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Risks for HIV Infection Among Adolescent Girls and Young Women in Mozambique

Isabelle Casavant
Walden University

Walden University

College of Health Sciences

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Isabelle Casavant

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Review Committee
Dr. Peter Anderson, Committee Chairperson, Public Health Faculty
Dr. Amany Refaat, Committee Member, Public Health Faculty
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Walden University
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Abstract

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MPH, University of Montreal, 2007

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Adolescent girls and young women (AGYW) living in Sub-Saharan African countries constitute 17% of the population, yet they account for one third of all new human immunodeficiency virus (HIV) infections. To prevent HIV infections among AGYW, it is necessary to understand why they are disproportionally infected. The purpose of the dissertation was to identify risk for HIV among AGYW living in a southern district of Mozambique. The analysis was driven by the Modified Socio Ecological Model and performed using a quantitative dataset collected for the Chokwe Combination Prevention of HIV (N=3354). Logistic regression analysis was conducted to assess whether an association existed between selected characteristics of AGYW (e.g., HIV prevention behaviors, attitudes, experience of gender-based violence), characteristics of their male sexual partners and the HIV status of the AGYW. The result of the analysis showed that being in school, always using condoms, never having experienced sexually transmitted infection, having an HIV-negative partner, having a faithful partner, and having a student as a partner were associated with lower odds of being HIV-positive. Age difference with the sexual partner, experience of gender-based violence, being pregnant in the last year, HIV knowledge, and HIV beliefs were not associated with being HIV-positive. The implications for positive social change from this research include providing policy makers and stakeholders with specific information on vulnerabilities and protectors to HIV of AGYW living in Mozambique and AGYW living in similar contexts. Addressing the specific risks of AGYW to HIV could help prevent new HIV infection among AGYW and could help improve the lives of AGYW and of their families.

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Dedication

I want to dedicate this dissertation to Kayla and Zaëly. I am so grateful to have you both in my life. I am proud to be your mom. You are both amazing and have been incredibly supportive and understanding of all the weekends, evenings and holidays I have spent working on the PhD over the last 5 years. I also want to dedicate this dissertation to my mother and my father.

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I would like to thank Duncan Mackellar and Daniel Shodell who have inspired me to start the PhD. Duncan Mackellar and Robert Nelson for their dedication to the Chokwe combination prevention of HIV, for their work ethics and for their support. Working alongside epidemiologists like you is an inspiration. I am grateful to Dr Anderson who accepted to become my chair when my dissertation was well underway. I am grateful for all the timely thorough and constructive feedback. Your kindness and understanding gave me hope that I could finish the dissertation. I would also like to thank Dr Refaat who accepted to come on board nearly at the end of the dissertation and who provided timely feedback and Dr Cunningham (URR) for her suggestions both at the proposal and dissertation stage which helped refined the research questions and improved the analysis.

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Chapter 1: Introduction to the Study

Introduction

In Sub-Saharan Africa (SSA), disparities in prevalence of human immunodeficiency virus (HIV) are consistently reported among adolescent girls and young women (AGYW) compared with adolescent boys and young men (ABYM). On average, AGYW acquire HIV 7 years earlier than their male counterparts (Dellar et al., 2015). AGYW account for 70% of all new infections among their age group (UNAIDS, 2015). One third of all incident HIV infections in SSA occurs in the AGYW population even if they account for only 17% of the population (UNAIDS, 2015). Substantial efforts to prevent new HIV infection and reduce HIV mortality during the last 10 years have resulted in considerable gains among the adult population; however, the same progress has not been reported among AGYW (PEPFAR, 2015).

To prevent new infections among AGYW, it is necessary to access information that highlights the specific needs of AGYW to remain HIV-negative (The Global Fund, 2017). To this day, however, few researchers have focused exclusively on the needs and vulnerabilities of AGYW, with consideration of the causes and interventions that can prevent HIV and reduce HIV disparities (Harrison, Colvin, Kuo, Swartz, & Lurie, 2015). Identifying the characteristics of AGYW who are at risk of HIV can contribute to reduce the gap in knowledge on AGYW vulnerabilities—which, in turn, can inform decisions to help reduce new HIV infection among AGYW (Price et al., 2018).

Through this dissertation, I identified risks for HIV infection among AGYW living in a southern district of Mozambique. I achieved this through bivariate and multivariate logistic regression analysis using a subset of the Chokwe Combination

Prevention of HIV (CP) data collected between 2016 and 2019. The CP evaluation was conducted by the Mozambican National Institute of Health and the Centers for Disease Control and Prevention (CDC). Since 2014, CP has offered annually home-based HIV testing and a short HIV survey to all consenting adult resident of a health demographic surveillance survey (HDSS) of a southern district of Mozambique. In addition, a 20% random sample of residents are selected to participate in a longer HIV health prevention survey (HPS). During past round of data collection, approximately 25,000 adults aged 15 to 59 years consented to be tested for HIV, and 6,000 consented to participate in the HPS (Shodell et al., 2018).

I gained important information on the risks for HIV infection of AGYW by comparing HIV-positive AGYW to HIV-negative AGYW on selected variables. These variables included number of sexual partners, use of condoms, experience of GBV in the last year, having had a child in the last year or being pregnant, had symptoms suggestive of STI it the last year or life, HIV-related knowledge and attitude, use of drugs or alcohol, being in school, and civil status. I gained equally important information by comparing the effects of selected characteristics of the male sexual partners as reported by the AGYW on the HIV status of the AGYW, including the age difference between the male sexual partner and the AGYW, type of employment of the partner, type of relationship with the partner, faithfulness of the partner, and HIV status of the sexual partner.

The analysis contributed to identifying individual protectors and risks to HIV of AGYW living in southern Mozambique including identifying characteristics of the male sexual partners associated with HIV-positive AGYW. The information can provide insight into how to work with AGYW, their male sexual partners, and the community

where they live. The information can be used by public health officials, donors, and policy makers to adjust or support existing interventions for AGYW or to help advocate for the implementation of new interventions that can address specific needs of AGYW living in SSA countries. I will share the results of the analysis with local authorities, public health officials, nongovernmental and community-based organizations working with AGYW in the district where I collected the data. This information can provide support to tailor interventions to meet the specific needs of AGYW and may help improve the focus of interventions to ensure that AGYW can remain HIV-free.

In this chapter, I will present background information on HIV and AGYW living in SSA, explain detailed information about Mozambique, and present the Modified Socio-Ecological Model (MSEM) selected to frame the dissertation and research questions. I will then present the problem statement and my purpose in this dissertation. This will be followed by the presentation of the research questions, including information on the variables that I have chosen to analyze, the assumptions, and the scope and delimitations of the dissertation.

Background

Since 1996, increased pervasiveness of HIV among AGYW compared with ABYM have been consistently reported in SSA countries (Dellar et al., 2015; Idele et al., 2014; Joint United Nations Programme on HIV/AIDS, 2014; Kharsany & Abdool Karim, 2016; Laga et al., 2001; Shisana et al., 2014; Zuma et al., 2016). In late 1990, girls aged 15 to 19 years had a three to eight times higher risk of being HIV-positive compared with boys the same age, as reported in five studies conducted in four SSA countries (i.e., Zimbabwe, Kenya, Zambia, and Tanzania; Laga et al., 2001). Two decades later, the

same disproportionate risk of acquiring HIV for AGYW is reported in most SSA countries. In Eswatini, formerly Swaziland, the 2014 prevalence of HIV was reported to be five times higher for girls 15 to 19 years old compared with boys of the same age (Idele et al., 2014), six times higher in South Africa (11.6% versus 4%; Shisana et al., 2014), and nearly four times higher in Mozambique (7% versus 2%; National Institute of Health Mozambique, 2015).

In 2001, Laga et al. (2001) urged researchers and policy makers to seek the causes of higher prevalence of HIV among AGYW and to provide evidence of interventions that would help AGYW remain HIV-free. At the time, potential causes of higher risk of HIV acquisition for AGYW were identified, but the author concluded that further research was necessary to confirm the vulnerabilities of AGYW to HIV. Unfortunately, current researchers continue to report a gap in knowledge on the distinct causes of HIV among AGYW, as well as a need for specific evidence-based interventions to address the specific needs of AGYW (Chandra-Mouli, Armstrong, Amin, & Ferguson, 2015; UNAIDS, 2015).

Despite high prevalence of HIV among AGYW, there is limited information on what makes them a more vulnerable population to HIV (Price et al., 2018). Important discrepancies in HIV prevalence are persistently noted between men and women, especially between AGYW and ABYM (UNAIDS, 2015). In Mozambique, the prevalence of HIV was estimated to be 13% in the adult population, with a prevalence of 15.1% for women compared with 10.2% for men (National Institute of Health Mozambique, 2015). The discrepancies in prevalence of HIV are even more significant between AGYW and ABYM. The prevalence of HIV was reported to be 7% for 15- to

19-year-old girls, compared with 2% for boys the same age, and 13% for young women aged 20 to 24 years, compared with 2% for men the same age (National Institute of Health Mozambique, 2015).

Through this dissertation, I intended to identify the risks for HIV infection of AGYW living in Mozambique. I explored the association between the characteristics of AGYW and of their male sexual partners on the HIV status of the AGYW. I conducted the analysis using a subset of data collected for the Chokwe Combination Prevention of HIV (CP) evaluation. The information can contribute to reduce the knowledge gap surrounding the vulnerabilities of AGYW to HIV. This, in turn, can inform policies and provide insight to develop targeted and specific interventions to prevent HIV among AGYW living in Mozambique and SSA countries.

Problem Statement

In Africa, approximately 1,000 young girls become infected with HIV every day (PEPFAR, 2015). AGYM account for one-third of new HIV infections and acquire HIV an average of 7 years earlier than their male counterparts (Dellar et al., 2015; UNAIDS, 2015). In the last decade, considerable efforts have been deployed to reduce HIV infection, which has resulted in a 30% reduction in HIV incidence in the general population (UNAIDS, 2015). In the same period, however, considerably higher HIV infection rates have been reported among AGYM in many SSA countries (Harrison et al., 2015).

AGYW living in SSA are infected disproportionally with HIV compared with boys and men of the same age (Dellar et al., 2015). Understanding how these inequalities and disparities arise is essential to design interventions that can successfully protect AGYW

from becoming HIV infected (Price et al., 2018; Wingood & DiClemente, 2000). Identifying individual risk factors of AGYW (i.e., socioeconomic, behavioral, biomedical, and characteristics of sexual partners) to HIV can help professionals to implement specific and targeted interventions to prevent new HIV infections among AGYW (Price et al., 2018).

To reduce HIV prevalence in AGYW, it is imperative to obtain more knowledge about the risks associated with HIV in AGYW (UNAIDS, 2015). It is crucial to understand what drives the HIV epidemic among young people. Knowledge gained from the factors that influence HIV acquisition among youth can lead to the improvement of HIV prevention intervention (MacPhail & Campbell, 2001; UNAIDS, 2015). By uncovering the characteristics of AGYW who remain HIV-negative compared with those who converted to HIV-positive and learning the characteristics of their male sexual partners, it will be possible to provide valuable information to public health stakeholders, donors, and policy makers working to reduce the vulnerabilities of AGYW to HIV.

Purpose of the Study

My purpose in this study was to identify risks for HIV infection among AGYW living in a southern district of Mozambique. I accomplished this by conducting bivariate and multivariate logistic regression with a subset of quantitative data collected for the Combination Prevention of HIV (CP) evaluation. The subset of data selected originates from three rounds of data collected between May 2016 to December 2016 (round 3), March 2017 to December 2017 (round4) and March 2018 to February 2019 (round 5). I have focused on information collected with AGYW who consented to participate in the

Health Prevention Survey (HPS) and who accepted to test for HIV or reported a prior HIV-positive diagnostic.

The subset of data included quantitative information (responses to the HPS questionnaire and HIV test results for the three rounds selected (2016-2019) for all consenting participants 15 to 59 years old for the three rounds of CP data selected for the analysis and include specific information for AGYW (i.e., number of sexual partners, use of condoms, experience of GBV, had a child in the last year or is currently pregnant, symptoms suggestive of STI in the last year and in life); HIV-related knowledge and beliefs about HIV, use of drugs or alcohol, transactional sex with last sexual partner, being in school, factors indicating poverty, and civil status (i.e., the independent variables); characteristics of the male sexual partners (i.e., age difference with the AGYW, type of employment, type of relationship, faithfulness, and HIV status of the male sexual partner; also independent variables); and the HIV serostatus of AGYW (i.e., HIV-positive or HIV-negative).

Research Questions and Hypotheses

In this study, I identified the risks for HIV infection among AGYW living in a southern district of Mozambique. I developed the following research questions to assess whether an association existed between selected characteristics of AGYW, those of their male sexual partners, and the HIV status of the AGYW:

Research Question 1: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e. male partner younger or 1-2 years older than the AGYW,

partners older than the AGYW by 3-4, years, older by 5-6 years, or partners 7 years or older than the AGYW), partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]?

Null Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive].

Alternative Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected characteristics of their male sexual partner as reported by AGYW (age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner], perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]).

Research Question 2: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never], use of drugs and alcohol, transactional sex with last sexual partner)?

Null Hypothesis 2: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never], use of drugs and alcohol, transactional sex with last sexual partner).

Alternative Hypothesis 2: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected HIV knowledge, beliefs and behaviors of AGYW (number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never], use of drugs and alcohol, transactional sex with last sexual partner.

Research Question 3: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]?

Null Hypothesis 3: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence,

currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single].

Alternative Hypothesis 3: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]).

Theoretical Framework for the Study

Understanding the sociocultural context in which the adolescent lives is necessary to analyze and propose interventions that can reduce their vulnerabilities to HIV. Theories and interventions focused solely on individual behaviors and motivation of adolescents living in SSA to prevent HIV have failed to demonstrate success (Michielsen, Chersich, Temmerman, Dooms, & Van Rossem, 2012). Recognizing the importance of the social and structural factors of HIV, Baral, Logie, Grosso, Wirtz, and Beyrer (2013) proposed the Modified Socio Ecological Model (MSEM). The model includes five layers of factors, which helps to understand the risks to HIV: individual factors, including biological and behavioral; interpersonal factors, including sexual network and gender-based violence; community-level factors, including gender norms, access to prevention, condom, HIV testing stigma, and discrimination; public policies; and HIV epidemic stage.

To have a better sense of the HIV risk facing a specific population, it is essential to consider the potential influence of the different factors of each of the layers of the

MSEM. For example, risks of acquisition of HIV of AGYW depend on where they live. An AGYW living in a community with very low HIV prevalence is less likely to acquire HIV compared with an AGYW with the same risk factors living in a hyperendemic community. The same is true for the presence of public policies that can help prevent HIV (e.g., access to HIV testing and care, access to education, laws to protect women and AGYW from HIV) and for each of the other layers of the MSEM. The MSEM provides valuable information on the choice of potential variables to analyses in relation to the HIV status of the AGYW (i.e., identification of exposure and risk factors among the available dataset) and can help articulate potential interventions that could help reduce AGYW vulnerabilities to HIV (Baral et al., 2013; Hanson, Zembe, & Ekstrom, 2015).

In the current dissertation, I investigated whether selected factors of the MSEM influenced the risk of HIV acquisition of AGYW. Figure 1 shows the different layers of the MSEM adapted to the context of AGYW living in Chokwe, Mozambique. I have highlighted in red variables for which quantitative data were available in the CP data set. The independent variables are found at the individual level and at the social and sexual networks while the information on the dependent variable (HIV status of the AGYW) is found at the HIV epidemic stage. In bold, I have listed the potential variables that could be associated, mediating or interacting with the vulnerabilities of AGYW to HIV for which no data were available in the CP dataset. In Chapter 2, I will further review the MSEM theory and provide information on the example of its use.

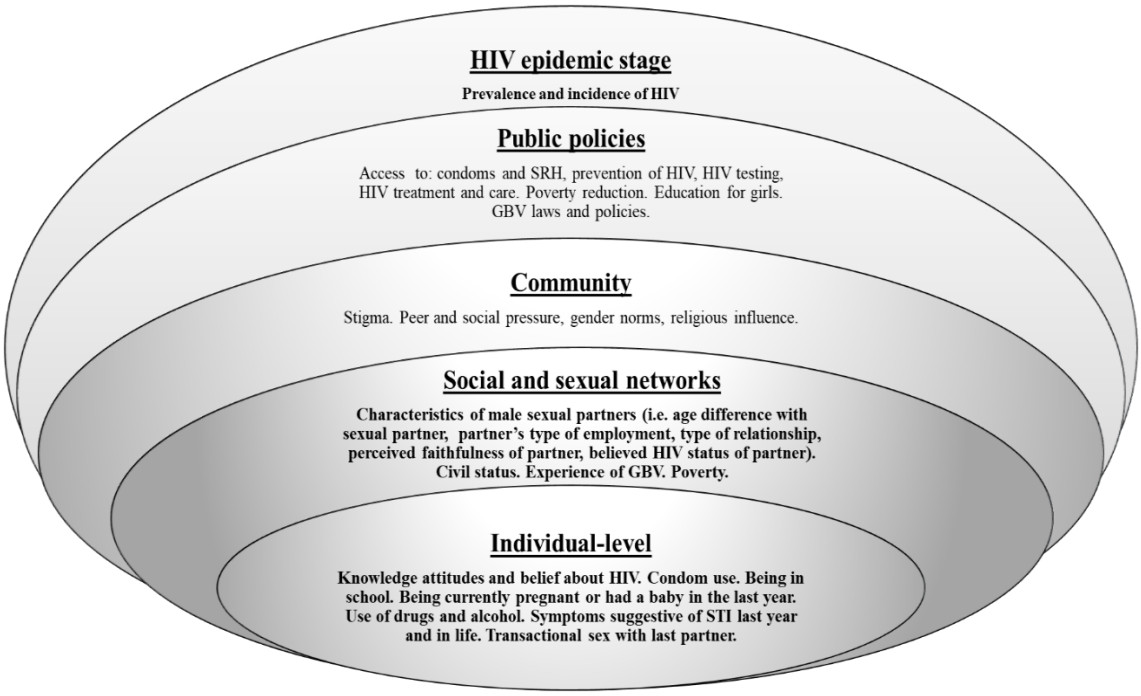

Figure 1. Socio-ecological model modified for AGYW living in Chokwe, Mozambique (adapted from Baral et al., 2013).

Nature of the Study

Quantitative analysis of the subset of data of the CP evaluation collected during the third to the fifth round (2016-2019) allowed me to assess whether a significant association existed between the HIV status (i.e., HIV-negative, HIV-positive) and selected characteristics of AGYW and of their male sexual partners. I selected the CP dataset because it contains quantitative information on many key variables identified in the literature as potential vulnerabilities to HIV for AGYW, because it contains information on male sexual partners of AGYW, and because it includes a recent HIV test result for the AGYW. Another strength of the CP dataset is that the study was conducted with a large number of randomly selected AGYW (i.e., 3 354) living in a southern district of Mozambique severely affected by HIV (i.e., 24.5% HIV prevalence among those aged 15 to 59 years old [MMWR, 2018]).

By analyzing the CP data, it was possible to describe the sociodemographic behavioral and characteristics of the AGYW and the characteristics of the male sexual partners of AGYW for HIV-positive and HIV-negative AGYW. Furthermore, I identified the risks of HIV among AGYW using bivariate and multivariate logistic regression analyses. The results of the analysis helped identify the personal characteristics of AGYW, and those of their male sexual partners, associated with HIV-positive and HIV-negative AGYW living in a southern district of Mozambique.

Study Variables

The variables chosen for the analysis included information on attitudes, beliefs, and behaviors regarding HIV of AGYW, characteristics of their male sexual partners, and the HIV status of the AGYW. The independent variables describe characteristics of the male sexual partners of the AGYW as reported by the AGYW, such as the age difference between the male sexual partner and the AGYW (i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years, or partners 7 years or older than the AGYW),, the partner's type of employment (i.e., unemployed, employed for wage, student), the type of relationship (i.e., casual, married, exchange sex for money/goods/services), the perceived faithfulness (i.e., yes, no, do not know), and the HIV status of the male sexual partner (i.e., HIV-positive, HIV-negative, or unknown HIV status). It also included information gathered with the AGYW on number of sexual partners, use of condoms (i.e., always, sometimes, never), experience of GBV (i.e., yes, no), having had a child in the last year or currently being pregnant (i.e., yes, no), presence of symptoms suggestive of STI in the life (i.e., yes, no), HIV-related knowledge and beliefs, use of drugs or alcohol (i.e., yes, no), being in school (i.e., yes, no), and civil status (i.e., married, living as married, single). The dependent variable for

the three research questions was the HIV status of the AGYW (i.e., HIV-positive or HIV-negative).

Definitions of Terms

In this section, I will provide definition for some of the terms used frequently in this dissertation. The definitions of the variables will be provided in Chapter 3.

Adolescence. Adolescence is marked with substantial physical and emotional changes (Harrison et al., 2015; Harrison, Newell, Imrie, & Hoddinott, 2010; World Health Organization, 2015b). Adolescence spans across the age of 10 to 24 years old and is composed of three periods with distinct biologicals social and psychological transition: 10 to 14 years old, 15 to 18 years old, and 19 to 24 years old (Bandura, 2006; Kurth, Lally, Choko, Inwani, & Fortenberry, 2015; World Health Organization, 2015b). During the adolescent period, youth are increasingly ready to become adults, and in the process, they must develop skills and internalize the roles that they will play in society (Crockett & Crouter, 2014). In each period, adolescents need to develop new competencies such as managing sexuality and learning the role that they will play as an adult (Bandura, 2006).

Adolescent boys and young men (*ABYM*). In this dissertation, *adolescent boys and young men* (*ABYM*) will be defined as boys and young men between the ages of 15 to 24 years.

Adolescent girls and young women (*AGYM*). In this dissertation, *adolescent girls and young women* (*AGYM*) will be defined as girls and young women between the ages of 15 to 24 years.

Acquired immune deficiency syndrome (*AIDS*). Acquired immune deficiency syndrome (AIDS) is the result of a severely compromised immune system due to

uncontrolled HIV. At that stage of the HIV infection, severe opportunistic infections threaten the life of the HIV carrier (CDC, 2018)

Computer-assisted personal interviewing (*CAPI*). The interviewers of the HIV health prevention survey used a computer-assisted personal interviewing (CAPI) device to conduct the questionnaire. CAPI is an easy, cost-effective way of collecting data on a portable device that allows to collect data in real time and help reduce errors (i.e., missing data, repeating the use of the same identifier, facilitate following the right skip pattern and can perform check on validity of some data; Brahme et al., 2018).

Gender-based violence (*GBV*). *Gender-based violence* (*GBV*) is defined as the abuse of power and control of one person over another based on gender. GBV can take the form of physical, sexual, or psychological violence (Canadian Status of Women, 2018).

Human immunodeficiency virus (*HIV*).The human immunodeficiency virus (HIV) is a virus that weakens the human system by destroying the cells that fight disease and infection (CDC, 2018). Although no cure exists yet against HIV, antiretroviral therapy can impede its progression to AIDS and help HIV-positive people live healthy lives (CDC, 2018) and can reduce its risk of transmission to others (Donnell et al., 2010).

Lay counselors. To reach the estimated 30% of people who do know their HIV status globally, the WHO (2018) recommended that countries with high prevalence of HIV use trained lay counselors to test for HIV using rapid HIV tests. Lay counselors are part of a larger strategy which aims to scale up and improve access to HIV testing, care and support by allowing the shifting of specific tasks that are usually performed by clinicians to lay people after a focus training (Magasana et al., 2017) All home-based

HIV testing for the CP study—including pre- and post-HIV test counselling and referral to health centers in case of HIV-positive results—were conducted by trained lay counselors.

Assumptions

A crucial assumption for this study was that the participants responded honestly to the health prevention survey (HPS). Truthfulness is crucial as the information on all the independent variables of the study originate from response given by the AGYW. Social desirability bias in the context of CP is conceivable given that some questions address subjects that may be considered taboo in the Mozambican context (e.g., gender-based violence, exchanging sex for money or favors,) or socially desirable (e.g., use of condoms, having tested previously for HIV). Because the interviewers read aloud the HPS questions using a CAPI tool, some participants may be ashamed to disclose their true attitudes, beliefs, and behaviors about HIV, HIV prevention, and HIV care. I also assumed that the men who have sex with AGYW and the AGYW of the district who have consented to the HPS are representative of other men who have sex with AGYW and other AGYW living in the district, in other parts of Mozambique and in other SSA countries.

Scope and Delimitations

In this dissertation, I focused on risk for HIV infection among AGYW living in Mozambique. I developed several research questions to explore whether an association existed between the HIV status of AGYW and their HIV knowledge, behaviors, and beliefs and characteristics of their male sexual partners. This was achieved with the analysis of a subset of data collected for the combination prevention of HIV evaluation

(CP) conducted in a southern district of Mozambique by the Mozambican National Institute of Health and the CDC. The CP dataset included information on all residents aged 15 to 59 years residing in a southern district of Mozambique who consented to test for HIV annually since 2014. The dataset also included additional information collected through the administration of an HPS to a stratified random sample of 20% of the residents based on a household sample. The analysis focused on information collected through the HPS and home-based HIV testing during three rounds of CP data collected between May 2016 and February 2019. I chose to use the CP data due to richness of the data collected, the large number of AGYW who participated annually, and the high prevalence of HIV in the district.

Limitations

A significant limitation of the dissertation is related to the fact that the CP data was designed to be analyzed as cross-sectional and thus results of the analysis can only indicate correlation. Even though CP was an open HIV cohort and all residents were offered HIV testing annually only 20% of the residents were randomly selected to respond to the HPS. Given that the number of HPS participants randomly selected for each round to achieve power included all 15 to 59 years old focusing the analysis on AGYW reduced considerably the number of questionnaire available to be analyzed. In an attempt to increase power, I merged the three rounds of CP data selected for the analysis.

The CP dataset also contains other potential limitations such as bias due to the instrument (i.e., HPS and HIV rapid test), participation bias, selection bias, and bias related to self-reported data. The HPS collected information on the attitudes, beliefs, and behaviors of participants, and on characteristics of the male sexual partners of AGYW.

Bias could occur if questions of the HPS were not clear, understandable, or did not measure what they intended to measure. The depth of information collected on beliefs, attitudes and social norms could have been limited by the quantitative nature of the study, limiting the participant's answer to what was selected as possible answers which may not have encompassed all the possible realities of participants and of AGYW. I also assumed that the questionnaire initially constructed in English was correctly translated to Portuguese and then to the local language (i.e., Changan). Equally important, poor data collection and poor respect of the standard operating procedures (SOP) could have resulted in nonaccurate information registered in the forms or in the database. These could include error in responses to individual questions of the HPS (e.g., age of the AGYW, age of her sexual partner, beliefs, use of condoms) or the HIV test result (e.g., registering the wrong result on the form, or data entry staff entering the wrong information).

Another important variable for the analysis is the serostatus of the AGYW, which is the dependent variable for the three research questions. An HIV rapid test was used to determine whether the AGYW is HIV-positive or HIV-negative. I assumed a minimal risk of false positive results given the overall prevalence of false HIV diagnostic found in Chokwe between 2014 and 2017 of 0.11 (95% CI, 0.08%-0.13%; Shodell et al., 2018).

The researchers of the CP project attempted to reduce the risk of selection and participation bias by using an updated list of all potential participants aged 15 to 59 years old living in the district covered by the HDSS. The list of eligible participants was created before the start of every round with the updated census information of the district. To increase the chance of participation for all eligible residents, the counselors and

interviewers were instructed to visit participants at their home at least three times at different times and on different days.

Selection bias could include refusal to participate or difficulty to find some of the participants. In this study, refusal to participate could be individual, or could be at the household level. Refusal at the household level follows Mozambican tradition, which required that interviewers first get approval of the head of the household before attempting to approach other members of the family. Consequently, some head of households may have refused to participate individually and accepted that other members of the family participated, whereas while other heads of household may have refused to participate and denied participation to all the members of their household. Given that the HDSS census provided the list of all eligible participants, the potential effect of participation and selection bias could be measured. The characteristics of nonresponder or people who refused to participate can be compared with characteristics of consenting participants (e.g., sex, age group and type of residence [urban versus rural]).

It is also possible that the residents of the district covered by HDSS and by the CP evaluation were not representative of other residents and AGYW of Mozambique or other SSA countries. AGYW who participated, and their male sexual partner, may have different sexual patterns and different risks behaviors than other AGYW of the districts of Mozambique. For example, it is estimated that up to 30% of residents of the district—mostly men—work outside of the district or in RSA for many months every year (data not published). Although the prevalence of HIV is high in Mozambique (11.5%; Reed, 2017), the prevalence of HIV in the district is even higher, with 25.6% prevalence of HIV among those aged 15 to 59 years (Shodell et al., 2018). These factors may limit the

ability to generalize the results of the analysis to AGYW living in other districts of Mozambique and AGYW living in other SSA countries.

Secondary data analysis often comes with limitations, such as a possible lack of information on procedures to collect the data or how the dataset was cleaned (e.g., how to treat missing data). In this case, this limitation was significantly reduced because the CDC researchers and epidemiologists who prepared the dataset were available to respond to questions. Also access to all the standard operating procedures was granted by the principal investigators.

Significance

The unmet needs of AGYW living in SSA countries translate into disproportionately higher risk of HIV acquisition (Bruce, Temin, & Hallman, 2012; Karim & Dellar, 2014). To achieve an AIDS-free generation, it is imperative to examine the causes of higher prevalence of HIV among AGYW and to present evidence-based interventions that address the specifics needs of AGYW (Bruce et al., 2012). To this day, a significant gap in knowledge exists when it comes to identifying the vulnerabilities to HIV of AGYW, especially for AGYW living in SSA countries (Joint United Nations Programme on HIV/AIDS, 2014; UNAIDS, 2015). Gaps in knowledge include lack of information that identifies the characteristics of male sexual partners of AGYW and information on characteristics of AGYW living in SSA countries associated with HIV.

The results of this dissertation could contribute to reduce the gap in knowledge by exploring whether characteristics of AGYW and their male sexual partners are associated with the HIV status of AGYW. The analysis was performed using a subset of the CP data collected in a country with a high prevalence of HIV and where little is known about the

vulnerabilities of AGYW to HIV. The analysis provided information on the characteristics that are associated with AGYW's risk of HIV. The information could provide public health officials and policy makers the information necessary to advocate and implement targeted interventions for AGYW living in the district where the information was collected. The information could also be used in other communities or countries sharing similar characteristics thus contributing to social change. The information gained could add to the limited body of knowledge on the vulnerabilities of AGYW to HIV and characteristics of their male sexual partners rendering them more at risk for HIV. Given limited funds and competing needs, the information gained could provide public health decision makers with the necessary information to respond and focus on the specific needs of AGYW living in SSA.

Summary

The specific needs of AGYW living in SSA to remain HIV-negative are still unmet (Bruce et al., 2012). Consequently, a three- to eight-fold higher prevalence of HIV continues to be reported between AGYW compared with ABYM in various SSA countries (Dellar et al., 2015; Laga et al., 2001; Underwood, Skinner, Osman, & Schwandt, 2011; UNAIDS, 2015). Mozambique, one of the 10 most HIV-affected countries in the world, is no exception to these disparities in HIV prevalence between AGYW and ABYW.

To design interventions that can protect AGYW from HIV, it is essential to understand how inequalities and disparities arise and what renders AGYW more vulnerable to HIV (Wingood & Diclemente, 2000; Karim & Dellar, 2014). Specific information on risks of HIV infection among AGYW living in a southern district of

Mozambique was gathered with the analysis of a subset of data collected for the CP evaluation. In the dissertation, I intended to explore whether an association existed between the HIV-positive or HIV-negative status of AGYW and characteristics of the male sexual partners of AGYW (i.e., age difference with AGYW, type of employment, type of relationship, faithfulness and HIV status of the men as reported by the AGYW), and characteristics of the AGYW (i.e., number of sexual partners, age difference with sexual partner, use of condom, pregnancy or having a baby less than 1 year old, presence of STI, civil status, factors indicating poverty, schooling, knowledge attitudes, and beliefs of HIV).

The MSEM proposed by Baral et al. (2013) served as the theoretical framework for this dissertation. The model was selected because it provides information on the social and structural drivers of HIV for AGYW. The MSEM illustrates how the risk of HIV acquisition of the AGYW is influenced by individuals' characteristics (e.g., knowledge, attitudes and behaviors about HIV, biological characteristics), their social and sexual networks (e.g., characteristics of their male sexual partners, families), their community (e.g., stigma, gender norms, religious influence), public policies (e.g., access to condoms, HIV testing, poverty reduction, education), and the HIV epidemic stage (i.e., prevalence of HIV in the community) where they live (Baral et al., 2013).

In the next chapter, I will provide background information on Mozambique, AGYW, and HIV. Chapter 2 also includes a review of literature on the variables selected for the analysis, as well as information on potential mediating, interacting or confounding variables. The MSEM level of influence is used to structure the information, starting with

the HIV epidemic stage through the individual level factors that can affect the risk of HIV among AGYW.

Chapter 2: Literature Review

Introduction

AGYM face a disproportionate risk of acquiring HIV compared with ABYM (Birdthistle et al., 2018; Dellar et al., 2015; Mitchum, 2016; UNAIDS, 2015). Seventy-one percent of all new HIV infections among those aged 15 to 24 years living in SSA are reported among AGYW (UNAIDS, 2015). Although considerable gain has been reported in the reduction of HIV incidence among the general population, the same progress has not occurred among youth, especially among AGYW (Dellar et al., 2015; UNAIDS, 2015). Given the anticipated youth bulge in eastern and southern Africa, it will not be possible to achieve an AIDS-free generation if new HIV infections are not prevented among youth, especially AGYW (UNAIDS, 2016d). To address the specific needs of AGYW to remain HIV-negative, it is necessary to determine their specific vulnerabilities to HIV (Delva & Abdool Karim, 2014).

My aim in this dissertation was to identify risk of HIV infection among AGYW living in a southern district of Mozambique. I evaluated whether a relationship existed between the HIV status of AGYW and specific characteristics of AGYW (i.e., number of sexual partners, age difference with sexual partners, use of condoms, experience of sexual gender based violence, being currently pregnant or having had a child in the last year, presence of sexually transmitted infection [STI], HIV-related knowledge, attitudes and beliefs about HIV, use of drugs or alcohol, transactional sex, being in school, being poor and civil status), characteristics of their male sexual partners (i.e., age difference with sexual partner, partner's type of employment, type of relationship with partner, faithfulness of partner, HIV status of partner).

In this chapter, I will present the theoretical framework of the MSEM, background information on Mozambique and the southern district where the CP evaluation was conducted, and the results of a literature search that I conducted on potential risks to HIV facing AGYW, for which data are available in the CP dataset.

Literature Search Strategy

I surveyed Medline, CINAHL, and PubMed to discover literature using the following search terms: *adolescent, HIV infection, sexual partner characteristics, risk behaviors, Mozambique,* and *Africa*. I also gathered information using the same terms with key agencies and organizations such as WHO, the CIA, UNICEF, PEPFAR, and UNAIDS. I conducted searches using the same database to find information on the socio-ecological model and the MSEM.

I limited the literature review to peer-reviewed articles published between 2012 and 2018. I made an exception for some seminal articles on both the theory chosen and for historical information on HIV and AGYW in SSA. After a revision of the selected articles, I procured, assesses and included articles cited in the chosen articles relevant to the dissertation in the review. I conducted the first search in October of 2017 and repeated every 3 months to see whether new articles corresponded to the search terms. I selected a total of 248 articles and kept 156 for the analysis.

Theoretical Foundation

Interventions based on behavioral theories such as the sociocognitive theory, the theory of reasoned action and planned behavior, and the transtheoretical model have established that it is possible to increase individual's capacities to adopt HIV prevention behaviors successfully. Yet, the effects on behavior change, using these models, is

limited because it does not consider the structural and societal influences on individuals (Fearon, Wiggins, Pettifor, & Hargreaves, 2015; Hardee, Gay, Croce-Galis, & Peltz, 2014; Kaufman, Cornish, Zimmerman, & Johnson, 2014; Michielsen et al., 2012; Slabbert, Knijn, & de Ridder, 2015). Prevention interventions that have solely focused on individual behaviors have demonstrated limited success, especially for AGYW living in southern Africa (Fearon et al., 2015; Harrison et al., 2010; Slabbert et al., 2015; Underwood et al., 2011). To have more chance of success it is necessary that a combination of interventions address the complex factors that affect the ability of young people to adopt HIV prevention behaviors (Michielsen et al., 2012; Sommer, 2011; Underwood et al., 2011).

