COLLEGE OF LAW AND MANAGEMENT STUDIES

School of Accounting, Economics & Finance

Analysis of sexual and reproductive healthcare utilisation among young people in Zimbabwe

By

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A thesis submitted in fulfilment of the requirements of Doctor of Philosophy in Economics

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Dedication

To my family.

Acknowledgements

I acknowledge the unwavering support I got from my able and caring supervisor, Professor Josue Mbonigaba. He guided me in scholarly writing, thus developing me scientifically. He provided constructive scholarly criticism throughout my Ph.D. journey. May God bless you, Professor.

The support received not only culminated in the current thesis but also in associated outputs and intermediate outputs. In this perspective, two papers namely, “Impact of the adolescent and youth sexual and reproductive health strategy on service utilisation and health outcomes in Zimbabwe,” related to chapter three and “Analysis of sexual and reproductive health risk preferences of Zimbabwean University students”, related to chapter four were published in *PLOS ONE* and *Malaysian Journal of Public Health* respectively. Chapter three and four are thus extended versions of the published papers. Shorter versions of chapters two and five are under review with *PLOS ONE* and *Emerald Journal of Health Research* respectively.

I also must mention emotional and academic support from my friend, Edgar Muhoyi from enrolment, travel across borders, as well as for his inspiring encouragement. Finally, may the good Lord bless all other persons I could not readily identify for the mention. I appreciate your constant helpfulness and am indeed thankful to you for assisting me to make this venture a success. Above all, I thank my Lord and Saviour Jesus Christ, for spiritual guidance during my Ph.D. journey. Indeed, I am more than grateful to Him for everything.

Abstract

Despite the development and implementation of an adolescent and youth sexual and reproductive health (ASRH) strategic plan in 2010, Zimbabwe has the third-highest HIV prevalence amongst sexually active teenagers in Southern Africa. The country can potentially suffer future socioeconomic decline due to adverse health outcomes resulting from the current risky sexual and reproductive health behaviour among its youth and adolescents. The attainment of the United Nations' Sustainable Development Goals (SDGs) may be compromised owing to this predicament. The thesis analysed the utilisation of adolescent and youth sexual and reproductive health services and their outcomes in four essays.

The first essay investigated the socioeconomic factors that influence ASRH service utilisation, the resultant outcomes and their distribution. The essay updated existing literature by providing recent evidence on ASRH specific socioeconomic determinants and their equity connotations, which has been lacking since the implementation of the ASRH strategy in 2010. The essay applied the logistic regression and concentration index techniques on the Zimbabwe Demographic Health survey (ZDHS) data. Findings revealed that inequalities favouring advantaged groups widened in STI treatment, HIV testing, STI treatment, as well as in condom and contraceptive use. Progress was made in early childbearing, which declined among the uneducated. Another positive development was the disproportionately higher HIV infection among females, which declined by almost half between 2005 and 2015.

The second essay analysed the impact of the government's ASRH strategy on the utilisation of ASRH services. The essay's contribution was its quantitative insight into whether a multi-pronged approach or commitment of more resources results in better ASRH outcomes. The difference-in-differences impact evaluation technique was applied to ZDHS data collected in 2010 and 2015. Results indicated that service utilisation for HIV testing and treatment of sexually transmitted infections (STIs) increased. The ASRH strategy also reduced HIV prevalence. These impacts differed by education status and place of residence. Results also showed that provinces that

received more resources did not attain better ASRH outcomes, suggesting that future focus should be on the quality of services.

The third essay sought to characterise the risk preferences of youth. Its contribution lies in using prospect theory to fit youth risk-taking in the domain of sexual and reproductive health as a departure from the normally assumed expected utility theory. Primary data was collected from university students in Zimbabwe using a socioeconomic questionnaire and pairwise lottery choice tasks based on hypothetical ASRH interventions with uncertain outcomes. Prospect theory parameters were estimated using patterns of the respondents' choices over the lottery tasks. This is the first study, to the researcher's best knowledge, that estimates ASRH risk parameters within the prospect theory framework. Bivariate techniques, ordinary least squares and interval regression methods were used to examine socioeconomic differences in risk preferences. Results indicated that the ASRH behaviour of youth fits within prospect theory. Bivariate and multivariate regression analyses showed that income, prior sexual and reproductive health knowledge, and alcoholism were associated with risk and loss aversion.

The fourth essay investigated the long-term consequences of ASRH practices from the female youths' perspective as the hardest hit gender. The essay's contribution lies in unearthing the magnitude of lifelong effects of failure to utilise ASRH interventions during adolescence, which is missing from Zimbabwean literature. The essay applied propensity score matching and multivariate regression techniques on ZDHS data collected in 2015. Findings revealed that non-utilisation of ASRH services leads to lower educational attainment, lesser chances of career development, poverty, as well as the contracting of STIs and HIV infections.

Overall, these findings have several implications. Firstly, health policymaking must consider inclusive ASRH strategies that target currently excluded youths in rural areas, uneducated and poor households, and consider their unique risk preferences. In addition to that, future ASRH strategies should focus on service quality and increased coverage to improve outcomes and attain SDG targets. Secondly, the nature of youths' risk preferences entails that ASRH awareness campaigns be positively framed to improve uptake of ASRH services. In addition to that, policymakers need to facilitate

youth economic emancipation to increase economic prospects, which improves economic reference points that are critical facilitators of risk aversion. Lastly, future ASRH strategies need to have better coordination and monitoring since they involve different implementers. Furthermore, the ASRH strategy needs to be integrated into other sectors' goals that it impacts, such as education and labour.

KEYWORDS: adolescent, youth, sexual and reproductive health, inequity

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List of Acronyms

ART	Antiretroviral Therapy
ASRH	Adolescents and youth Sexual and Reproductive Health
AYP	Adolescents and Young People
CSE	Comprehensive Sexuality Education
CPT	Cumulative Prospect Theory
DID	Difference-in-Difference
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
HPV	Human Papillomavirus
HTC	HIV Testing and Counselling
ICPD	International Conference on Population and Development
MoHCC	Ministry of Health and Child Care
NAC	National AIDS Council
NGOs	Non-Governmental Organisations
RH	Reproductive Health
SADC	Southern African Development Community
SBCC	Social and Behaviour Change Communication
SDG	Sustainable Development Goal
STI	Sexually Transmitted Infections
VIAC	Visual Inspection with Acetic Acid and Camera
VMMC	Voluntary Male Medical Circumcision
ZDHS	Zimbabwe Demographic Health Survey
ZNFPC	Zimbabwe National Family Planning Council

List of Publications and Research Outputs

Prior to submission, one essay has been published, another has been accepted for publication, whilst two are being prepared for submission to journals.

Articles Published

1. Muchabaiwa L, Mbonigaba J (2019) Impact of the adolescent and youth sexual and reproductive health strategy on service utilisation and health outcomes in Zimbabwe. *PLOS ONE* 14 (6): e0218588. https://doi.org/10.1371/journal. pone.0218588
2. Muchabaiwa L, Mbonigaba J (2021). Analysis of sexual and reproductive health risk preferences of Zimbabwean University students. *Malaysian Journal of Public Health.* Vol 21 No 1. https://doi.org/10.37268/mjphm/vol.21/no.1/art.489

Manuscripts under Review:

1. "Examination of socio-economic disparities in the utilisation of adolescent and youth sexual and reproductive health services and outcomes in Zimbabwe 2000-2015." Under Review at *PLOS ONE.* Working on required revisions.
2. "Effects of early childbearing among Zimbabwean women." Under Review at *Emerald Journal of Health Research*. Working on required revisions.

Chapter I

Introduction

1.1 Background

Adolescence and youth, defined as age ranging 10-14 and 15-24 respectively (GoZ, 2009, Darroch et al., 2016), are key stages in life during which a child biologically, cognitively, socially and emotionally transforms into adulthood. This critical transition significantly influences their decision choices, with consequences in health and economic wellbeing, for the rest of their lifetime. More specifically, adolescence is the age during which children are oriented and learn about sex and sexuality, and are thus exposed to sexual and reproductive health risks, including HIV infection and sexually transmitted infections (STIs) (Allen, 2013). Females are more vulnerable and face the additional risk of early and unplanned pregnancy, early childbirth, dropping out of school and cervical cancer; further exposing them to economic exclusion, high morbidity, and premature mortality risks (UNDP, 2012).

Sixty-one (61) percent of the Zimbabwean population is below the age of twenty-five (25), half of which consists of adolescents and young people (ZIMSTAT, 2012). Such demographic composition is common worldwide, with fifty (50) percent being under twenty-five (25) years (UNDP, 2012). Globally, commitments to invest in adolescent and young people's health began at the 1994 International Conference on Population and Development (ICPD) held in Cairo. In 2011, an Inter-Agency Task Team on HIV and Young people meeting in Paris, France, realised that progress had been slow, with HIV prevalence having only declined by twelve (12) percent against a target of twenty-five (25) percent by 2010. In 2010, Zimbabwe developed the Adolescents and Youth Sexual and Reproductive Health (ASRH 2010-2015) strategy with a primary purpose of improving the sexual and reproductive health status of Adolescents and Young People (AYP). The strategy identified ignorance, peer pressure, information asymmetry, cultural and religious barriers, limited coverage, and gender disparities

(GoZ, 2009) as sources of negative ASRH outcomes and defined an ASRH minimum package, as exhibited in appendix 1.1. The Zimbabwean ASRH strategy's main aim was to adopt a preventive, promotive, curative, and counselling approach for AYP. The strategy further grouped these youths into in school, out of school, and tertiary level students, each group with its specific ASRH package. This was adopted in the Zimbabwe HIV/Aids Strategic plan III (2016-2020), aiming at zero new HIV infections by 2030. This dissertation analysed select ASRH interventions and their outcomes in Zimbabwe.

1.1.1 ASRH Interventions

The health sector and the education sector separately implemented programs to improve ASRH in Zimbabwe since the country's attainment of Independence in 1980. While the Ministry of Health and Child Care (MOHCC) carried the mandate from Independence through the Zimbabwe National Family Planing Council (ZNFPC), the Ministry of Education (MoE) implemented HIV and life skills education in primary schools in 1993 (Mlingo, 2008). The education curricular was revised to include HIV and life skills in the general paper subject, beginning with the fourth grade. Sexuality education was however missing from the curricular and left for traditional family educators such as uncles and aunts (Kim et al., 2001). These individuals have traditionally taken the role of sexuality education to youth in Zimbabwe. However, owing to increasing urbanisation and mordenisation, there have been significant distances between families, and, this has compelled uncles and aunts to relinguish their role. On the other hand, their role has also become inappropriate due to their disconnect with youth and human rights considerations (Nyanungo, 2018, Shaw, 2007, Sherman and Bassett, 1999). These factors have led to a vacuum in sexuality education, which is not addressed by either the traditional extended family institution or the formal education and health institutions. Coupled with legal barriers to the provision of contraceptives and condoms to adolescents, the lack of sexuality education was associated with the rise in risky sexual behaviour, STI and HIV infection between mid-90s and mid-2000s (Mlingo, 2008, Kim et al., 2001, Gregson et al., 2010).

Sexuality education to promote behavioural change took centre stage among policy debates at the onset of the 21st century (Mlingo, 2008). Researchers and institutions such as the ZNFPC began assessing the efficacy of sexuality education in selected communities in Zimbabwe. The findings suggested that comprehensive sexuality education along with HIV/AIDS education and a provision of adolescent friendly counselling, testing services would increase safe sexual practices among adolescents and youths. These findings informed the development of the ASRH strategy launched in 2010.

1.1.1.1 HIV/AIDS and Testing

The age at which an adolescent initiates sex marks the beginning of increased exposure to reproductive health risks such as sexually transmitted infections, unintended pregnancies, and HIV. Zimbabwe Demographic Health Survey (ZDHS) 2010/11 data showed that the median age at first intercourse was 19 years for people aged 15-24 years (ZIMSTAT and ICFI, 2012). About 13 percent of sexually active females and 70 percent of males aged 20-24 reported a higher likelihood of sexual intercourse in the 12 months preceding that survey. However, against a target of 90 percent of the population at risk tested, HIV testing in 2015 covered 48.8 percent for women aged 15-49 years and 42 percent of women aged 15-24 years (ZIMSTAT and ICFI, 2016). For men aged 15-49 years, 35.9 percent were tested in 2015 compared to 26.4 percent of those aged 15-24 (ZIMSTAT and ICFI, 2016).

Zimbabwe has one of the highest HIV prevalence rates in Africa, at 14.1 percent among adults aged 15-49. The HIV prevalence is 1.6 times higher in females than in males for the 15-24 age groups (ZIMSTAT and ICFI, 2016). A combination of prevention interventions associated with HIV testing is used to reduce new HIV infections in Zimbabwe. The combination consists of social and behaviour change; increased condom promotion and distribution; voluntary medical male circumcision (VMMC); prevention and control of sexually transmitted infections (NAC, 2015). HIV Testing and Counselling (HTC) has been identified as a strategic entry point for antiretroviral therapy (ART); and as such, it is important to get tested regularly so that people infected with HIV enjoy the benefits of early initiation of ART. Early initiation of ART leads to faster suppression of the viral load, thereby making the use of ART a

prevention strategy. Furthermore, knowledge of HIV status helps HIV-negative individuals make specific decisions to reduce their risk of contracting the virus, and to increase safe sex practices to remain disease-free. For HIV-positive individuals, knowledge of their status allows them to take action to protect their sexual partners, to access treatment, and to plan for the future.

1.1.1.2 Voluntary Male Medical Circumcision

Research-based evidence currently suggests that voluntary male medical circumcision (VMMC) is associated with a 60 percent lower risk of HIV transmission (WHO and UNAIDS, 2007). In 2009, Zimbabwe developed and adopted the VMMC policy, making the medical procedure one of its HIV prevention interventions. VMMC is being offered more widely throughout the health care system. However, it is worth mentioning that, against a national target of having 1.3 million males circumcised by 2017, only 600 000 have been circumcised (Mananavire, 2016), with adolescent and young males' circumcision rate of 19 percent standing slightly higher than the national average of only 14 percent. In other African countries, the circumcision rates average 62 percent, with West Africa having as much as 90 percent circumcision (Morris, 2016).

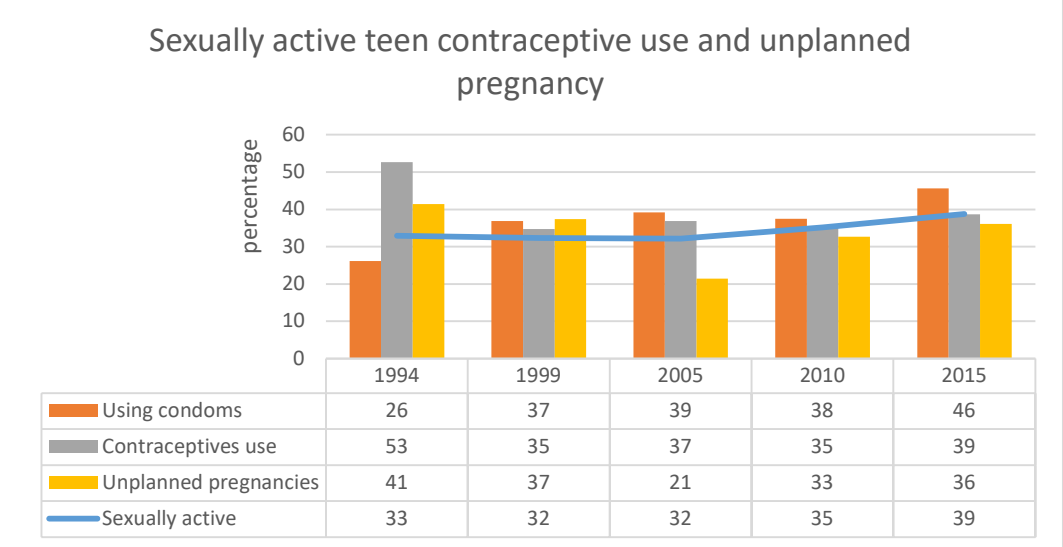
1.1.1.3 Cervical Cancer Screening

Cervical cancer is one of the leading causes of death among women. Its burden is high in developing countries, whereas it is relatively insignificant in developed countries. Cervical cancer can be preventable when it results from treatable human papillomavirus (HPV) infection that remains untreated for a minimum of 7 years (Petry et al., 2014). In Zimbabwe, it is screened using the Pap smear test or the Visual Inspection with Acetic Acid and Camera (VIAC). The test is recommended for women from the time they become sexually active. Early screening for cervical cancer, or rather, HPV, can reduce new cervical cancer cases by 70-80 percent (Petry et al., 2014). Besides HPV, risk factors for cervical cancer include early age of sexual intercourse, multiple sexual partners, HIV infection, and STIs (Makoni, 2016); therefore indicating the need for this service for adolescents and young people. All Zimbabwean provinces have cancer screening centres, which amount to 88

countrywide. In spite of the existence of these centres, of the 79 percent of women in Zimbabwe who have heard of cervical cancer, only 13 percent have ever had a cervical cancer test (ZIMSTAT and ICFI, 2016). Moreover, only 6.3 percent of women aged 15-24 have ever had a cervical exam.

1.1.1.4 Contraceptives Use

The use of contraceptives helps mitigate unwanted pregnancies, maternal and child mortality, whilst improving future life prospects (Aina and Aina-Pelemo, 2019, Ngome and Odimegwu, 2014). Figure 1.1 shows the proportion of sexually active adolescents aged between 15 to 19 years old and contraceptive use in percentages. Sexually active adolescents increased from 33% in 1994 to 39% in 2015.



	1994	1999	2005	2010	2015
Using condoms	26	37	39	38	46
Contraceptives use	53	35	37	35	39
Unplanned pregnancies	41	37	21	33	36
Sexually active	33	32	32	35	39

Source of data: Zimbabwe Demographic Health Survey reports 1994, 1999, 2005, 2010, 2015

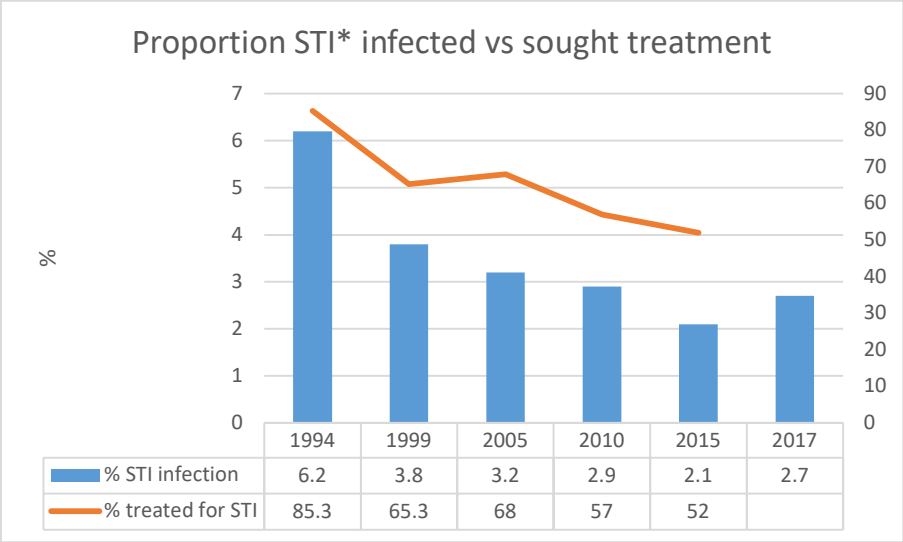
Figure 1.1 Sexually active teen contraceptive use and unplanned pregnancy

Conversely, contraceptive use fell from 53% in 1994 to 39% in the same year. Although unplanned pregnancies among adolescents fell from 41% in 1994 to 21% in 2005, they increased to 36% in 2015. These unwanted pregnancies arise as a result of the inadequate use of contraceptives. Literature shows that such unwanted pregnancies amongst youths in Zimbabwe result in unsafe and illegal abortions. Specifically, Sully et al. (2018) found that 25% of these unwanted pregnancies result

in abortions. These abortions carry a high risk of mortality (Chikova and Chikova, 2019). According to Ganatra et al. (2017), 23.5% of the abortions are unsafe, and as a result, 40% of them result in complications (Riley et al., 2020).

1.1.1.5 Condom Use

Figure 1.1 above shows the proportion of youth using condoms, contraceptives, and the proportion of unplanned pregnancies and youth who are sexually active. The use of condoms has been increasing among the youth in Zimbabwe. Condom utilisation works both as a contraceptive and protection against STIs and HIV/AIDS. Sexually active adolescents reporting the use of condoms increased from 26% in 1994 to 46% in 2015. Figure 1.2 shows youth STI prevalence on the left vertical axis and the proportion of those STIs treated at a health facility on the right vertical axis.



*STI is abbreviation for sexually transmitted infection
Sources: Munjoma et al., (2010b) and Ministry of Health and Child Care, (2017)

Figure 1.2 Proportion of STI infected compared to proportion who sought treatment

Although the increased use of condoms can be stated as one of the reasons for the reduction in HIV prevalence from 30% in 1999 to 14.1% in 2017 (Munjoma et al., 2010b, MOHCC, 2017), as well as STIs as shown in figure 1.2, there has been a sudden increase in STIs from 2.1% to 2.7% from 2015 to 2017 which suggests a

decline in protected sex. In addition to that, the increase in unplanned pregnancies from 21% in 2005 to 36% in 2015, as shown in figure 1.1, in contrast, to the rise in condom use from 39% to 46% over the same period, suggest the condoms are not being used properly.

1.1.1.6 STI Treatment

The most common STI infections in Zimbabwe are Syphilis, Gonorrhoea, and Human Papillomavirus (HPV). These STIs have negative health and economic consequences, which imply that prevention and treatment are important. Health consequences include reproductive disorders, infant infections, liver failure, cancer, nervous system disease, and higher chances of HIV infection (Chesson et al., 2017). Economic consequences include the cost of treatment as well as the cost of managing the health consequences of STIs. Despite these health and economic consequences, the treatment of STI infections among Zimbabwean youth has been declining. Treatment for STIs fell from 85.3% in 1994 to 52% in 2015, as shown in figure 1.2.

1.1.2 Immediate ASRH Outcomes

1.1.2.1 HIV Infection

ASRH interventions such as condom use and HIV testing help reduce HIV incidence and HIV infection. HIV incidence refers to the number of new HIV infections in a population in a given period, while HIV prevalence refers to the proportion of people HIV positive at a given point in time (MOHCC, 2017). HIV incidence currently stands at a weighted average of 0.47%, of which females have a higher rate of 0.60% compared to males' rate of 0.30% (MOHCC, 2017). HIV prevalence stands at 14.1%, which is a major achievement from 26.5% estimated in 1997 (NAC, 2015). HIV infection is detrimental to the individual, his household, and the country. Effects on an individual level have been noted in productivity. A study in Kenya found that HIV positive individuals worked fewer days and were less efficient. As a result, they lost their jobs and ended up earning less incomes (Fox et al., 2004).

At the household level, the loss of a job or decline in productivity impoverishes the family. Evidence from sub-Saharan Africa has shown that HIV/AIDS leads to lower

investment at the household level, which results in lower incomes and food insecurity (Asenso-Okyere et al., 2010). In addition to that, substantial family resources must be reallocated towards medical and other HIV-related expenses (Lara et al., 2012). Furthermore, there is a risk of HIV transmission to offspring, which currently stands at 7.78% for Zimbabwe (Sibanda et al., 2020). HIV-positive orphans were found to have reduced school attendance due to illness days and medical appointments (Zinyemba et al., 2020). Further evidence of intergenerational transmission of the effects of HIV manifests in the education outcomes of orphans. The death of a parent has been found to significantly reduce school attendance and school completion for orphans in Zimbabwe (Gundersen et al., 2006, Pufall et al., 2014).

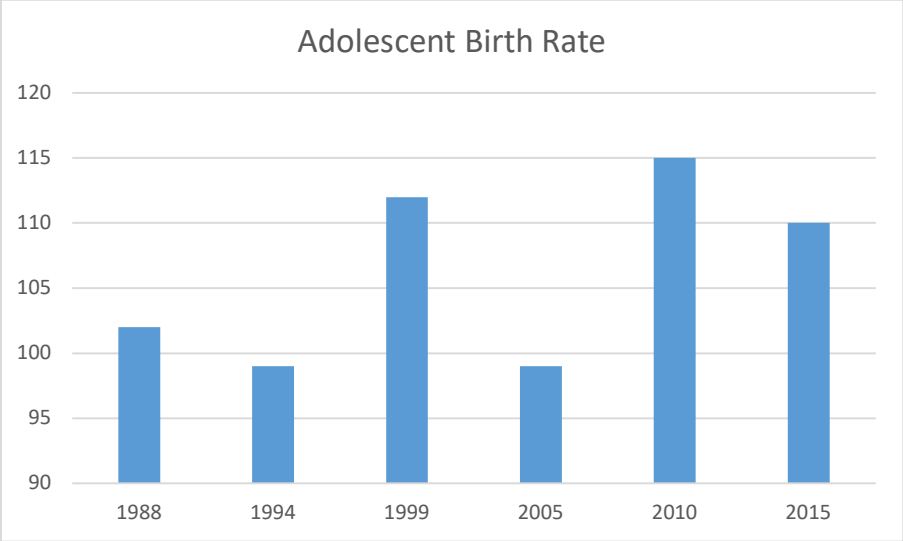
The HIV cost on productivity at the national level is captured by its effect on GDP. Nketiah-Amponsah et al. (2019) showed that HIV reduced GDP per capita by 0.47% per 1% increase in prevalence for sub-Saharan Africa countries. Zimbabwe alone lost 13.3% of potential GDP in over a decade due to HIV/AIDS (Matshe and Pimhidzai, 2008). At the national level, the Zimbabwean government allocates substantial amounts to HIV/AIDS prevention and treatment. Such commitment of resources comes at an opportunity cost of other emerging non-communicable diseases and other developmental projects such as infrastructure. These resources are raised from taxes obtained from the working population as well as formally registered companies.

1.1.2.2 STI Infection

Another outcome arising from the non-utilisation of ASRH services consists of STI infection, which can result in morbidity and mortality if untreated. Common STI infections in Zimbabwe are Syphilis, Gonorrhoea, and Human Papillomavirus (HPV). Syphilis prevalence was estimated at 2.7%, with females having a higher rate at 3% than 2.4% among males (MOHCC, 2017). HPV has long-term effects on cervical cancer, resulting from the infection's lesions (WHO, 2019). HPV infection has been noted to occur mostly at the beginning of sexual activity (CDC, 2016). Trends of STI infection in Zimbabwe are presented in figure 1.2. STI infection fell from 6.9% in 1994 to 2.1% in 2015. There has been a recent rise in STI infections to 2.7% (MOHCC, 2017) in 2017, from 2% in 2015, suggesting an increase in risky sexual behaviour amongst youths.

