not among AGYW specifically

(Bayu, Berhe, Mulat, & Alemu, 2016; Rosser, Njoroge, & Huchko, 2016). For this review, the reasons have been grouped according to the individual, the social support systems, the health systems (institutional), and policy environment (Hoque, Ghuman, Coopoosmay, & Van Hal, 2014; Ncube, Bey, Knight, Bessler, & Jolly, 2015; Roncancio, Ward, & Fernandez, 2013). Women often do not access screening because they are not aware of cervical cancer, are not aware of the availability of the screening services, or are afraid of the results of the screening (Kasting et al., 2016; Lyimo & Beran, 2012a). Women who access the screening services report that peer support or a community referral or a health provider referral influenced their decision to screen (Akinyemiju, 2012; Bayu et al., 2016; Jia et al., 2013). Health care providers report that they can provide screening services if the environment is enabling with policy, guidelines, and infrastructure (Brouwers et al., 2011; Ndejjo et al., 2016; Ntekim, 2012). Political support for the scale-up of screening services also supports the uptake of the cervical screening (Ntekim, 2012).

Among AGYW, health care access is suboptimal (Dellar, Dlamini, & Karim, 2015), especially among HIV-infected populations where stigma and discrimination related to HIV is predominant (Ralph & Brindis, 2010; Tsai, Lin, Chou, & Lin, 2014; Villalobos et al., 2017). In Tanzania, an estimated 50% of adolescents become sexually active and about 25% of adolescents give birth, but reproductive health services are nonexistent and health care access for pregnant young women is limited (Hokororo et al., 2015). In Nigeria, adolescents and youth account for 46% of the population but their health service use is low. The reasons for the low health care service use include services that are not appropriate for adolescents and young people, misinformation or bias toward

adolescents who seek reproductive health services, long distances to facilities that provide youth friendly services, and the cost of the services (Azfredrick, 2016). In Swaziland, there is limited evidence available describing use of health care services by AGYW in general with even less evidence of the determinants of cervical screening among this population, yet they are the most affected by HIV and cervical cancer is on the rise in this group (Finocchario-Kessler et al., 2016a; Kim, Campos, O'Shea, Diaz, & Mutyaba, 2013). Thus, I investigated the health institutional determinants of cervical cancer screening among HIV infected AGYW in Swaziland to provide evidence that public health practitioners may use to inform and improve cervical cancer prevention programming to increase cervical cancer awareness, prevention, and early detection among HIV-infected AGYW thereby reducing morbidity and mortality caused by cervical cancer.

## Problem Statement

Despite the rise in cervical cancer rates among AGYW, that is expected to double over the next 10 years in the HIV-infected populations in sub-Saharan Africa, there is a lack of evidence regarding the determinants of uptake of cervical cancer screening in this population that could inform interventions (Boardman & Robison, 2013; Bynum et al., 2016; Finocchario-Kessler et al., 2016). HIV-infected AGYW are a growing population in sub-Saharan Africa whose health care needs are not being addressed (Kirby, 2016; Ramjee & Daniels, 2013; Sommer, 2011). Due to their positions in society, they are more likely to have poor HIV treatment outcomes and present with an AIDS defining illness such as cervical cancer (Dellar et al., 2015). The late presentation with cervical cancer leads to high morbidity and mortality rates as well as increased health care costs. In 2016,

the Swaziland cancer registry showed that out of 2,000 women who received cervical cancer screening, 65% were HIV-infected AGYW. Among the HIV-infected AGYW who were screened, 45% had cervical abnormalities and 20% had late stage cervical cancer, proportions much higher than the AGYW who did not have HIV (Swaziland Ministry of Health, 2016). However, cervical cancer is curable when detected early, suggesting a lack in the preventative health systems that delay the early diagnosis of cervical lesions in the HIV-infected AGYW population in Swaziland. There is a need for interventions that promote AGYW's well-being and longevity informed by evidence generated from research (Department of Maternal Newborn Child and Adolescent Health, 2012; Sommer & Mmari, 2015) such as this study.

## Purpose of the Study

Cervical cancer is a major contributor of morbidity and mortality among Swazi women and especially HIV-infected AGYW (Information Centre on HPV and Associated Cancers, 2016; Swaziland Ministry of Health, 2016). These women are at increased risk of cervical cancer partly because of their low participation rates in preventative cancer screening programs and their HIV infection (Swaziland Ministry of Health, 2015b). Therefore, the purpose of this study was to investigate the relationships between health care institutional factors and young HIV-infected Swazi women's participation in cervical cancer screening using secondary quantitative data.

Although there are studies on barriers to the uptake of cervical cancer screening in HIV-infected women, no age disaggregation is usually provided though it has been established that AGYW are a vulnerable population with their own specific barriers that need to be addressed (Bailey, 2012). Understanding the health system barriers for this

vulnerable population is critical to reducing the morbidity and mortality rates from cervical cancer in this population (WHO, 2013). This quantitative study had four main independent variables: the availability of screening services in health facilities, the presence of staff who are trained to do cervical cancer screening, the provision of referrals to eligible women to attend cervical cancer screening, and age bracket of the woman undergoing cervical cancer screening. The dependent variable was the uptake of cervical cancer screening. Most of the studies on cervical cancer screening uptake are qualitative and do not quantify the extent of the problem or describe significant relationships between institutional factors and cervical cancer screening uptake (Akinyemiju et al, 2015; Dulla, Daka, & Wakgari, 2017; Kasting et al., 2016; Visanuyothin, Chompikul, & Mongkolchati, 2015; Wood et al., 2016).

## Research Questions

The research questions allowed for the description of the relationship between the selected health care institutional factors and the uptake of cervical cancer screening among the target population.

Research Question 1: What is the relationship between the availability of trained health providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$1: There is no relationship between the availability of trained health care providers and the rate of uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

$H_a1$: There is a relationship between the availability of trained health care providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

Research Question 2: What is the relationship between the availability of cervical cancer screening services in a facility and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0 2$: There is no relationship between the availability of cancer screening services within a facility and the uptake of cervical cancer screening.

$H_a 2$: There is a relationship between the availability of cervical cancer screening services within a facility and the uptake of cervical cancer screening.

Research Question 3: What is the relationship between the provision of a referral for cervical cancer screening among eligible HIV positive adolescent girls and young women and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0 3$: There is no relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

$H_a 3$: There is a relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

Research Question 4: Is there a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women?

$H_0 4$: There is no difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

$H_a4$: There is a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

## Theoretical Framework

I used the systems thinking theory to guide the research. The systems thinking theory was first proposed by Ludwig von Bertalanffy in the 1940s and further refined by Ross Ashby in 1956 (Peters, 2014). Von Bertanalanffy proposed this theory to highlight the unity of science (Cordon, 2013). He posited that systems are open to and interact with their environments and that their natures can change through gaining new properties resulting in continual evolution with improvements (Peters, 2014). Proponents of the systems theory posit that for a system to work, all parts are interlinked and support each part (Diez Roux, 2011; Luke & Stamatakis, 2012).

The health system needs to improve to address safety, quality, and cost and become more patient centered and focused on patient health outcomes. One method that has been used in other industries to address similar gaps is a systems thinking approach to improvement (Peters, 2014). The systems approach has not been used traditionally in the health industry; however, industries that have used a systems approach have reported improvements in quality and value. A systems approach incorporates all elements that influence health and their interactions (Jeffcott, 2014; Leischow & Milstein, 2006). However, there is a challenge in addressing the cultural, structural and technological barriers and is further compounded by ensuring that the health improvements are centered on the patients and engage the patients (Cordon, 2013).

Shortfalls occur in health care despite health care providers spending time and effort caring for the patients, illustrating that the problem may be with the design and

implementation of the multiple systems in health care. The more complex the health care required by the patients, the more likely they are to experience multiple incidences of harm including the loss of dignity and respect (Arnold & Wade, 2015; Roberts, Fisher, Trowbridge, & Bent, 2016). One instance of harm is the failure to provide patient with relevant care like AGYW who should receive cervical cancer screening but do not (Peters, 2014). Many of the public health programs add unnecessary burden to clinical work and remove the focus from the patient (Parham et al., 2015). The lack of standard procedures and measurements leads to issues in providing care (Black, 2013; Reeve et al., 2013). The introduction of technology into health systems has also affected efficiency and limited interoperability between data repositories, making health systems even more unwieldy (Gaynor, Yu, Andrus, Bradner, & Rawn, 2014; Iroju, Soriyan, Gambo, & Olaleke, 2013). However, if e-technology for health were incorporated adequately, productivity would increase and health care costs related to data would reduce (Cardoso, Marins, Portela, Abelha, & Machado, 2014; Iroju et al., 2013). The solution to the challenges in the health care system is to understand and attempt to address the nonfunctioning processes and to use a systems approach in doing so (Braithwaite, 2018; Carayon et al., 2014) and create a sustainable health system that promotes and supports the practice of the health care provider.

A systems approach can improve health care by considering the multiple elements involved in providing care for patients and the multiple determinants of health. Understanding the functioning and interactions of these elements can help plan, design, and integrate processes, policies, organizations, and people to provide cost efficient health care (Elkins & Gorman, 2013). The systems theory approach can be applied to all

levels of the health system such as the health facility, regional health management teams, public health programs, and the ministry of health officials. Specific tools that include problem identification tools, resource use, and human factor engineering to identify safety, quality, and reliability challenges are used in the application of the systems theory (Cordon, 2013). Additionally, using a systems approach requires data management systems, supportive leadership, engagement of patients, families and health care providers, and a potential to remodel the existing health care pathways (Htway & Casteel, 2015).

Systems thinking concepts in health care can apply to any health care system from prevention of disease to end of life care. Public health systems are multilayered and multifaceted and for each layer to function optimally, there should be close interactions between relevant layers or facets (Peters, 2014). This consists of policy makers both in the local environment like the local government and the external environment like the WHO as well as structures and groups of individuals in institutions and agencies that influence and implement the way health care is delivered. The components of systems thinking include the environment in that the system exists; the inputs like technology, workforce, infrastructure, quality management; expected outputs like people receiving care they need; the processes involved like screening, diagnosis, treatment; the hierarchy that governs the system from policy makers to care providers; whether the system is goal -driven; and information available regarding the system.

Failures of cervical cancer screening programs have been attributed to failures in system quality management rather than failure of technology (Nygård, 2011). The goal of the systems quality management is to confirm that women in targeted demographic

groups are screened and receive appropriate follow-up (McGraw & Ferrante, 2014). The parts of the system are related to the four-level model of health systems (individual, interpersonal, institution, and community), that can be used to outline the factors that affect the uptake of cervical cancer screening in targeted groups of women (Huchko, Bukusi, & Cohen, 2011). For this research, I focused on the institutional or supply-side factors and the health care providers, cervical cancer screening infrastructure, and patient management systems in the current health care system in Swaziland.

## Nature of the Study

The nature of this study was quantitative. The methodology of a study is determined by the issue the researcher is examining, the research questions, and the type of data to be analyzed (Kothari, Kumar, & Uusitalo, 2014). Because secondary data were used in this study, it was a cross-sectional analytical retrospective survey (Rabinovich, 2011). Data were sourced from the Ministry of Health's Health Management Information Systems (HMIS). All AGYW registered in HIV care were eligible for inclusion in the data review. Data were triangulated from the national service availability and readiness assessment (SARA) 2017, the HIV client management system, and the national training information system. The common denominator to these datasets was the unique facility identity number.

The independent variables included:

- the availability of screening services in health facilities, that involved cervical cancer screening equipment, the ability to perform on-site treatment or link patients to appropriate treatment services, advertisement of screening services in the clinic service listing.

- the presence of staff who are trained to do cervical cancer screening as recognized by the sexual reproductive health program as being able to perform the screening.
- the provision of referrals to eligible women to attend cervical cancer screening. Health care providers are required to complete and provide the national referral form for screening services and the referral should be documented in the facility registration logbook. Hence, this variable was extracted to calculate the proportion of eligible women provided with a referral and whether there is a significant relationship between providing a referral and uptake of the screening.
- the age bracket of the woman undergoing cervical cancer screening. The young HIV-infected women were disaggregated into adolescents 15-18 and young women 19-24. Due to transition in maturity, lifestyle, and legal rights that happen between these ages, the uptake of cervical cancer screening services was expected to be different between the two age groups.

The dependent variable was the uptake of cervical cancer screening, that was defined as the acceptance and receipt of cervical cancer screening in an eligible woman or women. Additional factors that were assessed include locality of the clinic (rural or urban) and ownership of the facility, as these may impact on the availability of the cancer screening services. The key study variables were extracted into one database and analyzed. The data were described using univariate analysis and bi- and multi-variate analyses including binomial logistic regression were conducted to test relationships using SPSS software.

## Literature Review Search Criteria

In this section, I review the public health literature related to cervical cancer screening among HIV-infected AGYW. Where the literature was limited or unavailable, reference was made to HIV-infected women in general. I identified the need for continued research to examine the systemic factors that determine uptake of cervical cancer screening among HIV-infected AGYW in Swaziland. Several studies have identified the importance of youth friendly services that incorporate cervical cancer screening and reproductive health (Hokororo et al., 2015; Jolly et al., 2017; Miller, Hanson, Johnson, Royalty, & Richardson, 2014; Mwaniki et al., 2014), but there is still a lack of literature providing evidence on the barriers to cervical cancer screening among HIV-infected AGYW despite cervical cancer being on the rise in this population.

I conducted the literature search from peer-reviewed journals, WHO, and cervical cancer organizations as well as country level reports on health care access to services for AGYW. The databases included MEDLINE with full text, Science Direct, Science Citation Index Expanded and CINAHL Plus with full text. The search terms key phrases and words included *HIV infected adolescents, HIV infected young women, Cervical cancer Screening, Cervical cancer screening programs, Cervical Cancer Prevention*. I considered articles that were published from 2013 to now. Seminal works in adolescent reproductive health that were older than 5 years were also reviewed if they had additional information on the variables being explored. The articles that contributed to the literature presented were entered into a matrix that outlined the article title, purpose of the article, year of publication, and contributing information.

# Literature Review

## HIV-infected Adolescent Girls and Young Women

Young women are defined as girls and women between the ages of 15 and 24. However, because of the significant transition in maturity, lifestyle, and legal rights that happen between these ages, they are further subdivided as adolescent girls 15-18 and young women 18-24 (Dellar et al., 2015). This distinction is important to design interventions that address the vulnerabilities of each age group (Abdool Karim, Baxter, & Birx, 2017). For instance, sexually active adolescent girls are increasingly being recognized as a population distinct from adult women (Boardman & Robison, 2013; Bynum et al., 2016). They are at a high risk of acquiring the HPV, but most infections and cervical intraepithelial lesions caused by HPV are cleared by the immune system, so most recent guidelines for cervical cancer screening do not recommend routine screening in women less than 21 years of age (WHO, 2013b). However, a retrospective review of the data in an academic medical clinic in the United States showed that there may be an increased risk of developing invasive cancer between the recommended screening intervals (Nitschmann, May, Mirkovic, & Feldman, 2016).

HIV-infected AGYW who are sexually active form a special population requiring cervical cancer screening because the incidence of preinvasive cervical cancer (cervical intraepithelial neoplasia), as confirmed by colposcopy, is 4 to 5 times higher in HIV-infected women and adolescents compared to HIV-negative women and adolescents with high-risk sexual behaviors (Memiah et al., 2012). Cervical intraepithelial neoplasia is common in HIV-infected women because:

- Both HIV and HPV are sexually transmitted

- HIV-infected women are more likely to have persistent HPV infection
- Persistent infection with one or more oncogenic HPV subtypes is a major factor in the pathogenesis of premalignant and malignant cervical disease

HIV-infected women who develop cervical intraepithelial neoplasia tend to have more aggressive disease and therefore guidelines for the prevention and treatment of opportunistic infections in adults and adolescents including HPV-related disease recommend screening should be initiated within 1 year of onset of sexual activity but no later than 21 years old, and the screening should continue throughout the woman's lifetime unlike the general population that ends at 65 years old (Grellier & Quéro, 2014). These guidelines also recommend that cervical screening be done at the time of the initial diagnosis of HIV and repeated every 12 months thereafter.

In sub-Saharan Africa where the HIV epidemic is concentrated, there is a lack of information on cervical cancer screening implementation in women 15 to 24 years old (Coleman et al., 2016; Parham et al., 2015). However, studies conducted on women generally reveal low rates of uptake of cervical cancer screening from 3% to 33% (Boardman & Robison, 2013; Bruni et al., 2016), with resulting high incident rates of cervical cancer—age standardized rates between 29.3 and 42.7 (Obi & Ozumba, 2014)—and high mortality rates from the disease (Bruni et al., 2016; Coleman et al., 2016; Maseko, Chirwa, & Muula, 2015c; Obi & Ozumba, 2014) .

## Cervical Cancer Screening

### Burden of Cervical Cancer

Cancer of the cervix, a preventable and treatable cancer, is a public health issue worldwide. It is the fourth most common cancer among women and seventh most

common cancer among people globally (Bruni et al., 2016). The age standardized cervical cancer incidence and mortality rates in low resource countries are almost twice than in higher resource countries where cervical cancer screening is routine (Dunne & Park, 2013; Mboumba Bouassa et al., 2017). On an annual basis, about 500,000 new cases are reported of which 85% are in developing countries (Bruni et al., 2016). Annually 266,000 women die from cervical cancer, and almost 90% of them are in developing countries (Finocchario-Kessler et al., 2016). The presence of systematic population-based screening in developed countries is to a large extent the reason for the large differences in cervical cancer related morbidity and mortality (WHO, 2013). These screening programs have reduced incidence and mortality by up to 60% and 75% respectively over the last three decades (Vacarella et al., 2016). For example, in England, a population-based case-control study that used data recorded between 1998 and 2013 indicated that screening prevents 70% (95% *CI*: 66–73%) of cervical cancer deaths (all ages), and this was improved among women who were screened regularly to 83% (95% *CI*: 82–84%; Landy, Pesola, Castañón, & Sasieni, 2016).