Some models can capture the different individual and structural drivers that directly or indirectly influence decision making. One of them is the socioecological Model (SEM) of Bronfenbrenner. The SEM aims to shift the focus from the individual and highlights the multiple factors influencing positive health behaviors (Kaufman et al., 2014). Bronfenbrenner initially developed the SEM to understand how personal and environmental factors influence a child's behavior. At the center of the SEM model are the individuals who interact and are influenced by interpersonal relationships (e.g., family, partners), community (e.g., schools, neighborhood), and society (e.g., gender inequality, religion, cultural norms, economic or social policies). The SEM is currently used by the CDC to inform different health promotion programs such as the colorectal cancer control program, violence prevention, and prevention of sexual abuse. The SEM uses specific information gathered at the individual, relationship, community and societal level to identify interventions that can help shape the behavior of individuals.

Socio Ecological Model and HIV

The SEM has been adapted to understand individual risks of HIV. The C-Change's SEM is a SEM adaption that highlights the importance of the community members perspectives on risks and vulnerabilities to HIV in southern Africa (McKee et al., 2000). According to McKee et al., individuals in a developing country are more likely to consider their families and communities preferences when adopting a new behavior. Consequently, individual change in southern African countries requires that professionals address and target family and community beliefs (McKee et al., 2000).

The Modified Socio Ecological Model

Another example of the adaptation of the SEM to understand risks associated with HIV is the MSEM. The MSEM has been proposed by Baral et al. (2013) to guide researchers, policy makers, and public health official in understanding the different layers of risks individuals face regarding HIV. Baral et al. presumed that without the knowledge of the social and structural factors that affects individuals' behaviors, there will likely be an increased risk of HIV acquisition for individuals. The MSEM retains the four original layers of Bronfenbrenner SEM's model and expands it with an extra layer, which considers the HIV epidemic stage in which individual lives.

The HIV epidemic stage in HIV acquisition is a crucial addition. Even though two individuals could potentially share the same characteristics in the four other layers of the SEM, they will not have the same risk of HIV acquisition depending on the prevalence of HIV in the community where they reside. Likewise, difference in other layers of the model can influence the risks of HIV. Two individuals with similar characteristics living in communities with similar prevalence of HIV will have a different risk of acquiring HIV depending on the policies in place that can mitigate the risks such as the existence

and accessibility for injecting drug users of a needle exchange program (Baral et al., 2013). To successfully guide action and research, the MSEM requires that specific characteristics of the individuals in their specific environment including the HIV epidemic stage be taken into consideration.

For this dissertation, I adapted the MSEM model to analyze some of the individual and contextual factors that can, directly and indirectly, influence the risk of HIV acquisition of AGYW living in Mozambique (Figure 2). At the individual level, the knowledge, attitudes, and beliefs of the AGYW about HIV can influence their use of HIV prevention interventions. AGYW may also be more at risk of getting infected with HIV given biological factors (e.g., immature cervix). At the social and sexual network level, the characteristics of their sexual partners will influence their risks of HIV acquisition of AGYW (e.g., if the sexual partner is HIV-positive or whether the partner uses condoms). At the community level, the stigma associated with HIV and harmful gender norms can increase the risk of HIV for AGYW (e.g., acceptance of partner's infidelity and lack of power in the use of condoms influence risk for AGYW). At the public policies level, AGYW vulnerabilities to HIV are influenced by access to different interventions and services (e.g., condoms, HIV testing, sexual and reproductive health services, education) which are essential to reduce the vulnerabilities of AGYW to HIV. These factors are happening in a setting with a very high prevalence of HIV (e.g., 24.5% not published), which further increase the risks of AGYW to HIV. The figure below (Figure 2) highlights the factors that potentially influence HIV acquisition for AGYW living in Mozambique. Highlighted in red are the variables selected for the dissertation questions for which

information is available in the health prevention survey of the CP evaluation conducted in Chokwe.

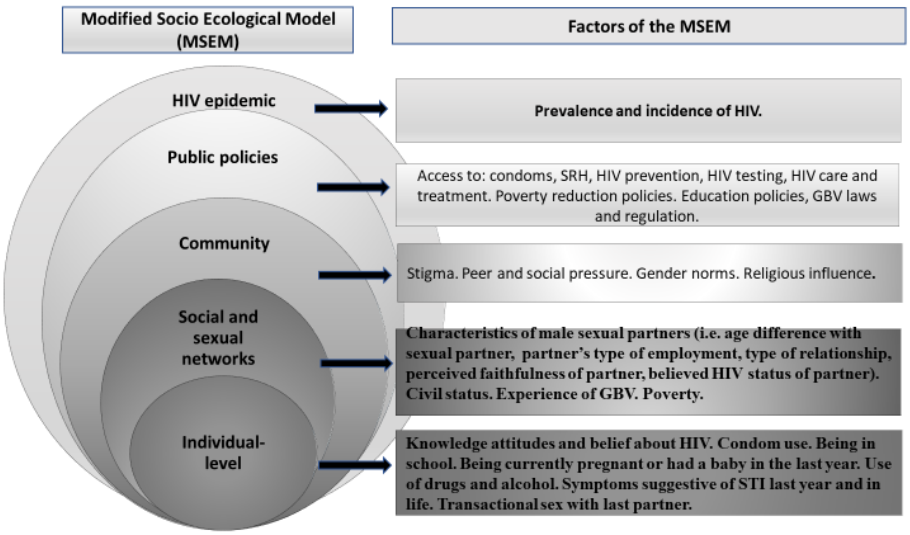

Figure 2. Individual and contextual factors influencing the risk of HIV acquisition of AGYW living in Mozambique using the MSEM of Baral et al. (2013).

The layers of the MSEM provide useful information on the different risk factors for HIV of AGYW living in Southern Africa. Using the MSEM can help policy makers and researchers understand the influences and structural drivers of HIV on the individual level. The MSEM provides important context information surrounding AGYW and HIV. It is especially important to use a model such as the MSEM for AGYW living in Mozambique and in other SSA countries where the AGYW lives are strongly influenced by family, community, policies, and interventions to support HIV prevention behaviors.

Background Information

Mozambique

Mozambique is a low-income country located in SSA on the coast of the Indian Ocean bordered by Tanzania, Malawi, Zambia, Zimbabwe, South Africa, and Swaziland (see Figure 3). Mozambique has an estimated population of 25.3 million (UNICEF,

2013), of which 65% are under 24 years old (Central Intelligence Agency, n.d.). Mozambique ranked 181 out of 188 countries on the human development index (United Nations Development Programme, 2016). In 2012, 26.2% of all adult deaths in Mozambique were due to AIDS (UNAIDS, 2015). With 12.3% of its adult population living with HIV (Central Intelligence Agency, n.d.), Mozambique has been consistently ranking eighth in countries most severely affected by HIV (Central Intelligence Agency, n.d.). Eight of the 10 most HIV affected countries of the world are also located in SSA. HIV prevalence among adults is 27.2% in Swaziland, 25% in Lesotho, 18.9% in South Africa, 13.5% in Zimbabwe, 12.40% in Zambia, and 9.2% in Malawi (Central Intelligence Agency, n.d.).

Figure 3. Mozambique political map.

Chokwe District, Mozambique

Chokwe is the southern district of Mozambique where the CP evaluation was conducted and from which the quantitative dataset used for the dissertation originates. Chokwe district ranked sixth out of the 149 districts for the highest number of people living with HIV and ranked fifth for the highest prevalence of HIV in the adult population (National Institute of Health Mozambique, 2015). Prevalence of HIV was 24.8% among residents of Chokwe 15 years old and older, with a marked difference between men (20.2%) and women (29%; National Institute of Health Mozambique, 2015). The district that ranked first for HIV prevalence is adjacent to Chokwe, and belongs to the same province, in which prevalence of HIV was 26.7% among the adult population (National Institute of Health Mozambique, 2015). In Chokwe district, it is estimated that 20,000 women and 13,000 men are HIV-positive (National Institute of Health Mozambique, 2015).

The prevalence of HIV among men and women who participated to the CP evaluation for rounds 1 to 3 (2014-2016) is illustrated in Table 1. These results are presented by round of CP data collection, by age group, by sex, and by urbanicity. In 2016, during the third round of data collection, the prevalence of HIV among young women aged 15 to 24 years was found to be 11.7%, compared with 2.6% for boys and young men. When disaggregated in smaller age bands, the prevalence of HIV among those aged 15 to 19 years was 5% and 1% for girls compared with boys, and 17% for girls compared with 4% for boys for those aged 20 to 24 years.

Table 1

Weighted Prevalence of HIV in Chokwe by Age, Sex, Urbanicity, and Age by Sex With a 95% Confidence Interval

			Round 1 (2014) P (95% CIs) *n* = 2,712	Round 2 (2015) P (95% CIs) *n* = 2,790	Round 3 (2016) P (95% CIs) *n* = 4,490
Age (years)	15-24		9.1 (7.2-11.0)	8.2 (6.5-10.0)	7.9 (6.5-9.3)
	25-34		38.5 (34.3-42.7)	36.8 (32.2-41.4)	31.2 (27.4-34.9)
	35-44		50.1 (45.0-55.2)	42.1 (36.6-47.5)	43.8 (39.3-48.4)
	45-59		36.2 (31.4-41.1)	37.0 (31.8-42.1)	36.5 (32.2-40.8)
Sex	Male		23.6 (20.4-26.9)	22.5 (18.7-26.2)	19.7 (16.6-22.8)
	Female		30.3 (28.0-32.7)	29.3 (27.0-31.6)	30.0 (28.1-31.8)
Urbanicity	Rural		28.0 (25.3-30.8)	26.3 (23.2-29.3)	24.6 (22.1-27.1)
	Urban		27.5 (24.9-30.0)	27.7 (25.4-30.0)	28.9 (27.1-30.8)
Age by sex	15-24	Male	3.2 (1.4-5.1)	2.8 (0.8-4.9)	2.6 (1.2-3.9)
		Female	13.0 (10.1-16.0)	11.9 (9.4-14.5)	11.7 (9.5-13.9)
	25-34	Male	37.0 (29.4-44.7)	30.4 (21.5-39.4)	22.0 (14.9-29.1)
		Female	39.3 (34.6-44.0)	40.4 (35.6-45.3)	36.4 (32.5-40.4)
	35-44	Male	47.3 (37.9-56.7)	44.7 (34.0-55.5)	40.0 (30.3-49.8)
		Female	51.4 (45.7-57.2)	40.7 (34.8-46.7)	45.8 (41.3-50.2)
	45-59	Male	39.1 (30.0-48.2)	40.0 (29.7-50.3)	36.9 (28.1-45.8)
		Female	34.8 (29.3-40.3)	35.4 (30.2-40.6)	36.3 (32.1-40.4)
Total			27.8 (25.8-29.8)	26.8 (24.6-28.9)	26.1 (24.4-27.9)

Note. Adapted from Shodell et al. (2018) and unpublished data.

Literature Review of Key Variables and Concepts

The information on AGYW and HIV and the variables chosen for the dissertation are presented using the structure of the MSEM model. The review starts with the outer layer of the MSEM, the HIV epidemic stage and then successively presents the other layers of the MSEM which contains information relevant to the dissertation. In Chapter 3, I will further review and define the variables and methods selected for the dissertation.

First Layer of the MSEM: The HIV Epidemic Stage

The outer layer of the MSEM takes into consideration the HIV epidemic stage. This layer is essential to comprehend and evaluate the risks of HIV for AGYW. In 2016,

34.5 (28.8-40.2) million adults were living with HIV, of which 55% lived in eastern and southern Africa. Adult women accounted for 17.8 (15.4-20.3) million people living with HIV (PLHIV; UNAIDS, 2016b) and 2.3 million were AGYW (UN Women, 2016). Researchers have estimated that only 15% of HIV-positive girls 15 to 24 years old are aware that they are HIV-positive (UNAIDS, 2015). AIDS is now considered a mature generalized hyperendemic in SSA countries, where it is transmitted mainly through heterosexual sex (Dellar et al., 2015; Idele et al., 2014; Robinson et al., 2017). Heterosexual transmission is estimated to be responsible for at least 90% of all incident HIV infections (Robinson et al., 2017). In the next section, I will review the mortality, prevalence, and incidence of HIV globally, in SSA countries, and in Mozambique.

AIDS-related mortality: Globally and SSA countries. HIV weakens the immune system if left untreated, which eventually leads to people living with HIV (PLWHIV) to develop opportunistic infections and cancers (CDC, 2018). This stage of the disease is called the acquired immunodeficiency syndrome (CDC, 2018). It is estimated that 35 million people have died of AIDS since the first case was reported by the CDC in 1981 (UNAIDS, 2016d). In 2015, 890,000 (830,000 – 1,200,000) people died of AIDS (UNAIDS, 2016d), making AIDS the first cause of death for adults living in SSA countries (Joint United Nations Programme on HIV/AIDS, 2014) and the second leading cause of death among adolescents (Dick & Ferguson, 2015).

Progress to reduce AIDS deaths has been uneven across countries and across different segments of the population. Between 2005 and 2012, a reduction of 32% in AIDS-related deaths was reported in the general population. During the same period, however, a 50% increase in AIDS related death was noted in the 10- to 19-year-old age

group (UNICEF, 2013). This is alarming, given that AIDS-related deaths among young people was not on the top ten list of causes of death among adolescents in 2005 (Dick & Ferguson, 2015).

AIDS-related mortality: Mozambique. Mozambique is one of the countries severely affected by AIDS deaths. In 2015, 62,000 people died of AIDS, which accounted for 40% of all adults' deaths (UNAIDS, 2016b). Scholars have estimated that 393 out of every 100,000 deaths are due to AIDS, with significant variations noted across the Mozambican provinces—ranging from 247 deaths per 100,000 to 847 deaths per 100,000 persons. (UNICEF, 2017b).

Prevalence and incidence of HIV: Globally and SSA countries. Eighty percent of all people living with HIV reside in 10 countries, of which seven are in SSA (Joint United Nations Programme on HIV/AIDS, 2014). Of all people with HIV, South Africa accounts for the most significant percentage of PLHIV with 25%, followed by Nigeria (13%), Mozambique (6%), Uganda (6%), Tanzania (6%), Zimbabwe (6%), Kenya (6%), Zambia (4%), Malawi (4%), and Ethiopia (3%; Joint United Nations Programme on HIV/AIDS, 2014).

In 2015, the highest prevalence of HIV in the adult population was found in Swaziland (28.8%) followed by Lesotho (22.7%), Botswana (22.2%), South Africa (19.2%), Zimbabwe (14.7%), Namibia (13.3%) Zambia (12.9%), Mozambique (10.5%), Malawi (9.1%), Uganda (7.1%), Tanzania (4.7%), and Kenya (5.9%). Researchers have estimated that 70% of the countries with the highest number of PLHIV are from SSA countries; however, all the countries with the highest prevalence of HIV are found in SSA (Africa, Health, Human & Social Development Information2016).

In 2016, 1.8 million (1.6-2.1) adults were newly diagnosed with HIV (UNAIDS, 2016b). This amounts to an 11% decrease in the number of incident cases per year compared with 2011 (UNAIDS, 2016b). Of all incident cases of HIV, 64% were found in SSA countries, totaling 710,000 (630,000 – 790,000) incident cases (UNAIDS, 2016d). Although AGYW aged 15 to 24 years account for 17% of the population of SSA, they represent 25% of all new HIV infections (UNAIDS & WHO, 2012).

Prevalence and incidence of HIV: Mozambique. Mozambique is one of the SSA countries most affected by HIV. HIV was first reported in Mozambique in 1986 (Audet et al., 2010). As in other SSA countries, heterosexual transmission is the most common form of HIV transmission, followed by vertical transmission from mother to child (Audet et al., 2010). In 2016, 1,623,822 Mozambicans were estimated to live with HIV (UNAIDS, 2016d).

Substantial variations in HIV prevalence are reported in Mozambique conditional on age, gender, and residence. In 2015, the overall prevalence of HIV in the adult population of Mozambique was 13%, 10.2% for men, and 15.1% for women. The prevalence of HIV ranged from 24.4% in the southern provinces (i.e., 17.6% men and 28.2% women) to 5.2% in the northern provinces (i.e., 3.3% men and 6.4% women; National Institute of Health Mozambique, 2015).

Although the incidence of HIV has been reduced by 40% since 2010, 83,000 (73,000 – 96,000) Mozambican adults were estimated to have acquired HIV in 2016 (UNAIDS, 2016b), which classified Mozambique as the second country with the highest number of new HIV infection in the world after South Africa (UNAIDS, 2016b).

Disparity in HIV prevalence between AGYW and ABYM are reported in most countries. The inequality, however, is greater in countries with a generalized HIV epidemic (Glynn, Biraro, & Weiss, 2009). In most SSA countries, the differences in HIV prevalence between boys and girls starts around the age of 15 years (Idele et al., 2014). In Swaziland, the HIV prevalence between boys and girls is roughly the same before age 14 years but is five times higher for 15- to 19-year-old girls compared with boys the same age (Idele et al., 2014; UNAIDS, 2015). In SA, the overall prevalence of HIV was reported to be up to six times higher for AGYW compared with ABYM with an HIV prevalence of 0.7% for boys and 6.6% for girls aged 15 to 19 years and 6.1% compared with 17.4% for those aged 20 to 24 years (Shisana et al., 2014; Zuma et al., 2016). The disparity in HIV prevalence between AGYW and ABYM has not significantly changed over time, as scholars have evidenced through HIV surveys conducted in SA between 2008 and 2012 (Zuma et al., 2016) and in other SSA countries between 2001 and 2013 (Kharsany et al., 2015).

As with prevalence, the incidence of HIV among AGYW varies across and within SSA countries. In SA, the number of incident case of HIV was four-times higher for girls at 2.54% (2.04-3.04) compared with boys the same age at 0.55% (CI 0.45-0.65; Zuma et al., 2016). In Mozambique, 7% of AGYW aged 15 to 19 years were HIV-positive, compared with 2% of boys the same age, and among those aged 20 to 24 years, the prevalence was 13% for young women, compared with 5% for men the same age (National Institute of Health Mozambique, 2015).

Second Layer of the MSEM: Public Policies

The second layer of the MSEM includes public policies related to HIV prevention and HIV care. Policies play an essential role to promote and protect the health of

individuals and communities. Policies are especially important when it comes to vulnerable populations such as AGYW (Dick & Ferguson, 2015; Underwood et al., 2011). Public policies can improve the health and wellbeing of AGYW by addressing the social, cultural, and economic barriers they are confronted with, mostly due to gender inequalities (The Global Fund, 2017).

In this section, I will review the structural factors and policies that may affect AGYW vulnerabilities to HIV, for which information is available in the HPS. The literature review includes information on the effect on the HIV serostatus of AGYW of sexual and gender-based violence (SGVB), child marriage (i.e., being married or living as married before the age of 18 years), poverty, access to education, access to sexual and reproductive health (SRH) services, and access to HIV testing. In the HPS, information is available on AGYW experience of SGBV, civil status (i.e., married, living as married, single), education (i.e., in school or not), pregnancy status (i.e., was pregnant the day of the HPS or had a baby the year prior to the HPS), and HIV status (i.e., positive, negative).

Experience of sexual and gender-based violence. Sexual and gender-based violence is defined as physical (e.g., slaps, kicks), emotional, psychological (e.g., belittling, intimidation), or sexual abuse (e.g., rape, coerced sex) that is perpetrated against someone based on their gender or inflicted because of unequal power in a relationship (UNHCR, 2018). Boys and men can be victims of SGBV; however, women and girls are disproportionally affected. Worldwide, scholars have estimated that one in 10 girls are raped or sexually abused before they are 20 years old (UNICEF, 2014), and that one in three women have experienced SGBV (World Health Organization, 2013).

In most countries, laws that ensure AGYW live in a safe environment free of sexual and physical violence are frail (Abdool Karim & Baxter, 2016; Chandra-Mouli, McCarraher, Phillips, Williamson, & Hainsworth, 2014; Loud, 2012). When such laws do exist, their impact can only be felt by AGYW if they are enforced at the community and or the government level (Underwood et al., 2011). In some countries, even when cases of economic and sexual exploitation of AGYW are identified, little is done to follow up on the issues (Underwood et al., 2011). In other communities, intimate partner violence (IPV) may be perceived as a normal component of a relationship and may even be perceived as a sign of love (Butts et al., 2017). In some countries, stigma and shame may prevent victims from seeking help (Abdool Karim & Baxter, 2016; Chandra-Mouli et al., 2014; Loud, 2012) and young victims of sexual violence may feel embarrassment or may be afraid of their parent's reaction if they reveal that they were victims of sexual abuse (Moore, Awusabo-Asare, Madise, John-Langba, & Kumi-Kyereme, 2007). Structural (e.g., access) and cultural norms (e.g., need permission from partner or parents to access services) may also prevent women from requesting SGBV and SRH services (Robinson et al., 2017). Finally, governments may be failing to enforce the laws and regulation even when victims of SGBV report events (Abdool Karim & Baxter, 2016; Underwood et al., 2011).

The consequences of sexual and gender-based violence include physical, emotional, and mental health problems (Abramsky et al., 2014; Ellsberg et al., 2015). Numerous scholars have found an association between intimate partner violence (IPV), SGBV, and HIV. In a pooled estimate of 28 studies conducted in 16 countries including 331,468 women, a statistically significant association was found between IPV and HIV

among the women of the general population compared with women at risk (e.g., sex workers), with an odds ratio of 1.44 (95% CI, 1.10, 1.87) in cohort studies and an odds ratio of 2.0 (95% CI, 1.24-3.22) in cross-sectional studies (Li et al., 2014). The same positive association was found in a review of data collected in the Demographic Health Surveys (DHS) of 12 SSA countries (Durevall & Lindskog, 2015). Married women who were victims of physical abuse were found to have an adjusted odds ratio of being HIV-positive of 1.22 (1.096-1.396)compared with women who did not report abuse while women in their first union with no premarital or extramarital sex, who reported SGBV had an adjusted odds ratio of 1.423 (1.232-1.643) of being HIV positive compared with women who did not experience SGBV (Durevall & Lindskog, 2015). Furthermore, the association between HIV acquisition and IPV increased when the prevalence of HIV was higher than 5% in the community (Durevall & Lindskog, 2015). The same association between SGBV and HIV was found in Tanzania, Uganda, and SA. In Tanzania, Msuya et al. (2006) found that among pregnant women who reported a partner who is physically or verbally abusive the increased risk of HIV was 1.66 (1.13-2.43, p.01). In Uganda, women who reported SGBV had an increased risk of HIV of 1.55 (95% CI 1.25-1.94, $p = .0000$; Kouyoumdjian et al., 2013), while in SSA countries, the odds ratio ranged from 1.22 and 2.60 (Kouyoumdjian et al., 2013).

SGBV and IPV are prevalent in many countries. More than one in four married couples (26.1%) reported IPV in 21 SSA countries (UNAIDS, 2016c). The percentage of girls aged 15 to 19 years who reported sexual violence in their lifetime ranged from above 20% in Cameroun and the Democratic Republic of Congo; above 15% in Uganda, Zimbabwe, Malawi, Zambia; close to 10% in Mozambique; and the lowest percentage

was reported in Ukraine and Cambodia (UNICEF, 2014). In Namibia, researchers estimated that 50% of girls aged 15 to 19 years have experienced SGBV by a partner (UNAIDS & WHO, 2007).

In Mozambique, 9% of girls aged 15 to 19 years reported forced sexual acts in their life, and close to 5% reported SGBV in the last year (Joint United Nations Programme on HIV/AIDS, 2014). SGBV was reported by 18% of women aged 20 to 24 years, with 73% of the offenders being their husband (National Institute of Health Mozambique, 2011). During a national survey, SGBV was reported by 24% of Mozambican women with a range of 10% to 40% depending on the province where the women were interviewed. Of those who reported SGBV, only 46% sought help, of which 60% help was limited to family, and did not include health or legal help (National Institute of Health Mozambique, 2015).

Coerced sex. Sexual coercion occurs when a woman feels she does not have a choice to avoid sexual intercourse (Moore et al., 2007). Sexual violence may be perceived as normal by the AGYW, ABYM and the community (Moore et al., 2007). Globally, 30% of women who had sex before the age of 15 in a multi-country study reported that they were forced (World Health Organization, 2005). Forced sex is reported by both boys and girls. It was reported by high school students in SA and Kwa Zula Natal by 6.7% of boys and 6.9% of girls (Abdool Karim et al., 2014). Different types of coerced sex forced sex were listed by youth living in Burkina Faso, Ghana, Malawi, and Uganda, including pressure through money or gifts; flattery, pestering, threatening to have sex with other girls, passive acceptance. Coerced sex was reported by 15% of AGYW living in Burkina Faso, 23% of those living in Uganda, 30% of AGYW living

Ghana, and 38% of AGYW lining in Malawi (Moore et al., 2007). The percentage of girls that were very willing to have sex in the same countries ranged from 41.3% to 57.3% (Moore et al., 2007).

Sexually abused children were found to engage in riskier sexual behaviors, have an earlier sexual debut, use less condoms, and have more sexual partners (LeClair, 2012). The association between sexual abuse and risky sexual behaviors are seen across countries. In SA, 9.5% of victims of childhood trauma had more than four sexual partners in the last year, and only 54.1% of them used a condom at their last sexual encounter (Gibbs et al., 2018). Children who were sexually abused were found to engage more in transactional sex with an odd of 1.52 (1.07-2.16), compared with youth with no history of sexual abuse (Gibbs, Willan, Misselhorn, & Mangoma, 2012). In Malawi, victims of physical or sexual violence were more at risk of infrequent use of condom with an odds ratio of 2.7 (95% CI, 1.0-7.8; VanderEnde et al., 2018). Young women victims of sexual abuse are also less likely to procure services for HIV prevention care and treatment compared with older (Abdool Karim, Baxter, & Birx, 2017).

AGYW may feel they are not entitled to refuse sex to their partners (Jewkes & Morrell, 2010; Laga et al., 2001; Loud, 2012; Mabaso, 2017; Mabaso et al., 2018; UNAIDS & WHO, 2012). Having sex may be perceived as a marital right and women are seen as the possession of their husband (UNAIDS & WHO, 2012). In some case, AGYW may be coerced or forced to have sex, and legal sanctions against the perpetrator do not often occur (Moore et al., 2007). In multi-country survey that was conducted in Burkina Faso, Ghana, Malawi, and Uganda among sexually active girls aged 12 to 19 years old, the author found that between 14.9 and 38.1% of girls reported that they were coerced to

have sex, and between 41.2 and 57.3% of girls reported to be willingly having sex (Rwenge, 2013).

The HPS contains information on experience of SGBV by AGYW, of which coerced sex is a subset. The AGYW were asked four questions assessing experience of SGBV with sexual partners, caregivers or family members in the last year. The experience of SGBV and coerced sex is limited to the last 12 months. This may limit the ability to assess the link of SGBV and HIV if the AGYW experienced SGBV more than 1 year prior to the HPS.

Civil status. Getting married early increase the risk of early pregnancies, dropping out of school, SGBV, and HIV (UNAIDS, 2015). AGYW who marry early may be less able to negotiate the use of condoms, control their SRH, and make their own decisions (UNAIDS, 2015). Factors associated with early marriage are poverty, low access to primary care and lower education (Raj & Boehmer, 2013). Girls who marry early are more at risk of SGBV (Raj & Boehmer, 2013) and may have a limited say in the number of children they want (UNAIDS, 2015). In Mozambique, a girl will have her first child on average 15 months after getting married (UNICEF, 2017b). In 2011, 38.7% of Mozambican who married before they were 15 years old had a child, compared 2.6% if they were not married. When girls were married between the age of 15 to 18 years, 51.2% had a child before they were 18 years old, compared with 10.3% of girls that were not married (National Institute of Health Mozambique, 2011).

Mozambique ranked ninth in the world and second in SSA countries for child marriage (UNICEF, 2015). This is despite a family law instigated in 2004 to prevent marriage before the age of 18 years (UNICEF, 2017a). In 2015, 52% of Mozambican

girls were married before they were 18 years old, and 14% before they were 15 years old (UNICEF, 2015). The prevalence of young girl being married before 15 years old varied between 2.5% in the south to 24.4% in the north of the country (National Institute of Health Mozambique, 2011). Variation in child marriage was also reported between urban and rural settings (i.e., 11.5% versus 16.5%, respectively). Similar variations were noted for marriage before the girls turned 18 years, with a range of 14.9% to 62.3% depending on the province and urbanicity. For boys, marriage rates under the age of 18 years ranged from 1.6% to 14.9% (National Institute of Health Mozambique, 2011).

One of the variables chosen for the analysis is the civil status of the AGYW. In the HPS participants are asked if they are married, living as married, single, divorced or widowed. For the analysis, a variable was created for AGYW who state they are married or living as married and who are less than 18 years old. This variable was one of the risks to HIV for AGYW assessed in the logistic regression model.

Poverty. The association between poverty and HIV is debated. Butts et al. (2017) discovered a positive association between poverty and HIV especially for AGYW. One of the pathways to HIV infection may be due to women and AGYW with low or no income engaging in unprotected transactional sex which increases their risks of acquiring HIV (UNESCO, 2013). Others have noted that poverty is associated with lower condom use, earlier sexual debut, having multiple partners, or the first experience of sex being coerced or transactional sex in AGYW (Mabala, 2006). Gillespie, Kadiyala, and Greener (2007) did not find a direct association between poverty and HIV when they reviewed eight studies conducted in SSA countries. Instead, Gillespie et al. argued that the association found between poverty and HIV is caused by mediating factors such as

education, residence, sexual risk-taking, condom use, and voluntary medical male circumcision. In a review of seven SSA countries, the authors concluded that poverty was positively associated with HIV in some countries, with some countries reporting variation within the country (Hargreaves, Davey, Fearon, Hensen, & Krishnaratne, 2015).

In Mozambique, researchers have estimated that 54% of the population lives below the poverty line (Central Intelligence Agency, n.d.). Using information collected in the HDSS linked to the CP dataset, it was anticipated to create a proxy for poverty. It was not possible to combine the information on access to electricity and the presence of indoor latrine in the household where the AGYW lives to the HPS questionnaire, and the variable poverty had to be dropped from the analysis.

Influence of being in school on HIV. Education help protects the rights of youth and protects them against HIV (UNICEF, 2015). Lower education is correlated with higher fertility, early marriage, early pregnancies, less wealth, and greater exploitation (UNICEF, 2015). Women with more education are more likely to negotiate safe sex and adopt safer sexual behaviors (Jellema & Phillips, 2004; Mabaso, 2017; Mabaso et al., 2018). Boys and young men with higher education are more likely to know about HIV, know how to protect themselves and are more likely to be receptive to the use of condoms (Jellema & Phillips, 2004). Staying in school also was found to protect AGYW from HIV by limiting the number and type of sexual partners (Stoner et al., 2017). Thus, education is an important factor to improve the health of youth and especially AGYW.

Education is one of the interventions that can help prevent HIV. With 6 years of primary school education, girls were in a better position to remain HIV-negative (UNICEF, 2013). In Botswana, for each additional year of secondary school, a reduction

of 11.6% in HIV incidence was noted among young girls with a global reduction of HIV of 8.1% (De Neve, Fink, Subramanian, Moyo, & Bor, 2015). In SA, prevalence of HIV was 6.4% for girls in school, compared with 18.3% for out of schoolgirls (Abdool Karim et al., 2014). Researchers have estimated that the cost per HIV infection averted with education is $27,753 USD (De Neve et al., 2015).

Good school attendance (i.e., more than 80% of the time) was also found to be an important factor in the prevalence of HIV and herpes simplex virus (HSV2; Stoner et al., 2018). When girls had good attendance, their prevalence of HSV2 was 6.7%, compared with 15.1% for girls with low attendance, and the HIV prevalence was 4.7% versus 6.3% for those with poor attendance (Stoner et al., 2018). The difference appeared to be mediated by the age of the sexual partner, with the protective effect of school limiting the selection of sexual partners closer in age and less likely to be infected with HSV2 and HIV (Stoner et al., 2018).

In Mozambique, 17% of girls and 18% of boys were enrolled in secondary education in 2015 (National Institute of Health Mozambique, 2015). Scholars have estimated that only 34% of Mozambican girls will finish primary school (National Institute of Health Mozambique, 2015). In 2015, 63.7% of AGYW were literate, compared with 75.6% of boys the same age (National Institute of Health Mozambique, 2015). When it comes to education and literacy, there are marked differences that are found across the different provinces of Mozambique.

One of the independent variables in the logistic model is being in school. One of the HPS questions evaluates whether the AGYW are currently in or out of school. A

variable was created for in school (i.e., yes or no). The HPS did not contain information on school attendance which could be a mediating factor for some AGYW.

Access to sexual reproductive health education. Most youth are not well prepared to face the biological and psychological changes that they experience during puberty (Chandra-Mouli et al., 2015). Youth need a comprehensive sexual and reproductive health education that includes information about body changes, sexuality, reproduction, contraception, information about sexually transmissible infections, including HIV, and how to reduce their risk of acquiring HIV (Chandra-Mouli et al., 2014, 2015; Montgomery, Hennegan, Dolan, Wu, & Scott, 2016). Comprehensive SRH courses should be given before youth become sexually active by providing them with information on how to stay safe and how to avoid unwanted sexual intercourse (Moore et al., 2007).

A key to ending HIV among the AGYW population include access to sexual reproductive health and HIV testing (HTC; UNICEF, 2015). Access to comprehensive SRH, including information about HIV, is essential to ensure that AGYW can remain healthy (Phillips & Mbizvo, 2016). In 2014, only 30% of youth had a correct and comprehensive knowledge of HIV, which is an increase of only 10% since 2010 (Chandra-Mouli et al., 2015). In eastern and southern Africa, scholars have estimated that 67.4% of girls aged 15 to 24 years old do not use any form of family planning (MacQuarrie, 2014). Among sexually active young women, 33% of girls aged 15 to 19 years old had a child, and 59% of those are 20 to 24 years old (Pettifor et al., 2016). Unmet family planning needs are higher among AGYW who are unmarried and among the younger girls (MacQuarrie, 2014).

Without access to SRH, the risk of unwanted pregnancies and the negative consequence of being sexually active without protection increase (Chandra-Mouli et al., 2014). As a result of early pregnancy, AGYW are more at risk of dropping out of school, having a child born prematurely, and having a second child in a short period. Furthermore, it is estimated that maternal deaths account for 26% of all deaths of young women (Chandra-Mouli et al., 2014). Teenage pregnancies are also highly correlated with HIV (Abdool Karim et al., 2012; Kharsany et al., 2014). By meeting the SRH needs, including family planning, it may be possible for AGYW to significantly improve their health outcomes.

Mozambique ranked eleventh in countries for unmet needs for family planning (MacQuarrie, 2014). The pregnancy rate among 15 to 19 years old is 8.2% (National Institute of Health Mozambique, 2015). Among those aged 15 to 24 years old, 47% of girls who are unmarried and 23.1% of those who are married reported unmet family planning needs (MacQuarrie, 2014). Contraception was reported by 8.4% of girls aged 15 to 19 years (i.e., 5.9% of married and 26.9% not married) and by 15.3% of young women aged 20 to 24 years. The STI rate among those aged 15 to 24 years is 4% (National Institute of Health Mozambique, 2015). Researchers have estimated that 26.2% of AGYW do not have their SRH needs met (National Institute of Health Mozambique, 2015).

Pregnancies. Globally, 16 million babies are born annually to mothers who are 15 to 19 years old, and 1 million to mothers who are under 15 years old (Chandra-Mouli, Camacho, & Michaud, 2013). Worldwide, 20% of girls will have their first child before they are 18 years old; this percentage increase to 33% in developed countries (Chandra-

Mouli et al., 2013). Death during childbirth is five times more likely to occur if the girl is pregnant before being 15 years old, and two times more likely if she is 15 to 19 years old, compared with women above 20 years (Patton et al., 2009). Girls who become pregnant are less likely to be able to negotiate or access SRH and are more likely to drop out of school, which increases their risk of HIV (Gilbert & Walker, 2002). Guidelines to prevent early pregnancies were released by the WHO which list the contributing factors to early pregnancies, the action, and recommendation and list some research recommendations (Chandra-Mouli et al., 2013). The six domains chosen to reduce pregnancies and improve reproductive outcomes among young girls are to: (a) prevent early marriage, (b) create understanding and support for early pregnancies, (c) increase the use of contraception, (d) reduce coerced sex, (e) reduce unsafe abortion, and (f) increase skilled antenatal, childbirth, and postpartum care (Chandra-Mouli et al., 2013).

Early pregnancies vary across the different provinces of Mozambique. It is possible to look at trends of young girls who become pregnant before the age 15 or 18 years across provinces of Mozambique over time using the National HIV Surveys conducted every 5 to 8 years. In 2011, the percentage of AGYW who had their first child before 15 years old ranged from 2.8% in the south of Mozambique to 11.7% in the north (UNICEF, 2015). Between 1997 and 2011, the percentage of girls getting pregnant before being 15 years old has gone in both directions with some province demonstrating a significant increase (i.e., 1.1% to 4.9%) and other provinces a significant decrease (i.e., 11.9% to 8.8%; UNICEF, 2015). In 2011, the percentage of girls who had their first babies before they were 18 years old ranged from 20.5% to 51.7%, with a decrease in percentage since 1997 in all but one province (UNICEF, 2015).