1.1.2.3 Teen Pregnancy and Childbearing

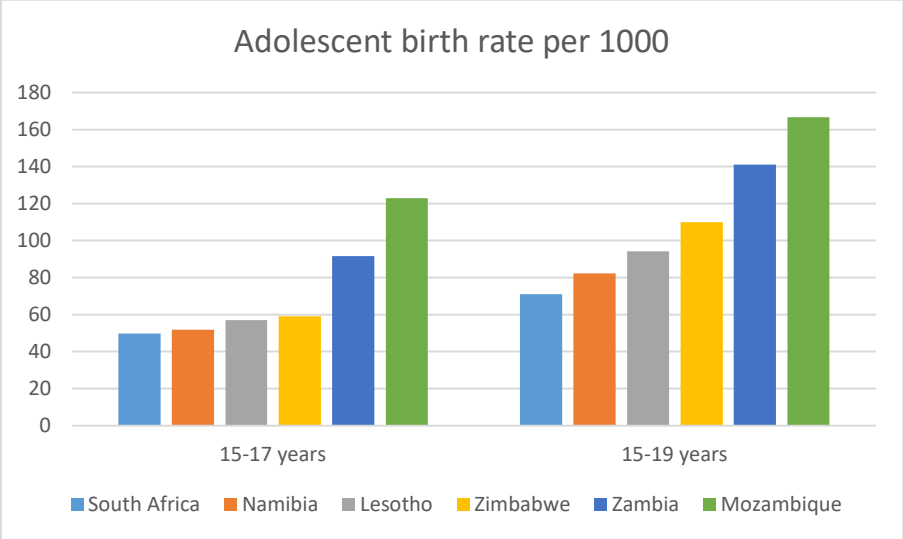
As measured by the number of live births per 1000 adolescents in Zimbabwe, the births among adolescents are among the highest globally (UN, 2020). Figure 1.3 shows birth rates among adolescents for Zimbabwe using datasets collected between 1988 to 2015. Since the ZDHS refers to information for 5 years preceding the survey, the 1988 dataset for example, consists of births by adolescents between 1983 and 1988 (ZIMSTAT & ICF 2016b). This range of data allows for the examination of trends in Zimbabwe's adolescent birth rates between 1983 and 2015. Adolescent child birth increased from 102 births per 1000 live births in the 1988 survey to 110 in 2015.



Source: Zimbabwe Demographic Health Survey 2015

Figure 1.3: Adolescent birth rates per 1000 live births in Zimbabwe

Compared to other countries in the Southern African Development Community (SADC), Zimbabwe has the third highest birth rate among adolescents after Mozambique and Zambia, as shown in figure 1.4. The figure shows that the situation is consistent whether we consider all adolescents on the right panel or only those under 18 in the left panel. These high birth rates are due to child marriages and early sexual initiation (UN, 2020).



Source: United Nations (2020)

Figure 1.4 Adolescent birth rate per 1000 live births in Southern Africa

Teen pregnancy is associated with birth complications, high mortality rates for both child and mother, and bleak economic prospects (Darroch et al., 2016). There are high chances of maternal mortality brought about by complications during the pregnancy and at birth (Darroch et al., 2016). Complications at childbirth have been shown to cause the highest mortality amongst pregnant adolescents (Darroch et al., 2016). The other negative consequences of teen pregnancy and motherhood include poor economic prospects such as completing school, labour force participation, and earnings. Health consequences include labour complications and transmitting STIs and HIV to their children. These negative consequences affect both the mother and their offspring and often results in intergenerational transmission of poverty and poor health (Lansford and Banati, 2018, Merrick, 2015). Sustainable Development Goal (SDG) 3.7 refers to improving contraceptives use and reducing adolescent birth rates to improve health and well-being (Denison et al., 2017). This role of contraceptives in poverty alleviation motivated the government to have contraceptives as part of the ASRH essential package.

1.1.3 Long term Health and Economic Outcomes

The ASRH health and economic consequences can persist until late adult life. HIV infection has no cure and thus has lifelong health and economic consequences. HIV

requires lifelong treatment that is beyond affordability to most individuals in Zimbabwe (Lara et al., 2012). Countries such as Zimbabwe have assumed the financing of HIV treatment to ease the economic burden on infected individuals and their households (NAC, 2015). Health problems of HIV-infected people include transmission to their children, opportunistic infections, and potential toxicity of HIV treatment (de Boissieu et al., 2016, Rubaihayo et al., 2016). STIs such as HPV create lesions that can develop into cervical cancer after periods as long as 20 years later (Chan et al., 2019). Unsafe abortions that are caused by unwanted pregnancies can cause infertility (Okafor et al., 2017, Lin et al., 2018, Thoma et al., 2019).

Long term ASRH economic costs affect females more than males. The consequences are mainly attributable to early child marriage and early childbirth, occurances which in turn cause failure to complete education (Wodon et al., 2016). As such, women who had early childbirth end up having lower-paying jobs or no jobs at all (Berthelon et al., 2017). Poor quality jobs in backward economic sectors such as agriculture, artisanal mining and commercial sex work are in most cases consequences of failure to complete education by females (Mwakumanya et al., 2016, Ibrahim et al., 2020). In addition to having low remuneration, the women endure deplorable working conditions and suffer most human rights abuses through gender-based violence and the violation of their sexual and reproductive health rights (Mwakumanya et al., 2016, Rustad et al., 2016). Child marriage is also associated will lower economic emancipation and asset ownership for the women involved (Wodon et al., 2017).

1.2 Research Problem and Overall Objective

Adolescents and youth, because of developments happening in their bodies and minds at this stage of their lives, are exposed to high risks of HIV infection, STIs, early pregnancy and childbearing. Female adolesents are exposed to cervical cancer, which develops later in their lifetime if HPV infection is not treated earlier. HIV/AIDS is one of the major contributors to mortality in Zimbabwe while cervical cancer is emerging as a dangerous carcinoma amongst females (MOHCC, 2016). Furthermore, early pregnancy and childbirth expose the adolescent and young females to higher morbidity and mortality. For females, this often results in school drop-out or deferment of studies. Although the Zimbabwean government has developed and implemented

strategies to avail this age group's preventive services to mitigate these reproductive health risks, utilisation is very low, and progress has been stalling over the past decade. No research has been carried out to investigate the low uptake of these services in Zimbabwe or quantify changes in utilisation patterns or behaviour. Although notable progress has been achieved in the provision of ASRH services in Zimbabwe, recent evidence has shown stalling improvement in HIV prevalence, particularly for tertiary education students. Whilst the national HIV prevalence rate has stabilised below 15 percent (MOHCC et al., 2014), it went up from 20 percent in 2014 to 23 percent in 2016 for students at state universities, with one university reportedly having 47 percent HIV positive students among those who were voluntarily tested (Mukwati, 2016). The number of STIs reported among the number of tertiary students with multiple sexual partners at 60 percent (Mbanje, 2013), is higher than that of the average population of 10.6 percent. Furthermore, the utilisation of preventative interventions targeted for this group, including male circumcision and cervical cancer screening, is still below national targets.

The design of the ASRH strategy appears biased towards addressing the supply side. The way the adolescents and young people perceive sexual and reproductive health risks and their attitudes towards such risks also needs to be ascertained to understand their preferences. Understanding these preferences can, in turn, assist the policymaker in designing a package that can effectively increase the utilisation of reproductive health services for this age group. Prospect theory offers an alternative explanation of decision making under uncertain outcomes (Barberis, 2012). According to the prospect theory, risk behaviour depends on whether the uncertain outcomes are perceived as gains or losses (Kahneman and Tversky, 1979, Attema et al., 2013). The perception of outcomes as gains or losses itself depends on certain reference points. The prospect theory literature has pointed out that decision making for such interventions that have an element of discomfort (VMMC and cancer screening) and uncertain outcomes (HIV test and cancer screening) require in-depth analysis into reference points from which individuals make their decisions as well as their risk preferences which are not well understood (Verma et al., 2014, Happich et al., 2009). Prospect theory has been used in studies in other disciplines like finance and politics but rarely applied in the health domain (Barberis, 2012). Understanding the target

group's risk preferences, parameters, and reference points is important to package and market ASRH services properly.

Therefore, this research's overall objective was to conduct an analysis of sexual reproductive healthcare utilisation among the youth in Zimbabwe. Specific objectives were to:

1) determine socio-economic factors that influence the utilisation of ASRH services and outcomes and assessing how their influence has evolved over time and the equity connotations;
2) assess the effects of the 2010-2015 government ASRH program on improving service utilisation and outcomes;
3) analyse and characterise their risk preferences using an alternative to the expected utility theory, the prospect theory; and
4) assess the economic consequences of failure to utilise reproductive health services at the individual and household levels.

1.3 Research Questions

This dissertation sought out to answer the following research questions:

- What are the socio-economic determinants of reproductive health services utilisation and outcomes among adolescents and young people in Zimbabwe, and are the utilisation patterns and outcomes equitable?
- Was the ASRH strategy implemented in Zimbabwe successful in improving youths' service utilisation and outcomes?
- To what extent are Zimbabwean youth risk-taking when it comes to ASRH service utilisation, and what socio-economic factors determine such risk behaviour
- What are the economic consequences of the non-utilisation of ASRH services to the individual, household, and health system?

1.4 Structure of the Thesis

The thesis is structured in four essays in line with the four objectives and the four research questions under investigation. Each essay constitutes a chapter and

addresses a specific objective (question) of the thesis. The thesis ends with a concluding chapter.

Chapter two: Socio-economic determinants of reproductive health services utilisation among adolescents and young people in Zimbabwe

Chapter two investigated the socio-economic determinants of ASRH service utilisation and outcomes in Zimbabwe. The chapter also investigated the inequalities in the utilisation of these services and in ASRH outcomes. This research was necessary to provide evidence on factors that require policy prioritisation to ensure an increase in ASRH service utilisation and better outcomes. The chapter used data from three datasets from the Zimbabwe Demographic Health Survey between 2005 and 2015. Data were analysed using logistic regression to identify key determinants, while the concentration index was used to determine disparity in ASRH services usage and outcomes. Results indicated that socio-economic factors such as wealth, education, gender, information access, and place of residence affect ASRH utilisation in Zimbabwe. HIV testing was found highly concentrated amongst the rich in 2005 with a declining disparity over time. Results also showed pro-rich STI treatment, pro-poor contraceptives use, pro-educated, pro-urban residence, and pro-female HIV testing with declining estimates. STI treatment was found pro-educated and pro-urban, with an increase in the effects. Condom use was found pro-educated with a declining pattern, pro-male with an increasing pattern, and pro-urban with a falling pattern. Contraceptive use was found increasingly pro-education and balanced across residence throughout the essay. Concentration indices also showed that early childbearing was inequitably biased against the poor. Youth without secondary education had higher HIV infection, and the pattern increased. HIV burden was disproportionately higher amongst female youth. Early childbirth was higher amongst those without secondary education, but the pattern was slowly declining and among rural residents. The chapter recommended balanced service provision across all socio-economic groups. The essay contributed to the existing literature by providing more recent adolescent and youth-specific evidence on socio-economic determinants of reproductive health service use, outcomes and their equity connotations. The chapter also highlighted the extent to which Zimbabwe has made progress in

increasing ASRH service utilisation, improving ASRH outcomes, and reducing ASRH inequalities over the past 15 years in which it has implemented ASRH reforms.

Chapter three: Impact of the adolescent and youth sexual and reproductive health strategy on service utilisation and health outcomes in Zimbabwe

Chapter three evaluated the impact of a multi-pronged adolescent sexual and reproductive health (ASRH) strategy implemented by Zimbabwe's government between 2010 and 2015. The strategy aimed to improve ASRH in terms of the uptake of condoms and HIV testing and outcomes in terms of sexually transmitted infection (STI) prevalence and HIV prevalence. The chapter combined the difference-in-difference and propensity score matching methods to analyse Zimbabwe demographic health survey cross-sectional datasets collected in 2010 as a baseline and in 2015 as post policy. Young people aged 15-19 years at baseline in 2010, who were exposed for the entire five-year strategy, were designated as the treatment group whilst young adults aged 25-29 at baseline were the control. Results showed that the ASRH strategy increased HIV testing amongst youth by 36.6 percent, while the treatment of STIs also increased by 30.4 percent. Findings also showed that the HIV prevalence trajectory was reduced by 0.7 percent. Although HIV testing increased for all socio-economic groups that were investigated, the effect was not the same. The chapter recommended designing future ASRH strategies to differentiate service delivery for youths in HIV hotspots, rural areas, and out of school. Additional recommendations include improving the strategy’s coordination and monitoring and aligning and enforcing government policies that promote sexual and reproductive health rights. The essay’s contribution was its quantitative insight into whether the ASRH strategy, implemented as a multi-pronged approach, improved ASRH utilisation and outcome variables. The analysis of the multiple complementary ASRH interventions as implemented in Zimbabwe is the first such attempt in scientific literature, to the researcher’s best knowledge. In addition to that, the essay provided an insight into whether the problem with ASRH programming was funding or allocative efficiency by comparing different provinces that used different resources.

Chapter four: Tertiary students sexual and reproductive health risk preferences

Chapter four estimated youths' risk preference parameters in a tertiary education setting to assist in understanding their risky sexual and reproductive health behaviour using prospect theory. It determined socio-economic factors that influence the prospect theory parameters. Primary data used in this essay was collected amongst 250 students at the Bindura University of Science Education. Research participants were asked to choose between two ASRH intervention options: male circumcision and cervical cancer screening for females, with uncertain outcomes. The chapter used bivariate techniques to examine differences in risk-taking behaviour. Ordinary least squares and interval regression techniques determined the socio-economic determinants of the risk behaviour function. The chapter established that the ASRH behaviour of youth fits within prospect theory. More specifically, results showed an average risk aversion parameter of 0.7 and a probability weighting parameter of 0.8. The probability weighting parameter implies that the participants were more focused on the outcomes with less concern for their likelihood. A loss aversion parameter of 2.26 was found, which indicates the need to reduce loss-framed messages in favour of positively framed awareness campaigns. Bivariate and multivariate regression analyses showed that income, prior sexual and reproductive health knowledge, and alcoholism were associated with risk and loss aversion. Recommendations made include health facilities addressing discomforts such as stigma, unfriendly staff and lack of privacy. Promoting positive framing of youth sexual and reproductive health in awareness campaigns was also recommended. Another suggestion made was economic emancipation to increase economic prospects, which improves reference points, which in turn changes the viewing of health interventions and outcomes from the loss domain to the gain domain. This research is the first-ever attempt to establish prospect theory risk parameters specific for youths in the sexual and reproductive health domain to the best of the researcher’s knowledge.

Chapter five: Effects of early child bearing on socio-economic and health outcomes

Chapter five explored the consequences of the non-utilisation of adolescent sexual reproductive health (ASRH) services. It focused on female youth who are the most affected in African household settings. The consequences were analysed for women

aged 20 to 29 years, 30-39 years, and 40-49 years. The age groups 20-29 represent the medium-term effects, while 30-49 years estimate the long-term effects. The extent of these consequences was assessed by comparing the health and economic outcomes of women who gave birth before the age of 18 and those who did at an older age. The assessment indicated a lack of uptake of condoms, contraceptives, and prevention of both HIV and STIs in the mentioned group, versus other women who gave birth after the age of 18. The chapter used 6,254 observations from the 2015 Zimbabwe Demographic Health Survey women's dataset. Data was analysed using propensity score matching, which accounts for self-selection effects. Multivariate regression techniques and structural equation modelling were used for robustness checks. Results showed that early childbirth condemns a woman to lower education attainment, lesser chances of career development; as well as higher risks of living in poverty and contracting STIs and HIV infection. The chapter recommended support for adult education and cash transfer incentives, child support for teenage mothers, public sector employment preferential treatment, and review of education regulations to support condoms in schools. As far as the researcher is aware, this is the first study to estimate the added economic burden attributable to non-utilisation of ASRH services.

Chapter six: Conclusion

Chapter six consolidated the dissertation's major findings and concluded based on the dissertation's objectives. Policy recommendations and areas for further research were also identified.

1.5 Operational Definitions

Adolescent refers to anyone aged 10 – 19 years (Mitchell et al., 2009).

Adolescent Sexual and Reproductive Health services: The government of Zimbabwe established a minimum package of ASRH services. These are presented in appendix 1.1. The health services are defined per approach. However, this research will be limited to a few of these services selected based on the measurability of outcomes (GoZ, 2009).

ASRH package refers to three approaches used by the Zimbabwean government to provide friendly ASRH services focused at the health facility, community, and schools. At the health facility, the strategy aimed to provide ASRH services and make them more acceptable. Each facility was tasked with setting up and equipping one room, given the name "Youth Friendly Corner". The community approach involved setting up community youth centres, community ASRH clubs, and involving private pharmacies and other institutions in those communities. The school-based approach involved schools, vocational and tertiary institutions whereby children and youth were to be educated on life skills and counselling by their peers and teachers (GoZ, 2009).

Reference point refers to a point from which an individual assesses the outcome of their action to determine whether they have made a gain or loss in utility. The concept is used in prospect theory and, most times, though not always, to refer to the status quo (Kahneman and Tversky, 1979).

Reproductive health refers to the ability "to have a responsible, satisfying and safe sex life"…and … "the capability to reproduce and the freedom to decide if, when and how often to do so" (WHO, 2002 p4).

Sexual health "is a state of physical, emotional, mental, and social well-being in relation to sexuality; it is not just the absence of disease, dysfunction or infirmity" (WHO, 2002 p5).

Young person refers to anyone between 10 to 24 years old (Mitchell et al., 2009).

Youth refers to anyone aged between 15 to 24 years (Mitchell et al., 2009).

Appendix 1.1: ASRH Minimum Package

Health Facility Approach	Community Approach	School Based Approach
Education and counselling services e.g. on: • Sexuality and growing up • Abstinence, consequences of abortion • Contraception, STIs/HIV • Skilled attendance • Ante and post natal care • Nutrition	Education and counselling services e.g. on: • Sexuality and growing up, relationships, abstinence, consequences of abortion • Contraception,STIs/HIV Substance and drug abuse	Education and counselling services e.g. on: • Sexuality and growing up, relationships • Prevention of pregnancy and STIs • Abstinence, consequences of early pregnancy, abortion, • Substance and drug abuse.
Provision of information and education on SRH	Provision of information and education on SRH	Life skill training e.g. on goal setting, decision making, negotiation and assertiveness
Provision of life and livelihood skills	Provision of life and livelihood skills	School health talks on issues like: sexuality and growing up, STI/HIV prevention, rape prevention, Careers
Provision of SBCC, audio/visual materials	Provision of SBCC, audio/visual materials	Facilitate a strong and effective linkage with health facilities and community youth centres
Provision of contraceptives	Provision of contraceptives	Recreational activities
Emergency contraception	Pregnancy testing	Integrate ASRH services with other services
Pregnancy testing		
Screening and treatment of STIs		
Comprehensive Post Rape Care		
Voluntary Counselling and Testing (VCT) services, incl PMTCT	Provision of Voluntary Counselling and Testing (VCT) services	
Essential obstetric care		
Post Natal Care	Facilitate a strong and effective linkage with schools and health facilities	
Abortion Care Services		
Promoting community based/school based SBCC activities – (outreach services)	Integrate ASRH services with other services	
Male circumcision (13 year olds and above)	Male circumcision (13 year olds and above)	
Recreational activities	Recreational activities	
Facilitate a strong and effective linkage with schools and community youth centres	Promoting community based/school based SBCC activities (outreach services)	
Integrate ASRH services with other services		

Source: GoZ (2009, p28)

Chapter II

Socioe-conomic determinants and inequalities in sexual and reproductive health services utilisation and outcomes among adolescents and young people in Zimbabwe

2.1 Introduction

The previous chapter highlighted that adolescence is a crucial period as a child transforms biologically, cognitively, socially, and emotionally into adulthood (Hochberg and Konner, 2020, Yeager, 2017). Decisions made during this phase of life have repercussions on lifetime economic and health outcomes which are potentially intergenerational (Von Soest et al., 2020). National governments and their local and international developmental partners are increasingly paying attention to gaps in ASRH outcomes, service provision and financing (Chandra-Mouli et al., 2015). In 2010, for instance, the Zimbabwean government facilitated a national level consensus towards improving ASRH services and outcomes packaged as the ASRH strategy 2010-2015.

While the previous chapter also highlighted the evolution of ASRH service and outcome indicators between 1988 and 2015, their socio-economic determinants are poorly understood. The current chapter provides a descriptive analysis of socio-economic determinants of ASRH service utilisation and outcomes before the ASRH strategy and five years after its implementation. Furthermore, the chapter also analyses equity in ASRH service utilisation and outcomes to identify perennially disadvantaged groups.

Despite a growing literature on adolescent and youth sexual and reproductive health in Zimbabwe, relatively little is known about the evolution of socio-economic determinants of ASRH utilisation and outcomes. Furthermore, as far as the researcher is aware, no study has yet analysed the evolution of equity in service utilisation and

outcomes before and after the implementation of the Zimbabwean ASRH strategy. Findings on socio-economic determinants across the successive surveys can help in identifying persistent variables which can be targeted by future interventions to increase ASRH service utilisation. Results from the equity analysis can guide public resource allocation to level ASRH outcomes.

2.2 Theoretical Literature Review

Research on socio-economic determinants of health has converged towards the bidirectional causality between health and socio-economic variables like income and education (Galama and Van Kippersluis, 2013, Schultz, 1961). Research on the mechanisms underlying this relationship -inequalities in particular- is ongoing in various disciplines, each guided by its theoretical frameworks (Galama and Van Kippersluis, 2013, O'Donnell et al., 2015, Yao et al., 2019). Economists use human capital theory to study the determinants of health and socio-economic inequalities to facilitate the design and evaluation of effective economic interventions.

The human capital theory posits that individuals invest in human capital, such as education and health, to increase productivity in the market and non-market or household sectors (Grossman, 1972, Becker, 1965). While individuals supply labour in the market sector in return for wages for their human capital investment, they buy consumption commodities and leisure to gain utility in the non-market sector. More specifically, in the health domain, Grossman (1972) developed the health capital model to explain the demand for health and investments through healthcare in return for a healthy time as output. Galama and Van Kippersluis (2019) extended the Grossman model for decreasing returns to health investment, made job related stress and desired length of life endogenous.

The Grossman health capital model posits that individuals derive utility from consumption $C(t)$ and health production $H(t)$ over a person's lifetime (Galama and Van Kippersluis, 2013, Grossman, 1972) as shown in equation (2.1):

$$\int_0^T U[C(t), H(t)]e^{-\beta t}\, dt \qquad (2.1)$$

Individuals pursue utility maximisation over a lifetime in which future consumption and health are discounted at the rate β. The individuals do not only derive utility from health

but also because it enables them to work and produce market goods and allows them to enjoy non-work activities like leisure and consumption (Grossman, 1972).

Health $H(t)$ is a derived demand which implies that equation (2.1) supports Becker's theory of time allocation (Becker, 1965), whereby households are both consumers and producers. This duality in household economic activity raises the need for optimal time allocation between production and consumption to maximise utility. Empirical studies on health inequalities focused on how individuals from different backgrounds balance production and consumption in the utility function in equation (2.1). Furthermore, they also investigated how different circumstances determine individuals' discounting of the utility function via component $e^{-\beta t}$.

Nonetheless, health stock depreciates with age at the rate of dt. To replenish health stock, individuals invest in health $I(t)$ through medical outlays and own time for exercise and hygiene to give net investment:

$$\frac{\partial H(t)}{\partial t} = f[I(t) - d(t)H(t)] \qquad (2.2)$$

The health demand model acknowledges that investment in health varies with age such that younger and older individuals are expected to have substantial medical outlays. Outlays by typical middle-aged individuals are less of a monetary nature but more of time, whereby they spend more time exercising, observing healthy habits, and less health risky behaviour.

In the model, an individual's assets portfolio $A(t)$ accumulates at the capital rate of return r, with the addition of earnings from the labour market which is a function of health $Y[H(t)]$ net of expenditures in health and non-health goods and services:

$$\frac{\partial A(t)}{\partial t} = rA(t) + Y[H(t)] - p_c(t)X_c(t) - p_m(t)m(t) \qquad (2.3)$$

where $p_c(t)X_c(t)$ represents total expenditure for non-health goods and services and $p_m(t)m(t)$ layout in medical goods and services. Equation (2.3) enables the analysis of variations in individuals' asset portfolios brought about by differences in health outlays $p_m(t)m(t)$, which is arguably rooted in their socio-economic backgrounds.

Earnings from labour $Y[H(t)]$ can be further expressed as a function of wage rate $W(t)$ and time spent working $\tau_w(t)$:

$$Y[H(t)] = W(t)\tau_w(t) \quad (2.4)$$

Individuals have a time constraint Ω in which to fit times for work $\tau_w(t)$, health investment $\tau_I(t)$, consumption $\tau_C(t)$ and sickness $\tau_s(H(t))$ which is a function of health:

$$\Omega = \tau_w(t) + \tau_I(t) + \tau_C(t) + \tau_s(H(t)) \quad (2.5)$$

Initial conditions for health capital stock are $H(0)$, overall capital is $A(0)$, while end conditions are $H(T)$ and $A(T)$, respectively.

To determine the relevance of human capital theory in guiding research on socio-economic disparities in health, Galama and Van Kippersluis (2013) outlined six empirical stylised facts to use for assessment. These stylised facts are also confirmed in several separate studies (Galama and Van Kippersluis, 2019, Conti et al., 2019, Ravesteijn, 2016, O'Donnell et al., 2015). Firstly, there is an association between health and socio-economic indicators such as education, income, and wealth. Equation (2.3) requires individuals to have money to commit to medical expenditures. Differences in health capital can thus be attributed to income and wealth. In this case, education also indirectly affects health since it determines income in the traditional human capital models (Becker, 1965).

The second stylised fact refers to health inequalities between low and high socio-economic groups widening with age. Equation (2.2) acknowledges the depreciation of health, which increases with age. The upcoming deprecation thus entails more investment in medical interventions to restore health. In the ASRH context, we would expect more sexual and reproductive health risks amongst older youth, which implies the need for more preventive health investments in this group.