Sub-Saharan Africa has the world's highest age-standardized incidence rates of cervical cancer with the highest incidence reported in Malawi (75.9 per 100,000; Mboumba Bouassa et al., 2017). Swaziland has the seventh highest age-standardized incidence rate at 53.1 per 100,000 women with an estimated 233 women being diagnosed annually and 188 dying from the disease annually (Bruni et al., 2016). Despite being one of the preventable cancers, cervical cancer is the leading cause of cancer deaths among women in Swaziland. Typically, cervical cancer affects women older than 40 years of age and progresses very slowly; however, in Swaziland, the epidemiology of cervical cancer

has changed due to the high HIV prevalence (32% among people 18-49) and is frequent in younger age groups (20-35; Swaziland Ministry of Health, 2016). The cancer is aggressive and associated with poor outcomes. Studies and reports developed in Swaziland showed that younger women are diagnosed with more aggressive forms of the cervical cancer more commonly in the HIV-infected population (Information Centre on HPV and Associated Cancers, 2016; Jolly et al., 2017; Malambo & Erikson, 2017; Swaziland Ministry of Health, 2016).

**Importance of Addressing Cervical Cancer Burden**

The need to address cervical cancer in developing countries is related to the impact on the health of women and by extension their families in society and the impact on the health system (WHO, 2013). The social impact of the loss of women in their reproductive and economically productive phase in their lives impacts not only their families but the society in which they live. Women are responsible for the well-being of the family and by extension the community. The impact on the health system is related to the prohibitive costs related to treating women with late stage disease that requires specialized health care and expensive medications as compared to preventing or detecting and treating early stage disease using low cost, low resource cervical screening (WHO, 2014b). A cost analysis conducted in South Africa found that screening and early treatment of cervical cancer precursors cost 80% less than treating invasive cervical cancer (Knegt, 2014).

**What is Cancer of the Cervix?**

Cancer is described as an atypical growth of cells (Information Centre on HPV and Associated Cancers, 2016). Cancer of the cervix is an abnormal growth of the

squamous cells of the cervix (also referred to as the entrance of the uterus). The atypical cells mature rapidly, function different to typical cervical cells, and their appearance is also different. In advanced disease, the cancer is characterized with invasion of other tissues both near and distant from the cervix such as the bladder, bones, and the lungs (Aziz & Aziz, 2016). This disease spread is usually via the hematogenous route.

**What Causes Cancer of the Cervix?**

The primary cause of cancer of the cervix is chronic infection with HPV (El-Khatib, Tota, & Kaufmann, 2012). Known as the silent infection, HPV is one of the most common sexually-transmitted infections (Dunne & Park, 2013). HPV infection is cleared by about 75% of women who get the infection, and in the remaining 25% who get the chronic infection between 60%-70% will go on to develop cancer of the cervix (Ibeanu, 2011). Cancer of the cervix grows slowly and with little symptomatology until later in the disease. Cervical cells that are chronically infected with HPV transform into atypical cells that form the precancerous stage, and high grade and anaplastic cells are precursors to invasive cervical cancer (Castellsague et al., 2012). Women who may have been infected in the teens, 20s, or early 30s may not manifest cervical cancer until 15 to 20 years later.

**What are the Main Risk Factors?**

There are multiple risk factors associated with the development of cervical cancer, but the most important ones include age, immune suppression, HPV infection, sexual behavior, smoking, hormonal factors, and genetics (Bruni et al., 2016; Georgia Cancer Centre, 2016):

**Age.** Any woman who has been sexually active is at risk of developing cervical cancer, and the risk increases as a woman gets older. The most consistent predictor of risk for cervical cancer is age. However, AGYW are more predisposed for precancerous lesions due to their physiology as well as riskier sexual behavior but are more likely to clear HPV infections (Van Kerrebroeck & Makar, 2016).

**Immune suppression.** Immune suppression, especially related to HIV infection, accelerates the development of cervical cancer (Thorsteinsson et al., 2016). Cervical cancer is an AIDS defining illness because HIV accelerates the disease progression (Kelly et al., 2018; Tirelli, Bernardi, & Vaccher, 2001). Women with HIV and HPV infection are 3 times more likely to develop cervical cancer than women who do not have HIV (Mukanyangezi et al., 2018; Thorsteinsson et al., 2016). Additionally, the cervical cancer in these women is aggressive.

**HPV infection.** Between 60% to 70% of the women with chronic HPV infection who account for about 5%-15% of women ever infected with HPV will go on to develop cancer of the cervix later in life (Petry, 2014). However, research has shown that persistent infection with high risk strain types of HPV combined with other factors, such as smoking and immunosuppression, cause the majority of cervical cancer cases (Murillo, Herrero, Sierra, & Forman, 2016; Richard et al., 2015).

**Sexual behavior.** Early sexual debut, multiple sexual partners, and unsafe sex increase a woman's exposure to HPV infection (Martín-Hernán, Sánchez-Hernández, Cano, Campo, & del Romero, 2013). Sexual behavior is not an independent risk factor for the development of cervical cancer and therefore other risk factors must be present as well (Bruni et al., 2016).

**Smoking, hormonal factors, and genetics.** In women with cervical dysplasia, tobacco use may play an influencing role in the development of cervical cancer (Castellsague et al., 2012; Matsumoto et al., 2010).Early age at first birth, extended use of contraceptives, and multiple births influence the development of cervical cancer (Roura et al., 2016). Research is providing more information regarding the risk of certain genetic profiles in women that predispose them to cervical cancer. However, this is not used routinely in the clinical or public health setting (Hu et al., 2015).

## Cervical Cancer Prevention

Primary prevention and secondary prevention are two interventions that can be used for cervical cancer prevention (WHO, 2014b).

**Primary prevention.** Primary prevention includes preventing infection with HPV or reducing the exposure to HPV infection (McGraw & Ferrante, 2014). Preventing HPV infection is achieved through vaccination against HPV in girls and boys who are not yet sexually active (El-Khatib et al., 2012). In many developed countries, HPV vaccination has been offered routinely since early 2000, while in developing countries, HPV vaccination is only starting to be available to vaccination programs. Vaccination against HPV has reduced HPV infections by more than 80% in countries where the uptake of the vaccination remains at above 75% (McGraw & Ferrante, 2014). Reducing exposure to HPV is usually achieved by means of safer sex practices such as delayed sexual debut, use of barrier methods during sexual intercourse, and monogamy. Because HPV infection does not present with any symptoms in infected individuals and sexuality is a challenge to change with varied success, reducing transmission of HPV in the absence of vaccination is a major public health challenge. The sexual transmission of HPV infection

is driven by many factors other than the individual's character such as poverty, gender norms that promote female subjugation, religious and cultural norms that frown on condom use, and situations that expose individuals to sexual violence (Kasting et al., 2016).

**Secondary prevention (cervical cancer screening).** Secondary prevention is currently the mainstay for prevention of cancer of the cervix in many developing countries while HPV vaccination is being scaled up. Secondary prevention of cancer of the cervix involves the early discovery and treatment of high grade precancerous lesions of the cervix and more recently testing for the presence of HPV in the cells of the cervix even before there are precancerous lesions (Parkhurst & Vulimiri, 2013). Early detection of precursors of cervical cancer is achieved through visually examining the cervix using different methods. Cervical cancer screening is applied to two groups of women (Randall & Ghebre, 2016b):

- Women who have high grade precancerous lesions in the cervix. The development of cancer of the cervix can be curtailed if these lesions are diagnosed early and treated promptly.
- Women who do not have any lesions. Routine HPV testing enables the identification of women who are higher risk of developing precancerous lesions and allows them to receive cervical screening in a timely manner as well as reduce unnecessary cervical screening and cytology. This is an important tool in situations where cytology is a challenge like in Swaziland.

Over the last three decades, cervical cancer screening has evolved from using cytology-based tests to DNA testing for HPV and more recently to the availability of self-

testing, thus improving access to screening for cervical cancer (Boone, Erickson, & Huh, 2012; Castle & Cremer, 2013; Sarai Racey, Withrow, & Gesink, 2013). However, in low resource settings like Swaziland, cytological testing is still the standard practice but has evolved from the traditional PAP smear to a "see-and-treat" method with visual inspection with acetic acid methodology (Akinyemiju et al., 2015; Lince-Deroche et al., 2015; Parham et al., 2015). See-and-treat methods reduce the number of visits a client needs to make to receive results and treatment thus improving the retention in care as well as the access to services and the uptake of the services by the women (Bruni et al., 2016). Cervical cytology detects early stages of cervical cancer when it can be cured preventing the morbidity and mortality associated with cervical cancer.

**Cervical Cancer Screening Programs**

Programmatic evaluations and research have demonstrated that systematic cervical cancer screening programs that are carefully planned out, can successfully reduce the number of new cases and deaths due to cervical cancer (McGraw & Ferrante, 2014). In several European countries where population based cervical cancer screening programs are institutionalized, the incidence of cervical cancer has decreased by more than 60% (Vaccarella et al., 2014). The high mortality due to cervical cancer in developing countries has been attributed to ineffective cervical cancer screening programs (Randall & Ghebre, 2016b). Evidence suggests that while sixty percent of women in high resource countries have undergone cervical cancer screening, only about 20% of women in low resource countries have undergone a cervical cancer screening (Mukakalisa, Bindler, Allen, & Dotson, 2014).

The challenges involved in preventing cervical cancer in developing countries are numerous however, one major barrier is the inability to have integrated, comprehensive and systematic cervical cancer screening programs (Catarino, Petignat, Dongui, & Vassilakos, 2015b; Mukakalisa et al., 2014). These programs must have a set of essential components (WHO, 2014b) that include:

- Availability of culturally appropriate informational, educational and communication strategies that are informed by audience segmentation to create demand for the cervical cancer services within the community.
- Building capacity of the service providers to increase awareness about cervical cancer prevention, how to diagnose and treat early as well as improve their skills at conducting the screening. This can be achieved through training that addresses both improvements in technical skills and patient education and counseling skills.
- Health facilities are able to provide cervical cancer screening services with functional systems to ensure the obtaining and subsequent processing of cervical samples are adhered to in a timely and quality assured manner.
- Health facilities have systems in place to ensure delivery of the results to the clients including an active tracking mechanism for women at high risk who do not honor their scheduled appointments.
- The availability of referral and linkage systems for women with abnormal results to ensure that these women receive appropriate care interventions in a timely manner.

- Health facilities that provide cervical cancer treatment are available and accessible for women in need of treatment.
- Monitoring and evaluation systems to ensure availability of statistics and information to inform programming.

Within developing countries in Sub-Saharan Africa, there has been limited impact of cervical cancer screening programs mainly because the programs are opportunistic and not systematic (Randall & Ghebre, 2016b). The program only reaches women who come to health facilities for other health issues or when they are symptomatic for cervical cancer. Although the infrastructure to provide the screening services may be available, the quality of services provided is weak due to inadequate numbers of trained and skilled health providers and there is poor utilization of services by the women due to inadequate demand creation  programs to raise awareness, traditional beliefs that prevent the women from seeking sexual reproductive health services (gynecological examination is a cause of embarrassment or a taboo) or inaccessible health services (Catarino, Petignat, Dongui, & Vassilakos, 2015a; Finocchario-Kessler et al., 2016; Kasting et al., 2016). Additionally, Health ministries do not invest resources required to maintain a population based organized screening service.

**Cervical Cancer Screening in Swaziland**

Over the last three decades in line with the HIV clinical management guidelines in Swaziland, there have been multiple attempts to introduce a systematic cervical screening program (Jolly et al., 2017). The initial programs were unsuccessful because cervical cancer prevention was not a government priority in the face of a raging HIV epidemic. The national Health policy does not specifically refer to cervical cancer

prevention but makes a general statement that cancer prevention efforts should be available within the health care settings (Swaziland Ministry of Health, 2015a). The HIV clinical management guidelines provide recommendations for cervical cancer screening among the HIV infected girls and women, but cervical cancer screening is not routinely or systematically provided to this population. Cervical cancer screening occurs in pockets around the country, often in facilities situated in urban areas where access to cytology services is easy and almost invariably linked to family planning services (Swaziland Central Statistics Office & World Bank, 2014). Thus, women with accessible health care and who are often at lower risk for cervical cancer, have more opportunity to receive cervical cancer screening and do receive it, while those without access who are often not clients of the family planning services are left out. This neglected population includes HIV infected AGYW in the rural areas (Fletcher et al., 2014).

In 2016, the Swaziland Cancer Registry reported that of 2000 women who had received a cervical cancer screening, 45% were found to have cervical abnormalities that included atypical cells, precancerous cells and early stages of neoplasia of which the precancerous cells and early stages of neoplasia are precursors to cervical cancer (Swaziland Ministry of Health, 2016). Of those with cervical abnormalities, 62% were HIV infected and all were between the ages of 17 and 35 years. The data from the HIV information system indicated that there were approximately 300,000 people infected with HIV of which 180,000 were women. Adolescent girls and Young women aged 25 years and less, made up 38% of this population (Swaziland National AIDS Program, 2016). In 2015, 3,000 HIV infected women had ever received a cervical cancer screen which was less than 2% of the HIV infected female population (Swaziland Ministry of Health,

2015b). These findings illustrate the low coverage of cervical cancer screening services in Swaziland that ultimately has a negative bearing on reducing the number of new cases of cervical cancer and the number of cervical cancer related deaths. Furthermore, the differences in cervical cancer morbidity and mortality between urban and rural women is in part caused by the differences in access to the screening services (Swaziland Central Statistics Office & World Bank, 2014).

In 2015, the Ministry of Health prioritized cervical cancer prevention thus demonstrating political will to tackle this issue. However, since the declaration, there has been very little effort by the government to develop a policy or invest resources to advance the program, relying on donor funding and implementing partners to implement cervical cancer screening within the health facilities. Additionally, the economic recession facing the country has hindered the implementation of many vital health programs including the cervical cancer screening program. With no guiding policy, cervical cancer screening efforts remain at the discretion of the sexual reproductive health program, the HIV/AIDS program and individual health facilities and these efforts are not coordinated (Jolly et al., 2017; Swaziland Ministry of Health, 2015b; Swaziland National AIDS Program, 2016).

**Barriers to Cervical Cancer Screening**

Design and implementation of Public health interventions depend on the documentation of the distribution (morbidity, mortality, life expectancy, etc.) and the determinants of health including equity, access to and quality of health services. Within health services, public health deals with preventive services such as screening or vaccination, as well as with health promotion and health care management. Addressing

service provision for cervical cancer screening attempts to reduce inequities in health care access and quality of cervical cancer preventive services as well as reduce inequalities among user groups (Finocchario-Kessler et al., 2016). As mentioned in the previous section, WHO recommends seven essential components for service provision of cervical cancer screening and available literature from settings similar to Swaziland will be reviewed here. There is a dearth in the literature regarding cervical cancer screening in HIV infected adolescent girls and what literature there is among young women is often not disaggregated for age. There have been few studies in similar settings to Swaziland that have evaluated the contribution of institutional system factors to the uptake of cervical cancer screening among HIV infected AGYW, whereas there is no published data available from Swaziland. With this study, I will attempt to provide evidence of the relationships of specific institutional factors and the uptake of cervical cancer screening among AGYW.

**Availability of cervical cancer screening services within health facilities.** WHO defines the availability of cervical cancer screening services within the health facility as the presence of infrastructure to offer the screening, the ability of the facility to send specimens for cytology and receive results, an information system to monitor the implementation of the screening and leadership within the facility to ensure continuity of services (WHO, 2014b). In Kenya**,** the availability of cervical cancer screening services in the local clinics despite the availability of the infrastructure was impacted by the lack of management capacity within the health facilities to plan for screening services (Huchko et al., 2011), whereas in Ethiopia, the lack of appropriate equipment and poor infrastructure for both screening and treatment services prevented the implementation of

cervical cancer screening within clinics (Gebreegziabher et al., 2016). Additionally, the absence of robust communication mechanisms between the different units involved in providing cervical cancer screening, diagnosis and treatment services (McCree et al., 2015), inadequate health information systems to monitor the screening program and failure of outreach programs to reach the at risk women (Fletcher et al., 2014; Kasting et al., 2016; Randall & Ghebre, 2016b) have been shown to reduce the availability of cervical cancer screening services.

Comprehensive screening and treatment services that are only provided in urban clinics or hospitals limit access to these services. In a low income estate in Durban, South Africa, HIV infected women reported a desire to have integrated services in community clinics as this improved access for them (Ports et al., 2015). In multiple rural communities in Nigeria, women had low knowledge of cervical cancer but were interested in finding out more and were anxious to have the opportunity to get screened but only if the screening was offered within their community clinics (Nwankwo, Aniebue, Aguwa, Anarado, & Agunwah, 2011). In Canada, where opportunistic screening has been successful except in the First Nations populations, a qualitative survey among health providers revealed that opportunistic cervical cancer screening programs do not perform well for First Nations women who experience significant screening-related health inequalities that are mainly influenced by structural barriers such as inadequately trained health care providers, lack of a recall based screening system as well as inadequate structural access and therefore recommend integrated and systematic screening for vulnerable populations (Maar et al., 2013). In Swaziland, HIV infected AGYW attend HIV clinics regularly for medication refills or for HIV or sexual

reproductive health care services including family planning. The HIV and sexual reproductive health services are mostly integrated into primary health clinics that offer both preventive and curative services (Church et al., 2015). These visits for HIV care can be used as an opportunity to implement cervical cancer screening among AGYW. However, the absence of routine cervical screening services is a missed opportunity for prevention or early diagnosis of the disease among this high-risk population (Murillo et al., 2016; Randall & Ghebre, 2016a; Rengaswamy Sankaranarayanan, Anorlu, Sangwa-Lugoma, & Denny, 2013). While many researchers find that the integration of services improves the uptake of services, there is also evidence from community-based studies that women are just as likely to access the service if it is available within their local clinic regardless of integration or not. Seemingly the uptake of cervical cancer screening is influenced by the availability of infrastructure and systems to support the screening within each clinic and not only the lack of integration of the services. Based on this evidence and using information from the Service Availability Mapping of 2017, I will assess the availability of cervical cancer screening services within facilities especially in those facilities that provide HIV care and treatment where AGYW receive care.