The CP dataset information includes whether AGYW are currently pregnant or if they had a baby in the last year. As with SGBV information is available only for the last year which can limit the capacity to measure its effect on HIV acquisition among AGYW.

HIV status. Awareness of HIV status is a fundamental step in the prevention and treatment of HIV (Baxter & Abdool Karim, 2016; World Health Organization, 2015a). To reach HIV epidemic control, the Joint United Nations Programme on HIV/AIDS (2014) aimed to have 90% of people living with HIV knowing that they are HIV-positive. Testing for HIV is the first step to better health. When diagnosed with HIV, PLWHIV can be linked to care and treatment reducing their risk of mortality and morbidity. When found, HIV-negative people can be counseled to remain HIV-negative by using condoms, reducing the number of sexual partners, and being referred to other HIV prevention interventions such voluntary medical male circumcision (World Health Organization, 2015a). HIV testing is vital to identify HIV-positive people and to help improve HIV prevention behaviors for those found HIV-negative.

Detecting HIV infection early is essential both to reduce morbidity and mortality related to HIV and reduces the risk of transmission of HIV to sexual partners (Joint United Nations Programme on HIV/AIDS, 2014). Globally, 52% of people living with HIV are aware of their HIV-positive serostatus (Joint United Nations Programme on HIV/AIDS, 2014). 61% of adult Mozambicans are aware of their HIV-positive status, with a range of 46 to 71% across the country (UNAIDS, 2017). The awareness of serostatus among HIV-positive youth is considerably lower (Kharsany et al., 2014). Globally, only 15% of HIV-positive AGYW know of their HIV-positive status (World

Health Organization, 2015a). In SA, only 9% of HIV-positive youth knew they were HIV-positive (Wagner et al., 2017). Low awareness of HIV among youth may be because the HIV infection is recent, which is more likely among young people (Kharsany et al., 2014). The percentage of youth who have done an HIV test is extremely low among youth living in SSA countries. Although coverage of HIV testing varies among SSA countries, between 2008 and 2012, only 29% of girls and 20% of boys aged 15 to 19 years old were ever tested for HIV (Idele et al., 2014).

In the HPS information is available on the history of HIV testing (i.e., if never tested for HIV, if plan to test for HIV in the following months). For the analysis, the HIV status of the AGYW was determined by the result of the home-based HIV rapid test conducted the day of the interview of the HPS. The result could be HIV-negative, HIV-positive, or indeterminate. If the AGYW reported a prior HIV-positive result, her HIV status was considered to be HIV-positive.

Third Layer of the MSEM: Community

In this layer of the MSEM, I will describe the community influence on the vulnerabilities of the AGYW to HIV. Communities are important because they provide the culture and social norms in which individuals and families are living (Kharsany & Abdool Karim, 2016). Women may be at higher risk of HIV due to social and cultural norms that create gender inequality (UNAIDS, 2016c). Gender and sexual norms effects on AGYW are nor measured directly in the HPS; however, gender and sexual norms can influence attitudes and behaviors of AGYW regarding the use of condoms, number of sexual partners, accepting infidelity of their male sexual partners, use of drugs and alcohol, staying in school, getting married, and HIV testing.

Gender norms. Harmful gender norms and gender inequality increase the risk of AGYW contracting HIV (Amaro, 1995; Butts et al., 2017; Harrison et al., 2015; Slabbert et al., 2015), and may encourage early marriage and early pregnancies. In addition to preventing young girls to pursue an education (UNAIDS, 2016c). In many countries, "Girls are born and raised in communities where they are not treated as equals, they are not permitted to decide their own health care" (UNAIDS, 2015, p. 5). Women are expected to be submissive and defer to their partners and violence may be perceived as normal or acceptable (Butts et al., 2017). Concepts of normality about SGBV persist in communities, as De Vries et al. (2014) concluded. In Malawi, Fedor, Kohler, and McMahon (2016) found that men were expected to have many sexual partners and women were expected to be faithful. Numerous studies have demonstrated the negative impact of gender imbalance in disparities in the health of women (Klein, Lomonaco, Pavlescak, & Card, 2013; Saleh-Onoya et al., 2009; Sarnquist et al., 2014; Teti et al., 2010; Wechsberg, Luseno, Kline, Browne, & Zule, 2010; Wingood et al., 2004). Gender norms and gender inequalities can prevent AGYW from accessing SRH, HIV testing, or from reporting SGBV (Bekker, Johnson, Wallace, & Hosek, 2015; Fedor et al., 2016; UNAIDS, 2015). Recognizing the importance of power issues and gender norms on individual behaviors is essential; therefore, the WHO (2018) recommended that SRH include intervention components to empower women.

Sexual norms. Sexual norms are transmitted across generation and girls are socialized to accept male dominance (Connell, 2003; Edin et al., 2016). Women are taught to be subordinate and accommodate the needs of men (Jewkes & Morrell, 2010; Loud, 2012). Uneven power dynamics may shame AGYW for expressing their sexuality

and may encourage subordination to their male partners (Moore et al., 2007; UNAIDS, 2015). AGYW may know what they can do to prevent themselves from HIV; however, they may feel unable to ask their partner or family to support them in their decisions (Slabbert et al., 2015). Some AGYW may be prevented from getting the information they need about their sexual health and may be unable to negotiate safe sex (Jewkes & Morrell, 2010; Laga et al., 2001; Slabbert et al., 2015). AGYW may be discouraged to carry condoms because it may be seen as a sign that they are promiscuous (Wingood & DiClemente, 2000). Motivation to be in a relationship is different for boys and girls. In a randomly selected youth survey in SA, girls reported they wanted a relationship to be admired, while boys reported that wanted to have sex. Boys also reported that they felt pressure to perpetuate gender norms (Edin et al., 2016). In some areas, women may accept sexual practices such as the insertion of a drying agent in the vagina to increase men's pleasure; this is known as *dry sex*. This practice may increase the risk of HIV acquisition to women by creating small abrasion inside the vagina (Ramjee & Daniels, 2013). Dry sex is still a practice in part of Mozambique (Audet et al., 2010).

Fourth Layer of the MSEM: Social and Sexual Network

In this layer of the MSEM, I will review the social and sexual network which can influence the HIV risks of AGYW. This section includes information about characteristics of the male sexual partners and how it can influence the HIV risks of AGYW. Some of the variable available in the HPS include the age difference between the AGYW and her male sexual partner, her partner's type of employment, the type of relationship the AGYW has with her partner, the faithfulness of the partner, and the HIV status of the partner. These variables were used as independent variables to assess whether these partner characteristics were associated with the HIV status of the AGYW.

Age difference of male sexual partners with AGYW. The age of the sexual partner can play an important role in the risk of HIV acquisition for AGYW. Age-disparate relationships are believed to be an important driver of HIV infection among AGYW (Gouws & Williams, 2017). Researchers conducting investigations in South Africa (Jewkes, Dunkle, Nduna, & Shai, 2012; Kharsany et al., 2015; Mabaso, 2017; Maughan-Brown, Evans, & George, 2016; Pettifor et al., 2005), Zimbabwe (Schaefer et al., 2017), and Tanzania (Msuya et al., 2006) have confirmed an association between AGYW age-disparate relationships and HIV. The authors of two studies conducted in Kwa Zulu Natal (Harling et al., 2014) and SA (Balkus et al., 2015), however, did not find the same association between HIV and older sexual partners. In the VOICE trial, the reported hazard ratio (HR) of HIV for AGYW with a sexual partner 5 to 10 years older was 1.0 (95% CI 0.74, 1.35), and 0.92 when the sexual partner was more than 10 years older (95% CI 0.49-1.74; Balkus et al., 2015). Another study which found no association between age discordant relationship and HIV was conducted by Harling et al. (2014) using surveillance Kwa Zulu Natal data between 2003 and 2012. The lack of association held true when the authors accounted for marital status, education, and household wealth (Harling et al., 2014).

AGYW may engage in a relationship with older men for different reasons varying from love to financial and social security (Abdool Karim et al., 2017). Some AGYW may engage in sex with older men because they perceive that they have more money to pay for necessities (Underwood et al., 2011). Age difference with sexual partners is more prevalent among girls than among boys. In a study conducted with high school students in SA, boys were more likely to have a partner closer to their age or younger, while one

in three young girls reported having a partner who is older by at least 4 years (Abdool Karim et al., 2014). Sturdevant et al. (2001) found that the average age difference between AGYW and their sexual partner ranged between 3 and 6 years. The trends of age-disparate relationship have varied between 2002 and 2012 for youth aged 15 to 19 years old in SA, ranging for girls between 18.5% (2005) to 33.6% (2012), while ranging for boys between 0.3% (2002) to 4.15 (2012; Zuma et al., 2016). In 2012, 33.6% of young women stated they engaged in an age-disparate relationship, versus 4.1% of young men—both the highest percentage reported since 2002 (Zuma et al., 2016).

AGYW with older partners have reported different HIV prevention behaviors than women who have partners the same age as they are. In a review of sexual behaviors of women in an age-disparate relationship in SA, young women in age discordant relationship reported more unprotected sex (aOR1.51, 95% CI1.09-2.11), and were more likely to describe the relationship as transactional (aOR 2.73 95% CI 1.64-4.56; Maughan-Brown et al., 2016). These factors are likely to put AGYW more at risk of HIV.

Mozambique and intergenerational sex. In the 2011 HIV National Survey of Mozambique, transactional sex and age-disparate relationship sex were associated with poverty, unemployment, and low usage of condoms (National Institute of Health Mozambique, 2011). Of all girls aged 15 to 19 years old, 10% had a sexual partner more than 10 years older in the last 12 months, compared with 0.2% for boys the same age. The percentage of girls in age disparate relationship was 12% in a rural area, compared with 8% for those living in urban areas. The prevalence of HIV was 50% higher among the girls who had a sexual partner 10 years older than themselves, compared with those

with a partner of the same age (National Institute of Health Mozambique, 2011). These results are similar to what De Vries et al. (2014) found in SA. The age difference between the AGYW and her sexual partner was calculated using two HPS variables. The age of the AGYW the day of the interview and the age of the male sexual partner as reported by the AGYW.

Faithfulness of sexual partner, type of relationship, HIV status of partner. Other characteristics of male sexual partners of AGYW that can increase the risk of HIV are the unfaithfulness of their sexual partners and the type of relationship they have with their partner (e.g., married, casual). In one study in SA, young women who had unfaithful partners had an OR risk of being infected with HIV of 22.57 (13.51-37.69), compared with women who did not report an unfaithful partner (Msuya et al., 2006). In another study also conducted in SA, the adjusted health hazard of HIV increased risk by 4.44 (0.72-29.7) when partners had other partners (Schaefer et al., 2017). An increased risk of HIV infection was found in unmarried AGYW in a new relationship (Shisana et al., 2014). When the AGYW perceived their sexual partners to be infected the odds ratio of HIV increased to 7.46 (95% CI 3.2-17.4).

Transactional sex. Motivation and social norms regarding transactional sex (TS) varies. Young women described a continuum of experience with their TS partners ranging from purely instrumental (i.e., exchange for money or gift) to some with whom the AGYW may have romantic feelings (Chandra-Mouli et al., 2015; Choudhry, Ambresin, Nyakato, & Agardh, 2015; Ranganathan et al., 2017). The motivation for TS ranges from survival (De Vries et al., 2014; Dunkle et al., 2007; Hardee et al., 2014; Leclerc-Madlala, 2008) to procuring extra money to pay for luxury items (Underwood et

al., 2011). Some young women may be coerced or forced by their parents and families into TS in order to support their families (Butts et al., 2017; Underwood et al., 2011). In other countries, TS may be acceptable, and men may be expected to provide gifts and money to their sexual partners (Ranganathan et al., 2017).

In order to illustrate the complexity and range of distal and proximal motivation to engage in TS, Stoebenau, Heise, Wamoyi, and Bobrova (2016) developed a model which describes economic and socio-cultural processes of TS. The model was proposed after reviewing 339 articles describing TS in SSA (Figure 4). The range of motivation for TS includes responding to basic needs, increasing their social status, and love. TS is influenced with various proximal and distal factors that can overlap (Stoebenau et al., 2016). The model in Figure 4 shows the complexity and range of reasons that influences TS among AGYW.

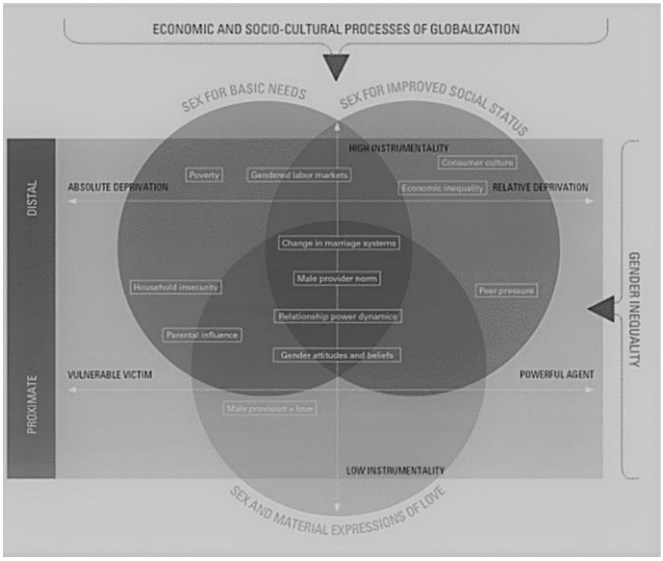

Figure 4. Economic and socio-cultural process of globalization (Stoebenau et al., 2016).

Poverty and lack of education as motivator and factor of TS are described in different African context. In Ghana, interviews conducted with women 18 to 20 years old who engaged in commercial sex work revealed that all had started looking for economic

opportunity to cover basic needs and most accepted to have sex with clients without condoms to be better paid (Onyango et al., 2012). The push factors to TS included dropping out of school, moving to the bigger cities, being alone, being unemployed, and having friends that do sex work (Onyango et al., 2012). Schaefer et al. (2017) found that the determinants of TS included socioeconomic status, marital status, rural versus urban location, and education. Education was found to reduce the risk of young women engaging in TS by 0.49 (0.36-0.68), while being from a poor household (i.e., the lowest quintile) increased the risk of TS (Schaefer et al., 2017). Orphans were more likely to engage in TS (Underwood et al., 2011). In Uganda, most women who engaged in TS came from the rural area and lower educational attainment (Choudhry et al., 2015). Sexual coercion was also reported in young women aged 15 to 24 years old engaging in TS (Choudhry et al., 2015). In Maputo, 17% of girls aged 14 to 20 years old interviewed from lower socio-economic status stated they had engaged in TS to help their families with basic needs, compared with none of the girls from the wealthier families (Machel, 2001). Meanwhile, 63% of girls of lower quintile stated they had received gifts or money for sex, as compared with 17% of AGYW of the middle class (Machel, 2001).

Young women engaging in TS may be more at risk of STI, unintended pregnancies, and sexual coercion (Moore et al., 2007). After adjusting for age and numbers of partners, the incidence of HIV among young women who engaged in TS compared with those who do not was IRR 3.29 95% (CI 1.02-10.55, p .046). The incidence rate ratio of young women who declared having a paying partner was of 2.05 (1.20-3.52 p. 009) compared with young women who did not engage in TS (Jewkes et al., 2012). In Uganda, 3.7% of women aged 15 to 24 years old reported having exchanged

sex for favors, and women who received money for sex had an odds ratio for HIV that was 8.04 (CI 95%, 2.55-25.37) higher than women who did not declare TS, after adjusting for other risky behaviors (Chandra-Mouli et al., 2015).

Young women who engage in TS may have riskier sexual behaviors. In Uganda, 12.4% of women aged 20 to 24 years old who engaged in TS had more than five sexual partners, compared with 1.8% for women who did not engage in TS (Choudhry et al., 2015). Condom use was less likely for women who engage in TS (no use of condom 21.9% for women who engaged in TS versus 15.2% for women who did not; Choudhry et al., 2015). In a focus group with young South African women, Ranganathan et al. (2017) found that women may be less able to negotiate use of condoms with their TS partners, because TS partners were described as having a more a more dominant voice in regard to use of condoms. Even though AGYM are conscious of the risk of HIV, young AGYW living in Zambia felt that knowledge of the risks of HIV acquisition when engaging in TS was not enough to prevent them from not using condoms (Butts et al., 2017). Even when conscious of the danger of TS and how to prevent HIV, AGYW may feel that they have no choice or power to adopt less risky sexual behaviors (e.g., condom use, reducing the number of sexual partners). One of the variables available in the HPS is whether the AGYW engaged in TS in her last sexual encounter. This variable will be used in the logistic regression.

Number of sexual partners and partner concurrency. One factor associated with HIV is the number of sexual partners. The odds of HIV were 10.80 (5.50-21.14) higher in women aged 15 to 24 years old who had more than five lifetime partners, and 13.38 (6.85-26.11) higher if women stated they had two concurrent partners in the last

year compared with women who had not (Moore et al., 2007). In another study, the odds ratio of HIV infection increased to 2.23 (95% CI 1.03-4.82) when AGYW had more than one sexual partner (Gouws, Stanecki, Lyerla, & Ghys, 2008; Gouws & Williams, 2017). In some SSA countries, HIV prevention to reduce the number of sexual partners did not seem to have an impact on the behaviors of men. On the contrary, a trend in an increasing percentage of young men having more than one sexual partner in the last year was reported in SA between 2002 (23%) and 2012 (37.5%); however, during that time, the number of women who had more than one partner remained the same (Shisana et al., 2014). Having more than one sexual partner was more prevalent among youth, with 22.4% of those aged 15 to 24 years reporting more than one sexual partner compared with 11.2% for those aged 25 to 49 years old and 4.2% among people older than 50 years (Zuma et al., 2016).

In Mozambique, the number of people who reported more than one sexual partner in the last year was 3% for girls and 12% of boys aged 15 to 19 years, and 4% and 24%, respectively, for those aged 20 to 24 years old. Those with a high school diploma had more sexual partners than those without (National Institute of Health Mozambique, 2015). In the current study's dataset, AGYW reported the number of sexual partners they had in the last year. This information was used in the logistic regression model (i.e., multiple sexual partner).

Fifth Layer of the MSEM: Individual Level

The last layer of the MSEM is composed of individual factors. This layer considers how individual beliefs, attitudes, knowledge, behaviors, and biological factors may affect HIV acquisition among AGYW. In this section, I will first describe the challenges of the adolescent period and then review how condom use, type of

relationship, and HIV knowledge, attitudes, and beliefs are associated with HIV. In the dissertation, I used the variables multiple partners, use of condoms, presence of symptoms suggestive of STI, HIV-related knowledge attitudes and beliefs, use of drugs or alcohol, and transactional sex with last partner as independent variables to assess whether a relationship existed between these factors and the HIV status of the AGYW.

Adolescence. In 2016, the world counted 1.2 billion adolescents aged 10 to 19 years old, representing 16% of the world population (UNICEF, 2016a). One hundred and 11 million of those adolescents live in eastern and southern Africa, with an additional 47 million aged 20 to 24 years old—which, in turn, represents 33% of the population (UNICEF, 2016). By 2050, scholars have estimated that the adolescent population in SSA will grow to 281 million (UNFPA, 2012). In a joint declaration in 2016, UNAIDS, UN Women, UNICEF, UNFPA, the World Bank, and UNESCO, and the World Health Organization stated that in order to achieve a sustainable development, it is imperative to invest in adolescent health and wellbeing. It is urgent to do so both because it is their fundamental right and it is cost-effective. Investment in adolescent health will secure triple health benefits and will avert the costs associated with ill health in the future (UNAIDS, 2016e).

Adolescence is marked with substantial physical and emotional changes (Harrison et al., 2010, 2015; World Health Organization, 2015b). Adolescence spans across the age of 10 to 24 years old and is composed of three periods with distinct biologicals social and psychological transition: 10 to 14 years old, 15 to 18 years old, and 19 to 24 years old (Bandura, 2006; Kurth et al., 2015; World Health Organization, 2015b). During this period, youth are getting ready to become adults, and in the process, they must develop

skills and internalize the roles that they will play in society (Crockett & Crouter, 2014). In each period, adolescents need to develop new competencies such as managing sexuality and learning the role they will play as an adult (Bandura, 2006). When developing interventions, the age and stage in adolescents need to be considered. Youth who are 15 years old will probably have different needs than those that are 24 years old. It is crucial to adapt interventions to fit the biological, social, and psychological needs of adolescents.

Knowledge, attitudes, and beliefs about HIV. In order to adopt behaviors that will protect them from HIV, AGYW must know about HIV, know how it is transmitted, and know how they can protect themselves (Shisana et al., 2014). Knowledge, however, is not enough, as AGYW must also be able to act on their knowledge (Phillips & Mbizvo, 2016). Surprisingly, even in countries with a generalized HIV epidemic, the percentage of boys and girls with a comprehensive knowledge of HIV is deficient. In SSA countries, comprehensive knowledge of HIV was found to be 26% among girls and 36% among boys (Idele et al., 2014).

As in other SSA countries, the comprehensive knowledge of HIV is low among Mozambican youth. Comprehensive knowledge of HIV is measured in the national HIV surveys that are conducted in Mozambique every 5 years with a series of five questions. The first two questions cover knowledge of HIV prevention (e.g., consistent condoms use and reducing the number of partners to one noninfected partner) and three questions assess general HIV knowledge (e.g., a healthy-looking person can be HIV-positive, HIV is not transmitted by mosquitoes, and HIV cannot be transmitted by sharing a plate with an HIV-positive person). Comprehensive knowledge of HIV varied depending on sex,

age, education level, urbanicity, and province where youth lived. Table 2 shows a summary of selected information from the National HIV survey conducted in 2015 stratified by age sex, age group, education, urbanicity, and region where they live (National Institute of Health Mozambique, 2015). Comprehensive knowledge of HIV by youth ranged from 17% if they lived in the north of the country to 61% if they lived in the south (National Institute of Health Mozambique, 2015). The level of knowledge found in the 2015 survey is similar to the level of knowledge found in the 2009 National survey (National Institute of Health Mozambique, 2015). Among AGYW, 58% of girls aged 15 to 19 years knew that a healthy-looking person could have HIV, 27.5% knew how to prevent HIV, and 43.2% reported using a condom during their last sexual encounter. In the 20 to 24 years old group, the results to the same indicators were 68.8%, 34.1%, and 41%, which only demonstrates a slight improvement over the younger girls (National Institute of Health Mozambique, 2015).

Number of sexual partners and HIV testing in Mozambique. The percentage of Mozambican youth aged 15 to 19 years old who had more than one partner was 2.7% for girls and 12.1% for boys aged 15 to 19 years old. 3.8% for the young women, and 24.4% for the young men aged 20 to 24 years old. Prior HIV testing was reported by 40% and 71.9% of those 15- to 19-year-old and 20- to 24-year-old girls and 18.2% and 34.4% for ABYM (National Institute of Health Mozambique, 2015; Table 2).

Table 2

Summary of the National HIV Survey of Mozambique

		A healthy person can have HIV	Knows how to prevent HIV	More than two sexual partners in the last 12 months	Used condoms in the last sex act if more than two partners in the last year	Number of sexual partners in a lifetime	Did an HIV test
Women	15-19	58	27.7	2.7	43.2	1.7	40
	20-24	68.6	34.1	3.8	41	2.1	71.9
	Without schooling	49	17.4	2	10.8	1.8	49.1
	University	92.2	64.1	1.7		2.6	90.8
	Urban	76.9	38.9	3.9	39.9	2.3	72.5
	Rural	57.5	25.3	2.4	18.4	1.9	54.5
	Gaza	85.9	27.5	2.1		2.2	80.1
	Poor	44.1	18.8	3.1	13	1.9	46.4
	Rich	78.8	43.6	4.1	45.4	2.3	76.1
Men	15-19	64.4	28	12.1	38.6	4.1	18.2
	20-24	75.1	32	24.4	39.8	6.5	39.4
	Without schooling	57.1	13.9	14.8	9.6	5.7	21.7
	University	91.1	62.3	27.1	62.4	6.5	84.2
	Urban	83	38.9	23.4	44.4	7	50
	Rural	65	26.2	18.9	10.7	6.4	29.7
	Gaza	86.7	44.1	24.7	38.2	8.0	49.7
	Poor	58.4	19.8	13.1	5.6	5.4	21.1
	Rich	85.7	43.5	25.9	53.8	7.0	57.1

Note. Mozambican National Institute of Health (2015).

Condom use. Even though consistent and correct use of male and female condoms can significantly reduce the transmission of HIV, STI, and prevent unintended pregnancy, condoms are not consistently used (Baxter & Abdool Karim, 2016; UNAIDS, 2016c). Condoms are considered be the most efficient means to reduce the sexual transmission of HIV (Chandra-Mouli et al., 2014; Joint United Nations Programme on

HIV/AIDS, 2014). When used consistently, condoms have a protective effect with an odds ratio of 0.27 (CI 95% .16-.45; Joint United Nations Programme on HIV/AIDS, 2014). More than 45 million HIV infections are believed to have been prevented with condom use since 1990 (UNAIDS, 2016a). Condoms are cost-effective at an estimated cost of $450 USD per infection averted (UNAIDS, 2016d). When used consistently in serodiscordant couples, condoms reduce the risk of HIV transmission by 70% (Giannou et al., 2016). The protective effect of condoms is even higher in the serodiscordant couples when the men are the HIV-positive partners (Giannou et al., 2016). In SA, youth who used condoms inconsistently had an increased odds ratio OR of HIV of 6.27 (2.08-18.84) compared with those who used it consistently (Naidoo, Chirinda, Mchunu, Swartz, & Anderson, 2015). Condom use is affected by structural factors (e.g., access), social factors (e.g., gender norms), and individual factors (e.g., knowledge, perceived risk of HIV, self-efficacy).

In South Africa, young people aged 15 to 24 years old were more likely to use condoms compared with the older age groups of those aged 25 to 49 years old and 50+ years old, with an average percentage of use of condom at last sexual encounter of 58.4%, 34.4%, and 12.4%, respectively (Shisana et al., 2014). Condom use was always significantly higher among young men compared with young women (Shisana et al., 2014). The percentage of young men using condoms increased from 57.1% to 85.2% between 2002 and 2008 but decreased to 67.5% in 2012. The same trend is observed in young girls—from 46.1% to 66.5%, with a decrease to 49.8% in 2012 (Shisana et al., 2014; Zuma et al., 2016).

Barriers to condom use for adolescents. AGYW face different barriers to use condoms such as lack of access, gender norms, and difficulty to negotiate its use with their sexual partners. Youth may feel unable, unauthorized or embarrassed to ask for condoms, may not be able to purchase them (Sturdevant et al., 2001; UNAIDS, 2016c). Most AGYW may believe that they do not need to use them (Sturdevant et al., 2001; UNAIDS, 2016c). AGYW have stated that the primary barrier to condom is their inability to negotiate its use (UNAIDS, 2016a). Asking for condoms may be perceived as a lack of trust in their partners or seen as a confession of unfaithfulness on their part (Baxter & Abdool Karim, 2016; Hardee et al., 2014). Some AGYW may feel that condom use is a decision under the control of men (Hardee et al., 2014; Sturdevant et al., 2001). In SA, AGYW listed intimacy and commitment as a prerequisite to have sex and perceived the act of asking for condoms as mistrust (MacPhail & Campbell, 2001). Some AGYW may be afraid to ask for condoms for fear of GBV, especially in age-discordant relationships (Karim, Abdool Karim, & Baxter, 2015; Sturdevant et al., 2001). Power imbalances between partners and disapproval of condom use is associated with lower use of condoms (Sales et al., 2008). Physical abuse, emotional abuse, an older partner, lack of parental communication and peer norms that do not support condoms use are factors that impede AGYW to use condoms (Nyamhanga & Frumence, 2014). Harmful gender norms are also reported to reduce the ability of AGYW to negotiate condoms (Butts et al., 2017). Other youth may believe sex will be less pleasurable for themselves or their partners. When available, condoms may be offered in a small quantity that will not satisfy their needs (UNAIDS, 2016c). Scholars have estimated that only eight condoms are available per sexually active person living in SSA (Joint United Nations Programme on

HIV/AIDS, 2014). A systematic review of gender inequality and self-efficacy has shown that increased condom use and reduced STI can be achieved when women are empowered (Robinson et al., 2017).

Condoms use: Mozambique. In Mozambique, condoms are distributed for free in health centers, sold for nonprofit, and sold for profit. Of men who used condoms, most stated that they obtained condoms from health centers (42%), shops (27%) and friends or school (13%; PSI, 2013). Condoms use in Mozambique remains low, with only 14.2% of men stating they had used a condom at last sex, compared with 7.8% for women (National Institute of Health Mozambique, 2011). In another study, 46.3% of Mozambican men reported that they never used a condom, and only 9.3% reported using them consistently in the last year (PSI, 2013). Condoms use varied by age, civil status, wealth, and type of partners. Condoms are more used by young men, those who are unmarried, and the men from the wealthiest quintile (National Institute of Health Mozambique, 2011). Condom use with nonregular sexual partners was reported by 38% of AGYW and by 42% of young men (National Institute of Health Mozambique, 2011). Capacity to negotiate condom when ones knows the partner has an STI was reported by 72% of men and 62% of Mozambican women (National Institute of Health Mozambique, 2015). As in other SSA countries, condom use varies depending on residence and education. Higher condom use was reported for women and men living in the urban area, and women who are more educated reported being more likely to believe a woman could negotiate condom use (National Institute of Health Mozambique, 2015).

Type of partnership. Depending on the type of relationship, AGYW may perceive they have more or less power to negotiate condom use (Chandra-Mouli et al.,

2015) and may be more at risk of HIV. AGYW may believe they do not need to use condoms or may believe they cannot ask their partner to use them based on the type of relationship they have (Phillips & Mbizvo, 2016). HIV incidence was associated with the type of partners with more risk for partners living together but not married at 3.08 (2.48-3.68), single at 2.28 (1.82-2.74), going steady at 1.99 (1.61-2.37), and married at 0.55 (0.45-0.65; Shisana et al., 2014). In 19 of 25 countries, only 60% of AGYW who stated having more than two partners reported consistent condom use (UNAIDS, 2016c). AGYW may feel more at ease to ask for condoms if the partner is a casual partner compared with a more stable relationship (Ghalla & Poole, 2009). In nonregular partnerships, condoms use is low among young people; however, young men are more likely than young women to use condoms, as scholars found in 31 out of 33 African countries that have conducted a Health Demographic Survey (UNAIDS, 2016c). Among AGYW, condom use with a nonregular partner ranged from 10% in Madagascar to 80% in Namibia, with most other countries ranging between 20 and 60% (UNAIDS, 2016c). Biological Factors Biological factors are believed to play an important role in the earlier acquisition of HIV by AGYW (Baxter & Moodley, 2015; Dellar et al., 2015; Kleppa et al., 2014).

Sexually Transmitted Infection

In the next section, I will review how sexually transmissible infections are associated in HIV transmission. I will review the risk associated with chlamydia, gonorrhea, bacterial vaginosis, and herpes simplex virus 2 (HSV2) human papillomavirus in the HPS, AGYW report symptoms suggestive of STI (e.g., discharge and sores) in the last year experience in life. These variables will be used in the logistic regression model (as control or independent variable).

The presence of sexually transmitted infection has consistently shown an increased risk of HIV acquisition and transmission (Chen et al., 2007). Naidoo et al. (2015) found that the presence of any STI was associated with increased OR of HIV of 13.68 (4.61-40.56) in young people aged 18 to 24 years old living in KwaZulu Natal.

. **Herpes Simplex Virus Type 2 (HSV2).** HSV2 is associated with an elevated risk of HIV in numerous studies conducted in SSA countries. Genital ulcer and vaginal discharge in the last 12 months increased the odds of HIV by 1.91 (95% CI 1.04-3.49) 1.75 (1.26-2.44) in young South African women part of a randomized clinical trial (Pettifor et al., 2016). In another study, the researchers found that HSV2 increased the risk of acquiring HIV by 2.8 for men and 3.4 for women (Glynn et al., 2009). Among young high school students, the prevalence of HIV was of 10.7% (95% CI 8.8-12.6) for those with HSV2, compared with 2.6% (CI 1.6-3.7) for students without HSV2 (Abdool Karim et al., 2014). In another group of young high school students, the presence of HSV2 increased the OR of HIV by 4.34 (2.64-7.13 p. 0.001; Delva & Abdool Karim, 2014). The population attributable risk of HSV2 and bacterial vaginosis to HIV was estimated to be 50% and 15% respectively in a cohort of women followed between 1993 and 2012 in Kenya (Masese et al., 2015). Lastly, in a systematic review and meta-analysis of 57 longitudinal studies, Looker et al. (2017) found that women with HSV2 had an adjusted risk ratio of HIV of 2.7 (2.2-3.4). Twelve percent of the world population, and 30% of the population living in Africa (i.e., 38% female, 25% male), are believed to carry the HSV2 (Looker et al., 2015). Ninety percent of people living with HIV were found to carry the HSV2 (Abu-Raddad et al., 2008).

Human Papillomavirus (HPV). Young women with HPV in Kwa Zulu Natal had a prevalence of HIV of 32.2% (95% CI 0.27-0.38) compared with young women who did not have HPV 22.5% (5% CI 0.21-.26; Mbatha et al., 2017).

Conclusion

AGYW remain at a disproportionate risk of acquiring HIV (Dellar et al., 2015; Mitchum, 2016; UNAIDS, 2015). AGYW have a three-fold higher risk of HIV than ABYM (Underwood et al., 2011) and acquire HIV an average of 7 years before ABYW (Dellar et al., 2015). AGYW account for 33% of all new HIV infection in SSA Africa, although they account for 17% of the population (UNAIDS & WHO, 2012). The needs of AGYW to remain HIV-negative are unmet in many countries (Adler et al., 2015; Bekker et al., 2015; Bruce et al., 2012; Plourde, Ippoliti, Nanda, & McCarraher, 2017). To this day, little is known about the specific risks of AGYW to HIV and how to remediate them (Harrison et al., 2015).

In the current study, the MSEM of Baral et al. (2013) was used to identify the different structural and individual drivers that can influence the behaviors and risks of HIV of AGYW living in SSA countries. The layers of the MSEM were used to structure the literature reviewed starting with the HIV epidemic stage, public policies, the community, the social and sexual networks and the individual level factors.
Through the literature reviewed, I identified the independent and dependent variables that could be used to respond to the research questions. The quantitative dataset selected to conduct the analysis originates from the Combination Prevention of HIV evaluation conducted in a southern district of Mozambique.

To address the specific needs of AGYW, more information is needed about their specific risk factors to HIV and evidenced-based interventions that prevent HIV among AGYW (Harrison et al., 2015; Price et al., 2018). One of the gaps identified in the literature review is the lack of information on the association between characteristics of AGYW and of their male sexual partners on the HIV status of AGYW living in SSA countries. This is especially true in Mozambique, where little specific information is available about HIV and AGYW. In the next chapter, I will detail the research questions and the methods I have selected to identify the risks of HIV among AGYW living in a southern district of Mozambique.

Chapter 3: Research Method

Introduction

My purpose in this dissertation was to identify if the HIV status of AGYW living in a southern district of Mozambique were associated with characteristics of AGYW (i.e., personal beliefs, knowledge, and behaviors) and the characteristics of their male sexual partners (i.e., age difference, type of employment, type of relationship, faithfulness to partner, HIV status). Through this study, I aimed to fill the gap in knowledge on the vulnerabilities to HIV of AGYW living in Chokwe, a southern district of Mozambique. In this chapter, I will detail the research design and rationale, the methodology (i.e., population, sampling strategy and procedures, power analysis, inclusion and exclusion criteria), the instrumentation and operationalization of the variables, the data analysis plan, internal and external threats to validity, the limitation of the study, and ethical considerations.

Research Design and Rationale

In this section, I will discuss the rationale for the research design and how it relates to the dissertation questions. I also provide an explanation of the study variables, a short definition of the variables, and the sources of information.

Research Design

By performing a secondary data analysis of a quantitative dataset collected for the Chokwe Combination Prevention of HIV (CP) evaluation, I aimed to help identify risks for HIV infection among AGYW living in a southern district of Mozambique. CP is an open census-based prospective cohort implemented in 2014. The overarching objectives of CP are to measures annually the prevalence and incidence of HIV, estimate the annual coverage of evidence-based HIV interventions, and estimate the prevalence of HIV risk

and preventive behaviors among adults living in Chokwe, a southern district of Mozambique. Annually, all eligible residents aged 15 to 59 years old covered by a Health Demographic Surveillance System (HDSS; i.e., approximately 50,000 residents) are offered home-based HIV testing. In addition, a random sample of the residents (approximately 20%) are offered to complete an HPS, which measures the uptake of HIV care and prevention interventions such as antiretroviral therapy, voluntary medical male circumcision, prevention of mother to child transmission of HIV, HIV counseling, and assess behaviors (e.g., condom use) attitudes, and beliefs about HIV. The CP dataset contains, since 2016, additional question directed at AGYW and men 15 to 59 years old who have sex with AGYW (National Institute of Health, 2016).