The importance of behaviours, lifestyles, information, and technology consists of the third stylised fact. Lifestyle habits and risky health behaviours such as drinking and smoking seem to be associated with health disparities. In addition to that, access and utilisation of available information and technology exacerbate health inequalities between the poor and the rich. Risky behaviours lead to health deterioration, which is

captured in equation (2.2). In the context of ASRH, the youth use their risk behaviours in terms of risky sexual experimentation and unsafe sexual practices. Technology enters equation (2.2) through the health production function. Any investments in health $I(t)$ will lead to higher health capital $H(t)$ for youths with access to information and better technology than those without. Thus, information and technology play the role of shifting the health production curve upwards in the standard concave production function (Grossman, 1972). Disparities in youth health are therefore expected between individuals with different levels of technology and information.

The role of ill health in reducing working hours and ultimately, income and wealth is the fourth stylised fact. Equation (2.5) explains this through the time constraint whereby sickness time $\tau_s(H(t))$ reduces the time available for other economic activities such as work and consumption. In the context of ASRH, some of out-of-school youth are already in employment, and thus sickness time through sexually transmitted infections or complications in pregnancies reduces the time available for work.

The fifth stylised fact refers to education as an essential factor in determining health. Education increases efficiency to investment referred to in equations (2.2) and (2.3). Youth with more education are more knowledgeable in seeking and utilising medical care. Furthermore, they can generate further healthy time by exercising and reducing health-harming practices. Moreover, most of the youth are still pursuing education, and thus sickness time through sexually transmitted infections or complications in pregnancies reduces the time available for schooling.

Early childhood endowments and investments form the sixth stylised fact. Early childhood development in terms of health and education positively affects later-life health outcomes. In addition to that, childhood socio-economic circumstances such as poverty and place of residence are indicators of intergenerational transmission of inequalities. Such poor socio-economic backgrounds affect health stock in equations (2.1) and (2.2) and, as such, health investment required to attain the desired level of health. This implies that youth from poor socio-economic backgrounds already have lower health capital; and as their families could not afford medical outlays required then, they as well cannot afford them presently.

Becker (1965) theory of the allocation of time is an alternative theoretical human capital model that explains the household's production and consumption of goods. While the model was not developed specifically for health, it can satisfy all the stylised facts except the role of ill health in working hours. Becker's model is limited to time being split between work and consumption time, not accounting for sick time. This is its main distinction from Grossman's model in terms of studying socio-economic health disparities.

Jacobson (2000) extended the Grossman model to capture decision making in a family with children. The Jacobson model predicts that decision making for a family differs from an individual's because it is influenced by the marginal cost and marginal benefits of health for the other household members. The foregone wage of the family member who takes care of the sick member is added to the sick member's treatment cost. The model posits that low-income families value marginal change in the child's health more than wealthy families since they tend to lose the most from time lost tending to the sick adolescent. In addition to that, the extended model suggests that children of ill parents will have fewer resources invested in their health since the same scarce resources have to be spent improving their parent's health. With these postulates, the Jacobson model provides an improved framework for socio-economic disparities in youth health as it addresses the intergenerational transmission of the disparities better than the Grossman model. These predictions have essential ramifications for the Zimbabwean ASRH policy. The wage that is lost while tending to a sick youth would be costly to households, especially in the current economic environment in Zimbabwe, where at least 85% of labour force is in subsistence self-employment (Rusvingo, 2015, Chipenda, 2019) on a hand to mouth basis. For example, this would imply that youth with pregnancy complications may be neglected as the household members cannot afford not to go to work. This would not be the case for families with better incomes and in formal employment who can obtain paid off days.

Galama and Van Kippersluis (2019) developed a health disparity-specific theory grounded in the Grossman model. The approach addresses stylised fact two by adding that health inequalities widen by age up to a certain age beyond which they begin to narrow down. We would thus expect inequalities in youth health to widen with age.

Secondly, the health disparity theory posits that individuals can choose jobs that affect health. Choices in more risky jobs are made with the expectation of higher incomes. In the Zimbabwean context, the harsh economic environment may push youth, mainly the uneducated and those from low-income families, into riskier work such as illegal artisanal mining and commercial sex work. Such choices serve to widen health disparities. Thirdly, the health disparities theory divides consumption into health and unhealthy consumption. Healthy consumption includes healthy foods, exercises, while unhealthy consumption involves health-damaging goods such as smoking and alcohol abuse. In the ASRH context, safe sexual practices and abstinence are considered healthy consumption, while unsafe sex is added to an unhealthy consumption. Unhealthy consumption increases the health depreciation rate while healthy consumption slows it down.

While the health capital model and its extensions provide a framework for identifying sources of socio-economic inequalities, the policy-relevant analysis needs to recognise instances of unfair disparities (Cookson et al., 2016). When analysing from a horizontal equity perspective, youth with equal needs are expected to have equal access to and utilisation of ASRH services. Unequal utilisation of ASRH services after controlling for heterogeneity in preferences and needs would thus indicate unfair health inequality.

Concentration indices have been developed to explore further the mechanisms through which these socio-economic factors contribute to health disparities (O'Donnell et al., 2008). They are rank dependent indices which compute the extent to which health outcomes are concentrated amongst the poor or the rich. Positive concentration indices suggest that a health outcome is concentrated amongst the rich, while negative indices suggest a concentration of the health outcomes amongst the poor (Erreygers and Kessels, 2017). O'Donnell et al. (2008) proposed a need standardised concentration index to compare individuals with equal needs compared to each other.

2.3 Empirical Literature Review

The empirical literature on the determinants of ASRH can be put into two categories. The first category focuses on the determinants of sexual and reproductive healthcare utilisation and outcomes, while the second category focuses on an in-depth analysis of how these factors contribute to the disparities in the utilisation of ASRH services. This section reviews these determinants, starting with determinants of SRH utilisation/outcomes and disparity in the general population to inform evidence in youth and adolescents.

Studies focusing on the determinants of SRH utilisation and outcomes in the general population found a variety of factors that ranged from education, wealth, place of residence, lack of knowledge, poverty, parity, inequality, healthcare coverage, quality, and urbanisation. One of the most recent studies in the general population used Bongaarts proximate determinants model and ZDHS data sets collected between 1988 and 2015 in Zimbabwe (Muza, 2019). The study found that education, wealth, and place of residence were the most significant predictors of reproductive healthcare outcomes. The study lacked specific insight into adolescents and youths as it focused on the general population. Similar findings were reported in studies that analysed determinants of sexually transmitted infections (STIs) in the general population; finding lack of knowledge, poverty, inequality, healthcare coverage, healthcare quality, and urbanisation as the most important factors (Aral, 2002, Newton-Levinson et al., 2016). Related studies on utilisation of ASRH services found that community-level factors such as stigma and embarrassment, were the most important in influencing the timing of STI treatment (Newton-Levinson et al., 2016, McSorley, 2013) and consequently, the STI outcomes. Parity, on the other hand, has been found having little influence among adolescents (Aninanya 2015) and will not be considered for this study. Related evidence report that social and cultural norms and values have also been found influencing HIV testing differently in males and females, whereby males have lower uptake of testing, which was attributed to cultural expectations and work commitments (Camlin et al., 2016). The present study considers religion and rural residence since these variables restrict open ASRH discussions.

Concerning determinants of SRH utilisation at a population level, studies made a variety of findings in terms of the factors and dynamics of inequalities using concentration indices. For example, Alam et al. (2015), analysing trends in inequalities in reproductive healthcare and maternal healthcare in six countries in Africa, including Zimbabwe between 1994 and 2011, found that reproductive healthcare utilisation was low, but increased over the period with the greatest increase recorded in Zimbabwe. The study further found that measures of inequalities in utilisation declined over time in countries where maternal health improved. These findings echoed those found in India (Sanneving et al., 2013), Ghana (Agyire-Tettey et al., 2019), Nigeria (Obiyan and Kumar, 2015), and Zimbabwe (Makate and Makate, 2017b). Whist the aforementioned studies focused directly on inequality in utilisation, Chirwa et al. (2019b) focused on the knowledge of HIV as an indicator of usage to assess whether there were socio-economic inequalities in the knowledge of HIV. Applying the concentration index on the Malawi DHS datasets for the years 2004, 2010, and 2016, they found that knowledge of HIV was concentrated amongst the rich, and inequality worsened over time across gender, inequalities in HIV knowledge were higher among men, while inequalities across rural and urban areas declined. Such a comparative analysis across time is yet to be conducted for Zimbabwe. A related study found that STI incidence seemed to be concentrated on women who were not empowered to negotiate safe sex and populations in geographical areas with limited treatment options and safe sex commodities (Ortayli et al., 2014). This is important within the current study context which consists of adolescent girls who are likely to have more vulnerability.

While the above studies focused on the determinants of SRH, some studies focused on youth and ASRH. In this respect, Samandari and Speizer (2010) studied the determinants of service use disparities among the youth. Indeed, their study investigated ASRH outcomes in Latin America over two decades using logistic regression and duration analysis models. The study found a fourfold increase in contraceptives in a decade but declining teen childbearing. The study further found that education, residence in urban areas, and household wealth were associated with inequalities in contraceptives use and teen childbearing. The study did not decompose the inequities. A related study by Santelli et al. (2017) applied linear regression models on macro-level data to study trends in teen childbearing inequalities in 142 countries.

Although they found teen childbearing decreasing between 1990 and 2012, they established that teen childbearing was relatively high in low-income countries in sub-Saharan Africa compared to countries in Western Europe and Central Asia. Their results suggest that better ASRH outcomes are associated with education, higher incomes, and lower inequalities. It is worth noting, however, that the study has some apparent weaknesses. It used GDP as a measure of income, hence not capturing households operating in the informal economy. Moreover, it used public education expenditure which does not capture private household expenditures, yet these are most relevant in the case of Zimbabwe. The country currently has significant private financing of education due to the government's limited fiscal space, which has left a considerable gap in school operations and new infrastructure to supplement growth.

In Zimbabwe, studies focusing on the determinants of ASRH disparities include Gregson et al. (2005a) who found poor ASRH outcomes such as HIV infection, STIs, and teen pregnancy amongst females, particularly those without secondary education. They reported that ASRH outcomes were worse amongst HIV orphans and needy children, an indicator that reduced access to and utilisation of ASRH services perpetuate the effects of poverty from parental effects on their offspring. Other studies, notably Gavin et al. (2006) and Munjoma et al. (2010b) corroborated these findings amongst female youth in Zimbabwe. They find that youth who are unemployed and who did not receive sexuality education were at higher risk of HIV infection, with females being the most affected. Whether these outcomes have improved overtime remains to be established. Focusing on the role of poverty, Landa et al. (2018) found that poverty contributed to poor ASRH outcomes amongst females in Zimbabwe as it was detrimental to negotiating safe sex, suggesting youth from the better-off family had better ASRH outcomes. As poverty is related to the education outcomes, other studies have found low education and poverty to be detrimental to ASRH outcomes and utilisation. The implication on the current study relates to explanatory variables that are likely to have significant influence on outcomes.

Applying qualitative methods, Mashamba and Robson (2002) arrived at similar findings in a study that focused on youths' reproductive health services in Bulawayo. Using interviews and focus group discussions of 22 youths, their study suggested that transportation costs inhibited reproductive healthcare utilisation amongst youth. The

finding suggests inequalities in utilisation as youth from low-income families would suffer a setback in usage due to non-affordability of transport costs. Other studies on free HIV testing have also shown costs including transport and food hindering access to adolescents from poor households (Sande et al., 2018). Their finding on the concentration of poor reproductive health outcomes amongst poor youths is also supported by Hardee et al. (2014) in a survey of the literature. The latter conceded that ASRH programming in developing countries was not addressing the social support requirements of poor and vulnerable youths and led to an increased risk of HIV infection.

Ngome and Odimegwu (2014) investigated socio-economic determinants of contraceptive use, a key component of ASRH essential package amongst Zimbabwean adolescents using ZDHS 2010/11 data. They used univariate, bivariate, and logistic regression techniques. They found access to information and education positively related to contraceptives use but did not establish the extent of inequality caused by these variables. Ndagurwa and Chemhaka (2020) studied the determinants of fertility, an ASRH outcome, amongst female youth in Zimbabwe, Rwanda, and Ethiopia over the period 1999 to 2011. They decomposed logistic regression model estimates and established that there were inequalities in fertility amongst youth who had begun childbearing by the age of 24 in these countries, driven by education differences. Their results showed wide differences in primary education in Ethiopia and Rwanda and secondary education for Zimbabwe. These results imply that we can expect education to be a significant driver of inequality in ASRH outcomes such as early childbearing. Ehlers (2010) established that non utilisation of reproductive health services by Zimbabwean youth was due to lack of information on how and where to access contraceptives, effects of the contraceptives, and lack of sex education. This finding implies that access to information reinforces education in promoting ASRH service utilisation, and as such, lack of it drives inequalities in youth health outcomes as supported in other literature (Hardee et al., 2014, Chirwa et al., 2019b).

ASRH disparities are similar for other health services such as maternal healthcare in Zimbabwe and other countries. Makate and Makate (2017b) studied the evolution of inequalities in maternal healthcare utilisation over two decades in Zimbabwe by applying the concentration index and decomposition analysis. Their study found that

maternal healthcare utilisation was concentrated amongst the rich and was increasing over the period. Wealth, education, access to information, and religion were key factors in the widening of inequalities.

With respect to the analysis of inequalities, different methodological approaches in ASRH have been the most used in studies of inequalities. The review of this methodology is necessary to justify the approach used in this chapter. Hosseinpoor et al. (2016) assessed regional inequalities in reproductive and maternal health in Zimbabwe, Bangladesh, Ghana, and Egypt between 1995 and 2010. They departed from the common concentration indices to summary measures of regional inequality; namely high to low absolute and relative difference, attributable population risk, weighted variance, absolute and relative mean difference, index of dissimilarity, and Thiel index. They found that health indicators for which service provision already reaches a high proportion of the population had the least inequality. The research found a slight decline in inequalities over the study period for Zimbabwe. In Ghana, the different measures contradicted in whether inequality increased or decreased. These inequality measures can be contradicting for the same datasets, implying that they are less standardised than concentration indexes. Furthermore, concentration indexes can be decomposed to give more information on socio-economic factors that drive the inequalities.

Gordon et al. (2020) assessed health inequalities over several dimensions in South Africa. Their study applied the concentration index and its decomposition on a national health and nutrition survey. They found that self-assessed poor health outcomes concentrated amongst the poor and better health outcomes amongst the rich. Household wealth and health insurance contributed 92% of inequality for private sector healthcare and 83% of publicly provided healthcare. Their results imply that wealth and health insurance coverage drive inequalities even for subsidised public healthcare. The role of wealth and insurance effects is also established for the United States over the period 2002 to 2008 (Hall et al., 2012) and Ghana (Novignon et al., 2019). However, health insurance coverage in Zimbabwe is very low at 6%, which suggests that household wealth is more likely to drive health disparities. Cookson et al. (2016) examined socio-economic inequalities in a higher income setting of England. They found the utilisation of public healthcare very high amongst the poor, but the

concentration shifts towards rich households when private healthcare, quality of care, and specialists. Similar findings are also expected in Zimbabwe since specialist and quality care is expensive. In addition to that, health outcomes would reflect that the poor utilise public healthcare, which has low quality as well as non-availability of essential medications due to limited fiscal space.

Most studies reviewed decomposed the concentration index in assessing inequalities in ASRH. This approach has been the standard practice in this type of research using bivariate rank-dependent indices (Wagstaff, 2005, Novignon et al., 2019). Kessels and Erreygers (2016) examined the performance of simultaneous equation modelling. They argued that single equation decomposition ignores the correlation between health and socio-economic status, suggesting that their estimates may have been riddled with endogeneity and confounding. Their approach is still in its infancy and has yet to be widely adopted, and thus no comparative SRH studies applying it exists. Firpo et al. (2009) developed an alternative index decomposition method called the recentred influence function (RIF). As a regression technique, the RIF has been used to assess the effect of changes in explanatory variables on the dependent variable's distribution (Rios-Avila, 2020). Heckley et al. (2016) applied the RIF regression technique to health inequality. They showed that individuals with extreme wealth endowments have the greatest influence on the Erreygers Index. While the Wagstaff and Erreygers Indices do not probe on outliers, the RIF attempts to identify them as this is important for policymakers to identify such people to prioritise resources towards those most in need. Heckley et al. (2016) applied the RIF method to Swedish data to examine education's role in income-related inequality. They found that education did not affect income-related health inequality in contrast to Wagstaff decomposition, which established an association. Despite that the RIF is a more recent health equity measurement and decomposition technique, its limited empirical use deems their results incomparable to previous studies. Furthermore, there is no widely agreed framework for the use of RIFs as a standard tool. Most health equity studies have thus continued using the standardised Wagstaff and Erreygers concentration indices to allow comparability with many previous studies. The present study thus proceeded with the standard and widely adopted Erreygers decomposition technique.

The empirical literature review has shown that a considerable amount of work has been carried out on the determinants of reproductive healthcare. The reviewed literature identified socioe-conomic determinants of sexual and reproductive healthcare utilisation and the disparities in the resultant health outcomes. While most of the previous literature generalised SRH issues for the whole population, the current essay establishes ASRH specific socio-economic determinants and disparities. In addition to that, since Zimbabwe implemented its ASRH strategy in 2010, empirical evidence on the extent to which socioe-conomic disparities in ASRH service utilisation and disparities in outcomes changed is sparse. The evolution of the distribution of ASRH utilisation and outcomes by socio-economic groups beyond the 2010 ASRH strategy is thus poorly understood. This chapter thus updates the existing evidence, which predates the 2010 ASRH strategy by carrying out an analysis of socio-economic determinants of ASRH service utilisation and outcomes across different surveys. It further implements concentration indices to highlight progress in ASRH disparities over the past 15 years, which is yet to be conducted for Zimbabwe. The research is thus important in designing future ASRH policies.

2.4 Methodology

This essay achieved its first objective of assessing socio-economic determinants of, and inequalities in ASRH utilisation using a multivariate logistic regression model and concentration indices. The same analytical techniques were applied to address the second objective of analysing socio-economic correlates of and inequalities in ASRH outcomes. The concentration indices were decomposed to establish the contribution of socio-economic factors to inequalities. The sources of these disparities have been highlighted in the Grossman model and empirical literature as sources of socio-economic disparities in healthcare utilisation and outcomes. The third objective of assessing the evolution in the determinants of and inequalities in ASRH service utilisation and outcomes is embedded in the analyses of the first two objectives. Therefore, to address the third objective, the chapter compared the logistic regression results for objectives one and two.

2.4.1 Logistic Model

The logistic regression model was used to assess the determinants of a binary utilisation and outcome variables, as has been the case in the literature (Zou, 2004). The logistic regression model is the most appropriate in these types of variables than Ordinary Least Squares because the latter cannot restrict predicted values within intervals observed with actual data (O'Donnell et al., 2008). The logistic regression models were estimated using the maximum likelihood techniques, which yield estimates that are consistent and asymptotically efficient (O'Donnell et al., 2016).

2.4.2 The Empirical Model

The logistic model used in this chapter is motivated in terms of a latent variable specification. This assumes that there is some continuous variable y^* that determines ASRH service utilisation and outcomes. This latent variable is modelled by a linear regression function of socio-economic characteristics of the individual represented by vector x:

$$y_i^* = x_i\beta + \varepsilon_i \qquad (2.6)$$

Of course, this latent variable is not observed. What is observed is the binary variable y takes the value 1 when $y_i > 0$ and 0 when $y_i < 0$ as in equation 2.7 below.

$$y_i = \begin{cases} 1 \; if & y_i^* > 0 \\ 0 & otherwise \end{cases} and \qquad (2.7)$$

The probability that y = 1 given **x** vector of variables is thus given by:

$$P(y_i = 1|x_i) = P(y_i^* > 0|x_i) \qquad (2.8)$$

Substituting equation 2.6 into equation 2.9 gives:

$$P(y_i = 1|x_i) = P(x_i\beta + \varepsilon_i > 0|x_i)$$
$$= \quad F\,(x_i\beta) \qquad (2.9)$$

By assuming that ε follows a logistic distribution, F becomes a cumulative distribution function for the logit model. The interplay between this chapter's objectives, theory, empirical findings and data allows the specification of the following ASRH healthcare utilisation and outcomes model;

P (y = 1|x) = F (age, age^2, education level, wealth, place of residence, religion, access to ASRH information, gender, marital status) (2.10)

These variables will be explained futher in the following section. The equation stipulates that the probability of a youth utilising ASRH services given observed characteristics X is given by a function F. F is a function of the observed characteristics X. By assuming that the stochastic term follows a cumulative logistic distribution, F becomes a cumulative distribution function for the logit model. Hence, equation (2.10) is a logit model. The maximum likelihood estimation technique is used to estimate log odds ratios (ORs) of the independent variables in equation (2.10). This model is used to achieve the first two objectives of the paper.

2.4.2.1 Variable Definition and Justification

The essay investigated if socio-economic factors influence ASRH utilisation and outcomes. ASRH services for which utilisation was assessed are HIV testing, STI treatment. Outcomes considered were HIV infection, STI infection, and early childbirth. These services are key targets in Zimbabwe's ASRH strategy. The socio-economic factors investigated were informed by theoretical and empirical literature. The essay also investigated the extent to which service utilisation and outcomes are disproportionately balanced over these socio-economic factors.

Utilisation Dependent Variables

HIV testing is a binary variable taking values; 1 if the respondent has ever been tested for HIV, and 0 otherwise. STI treatment is a binary variable taking values; 1 if a respondent who ever had an STI sought treatment at a health facility, and 0 otherwise. Condom use is a binary variable taking values; 1 if a sexually active respondent ever used a condom during sexual intercourse; and 0 otherwise. Contraceptive use is a binary variable taking values; 1 if the respondent currently uses any form of modern contraceptive; and 0 if using traditional or none. The variable thus includes only sexually active respondents.

Outcome Dependent Variables

HIV infection is a binary variable taking values; 1 if the respondent was HIV positive, and 0 otherwise. STI infection is a binary variable taking values; 1 if the respondent has ever had an STI; and 0 otherwise. Early childbirth is a binary variable taking values; 1 if the respondent ever had childbirth before the age of 18; and 0 otherwise.

Independent Variables

The socio-economic determinants assessed in this study are guided by the PROGRESS-Plus framework. The PROGRESS-Plus framework features in current literature as a guide for assessment of socio-economic inequalities (Welch et al., 2017, Maden et al., 2018, Cochrane et al., 2019). PROGRESS is an acronym for place of residence, race/culture, occupation, gender, religion, education, socio-economic status and social capital whilst Plus captures any other additional variables (O'Neill et al., 2014, Welch et al., 2017).

Place of residence is a binary variable taking values; 1 if respondent is from urban areas, and 0 otherwise. Rural areas have been historically disadvantaged in terms of health infrastructure, which suggests that urban youth have better access to ASRH services and thus higher utilisation and better outcomes than their rural counterparts. This assumption is supported by empirical literature confirming the same (Chirwa et al., 2019b).

Religion is a binary variable that takes values; 1 if the respondent belongs to churches that allow medical care, and 0 for those that discourage medical care such as apostolic and traditional sectors/churches. In this chapter, we combine religion and culture since they have similar implications in terms of norms and beliefs on healthcare utilisation. In addition to that, 99.7% of the population in Zimbabwe is classified as of African race and ethnicity (ZIMSTAT, 2012) leaving 0.3% for other races, a figure that is negligible for consideration in the analysis. Occupation is not considered, given that our dataset consists of adolescents and youth.

Gender is a binary variable taking value of 1 if respondent is male, and 0 otherwise. Empirical literature shows that health facilities were generally unfriendly for youths, particularly females (Thomée et al., 2016, Callahan et al., 2017, Alli et al., 2013). The ASRH strategy aimed to reform service delivery to be more friendly for females, and thus, male advantage in ASRH service utilisation and outcomes was expected to disappear across the three datasets analysed. Pro-male disparities in ASRH utilisation and outcomes were also expected to fall.

Education level refers to the respondent's highest stage of formal learning. It is a categorical variable taking values 1 to 4 for no education, primary, secondary, and tertiary education levels. No education is the reference category. Theoretical literature suggests that the educated are more efficient producers of health (Grossman, 1972), and thus a positive relationship with utilisation and outcomes is expected. In addition to that, the uneducated are expected to be disproportionally burdened with poor outcomes.

Socio-economic status is measured by wealth status which classifies the sample into quintiles taking values 1 for the poorest, 2 for poor, 3 for middle class, 4 for rich households and 5 for richest households. The variable was made from weighted values of a household's combined assets estimated using principal component analysis in the ZDHS data. The reference group is the poorest category. Both theoretical and empirical literature indicates that wealth is an enabler of ASRH utilisation because the services impose direct and indirect costs on users (Grossman, 1972, Makate and Makate, 2018). It is thus expected to have a positive relationship with utilisation and outcomes. Furthermore, it is also expected that youth from a poor background have a disproportionate share of poor health outcomes. On the other hand, the ASRH strategy implemented in 2010 was meant to remove barriers to costs of ASRH services. Empirical results of the chapter will confirm the result.

Social capital is represented by marital status, which takes values 1 if married and 0 otherwise. The additional variable is information, which takes values 1 if the respondent indicated that they had access to print and electronic media, and 0 otherwise. The ASRH strategy used electronic media to raise awareness of ASRH service utilisation and outcomes. Thus, the variable is expected to have a positive effect on utilisation and outcomes and a source of socio-economic disparity.

Social capital is represented by marital status, which takes value 1 if the respondent is married, and 0 otherwise. Empirical literature suggests that married adolescents utilise less ASRH services resulting in poor outcomes (Chirwa et al., 2019a, Mekonnen et al., 2018). We would thus expect the same relationship in Zimbabwe. The additional variable is family planning information, which takes values 1 if the respondent indicated that they ever received family planning information, and 0 otherwise. A

positive relationship between exposure to family planning information and ASRH utilisation and outcomes is thus expected.

Age is a binary variable taking values 1 if the respondent was over 18 years old, and 0 otherwise. From the Grossman model, demand for health is high during early age, falls until midlife, and starts rising as a person ages. For ASRH, however, the age range of 15 to 24 years is not long enough to capture such a quadratic relationship. The study just focused on the binary variable whether the respondent was older than 18, which is the age of maturity in Zimbabwe.