**Availability of trained health care providers.** Health care workers can significantly contribute to improvements in cervical cancer screening practices among women as they are usually the first point of contact within the health care system (Maseko et al., 2015c. In Uganda and Ethiopia, countries with high incidences of cervical cancer, poor knowledge of cervical cancer and the rationale for screening as well as poor awareness of the available screening guidelines among health care workers have hampered the systematic implementation of cervical cancer screening (Dulla et al., 2017;

Wanyenze et al., 2017). Assessments of public health approaches to reduce cervical and breast cancer have shown that health care workers need be knowledgeable and skilled to improve their compliance with the recommended practices that promote prevention interventions for cervical cancer such as screening (Liljestrand & Sambath, 2012; Miller, Plescia, & Ekwueme, 2014). Studies from South Africa, Zambia and Malawi, countries with high HIV prevalence and high cervical cancer incidence have shown that training and post training mentorship are two methods to improve health care worker knowledge and skills regarding cervical cancer screening (McFarland, Gueldner, & Mogobe, 2016). However, training and mentorship alone are not sufficient and health care worker attitude that can be a main barrier to screening as it is perceived as "extra work" resulting in missed opportunities for cervical cancer screening, needs to be addressed during training and mentorship (Brouwers et al., 2011; Paz-Soldán, Bayer, Nussbaum, & Cabrera, 2012). In Swaziland, with a doctor population ratio of 10 to 100,000, a nurse population ratio of 56 to 100,000 and a midwife population ratio of 64 to 100,000, provision of health care services is a challenge and therefore the introduction of what is considered a non-essential service by the health care providers is resisted (Riley et al., 2012; Scheffler, 2012). Other public health programs in Swaziland like the Swaziland National AIDS Program (SNAP) addressed the poor coverage of HIV treatment services by implementing task shifting and continuous training and mentoring of health care providers to scale up the initiation of Antiretroviral therapy in the country to successfully achieve treatment coverage of 82% (Dlamini-Simelane & Moyer, 2017; Mdege, Chindove, & Ali, 2013). The sexual and reproductive health program under which cervical cancer screening lies, adapted the WHO training package on Cervical cancer

screening and is training health care providers in clinics (Jolly et al., 2017; Malambo & Erikson, 2017). However, the quality of the training and the continuous mentorship are not standardized, and post training evaluations are not available to ascertain the competency in terms of knowledge and skills of the providers to offer cervical cancer screening to eligible women (Jolly et al., 2017). It is also not known what proportion of health care workers who have been trained on cervical cancer screening are actually providing the services. Using the national In-service training data base, I assessed the number and placement of trained health care providers who are providing cervical cancer screening. However, due to the use of secondary data that was limited in the kind of variables, it was not possible to evaluate the skills of the trained providers within the clinical setting or the quality of the service they are providing.

**Provision of referrals for cervical cancer screening.** Women value guidance from their providers regarding what to screen for and how to get screened, and are more likely to go if they have a provider's referral (J. J. Kim et al., 2015; Peirson, Fitzpatrick-Lewis, Ciliska, & Warren, 2013). The provision of referral for services ensures that both women and health care providers are making use of available resources within the public health sector, the women receive the care they need while the health care workers make better use of the available resources within the health system (Wåhlberg, Valle, Malm, & Broderstad, 2013). In most sub-Saharan countries with no guiding policies on service provision for cervical cancer screening, unavailability of service directories and few trained health care providers, the provision of referrals for cervical screening to women who are eligible is opportunistic rather than routine (McFarland et al., 2016; Morhason-Bello et al., 2013; Randall & Ghebre, 2016b). Evidence from Ethiopia and Malawi

suggest that referrals are not provided routinely but if women request the service, or the health care worker is reminded by either a job aid or a peer, or if they themselves take an interest in cervical cancer prevention and awareness activities (Maseko et al., 2015b; Roman et al., 2014), referrals for cervical cancer screening are provided and follow up is made to ensure that the woman receives the service. In Swaziland, although there is a national referral system within the health care system, the referral document is generic and not user-friendly for health care providers and neither is there a standardized mechanism for the flow of information to and from the sending and receiving facilities (Macintyre et al., 2011; MacKellar et al., 2016). The health records system is paper based and therefore there are no systematic triggers to remind the health care provider to provide a referral for services should the facility not have the services (Macintyre et al., 2011). A review of the referrals provided for patients who have been newly diagnosed with HIV in Swaziland found that only 50% of patients were routinely provided with referrals and only 30% of those were ultimately linked to HIV care (MacKellar et al., 2016). Given that the cervical cancer screening is opportunistic, it is not known how many of the eligible women receive referrals for cervical cancer screening and whether those who receive a referral, are followed up appropriately. With this study, I evaluated the proportion of AGYW in HIV clinics that did not offer cervical cancer screening who received a referral and went on to receive the service. With this evidence, it may be possible to describe the possible communication loops required to improve the flow of information between sending and receiving facilities.

**Differences in uptake of services between HIV-infected adolescent girls and young women.** For cervical cancer screening to be effective, asymptomatic women need

to access the services. This is a challenge because many young people only attend health facilities when they are unwell. Additionally, to access a service, the recipient needs to know about the service and its benefits (Bayu et al., 2016). Prior studies have shown that a major barrier to the uptake of cervical cancer screening is the lack of knowledge among women and their communities (Abiodun, Olu-Abiodun, Sotunsa, & Oluwole, 2014; Kahesa et al., 2012). Other barriers include fear of the procedure, social and cultural norms that do not allow women to expose themselves to people other than their husbands or talk about diseases that affect the female reproductive organs, stigma related to sexual promiscuity and cervical cancer as well as lack of communication between the health care workers and the recipients of care (Idowu, Olowookere, Fagbemi, & Ogunlaja, 2016; Jain, Halder, & Mehrotra, 2016). For HIV-infected women, service uptake is hampered by limited integration of HIV and cervical cancer prevention and treatment services as well as stigma and discrimination (Fletcher et al., 2014). Where integration has happened, there is limited tracking of service uptake. There is a paucity of evidence regarding cervical cancer screening among HIV infected adolescents and young women in Southern Africa but evidence from Europe and North America suggests that adolescents and young women tend to be screened unnecessarily creating both management and emotional issues for both the adolescent and the service provider (Van Kerrebroeck & Makar, 2016). However, the European population is different than that found in Swaziland or Southern Africa in that, the proportion of adolescents with HIV are few, they can clear off the HPV infection with very little untoward outcomes (Boardman & Robison, 2013). Despite the recent change in guidelines that do not recommend the routine screening of adolescents, there is a provision for the routine screening of HIV infected adolescents and

young women due to the recognition of the increased risk of developing cancer of the cervix (WHO, 2013). Zambia, a country with the highest cervical cancer rates in Africa at 58.4 per 100,000, has the largest and most well established cervical screening program in Southern Africa (Parham et al., 2015). In 2017, the country reported a total of 90 cases of cervical cancer in women aged 15 -24 years, while thirteen countries in Eastern Africa reported a total of 901 cases in the same age group (Bruni et al., 2016). In Malawi, 35%-50% of the cervical lesions detected in young women were found to be in advanced stages and screening only took place because they were symptomatic (Maseko et al., 2015a; Msyamboza, Phiri, Sichali, Kwenda, & Kachale, 2016b; Munthali, Ngwira, & Taulo, 2015) Kaufman et al (2016) conducted a systematic review of voluntary male medical circumcision in high HIV prevalence Sub-Saharan countries and found that even in the presence of adolescent friendly services within health facilities, adolescents will not necessarily access the available services in a timely manner. The inability to access adolescent sexual and reproductive health services was related to provider incompetency, lack of privacy, and limited service availability hours (Kaufman et al., 2016). The lack of integrated HIV and sexual reproductive health service delivery points means there are missed opportunities for the routine cervical cancer screening of HIV infected AGYW (Fletcher et al., 2014; Setse et al., 2012). Despite great progress in the provision of HIV services in almost all health facilities in Swaziland, the HIV program is run as a vertical program and therefore the integration of services is inconsistent (Obure et al., 2016). Obure et al. (2016) went on to compare the integration of HIV and sexual reproductive health services in facilities in Kenya and Swaziland and found that in facilities where integration had occurred, the quality of care was not any better than in non-integrated

sites. They concluded that competent staff in adequate numbers, a robust educational program and functional infrastructure play a greater role in delivery of adolescent health services. Young women aged 20 -24 years have greater opportunity for cervical cancer screening during routine family planning visits, ante- and post- natal care check-up as well as during child welfare visits (Lyimo & Beran, 2012b). However, their uptake for cervical screening is still poor. Research done in China, Kenya, and Nigeria show similar findings that knowledge of cervical cancer and its prevention as well as distance from a cervical cancer screening facility are among the main determinants of screening among young women (Jia et al., 2013; Ndikom & Ofi, 2012; Sudenga, Rositch, Otieno, & Smith, 2013). In Swaziland, young women enter the health system during antenatal care where they receive the first HIV test, including screening for other sexually transmitted diseases. However, due to poor tracking and monitoring systems, there is limited data regarding their uptake of services including cervical cancer screening (Mak et al., 2013; Tsawe et al., 2015). It would seem from the review of the literature, that the factors that prevented young women (20-24 years) from accessing cervical cancer screening are slightly different than those affecting adolescent girls (15-19 years) and in the context of Swaziland needed to be investigated further to inform the programming of cervical cancer screening services given the growing population of HIV infected AGYW. I reviewed the data to compare the uptake of cervical cancer screening between AG and YW and described any differences.

## Definitions

*Adolescent girls and young women (AGYW):* Descriptor term for young women who lie between the ages of 15 and 24 years. AG are those who fall between 15 and 18 years and YW fall between 19 and 24 years (Dellar et al., 2015).

*High at-risk population:* Subpopulations who are at an increased for a specific negative health outcome (Howard & Sacco, 2009).

*Availability of cervical cancer screening in facilities:* The WHO provides criteria to define availability of cervical cancer screening at a health facility. The criteria include the presence of infrastructure to offer the screening, the ability of the facility to send specimens for cytology and receive results, an information system to monitor the implementation of the screening and leadership within the facility to ensure continuity of services (WHO, 2014b).

*Trained health care providers:* Health care providers who receive a mandated or government approved skills or knowledge building intervention (Ameh & Van Den Broek, 2015).

*Referral system:* a formal mechanism that allows a client to receive a service elsewhere and the mechanism allows for tracking of the client (Gulati & Penn, 2014).

## Assumptions

The assumption was that all AGYW who were accessing HIV care and treatment would have had equal opportunity to hear about cervical cancer screening and that their knowledge and attitudes permitted them to participate in preventive care. However, their attitudes and perceptions may have prevented them from participating in cervical cancer screening despite the availability of all health care components. The other assumption

was that all health facilities that had the infrastructure for cervical cancer screening were promoting the services and all health care providers who had received training on cervical cancer screening would provide the services. In reality, not all facilities with the infrastructure for cervical cancer screening were promoting the service and not all trained health care providers were providing the screening services. The assumptions were necessary to make because the exploration of these institutional factors would highlight the factors that play a role in the uptake of cervical cancer screening in the target population. Secondary data were used in this study and was assumed to be valid and reliable because the data were collected using established measures that had been validated by the Strategic Information Department in the Ministry of Health and the data contained enough samples to provide a representation of the broader population.

## Scope and Delimitations

This study extended only to HIV infected AGYW in Swaziland and therefore may not be generalizable to non- HIV infected AGYW in Swaziland and HIV infected AGYW in other settings whose public health systems may be unlike that of Swaziland. 1 acknowledge that although there are other contributors to the uptake of cervical cancer such as educational level, knowledge of the AGYW, attitudes of the community and the AGYW towards cancer screening, culture and health seeking behaviors this study was delimited to the exploration of specific institutional (health services) factors that affect the uptake of cervical cancer screening among AGYW. The exploration of institutional factors is not all encompassing, and I only examined the availability of screening services, trained health care providers, the provision of referrals for cervical cancer screening and the difference in uptake between AG and YW. The choice of institutional

factors was determined by the available variables in the datasets from which the study data were extracted. The use of retrospective secondary quantitative data whose quality at collection could not be guaranteed may have affected the study outcomes. Additionally, it was not possible to interrogate the data in depth because the interrogation was limited by the quantitative nature of the study.

## Significance, Summary and Conclusions

Although it is two years since the National declaration on prioritization of cervical screening, little implementation has happened within the health care facilities in Swaziland. The Sexual Reproductive Health Unit with funding from Bristol Myers Squibbs Foundation developed an action plan to provide basic equipment to conduct the screening tests and train health care providers to use the equipment (Jolly et al., 2017). However, this funding has not yet translated into effective program implementation, there is no uniformity in level of provision of cervical cancer screening across the regions let alone within the same region and the outcomes of these activities are not yet evaluated especially among adolescent girls and young women who are a vulnerable population requiring strong prevention efforts (Church et al., 2015). These issues highlight the need for mainstreaming cervical cancer screening programs within the public health system. To curtail excessive expenditure on infrastructure and in view of the high HIV prevalence in this country (32%), cervical cancer screening services in this country should preferably be population based, systematic and integrated within primary care clinics and leveraging existing infrastructure for provision of screening (Church et al., 2015; Parham et al., 2015). This literature review summarized some of the available evidence on the system barriers to cervical cancer screening among women and when available on AGYW to

provide a context for the analysis of the situation in Swaziland. I reviewed the available data to describe the health system determinants of cervical cancer screening among HIV infected AGYW whose treatment outcomes impact negatively on themselves, the HIV and Sexual and Reproductive Health Unit program performance and the communities within which they live. The results of the study may be used to inform public health programming within this population to improve cervical cancer screening and reduce both the morbidity and mortality associated with this cancer in this population.

This study was important because it focused on cervical cancer screening among a high-risk population in Swaziland. Early detection of cervical cancer in this group will provide an opportunity for early treatment thereby reducing morbidity and premature mortality and associated elevated health care costs (Hung, Liu, Cheng, & Wang, 2014). I sought to identify gaps in the health care inputs that affect the uptake of cervical cancer screening. The contribution of this study to the current limited literature regarding cervical cancer screening in Swaziland was to provide additional evidence regarding the determinants of cervical cancer screening in high risk young women. The findings may generate additional questions that will form the basis for more research. The sexual reproductive health program of the Ministry of Health can use the findings to improve cervical screening services within the country. Public health practitioners can also use the significant findings to inform health promotion and education programs for both health care workers and clients, as well as policy guidelines to inform screening recommendations.

Young women are the backbone of many communities in Swaziland as the men migrate looking for work and therefore are responsible for both social and economic

growth in their communities (Brixiová & Kangoye, 2016). If they are affected by cervical cancer for which there is limited treatment, communities will suffer as will the children and the elderly who these women take care of (Hajizadeh, Sia, Heymann, & Nandi, 2014). This study could contribute to positive social change by responding to the Swaziland National Health Policy 2015-2020 goal to reduce the incidence of cancer deaths through improvements in the equitable and accessible delivery of health services for priority populations like adolescent girls and young women (Swaziland Ministry of Health, 2015a).

Section 2: Research Design and Data Collection

## Introduction

HIV-infected young Swazi women are at increased risk of cervical cancer because of their low participation in preventative screening programs and their HIV infection (Swaziland Ministry of Health, 2015c). Cervical cancer is a major contributor of morbidity and mortality among Swazi women and especially HIV-infected young women (Information Centre on HPV and Associated Cancers, 2016; Swaziland Ministry of Health, 2016). The purpose of this study was to examine the relationships between health care institutional factors and the uptake of cervical cancer screening among HIV-infected AGYW to inform policy and interventions to reduce morbidity and mortality related to this disease. In this section, I describe the research design and the rationale and the conduct of the research including data

## Research Design and Rationale

The overall design of my study was a quantitative approach, as I used secondary data extracted from the Swaziland Ministry of Health's HMIS to answer the research questions (see Creswell, 2014). I also used a correlational cross-sectional study design to explore the relationships between health care institutional factors and the uptake of cervical cancer screening among HIV-infected AGYW in Swaziland. A cross-sectional design was deemed appropriate because the intention of this research was to determine the empirical relationship between the independent and dependent variables and not determine causation (Sedgwick, 2014a). The study methods did not include the observation or interviewing of participants but rather the examination of routine data from surveys, making this study also retrospective in nature (Sedgwick, 2014b). The

factors that were investigated included the availability of cervical cancer screening services in clinics, the presence of trained health care providers, the availability of referral systems for screening, and the age of the women. Other covariates included location of the clinic and ownership of the clinic.

**Independent variables.** The independent health care institutional factors that I investigated included:

- The availability of cervical cancer screening services in a facility, that was defined as the facility having the infrastructure to conduct the screening, the mechanisms to obtain pathology results of the screening test, and the systems to feedback to the patient to trigger appropriate health seeking behaviors (WHO, 2013)
- The presence of trained health care workers within the facility that was defined as a health care worker who has undergone an accredited training on cervical cancer screening and is recognized by the Sexual and Reproductive Health Unit as being a trained provider
- The provision of referrals for cervical cancer screening to eligible women, that encompassed a health care provider referring an eligible woman for cervical cancer screening and documenting the referral as well as the outcome of the referral in the patient record (Miller, Hanson, et al., 2014)
- Although not an institutional factor, I also examined the difference in uptake of cervical cancer screening between HIV-infected adolescent girls and HIV-infected young women.

**Dependent variable.** There was only one dependent variable for the study, that was the uptake of cervical cancer screening. This was defined as the acceptance, seeking out, and receipt of cervical cancer screening in an eligible woman or women (Mwaniki et al., 2014).

Additional factors that were assessed included locality of the clinic (rural or urban) and ownership of the facility. These were categorized as government owned, missionary owned, private for profit, and private not for profit, as these may have played a role in the availability of the cancer screening services in a clinic.

## Rationale for Secondary Data Analysis

Secondary data analysis is a valid research design that requires the rigor demanded of primary data analysis research designs, that consists of the researcher collecting, analyzing, and interpreting data (Johnston, 2014). Similarly, in secondary data analysis there are procedural and evaluative steps: the researcher is required to develop research questions, identify potential datasets, and then evaluate the dataset to ensure it can answer the research questions (Johnston, 2014; Koziol & Arthur, 2012). Fundamental to secondary data analysis is the application of theoretical knowledge and conceptual skills to use existing data to address the research questions (Cheng & Phillips, 2014).

**Advantages of secondary data analysis.** The advantages associated with secondary analysis are the timeliness of production of results, cost effectiveness, and convenience it provides as minimal financial resources have to be allocated to the data collection processes (Johnston, 2014). The availability of quality secondary data allows researchers to access and use datasets that have larger sample populations that are more representative of the target population, that allows for more generalizable findings and

increased validity (Windle, 2010). Secondary data analysis also presents opportunities to conduct research and allows for building capacity for empirical research (Cheng & Phillips, 2014). Finally, using secondary data allows research studies to be completed quicker and results produced in a timely manner to inform policy and practice (Goodwin, 2012).