I used a subset of the CP HPS data collected with AGYW during the 2016 and 2017 and 2018 round of data collection to describe the characteristics of HIV-negative and HIV-positive AGYW. Furthermore, I conducted univariate and multiple logistic regression with selected variables to evaluate whether a significant association exists between characteristics of AGYW and of their male sexual partners and their HIV status. This is possible because the dataset included information on HIV-related knowledge, attitudes, and behaviors of AGYW (i.e., independent variables), contained information on male sexual partners of AGYW (i.e., independent variables), and included a recent HIV test result for the AGYW (i.e., dependent variable).

Rationale

The CP dataset provided a unique opportunity to explore whether the characteristics of AGYW living in Chokwe, Mozambique and those of their male sexual partners were associated with the HIV status of AGYW. The choice of secondary data analysis for the CP data was justified by the fact that the subset of data contained specific

information collected with a large number of AGYW living in Chokwe, Mozambique, which is uncommon. A total of 3,354 AGYW consented to participate in the HPS, of which 9% were HIV-positive (to be published, Pathmanathan et al., 2019). The choice of secondary data analysis was also based on time and resources. Collecting information on the scale of CP would require substantial funding to cover the logistics (e.g., acquisition of material, renting offices) and to support the team conducting and supervising the activities (e.g., salaries for close to 200 staff, trainings), and time (i.e., 2 years of data collection for the subset of data selected), which is out of my reach as a PhD student

Variables

Dependent variable. The dependent variable for the three research questions is the HIV serostatus of the AGYW. The HIV serostatus of the AGYW was determined by the result of the home-based HIV rapid test conducted by trained lay counselors as part of the CP evaluation. AGYW can be HIV-positive or HIV-negative. If an AGYW self-reported a prior HIV-positive test result, she was considered to be HIV-positive. If the result of the HIV test result was found to indeterminate or if the AGYW refused to conduct an HIV test, the HPS information collected with that AGYW was not be used for the logistic regression analysis.

Independent variables. In alphabetical order, the independent variables for the analysis included:

Age difference between the sexual partner and the AGYW. The age difference between the male sexual partners and the AGYW was calculated using the age of the male sexual partner (i.e., estimated age defined by the AGYW) minus the age of the AGYW the day of the interview for the HPS (i.e., self-report). The age difference was then grouped into four categories for the analysis: sexual partner younger than the

AGYW, same age or 1 to 2 years older, partner older by 3 to 4 years, male partner older by 5 to 6 years, and partner older by 7 or more years than the AGYW.

Behaviors. *Behaviors* are defined as actions that people take (Oxford Dictionary Online, 2018). Behaviors are influenced at different levels, including individual, interpersonal, community, institutional and structural (Kaufman et al., 2014). Using the socioecological model, Kaufman et al. illustrated the different factors influencing HIV-related behavior at each of the level (see Figure 5). The questions related to behaviors of AGYW retained for the analysis concern condom use, use of drugs and alcohol, HIV testing, and transactional sex. In this section I described these variables independently.

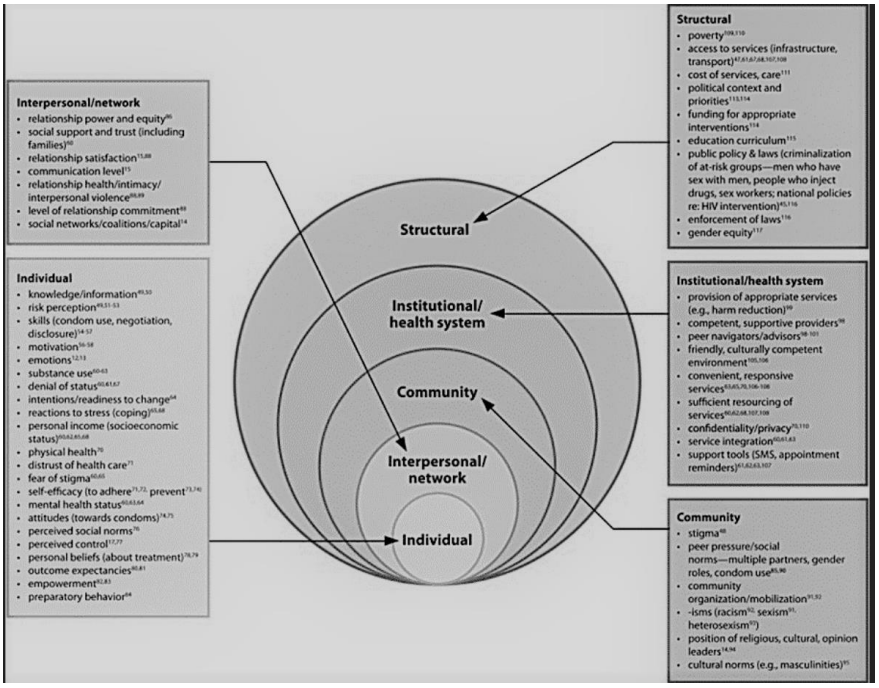

Figure 5. Factors influencing HIV-related behaviors and or behavior change at each level of the socio-ecological model of Kaufman et al. (2014).

Beliefs. *Beliefs* are defined as "the acceptance that something exist or is true, especially one without proof" (Oxford Dictionary Online, 2018). The HPS questionnaire contained six questions concerning participants' beliefs about HIV (e.g., condom use,

HIV testing, family planning). I created a belief scale where each belief was given a value of 0 if wrong and 1 if correct. The maximum score for the belief scale was 6 with a calculated Cronbach alpha coefficient of 0.881.

Condom use. Condom use was measured with two questions. The first was the AGYW self-report of condom use in the last 12 months. The AGYW could report always, sometimes, or never using condoms in the last 12 months. The other question asked the AGYW to report whether she used condoms with her last sexual partner.

Civil status. Civil status was measured through the self-reported answer to the question, "What is your current marital status?" The AGYW could report being single, married, in a marital union, divorced, separated, or widowed. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing

Currently in school. To assess this variable, I used the HPS question, which asked the AGYW to describe her current work situation: employed for wages, self-employed, out of work more than 1 year, out of work less than 1 year, homemaker, student, retired, or unable to work. If the AGYW reported being a student, she was considered to be currently in school (i.e., yes = 1), whereas I considered all other AGYW to be out of school (i.e., no = 0). When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

Drugs or alcohol. I used four questions of the HPS to assess the use of drugs or alcohol by the AGYW. If the AGYW responded yes to the use of drugs or alcohol in any of those questions, the use of drugs or alcohol I considered the answer as a yes (i.e., 1). If the AGYW responded no to all the question, I considered the answer to be no to the use

of drugs and alcohol (i.e., 0). When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

Gender-based violence. *Gender-based violence* (*GBV*) is defined as the abuse of power and control of one person over another based-on gender. GBV can take the form of physical, sexual, or psychological violence (Canadian Status of Women, 2018). In 2013, the United Nations Commission on the Status of Women estimated that one in three women in the world had suffered GBV, with direct and indirect consequences on their families and communities. Women and girls exposed to GBV are an estimated three times more likely to become HIV infected (PEPFAR, 2015).

The information on experience of GBV by the AGYW was self-reported. AGYW were asked four question on their experience of GBV. One question focused on the experience of GBV by the AGYW with her last sexual partner, two questions focused on physical and sexual abuse in the last 12 months, and one question asked about experience of sexual abuse by AGYW from a caregiver or relative in the last 12 months. AGYW were considered as having experienced GBV if they reported abuse in one of the four GBV-related questions. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

HIV status of the sexual partners of AGYW. One of the questions of the HPS, asked the AGYW to report the HIV results of their male sexual partners. The AGYW could report that she believed, or she knew that her sexual partner was HIV-positive, HIV-negative, indeterminate, or that she did not know of his HIV status (unknown HIV status). When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

HIV-related knowledge. *Knowledge* is defined as "the fact or condition of knowing something with familiarity gained through experience or association or the fact or condition of being aware of something" (Merriam Webster, 2018). Knowledge, however, is usually not enough to ensure that an individual will adopt HIV-protective behavior (MacPhail & Campbell, 2001). Even if aware that condoms can protect against HIV, other constraints and factors can influence their use. In South Africa, social norms, individual perceptions of health, perception of vulnerability to HIV, gender power relationship, and economic constraints were all critical factors in decision making to use a condom among youth in a qualitative study conducted by MacPhail and Campbell.

In the HPS knowledge was measured with 12 questions. The AGYW were asked whether they knew about HIV, about the benefit of voluntary medical male circumcision, about transmission of HIV from mother to child, the effect of antiretroviral treatment (ART) on HIV transmission, and the capacity to live a healthy live with HIV if a person is adherent to ART treatment. For each correct answer, the AGYW were given a score of 1. The maximum score for knowledge is 12, with a Cronbach alpha coefficient of 0.813. The score for HIV-related knowledge was categorized depending on the result with (i.e., zero right answers, one to four right answers, five to eight right answers, and all nine right answers). When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

HIV stigma. Eight HPS questions assessed stigma people living with HIV (PLWHIV) should face and the perceived stigma PLWHIV are facing in the community (e.g., Question 2.12 asked, "Should people with HIV be isolated from other people? and Question 2.17 asked whether people with HIV in this community face verbal abuse or

teasing). For each question, participants were given a card and asked to select on the 5-point scale what described best their personal belief for each of the statement. The scale went from strongly agree to strongly disagree. Answer that denoted stigma, were given a score of 2, a score of 1 in case the answer was neutral, and a score of 0 if the response did not demonstrate or did not perceive PLWHIV were facing stigma. The maximum value for this scale is 24. The Cronbach alpha coefficient is 0.701. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

Number of sexual partners. To find out the number of sexual partners of the AGYW, the AGYW were asked a series of questions. The first question assessed whether the AGYW was sexually active by asking, "Have you ever had sexual intercourse?" If the AGYW answered yes, then she was asked to report the number of sexual partners she had in the last 12 months who live in the district of Chokwe, in the province of Gaza but not in Chokwe district, in Mozambique but not in Gaza province and South Africa or in other countries. The AGYW could report that she had no sexual partner, could indicate that she did not have a sexual partner in the last year, or could specify if she had one, two, or more sexual partners. The variable considered the number of sexual partners reported by the AGYW (i.e., 0-50). The value of 88 was used if AGYW did not report being sexually active and 99 if the AGYW did not know how many sexual partners she had. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

Partner faithfulness. The AGYW were asked whether they believed that their sexual partners were faithful to them. The faithfulness of the male sexual partner was

based on two question. The first question asked, “Beside you, does your sexual partner have any other sexual partners? (i.e., yes, no, or do not know).” If yes, the AGYW was then asked whether she knew the number of other sexual partners her sexual partner had. The AGYW could report that she believed her sexual partner did not have any other sexual partners, had other known sexual partners, or that she did not know if her sexual partner had other partners. The variable was coded as yes if the AGYW believed her male sexual partner had other sexual partners (i.e., yes =1), as no if the AGYW did not believe her male sexual partner had other sexual partners (i.e., no= 0), or as do not know if the AGYW did not know if her male sexual partners had other sexual partners (i.e., does not know= 99). When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

***Partner type of employment and work situation*.** The AGYW were asked two questions to determine the type of employment and work situation of their male sexual partner. First, the AGYW were asked to describe the current work situation of her male sexual partner. The second question asked the AGYW to define the type of employment of her sexual partner. The work situation could be defined as unemployed (i.e., more than 1 year or less than 1 year), self-employed, employed for a wage, retired, unable to work, or student. The type of employment was further defined as a trucker, miner, agriculture, vendor, construction, fishing, police, military, or other. In the logistic regression the variable for the work situation was categorized as 1 if the male sexual partner was reported to employed for wages or self-employed, 2 if the male sexual partner was reported to be out of work for more than a year or 4 out of work for less than a year, if the or if the partner was a homemaker, retired or if the male partner was reported not to be

able to work and 3 if the male partner was a student, The variable was coded as 99 if the AGYW did not know what type of work her partners did. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing. The type of employment of the male sexual partner was only be used for descriptive analysis.

Pregnancies. The AGYW self-reported whether she was pregnant the day of the interview or if she had a baby in the last year. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing.

Poverty. Poverty was supposed to be reported using information collected for the HDSS. The indicator was to assess if the household where the AGYW lived the day of the HPS had access to electricity (i.e., yes or no) and to an inside toilet (i.e., yes or no). As a result, a proxy to access poverty was to be created with a three-level variable. The AGYW could either live in a household with 1 or 2 factors indicating poverty (i.e., 1 factor indicating poverty = household with either no electricity and no indoor toilet, 2 factors indicating poverty = household with no electricity and no indoor toilet) or the AGYW could live in a household with no factor indicating poverty (i.e., 0 factor indicating poverty = AGYW lived in a household with access to both electricity and indoor toilet). Unfortunately, I was not able to merge the information of the HDSS to the information of the AGYW for the three rounds of data selected (i.e., missing more than 40%) and as a result the variable poverty was not kept for the analysis.

Sexually transmitted infection. Information on sexually transmitted infection (STI) was collected by looking at the answers on reported experience of abnormal vaginal discharge and or sores in the genital area in the last 12 months or in lifetime. The

presence of STI was defined as yes (i.e., yes=1) if the AGYW reported symptoms suggestive of STI in the last year or in her life. and no=0 if the AGYW did not report any symptoms suggestive of STI in her lifetime. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing

Type of relationship. The type of relationship with the male sexual partner was defined by the AGYW as spouse (married or living with as married,) casual (someone with whom the participant had sex only once, a few times or occasionally), exchange partner (i.e., partner who is a not a steady or casual partner who was paid or who paid participant to have sex). This variable was coded as 1 if the AGYW stated her male sexual partner was a spouse, 2 if she reported her sexual partner to be a casual partner, 3 if she reported that her sexual partner was an exchange partner and 88 if the AGYW is not sexually active and 99 if the AGYW does not know the type of relationship she is in with her sexual partner. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing

Transactional sex. Transactional sex was defined as the exchange of sex for food, money or other commodities with the last sexual partner in the past 12 months. In the HPS the AGYW were asked if during the last 12 months they had sex with their last sexual partner in exchange of food, shelter, transportation, money, or drugs. If the AGYW reported having had sex in exchange for money, favors, food, transportation or shelter in the last 12 months her answer she was be coded as yes =1 and if she did not report any transactional sex it was coded as no=0. When the AGYW did not respond to the question or if the answer was missing, I considered the information as missing

Methodology

Population

Between 50,000 to 52,000 residents aged 15 to 59 years old lived in Chokwe during the third (May-December 2016), fourth (March-December 2017) and fifth round (March 2018- February 2019) of CP data collection (unpublished). The residents lived in ~ 19,700 households, of which ~4,600 households were selected in each round for the HPS component (Table 3).

The subset of the CP dataset of AGYW who consented to participate in the HPS during the third, fourth, and fifth rounds of CP evaluation and who accepted to test for HIV was selected for the analysis. A total of 3,354 AGYW consented to participate (1,985 15 to 19 years old, 1,369 20 to 24 years old), of which 314 were HIV-positive (Table 3).

Table 3

Description of Eligible and Consenting CP Participants for Rounds 3-5 of Data Collection

	Round 3	Round 4	Round 5	Total
Number of eligible residents for CP	52,088	50,674	-	n/a
Number of eligible households	19,733	19,602	19,673	n/a
Eligible household for HPS	4,608	4,617	4,623	n/a
Eligible participants	8,789	8,505	7,808	n/a
Participants contacted for the HPS (15-59 years old)	6,024	5,577	4,096	15,697
Participant consented	5,108	4,433	5,551	15,092
Participants analyzed (15-59 years old)	5,098	4,420	4,086	13,604
AGYW participants 15-19 years old	688	641	656	1,985
AGYW participants 20-24 years old	495	417	457	1,369
Number of AGYW HIV-positive	96	63	155	314

Sampling and Sampling Procedures

Decisions to select a sample of a larger population for a survey are usually based on ethical, logistical, budget and time restrictions (Martínez-Mesa, González-Chica,

Duquia, Bonamigo, & Bastos, 2016). Sampling can be probabilistic (i.e., simple random sampling, systematic random sampling, stratified sampling or complex sampling) or nonprobabilistic (i.e., accidental, convenience, purposive, quota or snowball sampling: Martínez-Mesa, González-Chica, Duquia, Bonamigo, & Bastos, 2016).

The researchers of the CP evaluation have selected a stratified random sample approach (urban/rural and men/women). Of all the HDSS residents aged 15 to 59 years old eligible to participate in the home-based HIV testing component of CP a randomly selected number of residents (20%) were offered to participate in the HPS (National Institute of Health, 2016).

The sample size for the selection of participants for the HPS component were calculated to detect, with a 95% confidence interval, a statistically significant differences in antiretroviral therapy coverage, incidence of HIV, and population viral load across two rounds of data collection. As one of the main objectives of the CP evaluation was to evaluate incidence of HIV over time the researchers determined that it would be necessary to identify between 170 and 200 HIV-positive males and 202-238 HIV-positive nonpregnant females for each of the strata (i.e., urban male, urban female, rural male, and urban female) to achieve statistically significant results. Based on the prevalence of HIV in the region for adult men and adult women prior to the beginning of the CP evaluation, it was estimated that it would be necessary to interview 1,190 men and 1,190 women in the urban and rural area to obtain the necessary sample of HIV-positive participants. Using the HDSS census data, estimating an 85% acceptance rate, and using the average number of females per household (i.e., 1.49 for the rural area and 1.77 for the urban area), it was estimated that it would be necessary to randomly select 20% of all households of

the HDSS to achieve the necessary sample size (National Institute of Health, 2016).

Power Analysis

Researchers must evaluate how they can reduce the probability of type I (i.e., null hypothesis is rejected when it is true) and type II errors (i.e., null hypothesis is accepted when null hypothesis is false) by determining the necessary sample size for their analysis (Chow, Saho, Wand, Lokhyinina, 2017). Researchers have to balance and determine the degree of precision (i.e., alpha (α) or the maximum probability of accepting a type I error) and the degree of power (i.e., beta (β) or accepting aa type II error) for their research question (Chow, Saho, Wand & Lokhnyinina, 2017).

Using G*Power a priori calculation for logistic regression given an α level of 0.05 (two-tailed) and an 80% power for an estimated odds ratio of 1.2, I determined that a total of 1,484 participants would be required to detect a statistically significant difference between HIV-negative and HIV-positive AGYW on the selected characteristics. When using the same setting with an estimated odds ratio of 1.5, I concluded that 308 participants would be needed. By increasing power to 95% for the same odds ratio, I determined that 2451participant would be necessary for an odds ratio of 1.2 or 503 if the odds ratio was set a 1.5.

Inclusion and Exclusion Criteria

Researchers must carefully choose the specific features (e.g., demographic, clinical, geographical) of the participants they want to include or exclude in their analysis (i.e., inclusion and exclusion criteria) and how the decision may impact the results and the external validity of their research (Patino & Ferreira, 2018).

Inclusion and exclusion criteria to participate in the CP evaluation were selected based on the probability of finding HIV-positive (i.e., prevalence of HIV is lower among

the 0-14 years old), logistic and budgetary restrictions (National Institute of Health, 2016). The inclusion criteria were to: (a) be registered in the HDSS, (b) be between the ages of 15 and 59 years old, (c) live in a household randomly selected for the HPS, and (d) to be able to consent. An additional inclusion criterion for the 15 to 17 years old, was to obtain the assent of a parent or the legal guardian unless the adolescent was considered emancipated (i.e., married, having a child, or being recognized as the head of a household by local authorities; National Institute of Health, 2016).

Exclusion criteria were to: (a) be under 15 years old or over 59 years old, (b) not registered in the HDSS as a resident, (c) being unwilling to participate or unable to consent (e.g., unable to comprehend the consent process, drunk or drugged the day of the interview) or (d) if minor not able to obtain the consent of a parent or caregiver (National Institute of Health, 2016).

The subset of data selected for the analysis contained information collected for all the participants 15-19 years old who consented to participate in round 3, round 4 or round 5 of CP which includes the result of the home-based HIV testing or disclosure of a prior HIV results.

Procedures for Recruitment Participation and Data Collection

Sixty trained HIV counselors and 15 interviewers visited each year all the households of the district (~ 19,000 households) to offer participation in the study (unpublished data). Each counselor was provided with a list of households which contained the names and unique identifier of all the eligible residents. All members of the households visited by the study team were offered HIV testing; however, only consenting eligible residents aged 15 to 59 years old could participate in the study, and only residents

of the randomly selected households were offered participation in the HPS (National Institute of health, 2016).

All counselors, interviewers, data entry staff, and supervisors were trained before the start of each round on standard operating procedures (e.g., how to find households, how to present the study, how to fill the study forms, how to conduct HIV testing and counseling), good clinical practices, and ethics (CDC, 2012). Community leaders and unit leaders—in which one-unit leader is selected by the community for 10 households—were met annually to explain the purpose of the study and the procedures and were presented with the results of the prior round (CDC, 2012). Meetings were held in each neighborhood after obtaining the permission of the local leaders. These meetings were used to inform the population of when the CP activities would take place to facilitate the visits of the counselors to the households and hopefully improve participation by having eligible residents present the day of the planned visit (CDC, 2012).

Consenting Participants

Participant to research should be provided with enough information (i.e., purpose of the research, procedures, potential risks, benefits and alternative) so they can voluntarily consent to participate (Gelling & Munn-Giddings, 2011). The CP protocol contains a section on ethical consideration, which includes procedures and forms to be used to obtain voluntarily informed consent (National Institute of Health, 2016). The ethical consideration section includes information on the mandatory training counselors, interviewers, supervisors and data entry staff must attend every year a good clinical practices and ethics course which includes a section on how to consent study participant (National Institute of Health, 2016). The training is based on the Family Health International (FHI) ethic training for research course and was given by facilitators

certified by the Mozambican Institute of Health. Another measure described in the CP protocol to protect the confidentiality of the information collected with the participants is the mandatory yearly signature of a confidentiality agreement form for all staff involved in the CP evaluation (National Institute of Health, 2016).

The consent forms used for the study, one for the HIV testing component and one for the HIV testing and HPS component, were approved by the Mozambican Institutional Review Board and by the CDC Institutional Review Board. Both consent forms contains information on the purpose of the study, the study procedures, the potential risks and discomforts (e.g., HIV testing and of sharing personal information), the benefits of the study, the steps taken to ensure confidentiality, the cost to the participants, the compensation, the right to refuse or withdraw from the study, the person to contact in case participants have further questions, and the consent statement.

The participants and the counselor that provided the information to the participants had to sign the consent form. In case the participant did not know how to write, a fingerprint was used to demonstrate consent. For participants aged 15 to 17 years old who were not considered emancipated (i.e., married, have children, or being head of the household), the assent of their parent or guardian was procured. Each participant was offered to keep a copy of the signed consent form. All consent forms were then stored in a secure and separate archival room as they contain both the name of the participant and their unique identifier (CDC, 2012).

Data Collection

The information on HIV testing for the consenting participants was collected on study forms using a unique identifier (National Institute of Health, 2016). All study forms were first audited for quality and then entered in the CP data base (i.e., double data entry;

CDC, 2012). The answers of to the participants to the HPS were recorded in real time using a CAPI device (National Institute of Health, 2016). In case the tablet was not functioning, the interviewers were requested to record the answers of the participants on the HPS paper questionnaire and the answers were entered later in the CP data base (CDC, 2012). Standard operating procedures detailed the data quality checks to be done regularly to ensure completeness and accuracy (CDC, 2012).

The list of eligible participants was made every year based on the latest HDSS census. Each year, each eligible resident was asked to consent to participate in the current round of data collection and were requested to sign the consent form. Consenting participants were made aware that the participation was voluntary and that they could withdraw from the study at any time (National Institute of Health, 2016).

As per the Ministry of Health (MoH) guidelines, all participants found to be HIV-positive were counseled and linked to HIV care using the MoH standard operating procedures (i.e., counseling post-test) and MoH referral forms. All the health centers (HC) providing services for people with HIV of the district were visited before the start of the study to inform them of the work to be done in the community. The HC expected to receive the greater number of newly HIV diagnosed participants were provided with extra staff to assist in welcoming the new HIV patients. As per protocol, all HIV-positive participants were supposed to receive at least five visits to assist them in accepting their HIV results, accept linkage to care and to support participants to adhere to care and treatment. The visits were planned 2 weeks, 1 months, 3 months, 6 months, and 1 year after the first HIV-positive test result. Visits were also made to the HC to ensure HIV-positive patients referred by the counselors arrived at the HC. This was done by

comparing the list of HIV-positive participants obtained in the community to the list of participants that arrived in the HC of their choice. The counselors also provided follow up to all the pregnant women via home visit or phone call to ensure they were linked to antenatal care, followed men referred to voluntary medical male circumcision services, and followed on the participants who stated that they were victims of GBV (National Institute of Health, 2016).

Access to the Dataset

The CDC granted access to a subset of the CP data, the protocol, and the standard operating procedures (Appendix A). The principal investigators, the associate director of science of CDC, and the local authorities are aware of the analysis for the dissertation and approved the use of the data. In return, I will share the results of the analysis with the principal investigators, CDC, and with the local, provincial, and national authorities. The dataset contained information collected with the HPS participants during the third, fourth, and fifth round of data collection which included socio-demographic information (i.e., age, civil status, work situation), HIV- related attitudes, HIV-related stigma, antenatal delivery and postnatal care, beliefs on male circumcision, and sexual behaviors (i.e., sexual activity status, number of sexual partners, type of relationship with sexual partner, characteristics of the male sexual partner, history of SGBV, use of condoms, symptoms suggestive of STI, use of HIV services [linkage to care, enrollment and retention, HIV medication, adherence to care, defaulting firm care], disclosure, and family planning). The dataset also contained information on the final HIV result (i.e., either the HIV test result or the self-report of a prior HIV result). The analysis will focus on the final HIV status of the AGYW and specific variables of the HPS that are further detailed in the next section.

The subset of CP data that did not contain any identifier of the participants, was password protected and will not be shared without authorization of the National Institute of Health and CDC. Once the dissertation is approved, the dataset will be kept for 5 years and then destroyed.

The independent and dependent variables selected for the research questions are presented in Table 4. The table contains information on the variables selected for the univariate and multivariate logistic regression with information on how the variables were operationalized. The HIV status of the AGYW is the dependent variable for the three research questions and is presented first. Then the independent variables are presented for each of the research question and grouped by characteristics of their male sexual partner (Research Question 1), knowledge, beliefs and behaviors of the AGYW (Research Question 2), experience of AGYW (Research Question 3). The question number is listed if the response of the AGYW were used as is for the analysis. In case the variables are calculated (e.g., HIV-related knowledge) or modified (e.g., age difference with sexual partner categorized), information is provided on how this was done.

Instrumentation and Operationalization of the Variables

Table 4

Operationalization of the Dependent and Independent Variables

Type of variable	Name of the Variable	Definition and Operationalization	Recoded values	Test used for the analysis
DV*	Final HIV status	Merging of two variables. Reported prior HIV-positive result (yes or no) and the result of the latest HIV test. HIV indeterminate test result were considered as missing result for the analysis.	0=Negative 1=Positive	Step wise logistic regression
Research Question 1. Characteristics of male sexual partners of AGYW				
IV**	Age difference between male sexual partner and AGYW Recode variable.	Calculated value from the age of the male sexual partner of the AGYW reported by the AGYW minus the age of the AGYW. The result is the age difference between the male sexual partner and the AGYW in years. This continuous result is then converted in a scale.	0. Male partner younger, same age or 1-2 years older than AGYW 1. Partner 3-4 years older 2. Partner 5-6 years older 3. Partner > 7 years older than the AGYW	Step wise logistic regression
IV**	Work situation of the male sexual partner	The response to the question 7.18 Which of the following best describe your last partner's current work situation? 1. Employed for wages 2. Self-employed 3. Out of work for more than a year 4. Out of work for less than a year 5. A homemaker 6. A student 7. Retired 8. Unable to work 88. Not applicable 99. Don't know The answers were recoded in 3 categories. the do not know are recoded as missing.	1. Employed for wages or self employed 2. Out of work (combines 3-4-5-7-8) 3. Student	
IV**	What kind of work does your last partner do (Sex23)	Question 7.18. What kind of work does your last partner do? This information is only used for descriptive purpose	1. Mining 2. Truck driving 3. Agriculture 4. Vendor 5. Construction 6. Fishing 7. Police 8. Military 9. Other	
IV**	Type of relationship	Question 7.3. Is the last person with whom you had sex a spouse, or a casual or exchange partner? Recoded to eliminate the do not know and not applicable.	1=Spouse 2=Casual partner 3=Exchange partner	
IV**	Perceived faithfulness of partner	Question 7.26 " Beside you, does your last sexual partner have any other sexual partner?	0=No 1=Yes 2=Do not know	
IV**	HIV status of sexual partner	Question 7.10. What was your partner's HIV test result? Recoded in 3 categories	1=Positive 2=Negative 3 = Do not know, did not receive results or indeterminate	
Research Question 2. HIV knowledge, beliefs and behaviors of AGYW.				

IV**	Knowledge	Correct knowledge to the 12 knowledge questions (questions 2.1-2.11). If the AGYW respond correctly to the question 1 point is allocated for the answer and 0 if the answer is wrong. The total score will be a maximum of 12.	0= if no right answers, 1 =1-4 right, 2 =5 to 8 right, 3 =9 to 12 right	Step wise logistic regression
IV**	Beliefs	Total of 6 beliefs questions (2.11 with subset a 6 questions). Each correct belief was scored as 1 as 0 if incorrect for a maximum of 6. The total was then categorized by number of right answers.	0 =0 1 = 1 - 3 2 = 4 - 6	
IV**	Number of sexual partners in the last 12 months	Question 7.2. in the past 12 months, with how many partners have you had sexual intercourse?	0 - 50 88 = NA 99 = Don't Know	
IV**	Multiple sexual partner	Recoded variable using the number of sexual partners. When reported more than 1 sexual partner coded as yes and no if one sexual partner or no partner.	0 =No 1 =Yes	
IV**	Use of condoms with last sexual partner)	Question 7.6. Was a condom used the last time you had sex with him/her? Used in descriptive analysis.	0=No 1=Yes	
IV**	Use of condom in the last 12 months	Question 9.1. In last 12 months, how frequently have you used condoms?	1=Always 2=Sometimes 3=Never	
IV**	Use of drugs or alcohol	Assess if the AGYW use drugs or alcohol. The variable of drug/alcohol use the merging of 4 questions. If participant report yes to use of drug or alcohol in one the four questions (10.1-10.3) the answer will be coded as yes for use of drug or alcohol and no otherwise.	0=No 1=Yes	
IV**	Transactional sex with last partner in the last 12 months with sexual partner	Question 7.28. During the past 12 months, did you have sex with your last partner in exchange for things like food, shelter, transportation, money, or drugs?	0=No 1=Yes 88=NA 99=Don't know	
Research Question 3 Selected experience of AGYW.				
IV**	Experience of Gender Base Violence in the last 12 months perpetrated by either a partner, caregiver or other (include sexual and physical violence).	When AGYW reported experience of GBV to one of the three GBV question then the AGYW was reported as having experienced GBV (question 8.1, 8.2, 8,3).	0=No 1=Yes	Step wise logistic regression
IV**	Pregnant or had a baby in the last year	Merging of two questions asking if AGYW was pregnant the day of the interview and had a baby in the last year (questions 4.2 and 4.3). The variable was recoded as 0=Did not report being currently pregnant or did not report having a baby in the last year 1=Was pregnant OR had a baby in the last year 2= currently pregnant AND a baby in the last year For the analysis the variable was further recoded as yes if the AGYW reported being pregnant and or had a baby in the last year.	0= No 1= Yes	

IV**	Presence of STI discharge or sore last year	Recoded from the report of vaginal discharge OR sores in the genital area in the last 12 months (Questions 11.2 and 11.6) The variable was used for descriptive analysis and not for the logistic regression.	0=No 1=Yes	
IV**	Presence of STI discharge or sore ever (lifetime)	Recode of report of vaginal discharge Orr sores in the genital area ever (lifetime; Questions 11.1 and 11.5)	0=No 1=Yes	
IV**	Being in school	Recode using question 1.10 which asks about current work situation. If the AGYW reported being a student, then the answer was coded yes (in school) and all other choices will be converted to a no (out of school).	0=No 1=Yes	
IV**	Poverty	A Proxy to poverty was to be created to assess if the household where the AGYW lived had access to electricity (i.e., yes or no) and to indoor toilet (i.e., yes or no). The information was to be extracted from the HDSS and merged with the dataset. The AGYW can live in a household with one or two factors indicating poverty or none. It was not possible to merge the two dataset and the variable was dropped from the analysis	0= access to both electricity and indoor toilet 1=Access to either electricity and indoor toilet 2= No access to electricity and indoor toilet	
IV**	Civil status	Self-report to the question 1.4 on current marital status. 1=Single 2=Married 3=Living as married 4=Divorced 5=Separated 6=Widow The variable was then recoded in 3 categories.	1= Single 2 =Married or in marital union 3=separated, divorced or widow	

***DV: Dependent variable, ** IV Independent variable,**

Data Analysis Plan

SPSS version 25 was used to analyze the selected variables. Data was reviewed for missing values and for outliers. Information on AGYW with indeterminate HIV test results, as well as those who refused to test for HIV or refused to provide information on prior HIV test results, were not included in the logistic regression analysis however were used for the descriptive statistics.

Research Questions

The three research questions selected to explore whether characteristics of the male sexual partners of AGYW and characteristics of AGYW living in a southern district of Mozambique were associated with the HIV status of AGYW are as follows:

Research Question 1: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e. male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years, or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive])?

Null Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]).

Alternative Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected characteristics of their male sexual partner as reported by AGYW (age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6

years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner], perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]).

Research Question 2: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner)?

Null Hypothesis 2: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner).

Alternative Hypothesis 2: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected HIV knowledge, beliefs and behaviors of AGYW (number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner.

Research Question 3: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]?

Null Hypothesis 3: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single].

Alternative Hypothesis 3: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]).

I computed descriptive statistics to describe sociodemographic and HIV knowledge, beliefs and HIV prevention behaviors of AGYW, their male sexual partners and the HPS participants 15-59 years old. Characteristics of HIV-positive and HIV-negative were compared (e.g., use of condoms, HIV prevalence, number of sexual partners). Separate analyses were then performed to determine whether an association exists between the selected variables and the HIV status of the AGYW. The results of the analysis and the interpretation of the findings will be presented in Chapters 4 and 5.

To answer Research Question 1, I examined the association between the HIV status of the AGYW and characteristics of the male sexual partners of the AGYW in three steps. In Step 1, I conducted univariate analysis for each of the variables: age difference with sexual partner (i.e., categorical: partner younger same age or 1-2 years older difference, partner 3-4 years older, partner5-6 years older, and partner 7 years and older, partner's type of employment (i.e., categorical: employed, unemployed , student), type of relationship (i.e., categorical: casual, married, exchange sex for money/goods/services), faithfulness of sexual partner (i.e., categorical: yes, no, do not know), HIV status of the sexual partner (i.e., categorical: HIV-positive, HIV-negative, does not know) in order to assess whether they were associated with the HIV status of the AGYW (i.e., HIV-positive or HIV-negative) at an alpha level of 0.05%. In Step 2, I identified the statistically significant IVs found in Step 1 and then selected them for Step 3. In Step 3, I conducted multivariate logistic regression to evaluate the impact of the IVs selected in Step 2 on the HIV status of the AGYW. For each of the IVs, I calculated an odds ratio of the AGYW being HIV-positive compared with an AGYW being HIV-negative.

To answer Research Question 2, I assessed the association between the HIV status of the AGYW and selected HIV knowledge, belief and HIV prevention behaviors of the AGYW. As with the first question, I conducted the analysis in three steps. First, I conducted univariate analysis for each of the variables: HIV related knowledge attitude and beliefs (i.e., categorical, scale), multiple sexual partner (i.e., categorical, yes or no), use of condoms (i.e., categorical, always, sometimes, never), use of drugs or alcohol (i.e., categorical yes or no), transactional sex (i.e., categorical yes or no) to assess if they were

associated with the HIV status of the AGYW (i.e., HIV-positive or -negative) at an alpha level of 0.05% In Step 2, I identified the statistically significant IVs found in Step 1 and selected them for Step 3. In Step 3, I conducted a multivariate logistic regression to evaluate the impact of the IVs selected in Step 2 on the HIV status of the AGYW. I then compared the odds ratio of the AGYW being HIV-positive compared with an AGYW being HIV-negative on the selected variables.