Insurance is a binary variable taking values 1 if the respondent had medical insurance, and 0 otherwise. The Grossman model recognises costs as barriers to access to health and, thus, health outcomes. The variable was not consistently applied to the analysis because only 6% of the population is covered by medical insurance in Zimbabwe, making it less relevant for some of the analyses.

2.4.3 Concentration index

The chapter uses the concentration index to analyse and decompose inequalities in ASRH service utilisation and outcomes. There concentration index has three main variants: the generalised, Wagstaff, and Erreygers concentration index. Erreygers (2009a) established four properties that indices should satisfy to reliably estimate health disparities, namely: transfer, mirror, level independence, and cardinal invariance.

The transfer property entails that a small transfer of endowments from a better-off individual to a lesser-off individual reduces the health disparities. All the concentration indices handle this condition, but each has weaknesses over the other three conditions (Erreygers, 2009a). The mirror condition demands that the absolute value of the concentration index for an attained health state relative to a targeted health value be a mirror image of a shortfall of similar magnitude. Level independence entails that the concentration index's value remains constant if everyone’s health levels change by the same amount. This condition implies monotonicity, as well. The Wagstaff index fails to satisfy the level of independence property. Cardinality requires that the index

measure remains the same in the event of a positive proportional transformation of the health variable. The generalised concentration index does not meet this condition.

Kjellsson and Gerdtham (2013) argued that the level of independence condition and its related axioms of monotonicity and convergence makes the Erreygers index more superior for absolute value judgments. Monotonicity stipulates that a well-off person's change from ill to good health implies a pro-rich change in the inequality index. Convergence posits that a gradual reduction of everyone's health leads to a state of perfect equality. The inequality index should converge to zero the Wagstaff index compromises between inequalities in health and ill health, which violates the mirror axiom.

2.4.3.1 Generalised concentration index

The concentration index estimates how ASRH service utilisation and outcomes vary across a distribution of socio-economic indicators (O'Donnell et al., 2016, O'Donnell et al., 2008, Kjellsson and Gerdtham, 2013). It is used as a measure of socio-economic inequality in ASRH utilisation and outcomes. Its general form can be expressed as:

$$C(h|y) = \frac{2cov(h_i,R_i)}{\bar{h}} = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{h_i}{\bar{h}}(2R_i - 1)\right] \quad (2.11)$$

where $h_i$is the ASRH service utilisation or outcome variable, $(2R_i - 1)$ is the fractional rank, which takes extreme values $\frac{1-n}{n}$ if the outcome is concentrated amongst the poor and $\frac{n-1}{n}$ if the outcome is concentrated amongst the rich (O'Donnell et al., 2016). Multiplying the standard concentration index by the mean of the health variable gives the generalised concentration index, which helps in differentiating between two variables with the same relative inequality, but different in terms of absolute inequality. The generalised concentration index is expressed in equation (2.12)

$$GCI(h|y) = \frac{1}{n}\sum_{i=1}^{n}[h_i(2R_i - 1)] \quad (2.12)$$

The equation takes extreme values $\bar{h}\left(\frac{1-n}{n}\right)$ if the outcome is concentrated amongst the poor, and $\bar{h}\left(\frac{n-1}{n}\right)$ if the outcome is concentrated amongst the rich (O'Donnell et al., 2016). The concentration index satisfies the transfer property but fails to satisfy the other three conditions.

2.4.3.2 Erreygers Concentration Index (ECI)

For categorical and binary health variables, the concentration index's absolute value depends on whether the computation was for an attained health value or shortfall from a targeted health value. To ensure that the conclusion is the same regardless of whether the researcher used attainments or shortfalls, Erreygers developed a mirror condition to correct the concentration index (O'Donnell et al., 2016, Erreygers, 2009b). The generalised concentration index becomes:

$$E(a|y) = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{4a_i}{(a^{max}-a^{min})}(2R_i - 1)\right] = -E(s|y) \quad (2.13)$$

which limits the index between the values -1 and +1. $E(a|y)$ is an index for attainment which should equal $-E(s|y)$, an index for shortfall. The equal sign is showing that the two carry similar values such that the mirror condition holds. Besides the mirror condition, the Erreygers Index satisfies the four desirable conditions for equity analysis**.**

2.4.3.3 Wagstaff Concentration Index

Wagstaff (2005), on the other hand, modified the concentration index to satisfy the mirror condition:

$$W(a|y) = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{(a^{max}-a^{min})a_i}{(a^{max}-\bar{a})(\bar{a}-a^{min})}(2R_i - 1)\right] = -W(s|y) \quad (2.14)$$

where $W(a|y)$ is an index for attainment which should equal $-W(s|y)$, an index for shortfall. The equal sign is showing that the two are equal such that the mirror condition holds. O'Donnell et al. (2016) argues that the Wagstaff concentration index does not satisfy the absolute invariance condition.

Despite the arguments put forward by Erreygers in (Erreygers, 2009b, Erreygers and Van Ourti, 2011b, Erreygers and Van Ourti, 2011a) and Wagstaff in (Wagstaff, 2005, Wagstaff, 2009, Wagstaff, 2011) in defending their works, Kjellsson and Gerdtham (2013) argue that the differences between the Erreygers Concentration Index (ECI) and Wagstaff Concentration Index (WCI) are normative and not technical. As such, there is no really superior index.

2.4.3.4 Decomposition of the Concentration Index

The RIF's emergence as a decomposition technique has already been discussed in the empirical literature review section. The lack of a widely agreed framework for its use as a standard tool is its major limitation. In this essay, the ECI was thus used to decompose each socio-economic variable's contribution using a technique developed by Wagstaff et al. (2003). The decomposition is based on the linear regression model:

$$h_i = \beta_0 + \sum_{k=1}^{k} \beta_k x_{ik} + \varepsilon_i \qquad (2.15)$$

where h_i is the health variable, x_{ik} are the socio-economic variables.

2.4.4 Data

This chapter used secondary data from the Zimbabwe Demographic and Health Surveys (ZDHS) conducted in 2005, 2010, and 2015 (ZIMSTAT and ICF., 1988-2015). The data was collected from adolescents and youths aged 15 to 24 years. Three datasets for females, males and HIV test results were merged 1:1 for each of the three waves. These were the individual recode that had data for females, the male recode which had data for males; and the HIV dataset, which had data for HIV testing. These datasets provide healthcare information on women who had pregnancy any time in the five years before the survey, from the time they were pregnant to the child's infancy. The datasets were obtained from Macro International's MEASURE DHS project website www.measuredhs.com.

2.4.5 Data Analysis

Data were analysed using Stata 15 software. The concentration indexes were estimated and decomposed using the conindex Stata module. The conindex module produces concentration index estimates, their standard errors, and significance levels to allow for statistical inference (O'Donnell et al., 2016). The ECI equation (2.13) and socio-economic determinants in equation (2.15) were estimated using conindex. Socio-economic determinants of utilisation and outcomes were analysed using multivariate logistic regression of the empirical model presented in equation (2.11). The analysis of changes in the socio-economic determinants and inequalities involved comparing their point estimates for each ZDHS survey year: 2005, 2010, and 2015.

2.4.6 Survey Design Features

The ZDHS is a two-stage survey involving stratification into rural and urban areas of provinces and then cluster sampling using census enumeration areas from which households are randomly selected (ZIMSTAT and ICFI, 2016). Consequently, samples are not selected with equal probability as they would in the case of simple random sampling. Each sampling unit is thus allocated a sampling weight in the dataset. In this study, data is controlled for stratification and cluster sampling. All the reported standard errors are adjusted for cluster and stratification procedures for demographic health surveys.

2.5 Results

2.5.1 Descriptive Statistics

Table 2.1 shows respondents' distribution across the socio-economic variables for the three datasets in 2005, 2010, and 2015 respectively. The combined dataset consists of 55% females and 45% males. This is close to the national statistics, in which 52% are females (ZIMSTAT, 2012). The wealth status variable has five categories. There is not much change across the three datasets. The education variable shows that none is the lowest level of education, and the higher education categories are extreme cases of education with a very small proportion in them. Those with primary education only fell from 27.9% in 2005 to 22% in 2015, and this coincides with increases in secondary and tertiary education attainment from 69.9% to 73.9% and 1.7% to 3.8%, respectively. Youth residents in rural areas fell from 67.2% to 61%, which suggests

increased urbanisation. Aral (2002) has shown that urbanisation affects the change in STIs over time with more urbanisation.

Table 2.1: Descriptive Statistics

	Year			
	2005	2010	2015	Total
Variable	Col %	Col %	Col %	Col %
Gender				
Female	56.5	54.4	53.6	54.7
Male	43.5	45.6	46.4	45.3
Total	100	100	100	100
Wealth Status				
Poorest	17.6	16.4	14.3	16
Poor	18.8	18	16.4	17.7
Middle	21	19.5	19.4	19.9
Rich	21.9	22	24.3	22.8
Richest	20.8	24.1	25.6	23.7
Total	100	100	100	100
Education Level				
None	0.5	0.5	0.3	0.4
Primary	27.9	23.1	22	24
Secondary	69.9	73.6	73.9	72.7
Higher	1.7	2.8	3.8	2.8
Total	100	100	100	100
Place of Residence				
Rural	67.2	64.6	61	64.1
Urban	32.8	35.4	39	35.9
Total	100	100	100	100
Access to Media				
Without access	25.2	21.9	19.8	22.1
With access	74.8	78.1	80.2	77.9
Total	100	100	100	100
Religion				
Apostolic and traditional	30.9	34.3	35.1	33.7
Other religious groups	69.1	65.7	64.9	66.3
Total	100	100	100	100
Marital Status				
Single	72.5	72.4	76.9	74
Married	27.5	27.6	23.1	26
Total	100	100	100	100
N	4,899	6,632	6,351	17,882

Source: compiled from Zimbabwe DHS 2005, 2010, 2015

Table 2.1 further shows that the proportion of youths with access to print and electronic media increased from 74.8% in 2005 to 80.2% in 2015, which signifies increased exposure to ASRH information distributed over the media. There was a rise in apostolic and traditional affiliation from 30.9% to 35.1. The role of religion in healthcare utilisation and outcomes is not clear.

On the one hand, religious groups provide social capital to support health and welfare amongst members; on the other hand, cultural norms and beliefs limit decision-making by females to resist unprotected sex, which can adversely affect their health (Mpofu et al., 2011). The proportion of married respondents declined from 27.5% in 2005 to 23% in 2015, suggesting a decline in early marriages.

2.5.2 Multivariate Analysis

The results of the first objective on socio-economic determinants and inequalities in the use of ASRH services are presented first. These are followed by findings on the second objective on socio-economic correlates of and inequalities in ASRH outcomes. Each of these sections presents odd ratios from logistic regression to identify important socio-economic determinants. The concentration indices are in the part of the first and second objectives that deal with inequalities. The third objective of the analysis of utilisation and outcomes across successive surveys is embedded in the analysis of the two objectives.

2.5.2.1 Socio-economic determinants of and inequalities in ASRH utilisation across successive surveys

Table 2.2 shows odds ratios of HIV testing, STI treatment, condom utilisation, and contraceptive use, given the socio-economic status. Wealth was not a significant predictor of HIV testing the entire study period apart from the richest wealth quintile for 2010 and 2015. The odds of youth from the richest households having an HIV test were 32% higher than those of the poorest in 2010. The inequality reversed in 2015, where the odds of those from richest households were lower by 29.1% in favour of the poorest youths (base category). This suggests an improvement in targeting youths from poor backgrounds. Higher education did not give any advantage to HIV testing in 2005 and 2010, but the difference was statistically significant for 2015.

Table 2.2: Odds ratios for service utilisation

	HIV test odds ratios			STI odds ratios			Condom use odds ratios			Contraceptives use odds ratios		
Variable	2005	2010	2015	2005	2010	2015	2005	2010	2015	2005	2010	2015
Wealth Status:	1.013	0.934	0.974	1.566	1.135	1.548	1.061	1.489	1.396	1.127	0.980	1.008
Poorer	(0.159)	(0.126)	(0.115)	(0.714)	(0.592)	(0.708)	(0.526)	(0.380)	(0.346)	(0.181)	(0.125)	(0.125)
	1.061	1.221	1.026	1.054	1.111	0.762	0.776	1.495*	1.695**	1.101	1.111	0.998
Middle	(0.211)	(0.152)	(0.131)	(1.120)	(0.537)	(0.347)	(0.378)	(0.339)	(0.384)	(0.204)	(0.150)	(0.134)
	1.082	1.288	0.856	1.224	2.287	0.985	1.867	1.899**	1.403	1.117	1.103	1.040
Richer	(0.247)	(0.203)	(0.119)	(0.872)	(1.325)	(0.574)	(1.009)	(0.469)	(0.336)	(0.230)	(0.177)	(0.155)
	1.125	1.320*	0.709**	1.825	1.589	0.482	1.900	2.703***	1.549	0.770	1.025	0.718*
Richest	(0.311)	(0.202)	(0.113)	(1.669)	(0.944)	(0.346)	(1.169)	(0.777)	(0.455)	(0.227)	(0.172)	(0.123)
Education												
level	0.930	0.834	3.249*	1.008	1.168	0.556	0.273	1.468	0.493	1.387	1.372	0.797
Primary	(0.671)	(0.313)	(2.216)	(0.589)	(0.377)	(0.440)	(0.248)	(1.009)	(0.642)	(1.196)	(0.573)	(0.393)
	1.580	1.232	6.353***	1.000	1.000	0.942	0.331	1.661	0.453	1.550	1.127	0.597
Secondary	(1.156)	(0.450)	(4.311)	-	-	(0.680)	(0.297)	(1.126)	(0.589)	(1.325)	(0.474)	(0.292)
			11.067**									
	3.325	1.632	*	1.000	1.000	1.000	0.501	3.634*	0.433	0.865	1.475	0.830
higher	(2.662)	(0.677)	(7.799)	-	-	-	(0.548)	(2.711)	(0.570)	(0.852)	(0.687)	(0.434)
	1.000	0.476**	0.781***	1.000	3.369***	0.660	1.000	2.986***	3.059***	1.000	2.142	2.962
Gender	-	(0. 038)	(0. 064)	-	(1.425)	(0.220)	-	(0.390)	(0.386)	-	(0.193)	(0.276)
Urban	1.331	0.748***	0.936	1.350	0.630	1.894	0.666	1.078	1.306	1.427*	0.938	1.155
residence	(0.239)	(0.074)	(0.120)	(1.007)	(0.283)	(1.002)	(0.275)	(0.181)	(0.248)	(0.295)	(0.113)	(0.153)
Exposure to	1.432**	1.169	1.226**	0.676	1.073	0.967	1.836	1.063	1.124	1.303	1.181	1.311***
media	(0.204)	(0.114)	(0.100)	(0.443)	(0.433)	(0.389)	(0.665)	(0.196)	(0.201)	(0.205)	(0.131)	(0.123)
	1.203*	1.105	1.428***	0.666	1.554	1.355	1.796**	0.841	1.300**	1.288	1.163*	1.271***
Religion	(0.134)	(0.083)	(0.112)	(0.393)	(0.489)	(0.463)	(0.472)	(0.117)	(0.172)	(0.223)	(0.101)	(0.110)
	4.096***	5.378***	6.202***	2.398	2.055	1.003	0.038***	0.049***	0.044***	19.108***	6.750***	5.745
Marital status	(0.490)	(0.480)	(0.785)	(1.573)	(0.915)	(0.306)	(0.009)	(0.008)	(0.007)	(3.486)	(0.651)	(0.680)
Family	1.597***	1.343***	1.377***	2.259	2.476***	1.303	1.396	1.397***	1.049	1.013	1.371***	1.291***
planning	(0.181)	(0.098)	(0.097)	(1.273)	(0.787)	(0.367)	(0.341)	(0.177)	(0.129)	(0.152)	(0.118)	(0.105)
	3.002***	3.824***	2.468***	1.814	4.217**	2.552**	0.410***	1.811***	1.228	5.861***	6.138***	5.636***
Age	(0.471)	(0.374)	(0.178)	(0.994)	(2.543)	(1.120)	(0.133)	(0.336)	(0.222)	(1.208)	(0.761)	(0.564)
Medical	1.327*	1.711***	0.819	1.573	2.501	4.087**	1.213	0.662	1.033	1.026	0.858	1.060
Insurance	(0.223)	(0.278)	(0.106)	(1.987)	(3.604)	(2.383)	(0.542)	(0.192)	(0.189)	(0.279)	(0.140)	(0.166)

Source: Author's own work. Coefficients are odds ratios; t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The odds of youths who completed or were pursuing primary, secondary, and tertiary education having an HIV test were 224%, 535%, and 1007% times higher than those of uneducated or out of school (base category) in 2015. This suggests that HIV education in the Zimbabwean education system increased HIV testing to the detriment of uneducated and out of school youths. While there was no difference in HIV testing by gender in 2005, a pattern of higher odds for males emerged in 2010, although it fell in 2015. The odds of females getting an HIV test were 52.4% lower than those of males in 2010, but the deficit declined to 21.9% in 2015. Place of residence is another soci-oeconomic factor with no statistically significant correlation with HIV testing in 2005.

The odds of youths from urban areas having an HIV test were 25.2% lower than those for youths from rural areas (base category) in 2010. This contrasts the expectation of more urban youths utilising ASRH services since health facilities are closer in urban areas than in rural areas. In 2015, residence did not have a statistically significant correlation with HIV testing. In general, access to media increased the odds of HIV testing and access to family planning specific information. The odds of youth exposed to general media information were 43.2% higher than for youth without access (base category) in 2010, but that advantage declined to 22.6% in 2015. ASRH awareness information was spread through radio, television, and newspapers. This finding suggests that youth without frequent access to electronic and print media are left behind in HIV testing.

Family planning specific information was distributed through different channels, including electronic and print media, health practitioners, community peer educators, teachers, and flyers. The odds of youth who had accessed such family planning information taking up HIV testing were 59.7% higher than those who had no such access (base category) in 2005. The advantage in odds declined to 34.3% in 2010 but increased slightly to 37.7% in 2015. This implies that ASRH specific information is key in promoting HIV testing. HIV testing increased for youth with tertiary education from 2005 to 2015, albeit dipping in 2010. The odds of HIV testing over uneducated youths were only statistically significant in 2015 for primary, secondary youths. This suggests a recently emerging health disparity.

Odds of youths from pro-medical religious affiliations were 42.8% higher than youths from anti-medicine religious groups (base category) in 2015. Odds for HIV testing were higher for married youths, and the odds increased throughout the study period. This finding suggests less uptake by single youths even though they are sexually active. The odds of youth covered with health insurance were 32.7% higher than for youth without insurance in 2005. The medical aid advantage increased to 71.1% in 2010, but the advantage had disappeared in 2015. This suggests that HIV testing involved out-of-pocket expenses between 2005 and 2010, but the situation changed to universal coverage by 2015. Odds for treatment for STIs were higher for older youths than younger adolescents throughout the study period.

Statistically significant predictors of STI treatment were gender, family planning information and age in 2010. The odds for STI treatment in 2010 were higher by 237%, 148%, and 322% for males, youth exposed to family planning educative information, and youth older than 18 years old respectively. In 2015, youth older than 18 years had 155% higher odds of seeking STI treatment than their younger counterparts aged 18 or younger (base category). Youth covered by health insurance had 309% higher odds of getting treated for STIs than their uninsured counterparts (base category). These findings suggest that the Zimbabwean health system might have been unfriendly for female youths, which discouraged them from seeking treatment in 2010 and the five-year period before the survey. The ASRH survey implemented in 2010 aimed at making health facilities more youth-friendly. That is probably why after 2010, the male advantage appears to have vanished. However, treatment of STIs seems to have increased for older youths in both 2010 and 2015 surveys. This finding suggests that the healthcare facilities might have become less friendly for adolescents below 18 years of age. Furthermore, medical insurance's influence appears to have been increasing since 2005, although it only became statistically significant in the 2015 survey. This suggests that STI treatment is costly such that only youths covered by health insurance can afford it. The odds of youth covered with health insurance getting treated for STIs were 32.7% higher than for youth without insurance in 2005.

The odds of youths from the richest and richer households utilising condoms were respectively 170.3% and 89.9% higher than for youth from the poorest households in 2010. The odds of youth with higher education utilising condoms were 263.4% higher

than for youth without any education in 2010, but this advantage disappeared in the 2015 survey. A pattern of gender bias in favour of male youths in condom utilisation emerged in 2010 and widened in the 2015 survey. This suggests that female condoms were less utilised in 2010 and even lesser in 2015. The odds of youth from pro-medical religious groups utilising condoms were 79.6 times higher than for youths from apostolic and traditional groups in 2005. This advantage disappeared in the 2010 survey but emerged again in 2015. This suggests negative effects of the economic crises in the period preceding the 2010 dataset such that there was no difference between the average youth who utilises health facilities and those who do not in terms of sexual risk protection.

Married youth utilised less condoms throughout the study period than single youths, but this can be expected as they have settled down. The odds of older youths utilising condoms were 59% lower than those of younger adolescents in 2005, indicating that youth older than 18 years of age were taking very high sexual risks. In 2010, the advantage reversed such that the odds of youths older than 18 years utilising condoms became 81.1% higher than for their younger adolescents. This is also a period in which exposure to family planning information gained prominence in influencing condom utilisation to an advantage of 39.7% for those with exposure to such information. This suggests that older youths easily processed family planning information compared to younger adolescents. In addition to that, the family planning information might have been less age-appropriate for younger adolescents.

Exposure to general media and family planning specific educational information increased the chances of contraceptives use. The odds of youth with access to general print and electronic media utilising contraceptives were 31.1% higher than for youths without access in 2015. Odds for youth exposed to family planning information utilising contraceptives were 37.1% higher than their unexposed counterparts in 2010. This advantage fell to 29.1% in 2015 but remained statistically significant at the 1% level. Married youths had higher odds of utilising contraceptives throughout the study period as well as youth from pro-medical religious groups. Lastly, youths older than 18 years had higher odds of utilising contraceptives than their younger adolescent counterparts. These findings show that contraceptives are less targeted towards adolescents as they are amongst older youth.

Overall, the logistic regression findings suggest that the 2010 survey had the most influential socioe-conomic factors. Since the 2010 survey data refers to the five years preceding the survey, the findings seem to point towards the effects of the economic crises of 2007 and 2008 in Zimbabwe, which led to the collapse of the health system. These results have shown that the most disadvantaged groups suffered the most in accessing health services in that period. After implementing the ASRH strategy in 2010, a period also associated with Zimbabwe's economic recovery, some of the socio-economic disadvantages receded as shown by the less significant roles of the socio-economic factors in the 2015 survey.

To establish the extent to which socio-economic differences in ASRH service utilisation highlighted above are inequitable, table 2.3 shows the disparities as concentration indices of the ASRH services: HIV testing, STI treatment, condom utilisation, and contraceptives use amongst females. The Erreygers concentration index (ECI) when implemented using the conindex Stata module shows the extent of the inequality, whether pro-poor and statistical significance. Pro-rich indices are shown by an ECI greater than 0, and vice versa is true.

The ECI value is the summation of the individual socio-economic factors' absolute contributions plus the remainder, which is the residual component, as shown in the absolute column. The percentage column shows the percentage contribution of each socio-economic factor to the overall ECI. The ECIs for HIV testing were 0.110, 0.012, and 0.037 for 2005, 2010, and 2015, respectively. These indices are greater than zero, which shows that HIV testing services were pro-rich. Only the index for the 2005 survey, however, was statistically significant. The index was decomposed into contributions from socio-economic factors. Better education, place of residence, insurance, and access to information contributed to HIV testing being pro-rich. Wealth contributed negatively to HIV testing being pro-rich.

In 2005 the ECI for HIV testing of 0.110 was made up of the major factors: education, which contributed 72%, urban residence 66%, while wealth negated the index by 44.9%. The HIV testing ECI for 2010 was 0.012. Wealth status contributed 525%, which was countered by rural residence, which contributed -547%.

Table 2.3: Disparities in ASRH service utilisation and their over time

	2005		2010		2015	
	Absolute	%	Absolute	%	Absolute	%
HIV						
Wealth	-0.049	-45	0.062	525	-0.153	-48
Gender	0.000	0	0.008	68	0.005	2
Residence	0.073	66	-0.065	-547	0.031	10
Education	0.079	72	0.035	293	0.111	35
Insurance	0.003	2	0.003	22	-0.001	0
Information	0.040	36	0.046	393	0.056	18
Residual	-0.035	-31	-0.077	-654	-0.047	-17
ECI	0.110*** (9.19)		0.012 (0.76)		0.003 (0.17)	
STIT						
Wealth	0.001	1	0.078	78	0.071	58
Gender	0.000	0	-0.005	-5	0.003	2
Residence	0.011	8	-0.046	-46	0.053	43
Education	0.096	69	0.027	27	0.185	151
Insurance	0.004	3	-0.003	-3	0.00	5
Information	0.056	40	0.084	84	0.034	28
Residual	-0.028	-21	-0.035	-35	-0.229	-187
ECI	0.139 -		0.100 (-1.45)		0.122* (-2.06)	
Condom use						
Wealth	0.123	56	0.095	50	0.086	39
Gender	0.000	0	-0.010	-5	-0.012	-5
Residence	0.004	2	0.087	46	0.107	49
Education	0.041	18	0.031	16	0.011	5
Insurance	-0.001	0	0.0011	0	0.002	1
Information	0.015	7	0.0252	13	-0.008	-4
Residual	0.039	17	-0.038	-20	0.034	15
ECI	0.221*** (-10.32)		0.192*** (-9.34)		0.219*** (-10.71)	
Contraceptive						
Wealth	-0.078	368	-0.009	21	-0.016	68
Residence	0.007	-31	-0.031	72	-0.002	8
Education	-0.022	104	-0.039	89	-0.069	291
Insurance	0.002	-7	-0.002	4	0.000	0
Information	0.006	-26	0.041	-95	0.047	-196
Residual	0.066	-308	0.083	9	0.017	-71
ECI	-0.021 (-1.63)		-0.043** (-3.01)		-0.024 (-1.46)	

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's own work

Other large contributions were 293% from education and 393% from ASRH information exposure. The HIV testing ECI for 2015 was 0.003. Wealth status contributed -48%, while education contributed 35%. These findings show that wealth, education, and access to ASRH information have been the major sources of inequality in HIV testing. While education and access to ASRH information drive HIV testing distribution towards economically advantaged youths, wealth status weighs this effect downwards, suggesting that HIV testing reached the poorest youths.