**Disadvantages of secondary data analysis.** Despite the advantages, there are disadvantages to using secondary data. The most common limitation is inherent to the use of secondary data in that the data were collected for another purpose and may not provide adequate or in-depth data that the researcher requires, limiting the location of study, the population, or even the variables (Schlomer & Copp, 2014). Another limitation is that the researcher using secondary data cannot guarantee the quality of the data that were collected. The researcher can review the data collection and validation processes but cannot correct the inadequacies of the data and therefore these will become inherent limitations or causes of bias to the secondary data analysis.

## Methodology

### Population

The population that I studied were HIV-infected young women between the ages of 15 and 24 attending HIV care clinics in Swaziland. The young women were further disaggregated into adolescent girls aged 15–18 and young women 19–24. This population makes up 10.4% of the total population in Swaziland, that has the second highest HIV incidence rate of 1.87 and accounts for 14 % of the HIV-infected population in Swaziland. There were 185 HIV care and treatment clinics in the country, and there were

12,329 HIV-infected AGYW enrolled in care by the end of March 2018. The population under study was drawn from these HIV care clinics.

**Data Set**

I used routinely collected data for my study that was provided by the Ministry of Health's HMIS unit that aggregates all facility level data at the national level. For this study, I used data from the HIV care clinics collected until March 2018, the training information management system, and the SARA 2017. The HMIS unit provided a semimerged set of data that included a listing of AGYW per facility and included a system generated unique identifier or serial number (this number is generated whenever the data is requested and is not a personal identification number), date of birth, treatment regimen, and referrals or future appointments for screening services as well as other care services clients receive such as tuberculosis screening and cervical cancer screening. The training information management system collects information on the type of training, the facilities that received the training and the number of nurses from each facility that were trained. A list was generated from the training information management system that provided each facility with number and cadre of provider who have been trained and certified to provide cervical cancer screening. The SARA 2017 is a comprehensive survey database that provided a listing of facilities that provide HIV care services to AGYW and their characteristics such as the presence of cervical cancer screening, location of the clinic, and ownership of the clinic.

To achieve the data set I needed to answer my research questions, I merged the patient level dataset and the SARA dataset into one dataset. The common variable was the facility unique identifier. All routinely collected data undergoes validation during

quarterly routine data quality audits that are conducted by the HMIS unit. As per the national data management guidelines, all facilities are required to conduct data quality checks, prior to submitting their quarterly reports (HMIS, n.d.). These procedures ensured that the data that was collected and deposited within the HMIS unit meets a certain quality standard and therefore improved the validity of this study.

The SARA 2017 data are available on the government website and required no specific permission to use. However, for the HIV care and treatment data and the health care provider training data, permission was sought from the HMIS unit. To be able to disseminate the research findings, I made a formal request to the National Health Research Review Board once the proposal was approved by Walden University.

**Sampling Procedures Used to Collect Data**

In the study, I employed total population sampling that is a type of purposive sampling (Laerd Dissertation, 2012; Wu Suen, Huang, & Lee, 2014). This is because the HIV-infected AGYW were a relatively small population in comparison to the rest of the people living with HIV attending HIV care clinics in Swaziland (only 14%). All facilities providing HIV care to the target population were included in the sample. There was no set number of AGYW in each health facility; therefore, all HIV-infected AGYW enrolled in these facilities were included in the study. The minimum sample size to adequately power the study was calculated to ensure that the number of AGYW in the data set met this minimum number and informed the interpretation of the results. The use of purposive sampling in my study affected the generalizability of the results (Parker, 2013). However, total population sampling ensured that all eligible AGYW in the target population were included in the study and enabled some analytical generalizations about the target

population (Laerd Dissertation, 2012). The disadvantage with total population sampling is that all people in the target group need to be included in the sampling frame and if they are not, an important characteristic may not be investigated (Parker, 2013).

**Sampling Frame**

A list of all health facilities that offer HIV care services in each of the regions in the country was obtained from the SARA 2017 and used as the sampling frame for the study. The health facilities were disaggregated according to level of care provided: primary health clinics, health centers, and regional or referral hospitals as well as the region in which they were located. To ensure completeness of the sampling frame, I consulted with the Swaziland National AIDS Program to confirm that all HIV care clinics by region were included (see Table 1).

Table 1

*Health Facilities in Swaziland that Provide HIV care by Region*

| Region | Primary Health Clinics | Health Centers | Hospitals |
|---|---|---|---|
| Shiselweni | 19 | 2 | 1 |
| Hhohho | 48 | 2 | 4 |
| Manzini | 66 | 0 | 4 |
| Lubombo | 37 | 1 | 1 |
| Total | 170 | 5 | 10 |

Primary health clinics make up 92% of all health facilities that offer HIV care. Health centers make up 2.6% of all health facilities providing HIV care and treatment services. Because health centers offer more services than the primary health clinics and have at least one doctor available, they tend to have more patients, especially children and adolescents, than the primary health clinics. Hospitals account for only 5.4% of all health facilities in Swaziland; however, they were the first institutions to offer HIV care and also provide management of treatment experienced patients and the vulnerable populations under which the AGYW fall. Thus, the total number of facilities that provide the sample of AGYW were 170 primary health clinics, five health centers, and 10 hospitals, making a total of 185 health facilities.

**Use of the sampling frame to obtain the sample size.** Once all the HIV care clinics were verified by the National AIDS Program, data from these facilities were requested from the HMIS and the data pertaining to the target population of AGYW were extracted. Given that there was no set number of HIV infected AGYW per health facility and their distribution across the different types of health facilities was varied, all AGYW

in each facility were included in the sample population. The use of all AGYW in the sample population increased the generalization of the results. Because the sample size was predetermined, this affected the power of the study to detect significant differences between the independent and dependent variables. A power analysis requires an effect size that is usually determined after the data collection and analysis (Ryan, 2013).

There is a lack of literature regarding institutional factors that impact on the uptake of cervical cancer screening among AGYW for me to have been able to reference an effect size to estimate the power of the study. Therefore, I conducted a post hoc power analysis to calculate the power and compared it with the one I estimated using an effect size value of 0.3 as it indicated a medium to large difference. I used the software G*Power 3.1.9.2 to compute the power analysis for sample size. I chose to use the $\chi^2$ test because I wanted to examine the relationship between nominal level categorical variables (Simpson, 2015). The margin of error chosen for the study was 5% with a 95% level of confidence. The analysis was a priori to compute a minimum sample size and power of the study. The output is as follows:

Input: Effect size w = 0.3

α err prob = 0.05

Power (1-β err prob) = 0.95

Df = 1

Output: Non-centrality parameter λ = 13.0500000

Critical $\chi^2$ = 3.8414588

Total sample size = 145

Actual power = 0.9507851

Based on this computation, a minimum sample size of 145 AGYW was required to achieve at least 95% chance of being able to detect a 30% effect size of the relationship between the independent and dependent variables.

I conducted the post hoc power analysis for a one sample study with a dichotomous end point using the uptake of cervical cancer screening among the population of 33%, the uptake of cervical cancer screening among the study population of 20.45%, the study population of 10,618 and an alpha level of 0.05 resulting in a post-hoc power of 100%. Figure 1 illustrates the calculation for the post-hoc power analysis.

$$Power = \Phi\left\{\frac{\sqrt{N * \frac{(P_1 - P_0)^2}{(P_0 * Q_0)}} - z_{1-\alpha/2}}{\sqrt{\frac{P_1 * Q_1}{(P_0 * Q_0)}}}\right\}$$

$$Power = \Phi\left\{\frac{\sqrt{10618 * \frac{(0.2045 - 0.33)^2}{(0.33 * 0.67)}} - 1.96}{\sqrt{\frac{0.2045 * 0.7955}{(0.33 * 0.67)}}}\right\}$$

$$Power = \Phi(29.778) = 1 = 100\%\ power$$

*Figure 1*: Post hoc Power analysis

**Inclusion and Exclusion Criteria**

All health facilities providing HIV care services were eligible to be included in this study. HIV care clinics that did not have any HIV infected AGYW enrolled in care were excluded from the analysis. Facilities with HIV care clinics that had not submitted quarterly data reports to the HMIS consistently over the two years 2016-2017 were also excluded because their data were incomplete. This exclusion criteria were included to ensure that only recent and updated data were used in the study.

The inclusion criteria for the study population were the AGYW aged between 15 and 24 years who have been diagnosed HIV positive and enrolled in HIV care. These AGYW should have been in care for at least two years to allow enough time within the clinic for the AGYW to receive at least one cervical cancer screening. All HIV positive AGYW who had been enrolled in the HIV clinic less than one year were excluded from the study.

**Instrumentation and Operationalization of Constructs**

The measuring instrument I used was in the form of a questionnaire. The questionnaire was a set of structured questions that was used to obtain and aggregate the data from the secondary dataset to answer the research questions without the need to interview the target population (Timmins, 2015). I selected the questionnaire method as the data collecting methodology because it made the quantification of information possible (Aitrs, 2012). Questionnaires can be used to diagnose institutional functioning (Liamputtong, 2013); however, the construction of a questionnaire is complex because every question or item must be formulated carefully based on the research questions (Rowley, 2014). The questionnaire can be extracted from service standards or guidance documents for consistency and validity (Govender, Mabuza, Ogunbanjo, & Mash, 2014). The questions that I used to interrogate the availability of cervical cancer screening services was informed by the WHO guidance on Cervical Cancer Screening programs (WHO, 2013). Other researchers who have conducted studies that investigated the systemic factors affecting uptake of cervical cancer screening have used the WHO guidance on Cervical Cancer Screening Programs as the basis for the development of

their tools (Akinyemiju, McDonald, & Lantz, 2015; Campos et al., 2015; R. Sankaranarayanan, 2014).

**Operationalization.** The main variables are defined in Table 2.

Table 2

*Definitions of Variables*

| Research Question | Variable | Data Source | Definition | Measurement |
|---|---|---|---|---|
| Facility characteristics | Facility type | Service Availability Mapping | There are three categories depending on services provided: Primary Health Clinic, Health Centre, or Hospital | Categorical: single response out of three options |
| | Facility Location | Service Availability Mapping | Classification of location of the facility as either rural or urban | Categorical with two options - single response out of two options that include rural location of clinic or urban location of clinic |
| | Facility unique identifier | Service Availability Mapping | Number that is assigned to the facility by the ministry | Categorical because this variable is alphanumeric. |
| | Facility Ownership | Service Availability Mapping | Facility can be owned by private, government or mission entities | Categorical: single response out of three options |
| | Facility has cervical cancer screening services | Service Availability Mapping | Facility meets the criteria for providing cervical cancer screening services including equipment to conduct screening, in-service communication and mechanism to examine samples and provide results to the clients | Nominal: Yes, facility has cervical cancer services or No, facility does not have cervical cancer screening services |
| | How often are services provided | Service Availability Mapping | Number of days per week that cervical cancer screening is offered | Categorical: single response out of three options. The number of times services are provided will be classified as 0, 1-3, >3 |
| | Does facility advertise cervical cancer screening services | Service Availability Mapping | Signage at the facility that advertises cervical cancer screening services | Nominal: the response is either a yes, services are advertised or no, services are not advertised |

*(table continues)*

| Research Question | Variable | Data Source | Definition | Measurement |
|---|---|---|---|---|
| Participant characteristics | Date of birth/age at last birthday | HMIS | Date of birth recorded in register of AGYW | Continuous (number of years) |
| | Date of enrollment into HIV care | HMIS | Date that AGYW was registered for HIV care | Categorical (date): the date will be used to calculate number of years that the client has been enrolled in HIV care |
| | Number of years AGYW has been in HIV care | HMIS | Length of time that the AGYW has been enrolled in HIV care | Continuous |
| | HIV treatment start date | HMIS | Date that AGYW was started on HIV treatment | Categorical (date): the date will be used to calculate number of years that the client has been on HIV treatment |
| | Number of years AGYW has been on HIV treatment | HMIS | Length of time in years that AGYW has been on HIV treatment | Continuous |
| | Eligible for cervical cancer screening | HMIS | AGYW has been diagnosed with HIV at least 12 months and should receive a cervical cancer screening as per HIV management guidelines | Categorical: the responses include either yes, eligible for screening or no, not eligible for screening. |
| | Received Cervical cancer screening | HMIS | AGYW has undergone cervical cancer screening in the last 12 months. | Categorical: the responses include either yes, has received cervical cancer screening or no, has not received cervical cancer screening. |
| Uptake of cervical cancer screening (calculated) | Received cervical cancer screening within the last 12 months | HMIS | Proportion of eligible AGYW that received a cervical cancer screen during 2016 - 2017 | Proportion or percentage of AGYW who were eligible for screening and then received the screening |
| | Results of screening documented | HMIS | Results of the screening available in the register | Nominal: either responds as yes, screening results are documented or no, screening results not documented |

*(table continues)*

| Research Question | Variable | Data Source | Definition | Measurement |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| What is the relationship between the availability of trained health providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland? | Does facility have trained cervical cancer screening providers? | Training Information Management System | The facility has providers who have undergone accredited cervical cancer screening training | Nominal: response is either yes, trained providers are available or no, there are no trained providers available |
| | Number of providers | Training Information Management System | Count of trained providers per facility | Continuous (number of trainers) |
| What is the relationship between the availability of cervical cancer screening services in a facility and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland? | Facility has cervical cancer screening services | Service Availability Mapping | Facility meets the criteria for providing cervical cancer screening services including equipment to conduct screening, in-service communication and mechanism to examine samples and provide results to the clients | Nominal: Yes, facility has cervical cancer services or No, facility does not have cervical cancer screening services |
| | How often are services provided | Service Availability Mapping | Number of days per week that cervical cancer screening is offered | Categorical: single response out of three options. The number of times services are provided will be classified as 0, 1-3, >3 |
| | Does facility advertise cervical cancer screening services | Service Availability Mapping | Signage at the facility that advertises cervical cancer screening services | Nominal: the response is either a yes, services are advertised or no, services are not advertised |
| | AGYW who received cervical cancer screening | HMIS | Count of number of AGYW who received cervical cancer screening | Continuous variable (number of AGYW) |

(table continues)

| Research Question | Variable | Data Source | Definition | Measurement |
|---|---|---|---|---|
| What is the relationship between the provision of a referral for cervical cancer screening among eligible women and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland? | Was referral documented? | HMIS | Patient provided with referral for next service is documented in the register/EMR | Nominal: Yes patient was provided a referral or No patient was not provided with a referral |
| | Were appropriate referrals provided to client | HMIS | If referral is documented, was it appropriate as determined by the need of the client. | Nominal: Yes appropriate referral was provided, No, inappropriate referral was provided |
| Is there a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women? | Uptake of cervical cancer screening disaggregated by AG and YW. | within study dataset | proportion of eligible AGYW who received a cervical cancer screen during 2016-2017 per age group | Continuous (proportion) |
| | Age group to differentiate AG and YW | within study dataset | study participants will be grouped into 15 to 19 years old and 20 - 24 years | Categorical |

## Data Analysis Plan

The data analysis plan articulates how the data were cleaned, transformed, and analyzed (Banks, Paige, & Mather, 2013; Michener, 2015). The data analysis plan is a roadmap for how the data were managed and the data analysis conducted. SPSS v25 was used to conduct the data analysis.

### Cleaning the Data

Data cleaning is the removal of outliers, dealing with missing data and assessing for normality to determine the need for data transformations (Chu, Ilyas, Krishnan, & Wang, 2016).

**Outliers.** All the variables measured on a continuous scale like age, length of time the AGYW has been in HIV care and length of time the AGYW has been on HIV treatment was assessed for outliers. If an observation had a standard deviation of greater

than ±3.29 from the variable's mean, it was considered as an outlier (Aguinis, Gottfredson, & Joo, 2013). This was accomplished by standardizing the scores of the variable (the variable's scores have a mean of zero and a standard deviation of 1) and looking for an observation greater than ±3.29 (Aguinis et al., 2013).

**Missing data.** Missing data is the absence of an observation on a variable. Handling missing data may be especially challenging when using secondary datasets and is necessary to reduce bias and enable the valid deduction of results (Palmer & Royall, 2010). Missing data may threaten statistical power by reducing sample size or, in more extreme situations, estimates derived by deleting cases with missing values may be biased, particularly if the cases with missing values are systematically different from those with complete data (Kaiser, 2014). There are many ways to deal with missing data and the selection of an appropriate remedy is determined by the percentage of missing data and the importance of the variable in the study (Dohoo, 2015; Groenwold, Donders, Roes, Harrell, & Moons, 2012). When missing data is less than 10%, it is acceptable to drop the observation, however, if larger proportions are missing, the re-weighting of the variable or multiple imputation are more appropriate choices (Osborne, 2013). Using SPSS, I generated frequency tables for all the variables to determine the proportions of missing data. If the missing data were less than 10%, the events would have been dropped if determined not to adversely affect the results of the study by running the statistical tests with and without the missing data (Dong & Peng, 2013; Howell, 2015). However, there were no missing data.

**Normality.** Majority of the parametric tests have the assumption of Normality. Normality refers to the shape of the distribution of scores (e.g., shape of a normal bell

curve) (Ghasemi & Zahediasl, 2012). I assessed for normality by examining the skewness and kurtosis of each continuous variable (age and length of time on treatment) using SPSS. The data approximated the normal distribution, and no further manipulation was done. However, had the data not been normally distributed, a transformation of the data may have been required. Some common transformations are the square root, logarithmic, and inverse.

**Specific Statistical Tests to Examine Each of the Research Questions**

The research questions enabled the description of the relationship between the selected health care institutional factors and the uptake of cervical cancer screening among the target population.

Research Question 1: What is the relationship between the availability of trained health providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$1: There is no relationship between the availability of trained health care providers and the rate of uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

$H_a$1: There is a relationship between the availability of trained health care providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

Research Question 2: What is the relationship between the availability of cervical cancer screening services in a facility and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$2: There is no relationship between the availability of cancer screening services within a facility and the uptake of cervical cancer screening.

$H_a$2: There is a relationship between the availability of cervical cancer screening services within a facility and the uptake of cervical cancer screening.