To answer Research Question 3, I determined whether the HIV status of the AGYW is associated with selected experience of AGYW. In Step 1, I conducted univariate analysis to assess if the following variables: experience of GBV (i.e., categorical, yes or no), being currently pregnant or having had a child in the last year (i.e., categorical, yes or no), presence of symptoms suggestive of STI (i.e., categorical, yes or no), being currently in school (i.e., categorical yes or no), and the civil status (i.e., categorical, married, living as married, single), are associated with the HIV status of the AGYW (i.e., HIV-positive or HIV-negative) at an alpha level of 0.05%. In Step 2, I identified the statistically significant IVs found in Step 1 and selected them for Step 3. In Step 3, I conducted multivariate logistic regression to evaluate the impact of the IVs selected in Step 2 on the HIV status of the AGYW. For each of the IVs, I calculated an odds ratio of the AGYW being HIV-positive compared with an AGYW being HIV-negative.

Threats to Validity

To generalize the results of quantitative research, it is important to recognize and reduce threats to internal and external validity (Onwuegbuzie, 2000). Threats to internal validity include history, maturation, testing, instrumentation, statistical regression,

different selection of participants, experimental mortality (e.g., loss to follow-up), and interaction effects (Slack & Draugalis, 2001). Strong internal validity is present when the dependent variable can be explained by the independent variable(s). Causal inference is influenced by three conditions: the cause precedes the effect, the cause and the effect are correlated, and the effect is not caused by another variable (Campbell & Stanley, 1963). Threats to external validity can limit our ability to generalize the results to other population. External validity is affected by the selection of the participants (Slack & Draugalis, 2001).

Although the CP dataset is the result of a cohort study which followed all consenting resident of the Chokwe district over time, the data selected for the analysis were investigated as cross-sectional. In order to include enough HIV-positive AGYW in the analysis, it was be necessary to merge three rounds of data of the larger CP evaluation. As such, it was not possible to confirm whether the selected independent variables precede the HIV-positive serostatus of the AGYW (i.e., the dependent variable).

One threat inherent with self-report is that participants may fear to be honest in their answers. This can happen when participants perceive the question as sensitive and may be afraid to report (e.g., GBV, exchange of money for sex) or when participants think that they should report the more socially desirable behaviors or attitudes (e.g., use of condoms, number of sexual partner), Tourangeau, Roger, Yan and Ting (2007) have reported that participants are more likely to misreport behaviors or beliefs especially if the questions address sensitive topics and the participant wants to avoid feeling

embarrassed or be subject to repercussion. As a result, the answers to some of the HPS question may be inaccurate, which may affect the results of the analysis.

Another threat is linked to different exposure of AGYW to interventions to reduce their risks to HIV. The rounds selected for the analysis were collected over a period of close to 4 years (April 2016 to February 2019), during which specific activities and intervention were implemented within the district to prevent HIV among AGYW. The activities did not cover all the AGYW of the district and seemed to favor AGYW in school and those living in more urban area (PEFAR, 2015). It is possible that some knowledge attitudes and behaviors of AGYW were positively influenced by interventions and activities held in selected schools. In addition, AGYW living in the more urban area of the district may have benefited from the integrated youth-friendly health care services, while it may have been more difficult for the AGYW living in the rural area to access the same high-quality and youth-friendly services. Information was available on both these potential variables (i.e., in school and place of residence); however, it was not possible to know which school the AGYW attended, whether that school was covered by the interventions, or whether the AGYW was able to access one of the integrated youth-friendly health centers.

Elements that reduce risks on internal and external validity with the CP dataset included the capacity to identify participant across rounds. Each resident was assigned a unique ID for the duration of the CP evaluation and using this ID it is possible to identify characteristics of eligible participants not found or who refused to participate (e.g., age, sex, residence Another strength is the fact that the same instrument and the same

interviewers conducted the HPS over the three rounds of data collection (National Institute of Health, 2016).

The external validity of this study is high. This is because the list of households for the HPS was based on a stratified random sample created from the list of all the households of the district covered by the HDSS (National Institute of Health, 2016). Using stratified random sampling greatly reduce the possibility of selection bias (Martinez-Mesa, Gonzalez-Chica, Duquia, Bonamigo & Bastos, 2016). This, in turn, can increase confidence in generalizing the results to other districts of Mozambique and to other countries sharing the same characteristics as Chokwe.

Confounding Variables and Interactions

Results in research can be distorted if the effect of confounding or mediating variables (i.e., factors that are correlated negatively or positively with the exposure and the outcome) are not considered (Vetter & Mascha, 2017). Results of the analysis can also be affected by variables that influence the outcome in different subgroup (Vetter & Mascha, 2017). In other studies, mediating and interacting variables found to impact risky sexual behaviors of AGYW included being part of a youth group, peer involvement in risk behaviors, close relationship with parents/guardian, if the AGYW did volunteer work in the community, unmet need for contraception (Birdthislte et al., 2018, Ziraba et al., 2017).

The assessment of confounding and interaction variables for this dissertation is limited by the lack of information in the original dataset on many potential variables (e.g., age at sexual debut, access to youth friendly services in the community or school, involvement of the parents in the life of the AGYW, AGYW self-esteem, influence of

peers on AGYW). Furthermore, the information on some of the variables is not complete for the analysis chosen (e.g., experience of GBV is limited to experience of GBV in the last year, information on birth history is limited to the last year, factors indicating poverty and education). Given those limitation, I used statistical analysis to assess if some of the selected variables had an interaction effect on the HIV status of the AGYW. One of the interactions assessed was age using two age group (i.e. AGYW 15-19 years old versus AGYW 20-24 years old).

Ethical Procedures

The Mozambican Institutional Review Board and by the CDC Institutional Review Board (IRB) have both reviewed and approved of the Combination Prevention of HIV protocol. The protocol was first submitted in 2012, and approval was sought afterward to both IRBs when amendments were made in 2015 to add questions to characterize the male partners of the AGYW (National Institute of Health, 2016) protocol). Yearly, all staff involved in CP were trained in good clinical practice and ethic by a certified facilitator of the Mozambican National Health Institute. To meet the requirements of the both IRBs, it was mandatory to acquire parental or guardian assent for all participants aged 15 to 17 years old who were not considered emancipated (i.e., married or head of household). To ensure the informed voluntary consent were obtained as per standard operating procedures audits were performed regularly on a random sample of households (CDC, 2012).

The protocol also describes procedures to report any unexpected findings, adverse events and details data ownership, sharing and retention procedures and technical and scientific supervision of the activities (National Institute of Health, 2016),

Confidentiality

To maintain confidentiality, all participants were allocated a unique participant number and names were not written or registered when using CAPI on the study forms, apart from the consent form (National Institute of Health, 2016). All the study forms are kept in secured archives with restricted access. Consent forms are kept in secured cabinet in a separate room with restricted access because the consent form contains both the names and the unique ID of the participants. The data entered in the data base and the data collected via CAPI is kept in a secure server with weekly back up to a secure FTP site. Access to the data base is password protected and is limited to trained personnel (i.e., data entry staff, data manager, principal investigators, authorized researchers). Access to the key between the names of the participants and their unique identifier is limited to a selected number of individuals (i.e., principal investigators, senior data managers). Additional procedures are in place in case of breach of confidentiality to inform the principal investigators and the IRB, both locally and CDC (CDC, 2012).

Conclusion

Descriptive, univariate, and multiple logistic regression analyses were used to determine whether selected characteristics of AGYW and of their male sexual partners were associated with the HIV status of AGYW living in a southern district of Mozambique. In this chapter, I presented information on the methodology selected to conduct the analysis which included details on the population, sampling strategy, power analysis, inclusion and exclusion criteria, definition and operationalization of the dependent and independent variables, threats to internal and external validity, and information on ethical procedures. In the next chapter, I will present the results of the analysis.

Chapter 4: Results

Introduction

This chapter contains the results of the analysis. In the first section, I will present the research questions and the hypotheses and restate the purpose of the dissertation. In the second section, I will summarize the origin and content of the quantitative dataset that I used for the analysis. In the third section, I will report the baseline descriptive and demographic characteristic of the sample. In the last section, I will report the results of the analysis for each of the research questions. In Chapter 5, I will present the discussion, conclusions, and recommendations following the results of the analysis.

My purpose in this study was to investigate whether there is an association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW and selected characteristics of AGYW and of their male sexual partner. The results of the analysis could help identify specific factors that can render AGYW more or less at risk of being HIV infected and could inform specific interventions to prevent new infections.

Research Questions and Hypothesis

The research questions and their respective hypothesis were:

Research Question 1: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e. male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years, or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange

partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive])?

Null Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected characteristics of their male sexual partner (i.e., age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner, perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]).

Alternative Hypothesis 1: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected characteristics of their male sexual partner as reported by AGYW (age difference of sexual partner with AGYW [i.e., male partner younger or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, older by 5-6 years , or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner], perceived faithfulness of partner and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive]).

Research Question 2: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual

partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner)?

Null Hypothesis 2: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner).

Alternative Hypothesis 2: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected HIV knowledge, beliefs and behaviors of AGYW (number of sexual partners, use of condoms in the last year [i.e., always, sometimes, never] or with last sexual partner [i.e., yes or no], use of drugs and alcohol, transactional sex with last sexual partner.

Research Question 3: Is there a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]?

Null Hypothesis 3: There is no significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and selected experience of AGYW (i.e., reported experience of gender-based violence,

currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single].

Alternative Hypothesis 3: There is a significant association between the HIV status of AGYW living in a southern district of Mozambique (i.e., HIV-positive, HIV-negative) and some selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of STI, being in school [i.e., yes or no], civil status [i.e., married, living as married, single]).

In this chapter, I will describe the dataset used for the analysis, present discrepancies from the original research questions, report the baseline descriptive and demographic characteristics of the population where the AGYW live, and provide the results of the analysis for each of the research question.

Origin and Description of the Dataset

I conducted the secondary data analysis for the dissertation using a subset of quantitative data collected for the Combination Prevention of HIV (CP) evaluation. The CP evaluation was led by the CDC in collaboration with the Mozambican National Institute of Health (INS). CP was an HIV surveillance evaluation conducted annually between 2014 and 2019 in Chokwe, a southern district of Mozambique covered by a health demographic and surveillance system (HDSS). The CP evaluation includes two main components: (a) offering home-based HIV testing for all residents of the HDSS aged 15-59 years old to estimate annual HIV prevalence and incidence and (b) offering a cross sectional health prevention survey (HPS) to household randomly selected (urban

and rural stratification) within the HDSS to estimate the annual coverage of evidence-based interventions and prevalence of HIV risks and HIV preventive behaviors.

The subset of data provided by CDC included (a) the quantitative data collected with all the residents aged 15-59 years old who consented to participate in the HPS during the third (March 2016-December 2016), fourth (March 2017- December 2017) and fifth (March 2018-February 2019) round of data collection, and (b) the HIV status for the HPS participants.

Participation

In each round selected for the analysis, 8799, 8500, and 7808 residents were eligible to participate in the health prevention survey. Thirty-one percent (Round 3), 34% (round 4), and 29% (round 5) of residents were not encountered at their home by the interviewers after at least three home visits. Fifty-two percent of the residents that the interviewers did not encounter were male. The most commonly found reason not to encounter the participants, based on information obtained by other family members or neighbors, was travel outside of Mozambique (43% in round 3, 44% in round 4, and 35% in round 5).

The encountered participants' refusal to participate ranged from 15% in round 3 to 26% in round 5 (Unpublished, Nelson see MMWR). Of those who refused, 37-43% were men and 33-35% were 15-24 years old. HPS data were collected from 13655 participants (5108 round 3, 4433 round 4, and 4114 round 5); however, only 13604 could be analyzed (5098 round 3, 4420 round 4, 4086 round 5). Of the 13604 HPS questionnaires included in the dataset, 5631 HPS were collected from participants aged 15-24 years old, of which 3680 participants were 15-19 years old (1695 boys, 1985 girls) and 1951 were 20-24 years old (582 young men, 1369 young women; Table 5).

Table 5

Participation in the HPS by Sex and Age by Rounds

	Age (years)			
	15-19	20-24	25-59	Total
	n	*n*	*n*	*n*
Male				
Round 3 (May 2016- December 2016)	575	188	630	1393
Round 4 (March 2017-December 2017)	586	194	547	1327
Round 5 (March 2018-February 2019)	534	200	445	1179
Total	1695	582	1622	3899
Female				
Round 3 (May 2016- December 2016)	688	495	2522	3705
Round 4 (March 2017-December 2017)	641	417	2035	3093
Round 5 (March 2018-February 2019)	656	457	1794	2907
Total	1985	1369	6351	9705
Total				
Round 3 (May 2016- December 2016)	1263	683	3152	5098
Round 4 (March 2017-December 2017)	1227	611	2582	4420
Round 5 (March 2018-February 2019)	1190	657	2239	4086
Total	3680	1951	7973	13604

Across the three rounds of data collection, I selected 1922 participants who consented to participate in more than one round, of which 698 were 15-24 years old. I made the choice to keep each participation round separate in order not to bias the random selection that was made at the beginning of each round; each participant had an equal chance of being selected for the HPS in each of the rounds.

To increase the power to detect whether an association existed between the HIV status of AGYW and characteristics of AGYW and of their male sexual partners, I then merged the three rounds of data. Figure 6 presents the total number of participants by age and sex. Women were more likely to participate (73.5%) compared with men (26.5%), and young people 15-24 (38.2%) were more common compared with the older age group (21%, 20.1% to 20.6% for the 25-34, 35-44 and 45-59 years old).

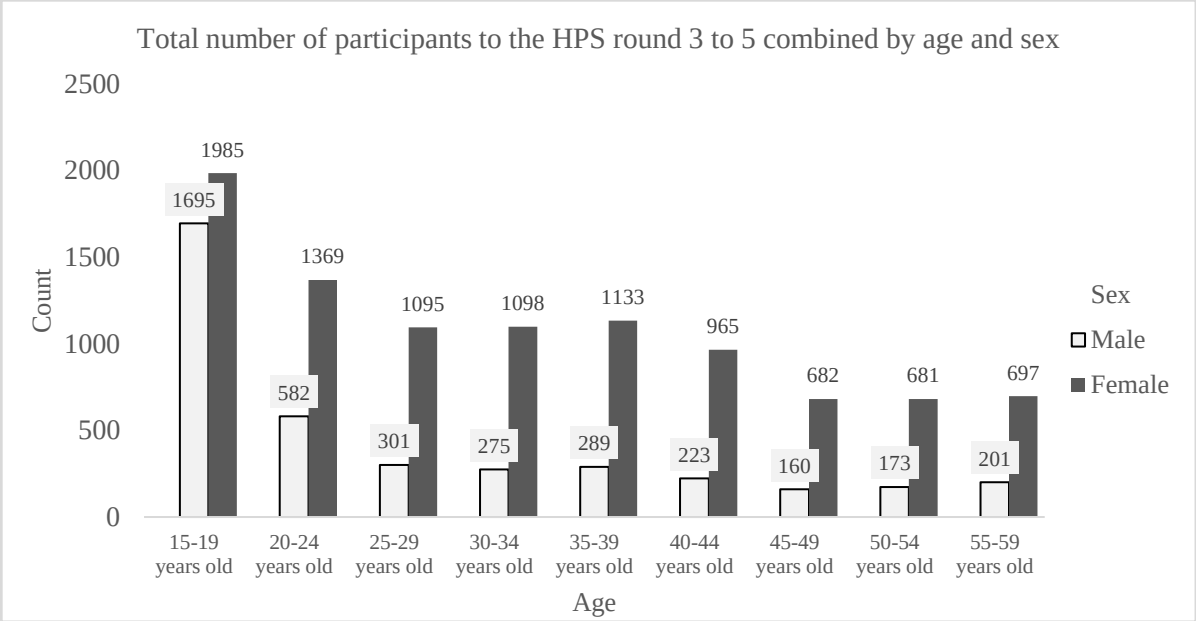

Figure 6. Total number of HPS participants after merging rounds 3 to 5 by age and sex.

Representativeness of the HPS Sample to the Population

I assessed the representativeness of the sample by comparing the distribution of participants of the HPS in round 3 to the HDSS data collected for the 2016 census. The distribution by age and sex between the HPS participants and the residents covered by the HDSS for the 2016 census is similar, yet women are overrepresented (73.5% women participated in the HPS versus the 62.9% reported by the 2016 census), while youth 25-34 years old were underrepresented (38.2% participation in the HPS versus 41.3% found during the 2016 census; Table 6). As a result, I applied weight to certain analysis (i.e., prevalence of HIV) in order to correct the over and under representation of certain groups (i.e., age, sex).

Table 6

Participation in the HPS by Age and Sex Compared With 2016 Census

	HDSS	Analyzed
	Census 2016	Round 3 HPS
	n (%)	*n* (%)
Adults 15-59 years old		
	50854 (100)	4483 (100)
Age (in years)		
15-24	21014 (41.3)	1714 (38.2)
25-34	13596 (26.7)	942 (21.0)
35-44	8137 (16.0)	903 (20.1)
45-59	8107 (15.9)	924 (20.6)
Sex		
Male	18873 (37.1)	1190 (26.5)
Female	31981 (62.9)	3293 (73.5)

Acceptance to Test for HIV or to Disclose a Prior HIV-Positive Result

The participants' overall acceptance to test for HIV or to disclose a prior HIV-positive result to the interviewer was 91% (12376). Acceptance ranged from 86.8% among 20- to 29-year-old men to 92.3% among 15- to 19-year-old women). Overall acceptance for HIV testing was higher among resident of the rural communities, at 93.2%, compared with urban communities at 87.1% (Table 7).

Table 7

Acceptance of HIV Testing or Disclosing Prior HIV-Positive Results among Selected Residents for the HPS Round 3-5 (2016-2019) by Age, Sex, and Urbanicity

	Age in years									Total		
	15-19			20-24			25-59					
	HPS	HTC or disclose		HPS	HTC or disclose		HPS	HTC or disclose		HPS	HTC or disclose	
	n	*n*	%	*n*	*n*	%	*n*	*n*	%	*n*	*n*	%
Sex												
Male	1695	1561	92.1	582	505	86.8	1622	1408	86.8	3899	3474	89.1
Female	1985	1832	92.3	1369	1254	91.6	6351	5816	91.6	9705	8902	91.7
Total	3680	3393	92.2	1951	1759	90.2	7973	7224	90.6	13604	12376	91
Urbanicity												
Rural	2272	2130	93.8	1138	1054	92.6	5178	4823	93.1	8588	8007	93.2
Urban	1408	1263	89.7	813	705	86.7	2795	2401	85.9	5016	4369	87.1
Total	3680	3393	92.2	1951	1759	90.2	7973	7224	90.6	13604	12376	91

Discrepancy from the Original Plan

Poverty

I originally planned to evaluate the potential effect of poverty on the HIV status of the AGYW. I intended to create a proxy variable for poverty by assessing whether the household where the AGYW lived the day of the interview had electricity (yes or no) and latrine (yes or no). Even though the poverty variables were collected annually as part of the HDSS, this information was missing in the dataset shared by CDC for more than 45% of the AGYW. As a result, I removed the poverty indicator variable from the second research question.

Stigma

Stigma was considered a potential confounder variable when designing the research questions; however, after analysis, I found very little difference in the results of the stigma scale between the different sex and age group (Appendix B). The Cronbach

alpha for the belief scale was 0.70 (8 items) for the 15-59-year age group and 0.74 for AGYW. As a result, I did not use stigma as a cofounder variable.

Age Difference between the AGYW and Her Male Sexual Partner

Given the small number of male sexual partners of the AGYW in some of the age difference categories (Figure 7), I coded this variable into four categories: (a) male partner younger, same age, or 1-2 years older; (b) male partner 3-4 years older; (c) male partner 5-6 years older; and (d) male partner older by 7 or more years than the AGYW (Figure 8).

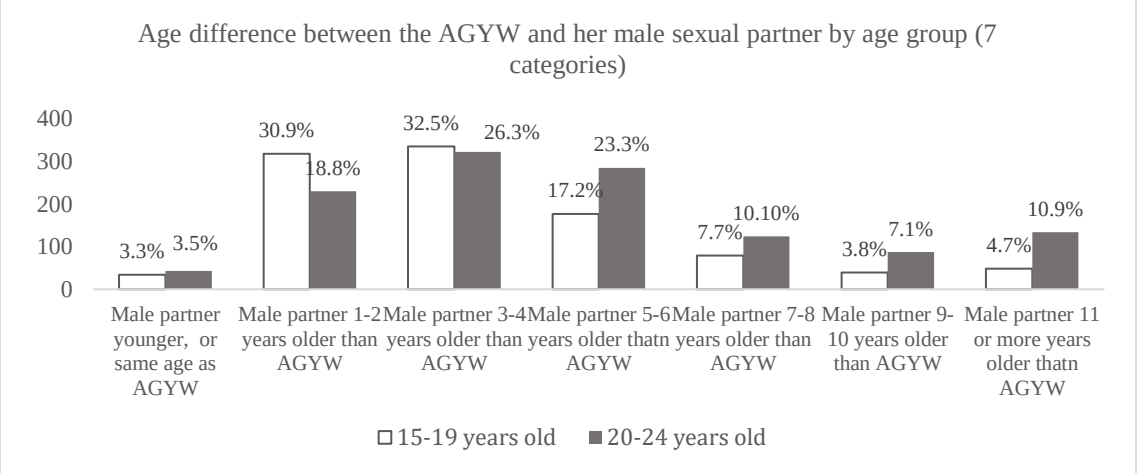

Figure 7. Age difference with male sexual partner by age of AGYW (7 categories).

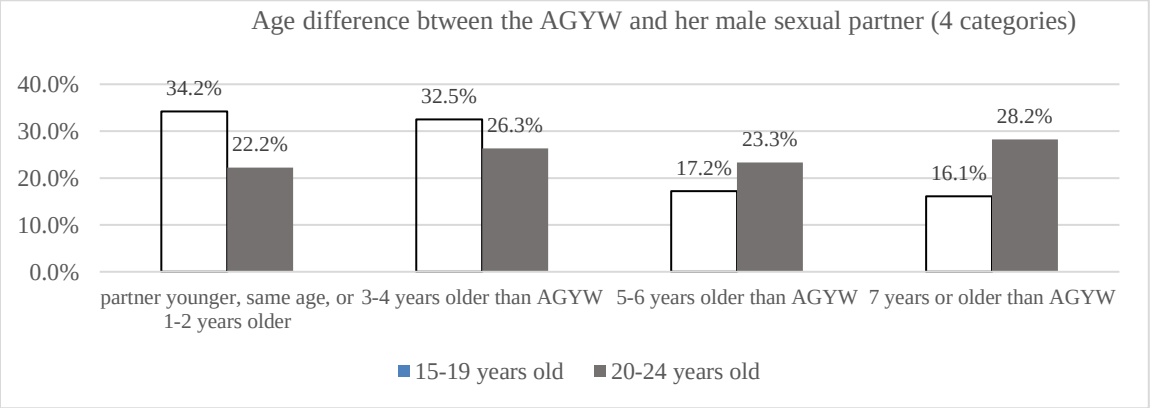

Figure 8. Age difference with male sexual partner by age of AGYW (4 categories).

Occupation of the Male Sexual Partner

Given the small number of male sexual partners reported in many of the occupations, it was not possible to analyze the occupation of the male sexual partner as a separate variable. I replaced the variable of occupation with work situation (i.e., employed or self-employed, unemployed, student).

Descriptive and Demographic Characteristics

History of HIV Testing Prior to the HPS

After three rounds of home-based HIV testing in the district covered by the CP evaluation, 98.6% (99.3% female, 95.5% male) of the 25-59 year age group, 97.7% (95.5% male, 98.6% female) of the 20-24 age group, and 80.3% of the 15-19 year age group (82.5% male and 78.8% female) reported that they had been tested for HIV at least once prior to the interview (Figure 9).

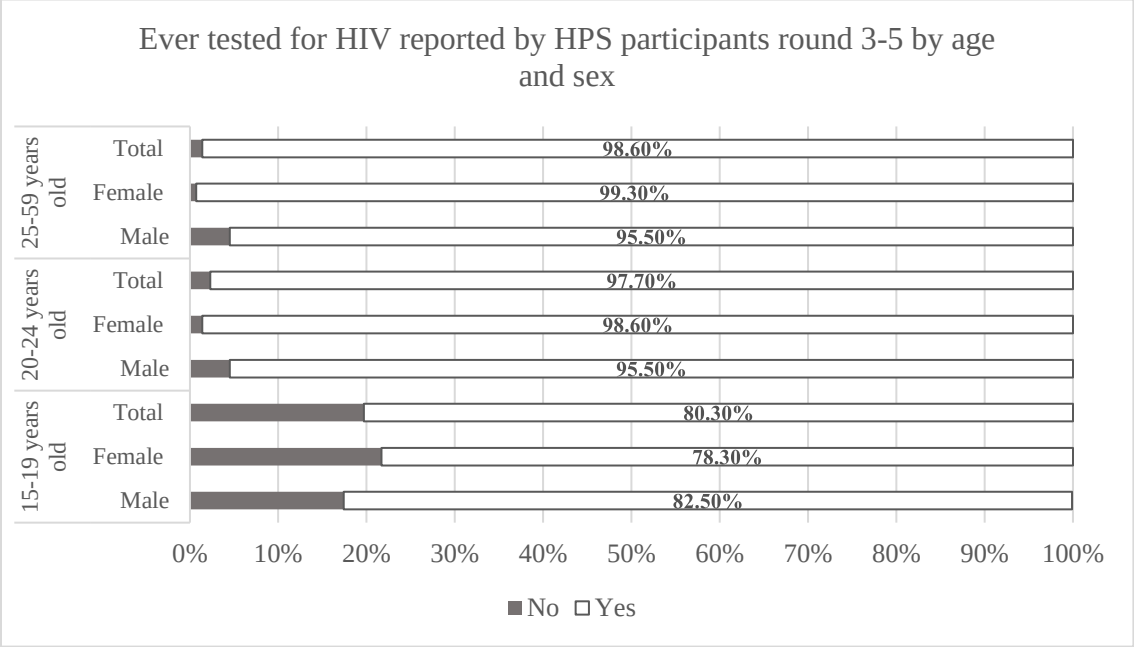

Figure 9. Ever tested for HIV reported by HPS participants (round 3-5) by age and sex.

HIV Prevalence

The weighted prevalence of HIV was 25.1% among participants 15-59 years old (18.3% for men, 29.1% for women), 3.2% among the 15-19-year group (2.4% boys and 4% girls) and 13% among the 20- to 24-year old group (3.2% young men and 18.4% young women; see Figure 10 and Appendix C). Figure 10 illustrates the weighted prevalence of HIV among HPS participants by age and sex.

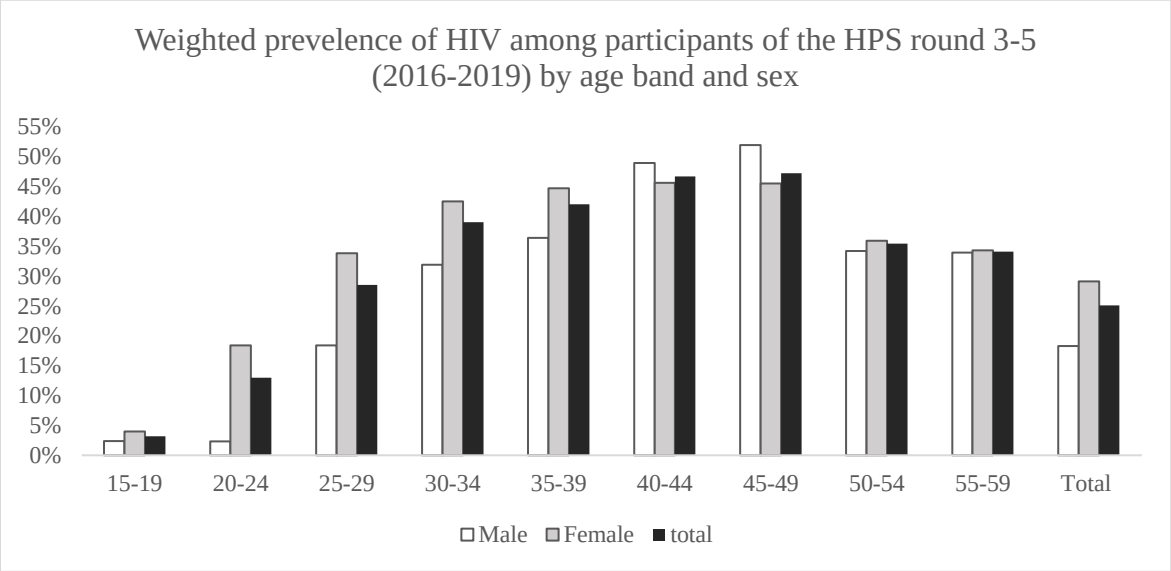

Figure 10. Weighted HIV prevalence by age and sex among participants in the HPS round 3-5 (2016-2019).

Demographic Characteristics of the Participants

In the following section, I will present the participants' demographic information by age and sex, including urbanicity, civil status, citizenship, travel outside of the district for more than 1 month (Table 8), work situation, and occupation (Table 9).

Both male and female participants in all age groups were more likely to be from rural communities (63.1%, *n* = 8,583 than from urban communities (36.9%, 5,019). Younger people were more likely to be single; 96.7% (*n* = 1,749) of the 15- to 19-year-old boys reported being single, compared with the overall percentage of 40.3% (*n* =

5,478). AGYW were more likely to be living with a partner than their male counterpart (16%, *n* = 293) of 15- to 19-year-old girls compared with 3% (n = 54) of the boys the same age and 54.3% (*n* = 2,783) of the young women 20 to 24 years old compared with 21.7% (*n* = 147) young men. The percentage who reported to be married is 0.4% (*n* = 7) of the girls versus 0.2% of the boys in the 15- to 19-year age group and 3.7% (*n* = 59) versus 0.6% (4) in the 20- to 24-year age group. Overall 6.1% (*n* = 829) of participants reported being married and 44.4% (*n* = 6,036) living with a partner. Nearly all the participants were Mozambican (99.4%, *n* = 13,506), with the same distribution of citizenship between sexes and across all age groups.

Being a student was reported as the current work situation by 71.6% (*n* = 1,211) of boys aged 15 to 19 years old and 65.5% (*n* = 1,595) of girls of the same age; this was reported by 30.9% (*n* = 179) of young men aged 20 to 24 years old, compared with 16.5% (*n* = 224) of young women of the same age. Agriculture was the most common reported occupation of working youth with 22.8% (*n* = 46) of boys aged 15 to 19 years old and 24% (*n* = 397) of girls; 26.5% of men aged 20-24 (*n* = 71) years old and 54.3% (*n* = 37) of young women). Participants aged 20 to 24 years old were more likely to have reported having traveled and lived outside of the district for more than 1 month compared with the all the other age groups with 7.2% (*n* = 48) of young males and 5.1% (*n* = 266) of young females, compared with 4.5% (*n* = 612) overall. Men at all age were more likely to have travelled outside of their district for more than 1 month compared with women (5.1% [*n* = 266] of men and 4.2% [*n* = 352] of women).

Table 8

Urbanicity, Civil Status, Citizenship, and Travel Outside of Mozambique for More than 1 Month by Age and Sex for Participants of the HPS Round 3-5 (2016-2019)

	Male				Female				Total			
	Age in years				Age in years				Age in years			
	15-19	20-24	25-59	Total	15-19	20-24	25-59	Total	15-19	20-24	25-59	Total
Urbanicity (missing 1)												
Rural (%)	38.5	30.1	31.6	33.8	39.8	38.9	38.6	38.9	39.2	35.8	36.2	36.9
Urban (%)	61.5	69.9	68.4	66.2	60.2	61.1	61.4	61.1	60.8	64.2	63.8	63.1
Total (count)	1812	678	2728	5218	1815	1261	5309	8385	3627	1939	8037	13603
Civil status (missing 9)												
Single (%)	96.7	75.7	19.2	53.4	82.8	38.5	13.2	32.1	89.8	51.5	15.2	40.3
Married (%)	0.2	0.6	10.3	5.5	0.4	3.7	9.3	6.5	0.3	2.6	9.6	6.1
Living with partner (%)	3.0	21.7	63.2	36.9	16.2	54.3	59.1	49.1	9.6	42.9	60.5	44.4
Divorced (%)	0	0	0.5	0.2	0	0.1	0.5	0.4	0	0.1	0.5	0.3
Separated (%)	0.1	2.1	5.5	3.2	0.6	2.7	5.6	4.1	0.4	2.5	5.6	3.7
Widow (%)	0	0	1.3	0.7	0	0.7	12.3	7.9	0.0	0.5	8.6	5.1
Total (count)	1809	678	2726	5213	1813	1262	5307	8382	3622	1940	8033	13595
Citizenship (missing 16)												
Mozambican (%)	99.4	99.3	99.3	99.3	99.1	98.7	99.6	99.4	99.3	98.9	99.5	99.4
South African (%)	0.6	0.4	0.3	0.4	0.9	1.2	0.2	0.5	0.7	0.9	0.2	0.4
Malawian (%)	0	0	0	0	0	0.1	0.2	0.1	0	0.1	0.2	0.1
Zimbabwean (%)	0	0	0.2	0.1	0	0	0	0	0	0	0	0
Total (count)	1805	678	2728	5211	1813	1261	5303	8377	3618	1939	8031	13588
Travel outside of district for more than 1 month (missing 1)												
No (%)	96.9	92.8	94.1	94.9	96.7	94.4	95.9	95.8	96.8	93.8	95.3	95.5
Yes (%)	3.1	7.2	5.9	5.1	3.3	5.6	4.1	4.2	3.2	6.2	4.7	4.5
Total (count)	1812	678	2728	5218	1815	1262	5308	8385	3627	1940	8036	13603

Table 9

Work Situation and Occupation by Age and Sex

	Male				Female				Total			
	Age in years				Age in years				Age in years			
	15-19	20-24	25-59	Total	15-19	20-24	25-59	Total	15-19	20-24	25-59	Total
Work situation (missing 46)												
Employed for wages (%)	4.5	14.8	28.2	15.9	0.9	4.1	6.2	4.8	2.6	7.3	10.7	8
Self-employed (%)	7.3	31	45.4	26.7	2.5	12.6	30.6	22.3	4.7	18.1	33.6	23.6
Out of work > 1 year (%)	0.1	0.3	0.4	0.2	0	0	0.1	0.1	0	0.1	0.2	0.1
Out of work < 1 year (%)	0	1.2	0.8	0.5	0	0.1	0	0.1	0	0.5	0.2	0.2
Homemaker (%)	15.9	21.2	22.6	19.5	31.0	66.7	61.3	55.9	24.1	53.1	53.5	45.4
Student (%)	71.6	30.9	1.2	36.3	65.5	16.3	1.2	16.5	68.3	20.6	1.2	22.2
Retired (%)	0.1	0	0.4	0.2	0.1	0	0.1	0.1	0.1	0	0.2	0.1
Unable to work (%)	0.2	0.2	0.4	0.3	0	0	0.1	0.1	0.1	0.1	0.1	0.1
Total (count)	1692	580	1614	3886	1982	1362	6328	9672	3674	1942	7942	13558
Occupation (17 more responses than the total of employed and self-employed*)												
Mining (%)	0	0.7	0.2	0.2	1.4	0	0.1	0.2	0.4	0.4	0.1	0.2
Truck driving (%)	3	4.5	5.7	5.2	2.9	0	0.3	0.4	2.9	2.4	2.2	2.2
Agriculture (%)	22.8	18.7	25.5	24	54.3	53.7	61.1	60.3	30.9	34.9	49.2	46.3
Vendor (%)	15.8	12.7	9.4	10.7	18.6	23.8	22.6	22.6	16.5	17.8	18.2	18
Construction (%)	20.3	26.5	15.4	17.8	1.4	0	0.1	0.1	15.4	14.2	5.2	6.9
Fishing (%)	2.0	0	1	1	0	0.4	0	0.1	1.5	0.2	0.4	0.4
Police (%)	0	0.7	2.4	1.8	1.4	0	0.5	0.5	0.4	0.4	1.1	1
Military (%)	0	0.4	1.2	0.9	0	0	0.1	0.1	0	0.2	0.5	0.4
Other (%)	35.6	35.1	38.6	37.7	20.0	21.2	14.8	15.5	31.6	28.7	22.8	24.1
Total* (count)	202	268	1185	1655	70	231	2345	2646	272	499	3530	4301

** Some respondents provided an occupation for their partner even if did not respond that they were employed or self-employed.*

Characteristics of Adolescent Girls and Young Women

The mean age of the 3354 AGYW who consented to participate to the HPS (round 3-5) was 18.91 years, with a SD of 2.84 years. The percentage of AGYW by age of the AGYW in years varied from 7% (i.e., 23 years old) to 14.3% (i.e., 16 years old) (Table 10).

Table 10

Frequency and Percentage of AGYW by Age in years

	Frequency	Percentage
Age (years)		
15	406	12.1
16	479	14.3
17	409	12.2
18	357	10.6
19	334	10
20	312	9.3
21	291	8.7
22	272	8.1
23	234	7
24	260	7.8
Total	3354	100

Prior HIV Diagnostic

Information on participants' prior knowledge of their HIV-positive status was available for 3058 (99.1%) of the 3086 AGYW tested for HIV. Of the 314 HIV-positive AGYW, 76 (24.2%) were diagnosed HIV-positive the day of the interview (34.7% of the 15-19 years old and 20.9% of the 20-24 years old), compared with 16.6 % of the boys aged 15-24 years (same for both age group), 10.3% of males aged 25-29 years, and 5.8% of females aged 20-24 years (see Figure 11 and Appendix D).