STI treatment had a concentration index of 0.122, statistically significant at the 10% level in 2015. The index is greater than zero showing that STI treatment was obtained mostly by youths from economically advantaged groups. Education contributed 151%, wealth contributed 58%, urban residence contributed 43%, and information contributed 28% to the disparity. The contributions of wealth and education to the disparity increased between 2005 and 2015. This shows that youth from a poor background and out of school need to be targeted to treat STIs timeously and reduce the risk of spreading STIs.

The concentration index for condom utilisation was positive and statistically significant at the 1% level throughout the study period. The concentration indices were all positive, which shows that condom utilisation was disproportionately balanced towards youth from advantaged backgrounds. The concentration index declined in 2010 but increased in 2015, showing no progress in reducing inequality in condom utilisation. The concentration index of 0.221 in 2005 was mainly driven by wealth status, which contributed 56%, and education 18%. In 2010, the contribution of wealth status to the concentration index fell to 50%, and urban residence gained prominence at 46% contribution while education contribution fell to 16%. ASRH information exposure also emerged as a source of disparity at 13% having increased from 7% in 2005. The concentration index of 0.219 in 2015 was mainly driven by wealth status with 39% and urban residence with 49%. The declining contribution of wealth status to pro-rich inequality shows that condom marketing and distribution successfully reached poor youth, but there is still ground to cover. The increasing contribution of urban residence suggests increasing the failure to market and distribute condoms in rural areas. The declining contribution of education shows that condom marketing and distribution also reached out of school youth successfully.

The use of contraceptives was negative and thus pro-poor the entire study period. This contrasts with other services such as HIV testing and STI treatment, which were biased towards youth from economically advantaged groups. The concentration index increased from -0.021 in 2005 to -0.043 in 2010 but fell to -0.024 in 2015. Only the concentration index for 2010 was statistically significant at the 5% level. Wealth and education have contributed towards pro-rich bias, while ASRH educational information has played a major role in the pro-poor bias. This result suggests that the family planning program has successfully covered the poor and uneducated who can benefit more from reduced families since they have fewer economic resources and opportunities.

Table 2.4 shows health disparities when socio-economic ranking youths by education, gender, and place of residence without the decomposition in Table 2.3. HIV testing is highly concentrated amongst youth with a higher level of education (at least secondary education) based on the concentration index sign. This disparity declined in 2010 but increased to slightly above the 2005 level in 2015. HIV testing is also shown to be concentrated among females throughout the study period. The pro-urban disparity in HIV testing is only statistically significant in 2005 but declined for 2010 and 2015.

There are sustained HIV testing disparities due to education. There were also sustained disparities in condom use due to education and gender. STI treatment is concentrated among the youth with at least secondary education but only statistically significant in 2015. This suggests that youths without secondary education have been left behind, and the disparity is widening. STI treatment is also concentrated amongst males in 2005 and 2010, but shifts to become concentrated among females in 2015. Pro-urban STI treatment fell in 2010 but almost doubled the 2005 level by 2015. Only 2015 has a statistically significant concentration index suggesting a pro-urban bias in access to STI treatment for urban-based youths.

The study does not find evidence of disparities in the use of contraceptives. The concentration of contraceptives use among the educated changed in 2010 when it becomes concentrated among the uneducated. The disparity widened in 2015.

Table 2.4: Concentration Index for other Socio-economic Ranking Variables

	2005	2010	2015
	HIV Testing		
Education	0.090***	0.044***	0.095***
	(10.75)	(3.57)	(7.52)
Gender	-0.105***	-0.262***	-0.164***
	(-10.69)	(-19.69)	(-10.72)
Residence	0.104***	0.010	0.017
	(9.80)	(0.67)	(1.09)
	STI Treatment		
Education	0.101	0.072	0.193***
	(.)	(1.29)	(4.34)
Gender	0.036	0.156**	-0.078
	(.)	(2.61)	(-1.44)
Residence	0.082	0.029	0.160**
	(.)	(0.39)	(3.00)
	Condom Use		
Education	0.149***	0.108***	0.094***
	(9.63)	(6.41)	(5.02)
Gender	0.399***	0.368***	0.450***
	(20.25)	(21.29)	(25.63)
Residence	0.146***	0.101***	0.127***
	(7.46)	(4.89)	(6.69)
	Contraceptives use		
Education	0.005	-0.017	-0.018
	(0.54)	(-1.60)	(-1.47)
Residence	0.010	-0.020	0.001
	(0.74)	(-1.42)	(0.07)

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's own work

Contraceptives use was marginally pro urban areas, reversed to advantage rural in 2010, and reverted to pro-urban in 2015. All the concentration indices are not statistically significant. This might suggest even distribution of contraceptives in both urban and rural areas. It also shows that education on its own is not a barrier in contraceptives use by female youths.

In summary, socio-economic determinants of ASRH service utilisation which maintained their importance on HIV testing throughout the three surveys were marital status, family planning information, and age. Marital status was correlated with condom use, and old age with contraceptive use through all three surveys. There was no clear pattern in these socio-economic determinants except for the association with marital status whose odds increased by 50% for married people. Sustained inequalities in HIV testing were observed and thus need to be addressed for education and gender. Sustained inequalities in condom use were also observed across wealth,

education, gender and place of residence. There was no clear pattern in the evolution of inequalities except the education disparity in condom use which declined but still significant.

2.5.2.2 Evolution of socio-economic correlates of and inequalities in ASRH outcomes

Regarding the determinants of ASRH outcomes, table 2.5 shows the results in terms of odds ratios of the HIV infection, STI infection, and early childbirth for the three surveys 2005, 2010, and 2015. There is no clear pattern in the change of the correlation between socio-economic factors and HIV infection. HIV infection was disproportionately higher among females than their male counterparts. The odds of HIV infection for males were 48.3% lower than for females in 2005. Although the figure dropped to 46% in 2010, it rose to 52.3% in 2015. This result shows that female youth face higher sexual risks than male youth. This explanation is supported by the result in table 2.2, whereby condom utilisation was higher among males than females, suggesting that females have less control over their safe sexual practices.

The odds of urban youths being infected with HIV were 57.9% higher than rural residents in 2010. However, the place of residence did not have any correlation in 2005 and 2010, which suggests that the anomaly had been corrected by 2015. The odds of married youth being infected by HIV were 107.5% higher than single youths (base category) in 2005, but this imbalance disappeared for subsequent surveys. This could be due to national ASRH campaigns encouraging youths to go for HIV testing before marital commitment. The odds of youth older than 18 years being infected by HIV were 130.7%, 75%, and 132.4% higher than their younger counterparts (base category) in 2005, 2010, and 2015, respectively. All odds ratios were statistically significant at the 1% level. The consistently higher risks of infection were due to higher risks of older youth as sexual activity increases. The odds of youth who had a historical STI also getting infected by HIV increased from 152.2% to 195.8% higher than those who never had an STI (base category) between 2005 and 2010. The odds had declined to 106.4% higher by 2015.

Table 2.5: Odds Ratios for Outcomes

	HIV infection odds ratios			STI infection odds ratios			Early childbirth odds ratios		
Variable	2005	2010	2015	2005	2010	2015	2005	2010	2015
Wealth Status:	1.368	1.026	1.122	1.381	1.094	1.988	1.354*	1.144	1.161
poorer	(0.295)	(0.253)	(0.271)	(0.551)	(0.472)	(1.083)	(0.231)	(0.191)	(0.211)
middle	1.018	1.152	1.466	1.286	1.165	1.883	0.914	0.885	0.964
	(0.221)	(0.314)	(0.354)	(0.968)	(0.496)	(1.124)	(0.187)	(0.156)	(0.183)
richer	1.119	1.313	1.183	2.262	0.923	1.177	1.132	0.890	0.771
	(0.280)	(0.381)	(0.352)	(1.132)	(0.560)	(0.886)	(0.280)	(0.178)	(0.208)
richest	1.004	1.023	1.042	1.192	0.845	0.792	1.305	0.680	0.380**
	(0.316)	(0.315)	(0.368)	(0.776)	(0.612)	(0.617)	(0.453)	(0.164)	(0.145)
Education level :	2.856	0.624	1.490	1.290	3.932	2.062	0.967	1.054	0.196
primary	(3.079)	(0.518)	(1.617)	(1.037)	(4.238)	(1.550)	(0.535)	(1.037)	(0.211)
secondary	2.464	0.485	1.086	0.796	2.235	1.666	0.357*	0.360	0.089**
	(2.651)	(0.400)	(1.183)	(0.624)	(2.310)	(1.041)	(0.207)	(0.356)	(0.096)
higher	1.777	0.414	0.444	1.000	1.000	1.000	0.088**	0.277	0.012***
	(2.090)	(0.387)	(0.535)	-	-	-	(0.106)	(0.347)	(0.017)
Gender	0.517***	0.540***	0.475***	1.135	2.778***	1.232			
	0.088	0.088	0.085	(0.324)	(0.888)	(0.338)			
Place of residence	1.078	1.579**	1.170	1.421	2.001	2.178	1.075	1.195	1.414
	(0.242)	(0.348)	(0.324)	(0.468)	(0.945)	(1.275)	(0.258)	(0.231)	(0.412)
Exposure to media	1.136	0.734*	0.822	0.876	1.182	0.760	0.680***	0.813	0.672**
	(0.222)	(0.128)	(0.138)	(0.320)	(0.432)	(0.296)	(0.084)	(0.118)	(0.115)
Marital status	2.075***	1.176	1.306	4.353***	6.680***	1.990**	1.391	0.702*	0.981
	(0.336)	(0.190)	(0.225)	(1.716)	(2.091)	(0.638)	(0.315)	(0.145)	(0.176)
Age	2.307***	1.750***	2.324***	1.452	5.696**	13.627***			
	(0.452)	(0.333)	(0.415)	(0.917)	(3.831)	(8.498)			
STI	2.522***	2.958***	2.064***						
	(0.012)	(0.067)	(0.032)						

Source: Author's own work. Coefficients are odds ratios; standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This reduction can be attributed to increased awareness of the risks associated with untreated STIs, such as lacerations exposing youth to a higher risk of HIV infection. The higher odds cannot be eliminated due to the clinically established evidence of STI-HIV co-infection (Kennedy et al., 2017). The odds of males getting an STI infection were higher than females throughout the study period but only statistically significant at the 1% level in the 2010 survey. This pattern suggests that many male youths engage in risky sexual activity with a smaller group of the female youth population or other older risky groups such as commercial sex workers.

STI infection rates were also high amongst married youth, which contrasts the expectation that single youths are more sexually risky. This finding suggests that the lack of condom use in married youths exposes them to a high risk of contracting STIs from each other. Chances of STI infection were also high and increasing for youth older than 18 years of age. This suggests a decline in safe sexual practice by older youth and also that awareness campaigns for safe sexual practice may be getting less effective.

The risk of early childbirth among youth from the richest households declined between 2005 and 2015. In 2015, the odds of youth from richest households having childbirth before 18 were 62% lower than for youth from the poorest households. This suggests that early childbearing could be related to economic hardships as female youth are manipulated by well-to-do males to engage in unsafe sex in exchange for financial reward. The odds of youth with secondary education and higher education having early childbirth were consistently lower over the study period. This shows that furthering education delays the risk of early childbirth and vice versa. Lastly, youth exposed to ASRH information had lower odds of early childbearing than their uninformed counterparts. This shows that sexual and reproductive health education for youth effectively delays childbirth amongst youth and adolescents.

Table 2.6 shows the disparities in HIV infection, STI infection, and early childbearing. Concentration indices of HIV and STI infection are marginal and statistically insignificant throughout the study period. The evidence from the concentration indices seems to be in support of odds ratio estimates. This suggests the inexistence of horizontal inequity in HIV and STI infections despite the correlation of these infections

and socio-economic variables. The concentration index for early childbearing is negative and statistically significant at the 1% level throughout the study period. In 2005, wealth contributed 11% towards the burden on the poor while education exerted influence in the opposite direction.

Table 2.6: Changes in Inequality in ASRH Outcomes

	2005		2010		2015	
	Absolute	%	Absolute	%	Absolute	%
HIV Infection						
Wealth	0.015	-3169	0.022	240	0.001	-29
Gender	0.001	-229	0.001	8	0.001	-19
Education	-0.007	1394	-0.013	-142	-0.011	250
Residence	0.000	-3	0.0307	323	0.006	-147
Information	0.010	-2018	-0.017	-180	-0.010	234
Marital Status	-0.013	2748	-0.004	-45	-0.005	125
Religion	0.002	-381	-0.001	-14	0.001	-31
Province	0.001	-161	-0.002	-25	-0.001	27
Residual	-0.008	1438	-0.006	-244	0.022	410
ECI	0.001 (-0.05)		0.009 (1.30)		-0.008 (-0.70)	
STI Infection						
Wealth	0.028	-12522	0.012	-513	-0.002	-1177
Gender	0.000	-54	-0.000	22	-0.000	-217
Residence	-0.002	771	0.018	-820	0.013	8141
Education	-0.010	4250	-0.011	503	0.004	2173
Condom use	0.002	-785	-0.002	106	-0.004	-2217
Information	-0.006	2463	0.001	-60	-0.002	-1489
Residual	-0.014	5837	-0.019	-264	-0.008	-5214
ECI	-0.000 (-0.07)		-0.002 (-0.57)		0.000 (0.06)	
Early Childbearing						
Wealth	0.0163	-11	-0.051	37	-0.275	170
Residence	-0.001	1	0.008	-6	0.092	-57
Education	-0.240	156	-0.251	183	-0.196	121
Religion	-0.010	7	-0.013	10	-0.036	22
Information	-0.037	24	-0.010	7	-0.014	8
Marital status	-0.012	7.57	0.012	-8	0.000	0
Residual	0.129	-185	0.168	-223	0.266	-264
ECI	-0.154*** (-5.83)		-0.138*** (-5.23)		-0.162*** (-5.61)	

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's own work

In 2010, the major drivers of inequality in early childbirth were place of residence, contributing 6%, and early marriages 8%, while education level pulled in the opposite

direction. Lastly, in 2015, place of residence contributed 57% towards the burden of early childbirth on the poor, but wealth status and education mitigated those effects.

Table 2.7 shows concentration indexes for ASRH outcomes using education, gender, and residence as socioe-conomic ranking variables. Because the sign is negative, HIV infection appears highly concentrated amongst youth with a lower level of education (without secondary education versus those with secondary education and higher), and the disparity has increased over the years, gaining statistical significance in 2015. Female youth have a higher concentration index relative to males for HIV infection statistically significant over the study period. The 2010 index fell by half from the 2005 figure and has stabilised up to 2015. The urban residence has a marginal burden of HIV infection relative to rural areas but only statistically significant in 2010. The same burden is evident for youth without secondary education, females, and urban residence for STI infection, albeit without statistical significance.

Table 2.7: Outcome Concentration Indices for other socio-economic Ranking Variables

	HIV Infection		
	2005	2010	2015
Education	-0.008	-0.011	-0.013*
	(-0.95)	(-1.91)	(-2.34)
Gender	-0.067***	-0.037***	-0.038***
	(-9.93)	(-5.60)	(-6.38)
Residence	0.006	0.021**	0.001
	(0.71)	(2.83)	(0.17)
	STI Infection		
Education	-0.004	-0.005	-0.001
	(-0.95)	(-1.80)	(-0.58)
Gender	-0.006	-0.001	-0.001
	(-1.68)	(-0.16)	(-0.43)
Residence	0.002	0.003	0.002
	(0.63)	(0.77)	(1.03)
	Early Childbirth		
Education	-0.237***	-0.216***	-0.202***
	(-11.58)	(-9.11)	(-8.42)
Residence	-0.107***	-0.064*	-0.089***
	(-5.16)	(-2.56)	(-3.36)

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's own work

Early childbearing is concentrated amongst youth with lower education (without secondary education). The concentration is statistically significant but declining over the study period. Early childbearing is also highly concentrated amongst rural youth

and statistically significant throughout the study period. Although the concentration index fell slightly between 2005 and 2015, it rose from its 2010 levels, which suggest the re-emergence of the burden.

In summary, socio-economic determinants of ASRH outcomes, which maintained their importance throughout the three surveys, were gender, age, and history of an STI infection. STI infection influenced HIV infection, while marital status influenced STI infection. There was no clear pattern in the changes of these socio-economic determinants. Sustained inequalities in early child birth were observed and thus need to be addressed especially amongst the less educated and rural residents. Sustained inequalities in HIV infection were also observed highly concentrated among females. The absence of a clear pattern of declining coefficients suggests stagnated progress in reducing these inequalities.

2.6 Discussion

Zimbabwe is a country with high levels of STI and HIV/AIDS infections among youth and adolescents. Despite the country's launching of its ASRH strategy in 2010 to improve safe sexual practices and improve reproductive health, uptake of ASRH services has been low resulting in high teen childbearing, hence high HIV and STI incidence and prevalence among youth. Better design of the ASRH strategy is needed but needs to be informed by relevant evidence.

This first essay of the thesis sought to establish the socio-economic determinants of ASRH service utilisation in Zimbabwe and determine if there were disproportionate distributions in service utilisation by the socio-economic factors. The second objective was to identify socio-economic correlates of ASRH outcomes and the extent to which these outcomes are disproportionately distributed across the socio-economic variables. Lastly, the chapter analysed changes in service utilisation and outcomes to establish if progress in ASRH over the past 15 years is promising. Evidence from these objectives can assist the policymakers in redesigning the ASRH strategy in the future.

The first objective yielded several observations. Firstly, wealth was found correlated to higher chances of HIV testing. Youth from the richest background took up HIV

testing more than poor youth, but wealth declined with time. Wealth was also associated with condom utilisation in the 2010 survey, but the correlation had vanished in the 2015 survey. Wealth had no significant association with STI treatment and contraceptives use. These findings indicate that the government succeeded in making ASRH services accessible for youths from poor households. This success can also be seen in the decomposition of the concentration indexes for HIV testing and contraceptives use in which wealth had negative contributions.

Secondly, education was found uncorrelated with HIV testing in the 2005 and 2010 surveys but emerged as a significant factor in 2015. The association increased with the level of education. Decomposition analysis of the concentration index also showed a substantial contribution of education towards disproportionate distribution of HIV testing to economically advantaged segments of the population. The other service associated with education was condom utilisation, but only in 2010. Education also substantially contributed to the disproportionate distribution of HIV testing to economically advantaged youths in 2010.

Thirdly, gender was found related to HIV testing, with females getting more services. On the other hand, males reported more condom utilisation than females. ASRH information exposure led to high HIV testing. Religion was also associated with ASRH service utilisation. Youths from pro-medical religious groups had higher HIV testing, condom use, and contraceptives use. Marital status was associated with higher HIV testing, contraceptives use, but lower condom use. ASRH information exposure was associated with HIV testing and contraceptives use. Lastly, age was associated with higher uptake of HIV testing, STI treatment, and contraceptives use. Overall, wealth, education, gender, religion, marital status, exposure to ASRH information, and age were established as critical socio-economic determinants of ASRH service utilisation.

Finally, concentration indexes showed that HIV testing was disproportionately higher amongst the economically advantaged youth. This association declined with time. STI treatment bias towards economically advantaged youths emerged in the 2015 survey. There was sustained disproportionate use of condoms by the economically advantaged youth. Contraceptive use was high amongst the economically disadvantaged, but this bias was only statistically significant in 2010.

In summary, inequalities in accessing HIV services, STI services, condoms, and contraceptives accounted for low utilisation of ASRH services. There was no conclusive evidence in terms of reducing the influence of socio-economic factors on ASRH service utilisation and health outcomes. Concentration indices showed that horizonal inequity in HIV testing due to wealth status disappeared while, by 2015, it had begun to emerge for STI treatment. There was evidence of sustained horizontal inequity in the utilisation of condoms by wealth class throughout the study period. Using other socio-economic factors as ranking variables, the study found evidence of sustained inequities on pro-educated HIV testing and condom use biased towards the educated, males, and urban youths. The absence of persistently declining inequality suggests stagnated progress in reducing inequalities in HIV testing, condom use, and the use of contraceptives associated with these socio-economic factors.

Findings on the second objective revealed that gender, age, and history of an STI infection which maintained their correlation with HIV infection throughout the three surveys while marital status maintained its association with STI infection. The lack of association between wealth and ASRH service utilisation was also evident in ASRH outcomes such as HIV infection and STI infection. The 2015 coefficient, however, suggests that wealth status might be an emerging issue in early childbirth. The concentration index for 2015 also showed wealth making a significant contribution to the poor's early childbirth burden.

Gender played a role in HIV and STI infection. HIV infection was high amongst females. This finding needs to be understood in the context of HIV testing, which was also found high amongst females. The higher HIV infection among females might thus be because high-risk men avoid HIV testing. STI infection was high amongst males. Poor ASRH outcomes were high amongst urban residents, although only HIV testing in 2010 had statistical significance. Access to ASRH educational information had a negative relationship with early childbearing. Married youths had higher HIV infection and STI infection. Youths older than 18 years had a higher infection of HIV and STIs compared to younger adolescents. STI infection was also found as a significant predictor of HIV infection, which is expected from HIV literature.

The last objective of changes in the determinants of ASRH utilisation did not produce consistent results. There was no sustained association between wealth or education and ASRH utilisation. There was sustained higher odds of accessing ASRH services by married youths, recipients of ASRH information, and older youths. There was also sustained higher odds of contraceptive use among married youths, ASRH information recipients, and older youths.

The analysis did not provide conclusive evidence on progress in nullifying the influence of socio-economic factors on ASRH service utilisation and health outcomes. Concentration indices showed that horizonal inequity in HIV testing disappeared, while by 2015, it had begun to emerge for STI treatment. There was evidence of sustained horizontal inequity in the utilisation of condoms by wealth class throughout the study period. Using other socio-economic factors as ranking variables, the study found evidence of sustained inequities on pro-educated HIV testing and condom use biased towards the educated, males, and urban youths.

The analysis showed a sustained high risk of HIV infection for females, youth older than 18, and those ever infected by STIs. Sustained risk of STI infection was evident for married youths and older youths. Sustained early childbirth was evident amongst youth who did not get exposure to ASRH educational information. There was evidence of a lower risk of early childbirth amongst youths with secondary and higher education in the 2005 survey, which disappeared in the 2010 survey, but later emerged in the 2015 survey. The chapter also revealed that the early childbirth burden was increasingly heavy on youths from poor households and rural areas. There was no inequity by wealth class for STI and HIV infections. Other socio-economic classes with sustained disadvantages include females for HIV infection as well as the uneducated and rural residents for early childbirth.

The research observed a weak association between wealth and HIV testing and contraceptives use, as well as lack of bias towards economically advantaged youth in utilising these services. This is consistent with the work by Hosseinpoor et al. (2016), who found that health indicators with the highest coverage had the least inequality in a study of four countries, including Zimbabwe, between 1995 and 2010. The coverage of HIV testing in Zimbabwe is high at 74% of the entire population (MOHCC, 2017)

and free of charge. In contrast, condom utilisation, which showed socio-economic inequality, stands at 27% among youths expected to use it more (Zimbabwe National Statistics Agency and ICF International, 2016). ASRH services are highly subsidised in Zimbabwe, and their high use by the poor is also established even in developed economies such as England (Cookson et al., 2016). The finding of socio-economic inequality in the subsidised condoms is in consistence with Gordon et al.'s (2020) findings in south Africa. This anomaly can be caused by high indirect costs to acquire those services, such as transportation.

Although this chapter found evidence of higher condom utilisation among the rich youths, the concentration index did not show lower HIV infection among the wealthy youth. This is contrary to the intuition that the richer youths would have a lower HIV infection. This indicates that unbalanced service provision for different socio-economic groups is not beneficial even to the groups with better access to services. This means that there is a need for balanced service provision across all socio-economic groups, which will always socially interact with each other beyond the walls of inequitable healthcare, countering the effects of the beneficiaries of the unbalanced ASRH service provision

This chapter established that education affects the uptake of HIV testing and early childbirth. This finding is similar to Muza (2019), who established a significant effect of education on reproductive health outcomes in Zimbabwe's general population. Gregson et al. (2005a) found a lack of secondary education associated with high HIV infection, STIs, teen pregnancy. Neal et al. (2015) also found that women without secondary education had the highest burden of early childbirths in East Africa. They conducted a trend analysis in East Africa, showing a lack of progress in reducing early childbirth as well as its burden amongst the poor.

Whilst this study has some similarities with the previous literature, it contributed to the literature in several respects. Firstly, it provided ASRH evidence specific to the Zimbabwean ASRH strategy, which is also current. Previous findings on trends in East Africa cannot be applicable to Zimbabwe due to different cultural practices that affect service utilisation (Mananavire, 2016, Binagwaho et al., 2012, Kharsany and Karim, 2016). It provided important determinants of utilisation and the distribution of ASRH

outcomes across key determinants. The importance of these determinants is context and age-specific and to this effect, no study has investigated ASRH specific determinants in Zimbabwe. The study's contribution thus lies in that no other study has investigated the distribution of ASRH services and outcomes among the Zimbabwe youth. Secondly, the effects of ASRH service utilisation can be measured in ASRH outcomes. The government implemented the ASRH strategy in 2010 to increase service coverage and reduce socio-economic disparities in outcomes. The essay thus provided an insight into the effectiveness of the ASRH strategy based on whether the influence of socio-economic factors on ASRH outcomes no longer prevails. Finally, the chapter analysed changes in the ASRH outcomes and their distribution to see how the ASRH strategy has successfully nullified socio-economic class differences. Overall, the study contributed to the literature in that no other research, to the best of the author's knowledge, has analysed compressively these ASRH specific socio-economic factors of service utilisation and outcomes.

The concentration of HIV testing, STI treatment, and condom usage amongst those in urban areas reinforces the need for innovative ways to encourage use in hard-to-reach areas. Kranzer et al. (2018a) found economic incentives to households in remote areas significantly increasing HIV testing amongst adolescents. HIV self-testing is gaining prominence as a means of covering hard-to-reach populations in terms of geographical barriers as well as cultural (Hatzold et al., 2019, Sibanda et al., 2019). It needs to be scaled up in Zimbabwe as a strategy to reach remote areas without access to nearby health centres as well as youths from cultures that act as barriers to as highlighted by the religion variable. In this era of financial austerity, a reallocation of public health resources from urban to rural areas and engaging the private sector to supply ASRH services in urban areas can prove to be worthwhile. Dean et al. (2018) have shown that STI clinics, for example, can be financially sustainable even when lower than half of the population is covered by medical insurance.