Research Question 3: What is the relationship between the provision of a referral for cervical cancer screening among eligible HIV positive adolescent girls and young women and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$3: There is no relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

$H_a$3: There is a relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

Research Question 4: Is there a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women?

$H_0$4: There is no difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

$H_a$4: There is a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

**Data Analysis**

The selection of the statistical analysis is based on two things: the way the hypothesis is stated in statistical language and the level of measurement of the variables (Karran, Moodie, & Wallace, 2015). To examine the research questions, that were examining the relationship between independent variables and a dichotomous outcome, a

chi-square analysis was conducted. For ordinal level variables, the Cochran-Armitage test of trend was performed (Wellek & Ziegler, 2012).

When examining the influence of one variable on another and the dependent variable is dichotomous, then a logistic regression is the appropriate test to use, if there are more than one categorical independent variables and the dependent variable is also categorical, the appropriate test to use is a bivariate logistic regression and the linear regression is the correct analysis if the dependent variable is interval level (Kasza & Wolfe, 2014).

**Univariable analysis.** An analysis was conducted to describe the characteristics of the population as well as determine the frequency of the outcome. The characteristics of the population were described by person, and place and illustrated as frequencies. Stratified frequencies were calculated across the age sub-groups. Further analysis was conducted to describe the frequency distribution of the outcome variable and a confidence interval for the prevalence estimate. Frequencies were used to describe the categorical data and histograms were used to visualize the continuous variables (Humphrey, Taylor, & Mittag, 2014; Weissgerber, Milic, Winham, & Garovic, 2015).

**Bivariable analysis**. Data to answer each of the research questions were displayed in two variable tables. Two variable tables were used to determine whether uptake of cervical cancer screening varied by age group. Two variable tables were also used to quantify the associations between the independent variables and the outcome variable with the rows representing the different levels of exposure and the columns representing absence or presence of the outcomes.

***Calculating Measures of association***. Measures of association were computed and interpreted for the associations between the independent variables and the outcome.

***Calculating Statistical Significance***. Given that my research questions were testing the relationship of the independent variable that was categorical to the dependent variable that had a dichotomous outcome, I used a Chi Square analysis. The chi-square is an appropriate statistical test when the purpose of the research is to examine the relationship between two nominal level categorical variables (Mchugh, 2013). I compared the calculated chi-square coefficient ($\chi^2$) and the critical value coefficient to evaluate the significance of the results. When the calculated value was larger than the critical value, with alpha of .050, the null hypothesis was rejected (suggesting a significant relationship) (Sharpe, 2015). The alpha value also known as the significance level is the probability of rejecting the null hypothesis when the null hypothesis is actually true (Krzywinski & Altman, 2013). The alpha value for this study was set at 0.05 or a five percent probability of rejecting the null hypothesis when it is true. In order to determine the degrees of freedom for a chi-square, it was necessary to use the following equation:

$df = (r - 1)(c - 1)$

The *r* value equals the number of rows, and the *c* value equals the number of columns. In order for a chi-square to run correctly, several conditions and assumptions must be met: the data must be random samples of multinomial mutually exclusive distribution and the expected frequencies should not be too small (Mchugh, 2013). As a precautionary measure in chi-square examination, the expected frequencies below five should not account for more than 20% of the cells, and there should be no cells with an

expected frequency of less than one. If the expected cell frequencies were less than 5, Yates continuity correction or Fisher's exact test was used to test for significance (if it is a 2x2 chi square), as it is a more conservative statistic (Connelly, 2016). For the ordinal level variables, a Cochran-Armitage test of trend was conducted and to compare two proportions, the test of two proportions was conducted (Wellek & Ziegler, 2012). The Cochran-Armitage test of trend otherwise known as the Chi Square test of trend was used to assess for the presence of an association between a binomial outcome variable with an independent ordinal variable with K categories, where K is any number more than two (Zhou, Ku, Huang, Xing, & Xing, 2017).

***Assessing for effect measure modification***. An effect size or effects measure was calculated for all significant tests. The Effect size is a simple way of quantifying the difference between two groups (Fritz, Morris, & Richler, 2012; G. M. Sullivan & Feinn, 2012). It emphasizes the size of the difference and how it relates to the general population. It suggests the clinical or "real world" relevance of the findings of the research. Usually, the effect size is agreed upon *a priori* so that a sample size can be calculated to adequately power the study. Phi $\varphi$ is a measure of effect size and is equivalent to the correlation coefficient *r* (Bosco, Aguinis, Singh, Field, & Pierce, 2015; Kelley & Preacher, 2012). It is used when the variables are categorical. Phi is defined by the formula:

$$\varphi = \sqrt{\frac{\chi^2}{n}}$$

where $n$ = the number of observations. A value of .1 is considered a small effect, .3 a medium effect and .5 a large effect (Lakens, 2013).

***Assessing the effect of potential confounders***. Confounding is an apparent association between the population and the outcome in this case the uptake of cervical cancer screening that results from a third factor that has not been considered in the relationship (Creswell, 2014). A confounder is an independent risk factor for the outcome and also happens to be associated with the independent variable or variables under investigation.

***Conducting multivariable analysis***. A multivariable analysis and modeling technique was conducted to address the hypotheses in the research questions. The results from the bivariable analysis informed the modeling technique to determine the final model or set of models that best described the data, as all statistically significant relationships needed to be included in the model (Connolly, 2011; Soley-Bori, 2013)., I used multivariable logistic regression to examine the relationship between the dependent variable that had a dichotomous outcome and the independent or predictor variables. The multivariable regression analysis model helped me understand how the typical value of the dependent variable (uptake of cervical cancer screening) changes when any one of the independent variables is varied (for example or presence of diagnostics), while the other independent variables are static. The dependent variable in my study was the uptake of cervical cancer screening and the independent variables included the presence of trained providers, availability of cervical cancer screening services within an HIV clinic, provision of a referral for appropriate services, and age group of the client. The multivariable logistic regression allowed me to predict values of the dependent / outcome variable for a specific independent variable as well as suggesting which independent

variables had a major effect on the dependent/ outcome variable. (Sperandei, 2014). In research question 1, the outcome variable was uptake of cervical cancer screening while the predictor variable was trained health care providers whose impact on uptake was assessed in the presence of other factors such as age group availability of referral services, and availability of cervical cancer screening services. In research question 2, the outcome variable was uptake of cervical cancer screening while the predictor variable was the availability of cervical cancer screening services in facilities whose impact on the uptake was assessed in the presence of availability of trained health care providers, age group and availability of referral services. In research question 3, the outcome variable was the uptake of cervical cancer screening services while the predictor variable was the availability of referral services whose impact on uptake was assessed in the presence of trained health care providers, age group and availability of cervical cancer screening services in facilities. In research question 4, the outcome variable was the uptake of cervical screening while the predictor variable was age group whose impact on uptake was assessed in the presence of other factors such as trained health care providers, availability of cervical cancer screening services and availability of referral systems. Other confounding variables that were put into each of these models included the location of the facility, facility ownership, and mean length of time the AGYW has been on antiretroviral therapy. In the analysis, the data were examined to see if it meets the assumptions of normal distribution, absence of multicollinearity, homoscedasticity, independence of observations, and linearity between the dependent and independent variables, prior to running the multivariable analysis.

## Threats to Validity

### External Validity

In quantitative research, external validity is important because as researchers, the conclusions we make from our studies should ideally be applicable to a wider population than the sample we studied (Matt, Brewer, & Sklar, 2010). These results can ideally be generalized to a larger population from which the sample was obtained or can be generalized to other populations or settings or time frames. External validity asks the question: To what extent can our conclusions be generalized to a wider population. No study can be completely externally valid. To assess the extent to which generalizations can be made, we have to determine how well the study sample represents the wider population (Polit & Beck, 2010; Yin, 2013). The extent to which study results are robust across different populations and settings varies according to the research paradigm (i.e., a positivist versus a post-positivist research paradigm). Positivists tend to build grander theories and therefore make broader generalizations from the results while Post-Positivists are less likely to have expansionist theories and make conservative generalizations. The various research designs (descriptive, quasi-experimental, experimental) also affect the external validity of the study conclusions (Banerjee, Chassang, & Snowberg, 2016).

Threats to external validity are any factors within a study that reduce the generalizability of the results of which there are a wide range including (a) selection bias; (b) threats due to the constructs, methods and confounding that has not been adjusted for; (c) the 'real world' versus the 'experimental world'; and (d) history effects and maturation.

**Selection bias.** People differ along a wide range of factors that are inherent to the person, such as age, gender, height, intelligence, attitude, behavior. When the sample that is studied does not represent the population from which the sample was selected, there has been a selection bias (Pearce & Richiardi, 2014; Westreich, 2012). Where selection bias occurs, it is challenging to argue that the results can be generalized to the wider population. In experimental research designs, selection bias can be reduced through the random selection and assignment of participants (Etikan, 2017). Random assignment ensures that the participants are randomly allocated to a group and are comparable across a range of general and specific characteristics including age and gender (Etikan, 2017). Selection bias is more likely to occur in research designs that do not randomly select or assign participants such as in quasi-experimental research like observational cohort studies or when purposive sampling is used, and this is a threat to the external validity of these types of studies (Pearce & Richiardi, 2014). Despite adequate selection techniques, the generalizability of the study results may be affected by extraneous variables that relate to the characteristics of the sample such as attitude, personality, culture over which the researcher has no control and these act as confounders (Kamangar, 2012; Sullivan, 2016). The uptake of cervical cancer screening is not only dependent on institutional factors but also on the attitude, knowledge and perceptions of the women who are eligible for cervical cancer screening (Dulla et al., 2017; Ndejjo et al., 2016). This quantitative study did not investigate these variables and therefore these will affect how the results are interpreted.

**Generalization and constructs**. The operationalization of the study (how the constructs, variables and interventions are defined) will affect whether the results from

the study can be generalized to a wider population. In quantitative research designs, broad concepts should be narrowed into constructs that can be measured. Constructs are the building blocks of theories, that help to explain how and why certain phenomena behave the way that they do. In assessing the determinants of cervical cancer screening among HIV infected young women, the theory that was utilized was a systems theory and one of the constructs was service availability that had many parameters. However, in this study, to measure the construct of service availability, presence of advertised services, presence of infrastructure, and presence of results delivery systems were some of the variables that were used to quantify the service availability; the use of multiple variables to measure a single construct reduces the risk of mono-operation bias, a threat to construct validity and therefore external validity. Because this was a limited view of service availability, I could only generalize across the construct and generalizations across the selected variables to measure service availability within the boundaries of the operational definition that I provided for the construct of service availability and the measurement variables.

**Internal Validity**

**Confounding and extraneous variables**. Confounding variables or confounders are those variables that can provide an alternative explanation for the results if they are present and are inherent characteristics in a study subject that the researcher cannot modify or remove, these include, age, sex, socioeconomic status, religion, education level (Kamangar, 2012). If these variables are not being studied, then they are also known as extraneous variables (Kamangar, 2012). Both confounding and extraneous variables can threaten the internal validity of the results. In experimental research design, these

extraneous variables can be controlled for by for instance case controlling and therefore reduce the confounding effect ( Sullivan, 2016). In my study that was not case controlled, the potential for confounding and extraneous variables was high and a consideration of testing of influence on the dependent variable by specific confounding variables such as location of the clinic and the ownership of the clinic was made.

## Ethical Procedures

In secondary data analysis, the original data were not collected to answer the present research question. My research used secondary data that were routinely collected at facilities and aggregated at the Ministry of Health HMIS Unit. I used data collected by the HMIS until March 2018 and provided a list of variables to inform the dataset requested from the SIU. I sought permission from the Ministry of Health to obtain deidentified facility level data. De-identified or anonymized information promotes privacy and prevents breach of patient confidentiality policies (Fullerton & Lee, 2011). Only data that pertained to HIV infected AGYW from the HIV care facilities were requested to prevent unnecessary data collection (Brakewood & Poldrack, 2013). The SIU de-identified all data that was shared and because I used a specific population within each facility population, all attempts were made to ensure that individual patients could not be identified by removing all patient identifying numbers and addresses. Because there were no direct interactions with the target population, no consent was sought from them (Wilkinson et al., 2016). Some of the data such as SARA requires no prior permission and is available on the government website and therefore consent to use it was implied. However, the HMIS unit provided me with a complete dataset including all the data extracted from the SARA. All the data was obtained electronically and was stored on

password protected external hard drives. The files were encrypted to prevent accidental exposure of the data. There were no hard copies of the data and therefore there was no need for a locked cabinet designated for data storage. Only the statistician and I had access to the data. All data will be kept in accordance with the Walden Institutional Review Board (IRB) which is five years. In addition to the University's IRB (number 08-06-18-0665327), I obtained permission from the Ministry of Health Research Review Board (number SRH027/2018) to publish and disseminate the results of the research.

## Summary

My research set out to investigate the institutional factors that affected the uptake of cervical screening among HIV-positive young women who were disaggregated into adolescent girls aged 15 – 18 years and young women aged 19 – 24 years. The factors that were investigated were: the availability of cervical cancer screening services, the presence of trained health care providers, provision of referral for services and differences in uptake of screening by age. This was a quantitative cross-sectional descriptive research design using secondary data. The secondary data included routinely collected patient level data and survey data, all of which were housed at the Swaziland Ministry of Health Strategic Information Unit. Bi-variate analysis was used to examine the relationships between the institutional factors and the uptake of cervical screening. Logistic regression was used to determine the influence of one or multiple variables on each other and the dependent variable. All data were described using frequency tables or histograms as appropriate. The potential limitations of this research included: the use of secondary data and therefore not all parameters of cervical cancer screening were interrogated and not all confounding variables could be controlled for thereby impacting

on internal validity; it was a cross-sectional study and therefore causation could not be determined; no patient perspective was collected and analyzed and this limited the depth of the research, and this study was only conducted among HIV-positive young women whose demographics may be different from HIV-negative young women thus limiting the generalizability of the results. Ethical considerations in this study included the use of de-identified data, all data were encrypted and only shared with the statistician who assisted with the statistical analysis. Approvals for data use and dissemination of results were sought from both Swaziland Ministry of Health Strategic Information Unit and the Walden University IRB and obtained prior to the start of the study.

## Section 3: Presentation of Results and Findings

### Introduction

In this quantitative retrospective study using secondary data, I sought to test the relationships between health system factors that predict the uptake of cervical cancer screening among HIV-infected AGYW aged 15 to 24 in Swaziland.

### Data Collection

Secondary data from the 2017 Swaziland SARA that included HIV care and treatment and cervical cancer services variables and routinely collected data in the HMIS were used in this study. The SARA survey is a comprehensive health facility-based assessment tool used to appraise the availability of health services based on a standard set of indicators and health facility readiness to implement services (WHO, 2016). The SARA survey data were collected between May and October 2017. Following conditional Walden University IRB approval (number 08-06-18-0665327) on August 6, 2018, I submitted a data request to the Swaziland HMIS to provide the two datasets: SARA and routinely collected patient information. I received approval from the HIMS on September 9, 2018 (SRH027/2018) and on September 12, 2018, received full approval from the Walden IRB to conduct my study. The HMIS provided deidentified data based on the data request form in two datasets—facility and training information in one dataset and patient level information in the other dataset. The HMIS did not have available data on referrals for cervical cancer screening for eligible AGYW and instead provided data on referrals for AGYW who had a positive visual inspection with acetic acid screen. Additionally, there were no data available on the outcomes of the referrals. The study population was HIV-positive AGYW 15 to 24 enrolled in HIV care and treatment. All

AGYW in the HIV care facilities that provided cervical cancer screening were included in the dataset and therefore the sample was considered representative of the population.

IBM SPSS version 25 was used for data analysis. Descriptive analysis included frequencies for categorical data and mean and median for continuous data. Correlation analysis was used to analyze relationships between variables and included Chi-Square, the Cochran Armitage test of trend, and the test of two proportions. Binomial logistic regression analysis was used to test the predictive model of all significant variables. The level of statistical significance accepted for all tests was $p = .05$. The dependent variable for this study was uptake of cervical cancer screening. The specific health systems factors evaluated included presence of trained health care providers, presence of cervical cancer screening infrastructure, provision of referrals as well as differences in uptake between age groups. These were the predictor variables in the study.

## Descriptive Statistics

### Health Facilities

There are 330 health facilities across the four regions in Swaziland. One hundred and eighty-five (56.1%) offer HIV care and/or HIV treatment services. Of these 185 facilities, 110 (59.46%) offer cervical cancer screening. Apart from the Shiselweni region (20, 18.2%), Hhohho (29, 26.4%), Manzini (32, 29.1%), and Lubombo (29, 26.4%) had similar numbers of facilities providing cervical cancer screening. Most of the facilities (66, 60%) were in rural areas. The distribution of facilities offering cervical cancer screening are in Figure 2.

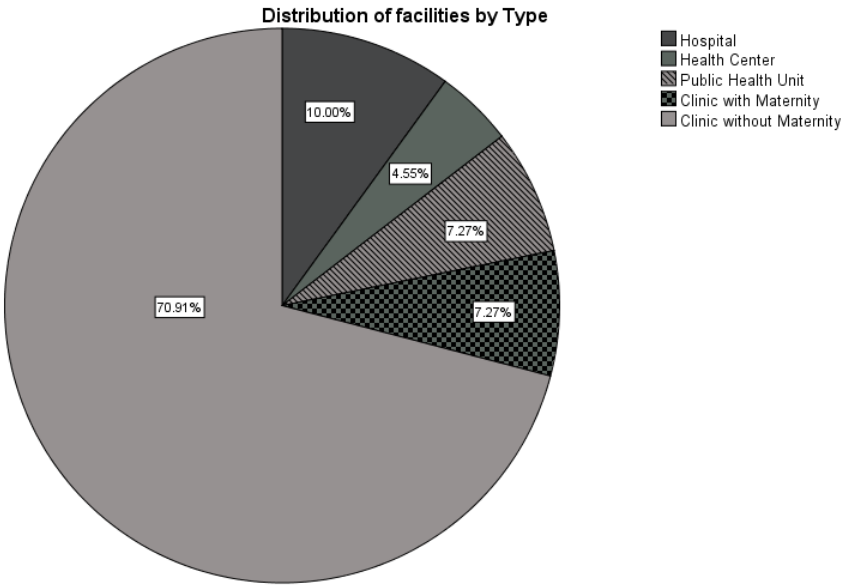


*Figure 2.* Distribution of types of facilities offering cervical cancer screening services.