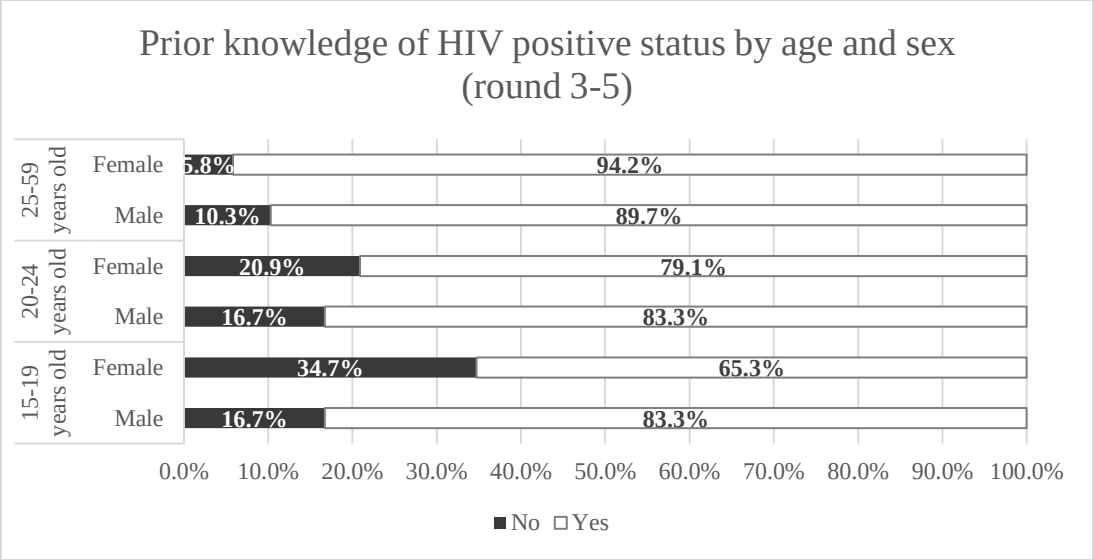

Figure 11. Prior knowledge of HIV-positive status by age and sex (round 3-5).

Twenty AGYW reported being HIV-positive and reported never having had sex prior to the day of the interview (Table 11).

Table 11

Percentage and Count of HIV-Positive AGYW by Report of Sexually Active (Yes or No)

	Age (years)		
	15-19	20-24	Total
	n	*n*	n
	%	%	%
No	18	2	20
	24.0%	0.8%	6.4%
Yes	57	237	294
	76.0%	99.2%	93.6%
Total	75	239	314

Of the 314 HIV-positive AGYW, 76.1% (239) knew that they were HIV-positive prior to the HPS interview. Information on the age of their first HIV-positive diagnosis was available for 80.3% (192). Table 12 presents the age at first diagnostic of the AGYW by who knew they were HIV-positive before the day of the interview by age group and by self-report of ever having had sex.

Table 12

Age at HIV Diagnostic for AGYW Who Knew They Were HIV-Positive Before the Day of the Interview

	Age in years		
	15-19	20-24	Total
Age (years)	*n*	*n*	*n*
Ever had sexual intercourse			
No			
0	1	0	1
4	2	0	2
9	1	0	1
11	1	0	1
14	1	0	1
15	1	0	1
16	2	0	2
18	2	1	3
Total	11	1	12
Yes			
9	2	2	4
13	1	2	3
14	2	0	2
15	3	0	3
16	4	1	5
17	10	10	20
18	4	16	20
19	2	22	24
20	0	31	31
21	1	37	38
22	0	16	16
23	0	20	20
24	0	6	6
Total	29	163	192

Sexually Active

Of the 3354 AGYW who consented to the HPS, 71.6% (2401) reported being sexually active (55.1% of the 15-19-year age group and 95.5% of the 20- to 24-year age group; Table 13). Of the 2401 AGYW who reported having had sexual intercourse, 97 % (2329) reported having at least one sexual partner in the last year (Table 13).

Table 13

AGYW Who Reported Ever Having Sexual Intercourse and Having a Sexual Partner in the Last Year by Age Group

	Age in years					
	15-19		20-24		Total	
	n	%	*n*	%	*N*	%
Ever had sexual intercourse						
No	890	44.8%	61	4.5%	951	28.4%
Yes	1093	55.1%	1308	95.5%	2401	71.6%
Total (missing 0)	1985	100%	1369	100%	3354	
Reported having a sexual partner in the last year						
Yes	1062	100%	1267	100%	2329	100%

Early Marriage and Being in School

To assess the percentage of early marriage and early pregnancies, I further analyzed participants' civil status and history of pregnancy using different age categories (i.e., 15-18 years old and 19-24 years old). As a result, 12.6% of AGYW aged 15-18 years old reported being married or living in a marital union, compared with 57.4% for the AGYW aged 19-24 years old. Current pregnancies or pregnancy in the last year was reported by 12.6% of the 15- to 18-year age group and 26.7% of the 19- to 24-year-old age group (Appendix E).

Among the participants aged 15-18 years old and currently in school, 2.2% reported being pregnant or having a baby in the last year, compared with 18.4% of those not in school. Of the participants aged 15-18 years old who were pregnant, 53.3% were single and 44.2% were married or in a marital relationship, while the percentage for those pregnant and aged 19-24 years was 22.4% single and 74.5% married or in a marital relationship (Appendix E).

Analysis

The independent variables selected for the research questions and how they were operationalized for the analysis are presented in Table 4. In this section, I will present a descriptive analysis of the independent variables (IV) selected and additional information on their operationalization for each of the three research questions. I will then explain the three steps of the logistic regression analysis for each of the research question, starting with the result of the independent logistic regression for each of the IV (Step 1), the selection of the statistically significant variables (Step 2), and the result of the logistic regression using all of the statistically significant variables found in Step 2 (Step 3).

Research Question 1. Descriptive Analysis and Operationalization of Characteristics of the Male Sexual Partner of AGYW

The first research question asked: Is there a significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected characteristics of their male sexual partner (age difference between the AGYW and her male sexual partner [i.e., male partner younger same age or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, partners older by 5-6 years, or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner], perceived faithfulness of partner [i.e., yes, no, does not know] and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive])?

Age difference between the male sexual partner and the AGYW. The AGYW reported the age of their male sexual partner to range from 12 to 65 years old, with a mean age of 24.83 years (SD of 5.24 years). The range of age difference with the male

partner ranged from the male partner being younger than the AGYW by 9 years to the male partner being older than the AGYW by 44 years, with a mean difference of 4.92 years and a SD of 4.13 years.

Table 14

Age Difference between the AGYW and Her Male Sexual Partner by Age Group

	Age in years		
	15-19	20-24	Total
	n	*n*	*n*
	%	%	%
Sex partner younger, same age, or 1-2 years older	352	271	623
	34.2%	22.2%	27.7%
Sex partner 3-4 years older than AGYW	335	322	657
	32.5%	26.3%	29.2%
Sex partner 5-6 years older than AGYW	177	285	462
	17.2%	23.3%	20.5%
Sex partner 7 years older or more than AGYW	166	345	511
	16.1%	28.2%	22.7%
Total	1030	1223	2253

Male sexual partner work occupation and type of employment. Table 15 illustrates the situation and occupation of the male sexual partner of the AGYW. During this analysis, I coded the work situation of the last partner in three categories: (a) employed for wages or self-employed, (b) unemployed (i.e., unemployed less or more than 1 year, homemaker, retired and unable to work), or (c) student (Table 15).

Table 15

Work Situation and Occupation of the Male Sexual Partner of AGYW by Age Group

	Age in years					
	15-19		20-24		Total	
	n	%	*n*	%	*n*	%
Work situation of last sexual partner						
Employed for wages	296	28.20	497	40.00	793	34.60
Self-employed	242	23.10	491	39.60	733	32.00
Out of work more than a year	2	0.20	2	0.20	4	0.20
Out of work for less than a year	2	0.20	6	0.50	8	0.30
Homemaker	90	8.60	82	6.60	172	7.50
Student	329	31.40	84	6.80	413	18.00
Retired	1	0.10	3	0.20	4	0.20
Unable to work	1	0.10			1	0.00
Do not know	86	8.20	75	6.00	161	7.00
Total (missing 40)	1049	100.1	1240	99.9	2289	99.8
Type of work of last sexual partner						
Mining	8	1.50	15	1.50	23	1.50
Truck driving	29	5.40	75	7.60	104	6.80
Agriculture	27	5.00	66	6.60	93	6.10
Vendor	87	16.20	150	15.10	237	15.50
Construction	157	29.30	273	27.50	430	28.10
Fishing			7	0.70	7	0.50
Police	9	1.70	26	2.60	35	2.30
Military	7	1.30	14	1.40	21	1.40
Other	190	35.40	336	33.80	526	34.40
Do not know	18	3.40	23	2.30	41	2.70
Total (none)	536	100	993	100	1529	100

Type of relationship. AGYW aged 20-24 years old were more likely to report that their last sexual partner was their spouse (80%) compared with those aged 15-19 years old (58.3%; Table 16). Few AGYW in both age group reported that their last sexual partner was an exchange partner (1.8% in the 15-19 years old group and 0.9% in the 20-24 years old group; Table 16). An exchange partner was defined as one who provides the AGYW with favors, money, transportation, or drugs for sex.

Table 16

Type of Relationship with Last Male Sexual Partner as Reported by AGYW by Age Group

	Age in years				Total	
	15-19		20-24			
	n	%	*n*	%	*n*	%
Type of relationship (last sexual partner)						
Spouse	619	58.3%	1014	80.0%	1633	70.1%
Casual partner	422	39.7%	238	18.8%	660	28.3%
Exchange partner	18	1.7%	12	0.9%	30	1.3%
Total (missing 0)	1062	100.00%	1267	100.00%	2329	100.00%

Perceived faithfulness of the male sexual partner. Half of the AGYW reported that their male sexual partner did not have other sexual partners (51.9% of the 15-19 years old and 50.3% of the 20-24 years old), while 7.7% of the 15- to 19-year age group and 13.4% of the 20- to 14-year old age group reported that their partners were unfaithful. A large proportion of the AGYW did not know whether their partners were faithful (36.1 % of the 20- to 24-year old group and 40.4% of the 15- to 19-year-old group; Table 17).

Table 17

Perceived Faithfulness of Last Sexual Partner

	Age in years				Total	
	15-19		20-24			
	n	%	*N*	%	*n*	%
Beside you does your last partner have any other sexual partner?						
No	543	51.9%	625	50.3%	1168	51.0%
Yes	81	7.7%	167	13.4%	248	10.8%
Do not know	423	40.4%	448	36.1%	871	38.1%
Total (missing 2)	1047	100%	1242	100%	2289	100%

HIV status of the male sexual partner. Of the AGYW who reported having a male sexual partner in the last year, 53.6% of the HIV-negative and 48.2% of the HIV-positive AGYW reported knowing that their male sexual partner had tested for HIV (Table 18). Among the AGYW who reported asking the HIV status of their male sexual

partner, 52.6% of the HIV-negative 15- to 19-year-old asked their partner for their result, compared with 37% of the HIV-positive group. Among the 20- to 24-year old, 59.6% of the HIV-negative and 55% of the HIV-positive participants asked their partner for their HIV test result (Table 19). Of the AGYW who knew of their male sexual partner's HIV status, 5.9% reported their partner to be HIV-positive (1.3% for the 15-19 years old and 9.5% for the 20-24 years old) and 88.2 % reported their male partners to be HIV-negative (Table 19).

Table 18

Male Sexual Partner Tested for HIV, AGYW Asked for Their Results Reported by AGYW by Age and HIV Status of the AGYW

	Age in years								Total			
	15-19				20-24							
	HIV -		HIV +		HIV -		HIV +		HIV -		HIV +	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Has this partner tested for HIV?												
No	246	26.6%	18	34.0%	268	28.9%	69	30.1%	514	27.8%	87	30.9%
Yes	475	51.4%	17	32.1%	517	55.8%	119	52%	992	53.6%	136	48.2%
Do not know	204	22.1%	18	34%	140	15.1%	39	17%	344	18.6%	57	20.2%
Total	925	100%	53	100%	926	100%	229	100%	1851	100%	282	100%
Did you ask your last sexual partner of his HIV test result?												
No	421	45.5%	33	61.1%	361	39.0%	99	43.2%	782	42.2%	132	46.6%
Yes	487	52.6%	20	37%	552	59.6%	126	55.0%	1039	56.1%	146	51.6%
Do not know	17	1.8%	1	1.9%	12	1.3%	3	1.3%	29	1.6%	4	1.4%
Total	926	100%	54	100%	926	100%	229	100%	1852	100%	283	100%

Table 19

Results of the HIV Test of the Male Sexual Partner of AGYW by Age

	Age years					
	15-19		20-24		Total	
	n	%	*n*	%	*n*	%
What is your partner's HIV result?						
HIV-positive	7	1.3%	67	9.5%	74	5.9%
HIV-negative	500	92.3%	600	85.1%	1100	88.2%
Do not know	34	6.3%	34	4.8%	68	5.5%
Total (missing 51)	51	100%	71	100%	1242	100%

Research Question 1, Step 1: Logistic regression. In Step 1, I performed a logistic regression analysis for each of the selected characteristics of the male sexual partners of the AGYW, which served as the independent variables, and the HIV status of the AGYW, which was the dependent variable. Table 20 presents the characteristics of male sexual partners of the AGYW by age, HIV status of the AGYW, and the results of the bivariate logistic regression analysis.

Table 20

Characteristics of Male Sexual Partners of the AGYW by Age, HIV status of the AGYW, and Result of Independent Logistic Regression (for Each Variable Separately)

	15-19 years old		20-24 years old		Total			95% CI for Exp (B)		
	HIV -	HIV +	HIV -	HIV +	HIV -	HIV +	AoR	Lower	Upper	Sig.
Age difference between the AGYW and her male sexual partner										
> 7 years older	15.3%	33.3%	25.4%	43.4%	20.4%	41.5%	3.85	2.64	5.6	.000
5-6 years older	17.1%	17.6%	23.3%	18.6%	20.2%	18.4%	1.71	1.12	2.63	.014
3-4 years older	32.4%	23.5%	27%	23.5%	29.7%	23.5%	1.5	.99	2,24	.052
< or 0-2 years older	35.3%	25.5%	24.3%	14.5%	29.8%	16.5%	Reference			.000
Total (count)	902	51	901	221	1803	272				
Work situation										
Employed	55.8%	62.5%	85.3%	85.2%	70.7%	81%	4.77	2.69	8.46	.000
Out of work	9.9%	18.8%	6.8%	12.9%	8.3%	14%	6.99	3.6	13.58	.000
Student	34.3%	18.8%	7.9%	1.9%	21%	5%	Reference			.000
Total	840	48	856	210	1696	258				
Type of sexual partner										
Exchange	1.8%	0%	0.9%	0.9%	1.4%	0.7%	.51	.12	2.16	.359
Casual	39.4%	38.9%	17.4%	24%	28.4%	26.9%	.92	.69	1.22	.556
Spouse	58.8%	61.1%	81.8%	75.1%	70.3%	72.4%	Reference			.567
Total (count)	924	54	927	229	1851	283				
Beside you does your last partner have any other sexual partner?										
No	53.8%	35.8%	52.4%	39.6%	53.1%	38.8%	Reference			.000
Do not know	39.2%	47.2%	36.5%	36%	37.9%	38.1%	1.38	1.03	1.83	.029
Yes	7%	17%	11.1%	24.4%	9%	23%	3.48	2.45	4.94	.000
Total	915	53	909	225	1824	278				
What is your partner's HIV result?										
Positive	0.6%	21.1%	1.9%	46.3%	1.3%	42.9%	67.79	35.36	129.96	.000
Do not know	5.9%	15.8%	3.6%	10.7%	4.7%	11.4%	5.0	2.69	9.31	.000
Negative	93.5%	63.2%	94.5%	43%	94%	45.7%	Reference			.000
Total	477	19	523	121	1000	140				

Age difference between male sexual partner and AGYW with HIV status of the AGYW. The odds of being HIV-positive for AGYW who reported having a male sexual partner 7 years or older than themselves was 3.85 higher (p = .000, 95% CI [2.64, 5.6]) than of the AGYW with a partner who was younger, the same age, or 1-2 years older. The odds of being HIV-positive were 1.71 higher (p = .014, 95% CI [1.12-2.63]) when the partner was 5-6 years older compared with the reference category of AGYW (i.e., AGYW who reported a partner younger the same age or 1-2 years older). The odds were not statistically significant higher if the partner was 3-4 years older (OR 1.494, p = .0.52, 95% CI [.99, 2.24] compared with the reference group; Table 20).

Work situation of the male sexual partner. AGYW had 4.77 higher odds to be HIV infected (p = .000, CI; 95% [2.69,8.46]) when their sexual partner was reported as employed for wages, compared with AGYW who reported their sexual partner to be students. The odds were 6.99 higher (p = .000, 95% CI [3.6-13.58]) when the partner was reported to be out of work compared with AGYW who reported their sexual partner to be students (Table 20).

Type of relationship with male sexual partner. I found no statically significant difference between the type of relationship with the male partner (i.e., spouse, casual or exchange) and the HIV status of the AGYW (Table 20).

Faithfulness of the sexual partner. AGYW who reported not knowing whether their male sexual partners were faithful had 1.38 higher odds of being HIV-positive (p = . 029, 95% CI [1.034-1.829]) compared with AGYW who reported their male sexual partner to be faithful. The odds were 3.48 higher when the AGYW reported her male sexual partner to be unfaithful (p = .000, 95% CI [2.45-4.93]; Table 20).

HIV status of the male sexual partner. AGYW who reported an HIV-positive male sexual partner had 67.78 higher odds of being HIV-positive (p = .000, 95% CI [35.36, 129.96]) compared with AGYW who reported an HIV-negative partner. The odds were five times higher if the AGYW did not know of the HIV status of her male sexual partner (p = .000, 95% CI [2.68-9.31]; Table 20).

Research Question 1, Step 2: Logistic regression. I found the variables of age difference between the AGYW and her male sexual partner, perceived faithfulness of the sexual partner, occupation of the sexual partner, and result of the HIV test of the sexual

partner to be statistically significant when performing the logistic regression for each of the variable independently. I selected these variables for Step 3.

Research Question 1, Step 3: Logistic regression. I performed logistic regression to test whether there is an association between the selected characteristics of the male sexual partner of AGYW (faithfulness, age difference, HIV status of the partner, and occupation of the partner) and the HIV status of the AGYW and the selected variables. The resulting Nagelkerke r^2 indicated that the model accounted for 40% of the total variance. The results of the Wald test indicated that three of the four predictors were statistically significant, while the age difference between the AGYW and her male sexual partner was no longer statistically significant. When AGYW reported their partner to be unfaithful, the odds of being HIV-positive were 2.105 higher (p = .036, 95% CI [1.048, 4.227]) and were 1.716 higher (p = .034, 95% CI [1.042, 2.887]) when they did not know about their partner's faithfulness. The AGYW who reported their partner to be employed for wages had 6.981 higher odds (p = .002, 95% CI [2.067, 23.586]) of being HIV-positive compared with AGYW who reported their partner to be students; these same odds were 12.319 higher (p.000, 95% CI [3.172, 47.843]) when the partner was unemployed. The odds of being HIV-positive for AGYW were 53.596 higher (p = .000, 95% CI [25.915, 110.846]) when the male partner was reported to be HIV-positive compared with AGYW who reported a male sexual partner to be HIV-negative. The odds were 5.501 higher (p = .000, 95% CI [2.739, 11.046]) when the AGYW did not know the HIV status of her male sexual partner (Table 21) than when the male partner was HIV-negative.

Table 21

Result of the Logistic Regression (Step 3) for Research Question 1 (Characteristics of Male Sexual Partners of AGYW and HIV Status of the AGYW)

							95% CI for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Perceived faithfulness of the male sexual partner								
Partner is perceived to be faithful			6.676	2	.036	Reference		
Partner perceived not be faithful	.744	.356	4.377	1	.036	2.105	1.048	4.227
Does not know if partner is faithful	.540	.255	4.499	1	.034	1.716	1.042	2.827
Age difference between male sexual partner and AGYW								
Younger same age or 1-2 years older			4.852	3	.183	Reference		
Partner 7 years or older than AGYW	-.118	.339	.121	1	.728	.889	.457	1.728
Partner 5-6 years older)	-.269	.398	.455	1	.500	.764	.350	1.668
Partner 3-4 years older	.596	.434	1.886	1	.170	1.814	.775	4.244
HIV status of the male sexual partner								
Partner HIV-negative			124.807	2	.000	Reference		
Partner HIV-positive	3.981	.371	115.322	1	.000	53.596	25.915	110.846
Does not know result of partner	1.705	.356	22.969	1	.000	5.501	2.739	11.046
Occupation of male sexual partner								
Partner of AGYW student			13.166	2	.001	Reference		
Partner employed for wage	1.943	.621	9.788	1	.002	6.981	2.067	23.586
Partner unemployed	2.511	.692	13.158	1	.000	12.319	3.172	47.843
Constant	-4.742	.706	45.132	1	.000	.009		

Question 2. Descriptive Analysis and Operationalization of the Knowledge, Beliefs, and Selected Behaviors of AGYW

The second question asked: Is there a significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [always, sometimes, never], use of drugs and alcohol, transactional sex with last sexual partner)?

Knowledge. A series of 12 HPS questions assessed HIV knowledge. The first question asked participants whether they knew about HIV. Among the 15- to 24-year-old

participants, 9.5% did not know about HIV; this percentage was higher among younger participants aged 15-19 years old (19.8% male, 18.5% female; Table 22). Among the participants who knew about HIV, 34.7% reported that they did not know anyone living with HIV; this percentage was higher among young people (42% among those aged 15-19 years old). Of those who reported knowing someone with HIV, 25.7% of the participants reported knowing between one and five people with HIV (Table 22).

Table 22

Have Heard about HIV, How Many People Known to Have HIV, How Many People Died of HIV, and Knowledge of HIV/AIDS by Age and Sex

	15-19 years old			20-24 years old			25-59 years old			Total		
	Male %	Female %	Total %	Male %	Female %	Total %	Male %	Female %	Total %	Male %	Female %	Total %
Heard of HIV/AIDS												
No	19.8	18.5	19.1	9.3	6.9	7.6	5.6	5.5	5.5	12.3	8.3	9.5
Yes	79.6	81.3	80.6	90.7	93	92.3	94.3	94.5	94.4	87.4	91.6	90.4
D/n	0.5	0.2	0.4	0	0.1	0.1	0.1	0	0.1	0.3	0.1	0.1
Total	1695	1983	3678	582	1367	1949	1619	6339	7958	3896	9689	13585
How many people known with HIV/AIDS												
0	44.6	39.8	42	35.6	35.9	35.8	32.7	31.2	31.5	37.9	33.5	34.7
1-5	19.7	25.3	22.8	21.5	28.8	26.7	23.3	27.4	26.5	21.6	27.2	25.7
6-20	2.8	4.3	3.6	5.7	11	9.4	12.8	13.3	13.2	7.8	11.3	10.4
1	0.9	0.7	0.8	1.9	1.4	1.6	3.6	2.6	2.8	2.3	2.1	2.10
DK*	32	29.8	30.8	35.2	22.9	26.5	27.5	25.5	25.9	30.5	25.9	27.2
Total	1348	1610	2958	525	1269	1794	1518	5970	7488	3391	8849	12240
How many people known who died of AIDS												
0	53.3	52.9	53.1	43.8	53.5	50.7	45	45.9	45.7	48.1	48.3	48.2
1-5	10.5	13.3	12	17.4	19.2	18.7	21.3	23	22.7	16.4	20.7	19.5
6-20	1	0.9	0.9	2.1	1.3	1.5	4	3.1	3.3	2.5	2.4	2.5
>21	0.8	0.1	0.4	0.2	0.3	0.3	0.5	0.5	0.5	0.6	0.4	0.5
DK*	34.4	32.8	33.5	36.5	25.7	28.9	29.3	27.4	27.8	32.4	28.1	29.3
Total	1346	1607	2953	523	1269	1792	1523	5971	7494	3392	8847	12239

*DK does not know

The survey used nine questions to ask participants who reported knowing about HIV whether it is possible for a healthy-looking person to have the AIDS virus; whether the virus that causes AIDS may be transmitted from mother to baby during pregnancy,

delivery, or breastfeeding; whether people can reduce their chance of getting the AIDS virus by using a condom every time they have sex; when man without HIV becomes circumcised, whether his risk for getting HIV increases, decreases, or remains the same; whether they had heard about ARV medicine that people infected with the AIDS virus can get from a doctor or a nurse; and when a person with HIV takes ARV medicines, whether his or her risk of giving HIV to a sexual partner increases, decreases, or remains the same. Each right answer was given a value of 1, while a wrong or "do not know" answer was given a value of 0. The sum of all answers was then calculated for a maximum value of 9. The number of right answers was further categorized into: (a) participants did not know or wrongfully answered all the knowledge questions, (b) participants had between one and four correct answers, (c) participants had between five and eight correct answers, and (d) participants had all the correct answers. Figure 12 presents the percentage of right answers by age and sex. The Cronbach alpha for the knowledge scale (9 items) was 0.813 for participants aged 15-59 years and 0.837 for those aged 15-24 years.

Young people aged 15-19 years old were appeared to be more likely to have no right answers to the knowledge questions than older participants (19.1% versus overall 9.5%) and more likely to know all the answers to the HIV knowledge questions (7.2% of the 15-19 year group nine correct answers, compared with 4% overall; Figure 12).

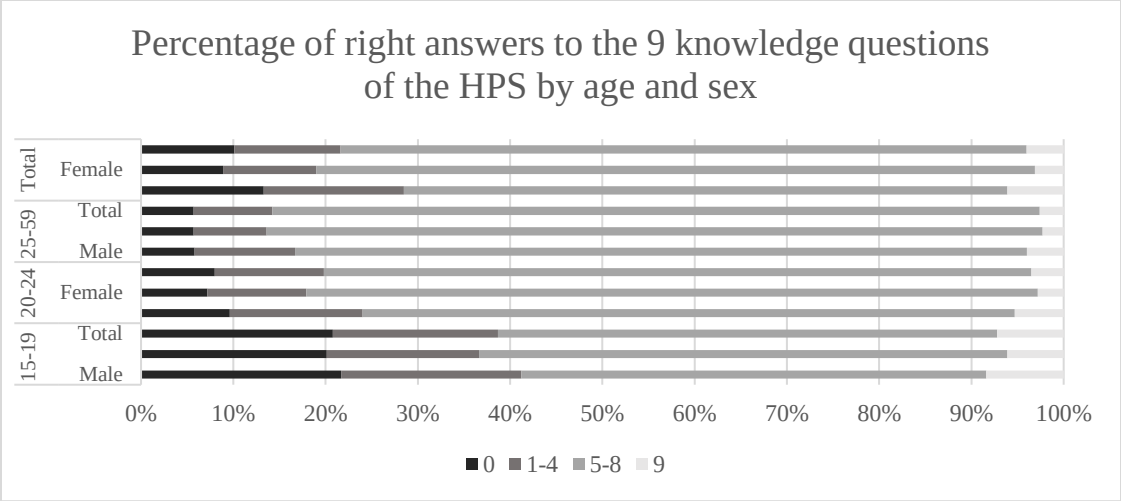

Figure 12. Percentage of right answers to the HPS knowledge questions by age and sex.

Belief. A belief scale was created with six HPS questions. Each correct answer was given a score of 1, while incorrect answers were given a score of 0. The score was computed for a maximum value of 6. Table 23 presents the percentage of right answer by age and sex for the each of the belief questions. The total on the belief scale (Figure 13) was further categorized for the analysis by number of right answers: (a) none of the belief questions were right, (b) one to three questions were right, and (c) four to six questions were right (Figure 13). The Cronbach alpha (6 items) was 0.90 for the AGYW and 0.88 for the 15- to 59-year-old HPS participants.

Table 23

Responses to Selected Beliefs of the HPS by Age and Sex

	Age in years											
	15-19			20-24			25-59			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
	%	%	%	%	%	%	%	%	%	%	%	%
PWHIV can have a long healthy life if they take ARV												
Disagree	4.1	3.8	4	3.9	3.5	3.6	3.3	3.5	3.4	3.7	3.5	3.6
Agree	91.9	91.4	91.6	94.7	95.6	95.4	95.9	95.8	95.8	94.3	95	94.8
DK*	3.9	4.7	4.4	1	0.9	0.9	0.8	0.7	0.7	1.9	1.4	1.5
Total (count)	991	1276	2267	414	1092	1506	1381	5385	6766	2786	7753	10539
Traditional medicine is as good as ART												
Disagree	84.3	85.5	85	89.1	90	89.8	91.1	93.7	93.2	88.4	91.8	90.9
Agree	5.6	4.2	4.9	4.6	4.7	4.6	4.5	3.6	3.8	4.9	3.8	4.1
DK*	10.1	10.3	10.2	6.3	5.3	5.6	4.4	2.7	3	6.7	4.3	4.9
Total (count)	992	1274	2266	413	1093	1506	1381	5387	6768	2786	7754	10540
ARV are only given to people who are feeling really bad												
Disagree	73.3	75	74.3	77.1	80.6	79.6	80.2	81.7	81.4	77.3	80.5	79.6
Agree	18.5	16.4	17.3	20.3	17.8	18.5	18.2	16.3	16.7	18.6	16.5	17.1
DK*	8	8.5	8.3	2.4	1.6	1.8	1.4	1.9	1.8	3.9	2.9	3.2
Total (count)	993	1273	2266	414	1093	1507	1382	5385	6767	2789	7751	10540
Persons taking ART need to hide their medication so other people will not find out												
Disagree	69.5	75.3	72.8	73.3	79.4	77.7	80.1	81.6	81.3	75.3	80.3	79
Agree	24	17.3	20.2	24.3	19.3	20.7	18.6	16.9	17.2	21.3	17.3	18.4
DK*	6.5	7.4	7	2.4	1.3	1.6	1.4	1.5	1.5	3.4	2.4	2.7
Total (count)	993	1276	2269	415	1092	1507	1379	5382	6761	2787	7750	10537
After testing HIV + no need to immediately get HIV care												
Disagree	26.8	29.4	28.3	29.4	36.6	34.6	31.4	32.7	32.5	29.5	32.7	31.9
Agree	66.5	64.3	65.2	68.7	62.1	63.9	67.7	66.3	66.5	67.4	65.3	65.9
DK*	6.6	6.3	6.4	1.9	1.2	1.4	0.8	1	1	3	1.9	2.2
Total (count)	993	1277	2270	415	1092	1507	1380	5375	6755	2788	7744	10532
They are special drugs for HIV + pregnant women to reduce transmission of HIV to the baby												
Disagree	4.8	4.8	4.8	3.6	3.8	3.7	4.8	5	4.9	4.7	4.8	4.7
Agree	85.1	87.5	86.4	92.1	94.1	93.5	91.7	93.5	93.1	89.4	92.6	91.7
DK*	9.8	7.8	8.6	4.1	2.2	2.7	3.5	1.6	2	5.8	2.7	3.5
Total (count)	993	1276	2269	417	1093	1510	1383	5392	6775	2793	7761	10554

*DK do not know

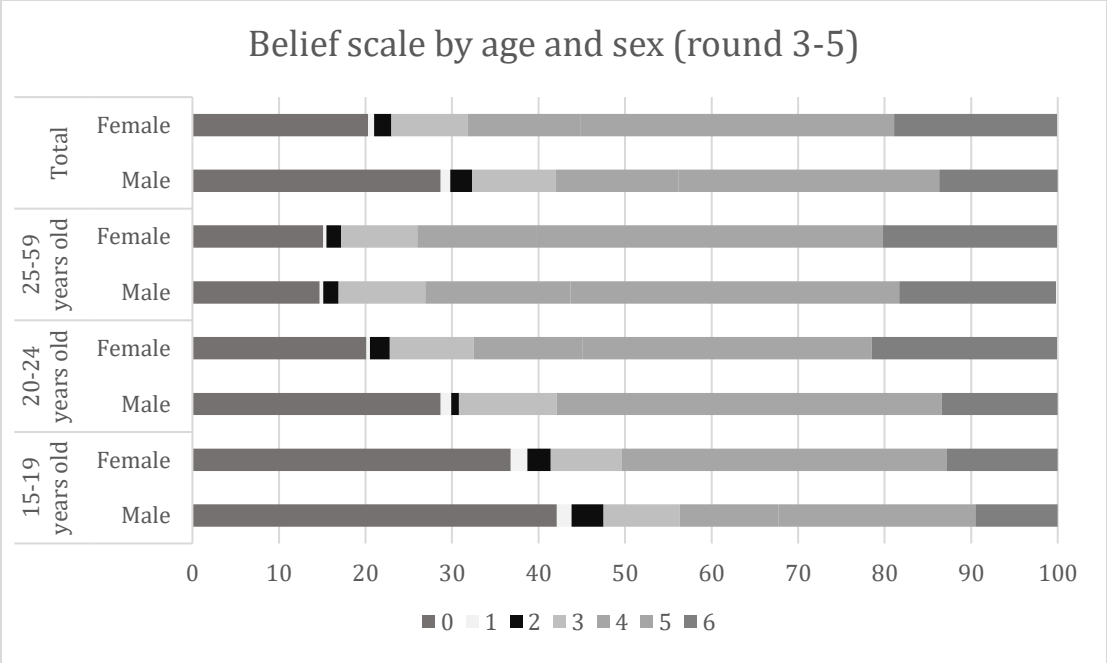

Figure 13. Belief scale by age and sex (round 3-5).

Selected behaviors of AGYW: Multiple partner, use of condoms last year, and drinking or use of alcohol. Table 24 presents selected behaviors of the participants and of the AGYW. The table includes information regarding whether the participants reported ever having intercourse, number of sexual partners in the last year, use of condoms with the last sexual partner, and the use of drugs and alcohol by age and sex. The table includes response of all HPS participants, including those who did not test for HIV.

I selected the variables of multiple sexual partners, use of condom in the last year, drinking and use of drugs, and transactional sex with last sexual partner for the logistic regression analysis. The multiple partner variable was created and coded as “yes” if the AGYW reported having more than 1 sexual partner in the last 12 months. The use of condoms with the last sexual partner was recoded to remove the “do not know” answer, which I recoded as missing. I measured the variable of drinking through a combination of

three different questions asking about drinking and use of drugs. If the AGYW reported using drugs or reported drinking in any of the questions, I coded this as "yes."

Table 24

Ever Had Sexual Intercourse, Number of Sexual Partners, Use of Condoms with Last Sexual Partner, and Use of Drugs and Alcohol for AGYW and All Participants by Age and Sex

	Women				Total including boys and men			
	Age in years				Age in years			
	15-19	20-24	25-59	Total	15-19	20-24	25-59	Total
	n %	*n* %	*n* %	*n* %	*n* %	*n* %	*n* %	*n* %
Ever had sexual intercourse								
No	821	69	241	1131	1679	120	317	2116
	45.23%	5.47%	4.54%	13.49%	46.29%	6.19%	3.94%	15.56%
Yes	993	1192	5066	7251	1947	1817	7718	11482
	54.71%	94.53%	95.42%	86.48%	53.68%	93.71%	96%	84.41%
Total	1815	1261	5309	8385	3627	1939	8037	13603
Use of condom with last sexual partner								
	53.9%	67%	77.90%	72.40%	47.8%	59.2%	75.3%	67.7%
Yes	439	383	874	1696	985	720	1615	3320
	45.5%	33%	19.70%	25.8%	51.7%	40.6%	23%	31%
Total	959	1160	4335	6454	1896	1770	6901	10567
Sum of sexual partners in the last 12 months								
1	821	986	3835	5642	1371	1314	5425	8110
	91.5%	90.8%	94.3%	93.3%	77.1%	80.4%	84.7%	82.6%
2	49	49	131	229	194	131	430	755
	5.5%	4.5%	3.2%	3.8%	10.9%	8%	6.7%	7.7%
3	22	34	69	125	116	84	266	466
	2.5%	3.1%	1.7%	2.1%	6.5%	5.1%	4.2%	4.7%
4	2	7	18	27	28	25	80	133
	0.2%	0.6%	0.4%	0.4%	1.6%	1.5%	1.2%	1.4%
5	2	4	3	9	24	24	66	114
	0.2%	0.4%	0.1%	0.1%	1.3%	1.5%	1%	1.2%
6	0	1	2	3	16	11	46	73
	0%	0.1%	0%	0%	0.9%	0.7%	0.7%	0.7%
7	0	0	1	1	7	6	19	32
	0%	0%	0%	0%	0.4%	0.4%	0.3%	0.3%
8	0	0	0	0	6	8	19	33
	0%	0%	0%	0%	0.3%	0.5%	0.3%	0.3%
9	1	2	5	8	2	7	17	26
	0.1%	0.2%	0.1%	0.1%	0.1%	0.4%	0.3%	0.3%
>=10	0	3	1	4	14	25	39	78
	0%	0.3%	0%	0.1%	0.8%	1.5%	0.6%	0.8%
Total	897	1086	4065	6048	1778	1635	6407	9820
Use of drugs or alcohol								
No	1703	1113	4698	7514	3215	1473	5869	10557
	94.3%	88.5%	89.2%	90.2%	89.1%	76.6%	73.9%	78.3%
Yes	103	144	571	818	395	449	2076	2920
	5.7%	11.5%	10.8%	9.8%	10.9%	23.4%	26.1%	21.7%
Total	1806	1257	5269	8332	3610	1922	7945	13477

Transactional sex with last sexual partner. I assessed the variable of transactional sex by asking AGYW, "During the last 12 months, did you have sex with your last sexual partner in exchange for things like food, shelter, transportation, money or drugs?" As indicated in Table 25, only 1.9% of participants aged 15-19 years old and 1.2% of participants aged 20-24 years old reported having transactional sex with their last sexual partner.