Finally, it is worth noting the chapter's limitations that emanate from retrospective reporting, which characterise DHS surveys (Larsen et al., 2019, Neal and Hosegood, 2015, Hertrich, 2017). The issues with data obtained through retrospective reporting result in recall bias, self-completion, and social desirability of responses that cause errors in reporting sexual and reproductive health events (Neal and Hosegood, 2015).

Recall bias is more common in older respondents (Pullum, 2006, Pullum and Staveteig, 2017, Neal and Hosegood, 2015), and since our sample consists of youths, we expect this to be of minor concern. Youths can also overstate their current age or age at first birth because it is socially desirable to do so and avoid legal repercussions (Neal and Hosegood, 2015, Bongaarts and Blanc, 2015). This would imply that our estimates on early childbirth and its distribution should be interpreted with this caveat in mind (Bongaarts and Blanc, 2015).

Further studies can consider computer technology to reduce recall bias, as demonstrated by Helleringer et al. (2019) in estimating age for reproductive women. Further research could also explore probing to validate answers. The current chapter provides useful information to public health policymakers on progress in the promotion of ASRH service utilisation despite the limited by data points. The chapter recommends replicating a similar study in the future with more survey data points to establish much clearer trends.

2.7 Conclusion

The chapter concludes that wealth status, education, place of residence, gender, and access to ASRH information through both print and electronic media have significant correlationships with ASRH services utilisation. Socio-economic disparities are visible for ASRH services and outcomes but exhibit different changing patterns over the study period. Socio-economic disparities have widened by education for STI treatment; residence for contraceptive use and STI treatment; and gender for condom utilisation. Inequities in outcomes have widened for early childbirth amongst the poor, rural residents, uneducated, as well as HIV infection amongst the last group. Positive developments include the decline in pro-rich uptake of HIV testing as well as decreasing dominance of condom use by the educated. The chapter recommends a balanced service provision across all socio-economic groups, further investment in community health workers and engaging community leaders.

Chapter III

Impact of the adolescent and youth sexual and reproductive health strategy on service utilisation and health outcomes in Zimbabwe

3.1 Introduction

The results in chapter 2 showed poor ASRH outcomes such as high HIV infection, STI infection, and early childbirth in the 2005 and 2010 ZDHS surveys. The findings showed that these outcomes were disproportionately concentrated among socio-economically disadvantaged groups. To increase service utilisation and to improve ASRH outcomes, the Zimbabwean government developed and implemented the ASRH strategy in 2010. Although the findings in chapter 2 showed mixed results in changes in utilisation patterns and outcomes, the current chapter sought to establish the impact of the ASRH strategy implemented in 2010. The chapter sought to establish the impact of the ASRH strategy on service utilisation and outcomes using impact evaluation techniques.

The poor ASRH strategies are not unique to Zimbabwe (WHO, 2011). Adolescents and youth worldwide face ASRH challenges such as risks of HIV and other sexually transmitted infections (STIs), unintended pregnancies, and unsafe abortions (Aarø et al., 2014). In 1994, representatives from 78 countries gathering in Cairo for the International Conference on Population and Development (ICPD) agreed on improving adolescent and youth sexual and reproductive health (ASRH) through age-appropriate health information (Popin and Unfpa, 1994). Notwithstanding this agreement, the sub-Saharan Africa region still had the highest rates of new HIV infections and the highest Disability Adjusted Life Year rates amongst young people (Gore et al., 2011, Fatusi, 2016, Mwale and Muula, 2017). African countries acknowledged the importance of ASRH and, as a result, implemented ASRH strategies both at community and facility levels. These strategies included comprehensive sexuality education (CSE), referred to as sexuality and relationship education curricula that are age-appropriate and

culturally relevant (Haberland, 2015, Haberland and Rogow, 2015). They also encompassed peer education, mass media campaigns, cash transfers, and youth-friendly centres- which are spaces created for young people to access ASRH health information and service (Ippf, 2012, Denno et al., 2015, Chandra-Mouli et al., 2015), and youth-friendly services- which are accessible and appropriate services that appeal to youths in a manner that promotes equity and interactions between users and providers (Thomée et al., 2016).

3.1.1 The Zimbabwe ASRH Strategy

Prior to the 2010 ASRH strategy, Zimbabwe implemented the ICPD action plan through various policies, including the National Reproductive Health Policy, Zimbabwe National HIV and AIDS Strategic Plan, National Health Strategy the Educational Policy. Poor ASRH outcomes such as high-risk sexual activity involving paid sex or sex with an older partner, an increase in STIs, and low uptake of HIV testing, as well as barriers to access youth-friendly services, were evident in 2005/06 Zimbabwe Demographic Health Survey (ZDHS) (GoZ, 2009). In response to these challenges, the government developed its first ASRH strategy for implementation between 2010 and 2015.

Amongst the barriers identified as aggravating ASRH outcomes include the lack of provision of comprehensive social and behaviour change communication (SBCC) materials, lack of life skills education, inadequate ASRH outreach services, prohibitive transport costs to referral health facilities. Only youth above 16 years of age were allowed voluntary HIV counseling and testing. Awareness of ASRH issues and skills to deal with them were low amongst health staff. Whilst there was no properly defined ASRH package across the Zimbabwean health system, commodities required for ASRH programme implementation were in short supply.

The first five-year ASRH strategy implemented in 2010 aimed to integrate socioeconomic, psychological, and physical factors through a multi-sectoral and participatory method involving adolescents and youth at all levels of programming in addressing barriers pointed out above. It departed from previous non-ASRH specific

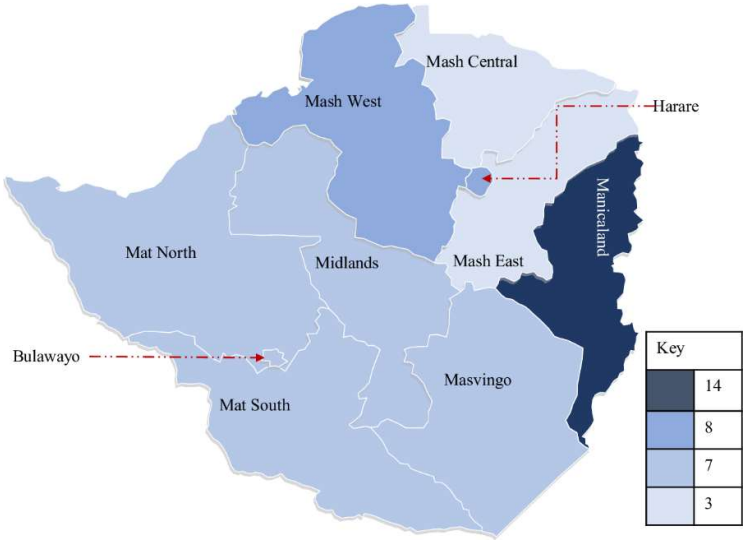
strategies, which were curative by design to focus more on preventative measures for sexually active young people and address barriers to service utilisation.

The goal of the strategy under evaluation in this chapter was to improve the sexual reproductive health of young people in Zimbabwe. One of the strategy's objectives was to encourage youth to practice safe sexual and reproductive health habits such as delaying or having protected sex, avoiding multiple sexual partners, and periodic HIV testing. Other objectives of the strategy included expanding access, availability, and use of youth-friendly ASRH services, facilitating a policy environment supportive of youth-friendly ASRH services and strengthening ASRH programme coordination and partnerships. The five-year strategy focused on changing risky sexual behaviour among young people, imparting life skills, providing youth-friendly services, and improving policy, advocacy, and coordination (Blum et al., 2015a).

Three main contact points with the eligible beneficiaries were identified as the community, health facility, and school. Community youth-friendly centres were established to offer sexuality education, counselling, recreational activities, and condoms. Health facilities availed a room and other available space for a youth-friendly corner that provided voluntary testing and counselling, condoms, family planning material, and other related services. Life skills, CSE, and counselling were also initiated in schools through teachers and peer educators.

Eligibility into the programme interventions was based on age ranging from 10 to 24 years. This means only youth and adolescents aged between 10 and 24 years between 2010 and 2015 could access youth-friendly corners and youth-friendly services and were targeted using youth-friendly awareness activities through the hospital, school, and community. Age groups 25 and above were ineligible for the ASRH programme but were exposed to the business-as-usual approach of accessing health services through the normal primary health facilities. For purposes of this dissertation, adolescents are aged between 10 and 19 years, while youth are aged between 15 and 24 years in line with the WHO and the Zimbabwean ASRH strategy definitions (GoZ, 2009). In addition to that, there is a clear age overlap between the two groups, such that the terms "adolescents" and "youth" are used interchangeably throughout the chapter.

United Nations agencies, the government, international development agencies, international and local non-governmental organisations (NGOs) funded various ASRH programmes between 2011 and 2015. Whilst local NGOs and the Ministry of Health and Child Care (MoHCC) implemented them, Zimbabwe National Family Planning Council (ZNFPC), the National AIDS Council (NAC), and MoHCC were coordinating. However, the programmes were not implemented uniformly across the country, as shown in table 3.1 and fig 3.1.



Source: Blum et al. (2015b)

Figure 3.1: Number of ASRH Programmes per Province

Key: the colour indicated on the key corresponds to the province of interest on the map, and the number corresponds to the number of programmes implemented.

Figure 3.1 and table 3.1 show provinces in which ASRH programmes were implemented in Zimbabwe. Fourteen (14) programmes were implemented in Manicaland province, which is higher than any other province. Eight programmes were implemented in Harare and Mashonaland West, while 7 programmes were implemented in Bulawayo, Masvingo, Matabeleland North, Matabeleland South, and Midlands. Mashonaland East and Mashonaland Central had only 3 programmes implemented, which was the least (Blum et al., 2015a).

Table 3.1: Distribution of ASRH Programme by Province

Province	Programmes implemented[#]	Population density[+]	Youth population per programme[+]	poorest quintile[*]	Never attended school[*]	Total fertility rate[&]	Teenage Pregnancy[&]	HIV prevalence 15-24[&]
National Level	17	13 061 239				4.1	23.5	5.5
Bulawayo	7	5%	31,565	0	1.9	2.8	11	5.9
Harare	8	16.3%	84,333	0	1.6	3.1	20.3	5.9
Manicaland	14	13.4%	41,188	16.0	5.1	4.8	27	3.4
Mashonaland Central	3	8.8%	125,151	23.8	9.6	4.5	30.3	5.2
Mashonaland East	3	10.3%	145,255	11.5	5.2	4.5	25.1	7
Mashonaland West	8	11.5%	61,966	23.7	6.8	4.5	23.6	4.4
Masvingo	7	11.4%	69,319	23.2	6.6	4.7	23.3	4.7
Matabeleland North	7	5.7%	36,595	69.5	8.8	4.1	31.1	8.5
Matabeleland South	7	5.2%	19,136	33.1	5.5	4.2	23.1	9.2
Midlands	7	12.4%	78,087	25.5	5.3	4.2	23	4.9

Sources:[#] (Blum et al., 2015a)

[+] (ZIMSTAT, 2012)

* (ZIMSTAT, 2009) [&] (ZIMSTAT and ICFI, 2012)

Manicaland province had the highest number of programmes implemented, while Mashonaland East and Mashonaland Central provinces had the least, as shown in column 2 of Table 3.1 and Fig 3.1. Several reasons might explain why Manicaland province received the most attention. First, the province has the highest adolescent population in the country (Care, 2016). Secondly, sexual activity amongst female teenagers remained high in contrast to declining patterns observed amongst their male counterparts (Remez et al., 2014). Thirdly, the region has the highest fertility rate at 4.8 against a national average of 4.1 and the highest teenage pregnancy rate at 27 percent against 23.5 percent national average (GoZ, 2016). Lastly, a cohort study conducted prior to the ASRH strategy showed HIV prevalence amongst teenagers in the region rising from 1.2 percent to 2.23 percent (Eaton et al., 2013).

The research exploited this uneven distribution of ASRH programmes in Zimbabwe to assess whether programmes intensity resulted in better ASRH outcomes. Due to differences in population across the provinces, we also consider the number of programmes per population in each province. Column 4 of Table 3.1 shows the inverse of this statistic presented as the youth population per programme. Matabeleland South province, for example, has the least population density. Its youth population per programmes at 19,136 is the lowest compared to 145,255 in Mashonaland East.

3.2 Literature Review

In evaluating the ASRH strategy, it is worth noting that literature analysing the impact of ASRH interventions has been diverse. This literature focused on various forms of ASRH interventions, including health education, peer education, mass media campaigns, cash transfers, youth-friendly centres, and youth-friendly services, with mixed results for the strategy's impact on intended outcomes. These studies evaluating the effectiveness of ASRH strategies to date have produced mixed results in low and middle-income countries.

Among the most recent literature are studies by Jewkes et al. (2008) and Scott-Sheldon et al. (2013), which evaluated the role of ASRH education and found that this education was effective in reducing sexually transmitted infections (STIs) in most low- and medium-income countries. Rink and Wong-Grünwald (2017) found that ASRH

education positively impacted increasing knowledge in Zimbabwe while reducing risky sexual behaviour in terms of the number of sexual partners. Similar results were reported by Dupas (2011), Scott-Sheldon et al. (2013), and Kalamar et al. (2016), who found that ASRH education was effective in reducing the incidence of unprotected sex and delaying sexual debut in South Africa. A more recent study by Dupas et al. (2017) indicated that ASRH education's effectiveness depended on the place of residence as they found the impact to be higher among Cameroonian teenage school girls in rural areas than it was among those residing in urban areas. Other interventions imparting knowledge that have been evaluated and found to have a positive impact include mass media campaigns and life skills training. For instance, Kalamar et al. (2016) found that mass media campaigns and life skills training had a positive impact on reducing the prevalence of STIs and multiple sexual partners, whilst increasing condom use, abstinence and health service utilisation in low- and middle-income countries. While the studies above found a positive impact of the ASRH, Duflo et al. (2015), found, in a study in Kenya, that ASRH education was ineffective in reducing pregnancy and STIs.

Literature reviewed also appears to have taken a consensus that education per se might be insufficient. As such, more literature has converged on comprehensive sexuality education (CSE). A review evaluating the impact of CSE strategies, for instance, reported its effectiveness in terms of reducing sexual risk behaviour (Haberland and Rogow, 2015, Michielsen et al., 2010, Rink and Wong-Grünwald, 2017), HIV, STIs, and the incidence of unprotected sex (Jewkes et al., 2008, Scott-Sheldon et al., 2013). CSE was also found more effective in delaying sexual debut in African countries and improving condom use (Michielsen et al., 2010, Kirby and Laris, 2009, Oringanje et al., 2009, Vanwesenbeeck et al., 2016). Other evidence attributed the success of CSE to its design, theoretically and empirically linking its success to the right age-targeting (Mwale and Muula, 2017) and consideration of gender power differences (Haberland, 2015). Other interventions imparting knowledge such as media campaigns and life skills training have been found to reduce the prevalence of STIs and multiple sexual partners and to increase condom use, abstinence, and health service utilisation (Kalamar et al., 2016).

With poverty being one of the aggravating factors for poor ASRH outcomes (Heinrich et al. 2017), a strand of studies focussed on evaluating the effects of tools to reduce poverty, such as cash transfers and subsidies. Evaluating ASRH from this perspective, Handa et al. (2015), Handa et al. (2017), and Heinrich et al. (2017) found that cash transfers reduced pregnancy, early sexual debut, and early marriage amongst female adolescents from poor backgrounds in Kenya and South Africa. In Malawi, Baird et al. (2012) established a significant positive impact of cash transfers in reducing STIs prevalence among adolescents in school, albeit not in those out of school. In Lesotho, Nyqvist et al. (forthcoming) reported that a financial lottery programme had a positive impact on reducing HIV, STIs incidence, and pregnancies after two years of following-up risk-taking individuals. Evaluating the effect of subsidies, Duflo et al. (2015) found evidence for the effectiveness of subsidies in reducing pregnancy in Kenya. Like a study in Zimbabwe by Hallfors et al. (2015), which found that subsidies had no impact on HIV and HSV-2 infections amongst female orphans in Zimbabwe, the study in Kenya reported that subsidies were not effective in reducing STIs prevalence.

Strategies focusing on facility and community-levels were promoted as they take services closer to the youths. Previous studies found mixed evidence of their effectiveness in improving ASRH outcomes amongst marginalised groups or increasing community awareness (Denno et al., 2015). Studies evaluating the effect of community peer education unearthed mixed evidence. Medley et al. (2009), Maticka-Tyndale and Barnett (2010), and Kalamar et al. (2016) found, for instance, that peer education had a positive impact on HIV knowledge, condom use, and community norms and attitudes, but it had no impact on STIs prevalence and sexual behaviour. Michielsen et al. (2012) associated the ineffectiveness of peer education with youth preferences for certain types of education. The absence of any impact was also attributed to other interconnected factors, such as experimental design and fragmented interventions. Youth-friendly centres have also been perceived as crucial in providing ASRH information and services in an environment where other social services like the internet and television are also offered (Chandra-Mouli et al. 2015). Evaluating these centres, studies find that generally, they had no impact. A study by Zuurmond et al. (2012) evaluated these centres from 1990 to 2010 in low- and middle-income countries and found a low utilisation rate. A more recent study in Zimbabwe reported low cost-effectiveness of youth centres (Blum et al. 2015), while a low

awareness of youth-friendly health services was also found in Malawi (Chandra-Mouli et al. 2015) where only 13% of young people were reported as having access to services.

While the studies above evaluated isolated SRH strategies, there has been a perception that a combination of complementary strategies might achieve a greater impact (Chandra-Mouli et al. 2015; Fatusi 2016). In this respect, Oringanje et al. (2009) showed that multiple interventions combining education and promoting contraceptives reduced unintended pregnancies, postponed sexual debut, and reduced STIs prevalence. Duflo et al. (2015) found that the combination of the HIV curriculum and subsidies reduced STIs more than subsidies alone. Maticka-Tyndale and Barnett (2010) and Scott-Sheldon et al. (2013) found that combining education from teachers and peers yielded a higher impact on delaying sexual debut compared to peer educators alone.

While these studies have enriched our understanding of how specific ASRH interventions influence service utilisation and health outcomes, they have a particular drawback. Evaluating interventions in isolation, in a limited number of combinations and in selected settings assumes an artificial and abstract environment and ignores many complex, interrelated factors operating at different levels to influence ASRH outcomes in a natural socio-political setting (Fatusi, 2016). This chapter addressed this drawback by evaluating multiple complementary interventions scaled up at the national level in Zimbabwe in a non-abstract setting. This is the first such study to evaluate the impact of the ASRH strategy in Zimbabwe as far as the researcher is aware. The chapter also adds to the literature: subgroup analysis by gender, wealth and place of residence to establish equity in ASRH services, which is missing from most ASRH evaluations (Denno et al., 2015).

3.2.2 Hypothesis

In an attempt to analyse the Zimbabwean ASRH strategy's impact, this chapter first evaluated the effect of the strategy on condom utilisation, STI treatment, HIV testing, HIV prevalence, and STI prevalence. It then disaggregated the effect by gender, household wealth, and residential location. Lastly, the chapter evaluated whether

policy intensity, as measured by the number of programmes implemented per province as well as the number of programmes per population in a province, would lead to superior ASRH outcomes. The null hypothesis is that the multi-pronged Zimbabwean ASRH strategy had an effect on ASRH service utilisation and outcomes.

3.3 Methods

3.3.1 Empirical Framework

Randomisation is widely accepted as a gold standard for programme impact evaluation (Lanza et al., 2013, Angrist and Krueger, 1999). Due to social policies that are not implemented with randomisation in mind, economists estimate their effects using adjusted regressions, matching techniques, regression discontinuity, instrumental variables, and the difference in difference (DID) techniques. A combination of these methods with propensity score matching has been shown to yield estimates close to randomised experiments (Lalonde, 1986, Dehejia and Wahba, 1999).

Our study combines propensity score matching and DID methods. The DID method is appropriate for the current study due to its before and after design. It is designed for panel and repeated cross-section data (Villa, 2016, Wooldridge and Imbens, 2007, Stuart et al., 2014) and accounts better for time-invariant unobserved heterogeneity (Villa, 2016). Propensity score matching allows for constructing of a counterfactual and reduced selection bias (Guo and Fraser, 2010, Rosenbaum and Rubin, 1983). Using propensity score matching to complement DID facilitates the balanced matching of treated and control observations (Villa, 2016).

In a study closely related to our approach, Stuart et al. (2014) developed and tested a model that combines propensity score matching and the DID approach to policy evaluation. This approach involves constructing propensity scores from four groups: treatment group at baseline, treatment group post-policy, control group at baseline, and control group post-policy. The researchers implement this approach for repeated cross-sectional data on an innovative payment and delivery system on out-of-pocket health expenditures. They found that the new payment and delivery system did not

result in increased out-of-pocket expenditures. The drawback, however, associated with this approach is increased standard errors. This is a consequence of the bias-variance trade-off, such that obtaining less biased impact estimates is associated with a cost of higher variance (Stuart et al., 2014). The current chapter makes use of the *diff* estimand developed by Villa (2016), which combines the DID approach and kernel-based propensity scores in Stata statistical software.

3.3.2 Econometric approach

This study's econometric specification is guided by the fact that we are seeking to establish the difference across two groups over time, which is attributable to the ASRH strategy. The effect of the ASRH strategy is obtained from estimating the equation:

$$y_i = \alpha_0 + \beta_0 T_i + \beta_1 t_i + \delta_1 T_i t_i + \beta_{ij} \sum X_{ij} + \varepsilon_i \quad (3.1)$$

where y_i is health indicator for person *i*

t_i is a dummy variable for time, taking the value zero for 2010 observations and one for 2015 observations.

$T_i$is a dummy taking the value one for the treatment group and zero otherwise.

3.3.2.1 Treatment Group

Eligibility into the programme was based on age. The ASRH strategy was implemented across the whole country and targeted young people aged 10-24 years. The study selected young people aged 15-19 years old in 2010 as the baseline treatment group as it benefited over the entire five-years of the strategy's implementation. By the end of the strategy implementation in 2015, the cohort was now aged 20-24, which becomes the post-strategy treatment group. Although targeted by the strategy, young people aged 10-14 years were excluded from the analysis because there is no secondary data on sexual and reproductive health information available for Zimbabwe.

3.3.2.2 Control Group

The 25-29 years age group in 2010 never benefitted in the strategy implementation period. Instead, it was exposed to the business-as-usual sexual and reproductive health approach and became the baseline control group. By 2015, this cohort was now aged 30-35, which also was not exposed to the ASRH programme and thus becomes the post-strategy control group.

The chapter further analyses whether higher programme intensity brought about better results. In this sub-analysis, the eligibility criterion was the region of residence whereby ASRH beneficiaries from Manicaland province, which received the highest number of interventions, were considered as the treatment group whilst those from Mashonaland East and Mashonaland Central provinces, which received the least programmes were considered as the control group. Youth aged 15-19 resident in Manicaland province, which had 14 ASRH programmes, were selected as the treatment group at baseline using the 2010 dataset. The same group from the same province was aged 20-24 in the 2015 dataset and were thus considered the treated group at follow up. Youth of the same ages from provinces with the least number of ASRH programmes (Mashonaland Central and Mashonaland East with 3 programmes) were considered as the control groups. Following the same reasoning, the research assesses the differences between Matabeleland South province, which has the lowest youth population per programme at 19,136, and Mashonaland East, with 145,255.

X_i represents covariates identified from the literature: residence, wealth status, gender, and marital status. The difference post-exposure (t=1) is obtained by subtracting health outcome indicators of the control (T=0) from those of the treated (T=1) post strategy:

$$(E[y_i|t_i = 1; T_i = 1] = \alpha_0 + \beta_0 + \beta_1 + \delta_1) - (E[y_i|t_i = 1; T_i = 0] = \alpha_0 + \beta_0) = \beta_1 + \delta_1 \quad (3.2)$$

The difference at baseline (t=0) is obtained by subtracting health outcome indicators of the control (T=0) from those of the treated (T=1) before the strategy:

$$(E[y_i|t_i = 0; T_i = 1] = \alpha_0 + \beta_1) - (E[y_i|t_i = 0; T_i = 0] = \alpha_0) = \beta_1 \quad (3.3)$$

The DID estimator is obtained by subtracting the average in equation (3.3) from equation (3.2): $\beta_1 + \delta_1 - \beta_1 = \delta_1$ (Villa, 2016, Wooldridge and Imbens, 2007). In this respect, the DID estimate is the change in the difference in group (treatment) outcomes across time.

3.3.3 Data

The data consist of repeated cross-sectional ZDHS datasets collected before ASRH implementation in 2010 and at the end of the strategy period 2015 (ZIMSTAT & ICF 2016b). The design of the survey, which has been conducted every five years since 1988, is independent of the design of the ASRH strategy and, thus, eligibility to treatment and control groups makes the study a quasi-natural experiment. ZDHS datasets are large nationally representative samples collected every five years, which allows for policy analysis on pooled cross-sectional data. No other survey carried out at the national level collects data on health indicators as comprehensive as the ZDHS. In addition to that, the survey design is subject to international standards as it is implemented in over 100 countries globally.

3.3.3.1 Dealing with Estimation Issues

Survey design features

The ZDHS is a two-stage survey involving stratification into rural and urban areas of provinces and then cluster sampling using census enumeration areas from which households are randomly selected (ZIMSTAT and ICFI, 2016). Consequently, samples are not selected with equal probability as they would in the case of simple random sampling. Each sampling unit is thus allocated a sampling weight in the dataset. In this study, data is controlled for stratification and cluster sampling. All the reported standard errors are adjusted for cluster and stratification procedures for demographic health surveys.

Selection bias across time and across groups

There are four main assumptions for the DID methodology namey group composition stability, parallel trends, no pre treatment effects, and no spill over effects (Fredriksson and Oliveira, 2019, Schwerdt and Woessmann, 2020). Changes in group composition and time trends are a source of selection bias (Stuart et al., 2014, Heckman and Vytlacil, 2007) when applying the DID method. Since the study uses repeated cross-sectional data, there is no identifier in the datasets linking individuals sampled in the second period to the first period. Group composition changes would lead to selection bias (Stuart et al., 2014). The essay used propensity score matching to control for selection bias. To ensure that there are no spill over effects of control groups, the research removed households which had another member who's age range fits that of the control group. To ensure that there are no pre-treatment effects, the study used variables exogenous to treatments such as gender and place of residence in propensity score matching. The parallel trends assumption is normally verified using a plot on at least two observations before the intervention to verify that the treatment group would have had the same trend as the control group before the intervention (Fredriksson and Oliveira, 2019). Figure 3.2 illustrates the parallel trend using HIV prevalence for the period 2005 to 2010.