The health facilities in Swaziland are classified as either government, mission/nongovernment organizations, industries, or privately owned. Government owns the most facilities (60, 54.5%) followed by mission/nongovernment organizations (25, 22.7%), private (21, 19.1%) and then industries (4, 3.6%). Table 3 provides a summary of the distribution of facilities by location, ownership, and type.

Table 3

*Distribution of Facilities that Offer Cervical Cancer Screening by Type, Ownership, and Location*

| | Facility ownership | | | | Total |
|---|---|---|---|---|---|
| | Government | Mission/NGO | Industry | Private | |
| Rural | | | | | |
| Hospital | 1 | 1 | 0 | 0 | 2 |
| Health center | 4 | 0 | 0 | 0 | 4 |
| Public health unit | 2 | 1 | 0 | 0 | 3 |
| Clinic with maternity | 5 | 3 | 0 | 0 | 8 |
| Clinic without maternity | 34 | 12 | 1 | 2 | 49 |
| Urban | | | | | |
| Hospital | 4 | 1 | 1 | 3 | 9 |
| Health center | 1 | 0 | 0 | 0 | 1 |
| Public health unit | 5 | 0 | 0 | 0 | 5 |
| Clinic without maternity | 4 | 7 | 2 | 16 | 29 |

*Note.* NGO = nongovernment organization

**Adolescent Girls and Young Women**

There were 12,329 AGYW enrolled in 118 (69.2%) of the 185 HIV care facilities by the end of March 2018. Based on the eligibility criteria, 1,711 AGYW were in care for less than 1 year and were excluded from the study. A total of 10,618 AGYW were included in the study: 9,956 AGYW were in 81 facilities that provide cervical cancer screening, and 662 AGYW were in 37 facilities that do not provide cervical cancer screening. Figure 3 shows the patient flow during the study.

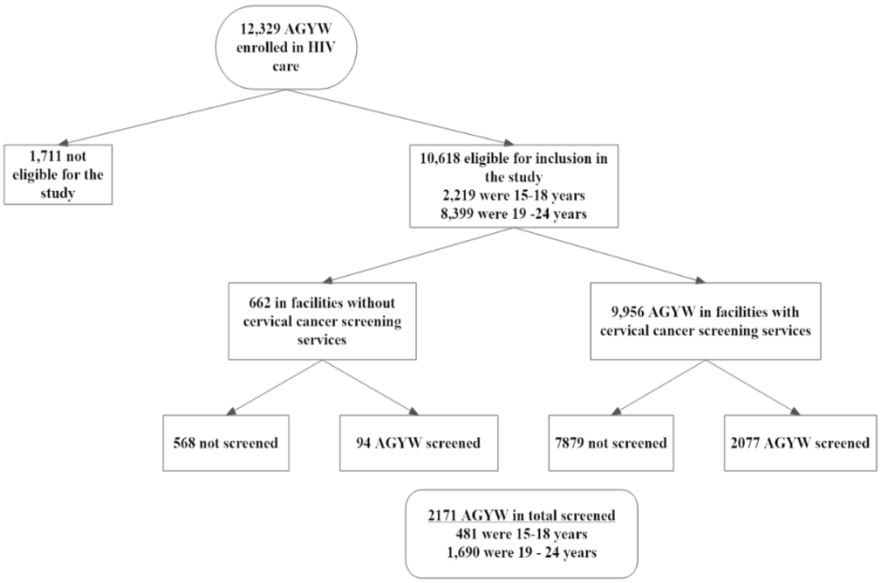


*Figure 3.* Study participant flow.

The mean age of the 10,618 AGYW was 20.96 (*SD* 2.734). Two thousand one hundred and nineteen AGYW (2,119, 20%) were between the ages of 15 to 18 years and their mean age was 16.62, whereas 8,499 AGYW (80%) were between the ages of 19 to 24 and their mean age was 22.1. Of the 10,618 AGYW, 575 (5.9%) were not on antiretroviral therapy and 10,043 (94.1%) were on antiretroviral therapy. Of those on antiretroviral therapy, the mean length of time on treatment was 3.83 years (*SD* 3.37) with a minimum of 1 year and a maximum of 17 years. The group of AGYW who were not on treatment were not assessed for length of time in care as the current data systems do not capture date of enrollment into care.

The majority of AGYW are found in the hospitals (5,749, 54.14%) followed by the clinics without maternity (2,467, 23.23%). The least numbers of AGYW were found in the clinics with maternity (262, 2.47%) and the public health units (526, 4.95%). This distribution pattern did not differ by age group. However, in the pre-antiretroviral therapy

group, there were no AGYW enrolled in care in either the public health units or in clinics with maternity services. See Table 4.

Table 4

*Distribution of Adolescent Girls and Young Women in Facilities by Age and Treatment Status*

| | Facility type | | | | | Total |
|---|---|---|---|---|---|---|
| | Hospital | Health center | Public health unit | Clinic with maternity | Clinic without maternity | |
| | | | On ART | | | |
| 15 - 18 | 1,177 | 443 | 26 | 61 | 421 | 2,128 |
| 19 - 24 | 4,126 | 1107 | 500 | 201 | 1981 | 7,924 |
| | | | Pre-ART | | | |
| 15 - 18 | 76 | 9 | 0 | 0 | 6 | 91 |
| 19 - 24 | 370 | 55 | 0 | 0 | 59 | 484 |

*Note.* ART = antiretroviral therapy

Urban facilities had more AGYW enrolled in HIV care than did rural facilities: 5,670 (53.39%) compared to 4,948 (46.61%). Table 5 summarizes the distribution of the AGYW by age group and facility location.

Table 5

*Distribution of Adolescent Girls and Young Women by Age and Facility Location*

| | | Location | | |
|---|---|---|---|---|
| | | Rural | Urban | Total |
| Age group | 15 - 18 | 1,131 | 1,088 | 2,219 |
| | 19 - 24 | 3,817 | 4,582 | 8,399 |

## Statistical Analysis

Cochran-Armitage test of trend, Chi-Square test, test of two proportions, and binomial logistic regression were used as the inferential analysis to test the relationships between the dependent and the independent variables.

### Association Between Trained Health Care Providers and Cervical Cancer Screening

Trained health care providers are one of the determinants for cervical cancer screening (Choma & Mckeever, 2015; Rosser, Hamisi, Njoroge, & Huchko, 2015). Multiple SARAs that have been conducted for cervical cancer show that the availability of trained health care providers improve the uptake of cervical cancer screening among women attending health care facilities (O'Neill, Takane, Sheffel, Abou-Zahr, & Boerma, 2013; WHO, 2016). I sought to determine whether there was a linear association between the number of trained staff available and the number of AGYW who received cervical cancer screening. The research question and hypotheses were:

Research Question 1: What is the relationship between the availability of trained health providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$1: There is no relationship between the availability of trained health care providers and the rate of uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

$H_a$1: There is a relationship between the availability of trained health care providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women.

The mean number of staff available for cervical cancer screening per facility was 3.19 (*SD* 4.21, 0-22). Most of the facilities (70, 63.6%) had one to two staff available to conduct cervical cancer screening, whereas five facilities that offer cervical cancer screening had no staff available. The hospitals reported the highest number of staff (11+ staff) available for cervical cancer screening followed by the public health units (six to 10 staff). See Table 6.

Table 6

*Number of Trained Staff to Conduct Cervical Cancer Screening by Facility Type*

| | Staff available | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 - 2 | 3 - 5 | 6 - 10 | 11+ | Total |
| Hospital | 0 | 2 | 2 | 1 | 6 | 11 |
| Health center | 0 | 1 | 3 | 1 | 0 | 5 |
| Public health unit | 0 | 2 | 1 | 5 | 0 | 8 |
| Clinic with maternity | 0 | 8 | 0 | 0 | 0 | 8 |
| Clinic without maternity | 5 | 57 | 12 | 4 | 0 | 78 |
| Total | 5 | 70 | 18 | 11 | 6 | 110 |

The majority of the facilities (97, 88.2%) offering cervical cancer screening had staff who have been trained on cervical cancer screening in the last 2 years; 57 (58.8%), are in rural localities, and 40 (41.2%) are in urban localities. All hospitals (11) and health centers (five) had staff who have been trained in last 2 years, whereas 87.5% of the staff in public health units (seven out of eight) and clinics with maternity (seven out of eight) and 85.9% of staff in clinics without maternity (67 out of 78) had received training in the last 2 years.

The Cochran-Armitage test of trend was used to determine whether there was a linear association between number of trained staff and uptake of cervical cancer screening because the number of trained staff was an ordinal independent variable and

the uptake of cervical cancer screening was a dichotomous dependent variable (see Bianchi et al., 2012; Wellek & Ziegler, 2012). The grouping of trained staff was considered ordinal as the grouping was zero staff, one to two staff, three to five staff, six to 10 staff and 11 or more staff. The assumptions to conduct the Cochran-Armitage test of trend included the presence of an ordinal independent variable, the dependent variable must be dichotomous, and that there ia a linear relationship/association between the two variables but not whether the trend is linear. The limitation of this test is that it does not test for curvilinear components. These assumptions were met by the study.

The proportion of AGYW who received cervical cancer screening was per grouping of staff available in the facilities were one to two staff (0.176), three to five staff (0.172), six to 10 staff (0.358), and 11 or more staff (0.216). See Table 7.

Table 7

*Adolescent Girls and Young Women Who Received Screening and Number of Trained Staff Available*

| | | Trained staff | | | |
|---|---|---|---|---|---|
| | Screened | 1 - 2 | 3 - 5 | 6 - 10 | 11+ |
| Yes | N | 353 | 548 | 373 | 803 |
| | % AGYW screened within Trained staff | 17.60% | 17.20% | 35.80% | 21.60% |
| No | N | 1655 | 2540 | 669 | 2915 |
| | % AGYW not screened within Trained staff | 82.40% | 82.80% | 64.20% | 78.40% |
| | Total | 2008 | 3188 | 1042 | 3718 |
| | % AGYW per trained staff grouping | 20.17% | 32% | 10.47% | 37.34% |

The Cochran-Armitage test of trend showed a statistically significant linear trend between number of trained staff and the uptake of cervical cancer screening score = 30.307, df (1), $p = .000$. The Cochran-Armitage test of trend was statistically significant ($p < .05$). Therefore, the null hypothesis was rejected in favor of the alternative hypothesis.

**Availability of Cervical Cancer Screening Services**

The WHO has defined a set of characteristics that determine the availability of cancer screening services in health facilities (WHO, 2013a). In Swaziland, the service characteristics criteria are based on the ability to conduct visual inspection with acetic acid for eligible women younger than 40 years and ability to conduct a PAP smear in women older than 40 years (Kessler, 2017; WHO, 2013b). The characteristics for visual inspection with acetic acid provision are presence of speculums, acetic acid, laboratory whether onsite or offsite, system for results retrieval and delivery to client, availability of guidelines, information and educational material, and advertisement of facilities (WHO, 2013a). These characteristics were assessed during the SARA survey conducted in 2017. The research question and hypotheses were:

Research Question 2: What is the relationship between the availability of cervical cancer screening services in a facility and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$2: There is no relationship between the availability of cancer screening services within a facility and the uptake of cervical cancer screening.

$H_a$2: There is a relationship between the availability of cervical cancer screening services within a facility and the uptake of cervical cancer screening.

There were 10,618 AGYW eligible for cervical cancer screening: 9,956 (93.8%) AGYW were in 81 facilities that provided cervical cancer screening and 662 (6.2%) AGYW were in 37 facilities that did not provide cervical cancer screening. A total of 2171 (20.45%) AGYW were screened: 2,077 (95.67%) AGYW were in facilities that provided cervical cancer screening and 94 (4.33%) AGYW were in facilities that did not provide cervical cancer screening. See Table 8.

Table 8

*Availability of Screening Services and Cervical Cancer Screening Uptake*

| Facility has cervical cancer screening services | | Screened | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| Yes | N | 2077 | 7879 | 9956 |
| | % within Cervical cancer screening services | 20.9% | 79.1% | 100.0% |
| No | N | 94 | 568 | 662 |
| | % within Cervical cancer screening services | 14.2% | 85.8% | 100.0% |
| Total | N | 2171 | 8447 | 10618 |
| | % of Total | 20.4% | 79.6% | 100.0% |

A Chi square test of association was carried out to test for the relationship between two nominal/dichotomous variables: availability of cervical cancer screening services and uptake of cervical cancer screening (Schumacker & Tomek, 2013). My data met the three assumptions required to conduct a Chi square test of association: there are two variables, both of which were categorical, there was independence of observations and all cells met the expected counts of more than five (Lund Research Ltd, 2013). The Chi square only informs whether the null hypothesis of no association can be rejected and not the magnitude of any association. To assess the magnitude of any association detected, Phi (φ) was used (Harmatz & Greenblatt, 2015; Janzing, Balduzzi, Grosse-

Wentrup, & Schölkopf, 2013). Phi (φ) is a measure of the strength of association of a nominal by nominal relationship when the variables are dichotomous. Its range is from negative one to positive one (-1 to +1).

There was a statistically significant association between availability of cervical cancer screening services and uptake of cervical cancer screening, $\chi^2(1) = 16.939$, $p = 0.00$. There was a positive but weak association between availability of cervical cancer screening services and uptake of cervical cancer screening, $\varphi = 0.04$, $p = 0.00$. Therefore, we can reject the null hypothesis in favor of the alternative hypothesis.

**Additional analysis of facilities that provide cervical cancer screening.** Of the 110 facilities offering cervical cancer screening, 89.1% had speculums available, 66.4% had acetic acid, 1.8% had a laboratory onsite to examine samples, 64.5% had guidelines available, 52.7% had informational and educational material available and 32.7% advertised cervical cancer screening.

A binomial logistic regression was conducted to determine whether any of these characteristics could predict uptake of cervical cancer screening. A binomial logistic regression is used to determine whether or not there is a relationship between a dichotomous dependent variable and two or more independent variables that may be categorical or continuous at the same time assessing for the potential influence of other explanatory variables on that relationship (Laerd Statistics, 2013; Sperandei, 2014). Therefore, binomial logistic regression can be used for a) controlling for other explanatory variables when assessing relationships between a dependent dichotomous variable and multiple independent variables b) predicting the probability of an event happening for an individual (Laerd Statistics, 2013). The main advantage of conducting a

binomial logistic regression is to avoid confounding effects by analyzing the association of all variables together. Several assumptions must be met to conduct the binomial logistic regression: there is one dependent variable that is dichotomous, there are one or more independent variables that are measured either on a continuous or nominal scale, there is independence of observations and the categories of the dependent and independent variables are mutually exclusive, the minimum number of cases per variable is 15, there should be a linear relationship between the continuous independent variables and the logit transformation of the dependent variable; there should be no multicollinearity; and there should be no significant outliers (Sperandei, 2014). My data set fulfilled all the assumptions.

A binomial logistic regression was performed to ascertain the effects of the presence of equipment, diagnostics, laboratory, results return mechanism, guidelines, information and educational material and advertisement of services at the facilities on the likelihood that participants would undergo cervical cancer screening. In this model there were no continuous variables and no outliers. The logistic regression model was not statistically significant, $\chi^2(7) = 8.761$, $p = .270$. The Hosmer and Lemeshow test that tests for goodness of fit in a regression model was not statistically significant ($p = .764$), indicating that the model is not a poor fit. The Hosmer and Lemeshow test is a formal test of the null hypothesis that the fitted model is correct, and its output is a *p*-value- a number between 0 and 1 with higher values indicating a better fit. The model explained only 0.10% (Nagelkerke $R^2$) of the variance in cervical cancer screening and correctly classified 82.1% of the cases. None of the seven predictor variables were statistically significant as shown in Table 9.

Table 9

*Likelihood for Screening Based on Availability of Cervical Cancer Screening Infrastructure*

| | | | | | | | 95% C.I. for Odds Ratio | |
|---|---|---|---|---|---|---|---|---|
| | B | S.E. | Wald | df | *p* | Odds Ratio | Lower | Upper |
| Availability of speculums | .106 | .162 | .428 | 1 | .513 | 1.111 | .810 | 1.526 |
| Availability of acetic acid | -.067 | .107 | .386 | 1 | .534 | .935 | .758 | 1.154 |
| Laboratory to examine samples | -.048 | .107 | .198 | 1 | .656 | .954 | .773 | 1.176 |
| Presence of a mechanism to return results to clients | -.244 | .166 | 2.150 | 1 | .143 | .784 | .566 | 1.085 |
| Facility has Cervical cancer screening guidelines | -.051 | .118 | .187 | 1 | .665 | .950 | .754 | 1.198 |
| Facility has in-service communication materials on cervical cancer | .059 | .090 | .438 | 1 | .508 | 1.061 | .890 | 1.265 |
| Advertisement of cervical cancer screening services | -.150 | .084 | 3.221 | 1 | .073 | .860 | .730 | 1.014 |
| Constant | -1.026 | .367 | 7.815 | 1 | .005 | .358 | | |

**Association Between the Frequency of Services Offered and Uptake of Cervical Cancer Screening**

Service availability affects accessibility to the services. Service availability is characterized by the type of service delivery (fixed, mobile, outreach), frequency of service delivery (daily, weekly, monthly) and times of service delivery (8:00 – 5:00, 24 hours; WHO, 2015).

Almost 96% (105, 95.5%) of facilities reported offering cervical cancer screening on a daily basis, 3.6% (four) of facilities reported offering services twice a week and only 0.9% (one) reported offering services thrice a week. A Chi square test of association was

carried out to test for the association between two nominal/dichotomous variables: frequency of services offered and uptake of cervical cancer screening (Schumacker & Tomek, 2013). My data met the three assumptions required to conduct a Chi square test of association: there are two variables, all of which were categorical, there was independence of observations and all cells met the expected counts of more than five (Lund Research Ltd, 2013). The Chi square only informs whether the null hypothesis of no association can be rejected and not the magnitude of any association. To assess the magnitude of any association detected, Phi (φ) was used (Harmatz & Greenblatt, 2015; Janzing et al., 2013). Phi (φ) is a measure of the strength of association of a nominal by nominal relationship when the variables are dichotomous. Its range is from -1 to +1. A chi-square test for association was conducted between frequency of services offered and uptake of cervical cancer screening. All expected cell frequencies were greater than five. There was no statistically significant association between frequency of services offered and uptake of cervical cancer screening, $\chi^2(2) = 0.568$, $p = 0.753$. There was a very weak association between frequency of services offered and uptake of cervical cancer screening, $\varphi = 0.008$, $p = 0.753$ and therefore we cannot reject the null hypothesis in favor of the alternate hypothesis.