Table 25

Transactional Sex in the Last 12 Months with Last Sexual Partner Reported by AGYW

	15-19 years old		20-24 years old		Total	
	n	%	*n*	%	*n*	%
Transactional sex with last sexual partner (missing 48)						
No	1024	97.6%	1221	98.5%	2245	98.1%
Yes	20	1.9%	15	1.2%	35	1.5%
Total	1049	100.0%	1239	100.0%	2288	100.0%

Research Question 2, Step 1: Logistic regression. I conducted logistic regression analyses for each of the independent variables selected for Question 2 in order to predict the HIV status of the AGYW. None of the variables were statistically significant, except for one subgroup of the knowledge question (i.e., not knowing about HIV), one subgroup of the belief question (i.e., 0 right answers), and one subgroup of the use of condoms (i.e., sometimes). Table 26 presents by age group and HIV status the knowledge, belief, multiple partners, use of condoms in the last 12 months, use of drugs or alcohol, and transactional sex with last sexual partner. The table also includes the adjusted odds ratio with the 95% confidence interval and the *p*-value.

Table 26

Knowledge, Belief, Multiple Partners, Use of Condoms in the Last 12 months, Use of Drugs or Alcohol, and Transactional Sex with Last Sexual Partner by Age and HIV Status of AGYW

	Age in years									
	15-19 years old		20-24 years old		Total		Aor	95% CI		
	HIV -	HIV +	HIV -	HIV +	HIV -	HIV +		Lower	Higher	Sig.
Knowledge (scale 0-9)										
0	20.8%	13.3%	7.7%	4.6%	16%	6.7%	.467	.227	.958	.038
1-4	16.5%	12%	10%	12.1%	14.1%	12.1%	.959	.496	1.857	.902
5-8	56.9%	69.3%	79.8%	79.5%	65.3%	77.1%	1.319	.734	2.370	.355
9	5.8%	5.3%	2.6%	3.8%	4.6%	4.1%	Ref			.000
Total (count)	1755	75	1013	239	2768	314				
Beliefs (scale 0-6)										
0 right answers	36.9%	25.3%	21.6%	15.1%	31.3%	17.5%	.443	.326	.602	.000
1-3 right answers	13%	13.3%	12.8%	11.7%	12.9%	12.1%	.743	.517	1.067	.108
4-6 right answers	50.1%	61.3%	65.6%	73.2%	55.8%	70.4%	Ref			.000
Total (count)	1757	75	1015	239	2772	314				
Multiple partner										
No	6.4%	7.0%	6.0%	8.0%	6.2%	7.8%	Ref			
Yes	93.6%	93%	94%	92%	93.8%	92.2%	1.272	.800	2.023	.310
Total (count)	962	57	963	238	1925	295				
Use of condoms in the last year										
Always	20.5%	17.5%	9.4%	8.9%	14.9%	10.6%	Ref			.00
Sometimes	37%	29.8%	39.2%	33.5%	38.1%	32.8%	1.695	1.130	2.545	.011
Never	42.6%	52.6%	51.5%	57.6%	47.0%	56.7%	1.211	.790	1.858	.379
Total (count)	947	57	960	236	1907	293				
Use of drugs or alcohol										
No	99.7%	100%	99.3%	99.6%	99.5%	99.7%	Ref			
Yes	0.3%	0%	0.7%	0.4%	0.5%	0.3%	.967	.624	1.500	.882
Total (count)	961	57	953	236	1914	293				
Transactional sex with last partner										
No	98.2%	98.1%	98.8%	99.6%	98.5%	99.3%	Ref			
Yes	1.8%	1.9%	1.2%	0.4%	1.5%	0.7%	.480	.114	2.032	.319
Total (count)	914	52	903	226	1817	278				

Knowledge. When AGYW did not respond correctly to any of the knowledge questions (0 right answers), the odds of being HIV-positive was 2.1 (p = .038, 95% CI [1.04- 4.4]) less compared with AGYW who had responded correctly to all of the knowledge questions. No other categories were found to be statistically significant.

Beliefs total. As for knowledge, I determined that the AGYW with no correct belief scores were less likely to be HIV-positive than AGYW with four to six right answers to the belief questions, with an odd of 2.2 (p = .000, 95% CI [1.66- 3.06]).

Multiple partner, drinking or use of drugs and transactional sex with last partner. I found no statistically significant association between AGYW's HIV status and the variables of multiple partners, drinking or use of drugs, and transactional sex with last partner.

Condom use. AGYW who reported using condoms sometimes in the last year had a 1.695 (p = .11, 95% CI [1.130, 2.545]) greater odds of being HIV-positive compared with AGYW who reported always using condoms in the last year.

Research Question 2, Step 2: Logistic regression. I selected the variables of knowledge, belief, and condom use in the last 12 months to conduct Step 3 of the logistic regression.

Research Question 2, Step 3: Logistic regression. I performed a logistic regression analysis to test whether there is an association between selected behaviors, knowledge, and belief (i.e., condom use in the last 12 months) and the HIV status of the AGYW. The results of the logistic regression are presented in Table 27. I determined that only two subcategories of the three variables are statistically significant. The Nagelkerke R^2 for the predictors selected was 2.4%. The odds of being HIV-positive were 1.758 higher (p = .007, 95% CI [1.168,2.644]) for AGYW who reported sometimes using condoms, compared with AGYW who reported always using condoms in the last 12 months. The odds of being HIV-positive were 1.53 lower when the AGYW responded wrongly to all the HIV belief questions (p = .0.48, 95% CI [.428,.996]), compared with the AGYW who responded correctly to four to six belief questions (scale 0-6).

Table 27

Result of the Logistic Regression for the Research Question 2

							95% CI for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Condom use in the last twelve months								
Always			10.266	2	.006	Reference		
Sometimes	.564	.208	7.326	1	.007	1.758	1.168	2.644
Never	.240	.220	1.191	1	.275	1.271	.826	1.955
Knowledge scale (total 9) in 4 categories								
All right (9)			3.740	3	.291	Reference		
None right	-.698	.442	2.497	1	.114	.497	.209	1.183
1-4 right	-.040	.365	.012	1	.912	.960	.470	1.963
5-8 right	-.128	.327	.152	1	.696	.880	.464	1.671
Belief scale (total 6) in 3 categories								
4-6 right			3.908	2	.142	Reference		
0 right	-.426	.215	3.906	1	.048	.653	.428	.996
1-3 right	-.073	.201	.133	1	.715	.929	.627	1.377
Constant	-1.999	.360	30.798	1	.000	.135		

Research Question 3. Descriptive Analysis and Operationalization of Experience of AGYW

The third research question asked: Is there a significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of sexually transmitted infection [STI]), being in school [yes or no], civil status [married, living as married, single])?

Experience of GBV. Participants were asked four questions to assess whether they had experienced GBV either physical or sexual with their last sexual partner in the last year, or with a parent or caregiver. Table 28 presents the reported experience of GBV (if reported; AGYW reported one, two, or three forms of GBV, or none in the last year)

by age for women only. I created a new variable to evaluate whether the AGYW experienced GBV. If the AGYW reported GBV in any of the three GBV questions, I coded the GBV variable as "yes."

Table 28

Experience of GBV (Physical or Sexual) in the Last Year (by Sexual Partner, Parent, or Caregiver) Reported by Women by Age

	Age (in years)					
	15-19		20-24		Total	
	n	%	*n*	%	*n*	%
Reported experience of GBV by sexual partner (physical and or sexual violence) or sexual violence from parent caretaker or relative in the last year						
No	632	95.80%	756	95.70%	1388	95.72%
Reported 1 form of GBV	19	2.90%	24	3.00%	43	2.97%
Reported 2 form of GBV	6	0.90%	4	0.50%	10	0.69%
Reported 3 form of GBV	3	0.50%	6	0.80%	9	0.62%
Total	660	100%	790	100%	1450	100.00%
Reported experiencing GBV						
No	632	95.80%	756	95.70%	1388	95.72%
Yes	28	4.20%	34	4.30%	62	4.28%
Total	660	100%	790	100%	1450	100.00%

Being pregnant or had a baby in the last year. Table 29 presents the percentage of AGYW who reported being pregnant the day of the interview or who had a baby in the last year by age. As few AGYW reported having a baby in the last year and were pregnant the day of the interview, I created a new variable for the analysis. If the AGYW reported being pregnant or having had a baby in the last year, I coded this variable as "yes." If she did not report being pregnant in the last year or did not report to be pregnant the day of the interview, I coded this variable as "no."

Table 29

Report of Pregnancy the Day of the Interview or Had a Baby in the Last 12 Months

	Age in years					
	15-19		20-24		Total	
	n	%	*n*	%	*n*	%
Pregnant or had a baby						
No	1689	85.1%	1002	73.2%	2691	80.2%
Pregnant or had a baby in the last year	292	14.7%	364	26.6%	656	19.6%
Had a baby in the last year AND is pregnant	4	0.2%	3	0.2%	7	0.2%
Total	1985	100%	1369	100%	3354	100%

Symptoms suggestive of sexually transmitted infection. Two variables were created for the sexually transmitted infection (STI): one for symptoms suggestive of STI (e.g., sores or vaginal discharge) in life, and one for symptoms of STI in the last year. Seventeen percent of participants reported a STI in life 17% (14.7% either discharge or sores and 3.3% both discharge and sores), while 10.8% reported an STI in the last 12 months (9.1% discharge or sores and 1.7 % both; see Table 30 and Appendix F). Among AGYW, 5.4% of those aged 15-19 years old reported sores or discharge, while 1.2% reported both in life, compared with 14.8% and 2.3% for the young women aged 20-24 years old (Table 30). I used the STI in life variable and only two categories (i.e., yes or no) in this analysis.

Table 30

Symptoms Suggestive of Sexually Transmitted Infection (Vaginal/Penile Discharge or Genital Sores) in Life or in the Last 12 Months Reported by AGYW

	Age in years			
	15-19		20-24	
	n	%	*n*	%
STI I in life (sores or vaginal discharge)				
No	1853	93.4%	1135	82.9%
Sore or discharge	108	5.4%	202	14.8%
Both Sores and discharge	24	1.2%	32	2.3%
Total	1985	100%	1369	100%
STI in the last year (sores or vaginal discharge)				
No	1898	95.6%	1223	89.3%
Sore or discharge	72	3.6%	127	9.3%
Both Sores and discharge	15	0.8%	19	1.4%
Total	1985	100%	1369	100%

Being in school. I created the variable of being in school from the variable of current work situation. The variable was coded as "yes" for the participants that reported being in school as their occupation. I coded all other choices reported by the participant for occupation as "no" (Table 31).

Table 31

In School the Day of the Interview by Age Group

	No	Yes	Total
	n	*n*	*n*
	%	%	%
15-19 years old	687	1298	1985
	37.46%	85.39%	59.18%
20-24 years old	1147	222	1369
	62.54%	14.61%	40.82%
Total	1834	1520	3354
	100%	100%	100%

Civil status. I merged the responses of "married" and "living with a partner" to form one category, and merged the responses of "separated," "widow," and "divorced" to create another category (Table 32).

Table 32

Civil Status of AGYW by Age Group

	Age in years		
	15-19	20-24	Total
	n %	*n* %	*N* %
Single	1618 81.59%	480 35.06%	2098 62.59%
Married or marital union	351 17.70%	835 60.99%	1186 35.38%
Separated, divorced or widow	14 0.71%	54 3.94%	68 2.03%
Total	1983	1369	3352

Research Question 3, Step 1: Logistic regression. The result of the independent logistic regression for Question 3 is presented in Table 33. I determined that GBV was not predictive of HIV status, while the odds of being HIV-positive for AGYW were 1.342 higher (p = .032, 95% CI [1.026, 1.774]) if they were pregnant the day of the interview or had a baby in the last year, were 1.897 higher (p = .000 95%CI [1.349, 2.668]) if they reported an STI in life, and were 5.555 higher (p = .000, 95% CI [4.028, 7.662]) if they reported not being in school. The odds of being HIV-positive were 2.181 higher (p- .006, 95% CI [1.251-3.802]) if the AGYW reported being separated widowed or divorced, compared with AGYW who reported being married or living in marital union, for which the odds were lower by 2.585 (p = .000, 95% CI [2.024, 3.289]) if they were single (Table 33).

Table 33

Experience of GBV, Pregnancies (Current or in the Last Year), Symptoms Suggestive of STI in Life (Sores or Discharge), Being in School, and Civil Status by Age and HIV Status of the AGYW with Results of Independent Logistic Regression

	Age in years									
	15-19		20-24		Total		Adjusted odds ratio	95% CI		
	HIV -	HIV +	HIV -	HIV +	HIV -	HIV +		Lower	Upper	Sig.
GBV										
No	95.5%	100%	95.7%	96.1%	95.6%	96.9%	Reference			
Yes	4.5%	0%	4.3%	3.9%	4.4%	3.1%	.688	.271	1.749	.432
Total (count)	577	36	606	127	1183	163				
Pregnant the day of the interview or had a baby in the last year										
No	85.1%	77.3%	72.8%	74.9%	80.6%	75.5%	Reference			
Yes	14.9%	22.7%	27.2%	25.1%	19.4%	24.5%	1.342	1.026	1.774	.032
Total (count)	1757	75	1015	239	2772	314				
Symptoms of STI in life										
No	93.6%	84%	83.7%	79.1%	90%	80.3%	Reference			
Yes, discharge or sores	5.3%	12%	14.5%	15.5%	8.7%	14.6%	1.897	1.349	2.668	.000
Yes, discharge and sores	1.1%	4%	1.8%	5.4%	1.4%	5.1%				
Total (count)	1757	75	1015	239	2772	314				
Being in School										
No	33.5%	65.3%	81.9%	91.6%	51.2%	85.4%	5.555	4.028	7.662	.000
Yes	66.5%	34.7%	18.1%	8.4%	48.8%	14.6%	Reference			
Total (count)	1757	75	1015	239	2772	314				
Civil status										
Separated, widowed or divorced	0.7%	1.3%	3.5%	7.5%	1.7%	6.1%	2.181	1.251	3.802	.006
Single	81.6%	73.3%	35.4%	29.7%	64.7%	40.1%	.387	.304	.494	.000
Married or in marital union	17.7%	25.3%	61.1%	62.8%	33.6%	53.8%	Reference			.000
Total (count)	1756	75	1015	239	2771	314				

Research Question 3, Step 2: Logistic regression. The variables of STI in life, pregnancy, and being in school demonstrated a statistically significant association with the HIV status of the AGYW. I used these variables for Step 3.

Research Question 3, Step 3: Logistic regression. I performed logistic regression to assess the effect of the variables selected in Step 2 (i.e., civil status, STI, pregnancy in the last year or the day of the interview and attending school) on the HIV

status of AGYW. The results indicated that three predictors remained statistically significant: civil status, STI, and attending school. AGYW who reported being separated had 2.398 (p = .003, 95% CI [1.337, 4.235]) higher odds of being HIV-positive compared with AGYW who reported being married. AGYW who reported STI in life had 1.535 (p = .017, 95% CI [1.080, 2.181]) higher odds of being HIV-positive than AGYW who did not report any STI in life. AGYW who reported not attending school had 5.286 (p = .000, 95% CI [3.618, 7.723]) higher odds of being HIV-positive compared with AGYW who reported attending school. The Nagelkerke R^2 for the model with the four predictors was 11% (Table 34).

Table 34

Result of the Logistic Regression for Research Question 3

							95% C.I. EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Civil status								
Married			10.451	2	.005			
Separated	.867	.294	8.684	1	.003	2.379	1.337	4.235
Single	-.110	.148	.558	1	.455	.896	.670	1.196
Sexually transmitted infection (STI) in life (no as reference)								
Reported STI	.428	.179	5.705	1	.017	1.535	1.080	2.181
Pregnant the day of the interview or had a baby in the last year (no as reference)								
Yes	-.174	.148	1.373	1	.241	.841	.629	1.124
Attending school (yes as reference)								
No	1.665	.193	74.090	1	.000	5.286	3.618	7.723
Constant	-3.370	.212	253.590	1	.000	.034		

Summary

In this chapter, I presented information on the dataset that I used to perform the analysis, baseline descriptive and demographic characteristics of the population sampled, how the variables were operationalized, and the results of the stepwise logistic regression

conducted to assess whether an association exists between the HIV status of AGYW (i.e., the dependent variable), the characteristics of male sexual partners, and selected experiences and behaviors of AGYW (i.e., the independent variables).

The characteristics of male sexual partners that are associated with a higher risk of HIV for AGYW are the work situation of the male partner (i.e., employed or unemployed compared with student), the faithfulness of the partner (i.e., unfaithful or unsure if partner is faithful compared with believed partner to be faithful), and HIV status of the partner (i.e., HIV-positive or unknown status compared with HIV-negative partner). The characteristics not associated with the HIV status of the AGYW were the age of the male sexual partner or the type of relationship the AGYW reported having with the male sexual partner (i.e., causal, exchange, spouse). When looking at the association between HIV knowledge, HIV belief and HIV status of the AGYW significant difference were found only in one of the subcategories (i.e., no knowledge and higher stigma), which were associated with less chance of being HIV-positive among the AGYW. Having multiple partners, use of drugs and alcohol, transactional sex with last partner, GBV, and being pregnant or having a baby in the last year were not associated with the HIV status. Consistent condoms use (i.e., always in the last 12 months compared with never and sometimes), being in school, never having reported STI in life, and civil status were associated with significantly less risk of HIV. In Chapter 5, I will present the interpretation of the findings, the limitations of the study, and my recommendations following the results found in Chapter 4.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

In SSA countries, AGYW are disproportionally infected with HIV compared with ABYM (Dellar, Dlamini, & Abdool Karim, 2015; Laga, Schwärtlander, Pisani, Sow, & Caraël, 2001; UNAIDS, 2015). In South Africa, eight AGYW and three ABYM are newly infected with HIV every hour (ONUSIDA, 2019). Although considerable progress has been made to reduce new HIV infection and HIV mortality among the general population, AGYW have not benefited equally (PEPFAR, 2015). The needs of AGYW to remain HIV-negative have not been met (Bruce, Temin, & Hallman, 2012; Karim & Dellar, 2014). In order to prevent new HIV infection among AGYW living in SSA countries, it is important to understand the specific risks and vulnerabilities that AGYW face (Joint United Nations Programme on HIV/AIDS, 2014; UNAIDS, 2015).

My purpose in this quantitative study was to identify whether there is a relationship between characteristics of AGYW and of their male sexual partner and the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique. The secondary data analysis was performed using a subset of quantitative data collected for the combination prevention of HIV evaluation conducted by the CDC and the Mozambican National Institute of Health. The variables that I selected for the research questions were the HIV status of the AGYW (i.e., HIV-positive, HIV-negative), characteristics of male sexual partner of AGYW (i.e., age difference between the AGYW and her male sexual partner, work situation, type of relationship, faithfulness, and HIV status of the male sexual partner), HIV knowledge, beliefs and behaviors of AGYW (i.e., multiple sexual partners, use of condom in the last 12 months, transactional sex with the

last sexual partner) and experience of AGYW (i.e., experience of gender-based violence, pregnancy in the last 12 months, STI, being in school, and civic status).

This chapter is divided in three sections. In the first section, I will present a brief summary and interpretation of the findings for each of the research questions. This is followed by a section on the limitations of the study. In the last section, I will present several recommendations based on the results of the analysis, as well as the implications for social changes.

Interpretation of the Findings

The MSEM of Baral et al. (2013) provides a framework which illustrates the individual and contextual factors influencing the acquisition of HIV for individuals. I presented an adaptation of the MSEM in Chapter 3, which highlighted specific factors that could be influencing HIV acquisition for AGYW living in a southern district of Mozambique. The characteristics of the AGYW selected for the analysis are concentrated in three of the layers of the MSEM: the HIV epidemic stage, the social and sexual network, and the individual level. The information for the analysis originates from the Chokwe CP quantitative dataset. The variables for which information is available on the CP dataset selected for the analysis are highlighted in red in Figure 14.

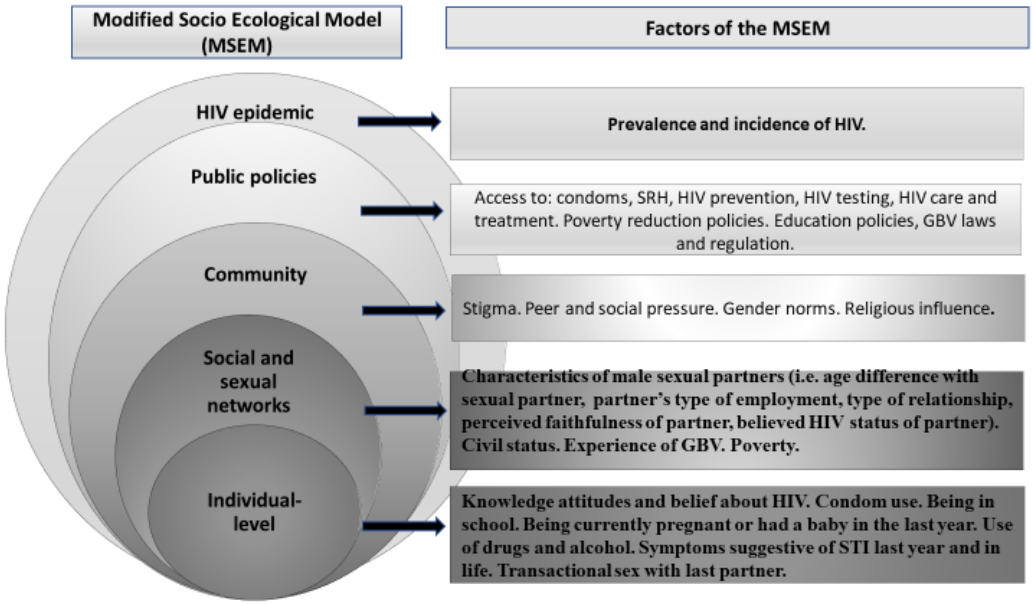

Figure 14. Individual and contextual factors influencing the risk of HIV acquisition of AGYW living in Mozambique using the MSEM of Baral et al. (2013).

The findings were organized by research questions. For each of the research question, a brief summary of findings from the literature is presented, followed by the results and interpretation of the analysis.

HIV Prevalence

In the MSEM model, the HIV epidemic stage is an important factor in the risk of acquiring HIV. Individuals living in communities with low prevalence of HIV have a lower risk of getting infected with HIV compared with individuals living in communities where the prevalence of HIV is high. Mozambique is one of the most HIV affected country consistently ranking eighth in the world in HIV prevalence (CIA, n.d.). In Chokwe, the weighed prevalence of HIV was found to be 24.5% among participants aged 15 to 59 years old. This is considerably higher than the 11.5% HIV prevalence reported among adults living in Mozambique by the National Institute of Health Mozambique (2015).

AGYW living in SSA are disproportionally infected with HIV compared with ABYM. In South Africa, a neighboring country to Mozambique, the prevalence of HIV was found to be up to six times higher among AGYW compared with ABYM (Shisana et al., 2014; Zuma et al., 2016). In a country-wide HIV surveillance conducted by the Mozambican National Institute of Health, the disparities in HIV prevalence ranged from 2.6 times higher among women aged 20 to 24 years, to 3.5 times higher among girls aged 15 to 19 years old compared with ABYM the same age (National Institute of Health Mozambique, 2015). Similar disparities in HIV prevalence between the AGYW and the ABYM were found with the analysis of the secondary dataset collected in the southern district of Mozambique. The weighted prevalence of HIV was 1.8 times higher for young girls compared with boys aged 15 to 19 years (4 % versus 2.4%) and 5.75 higher for young women aged 20 to 24 years compared with young men of the same age (18.4% versus 3.2%; see Figure 9 and Appendix C).

The discrepancies in prevalence of HIV between the AGYW and ABYM confirm the urgency to identify the factors that render AGYW more vulnerable to HIV. This is especially important in a context as the one encountered in the southern district of Mozambique where the prevalence of HIV is very high (i.e., 24.5% among the 15-29-year-olds) and where the prevalence of HIV among AGYW is 1.8 to 5.75 higher than their male counterparts.

Research Questions

Interventions should focus on the specific needs and vulnerabilities of the AGYW to ensure they can remain HIV-negative (Chandra-Mouli et al., 2015; UNAIDS, 2015). Through the three research questions developed for the current dissertation, I attempted

to identify specific factors that render AGYW living in a southern district of Mozambique more or less at risk of being HIV-positive. This information could be used by public health officials to design and tailor interventions to the needs of the AGYW. In the following section, I will present the results of the analysis for each of the research questions.

Research Question 1: Sexual Network Influence on HIV for AGYW

The first research question focused on components of the fourth layer of the MSEM which illustrate the effect of the social and sexual network on risk of HIV acquisition for AGYW.

The first question asked: Is there a significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected characteristics of their male sexual partner (age difference between the AGYW and her male sexual partner [i.e., male partner younger same age or 1-2 years older than the AGYW, partners older than the AGYW by 3-4, years, partners older by 5-6 years, or partners 7 years or older than the AGYW], partner's work situation [i.e., employed for wages or self-employed, unemployed or student], type of relationship [i.e., casual, married, exchange partner (sex for money/goods/services)], perceived faithfulness of partner [i.e., yes, no, does not know], and the HIV status of sexual partner [i.e., unknown HIV status, HIV-negative, HIV-positive])? The results of that analysis for the selected variables are:

Age difference of male sexual partners with AGYW. After conducting the analysis, the odds of being HIV-positive was not associated with the age of the male sexual partner of the AGYW with a partner who is younger, the same age, or 1-2 years older as the reference category.

In some studies, age difference of male sexual partners with the AGYW was reported to be a risk factor for HIV for AGYW living in South Africa (Gouws & Williams, 2017 ; Jewkes, Dunkle, Nduna, & Shai, 2012; Kharsany et al., 2015; Mabaso, 2017; Maughan-Brown, Evans, & George, 2016; Pettifor et al., 2005), Zimbabwe (Schaefer et al., 2017), and Tanzania (Msuya et al., 2006). In other studies, however, an age difference with the sexual partner was not found to be associated with the HIV status of AGYW living in Kwa Zulu Natal (Harling et al., 2014) and South Africa (Balkus et al., 2015).

The results of the analysis did not support the hypothesis that age difference is a factor associated with HIV in Chokwe. This may be due to the fact the sample size was too small to detect differences for this variable. Of the 3354 AGYW who participated in the HPS, 2329 reported having a sexual partner in the last year, 2253 reported the age of their partner and of those only 1040 reported the HIV status of their partner (i.e. HIV positive, HIV negative, or do not know the HIV status of their partner). This sample is smaller than the estimated number of 1, 484 participants calculated using G*Power for logistic regression to detect a statistically significant difference using an α level of 0.05 (two-tailed) and an 80% power for an estimated odds ratio of 1.2, . It is also possible that age difference is not a factor associated with higher likelihood of being HIV-positive for AGYW living in Chokwe. If age difference is not a factor associated with HIV among AGYW, interventions to prevent new HIV infection among AGYW should not focus on this characteristic of the male sexual partner and should focus instead on other characteristics of the sexual partner that are associated with HIV-positive AGYW.

Work situation of the partner. The odds of being HIV-positive was higher for AGYW who reported that their male sexual partner was employed for wages or self-employed or if the AGYW reported her partner to be unemployed, compared with AGYW who reported that their sexual partners were students.

A potential interaction which could have affected the result of this analysis is the age of the AGYW. Younger girls may have been more likely to report that their male sexual partner was a student compared with older AGYW (i.e., men older than 19 years old were less likely to report being a student compared with younger boys, and AGYW median age difference with sexual partners was 4.23 years). Younger girls were also less likely to be HIV-positive (i.e., 4% of the 15-19 years old compared with 18.4% of the 20-24 years old group).

After conducting a separate analysis for the 15- to 19-year-old age group and the 20- to 24-year-old age group, the same association continued. The risks of HIV were higher if the partners were employed or unemployed, compared with when AGYW reported partners to be a student; this was true among the older AGYW as well.

Type of relationship. I found no statistically significant difference between HIV-negative and HIV-positive AGYW and the type of relationship reported by the AGYW (i.e., exchange partner (p = .359, 95% CI [. 12, 2.16]), and casual partner (p = . 556, 95% CI [.69,1.22]) when using regular partner or spouse as a reference category. One important limitation of this analysis is that few AGYW reported that their last sexual partners were transactional sex partners (1.8% of the 15- to 19-year old group and 0.9% of the 20- to 24-year-old group).

Faithfulness of sexual partner. Unfaithfulness or unknown faithfulness of the sexual partner was positively associated with the HIV status of the AGYW when comparing AGYW who reported faithful partners. The odds of being HIV positive for AGYW who reported their partner to be unfaithful were 2.105 higher (p = .036 95% CI [1.048, 4.227]) and were 1.716 higher (p = .034, 95% CI [1.042, 2.887]) when they did not know about the partner's faithfulness compared with AGYW who reported their partner to be faithful (Table 21). This supports findings reported in two studies in SA, where perceived unfaithfulness of the male sexual partner was associated with a 22.57 (13.51-37.69) higher risk of HIV infection in one study (Msuya et al., 2006) and an increased risk of HIV of 4.44 (0.72-29.7) in another one (Schaefer et al., 2017).

HIV status of partner. I found a significant positive association between AGYW positive status who reported an HIV-positive partner or who reported not knowing the status of the male sexual partner when using HIV-negative partner as a reference category. The odds of being HIV positive for AGYW who reported an HIV positive partner was 53.596 higher (p = .000, 95% CI [25.915, 110.846]) than the AGYW who reported an HIV negative partner and were 5.501 higher (p = .000, 95% CI [2.739, 11.046]) when the AGYW did not know the HIV status of her male sexual partner compared with the AGYW who reported an HIV negative partner (Table 21). This supports findings of increased odds of being HIV-positive of 7.46 (95% CI [3.2-17.4]) when partners of AGYW are HIV-positive in SA (Shisana et al., 2014).

Research Question 1 results of the logistic regression. The results of the stepwise logistic regression conducted with the HPS dataset ($p<0.05$ two-tailed) confirmed that I could reject the null hypothesis which stated that there is no association

between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and some characteristics of their male sexual partner as reported by AGYW. I found a statistically significant association between the HIV status of the AGYW for three of the five characteristics that I selected as IV (i.e., work situation of the male sexual partner, HIV status of the partner and perceived faithfulness). The age difference and type of relationship were not statistically associated with the HIV status of the AGYW.

Questions 2 and 3: Social Network and Individual Level Factors and HIV

The second and third question of the dissertation focused on factors associated with the social and individual factors of the MSEM. I tested whether individual factors (i.e., HIV beliefs, HIV knowledge, HIV prevention behaviors, and biological factors) and social factors (i.e., GBV, type of relationship, education) were associated with the HIV status of the AGYW. It was possible to conduct this analysis using the HPS data collected for CP as the dataset contains quantitative information on HIV knowledge, HIV beliefs, number of sexual partners, experience of GBV, history of pregnancy in the last year, symptoms suggestive of STI, being in school, and civil status.

Question 2 HIV knowledge, HIV belief and behaviors, and HIV status. The second question asked: Is there a significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected HIV knowledge, beliefs and behaviors of AGYW (i.e., number of sexual partners, use of condoms in the last year [always, sometimes, never], use of drugs and alcohol, transactional sex with last sexual partner)? The results of the analysis for the selected variables are the following.

HIV knowledge. HIV knowledge was not associated with the HIV status of the AGYW in three of the four subcategories of knowledge (i.e., one to four right answers, five to eight right answers, and all right answers); however, it was a protective factor for AGYW who failed to answer correctly any of the nine HIV knowledge questions (i.e., 0 right answers; OR .467, p = .038, 95% CI [.227-.958]).

The results of the analysis may have been influenced by the fact 75.8% of the HIV-positive AGYW already knew their HIV status before the day of the HPS interview. AGYW who knew of their HIV status before the day of the HPS would likely know more about HIV compared with HIV-negative AGYW or AGYW who were diagnosed as HIV-positive on the day of the interview. AGYW with prior knowledge of their HIV status should have been exposed to HIV posttest counseling when they were diagnosed HIV-positive and could have had frequent contact with health care professionals for their HIV care and treatment since their diagnosis. Further analysis is needed to understand why the AGYW with no knowledge of HIV were less likely to be HIV-positive. One potential explanation is that AGYW who already knew they were HIV-positive when the HPS were conducted were more likely to know about HIV (i.e., counseling post HIV-positive results, learning while being followed in the clinics for their HIV care) than the AGYW who were diagnosed HIV-positive after the HPS was conducted.

Beliefs about HIV. Belief was found to be a marginally significant (p = .038) predictor of HIV for one of the three subcategories of the belief scale (i.e., no right answers; OR .653, 95% CI [.428, .996]). The association between belief and HIV was no longer significant when the belief scale was combined in the last step of the logistic regression with HIV knowledge and condom use.

Multiple sexual partners. Reporting multiple sexual partners was not a statistically significant factor associated with the HIV status of AGYW (p = .31, OR 1.272, 95% CI [.8, 2.023]). In other studies, the odds of being HIV-positive among AGYW who reported more than five sexual partners in their life time was higher compared with those who did not (OR 10.80, 95% CI [5.5,21.14]), and was higher when AGYW reported concurrent sexual partners (OR 13.38, 95% CI [6.85-26.11]; Moore et al., 2007) or reported more than one sexual partner (OR 2.23, 95% CI [1.03-4.82]; Gouws & Williams, 2017). Contrary to these studies, the information used for the analysis was limited to the number of sexual partners the AGYW reported in the year prior to the interview. The results of my analysis may have differed if AGYW would have been asked to report the number of sexual partners in life.

Compared with AGYW living in Mozambique AGYW living in Chokwe were more likely to report having more than one sexual partner in the last year. Among the HPS participants, 91.5% of the participants aged 15-19 years old and 90.8% of those aged 20-24 years old reported having only one sexual partner in the last year, compared with 97.3% of the 15-19 year and 96.2% of the 20-24 year groups across Mozambique (National Institute of Health Mozambique, 2015). It is possible that the risk of HIV among AGYW who reported more than one sexual partner is confounded by condom use.

Condom use. I found a significant association between AGYW who reported using sometimes condoms and AGYW who reported always using condom. The odds were not significant for the AGYW who reported never using condoms (p = .275, OR, 1.271, 95% CI [.826,1.955]). These results support previous researchers' recommendations of consistent condom use as the most effective way to reduce the

sexual transmission of HIV (Chandra-Mouli et al., 2014; Joint United Nations Programme on HIV/AIDS, 2014). The risk of acquiring HIV was significantly lower among people who reported consistent condom use compared with those who did not (OR .27, 95% CI [.16, .45]; Joint United Nations Programme on HIV/AIDS, 2014). Still, many AGYW do not use condoms consistently. Of the AGYW who participated in the HPS, only 33% (20-24 years old) to 45.5% (15-19 years old) of the participants reported consistent condom use in the last year. Like other SSA countries, however, young people of both sexes living in Chokwe were more likely to report consistently using condoms compared with those in the older age group (i.e., 45.5% and 51.7% of the 15- to 19-year-old girls and boys, 33% and 40.6% of the 20- to 24-year old young women and young men, and 19.7% and 23% among 15- to 59-year-old women and men). Factors that may have influenced the results of this analysis include that the sample size may have been too small to detect a significant association when condoms were reported to "never" be used, compared with "always;" other factors may also have interacted or confounded the results (i.e., type of relationship, age, HIV status of the sexual partner).

Use of drugs and alcohol. Use of drugs and alcohol was not associated with HIV status of the AGYW (OR .967, p.=.882, 95% CI [.882, 1,5] Few AGYW reported using drugs or alcohol (10/2207). Of the HIV-positive AGYW, none of participants aged 15 to 19 years and 0.3% (n = 3) of the participants aged 20 to 24 years reported using drugs and or alcohol. This may have limited my capacity to detect whether an association existed.