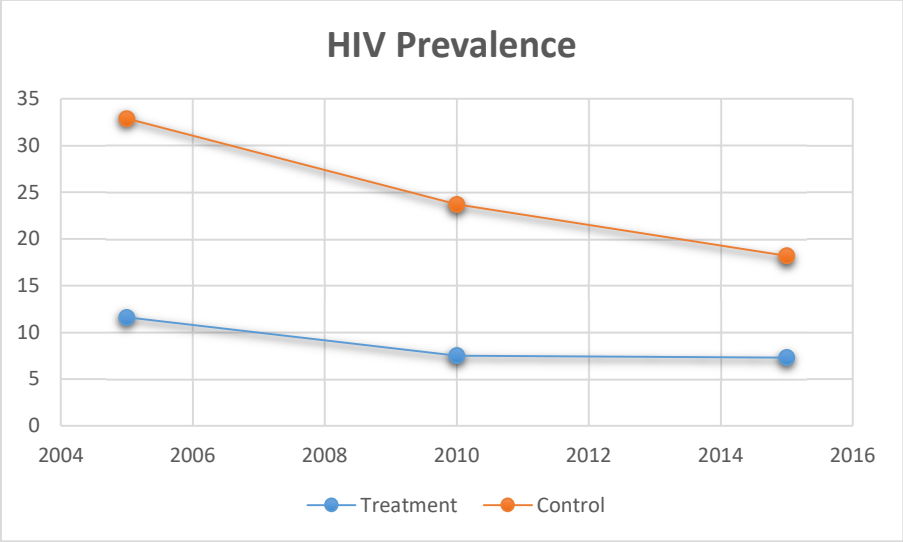


Figure 3.2. Parallel trend in HIV Prevalence

Source: (ZIMSTAT and ICF., 1988-2015)

Propensity score matching

The diff estimand used in this chapter combines the simple DID before and after approach, with propensity score matching and balancing. The propensity scoring approach, proposed by Rosenbaum and Rubin, is used to minimise selection bias from changes in group composition (Rosenbaum and Rubin, 1983). Kernel propensity scores are used to make the post-ASRH strategy groups (treated and control) similar to the pre-ASRH strategy groups (treated and control). Baseline characteristics of units of analysis are used to estimate the kernel propensity score. Kernel weights are then estimated from the propensity scores. The kernel weights are used to adjust equation 3.1 so that it produces a kernel propensity score weighted DID treatment effects. This study used the default standard error estimates which are obtained using linear regression. Both bootstrapped and robust standard errors can also be obtained by specifying the requirement in STATA. Data cleaning, the matching, and data analysis were conducted in Stata 15 statistical software.

3.4 Results

3.4.1 Socio-economic Variables

Table 3.2 provides characteristics of control and treatment groups and the statistical significance of their differences. It shows that chi-square tests of independence for categorical variables are all significant, suggesting that the data is not balanced on the socioeconomic variables across the four groups. The data need to be balanced to reduce selection bias. The differences in age and wealth index as continuous variables were diagnosed using one-way ANOVA, which showed significant differences. The age difference is expected due to the deliberate selection of these age groups for the strategy evaluation. The significance of differences in categorical variables was established using the chi-square test, while the difference in continuous variables was done using the ANOVA test. Data for age and wealth index (continuous variables) is in real numbers, while all other data is in percentages. Proceeding to the DID analysis with such unbalanced data leads to the selection bias problem highlighted earlier. Propensity scores are used to balance data for socio-economic variables. However,

only a few variables can be used for balancing to make the balancing procedure feasible (Guo and Fraser, 2010).

Table 3.2 Socioeconomic characteristics by group

Group	**1**	**2**	**3**	**4**	**p-value of differences**
Year	**2010**	**2010**	**2015**	**2015**	
Treatment	**Treatment**	**Control**	**Treatment**	**Control**	
Variable					
Age (Mean)	17	27	22	32	0.00
Wealth Index (Mean)	37.68	47.97	36.07	43.28	0.00
Gender %					
Female	52.10	56.31	61.11	60.03	
Male	47.90	43.69	38.89	39.97	0.00
Religion %					
Apostolic Christians	32.5	32.438	32.82	36.11	0.03
Other	67.5	67.562	67.18	63.89	
Education (%)					
None	0.42	24.61	74.49	0.49	
Primary	0.39	19.77	72.02	7.81	
Secondary	1.01	25.23	67.36	6.40	0.00
Higher	0.59	23.18	65.25	10.98	
Residence %					
Rural	70.77	53.55	65.49	54.96	
Urban	29.23	46.45	34.51	45.04	0.00
Observations					10,247

Source: ZDHS datasets 2010 and 2015

Proceeding to the DID analysis with such unbalanced data leads to the selection bias problem highlighted earlier. Propensity scores are used to balance data for socioeconomic variables. Only a few variables, however, can be used for balancing in order to make the balancing procedure feasible (Guo and Fraser, 2010). Propensity score balancing is used and table 3.3 shows how the balance has improved.

Propensity Score Balancing

Table 3.3 shows the means and standard errors prior to and post propensity score weighting. For groups 2 to 4, standard biases are presented relative to group 1. Disparities in group means have fallen and means are now closer to group 1 values after propensity score weighting, which implies a more balanced data set. Relative to group 1, disparities in standard biases are also lower after weighting.

Table 3.3: Standard Biases pre- and post-propensity score weighting

Panel A: unweighted standard biases								
mean					**Standard biases**			
	Group 1	**Group 2**	**Group 3**	**Group 4**	**sd**	**2 v 1**	**3 v 1**	**4 v 1**
wealth index	3.14	3.49	3.23	3.38	1.40	0.25	0.06	0.17
education	1.76	1.88	1.81	1.88	0.45	0.27	0.11	0.28
gender	0.48	0.44	0.41	0.41	0.50	-0.09	-0.14	-0.15
residence	0.33	0.47	0.39	0.47	0.47	0.32	0.14	0.31
Panel B: weighted standard biases								
mean					**Standard biases**			
	Group 1	**Group 2**	**Group 3**	**Group 4**	**sd**	**2 v 1**	**3 v 1**	**4 v 1**
wealth index	3.14	3.13	3.17	3.09	1.40	-0.01	0.02	-0.04
education	1.76	1.75	1.76	1.73	0.45	-0.02	0.00	-0.06
gender	0.48	0.48	0.48	0.47	0.50	0.00	-0.01	-0.02
residence	0.33	0.32	0.33	0.32	0.47	-0.01	0.00	0.00

Source: Author's own work

Legend: 2v1 is difference in mean between group 2 and group 1; 3v1 is difference in mean between group 3 and group 1; 4v1 is difference in mean between group 4 and group 1. Sd stands for standard bias

3.4.2 Difference-in-Difference Estimation Results

Tables 3.4-3.7 show results of DID analysis for six models estimating the impact measures of ASRH strategies with respect to condom use, STI prevalence, STI treatment, HIV testing, and HIV prevalence by comparing results of the treatment group relative to the control group. The "Before" panel shows estimates of the differences in the outcome indicator − change in condom use, for instance − between the treatment and control groups before the 2010 ASRH strategy. The "After" panel shows estimates of the differences in the outcome indicator between the treatment and control groups at the end of 2015. The last row labelled Diff-in-Diff shows the impact estimated, which is equal to the difference in the "After" panel estimates minus the difference in the "Before" panel estimates.

Table 3.4: National level strategy impact

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI treatment	(4) HIV Testing	(5) HIV Prevalence
Before					
Control	0.733	0.028	0.528	0.562	0.153
Treated	0.683	0.003	0.282	0.186	0.038
Diff (T-C)	-0.050	-0.025	-0.246***	-0.376***	-0.114***
	(0.088)	(0.007)	(0.080)	(0.022)	(0.018)
After					
Control	0.713	0.026	0.459	0.780	0.189
Treated	0.760	0.022	0.517	0.769	0.067
Diff (T-C)	0.047	-0.004	0.058	-0.011	-0.121***
	(0.108)	(0.013)	(0.111)	(0.036)	(0.027)
Diff-in-Diff	0.097	0.021	0.304**	0.366***	-0.007***
	(0.139)	(0.015)	(0.137)	(0.042)	(0.032)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

To effectively increase demand for ASRH services, implementers also involved parents as community gatekeepers (GoZ, 2009), which raised the need to adjust our control group such that it did not include parents of targeted youth. Households that had siblings targeted by the strategy were dropped from the analysis to control for spillover effects in the control group for the 2015 dataset.

3.4.2.1 Condom use

The ZDHS survey asked respondents about condom use during the last sexual encounter with the most recent partner and the number of sexual partners in the 12 months preceding the survey. A variable combining these two aspects to investigate condom use by individuals with more than one sexual partner in the last 12 months was created. As shown in table 3.4, condom utilisation by individuals in the treatment group who were sexually involved with at least two partners in the past 12 months was lower than the control group by 5 percent at baseline. After the strategy's implementation, utilisation in the treatment group was higher by 4.7 percent. The overall effect of the ASRH strategy was a rise in condom utilisation in the treatment group by 9.7 percent (diff-in diff row), albeit not statistically significant. The evidence is insufficient to conclude that there was any significant improvement in condom

utilisation by the targeted group.

3.4.2.2 STI Prevalence

At baseline, STI prevalence was 0.3 percent for the treatment group compared to 2.8 percent for the control group and a difference of 2.5 percent. Post-strategy, it increased to 2.2 percent and 2.6 percent for the treatment and control groups, respectively. The strategy's overall effect is not statistically significant and thus, insufficient evidence to conclude that the ASRH strategy had any bearing on STI prevalence.

3.4.2.3 STI treatment

At baseline, only 28.2 percent of STI infected young people sought treatment compared to 52.8 percent in the control group. Post-strategy, the treatment of STIs amongst young people increased to 51.7 percent but declined for the control group to 45.9 percent. The strategy's overall effect was an increase in STI treatment of 30.4 percent statistically significant at the 5 percent level.

3.4.2.4 HIV testing

The proportion of the targeted group who had ever had an HIV test before the strategy was 18.6 percent, which was lower than the control group's 56.2 percent. After implementing the ASRH programme, the proportion of the young people ever tested increased to 76.9 percent while the control group increased to 78 percent. The overall change in the proportion ever tested for HIV attributable to the ASRH strategy on the treatment group was an increase in the proportion tested of 36.6 percent, which is statistically significant at the 1 percent level.

3.4.2.5 HIV Prevalence

The prevalence of HIV for the treatment group was 3.8 percent at baseline. It was 11.4 percent lower than the control group with 15.3 percent prevalence, but the gap was statistically insignificant. After implementing the strategy, the gap widened to 12.1 percent significant at the 1 percent level, where the prevalence had increased to 6.7

percent for the treatment group and 18.9 percent for the control group. The difference in difference estimand suggests that although HIV prevalence increased in the targeted group, the ASRH strategy managed to lower its trajectory by 0.7 percent significant at the 1 percent level.

3.4.3 Subgroup Analysis

The DID analysis was further conducted by subgroups of gender, household wealth, and residential location presented in appendixes 3.1-3.3, respectively. The analysis revealed that the ASRH programme increased HIV testing for both males and females significantly at the 1 percent level and that the rise was more marked in females. HIV testing also went up significantly across wealth status and place of residence. The increase in HIV testing was higher for urban residents than for their rural counterparts and higher for treatment group members from rich households, all significant at the 1 percent level. HIV prevalence reduction was significant amongst urban youth but no significant change amongst their rural counterparts. STI prevalence increased significantly amongst rural youth without significant change amongst urban youths. The strategy increased the treatment of STIs for both males and females. STI treatment also increased amongst young people in rural areas, but that coincided with a rise in STI prevalence in the same group as well. No effect was noted on condom use across all subgroups.

3.4.4 Programme Intensity

A question that is worth answering is whether higher programme intensity brought about better results. To answer this question, the impact of ASRH was analysed by using the province with the highest number of ASRH programmes (Manicaland, with 14) as the treatment group and provinces with the lowest number of ASRH as control groups (Mashonaland Central and Mashonaland East with 3 programmes). Tables 3.5 and 3.6 present the effects of higher programme intensity on ASRH outcomes. In Table 3.5, results of Manicaland province are compared to Mashonaland Central while in Table 3.6 they are compared to the results of Mashonaland East.

As Table 3.5 shows, condom use in Manicaland province and Mashonaland Central were similar before the strategy. After the ASHR strategy, condom utilisation rose in

both provinces but was higher in Manicaland by 18.4 percent, in line with expectations of more programmes implemented.

Table 3.5: Difference-in-differences estimation results Manicaland vs. Mashonaland Central Province

VARIABLES		(1) Condom use	(2) STI Prevalence	(3) STI treatment	(4) HIV Testing	(5) HIV Prevalence
Before						
	Control	0.500	0.006	0.419	0.185	0.022
	Treated	0.500	0.004	0.345	0.190	0.024
	Diff (T-C)	0.000	-0.003	- 0.074	0.005	0.001
		(0.526)	(0.005)	(0.227)	(0.028)	(0.011)
After						
	Control	0.696	0.017	0.617	0.762	0.061
	Treated	0.880	0.051	0.700	0.784	0.039
	Diff (T-C)	0.184	0.034	0.083	0.022	-0.022
		(0.153)	(0.016)	(0.175)	(0.039)	(0.021)
Diff-in-Diff		0.184	0.037**	0.157	0.018	-0.023
		(0.548)	(0.017)	(0.287)	(0.048)	(0.024)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

However, the overall impact was statistically insignificant, and thus, it cannot be concluded that higher programme intensity translated to improvement in condom utilisation. While STI prevalence increased by 3.7% in the treatment group, significant at the 5 percent level, the corresponding increase in STI treatment by 15.7 percent is not significant. HIV testing also increased by 1.8 percent for Manicaland, but it was statistically insignificant. The rise in HIV prevalence in Manicaland province was lower than that of Mashonaland Central giving a DID estimate of 2.3 percent, which is not statistically significant. We thus do not find evidence of better outcomes with higher programme intensity for condom use, STI treatment, HIV testing, and HIV prevalence.

In Table 3.6, condom use increased by 32.6 percent, while STI prevalence and HIV prevalence increased by 1.8 percent and 0.2 percent, respectively. Treatment in STIs and HIV testing also went down in Manicaland relative to Mashonaland East province. None of these changes is statistically significant; thus, there is no evidence of any effects of higher intensity in the ASRH strategy implementation. An alternative way to assess intensity was to consider the number of programmes per population in a province. Matabeleland South province had the least youth population per programme in contrast to Mashonaland East.

Table 3.6: Difference-in-differences estimation results: Manicaland vs. Mashonaland East Province

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI treatment	(4) HIV Testing	(5) HIV Prevalence
Before					
Control	0.748	0.003	0.000	0.189	0.052
Treated	0.491	0.005	0.250	0.201	0.025
Diff (T-C)	-0.257	0.002	0.250	0.012	-0.028
	(0.341)	(0.004)	(0.227)	(0.030)	(0.015)
After					
Control	0.844	0.031	0.575	0.793	0.065
Treated	0.913	0.051	0.750	0.784	0.039
Diff (T-C)	0.069	0.020	0.175	-0.008	-0.026
	(0.108)	(0.019)	(0.213)	(0.039)	(0.021)
Diff-in-Diff	0.326	0.018	-0.075	-0.020	0.002
	(0.358)	(0.019)	(0.311)	(0.049)	(0.026)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

Since programmes relate to resources committed to improving ASRH indicators, this statistic suggests that resources in Mashonaland East were thinly spread on a higher population in contrast to Matabeleland South province. There is thus reason to expect superior outcomes for Matabeleland province. Table 3.7 shows the DID results of Matabeleland South as the treatment group and Mashonaland East as the control.

Table 3.7: Difference-in-differences estimation results: Matabeleland South vs. Mashonaland East Province

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI treatment	(4) HIV Testing	(5) HIV Prevalence
Before					
Control	0.922	0.000	0.000	0.169	0.052
Treated	0.712	0.002	0.334	0.175	0.042
Diff (T-C)	-0.210	0.002	0.334	0.006	-0.010
	(0.202)	(0.002)	(0.293)	(0.030)	(0.017)
After					
Control	0.860	0.025	0.562	0.764	0.069
Treated	0.640	0.023	0.636	0.837	0.152
Diff (T-C)	-0.220*	-0.002	0.074	0.073*	0.083***
	(0.127)	(0.014)	(0.223)	(0.042)	(0.030)
Diff-in-Diff	-0.010	-0.004	-0.260	0.067*	0.093***
	(0.238)	(0.014)	(0.368)	(0.052)	(0.034)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

The results suggest that Matabeleland South had a superior outcome only for HIV testing, which was 6.7% higher than Mashonaland East, which is statistically

significant at the 10 percent level. Matabeleland South province had a higher HIV prevalence relative to Mashonaland East. This finding contrasts with expectations and the insignificant impact on condom utilisation, STI prevalence, and treatment.

3.5 Discussion

Poor sexual and reproductive health among young people threatens their future, especially in countries with high HIV prevalence (Mondal and Shitan, 2013, Hindin and Fatusi, 2009, Zuma et al., 2016, Shisana et al., 2014). To preserve these young people's well-being, effective interventions need to be ascertained or improved through evaluation and monitoring. This impact evaluation study was premised on the expectation that the implementation of multiple complementary interventions of reproductive health would result in synergies of the interventions and better outcomes. In addition to that, it was expected that more resources employed in some provinces would lead to much better outcomes. The findings suggest that the strategy had significant effects on increasing the treatment of STIs, increasing HIV testing, and reducing the HIV prevalence trajectory. Subgroup analysis showed that the ASRH programme increased the uptake of HIV testing regardless of gender, household wealth, and residential location. Even more encouraging was the finding that the rise in HIV testing was higher amongst females, who are normally left behind. The evidence from the research, however, does not support any impact on the use of condoms nor reduction of STI prevalence. Furthermore, the study found mixed evidence on the effect of higher programme intensity.

The finding of HIV prevalence trajectory falling is in line with declining national-level HIV prevalence from a high of 25.6 percent at its peak in 1997 to 15.2 percent in 2010 and now to 13.4 percent in 2015 (O'Brien and Broom, 2011, ZIMSTAT and ICFI, 2012, ZIMSTAT and ICFI, 2016, MOHCC, 2017). Declining HIV prevalence can be brought about by HIV-infected people dying or decline in new infections, but recent scientific evidence suggests the latter (Hargrove et al., 2011, Halperin et al., 2011, Gregson et al., 2010, Gaillard, 2006, Steen et al., 2009). The ZIMPHIA report of 2016 shows that HIV incidence fell from 0.88 percent to 0.5 percent in 2015, which is attributed to progress in controlling the epidemic (MOHCC, 2017). Hargrove et al. (2011) relate the declining pattern to emigration, reduction in risky sexual behaviour, scaling up of

voluntary HIV counselling and testing as well as prevention of mother-to-child transmission and increased knowledge about HIV and AIDS. The increase in knowledge is also supported by the 2015 ZDHS report, which shows that knowledge of HIV prevention methods increased by 4 percent from 78 percent in 2010 (ZIMSTAT and ICFI, 2016). Halperin et al. (2011) established a positive association between the declining trends and reduction in extramarital, commercial, and casual sex relations, along with mass media and church-based prevention activities in Zimbabwe. Gregson et al. (2010) found the decline in HIV prevalence associated with the scaling up of ART in Zimbabwe, declining risky sexual behaviours, declining multiple sexual partners, and reduced involvement with commercial sex workers.

The current study found increasing HIV testing and a lower HIV prevalence trajectory occurring with no significant change in condom use. This leads to the conclusion that other prevention approaches identified in the literature had a dominant effect on reducing new infections. These include risk-reducing behaviour, namely extramarital, commercial, and casual sex relations complemented by CSE, mass media, scale-up of voluntary counselling and testing, and other church-based prevention activities (Halperin et al., 2011, Gregson et al., 2010). Scientific evidence reviewed earlier also indicates that CSE and media campaigns have a positive effect in reducing sexual risk behaviour (Haberland and Rogow, 2015, Michielsen et al., 2010, Rink and Wong-Grünwald, 2017) thus also reducing HIV infection and STIs (Jewkes et al., 2008, Scott-Sheldon et al., 2013).

The lack of impact on condom utilisation can be attributed to legal barriers in distributing condoms and contraceptives to Zimbabwe's school-going youth. Despite evidence that 41 percent of female youths are sexually active by the age of 18 (ZIMSTAT and ICFI, 2016), the government does not allow the distribution of condoms in schools (Bhebhe, 2018). This does not only contrast with the ASRH strategy, but it also works against the spirit of promoting safe sex, which, as evidenced by this study, affects condom uptake beyond school-going years. Chandra-Mouli et al. (2015) refer to such implementation as a piecemeal approach to ASRH. Such barriers to the distribution of such a critical commodity can reverse CSE's gains pointed out in the literature review instead of complementing them. This could also have contributed to the lack of progress in reducing STI prevalence, also established in our results.

STI treatment is important as it helps in managing STI incidence, STI prevalence (Steen et al., 2009), and HIV infection (Mayaud and McCormick, 2001). Under the ASRH strategy, STI patients were also offered HIV testing and counselling to facilitate the containment of HIV incidence and encourage the treatment of the sexual partner. The finding of STI treatment improving and HIV trajectory going down suggests a success story of the STI management approach adopted and resonates well with findings elsewhere in Africa (Grosskurth et al., 1995). This finding entails the need for more resources for the current STI management approach to consolidate gains as well as stocking hard to reach health facilities with medicines and HIV testing kits.

The lack of impact by the high-intensity implementation of the ASRH strategy comes against the study expectations. The researcher expected better outcomes in Manicaland, since it had more ASRH programmes implemented in comparisons to other provinces. The finding suggests poor coordination of ASRH programmes by implementers, as highlighted by Blum et al. (2015b). Marimo et al. (2015) attribute the lack of impact of the ASRH strategy to poor implementation, which was also highlighted by Michielsen et al. (2010) for interventions covered across 28 studies in Africa. This evidence suggests that more resources do not necessarily lead to better outcomes but that there is a need for better packaging of the combined strategies, which can be done by looking at each component's design, the distributions, and their interactions.

The unexpected increase of HIV prevalence in Matabeleland South has been observed in national reports before (Duri et al., 2013, WFP, 2014, MOHCC, 2017, NAC, 2018). HIV hotspots have been identified in artisanal mining areas and border towns in the province (WFP, 2014). The chapter recommends the use of pre and post-exposure prophylaxis with high adherence monitoring, which have been found more effective in recent literature for such high-risk groups because they do not apply protective measures consistently (Gray et al., 2018, Bekker et al., 2015, Fonner et al., 2016, Bekker et al., 2018a).

The results obtained in this chapter have some precedent in the literature. While the literature reviewed arrived at mixed evidence with respect to ASRH strategies, this

chapter indicated that the ASRH strategy successfully combated the HIV epidemic by increasing testing, reducing prevalence trajectory, and increasing the treatment of STIs. Such success in the literature has been attributed to the right age-targeting (Mwale and Muula, 2017) and targeting specific marginalised communities (Aninanya et al., 2015). Furthermore, this chapter does not find major discrepancies across socioeconomic groups; however, it suggests that there can be improvements in young people's sexual and reproductive health by revising government policy on condom distribution.

The Lancet Commission on adolescent health and well-being and other researchers have suggested implementing multi-interventions to complement each other to improve ASRH outcomes in pursuit of SDG3 (Fatusi, 2016, Patton et al., 2016, Chandra-Mouli et al., 2015, Griggs, 2015). The finding on policy intensity suggests the need to go beyond multi-pronged interventions to consider how to synergise them at the design and implementation stages. The implementation of HIV prevention strategies involved different programme implementers, each championing a particular intervention or set of interventions (Blum et al., 2015a). There was no framework to guide coordination or monitoring and evaluation of the various players (Marimo et al., 2015, Blum et al., 2015a). The study suggests developing a coordination framework to ensure that the efforts of the different implementers complement each other and avoid duplication of roles that waste resources that could be useful elsewhere. Such a framework has to guide implementers as they design their workplans. Besides, there is a need to align government policies from the status quo where on the one hand, the ASRH strategy promotes the uptake of contraceptives while on the other, government policy prohibits the distribution of condoms in schools (Bhebhe, 2018). Without such changes, some components might play a deleterious role, with the likelihood of cancelling the effect of the overall combination.

Considering the evidence in this chapter and previous studies, the chapter recommends better design of interventions and alignment of the strategy to national laws to reduce the strategy's implementation barriers. The study recommends better coordination of the various implementers to facilitate synergies to ensure better results of the strategy. To reduce STIs and HIV prevalence in identified HIV hotspots, the chapter recommends scaling up pre and post-exposure prophylaxis together with

increased adherence monitoring. HIV hotspots like mining areas are also characterised by sexual violence against women, which hinders the adoption of safe sexual practices (Damba et al., 2013). The study suggests that law enforcement agents enforce human rights in general and sexual and reproductive health rights in the HIV hotspots. To reduce STI prevalence, particularly in rural areas, the ASRH programme design can be improved by differentiating the approaches used to deliver services for youths in school relative to those out of school, to reach at-risk populations in HIV hotspots relative to those in less risky locations, as well as those in urban versus those in rural areas. Furthermore, delivering ASRH services through youth-friendly centres needs more monitoring to avoid them being dominated by male youths at the expense of females, as Blum et al. (2015a) found, particularly in rural areas, which are more patriarchal societies.

The limitations of this chapter are worth mentioning. The ASRH programme was implemented across the whole country, implying no perfect control group to compare to the targeted group. The age group closest to the treatment group but which was not the target of the ASRH strategy was used as the control group. Duflo (2001) used a similar identification strategy when studying a social experiment in Indonesia. There is a high chance that the post strategy control group could have been contaminated due to ASRH beneficiaries' presence in the household. The researcher managed this by excluding households that had members targeted by the strategy from the control group. Future ASRH strategies should collect baseline data and the end of strategy data for a full evaluation and use by future studies. The chapter also does not focus on how the youth make ASRH decisions. There is a need for further study to understand risk-taking amongst the youth towards ASRH to inform the design of effective service delivery in the future.