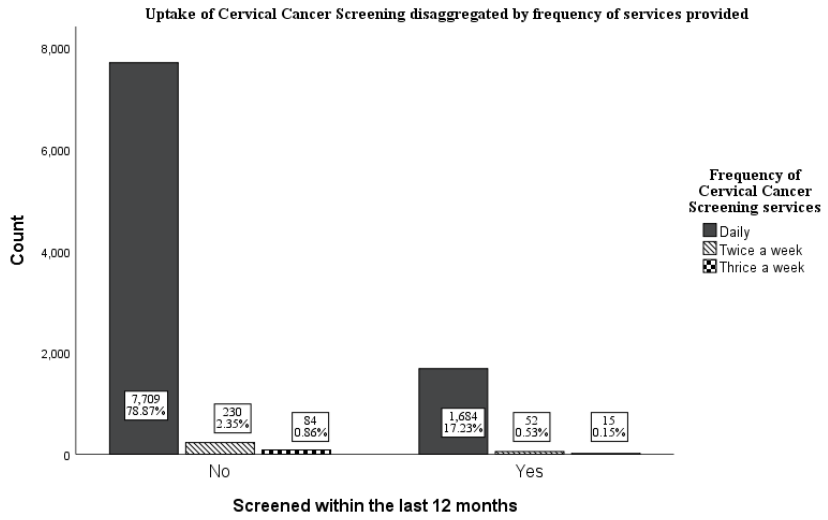


*Figure 4.* Uptake of cervical cancer screening by frequency of screening services.

**Proportion of screened adolescent girls and young women who receive their results within one month.** On average, 40.74% (SD +/- 12.88%, range: 62%) of AGYW who have received cervical cancer screening and require further laboratory testing will receive their results within four weeks. Those in the urban areas are more likely to receive their results within four weeks than those in the rural areas, 46% vs 31.59%. There was no difference in proportion of clients who received results between facilities whose staff had been trained in the last two years and those who had not been trained: 37.32% versus 37.77%.

**Core Characteristics for Cervical Cancer Screening and its Uptake**

Twenty-three (20.9%) facilities had all the core service characteristics that classify the facility to have cervical cancer services, 87 facilities had some of the characteristics and 75 facilities did not have any cervical cancer screening services. Of the 23 facilities with all the core service characteristics, six (26.1%) are hospitals, eleven

(47.8%) are clinics without maternity, two (8.7%) are public health units, two (8.7%) are clinics with maternity and one (4.34%) is a health center. See Table 10.

Table 10

*Summary of Facilities and Core Service Characteristics for Cervical Cancer Screening*

| Facility offers cervical screening | Facility Type | Frequency (N) | Percent |
|---|---|---|---|
| No, Does not have any core service characteristics | Clinic with Maternity | 4 | 5% |
| | Clinic without Maternity | 69 | 92% |
| | Hospital | 2 | 3% |
| Yes, has some core service characteristics | Clinic with Maternity | 6 | 7% |
| | Clinic without Maternity | 67 | 77% |
| | Health Center | 3 | 3% |
| | Hospital | 5 | 6% |
| | Public Health Unit | 6 | 7% |
| Yes, has all the core service characteristics | Clinic with Maternity | 2 | 9% |
| | Clinic without Maternity | 11 | 48% |
| | Health Center | 2 | 9% |
| | Hospital | 6 | 26% |
| | Public Health Unit | 2 | 9% |

Within the 23 facilities with all the core service characteristics, there were 6,434 AGYW of whom 1197 received cervical cancer screening. In the 87 facilities that had some of the core service characteristics, there were 3,522 AGYW of whom 880 received cervical cancer screening and in the 75 facilities without any core service characteristic, there were 662 AGYW of whom 94 received cervical cancer screening. See Table 11.

Table 11

*Uptake of Cervical Cancer Screening by Availability of Core Service Characteristics*

| | | Screening uptake | | Total |
|---|---|---|---|---|
| | | Yes | No | |
| All core service characteristics | N | 1197 | 5237 | 6434 |
| | % within screening uptake | 55.1% | 62.0% | 60.6% |
| Some core service characteristics | N | 880 | 2642 | 3522 |
| | % within screening uptake | 40.5% | 31.3% | 33.2% |
| No core service characteristics | N | 94 | 568 | 662 |
| | % within screening uptake | 4.3% | 6.7% | 6.2% |
| Total | N | 2171 | 8447 | 10618 |
| | % within screening uptake | 100.0% | 100.0% | 100.0% |

A Cochran-Armitage test of trend was run to determine whether a linear trend exists between the availability of core service characteristics and the proportion of AGYW who received cervical cancer screening. The availability of core service characteristics was classified as having all core service characteristics ($n$ = 6434), having some core service characteristics ($n$ = 3522) and having no core service characteristics ($n$ = 662), and the proportion of AGYW who received a cervical cancer screening was 0.551, 0.405 and 0.043, respectively. The Cochran-Armitage test of trend showed a statistically significant linear trend, $p$ = .002, with facilities having all core service characteristics associated with a higher proportion of AGYW who received a cervical cancer screening.

**The association between referrals and the uptake of cervical cancer screening.** The uptake of health services can be enhanced by the provision of referrals to

clients actively by health care providers (Denno, Hoopes, & Chandra-Mouli, 2015). This is especially noted when those services are not available in the local health facility (Shannon, Vinson, Cook, & Lennon, 2016). The research question and hypothesis were:

Research Question 3: What is the relationship between the provision of a referral for cervical cancer screening among eligible women and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

$H_0$3: There is no relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

$H_a$3: There is a relationship between the provision of a referral for cervical cancer screening in eligible women and the uptake of cervical cancer screening.

The data provided by HMIS did not have data on referrals for screening but rather referrals for further management of a positive visual inspection with acetic acid test. The data were also missing the outcomes of the referrals. The analysis, therefore tested for an association between the age of the AGYW and the provision of a referral for further management. HIV adolescent girls and young women who have a positive screen need to receive further testing and treatment as a matter of urgency as they are more likely to develop cervical lesions that may rapidly progress to neoplasia (Peto, 2014; Salakos, Paltoglou, & Top, 2014; Singh, Chilton, & Prime, 2012). However, more young women than adolescent girls are more likely to be referred for further testing and treatment because of provider bias, accessibility to services and demand side barriers (Bardají et al., 2018; Finocchario-Kessler et al., 2016; Ghebre, Grover, Xu, Chuang, & Simonds, 2017; Kasting et al., 2016).

Of the 220 AGYW whose cervical cancer screening test was positive (49 were in age group 15 – 18 and 171 were in 19 - 24 age group), only 56 (25.5%) were provided with a referral for further evaluation. Twelve (21.43%) were in the age group 15 – 18 years and 44 (78.57%) were in the age group 19 – 24 years. By age group, there was little difference between the proportion of those who were15 -18 years old and 19 -24 years old who received referrals: 24.5 % compared to 25.7% respectively. Hospitals provided most of the referrals (46.43%) followed by clinics without maternity (33.93%). Table 12 summarizes the distribution of the AGYW who received a referral by age group, and Table 13 summarizes the distribution of the AGYW who received a referral by facility type.

Table 122

*Referrals to Adolescent Girls and Young Women with Positive Cervical Cancer Screening by Age*

| | | Provision of referrals | | |
|---|---|---|---|---|
| Age Group | | Yes | No | Total |
| 15 - 18 years | N | 12 | 37 | 49 |
| | % within Provision of referrals | 21.40% | 22.60% | 22.30% |

| | | | | |
|---|---|---|---|---|
| | % of Total | 5.50% | 16.80% | 22.30% |
| 19 - 24 years | N | 44 | 127 | 171 |
| | % within Provision of referrals | 78.60% | 77.40% | 77.70% |
| | % of Total | 20.00% | 57.70% | 77.70% |
| All AGYW | N | 56 | 164 | 220 |
| | % of Total | 25.50% | 74.50% | 100.00% |

Table 13

*Referrals to Adolescent Girls and Young Women by Age Group and Facility Type*

| | | Facility Type | | | | | |
|---|---|---|---|---|---|---|---|
| Age Group | Provision of referral | Hospital | Health Center | Public Health Unit | Clinic with Maternity | Clinic without Maternity | Total |
| 15 to 18 years | Yes | 5 | 3 | 0 | 1 | 3 | 12 |
| | No | 20 | 8 | 1 | 2 | 6 | 37 |
| 19 to 24 years | Yes | 21 | 6 | 0 | 1 | 16 | 44 |
| | No | 64 | 21 | 9 | 2 | 31 | 127 |
| Total | Yes | 26 | 9 | 0 | 2 | 19 | 56 |
| | No | 84 | 29 | 10 | 4 | 37 | 164 |
| | Total | 109 | 38 | 10 | 6 | 57 | 220 |

A chi-square test for association was conducted to test the association between age group of the AGYW and the provision of a referral. All expected cell frequencies were greater than five. There was no statistically significant association between age group of the AGYW and provision of a referral, $\chi^2(1) = 0.031$, $p = 0.860$. The association between age group and provision of a referral was weak as well, $\varphi = -0.012$, $p = 0.860$. Therefore, we cannot reject the null hypothesis in favor of the alternative hypothesis.

**Difference in Uptake of Cervical Cancer Screening by Age**

Age is a determinant of cervical cancer screening both from a systems perspective and an individual perspective (Massad et al., 2013; Morema, Atieli, Onyango, Omondi, & Ouma, 2014; Salvatore Vaccarella, Lortet-Tieulent, Plummer, Franceschi, & Bray, 2013). Teenagers are less likely to access sexual and reproductive health services due to fear of discrimination and prejudice by the health facility staff and a fear of being rebuked by their parents whereas young women tend to be marginalized due to socioeconomic and cultural influences (Chapman Lambert, 2013; Morema et al., 2014; Waller, Jackowska, Marlow, & Wardle, 2012). HIV infected AGYW enrolled in care present a unique opportunity to offer cervical cancer screening routinely for eligible AGYW (Morema et al., 2014; Waller et al., 2012). Based on the recent Cervical Cancer Screening guidelines, all HIV infected girls and women (if infection was not obtained perinatally) should be screened at diagnosis of HIV and thereafter annually regardless of their treatment status (Isidean, Louvanto, & Franco, 2014; WHO, 2013b). In this study, I sought to determine whether there was a difference in uptake of cervical cancer screening between adolescent girls and young women. The research question and hypotheses were:

Research Question 4: Is there a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women?

$H_0$4: There is no difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

$H_a$4: There is a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women.

Of the 10,618 AGYW who were eligible for cervical cancer screening, 2219 were in the age group 15 - 18 years and 8399 were in the 19 -24-year age group. Only 2171 (20.44%) had received cervical cancer screening in the last 12 months. Of the 2171 AGYW who were screened, 471 were in the age group 15 to 18 years and on antiretroviral therapy, 1610 were in the age group 19 to 24 years and on antiretroviral therapy while 10 in the age group 15 to 18 years and 90 in the age group 19 to 24 years were in pre-antiretroviral therapy care. Figure 5 illustrates the distribution of the AGYW by age group and treatment status while Table 12 provides a summary of the crosstabulation between Age group of the AGYW by cervical cancer screening status.

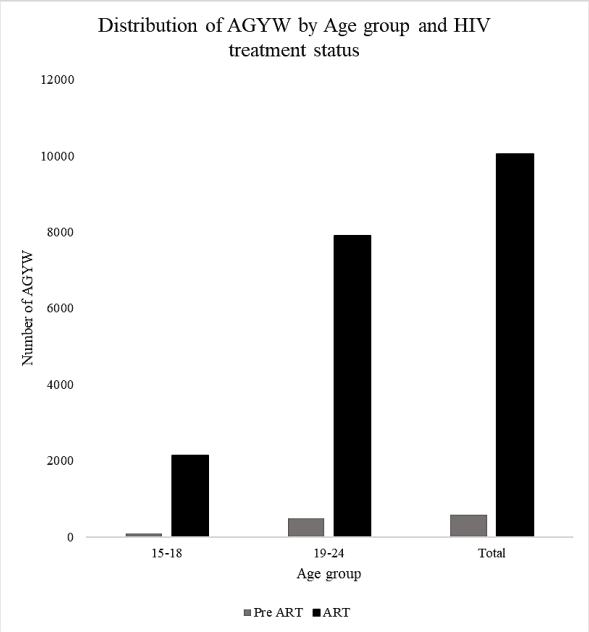


*Figure 5.* Distribution of adolescent girls and young women by age group and treatment status.

Table 14

*Age Group by Screening Status*

| Age Group | | Screening | | Total |
|---|---|---|---|---|
| | | Yes | No | |
| 15-18 | N | 481 | 1,738 | 2,219 |
| | % within Age Group | 21.7% | 78.3% | 100.0% |
| 19-24 | N | 1690 | 6709 | 8399 |
| | % within Age Group | 20.1% | 79.9% | 100.0% |
| Total | N | 2171 | 8447 | 10618 |
| | % of Total | 20.4% | 79.6% | 100.0% |

The test of two proportions also known as the Chi-square test for homogeneity was used to determine the difference in uptake of cervical cancer screening between adolescent girls and young women. The test of two proportions can be used to assess if a difference exists between the proportions of two independent groups on a dichotomous dependent variable. Four assumptions need to be met to use this statistical test: both independent and dependent variables are dichotomous, the observations are independent of each other, the sample size should be more than 5 observations and retrospective purposively sampled two groups each having a specific characteristic. My dataset met all these assumptions and the test of two proportions was conducted. Ten thousand, six hundred and eighteen (10,618) AGYW were grouped according to whether they were adolescent girls (15 – 18 years) or young women (19 -24 years), 2,219 in the 15 – 18 year age group and 8,399 in the 19 – 24 year age group. Four hundred and eighty one in the 15 – 18 year age group (21.67%) received cervical cancer screening compared to 1,690 (20.12%) in the 19 – 24 year age group, a non-statistically significant difference in proportions of 1.56, $p$= 0.106. The difference between the two independent binomial

proportions was not statistically significant ($p > .05$). Therefore, we fail to reject the null hypothesis and cannot accept the alternative hypothesis.

## Summary of Results

Using secondary data that had been de-identified and provided by the HMIS unit at the Ministry of Health in Swaziland (formerly Swaziland), I studied the determinants of cervical cancer screening among HIV positive AG and YW enrolled in HIV care and treatment using three of the original four research questions:

Research Question 1: What is the relationship between the availability of trained health providers and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

Research Question 2: What is the relationship between the availability of cervical cancer screening services in a facility and the uptake of cervical cancer screening among HIV-positive adolescent girls and young women in Swaziland?

Research Question 4: Is there a difference in uptake of cervical cancer screening between HIV-positive adolescent girls and HIV-positive young women?

For RQ 3 that was examining the relationship between the provision of a referral for screening and the uptake of cervical cancer screening among HIV-positive AGYW in Swaziland, the data provided by HMIS consisted of referrals provided to HIV-positive AGYW who had received a cervical cancer screening and the screen was positive. Therefore, I analyzed the relationship between the provision of referral for further management and age group of the HIV-positive AGYW.

Most facilities (70%) had 1-2 trained staff available for cervical cancer screening but the most screening (35%) occurred in facilities where there were 6-10 trained staff

available for cervical cancer screening. A Cochran- Armitage test of trend was conducted to determine the presence of any linear association between number of trained staff and the uptake cervical cancer screening by age group. There was a statistically significant difference in the uptake of cervical cancer screening based on number of trained staff available ($p$= 0.00) and therefore I rejected the null hypothesis in favor of the alternate hypothesis.

To determine the uptake of cervical cancer screening based on availability of cervical cancer screening services, I compared the AGYW who received screening in facilities with cervical cancer screening services and those who received screening in facilities without the cervical cancer screening services. There was a statistically significant but weak association between availability of cervical cancer screening services and uptake of cervical cancer screening ($\chi^2(1) = 16.939$, $p = 0.00$, $\varphi = 0.008$), therefore I rejected the null hypothesis in favor of the alternate hypothesis. Using the Cochran-Armitage test of trend, I also assessed the uptake of cervical cancer screening in those facilities that had all the characteristics, those that had some of the characteristics, and those that had none. AGYW who were in facilities that had all the component infrastructure were more likely to receive cervical cancer screening than those in facilities who did not have all the components ($p = 0.002$) and therefore I rejected the null hypothesis in favor of the alternate hypothesis

I used a Chi square test of association and Phi φ to describe the association between frequency of service availability and uptake of cervical cancer screening. There was no statistically significant association between the frequency of services offered and

the uptake of cervical cancer screening ($p$=0.753) and therefore I accepted the null hypothesis.

The test of two proportions was conducted to determine if there was any difference in uptake of cervical cancer screening in the adolescent girls compared to uptake among the young women. The proportions by age group of AGYW who received cervical cancer screening were similar: 21.67% among adolescent girls compared to 20.12% among young women, a nonstatistically significant difference in proportions of 1.56, $p$ = 0.106. The difference between the two independent binomial proportions was not statistically significant ($p$ > .05) and therefore, I failed to reject the null hypothesis.

The data to test the association between cervical cancer screening and referral for screening were not available and the HMIS instead provided data on referral for further management for a positive visual inspection with acetic acid screen. This information was analyzed for which age group was more likely to receive a referral for further management for a positive visual inspection with acetic acid screen. Although more young women (44,78.6%) received a referral, the difference in proportions by age group was small: 24.5% among AG compared to 25.7% among young women and was not statistically significant ($\varphi$ = -0.012, $p$=0.861) and therefore I failed to reject the null hypothesis. In the next section, I will discuss the interpretations of the results in context with the literature review, the limitations of the study, recommendations for future research, implications for social change, as well as an overall conclusion of the study.