Transactional sex with last sexual partner. I concluded that transactional sex with the last sexual partner was not associated with the HIV status of the AGYW. Few

AGYW reported transactional sex with their last sexual partners—only 1.5% (27/1817) of the HIV-negative AGYW and 0.7% (2/278) of the HIV-positive AGYW. Social desirability bias may have affected the number of AGYW who have reported transactional sex. Another limitation is that the question limited the report of transactional sex to the experience with her last sexual partner. It is possible that AGYW may have other, less recent partners with whom they exchange favors or money for sex.

Question 2 results of the analysis. I rejected the second null hypothesis and have evidence to support that alternative hypothesis which stated a statistically significant association exists between the HIV status of AGYW living in a southern district of Mozambique and some selected HIV knowledge, beliefs, and behaviors of AGYW. The characteristics that I found to be significantly associated with HIV were always (in contrast to sometimes) using condoms in the last year and having no knowledge of HIV. The variables of belief, transactional sex, multiple partners, and use of drugs or alcohol were not associated with the HIV status of the AGYW.

Multiple partners, transactional sex, drug and alcohol use, and beliefs were not associated with HIV. It is possible that these factors do not affect the likelihood of acquisition of HIV, that AGYW who reported those behaviors are behaving differently than AGYW who do not (i.e., use of condoms), or that it was not possible to detect an association due to a low number of AGYW who reported these behaviors. Further research should be conducted to understand how these HIV prevention behaviors are interconnected and affect the association with HIV.

Research Question 3: Experience of AGYW and HIV

To answer the third question of the dissertation, I determined whether an association existed between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW

living in a southern district of Mozambique and selected experience of AGYW. This question asked: Is there an association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and selected experience of AGYW (i.e., reported experience of gender-based violence, currently pregnant or pregnancy in the last year, reported symptoms suggestive of sexually transmitted infection [STI]), being in school [yes or no], civil status [married, living as married, single])? The results are presented according to the variables.

GBV. The result of the logistic regression between reported experience of GBV and the HIV-positive status of AGYW was not statistically significant (p = .432, odds .688, 95% CI [.271-1.749]). This is contrary to what was reported in a pooled estimate including 16 countries and 28 studies, in which the odds of being HIV-positive were 1.44 (95% CI [1.10, 1.87] to 2.0 (95% CI [1.24-3.22]) higher for women who reported GBV (Li et al., 2014). This may be because the AGYW were asked to report GBV that occurred in the year prior to the HPS, and not lifetime experience of GBV. Among the HPS participants, GBV in the last year was reported by 28 (4.2%) of the 660 participants aged 15-19 years old and 34 (4.3%) of the 790 participants aged 20-24 years old (compared with 3.6% of the participants aged 25-29 years old).

Pregnancies. I found no association between history of pregnancy in the last year and HIV-positive status of the AGYW when pregnancy was used as a variable in the third step of the logistic regression. Other researchers have reported associations between pregnancy and an increased risk of dropping out of school, premature birth, HIV-positive status, and maternal death (Chandra-Mouli et al., 2014). Limiting report to experience of pregnancy in the last year may have suppressed an existing association with HIV;

however, association between pregnancies, being out of school, and being married were found.

Sexually transmitted infection. An association was found between STI and status of the AGYW. The odds of HIV were 1.897 (p = .000, 95% CI [1.349,2.688]) higher for the AGYW who reported an history of STI in life compared with AGYW who reported never having a STI. This confirms the results of studies conducted in Kwa Zulu Natal, where sexually transmitted infections were associated with an increased risk of HIV (OR 13.68, 95% CI [4.61,40.56]) among youth aged 18-24 years old (Naidoo et al., 2015) and in SA, where genital ulcer and vaginal discharge in the last 12 months increased the odds of HIV by 1.91 (95% CI 1.04-3.49) and by 1.75 (1.26-2.44; Pettifor et al., 2016). Even though a significant association was found, the strength of the association between STI and HIV may be reduced due to underreports of STI due to asymptomatic presentation of STI or shame to report STI to the interviewers, both in the studies reported and among the current HPS participants.

Being in school. I found a significant positive association between not attending school and being HIV-positive among AGYW (p = .000, OR 5.286, 95% CI [3.618,7.723]). As older AGYW may be less likely to be in school, I conducted further analysis for the 15- to 19-year-old age group and the 20- to 24-year-old age group to assess whether this association could be maintained. Of the 75 AGYW HIV-positive HPS participants aged 15 to 19 years old, 65.3% (49) were not in school. Among the 239 HIV-positive participants aged 20-24 years old, 81.9% (195) were not in school (Pearson chi square 32.206, DF1, 2-sided p = .000). When limiting the analysis to the 15-18 years old HIV-positive girls, 42.5% of the HIV-positive participants reported being in school,

compared with 57.4% who reported not being school (Pearson chi square 22.237, df 1, 2-sided $p = .000$).

This confirms previous findings wherein researchers discovered lower HIV prevalence among SA girls who reported being in school (6.4%) compared with those not in school (18.3%; Abdool Karim et al., 2014). Being pregnant was also associated with reporting not being in school. Among the participants aged 15 years old who reported being pregnant or had a baby in the last year, 67.8% (10/15) were not in school; of those aged 16 years old, 63.8% (30/47) were not in school.

Civil status. I found a statistically significant difference between the HIV status of the AGYW and the different civil status of the AGYW (i.e., separated, widowed or divorced, single, married or in a marital union). Compared with AGYW who reported being married or in marital union, separated, divorced, or widowed AGYW had a higher chance of being HIV-positive ($p = .006$, OR 2.181, 95% CI [1.251, 3.802]), while single AGYW were less likely to be HIV-positive ($p = .000$, OR .387, 95% CI [.304,.494]). AGYW who were single had less risk of being HIV-positive, followed by married AGYW, with a higher risk of being HIV-positive for widow or separated AGYW. AGYW who reported being married were less likely to be in school and more likely to be pregnant.

Early marriage was reported by a significant number of AGYW, with 12.6% of the adolescent girls aged 18 years or younger reported being married or living in a marital union and 0.5% reported being separated, divorced, or widowed (Appendix E). The day of the HPS interview, 6.6% of the participants aged 15-18 years old reported being pregnant or having a baby in the last year. Marriage was reported by 2.5% (10) of the 406

15 years old HPS participant and 3.7% (15) reported being pregnant or having a child in the last year. Among the 470 16-year-old participants, 29 reported being married (6.1%), one (0.2%) reported being separated, and 47 (9.8%) reported being pregnant or having had a baby in the last year. The percentage of young girls who reported early marriage was within the range reported by the National Institute of Health of Mozambique (2011), which found that between 2.5% (in the south) to 24.4% (in the north) of girls were married before the age of 15 years old (National Institute of Health Mozambique, 2011). This confirms UNAIDS (2015) statistics that early marriage is associated with higher chance of pregnancy, lower education, and higher HIV prevalence.

Research Question 3 results of the analysis. After conducting the stepwise logistic regression, I rejected the null hypothesis and have evidence to support the alternative hypothesis which stated that there is a statistically significant association between the HIV status (i.e., HIV-positive, HIV-negative) of AGYW living in a southern district of Mozambique and some selected experience of AGYW (i.e., experience of GBV, pregnant of had a baby in the last year, report of STI, being in school, and civil status). Three factors were positively associated with the HIV-positive status of the AGYW: STI, not being in school, being separated or widowed, and being married. Reports of GBV and pregnancy in the last year were not found to be statistically significant (Table 34).

Limitations of the Study

In this section, I will explain the potential limitations of the study and how they may have affected the results of the analysis. I will then discuss the validity and

reliability of the study and posit how the results of the analysis can be generalized to other populations.

Information Limited to Last 12 Months

One of the main objectives of the current CP evaluation was to assess annually trends in HIV prevention behaviors. As a result, the HPS questions were designed to collect experienced and behaviors of the participants in the 12 months prior to the day of the interview. With this design, CP researchers have the ability to measure changes and trends over time. This, however, greatly reduced the capacity to measure the association between selected experienced of AGYW (i.e., history of pregnancies, experience of GBV, or number of sexual partners in life) and the HIV status of the AGYW. By limiting the report of experience and behaviors to the last year, the effect of some experience of AGYW on their HIV status may have been missed, or the strength of the association may have been reduced (i.e., GBV, pregnancies, number of sexual partners).

Sample Selection

The sample of participants randomly selected for each round of CP was based on the number of adults aged 15-59 years old needed to achieve power to detect a statically significant change in HIV incidence across five rounds of data collection (CDC, 2012). The dissertation questions however focused on AGYW thus limiting the number of HPS data eligible for the analysis to women between the ages of 15 to 24 years old. Using a subset of the data collected may have reduced the capacity to find statistically significant difference between HIV-positive and HIV-negative AGYW for some of the variables. To partly reduce this limitation, I merged the information of the three rounds of available CP data. Still, the sample size may have been too small, especially for some of the variables (i.e., transactional sex, GBV, use of drugs and alcohol). This can also be highlighted with

some of the results which have very have large confidence intervals (i.e., 25.915 to 110.846 between HIV-negative partner and HIV-positive partners) and others with CI that are close to 1 (i.e., faithfulness of the sexual partner with a 95% CI of 1.042 to 2.827 if the AGYW does not know if her partner is faithful or not and from 1.048 to 4.227 when AGWY reported a partner that is not faithful).

Selection of Participants

Youth go through distinct biological, social, and psychological transitions between the age of 10 and 24 years old, which can be divided into three periods: 10-14, 15-18, and 19-24 years old (Bandura, 2006; World Health Organization, 2015b). Given the CP data available, it was not possible to look at specific factors affecting younger AGYW aged 10-14 years old (i.e., data were collected only for AGYW 15-24 years old). In addition, it was not possible to separately analyze the data collected from 15- to 18-year-old girls and 19- to 24-year-old women (i.e., number of HIV-positive AGYW too small for some of the variables such as GBV, pregnancies in the last year, multiple sexual partners, and others). Future researchers should try to identify needs of AGYW in these three age groups by ensuring that younger AGYW are included in the analysis, as well as that enough AGYW in each of the subgroups are randomly selected to detect the presence of statistically significant associations.

Self-Reported Data

As with other analyses that rely on self-reported data, it is possible that some AGYW did not report or exaggerated some of their experiences or behaviors. AGYW may have avoided reporting behaviors that may be perceived as not socially desirable in the community where they live (i.e., having sex, having multiple sexual partners, engaging in transactional sex), may have feared reporting others (i.e., experience of

GBV), or may have exaggerated other behaviors (i.e., use of condoms). Instances of underreporting may also have occurred, given social norms that may affect the perception of the AGYW (i.e., coerced sex by sexual partner being perceived as normal) or may be affected by a lack of knowledge (i.e., symptoms of STI believed to be normal) or underreport of STI (i.e. asymptomatic STI).

Survey

The HPS questionnaire was translated from English to Portuguese and then to the local language (Xangan). While the study protocol reported having done back translation, some of the meaning or content of some of the question may have been lost (CDC, 2012). The survey was administered by an interviewer using a CAPI system, which may have limited the capacity of some respondent to honestly respond to some of the questions (i.e., having to report to another person their response compared with self-administered questionnaire).

Cross-Sectional Design

Given the nature of the study (i.e., cross sectional), it was not possible to determine whether a causal relationship exist between the factors selected as independent variables and the dependent variable (i.e., HIV status of the AGYW) only association can be reported.

Confounding and Interaction

The importance of some interaction and confounding factors may have been missed in the analysis. For example, age of the AGYW was listed earlier as a variable that may be a potential confounder and may also interact with some variables. For example, the age of the AGYW can influence the selection of male sexual partner which may in turn influence the occupation of the sexual partner (IV). The HIV status of the

AGYW (DV) can also differ depending on the age of the AGYW. Younger AGYW are more likely to report having a partner as a student than older AGYW and older AGYW are more likely to be HIV positive than younger AGYW. Other examples of cofounding include the responses to HIV knowledge of AGYW with a prior diagnostic of HIV. AGYW who knew they were HIV positive may know more about HIV, given their frequent contact with clinicians for their HIV care than AGYW who learned they were HIV positive the day of the interview. Another example where interaction or confounding may have been missed includes the consistent use of condoms. Condom use may affect and may be affected by other variables. For example, consistent condom use may have been influenced by the age of the AGYW (i.e., younger AGYW reporting more consistent condom use versus older AGYW), by the type of partner (i.e., married or in a marital union and older AGYW were more likely to report being in a married or marital union), and by type of relationship (i.e., transactional sex, single AGYW may be more or less likely to use condoms).

Validity

Validity in quantitative analysis is defined as the capacity of the instrument used to accurately measure what it is intended to measure (Heale & Twycross, 2015). The instrument selected must have the capacity to measure all the aspect of a construct (i.e., content validity), be able to measure it accurately (i.e., construct validity) and be able to report the same results over time (i.e., stability) and across population (i.e., equivalence; Heale & Twycross, 2015). The dataset used for the analysis originated from a previously conducted CDC study; as such, I assumed the validity of the HPS instrument to be high.

Reliability

A reliable instrument must measure consistently the construct it seeks to study (Heale & Twycross, 2015). The HPS questionnaire was designed by the CDC and includes questions used in other studies evaluating the same construct. For the current dissertation, I calculated a Cronbach alpha for the HIV belief, and HIV knowledge scale, with results above 0.8 in all age and sex subgroups.

Generalizability

The results of the analysis apply to AGYW who live in the southern district of Mozambique where the CP evaluation tool place and participated in the HPS between 2014 and 2019. Given that the participants were randomly selected among all the HDSS residents and that the consenting participants are representative of the population living in the district of Chokwe, it is possible to generalize the results to the other AGYW who live in the district. The results could also be generalized to other context sharing similar characteristics (e.g., HIV prevalence, public policies, community, social and sexual network) than the one found in Chokwe, such as another province of Mozambique or SSA country that shares similar characteristics.

Recommendations

In this section, I will present recommendations to help decrease the risks of HIV infection among AGYW. These recommendations can be grouped in categories: characteristics of male sexual partner, experience of AGYW s (i.e., early marriage, ensuring AGYW remain in school), and behaviors (i.e., consistent use of condoms and prevention of STI). In this section, I will also provide suggestions for further research in

order to better understand the association between selected characteristics and HIV-positive status of AGYW that were not possible to be measured with this analysis.

Characteristics of Male Sexual Partner

The risk of HIV among AGYW who reported an HIV-positive partner (OR, 53.596, p = .000, 95% CI [25.915,110.849]) or who for AGYW who did not know the HIV status of their male sexual partner (5.501. p = .000, 95% CI [2.739, 11.046]) was significantly higher than the AGYW who reported an HIV-negative partner. As the selection of male partner is usually not made based on HIV status (i.e., only selecting HIV-negative partners), it is important that AGYW are made aware of the HIV status of their male partner so they can adopt HIV prevention behaviors accordingly. For example, if a partner is HIV-positive, AGYW could consistently use condoms, use prophylaxis before exposition to prevent HIV (PrEP), or ensure that their partners are adherent to antiretroviral therapy to reduce their chance of acquiring HIV (Eisinger, Dieffenbach, & Fauci, 2019). AGYW should be able to request that their partner test for HIV and that they share their HIV results with them so they can make the best decision to protect themselves. This intervention should be implemented at the policy level (i.e., access to HIV testing, access to HIV care and treatment), at the community level (i.e., changing gender norms to ensure AGYW have an equal voice in the health of both partners, encourage men and women to know their HIV status and be adherent to care), at the sexual network level (i.e., male partner and AGYW have an equal say in the decision made about health), and at the individual level (i.e., knowledge of HIV, how it is transmitted and how to protect themselves).

Faithfulness of the male partner can also be outside of the control of AGYW. It may be difficult for AGYW to ask her male partner to remain faithful given norms that

tolerate or even encourage male partner to be unfaithful. Social norms can even prevent AGYW from using condoms with partners they know or believe to be unfaithful. Interventions could be implemented at the community level and the social and sexual network level (i.e., to change gender norms, educate on the risk associated with multiple sexual partners, accept the empowerment of AGYW to be able to use condoms when she feels she is at risk), as well as at the individual level (i.e., educate AGYW on risk of HIV and how to protect themselves, empower AGYW to use condoms).

Prevent Early Marriage and Encourage Education

Efforts are needed to prevent early marriage in Chokwe and to encourage AGYW to remain in school. Among the HPS participants, 12.6% of the AGYW less than 18 years old reported being married. Of the 15 years old interviewed, 2.5% reported being married or living in a marital union. Among the 16 years old, 6.6% reported being married or living in a marital union. This significant number of married young girls was reported even though marriage before the age of 18 years old is illegal in Mozambique. The effect of early marriage detected with the analysis was an increased risk of being pregnant compared with those not married and AGYW who were married were less likely to be in school. In turn, the AGYW not in school were more likely to be HIV-positive (OR 5.286 p = .000, 95% CI [3.618, 7.723]). Interventions should be conducted to inform parents and the community of the risk associated with early marriage and the importance for AGYW to remain in school. This could help to protect AGYW from HIV and early pregnancies.

Consistent Use of Condoms

AGYW should know about the importance and how to consistently use condom. Some AGYW may have limited access to information and others may be unable to

negotiate its use. Inability to negotiate condom use was found as the primary barrier to its use in an UNAIDS (2016a) report. Such interventions should ensure that AGYW have access to SRH information including younger and out of schoolgirls. Interventions at the community, social, sexual network, and individual levels should seek to empower AGYW to be able to use condoms.

STI Prevention

AGYW who reported STI had a significantly higher risk of being HIV-positive. STI can be prevented by consistently using condom and by accessing early treatment of the STI for all partners. Interventions should ensure that AGYW use condoms consistently and provide AGYW with information on symptoms of STIs and where to get treatment when they have symptoms. Again, such interventions could be implemented at different levels: policies (i.e., access to SRH and STI treatment, access to condoms) and at the community, sexual network, and individual levels (i.e., changing gender norms on condom use, information on STI signs and treatments).

Recommendation for Further Research

Recommendation for further analysis include assessing whether the protective association found between not knowing about HIV and being HIV-negative is maintained when controlling for prior knowledge of HIV status. This could be accomplished by comparing AGYW who are newly diagnosed HIV-positive to HIV-negative AGYW. Researchers could also investigate whether HIV condom use among AGYW who report more than one sexual partner is different compared with those with only one sexual partner, or whether condom use is different by type of sexual partner (i.e., HIV-negative or positive sexual partner, type of relationship). Limitations of the current study also include my inability to assess the direct impact of gender and social norms on the risk for

HIV. Harmful gender norms and gender inequality have been reported to play a role in early marriage, early pregnancies (Amaro, 1995; Butts et al., 2017; Harrison et al., 2015; Slabbert et al., 2015), and education for girls (UNAIDS, 2016c). As such, further research should be conducted to increase our knowledge of the role gender norms, peer pressure and other community influence have on HIV for AGYW.

Implication for Social Change

Research Question 1: Characteristics of the Male Sexual Partners and HIV Risk for AGYW

To reduce the number of new infections among AGYW, it is important to understand what the specific risks for HIV for AGYW are. As a result of the logistic regression analysis, it was possible to identify the characteristics of the male sexual partner that are associated with higher risk of HIV for AGYW living in Chokwe: HIV-positive or HIV unknown status of the male partner, unfaithfulness of the partner or not knowing if the partner is faithful, and partners who are employed or unemployed, rather than students. It was also possible to identify the characteristics that are not associated with the HIV status of the AGYW, including age of the male sexual partner and the type of relationship.

As a result of this analysis positive social change includes the capacity of policy makers to focus and tailor interventions to the characteristics of the male sexual partners demonstrated to increase the HIV risk for AGYW. Given that AGYW who live in Chokwe may have limited or no power regarding many of the characteristics of their male sexual partner (i.e., ensuring that male partners know and share their HIV status, faithfulness of the partner), and may have limited or no power to act on HIV prevention behaviors that could help reduce risk of acquisition (i.e., consistent use of condoms)

interventions should seek to empower AGYW and provide them with a favorable environment (i.e., changing harmful gender norms). This could be achieved by addressing the factors at each of the level of the MSEM: public policy, community, social, sexual network, and individual.

To reduce the risk of HIV associated with having an HIV-positive partner or having a partner for which the HIV status is unknown, conditions must be in place for the male partners to know their HIV status and to share the results of their HIV test with their sexual partners. Policies should ensure access to quality HIV testing, interventions at the community level should empower AGYW to have access the information (i.e., right of the AGYW to know the HIV status of her partner), and interventions at the sexual network level should inform and encourage partners to test for HIV and share their results with their partner. Lastly, interventions at the individual level could target AGYW and their male sexual partner so they know the importance of knowing their HIV status and knowing the HIV status of their partner and the importance of using condoms when their partner is HIV-positive or does not know his HIV status. If the male partner is HIV-positive, policies should be in place to provide access to quality HIV care and treatment. Good adherence to HIV treatment will reduce the HIV viral load, which, in turn, reduces the risk of HIV transmission to one's sexual partners (Eisinger et al., 2019). Intervention should target gender norms to ensure that HIV-negative AGYW can protect themselves if their male partner is found to be HIV-positive (i.e., consistent use of condoms). At the individual level, AGYW should be aware of HIV and know how they can protect themselves.

The same recommendations could be made for the risks associated with the infidelity of the male sexual partner. Interventions at the community, social, and sexual network level could address the importance of fidelity by targeting gender norms which tolerates and encourages infidelity of male partners. Unfaithful partners should be encouraged to use condoms with their sexual partners and test for HIV regularly. Interventions should support the empowerment of AGYW to negotiate condom use if she believes that her partner is unfaithful or that she is at risk of HIV.

Research Question 2: HIV Prevention Behaviors and HIV Risk for AGYW

Consistent condom use was found to be associated with less likelihood of being HIV-positive among AGYW; however, consistent condom uses in the last year was reported for less than 45% of the participants. AGYW should be empowered to negotiate condom use in a relationship where she may be more at risk of HIV (i.e., having a partner who is unfaithful or questionably faithful, or having an HIV-positive partner or an HIV-unknown partner).

Interventions to reduce HIV among AGYW should focus on increasing the capacity for AGYW to use condoms consistently. Interventions could be conducted at the policy level (i.e., access to SRH and condoms), as well as at the social and sexual network level (i.e., change gender norm to empower AGYW to negotiate the use of condom, encourage consistent condom use by male sexual partner). Other interventions could target AGYW at the individual level by increasing their knowledge (i.e., importance of consistent condoms use, knowledge of HIV risk and transmission, capacity to negotiate condom use, and awareness of partners' HIV status).

Research Question 3: Selected Experiences and HIV Risks for AGYW

Of the five variables describing experience of AGYW (i.e., GBV, being pregnant, STI, being in school, and civil status), I found three to be statistically significant when comparing HIV-negative AGYW and HIV-positive AGYW (i.e., STI, being in school and civil status). As with the characteristics of the male sexual partner, some of the experiences which rendered AGYW more vulnerable to HIV may lie partially or totally outside of their control (i.e., civil status, which includes early marriage, being in school, GBV, being pregnant, and STI status).

Lack of enforcement in Mozambique of the laws and policies to prevent early marriage combined with cultural and social norms which encourage AGYW to be in relationship at an early age can strongly influence AGYW's decision to be married or to enter a marital union. The same social norms may prevent her from deciding whether she can remain in the relationship (i.e., be separated or divorced). The capacity of AGYW to stay in school may be strongly influenced by cultural and gender norms, lack of policies to ensure education of all youth until they reach a certain age, poverty, and other factors such as civil status or pregnancy. Finally, even though STIs have a component of individual prevention (i.e., use of condoms), AGYW may be powerless to negotiate their use, be unable to recognize the signs of STI (i.e., lack of knowledge), or lack access to STI treatment (i.e., no access to SRH, or barriers to access services as some AGYW may need the permission of her partner or family to access the health center). Cultural and gender norms may prevent AGYW from asking to use a condom even when she knows that her partner has an STI. This was reported in a country wide survey of HIV, where Mozambican men and women both overwhelmingly reported that even if a woman knew her partner had an STI the decision to use a condom relied solely on the decision of the

partner (National Institute of Health Mozambique, 2011).

AGYW may be limited in their ability to adopt HIV prevention behaviors (e.g., use of condoms) or to select characteristics associated with less risk of being HIV-positive (i.e., staying in school, staying single or preventing early marriage, being STI free). Vulnerabilities (i.e., early marriage, STI) and protectors (i.e., staying in school) can be addressed with public policies (i.e., access to education, enforcement of laws to prevent early marriage, access to SRH), at the community level (i.e., change negative gender norms and encourage empowerment of AGYW), at the social and social network level (i.e., ability of AGYW to negotiate condoms use, decide if she wants to get married or in a marital union), and at the individual level (i.e., knowledge of STI symptoms and how to prevent them, knowing the importance of education).

Conclusion

In SSA countries, AGYW are disproportionally infected with HIV compared with their male peers (Dellar et al., 2015; Idele et al., 2014; Joint United Nations Programme on HIV/AIDS, 2014; Kharsany & Abdool Karim, 2016; Laga et al., 2001; Shisana et al., 2014; Zuma et al., 2016). My analysis of the Chokwe Combination Prevention of HIV quantitative dataset confirmed that discrepancies in HIV prevalence reported in other SSA countries are also present in Chokwe, where AGYW are 1.8 to 5 times more likely to be HIV-positive compared with ABYM.

Specific factors that render AGYW more vulnerable and disproportionally infected with HIV are not well understood (Harrison et al., 2015). The purpose of the dissertation was to bridge this gap by identifying the factors that are associated with HIV infection among AGYW living in a southern district of Mozambique.

As a result of the analysis, characteristics associated or not associated with HIV-positive AGYW were identified. The characteristics associated with HIV-positive AGYW were: having an HIV-positive partner or a sexual partner for which the AGYW did not know the HIV status, as opposed to HIV-negative; having a partner employed for wages or unemployed, as opposed to being in school; reporting an unfaithful partner or not knowing if the partner is faithful, as opposed to having a faithful partner; being married, separated, widowed, or divorced, as opposed to being single; using condoms only sometimes, as opposed to always using condoms; reporting an STI; and not being in school. The characteristics which did not demonstrate an association with the HIV-positive status of the AGYW included: the age difference between the AGYW and her male sexual, HIV beliefs, HIV knowledge, stigma, history of pregnancy in the last year, and GBV.

The literature review and the MSEM model of Barat et al. (2013) indicated that AGYW may be unable to act independently on many of the characteristics that render them more at risk of contracting HIV. Even if AGYW could know about the factors which are more likely to increase their chance of acquiring HIV, they may be unable to or have limited control to avoid them or to adopt HIV-preventative behaviors.

To address the factors which are associated with HIV among AGYW, it is important that policy makers reinforce factors that protects AGYW from HIV (i.e., being in school, always using condoms, being free of STI), and should seek to remediate factors that increase their risk to HIV (i.e., having a partner who is HIV-positive or for which the AGYW does not know the result). This will only be possible if interventions can be conducted at the public and policy level (i.e., prevention of early marriage, access to

education, access HIV testing, access to SRH services), at the community level (i.e., changing harmful gender norms), with the social and sexual network of AGYW (i.e., characteristics of the male sexual partners), and at the individual level (i.e., comprehensive knowledge of HIV and how it can be prevented, capacity to negotiate consistent condom use).

Given the HIV discrepancies between AGYW and ABYM and the anticipated youth bulge in Eastern and Southern African countries, an AIDS-free generation will not be achieved if specific interventions are not implemented to avert new infection among AGYW (UNAIDS, 2016d). The results of the analysis conducted for the current dissertation helped identify characteristics of AGYW living in a southern district of Mozambique which were associated with more or less risk of being HIV-positive. The information could be used by different stakeholders (i.e., public health officials, donors, and policy makers) to adjust or support existing interventions aiming to reduce the risk of HIV for AGYW (i.e., use of condoms, intervention to diagnose and treat STIs). This information could also be used to advocate for the implementation of other interventions that address specific characteristics and needs of AGYW living in the southern district of Mozambique or other SSA countries sharing similar characteristics (i.e., ensuring AGYW stay in school). The information will be shared with the local authorities, public health officials, and nongovernmental organizations working in the district where the data were collected, as well as with the CDC team who provided the database used for the analysis. The implications for positive social change from this research include providing policy makers and stakeholders with specific information on vulnerabilities to HIV of AGYW living in Mozambique. The information could be used to advocate for and implement

targeted interventions to prevent HIV among AGYW living in the southern district where the data were collected, as well as in other district of Mozambique and other countries in SSA sharing similar characteristics. This is especially important, as solutions must be found to avert new infections among youth—especially AGYW—in order to achieve an AIDS-free generation (UNAIDS, 2016d). Repercussions of the interventions that could prevent HIV among AGYW could also help improve the lives AGYW and older women living in the community by empowering women to make decisions regarding their sexual and reproductive health, encouraging young women to stay in school, preventing early marriage, and changing harmful gender norms.

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Appendix A: Data Use Agreement With CDC

DATA USE AGREEMENT

This Data Use Agreement ("Agreement"), effective as of (April 12th 2019)) ("Effective Date"), is entered into by and between (Isabelle Casavant)("Data Recipient") and (CDC.) ("Data Provider"). The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS") for use in research.

1. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with Center for Global Health (CGH) regulations for access and use of de-identified data.

Data Fields in the LDS. **No direct identifiers such as names may be included in the Limited Data Set (LDS).** In preparing the LDS, Data Provider or designee shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research:

A Subset of the Chokwe Combination Prevention of HIV Information collected with adolescent girls and young women (AGYW) 15-24 years old during the 2016 and 2017 round of data collection. The data set will include all the responses to the health prevention survey of the AGYW who consented to participate and who have the assent of their parent if less than 18 years old. The data set will also include the result of the HIV test and contain information on 2 indicators of the HDSS (poverty indicator: access to electricity and indoor latrine in the house where the AGYW reside)).

2. Responsibilities of Data Recipient. Data Recipient agrees to:

a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

3. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its research activities only.

4. Term and Termination.

Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

a. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

b. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

c. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

d. Effect of Termination. Sections 1, 3, 4, 5 of this Agreement shall survive any termination of this Agreement under subsections c or d.

5. Miscellaneous.

a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding protection of data and participant privacy.

c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER

Signed: [redacted]

Print Name: [redacted]

Print Title: [redacted]

DATA RECIPIENT

Signed: [redacted]

Print Name: [redacted]

Print Title: [redacted]

Appendix B: Stigma Demonstrated Based on HPS Questions

Value ranged between 8 (if all strongly disagree on all the stigma questions) to 40 (if strongly agree to all the stigma questions)

	15-19 years old			20-24 years old			25-59 years old			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
	%	%	%	%	%	%	%	%	%	%	%	%
No stigma (8)	80.1	79.8	79.9	80.2	82.1	81.6	80.8	80.8	80.8	80.4	80.8	80.7
9-16	16.8	17.1	16.9	18.3	16	16.6	17.8	16.9	17.1	17.5	16.8	17
17-25	3.1	3.1	3.1	1.5	1.8	1.8	1.4	2.2	2.1	2.1	2.3	2.3
Strong stigma (25-40)	0	0.1	0	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1

Appendix C: HIV Prevalence

Prevalence of HIV by 3 Age Band and Sex (Unweighted and Weighted Prevalence).

		HIV-positive	HIV-positive Weighted	Total	Weighted total
		N	*N*	*N*	
		%	%	%	%
15-19 years old	Male	36	39	1561	1652
		2.30	2.40	100	100
	Female	75	67	1832	1656
		4.10	4.00	100	100
	Total	111	106	3393	3308
		3.30	3.20	100	100
20-24 years old	Male	12	13	505	575
		2.40	2.30	100	100
	Female	239	210	1254	1141
		19.10	18.40	100	100
	Total	251	223	1759	1716
		14.30	13.00	100	100
25-59 years old	Male	516	775	1408	2284
		36.60	33.90	100	100
	Female	2367	1929	5816	4770
		40.70	40.40	100	100
	Total	2883	2704	7224	7054
		39.90	38.30	100	100
Total	Male	564	827	3474	4511
		16.20	18.30	100	100
	Female	2681	2206	8902	7567
		30.10	29.20	100	100
	Total	3245	3033	12376	12078
		26.20	25.10	100	100

Appendix D: Prior Diagnostic of HIV

Sex	Prior knowledge of HIV status	15-19 years old	20-24 years old	25-59 years old	Total
Male	No	6	2	53	61
		16.7%	16.7%	10.3%	10.8%
	Yes	30	10	463	503
		83.3%	83.3%	89.7%	89.2%
		36	12	516	564
	Total	100%	100%	100%	100%
Female	No	26	50	138	214
		34.7%	20.9%	5.8%	8%
	Yes	49	189	2229	2467
		65.3%	79.1%	94.2%	92%
		75	239	2367	2681
	Total	100%	100%	100%	100%
Total	No	32	52	191	275
		28.8%	20.7%	6.6%	8.5%
	Yes	79	199	2692	2970
		71.2%	79.3%	93.4%	91.5%
		111	251	2883	3245
	Total	100%	100%	100%	100%

Appendix E: Report of Pregnancy, Current School Status, and Age Group

In school									
	No			Yes			Total		
Age	15-18	19-24	25-59	15-18	19-24	25-59	15-18	19-24	25-59
(years)	*n*	*n*	*n*	*n*	*n*	*n*	*n*	*n*	*n*
	%	%	%	%	%	%	%	%	%
Currently pregnant or had baby last year									
No	702	1441	7060	2240	585	91	2942	2026	7151
	81.6%	77.5%	89.7%	97.8 %	94.2%	92.9%	93%	81.7%	89.0%
Yes	158	419	815	50	36	7	208	455	822
	18.4%	22.5%	10.3%	2.2%	5.8%	7%	6.0%	18.0%	10.0%
Total (count)	860	1860	7875	2290	621	98	3150	2481	7973

Report of pregnancy by civil status and age group						
	No			Yes		
Age (in years)	15-18	19-24	25-59	15-18	19-24	25-59
Separated, widow or divorced (count)	6	59	1361	4	14	68
% within R Q3 civil status	60%	80.8%	95.2%	40%	19.2%	4.8%
% within Q3 Pregnant or had baby last year	0.2%	2.9%	19%	1.9%	3.1%	8.3%
% of Total	0.2%	2.4%	17.1%	0.1%	0.6%	0.9%
Single (count)	2782	1172	922	112	102	93
% within R Q3 civil status	96.1%	92%	90.8%	3.9%	8%	9.2%
% within Q3 Pregnant or had baby last year	94.8%	57.8%	12.9%	53.8%	22.4%	11.3%
% of Total	88.5%	47.2%	11.6%	3.6%	4.1%	1.2%
Married or in marital union (count)	148	795	4862	92	339	661
% within R Q3 civil status	61.7%	70.1%	88%	38.3%	29.9%	12%
% within Q3 Pregnant or had baby last year	5%	39.2%	68%	44.2%	74.5%	80.4%
% of Total	4.7%	32%	61%	2.9%	13.7%	8.3%
Count	2936	2026	7145	208	455	822
% within R Q3 civil status	93.4%	81.7%	89.7%	6.6%	18.3%	10.3%
% within Q3 Pregnant or had baby last year	100%	100%	100%	100%	100%	100%
% of Total	93.4%	81.7%	89.7%	6.6%		10.3%

Appendix F: Report of Type of STI by Sex and Age Group

	15-19 years old		20-24 years old		25-59 years old		Total	
	Count	%	Count	%	Count	%	Count	%
STI in life (vaginal/penile discharge or sores in genital area)								
Male								
No	1635	96.5%	515	88.5%	1322	81.5%	3472	89.0%
Sore or discharge	53	3.1%	59	10.1%	228	14.1%	340	8.7%
Both Sores and discharge	7	0.4%	8	1.4%	72	4.4%	87	2.2%
Total	1695	100%	582	100%	1622	100%	3899	100%
Female								
No	1853	93.4%	1135	82.9%	4973	78.3%	7961	82%
Sore or discharge	108	5.4%	202	14.8%	1117	17.6%	1427	14.7%
Both Sores and discharge	24	1.2%	32	2.3%	261	4.1%	317	3.3%
Total	1985	100%	1369	100%	6351	100%	9705	100%
STI in the last 12 months (vaginal/penile discharge or sores in genital area)								
Male								
No	1666	98.3%	547	94%	1508	93%	3721	95.4%
Sore or discharge	29	1.7%	32	5.5%	83	5.1%	144	3.7%
Both Sores and discharge	0	0%	3	0.5%	31	1.9%	34	0.9%
Total	1695	100%	582	100%	1622	100%	3899	100%
Female								
No	1898	95.6%	1223	89.3%	5537	87.2%	8658	89.2%
Sore or discharge	72	3.6%	127	9.3%	686	10.8%	885	9.1%
Both Sores and discharge	15	0.8%	19	1.4%	128	2%	162	1.7%
Total	1985	100%	1369	100%	6351	100%	9705	100%