Section 4: Application to Professional Practice and Implications for Social Change

## Introduction

The global burden of cervical cancer, a genital tract cancer caused by infection with HPV (Bruni et al., 2016), is mainly in the lower- and middle-income countries where 86% of cases occur (Bruni et al., 2016). Cervical cancer is an AIDS-defining illness (Chan et al., 2003), and the global distributions of HIV and cervical cancer have little variation, with the highest rates found in sub-Saharan Africa. In Swaziland, cervical cancer is the most common cause of cancer-related death among women (Swaziland Ministry of Health, 2015c).

Women who are infected with HIV are at increased risk of dying from cervical cancer (Ghebre, Grover, Xu, Chuang, & Simonds, 2017). They are more likely to have persistent infections with high-risk HPV types and to have rapidly progressive precancerous lesions (Ginindza, Sartorius, & Za, 2018). Due to this amplified risk, cervical cancer screening guidelines for HIV-infected and non-HIV-infected women differ (Kessler, 2017; McGraw & Ferrante, 2014). The screening guidelines for adults and adolescents also differ. Due to the high rate of spontaneous clearance of HPV infections and the risks associated with over-screening among adolescents, it is recommended that screening does not begin until the age of 21 except if an adolescent girl or young woman is HIV infected (American College of Obstetritians and Gynecologists, 2016). HIV-infected adolescents are a high-risk population, so cervical cancer screening is recommended twice in the first year they are diagnosed if they are sexually active and annually thereafter. However, there are multiple health system factors that affect cervical cancer prevention: the availability of an organized screening program,

the existence and quality of the facilities for screening and diagnostic follow-up, and the facilities available for treating diagnosed lesions (Dollin, 2013; Finocchario-Kessler et al., 2016). But according to the Swaziland SARA 2017 report, the coverage for cervical cancer screening in Swaziland is 33% for all women.

The purpose of this study was to examine the relationship between the WHO recommended service delivery components for cervical cancer screening (WHO, 2014a) and the uptake of cervical cancer screening among HIV-positive AGYW in Swaziland. I conducted a retrospective analytical study using secondary data from the SARA survey conducted in 2017 and routine clinical data that was provided by the Swaziland HMIS Unit. The data analysis included univariate, bivariate and multivariable analyses that demonstrated that the presence of trained staff and the presence of all components of a screening program (equipment, diagnostics, guidelines, in-service communication materials, laboratory and advertisement of services) had a statistically positive significant association with the uptake of cervical cancer screening by HIV-positive AGYW. The findings showed that AGYW enrolled in HIV care with facilities with a larger complement of staff trained on cervical cancer screening ($p = 0.00$) and facilities that had all components required for cervical cancer screening ($p = 0.024$) were more likely to receive cervical cancer screening regardless of their age group. There was no difference in uptake of cervical cancer screening ($p = 0.104$) or referral for further care ($p = 1.0$) by age group.

## Interpretation of the Findings

### Study Findings and Past Research

**Presence of trained staff to provide cervical cancer screening and uptake of cervical cancer screening by HIV positive adolescent girls and young women.** The results showed that HIV positive AGYW accessing care in facilities with larger numbers of staff trained on cervical cancer screening were more likely to receive cervical cancer screening ($p = 0.00$). Despite 95% of the facilities having trained staff available to offer cervical cancer screening, 64% of them had only one to two staff available, and the number of AGYW who received cervical cancer screening in these facilities was low in comparison to facilities that had three or more trained staff available. These findings are similar to other research findings. For example, Rosser et al (2015) reported that a lack of trained staff affects uptake of cervical cancer screening and recommended education for both providers and patients to improve uptake. O'Neill et al. (2013) also reviewed SARAs from six countries, suggesting that workforce availability and competence affected the provision and uptake of services. Although there may be inadequate infrastructure, a trained workforce is able to generate and meet demand for the service thereby increasing uptake and coverage of cervical cancer screening (Coleman et al., 2016; Kim & Han, 2016). In Swaziland, where the rate of screening for all women is low at 33%, trained and adequate number of staff can contribute to the uptake and coverage of cervical cancer screening services. My findings demonstrated that it is not enough to have trained staff in a facility, but they must also be in adequate numbers (three or more) if the uptake for cervical cancer screening is to increase

**Availability of cervical cancer screening services.** I examined the association between the availability of cervical cancer screening services at facility level and AGYW's uptake of cervical cancer screening. In a bivariate analysis, HIV-positive AGYW enrolled in care in facilities that had all the recommended components for a cervical cancer screening service were more likely to receive cervical cancer screening as compared to facilities with some of the components or those without any of the components ($p = 0.02$). Descriptive and logistic regression statistics for each component of the cervical cancer screening system further illustrated that no single component on its own had a statistically significant likelihood to improve cervical cancer screening uptake among the AGYW.

These findings are similar to Parham et al. (2015), who attempted to scale up cervical cancer screening in a populous town in Zambia using low cost and low technology methods for screening and treating positive screens during a single visit. But scaling up cervical cancer screening is not feasible if all components of the screening service and skilled human resources are not available (Parham et al., 2015). Parham et al. found that facilities that did not have guidelines or equipment or a laboratory onsite were less likely to offer the same day service than those that had all components of the screening service.

Another study related to the current study's findings was conducted by Maseko et al. (2015c), who identified barriers to cervical cancer screening in Malawi, a country in sub-Saharan Africa with one of the highest age-standardized incidence rates of cervical cancer. Maseko et al. found that there was a lack of policies, lack of trained human resources and lack of equipment and diagnostics to conduct the screening, that limited

cervical cancer screening services for eligible women. The barriers to the uptake of cervical cancer screening can be categorized as individual, community, and health system. Therefore, to improve the uptake of cervical cancer screening in any country, all three of these categories need to be addressed simultaneously to generate demand, address stigma, and improve supply for cervical cancer screening (Maseko et al., 2015b). I also found that the uptake of cervical cancer screening was higher in the presence of all components of service delivery (guidelines, equipment, diagnostics, laboratory services and a results return mechanism, in-service communication and advertisement of the services) than when some of the components were missing or there was no service at all that is supported by previous findings and reaffirms the need for the Ministry of Health to ensure that all service components are available at each level of the health system (clinics, health centers, and hospitals).

**Provision of referrals for further management of a positive screening test.** The timely and appropriate referral for further management of a positive screening test improves the outcomes of cervical cancer, especially in HIV-infected adolescent girls. High rates of cervical lesions in adolescent girls are due to high rates of HPV infection (Foxx et al., 2017; Kerrebroeck & Makar, 2016). However, these lesions clear away spontaneously in 90% of the population who are not HIV infected (Foxx et al., 2017). In HIV-infected adolescent girls, many of these lesions do not clear away and rapidly progress into precancerous and cancerous lesions, making referral for further management vital for early diagnosis, prevention, and treatment of cervical cancer in this age group (Ghebre et al., 2017). There was a non-statistically significant difference in

proportions of adolescent girls who were referred for further care (24.5%) compared to the proportion of young women who were referred for further care (25.7%), $p = 0.860$.

These findings are comparable to studies in Malawi, a country with high HIV prevalence and incidence among AGYW and the highest age standardized incident rates of cervical cancer in the world. Based on findings from the Malawi Population-Based HIV Impact Assessment 2015-2016, HIV-infected adolescent girls enrolled in HIV care were less likely to receive cervical cancer screening and referrals for further management compared to older age groups (Jonnalagadda et al., 2018), and younger women with positive cervical cancer screens were less likely to receive follow up for further treatment (Msyamboza, Phiri, Sichali, Kwenda, & Kachale, 2016a). This is because younger age groups were less likely to complete follow up or have the resources to go to a treatment facility and service providers did not prioritize younger age groups for referrals. Swaziland is similar to Malawi in that HIV-positive adolescent girls with a positive cervical cancer screen are not referred any differently than HIV-positive young women, a situation that needs to be addressed. Because of the lack of follow up in this population, it would be important to either offer same day treatment on site or have a mechanism to follow up these adolescent girls to ensure that they receive the appropriate treatment.

**Difference in cervical cancer screening uptake by age group.** Older women are more likely to receive cervical cancer screening due to less discrimination around sexuality and generally sexual reproductive health services are more user friendly for them than for adolescent girls (Boardman & Robison, 2013; Ghebre et al., 2017). I compared two age-groups: adolescent girls (15–18) and young women (19–24). Findings of a bivariate analysis showed that there was no statistically significant difference in

proportions of adolescent girls who received cervical cancer screening (21.7%) and the proportion of young women who received cervical cancer screening (20%), $p = 0.106$.

These findings from this study do not align with findings from previous studies. In South Africa, where HIV and cervical cancer incidence and prevalence is similar to Swaziland, HIV-infected adolescents were less likely to receive cervical cancer screening than HIV-infected young women because health care providers are not knowledgeable on risk of cervical cancer among adolescents and adolescent-friendly health services are not common despite adolescent girls being a high risk population (Hoque, Ghuman, Coopoosmay, Van Hal, 2014; Hoque, Ghuman, & Van Hal, 2013; Hoque Monokoane, & Van Hal, 2014). In addition, in Nigeria, where HPV vaccination is not institutionalized, routine cervical cancer screening is offered to women above the age of 21 regardless of their HIV status, and cervical examinations in adolescents are only conducted if there are specific complaints that skews the uptake of cervical cancer screening in HIV-infected AGYW to only young women (Ahmed, Ahmed, Idris, & Sabitu, 2013; Awodele et al., 2011; Ugwu, Obi, Ezechukwu, Okafor, & Ugwu, 2013). In countries where HPV vaccination is being rolled out or scaled up, it has been demonstrated that adolescent girls' knowledge of cervical cancer and their risk for cervical cancer is very low regardless of their HIV status (Jain, Halder, & Mehrotra, 2016; Kim & Han, 2016; Leinonen et al., 2017; Subramanian et al., 2016). Implementing strategies to improve uptake of cervical cancer screening among HIV-infected AGYW equally is a recommended best practice. Although Swaziland screens them equally, with the current cervical cancer screening uptake rate among AGYW at only 21.5%, the effort needs to increase to ensure that all HIV-positive AGYW receive cervical cancer screening

according to the guidelines. The results from Swaziland may be dissimilar to other areas because most of the HIV-positive adolescent girls in Swaziland are receiving their care in hospitals and health centers that run special adolescent clinics and have more trained staff available to offer the service.

**Study Findings and Systems Thinking Theory**

This study used the systems thinking theory that posits that multiple elements with dynamic processes influence a given outcome at varying levels. The systems thinking theory has been used to improve health outcomes by understanding the functioning and interactions of elements involved in providing care for patients and the multiple determinants of health at different levels of the health system (Cordon, 2013). The more complex the health care required by the patient for example those with HIV infection, the more likely they are to experience multiple incidences of harm including the loss of dignity and respect (Classen et al., 2011; Levinson, 2010, 2012). One instance of harm is the failure to provide patient with relevant care, for instance HIV infected AGYW who should receive cervical cancer screening but do not (Peters, 2014). I examined the health system components of trained health providers, service delivery, and referrals as determinants of the uptake of cervical cancer screening among HIV positive AGYW. The findings of the study support the systems thinking theory by showing that HIV positive AGYW enrolled in care in facilities that provide all service delivery components and had a large enough trained staff complement were more likely to receive cervical cancer screening than those enrolled in care in facilities that had few or no trained staff or those enrolled in care in facilities that had some of the service delivery components or none at all. The systems thinking theory was useful in guiding the

identification of the study deliverables including the breakdown of the service delivery elements, the design of the study questions, analysis and the interpretation of the findings.

## Limitations of the Study

I used secondary quantitative data that was not purposely collected for this study and some of the variables were not available for analysis, such as data on the provision of referrals for cervical cancer screening for AGYW who are in facilities that do not offer cervical cancer screening in the original context of the study. The service delivery data were of a cross-sectional nature collected at one point in time (Sedgwick, 2014a) and therefore it was not possible to determine any causal inferences, nor explanatory dimensions to observations. It also did not allow for sequencing of events between independent and dependent variables nor any trend analysis on the study outcome (Alexander, Lopes, Ricchetti-Masterson, & Yeatts, 2014; Van der Stede, 2014).

I did not collect information from the target population directly, and therefore could not assess the demand side factors of a health system that potentially could affect the uptake of cervical cancer screening. Factors like facility waiting times, distance to the health facility, education level and other socioeconomic characteristics are important factors that would have provided greater insights into the relationship between demand for cervical cancer screening and the uptake of cervical cancer screening. In Nigeria and in the United States, a low uptake of cervical cancer screening exists despite having all the service delivery components. The low uptake is attributed to women's perceptions of risk and stigma that prevent them from using the services regardless of the availability of services and trained staff. In Nigeria, a low level of knowledge about cervical cancer and its prevention were identified as the major determinants of low cervical cancer screening

uptake (Nwobodo & Ba-Break, 2016) whereas in the United States, health care system distrust was a barrier to cervical cancer screening even after controlling for demographic, socioeconomic and service delivery determinants (Yang, Matthews, & Hillemeier, 2011). Other essential dimensions of health system determinants not covered in this study include leadership, political will as well as financing for cervical cancer screening in the country. The non-interventional nature of the study did not allow any cause- and-effect analysis in the absence of variable manipulation.

## Recommendations for Further Research

I have highlighted the important role of the availability of adequate numbers of trained staff and the availability of all service delivery components in influencing the uptake of cervical cancer screening in Swaziland. I found some data gaps in the health information system relating to the referral of patients for services that were not available within the facility that would need to be addressed to strengthen the health sector referral and linkages systems as part of the Universal Health Coverage goals (Wong, 2015).

I recommend that researchers conducting studies on the determinants of cervical cancer screening uptake and coverage should consider the inclusion of other health system characteristics mentioned above that were not measured in this study to foster a much better understanding of health facility related dynamics on the uptake of cervical cancer screening among HIV positive AGYW. Additionally, the cross-sectional quantitative nature of this study did not allow any causal inferences, nor explanatory dimensions to the findings and therefore a mixed-methods or a prospective study of uptake of cervical cancer screening could help provide an in-depth understanding of the

demand and supply dynamics for the uptake of cervical cancer screening as well as establish cause-and-effect relationships or associations among the independent variables.

## Implications

### Implications for Practice

While it is ideal to take a holistic approach in addressing the health system barriers to uptake of cervical cancer screening in HIV positive AGYW, the current financial climate in Swaziland precludes the Ministry of Health from doing so and therefore prioritization of interventions based on their potential to maximize impact will be necessary (Swaziland Ministry of Health, 2015a). The information generated from this study may play a significant role in providing the evidence to design the cervical cancer service delivery interventions to improve the uptake of screening services. The findings point to three intervention areas: adequacy of numbers of trained health providers, availability of all components for screening service delivery at the facility level, and referrals of HIV positive adolescent girls for further management once they have a positive screening test.

Like many lower- and middle-income countries, Swaziland experiences a human resource for health shortage compounded with a maldistribution of existing human resource between rural and urban areas (Campbell et al., 2013; Fulton et al., 2011; Spero, McQuide, & Matte, 2011). Although the Ministry of Health drafted a task shifting brief in 2010, no further progress has been made to finalize and implement this policy that would encourage cross-training and redistribution of roles and scope of practice for doctors, nurses and other lay health providers (Fulton et al., 2011). Information generated by this study could be used to provide a rationale to finalize and pilot the policy.

Secondly, procurement and supply chain management systems both at national and facility levels should be strengthened to ensure that the diagnostics (acetic acid) and equipment (speculum) to conduct the screening are continuously in stock and minimize missed opportunities to screen HIV positive AGYW who are accessing HIV care and treatment in the same clinics.

Robust referral and linkage mechanisms within a health system ensure that clients are retained in care and receive appropriate follow up for their disease condition (Belhadj, Rasanathan, Denny, & Broutet, 2013; Mwaka, Wabinga, & Mayanja-Kizza, 2013; Nakisige, Schwartz, & Ndira, 2017). Ensuring that there is a reflexive referral mechanism for the most vulnerable or high-risk clients provides a return on investment in terms of less morbidity (less disease complications) and less cost in treating them (Binagwaho et al., 2013; Mwaka et al., 2013). The Ministry of Health could adopt best practices from elsewhere to ensure that HIV positive adolescent girls receive the referrals they need and are linked to care to ensure the best health outcomes for them.

**Implications for Positive Social Change**

I examined a crucial health issue affecting a vulnerable and priority population in Swaziland. With a youth bulge in the population and 30% of new HIV infections occurring in women aged 15 – 24 years (Ginindza et al., 2018), preventing additional morbidity from cervical cancer in this population is not only necessary but mandatory. The uptake of cervical cancer screening in women in Swaziland remains sub-optimal even in facilities where the services are routinely available, and this is even more pronounced in AGYW. A limited understanding of the drivers of uptake of cervical cancer screening may have contributed to this situation.

I hope to foster positive social change by generating knowledge on the institutional level health system factors that contribute to the low uptake of cervical cancer screening among HIV-positive AGYW in Swaziland. This knowledge may help policy makers, health managers, and service providers understand how to strengthen the health system to improve uptake and, in the longer-term, coverage of cervical cancer screening services in Swaziland.

The findings, if used contextually, could inform any public health interventions aimed at improving uptake to cervical cancer screening in HIV positive AGYW in similar settings, and ultimately reduce the high costs, morbidity and mortality related to cervical cancer in this population.

For these reasons, the dissemination of the study findings will target the Swaziland Ministry of Health and health facilities, the Ministry of Education, the Private health sector and Community Based Organizations that work with adolescent girls and young women. Local civil society organizations will also be targeted through policy, and program strategic and implementation meetings, workshops and conferences. I will publish the study findings in at least one peer-reviewed journal to further share its findings with the international community.

## Conclusion

The low uptake of cervical cancer screening in the absence of widespread HPV vaccination in low- and middle-income countries like Swaziland that have high incident rates of Cervical cancer, demonstrates the urgent need for innovative interventions to provide screening for this preventable and curable cancer (Coleman et al., 2016; Ghebre et al., 2017).

This information produced by my research may be useful to guide the Swaziland Ministry of Health in the allocation of resources for cervical cancer screening within health facilities as well as inform country guidance and implementation plans. Further research is needed to understand the demand side drivers that influence the uptake of cervical cancer screening by HIV positive AGYW in Swaziland at both individual and institutional levels. However, the findings from this study support the hypotheses that adequate numbers of trained providers and the availability of all components of cervical cancer screening services influence the uptake of cervical cancer screening among HIV positive AGYW and I suggest that more emphasis needs to be placed on referring the most vulnerable or highest risk group who have a positive screening result.

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