3.6 Conclusions

This study was undertaken with the expectation that the combined set of ASRH interventions coordinated at a national level in Zimbabwe would result in increased ASRH outcomes. Evaluating this strategy's effectiveness, using the DID method combined with propensity score matching, the chapter concludes that the ASRH strategy resulted in improvements in HIV testing, STI treatment, and reduced HIV

prevalence trajectory. The study could not find evidence supporting an impact on condom use or reduction of STI prevalence. Furthermore, the research did not find superior outcomes in regions with more resources. This suggests that the key for better outcomes from future ASRH strategies lies in redesigning service delivery approaches to target HIV hotspots and rural areas and improving the strategy's coordination and monitoring, as well as aligning and enforcing government policies that promote sexual and reproductive health rights.

Appendix 3.1: Impact by Gender

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI Treatment	(4) HIV Testing	(5) HIV Prevalence
			Panel (a) Males		
Before					
Control	0.792	0.024	0.574	0.405	0.098
Treated	0.740	0.004	0.306	0.116	0.033
Diff (T-C)	-0.051	-0.020**	-0.268*	-0.290***	-0.066***
	(0.095)	(0.010)	(0.146)	(0.028)	(0.020)
After					
Control	0.753	0.029	0.303	0.625	0.095
Treated	0.765	0.025	0.494	0.653	0.030
Diff (T-C)	0.012	-0.004	0.191	0.028	-0.064*
	(0.107)	(0.020)	(0.165)	(0.063)	(0.033)
Diff-in-Diff	0.063	0.017	0.459**	0.317***	0.001
	(0.143)	(0.022)	(0.220)	(0.069)	(0.039)
			Panel (b) Females		
Before					
Control	0.398	0.034	0.538	0.727	0.227
Treated	0.436	0.002	0.221	0.253	0.042
Diff (T-C)	0.038	- 0.032***	-0.318***	-0.474***	-0.185***
	(0.229)	(0.012)	(0.092)	(0.031)	(0.031)
After					
Control	0.380	0.023	0.296	0.908	0.267
Treated	0.733	0.020	0.543	0.866	0.097
Diff (T-C)	0.354	-0.003	0.247**	-0.042	-0.170***
	(0.332)	(0.016)	(0.124)	(0.034)	(0.039)
Diff-in-Diff	0.315	0.029	0.565***	0.432***	0.015
	(0.403)	(0.020)	(0.155)	(0.046)	(0.049)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

Appendix 3.2: Impact by Household Wealth

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI Treatment	(4) HIV Testing	(5) HIV Prevalence
			Panel (a) Rich		
Before					
Control	0.837	0.012	0.288	0.657	0.086
Treated	0.888	0.004	0.349	0.187	0.043
Diff (T-C)	0.051	-0.008	0.060	-0.470***	-0.043**
	(0.086)	(0.006)	(0.141)	(0.026)	(0.018)
After					
Control	0.866	0.024	0.513	0.818	0.176
Treated	0.800	0.022	0.582	0.768	0.064
Diff (T-C)	-0.066	-0.002	0.070	-0.050	-0.112***
	(0.114)	(0.017)	(0.181)	(0.047)	(0.039)
Diff-in-Diff	-0.117	0.006	0.009	0.421***	-0.069
	(0.143)	(0.018)	(0.230)	(0.053)	(0.043)
			Panel (b) Poor		
Before					
Control	0.736	0.038	0.627	0.447	0.265
Treated	0.480	0.004	0.285	0.182	0.031
Diff (T-C)	-0.256	-0.034**	-0.342***	-0.265***	-0.234***
	(0.156)	(0.015)	(0.116)	(0.043)	(0.040)
After					
Control	0.603	0.031	0.509	0.780	0.234
Treated	0.657	0.020	0.489	0.769	0.072
Diff (T-C)	0.054	-0.011	-0.020	-0.011	-0.162***
	(0.191)	(0.020)	(0.211)	(0.051)	(0.039)
Diff-in-Diff	0.310	0.023	0.322	0.254***	0.072
	(0.246)	(0.025)	(0.241)	(0.067)	(0.056)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

Appendix 3.3: Impact by Place of Residence

VARIABLES	(1) Condom use	(2) STI Prevalence	(3) STI Treatment	(4) HIV Testing	(5) HIV Prevalence
			Panel (a) Urban		
Before					
Control	0.886	0.015	0.444	0.655	0.086
Treated	0.864	0.003	0.236	0.173	0.049
Diff (T-C)	-0.022	-0.012	-0.208	-0.482***	-0.037*
	(0.097)	(0.008)	(0.155)	(0.029)	(0.020)
After					
Control	0.854	0.028	0.491	0.824	0.200
Treated	0.813	0.025	0.571	0.767	0.065
Diff (T-C)	-0.042	-0.003	0.080	-0.058	-0.135***
	(0.123)	(0.020)	(0.166)	(0.051)	(0.046)
Diff-in-Diff	-0.020	0.009	0.288	0.424***	-0.098**
	(0.156)	0.022	(0.227)	(0.058)	(0.050
			Panel (b) Rural		
Before					
Control	0.626	0.038	0.584	0.484	0.199
Treated	0.578	0.003	0.302	0.193	0.033
Diff (T-C)	-0.048	-0.035***	-0.283***	-0.291***	-0.165***
	(0.125)	(0.011)	(0.093)	(0.030)	(0.026)
After					
Control	0.642	0.022	0.430	749	0.181
Treated	0.690	0.020	0.457	0.771	0.069
Diff (T-C)	0.049	-0.002	0.027	0.022	-0.112***
	(0.144)	(0.016)	(0.151)	(0.048)	(0.032)
Diff-in-Diff	0.096	0.032*	0.310*	0.313***	0.053
	(0.190)	(0.019)	(0.178)	(0.056)	(0.041)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Author's own work

Chapter IV

Tertiary students sexual and reproductive health risk preferences

4.1 Introduction

The Zimbabwean government spends an average of $200,000 on HIV and STI prevention activities annually (NAC, 2015), yet youths seem to continue engaging in risky SRH behaviour, including unprotected sex and multiple sexual partners. Consequently, Zimbabwean youths have poor ASRH outcomes such as high STI infection, HIV incidence, and teen pregnancy. The previous chapter evaluated the impact of a government strategy implemented in 2010 to improve ASRH utilisation and outcomes. It established that there was no significant impact on condom use nor reduction of STI prevalence, which suggests high sexual risky behaviour among youths. Furthermore, the chapter found that regions with more ASRH resources did not produce superior ASRH outcomes, suggesting that resources were not efficiently allocated to youth needs. Inefficient allocation of resources could have been due to misunderstood risk preferences. To increase ASRH service utilisation such as condoms and increase efficiency in converting resources, youth risk-taking ought to be understood.

This chapter seeks to establish sexual and reproductive health risk preference parameters of youths in a tertiary education setting and their determinants using an alternative theoretical framework to study youth risk-taking. The analysis intends to inform policy action to address risky sexual and reproductive health behaviour of youth. The chapter contributes to the literature by implementing prospect theory following Attema et al. (2016), finding that expected utility theory, a gold standard for risk preference elicitation, is violated for the health domain. A thorough research on existent literature has indicated that apart from the current chapter, no other study has established prospect theory parameters specific for youths in the sexual and

reproductive health domain. The chapter also presents a more technical approach to studying utility preferences for ASRH services in contrast to the most applied qualitative approaches.

Sexual and reproductive risk-taking behaviour imposes morbidity and cost consequences through treatment and lost productivity (Lawless et al., 2013). Zimbabwe's HIV prevalence of 14.5% (National AIDS Council, 2018) is currently ranked 6th highest in the world. As of 2016, 1.4 million Zimbabweans (National AIDS Council, 2018) were HIV positive, all of whom require treatment as per the current treatment guidelines, which requires up to $350,000 per year (NAC, 2015). Understanding sexual and reproductive health behaviour becomes imperative for the government to prevent new infections for the government, given its shrinking fiscal space.

Establishing utility preferences and their parameters within prospect theory will assist policymakers with an alternative approach that brings another perspective to understanding the uptake of ASRH services and understanding youths and adolescents risk attitudes, and decisions. The interpretation of their utility preferences and decision-making under uncertainty within prospect theory might bring about the need to change how the ASRH packages are designed. Furthermore, since prospect theory health preferences have not yet been established for youths and adolescents, the prospect theory parameters estimated for this study can be used for other healthcare studies targeted for this age group and applying the same theory.

4.2 Literature Review

4.2.1 Theoretical Literature

Both psychology and economic theories guide the chapter. From a psychological perspective, Korin (2016) identifies individualist, structuralist, and health belief theories to guide health decisions before full adulthood. The individualist school argues that health outcomes are within a person's control and result from a person's choices regarding the maintenance of their health. This school focuses on changing individuals' knowledge, attitudes, and beliefs to obtain preferred health behaviour and

outcomes. The structuralist school of thought, on the other hand, argues that there are community, national, and international level factors that are beyond an individual's control. This school focuses on the political, environmental, social, technological, economic, and legal environments within which an individual operates (Bandura, 2004). Advocacy and Policymaking have shifted towards a hybrid of the two schools which seek to understand how structural factors influence individual factors to determine health behaviour and outcomes (Glass and McAtee, 2006, Head and Noar, 2014, Field et al., 2014, Peters and Kok, 2016).

The health belief model seeks to explain adherence to preventive health services. The model predicts that an individual adheres to take preventive action if they perceive that: they are susceptible to illness; the illness has severe consequences; taking action will mitigate consequences; and that the costs of taking action are lower than the benefits (Korin, 2016). This paper blends a hybrid of these psychology theories with the prospect theory from economics to analyse personal and structural level data from university students to establish their risk-taking parameters and understand how they influence those parameters within the prospect theory framework.

4.2.1.1 Expected Utility Theory

Demand for health models (Cameron et al., 1988, Pohlmeier and Ulrich, 1995, Muurinen, 1982, Grossman, 1972, Jacobson, 2000, Wagstaff, 1993) do not necessarily explain how individuals make decisions for health in the presence of risk, or more specifically, uncertain health outcomes. Decision making has thus been traditionally made within Expected Utility Theory (EUT) developed by Bernoulli (Bernoulli, 1954). Von Neumann et al. (2007) established four axioms that a rational person is expected to adhere to in making decisions under EUT. These are independence, completeness, transitivity, and monotonicity with reduction and invariance added later (Moscati, 2016, Takemura, 2019).

Transitivity assumption holds that given a lottery offering prize A, which is preferred to B and also that B is preferred to another prize C, then A should also be preferred to C. Independence assumption entails that given a lottery with prize A, which can be

attained with probability p and is weakly preferred to prize B also with a probability p, then the introduction of another prize C with a probability 1-p should not disturb the original preference ordering of A to B (Cohen, 1996). This should hold when the prizes are mutually exclusive. When the prizes are complementary, for example, when prize C complements B more than it does A, then there can be a reversal in preference ordering (Cohen, 1996). In health, the axiom implies that when a common consequence is added to two decisions that a patient or medical practitioner should make, the choice should be the same as when the common consequence was not added.

Monotonicity holds that for two identical gambles, the decision-maker chooses the gamble with more of the preferred outcome (Takemura, 2019). In terms of probability, monotonicity implies that the gamble with a higher likelihood of the preferred outcome and lower likelihood of the less preferred outcome should be chosen. The reduction axiom holds that a decision-maker is indifferent between two gambles that have the same probability and prize of winning (Cohen, 1996). The invariance assumption holds that how similar prospective outcomes are presented (framed) does not affect preference over those outcomes. When uncertain prospective health outcomes, for example, are presented as gains, we should expect a patient's choice that is not different from a case where they are presented as losses (Chiu and Wu, 2010).

Given an array of uncertain outcomes $(x_1, x_2, \dots, x_n)$ with known probabilities $(p_1, p_2, \dots, p_n)$ that should sum to one, and a rational decision-maker for whom the EUT axioms hold true, then quantitative numbers can be assigned to each possible outcome as the utility value $\big(u(x_i)\big)$. The lottery or prospect with the highest probability-weighted utility value is expected to be the choice of the rational decision-maker $U(x) = \big(\sum_{i=1}^{n} p_i\, u(x_i)\big)$ (Chiu and Wu, 2010, Moscati, 2016). The shape of the utility function $U(x)$ describes the decision makers' risk preference. A concave utility function which implies diminishing marginal utility resembles risk aversion, whereas a convex function resembles a risk seeking.

However, individual decision-making has been observed to be inconsistent with the predictions of EUT (Attema et al., 2016, Moscati, 2016, Abellan-Perpinan et al., 2009)

and thus the emergence of prospect theory as an alternative framework. Monotonicity violations have been noted in experiments where the outcome C is greater than the minimum outcome of the superior gamble (Kourouxous and Bauer, 2019). Decision-makers have been found violating the reduction axiom by overestimating utility in compound lotteries, which involve a higher probability of winning in earlier stages than lotteries in reduced form (Tversky and Kahneman, 1979). Probability weighting, which is considered in prospect theory but ignored in EUT, is considered a EUT violation source (Tversky and Kahneman, 1979).

4.2.1.2 Prospect Theory

In 1979, Daniel Kahneman and Amos Tversky published a paper titled “Prospect Theory: An Analysis of Decision under Risk," in which they demonstrated violations of EUT predictions over several classes of choice problems (Tversky and Kahneman, 1979). They demonstrated that contrary to the prior view of individuals as risk-averse, people are only risk-averse for large probability gains but risk-seeking for small probability gains (Chiu and Wu, 2010). Furthermore, they showed that this pattern flips to risk aversion for small probability losses and risk-taking for large probability losses (Chiu and Wu, 2010), resulting in an S-shaped utility function. This is characterised as the fourfold pattern of risk attitudes (Tversky and Kahneman, 1992). The invariance assumption thus holds that preferences between lotteries are independent of how they are presented. While the invariance assumption under EUT is violated in actual decision making, prospect theory posits that one option can produce different preferences when framed differently but in consistence with the fourfold pattern.

In addition to addressing the violations in EUT axioms, Tversky and Kahneman (1979) introduced value functions under prospect theory (PT), which attach weighted probabilities to outcomes. The S-shaped probability weighting function in prospect theory results in individuals overvaluing small probabilities (more unlikely events) whilst undervaluing large ones (most probable events). This means that individuals treat more unlikely health outcomes more importantly than those with high likelihood, and this has been confirmed in the empirical literature (Tversky and Kahneman, 1992, Camerer and Ho, 1994, Bleichrodt and Pinto, 2000). Applied to health, a patient might

accept an intervention that reduces their risk of contracting a disease from 6 percent to 1 percent but reluctant to accept an intervention that reduces the risk from 85 percent to 80 percent.

Furthermore, Tversky and Kahneman (1979) introduced framing into decision making by showing that people classify outcomes into losses and gains rather than final wealth as expounded under EUT. They showed that the final choice decision relies on the change in the final value of their choices' outcomes. These final decisions depend on whether the decision-maker views the gamble as a gain or loss relative to a reference point under prospect theory for which due to risk aversion, people prefer avoiding losses and, as such, are more sensitive to losses than gains of the same magnitude.

In the case of male circumcision used in this paper, a man may accept circumcision if informed that it results in additional years lived from current age due to its potential to reduce risk of HIV infection with the VMMC procedure, and that fewer years may be lived without the procedure. The additional years, in this case, are a gain. An alternative framing as a loss involves informing the man that given the current life expectancy of say 60 years in Zimbabwe, if they choose circumcision, they have a chance of living surpassing that by 10 more years to 70. On the other hand, without the procedure, they would probably not live beyond 50 years, thus, a loss of 10 years.

Prospect theory identifies two phases in decision making. The first phase involves the editing or analysis of offered prospects whereby individuals ignore their similarities and focus on their differences. In the second phase, the decision-maker evaluates each of the edited prospects and selects of the one yielding the highest value.

The Editing Phase

The editing phase involves coding, combination, segregation, and cancellation. Reference point location and coding of outcomes as gains or losses are susceptible to the formulation of the offered prospects and individual expectations. Furthermore, decision-makers can simplify prospects by combining probabilities with identical outcomes.

The final value of an edited prospect, V, is expressed in terms of π and v. π associates with each probability p a decision weight $\pi(p)$, which reflects the impact of p on the overall value of the prospect. v assigns to each outcome x a number $v(x)$, which reflects a subjective value of that outcome. v measures the gains and losses, or, the value of deviations from the reference point.

Given a prospect with outcomes $x$and y with probabilities p and q respectively, the final value of the edited prospect is:

$$V(x,p;y,q) = \pi(p)v(x) + \pi(q)v(y) \qquad (4.1)$$

where $v(0) = 0$, $\pi(0) = 0$, and $\pi(1) = 1$, V is defined on prospects whilst v is defined on outcomes but both coincide for certain outcomes $V(x,1.0) = V(x) = v(x)$

For strictly positive and negative prospects ($x > 0 > y$, $x < 0 < y$and $p + q = 1$), equation (4.1) changes to

$$V(x,p;y,q) = v(y) + \pi(p)[v(x) - v(y)] \qquad (4.2)$$

Equation (4.2) says that the value of strictly positive and negative prospects equals the value of the riskless component plus the value difference between the outcomes times the weight of the more extreme outcome.

Prospect theory predicts that people evaluate outcomes basing on changes relative to a reference point instead of net asset levels. Given a gamble that has a 20 percent chance of winning \$50, which costs \$10 to participate, the expected value of the gamble is:

0.2X\$50+0.8X0 = \$10,

which is equal to the cost of the gamble. People would thus be expected to be indifferent between accepting the gamble or not under EUT. Maurice Allais, a French economist, was the first to formalise the criticism of EUT for its failure to explain why most people always declined such a gamble using experimental evidence of what is now called the Allais paradox (Allais, 1953). The certain loss of the \$10 does not compensate for the 20 percent chance of winning the \$50 and 80 percent chance of

not winning anything. Prospect theory explains that individuals will decline the gamble because they put more weight on losses than gains, as explained in subsequent paragraphs.

Figure 4.1 shows an illustration of the prospect theory value function. The curvature of the value function explains risk aversion relative to the reference point. The value function in figure 4.1 is steeper for losses than for gains, which means that losses weight more than gains.

Value Function

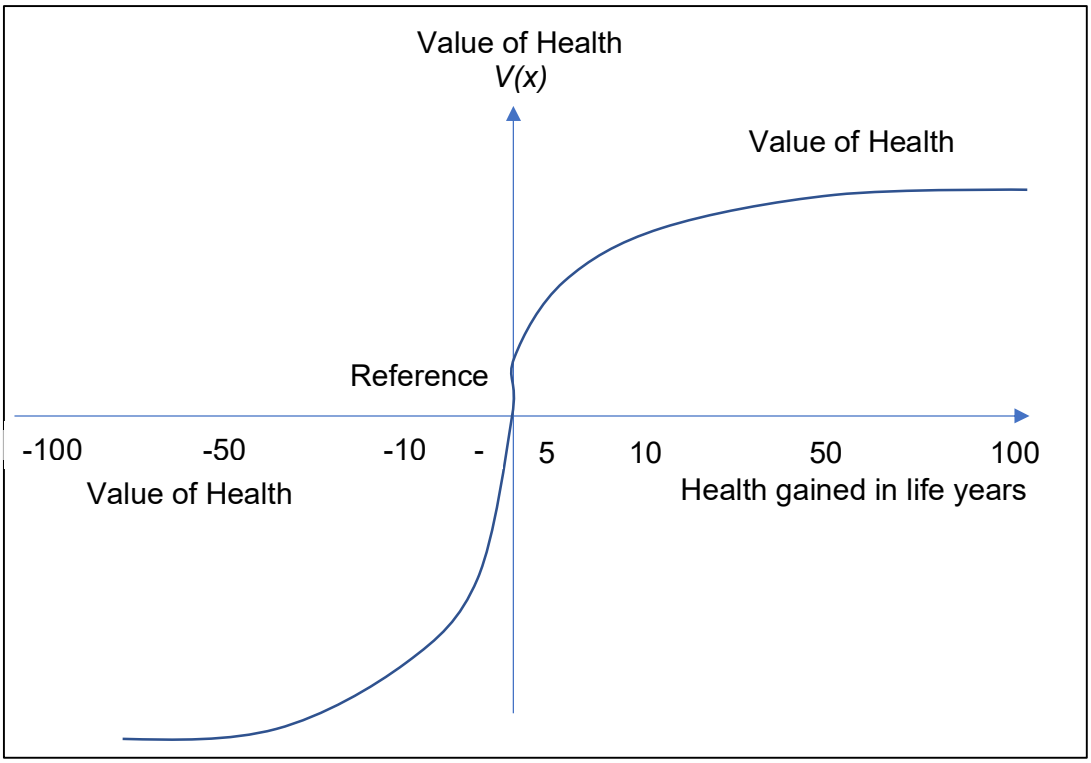


Figure 4.1: The S-Shaped value function

Adapted from Kahneman and Tversky (Tversky and Kahneman, 1992)

The value function is concave for values above the reference point and convex for losses below the reference point. This means that differences between small gains or losses close to the reference point are assigned a high value whilst differences further away from the reference point are assigned small values. $5 when gained by someone

with an initial endowment of $10 has more weight that when gained by someone with an initial endowment of $1000. In figure 4.1, the increase from $10 to $15 involves an initial endowment closer to the reference point of $0. This is in contrast to an increase from $1000 to $1005, which has an initial endowment further from the reference point and as such is weighted lower. Although the objective value of $5 is the same, it is viewed as smaller further away from the reference point. The value function is steeper for losses than for gains, which implies that losses are assigned greater values than those assigned to gains of identical magnitude. This means that the chance of losing $10 in a gamble is given more weight than that of gaining $10.

The S-shape (convexity for losses followed by concavity for gains) and the value function's steepness have three implications. Firstly, the S-shape implies that minor changes near a reference point have a higher influence on decisions than equivalent changes further from a reference point. In monetary terms, a person might walk across town to buy a $10 worth of shoes on promotion at $8 but would not do so to buy a $600 fridge on promotion for $598.

Figure 4.1 above presents the S-shaped value function for the health domain, with the horizontal axis having health gains to the right, and health losses to the left all being measures in life years. Applied to health, a patient might accept an intervention that reduces their risk of contracting a disease from 6 percent to 1 percent but reluctant to accept an intervention that reduces the risk from 85 percent to 80 percent. The S-shape is asymmetric around the reference point, which implies why people are not indifferent between gambles with an equal probability of losing or winning the same amount. For this reason, the framing of a decision choice in terms of gains or losses, thus affects decision-making behaviour.

The loss domain to the left of the reference point in figure 4.1 is convex but for the gain domain it is concave. Convexity is associated with risk-seeking whilst concavity is associated with risk avoidance. McDermott (1998) postulated that the perceived domain determines the risk-taking of an individual. The asymmetry between gains and losses also implies that people will be risk-seeking for losses but risk-averse for gains. The prospect of losses is given more weight than that of gains, and consequently, individuals take greater risks to avoid losses than to safeguard a conceivable gain.

The probability weighting function

In EUT, individuals multiply the value of an outcome with the likelihood of it actually occurring while PT predicts that individuals multiply the perceived value of outcomes by decision weights (Chiu and Wu, 2010). Prospect theory predicts that people overweight low-probability events and underweight high probability events. A person, for example, is expected to take the decision over action that increases chances of contracting an infection from 0 to 1 percent more weight (more seriously) than they would for an action that increases the chance from 60 to 61 percent even though there is 1 percent increase in likelihood under both circumstances (McDermott, 1998).

Cumulative Prospect Theory

In its original version, Prospect Theory has two limitations, namely (i) it can only be applied to gambles with two non-zero outcomes and (ii) it predicts that people will sometimes choose dominated gambles. Kahneman and Tversky (Tversky and Kahneman, 1992) revised the theory into Cumulative Prospect Theory (CPT), which addressed these two limitations.

CPT is compatible with gambles with more than two outcomes:

$$(x_1, p_1; x_2, p_2; \ldots; x_n, p_n)$$

where outcomes are arranged in increasing order. Whilst an individual would evaluate the gamble under EUT as

$$\sum_{i=1}^{n} p_i U(W + x_i),$$

where W is current wealth, the evaluation under prospect theory would be

$$\sum_{i=1}^{n} \pi_i v(x_i),$$

The same tenets of PT (reference dependence, loss aversion, diminishing sensitivity, and probability weighting) apply to CPT as well. Lab experiments testing utility theory involve complex scenarios and analytical approaches. This study implemented prospect theory which involves only two choices instead of CPT, which would involve more than two. More choices would increase training time of study participants which was limited for the researcher.

4.2.2 Empirical Evidence

The empirical analysis of risk preference with prospect theory as a guiding framework has been applied in a number of domains which involve a lot of risk-taking, including finance (Gregoriou et al., 2019), agricultural economics (He et al., 2019, Nguyen and Leung, 2009) and political economics (Pavlović, 2019, Barberis, 2013). The findings from these studies confirmed prospect theory predictions, the impact of reference points in decision making, the inclination towards reducing losses than consolidating gains of similar magnitude, and the overweighting of low-probability events.

In the field of health economics, Abellan-Perpinan et al. (2009) showed that prospect theory produces better health evaluations over risky prospects. Their findings showed that utilities could not be reliably transferred to different decision contexts. This suggests that although prospect theory performs better than EUT, there is a need for studies such as the current one to establish context-specific utility parameters in different health conditions or epidemiological contexts so that health decisions consider the preferences of those affected by them. They also established a violation of monotonicity under expected utility theory. Several studies have applied CPT in health economics. They involved hypothetical diseases affecting variables such as life years (Bleichrodt and Pinto, 2000, Attema et al., 2013); tinnitus (Happich et al., 2009), cancer (Bern-Klug et al., 2019), nurses attitudes and behaviours (Rostami, 2019), health state valuation (Pinto-Prades et al., 2019, Lipman et al., 2019) and disease surveillance (Attema et al., 2019).

Rasiel et al. (2005) examined risk-seeking by terminally ill patients who make risky treatment decisions as their health conditions worsen in contradiction with risk aversion assumed by the concave EUT function. They found that patients' reference points determine their treatment choice, which would not be possible with EUT. Bleichrodt and Pinto (2000) investigated the probability weighting function from utility preferences elicited from students through hypothetical diseases that threaten their life duration. The study confirmed the overweighting of small probabilities. Attema et al. (2013) quantified the full function of CPT in the health domain and measured utility of life duration, probability weighting, and loss aversion. They also presented hypothetical life-threatening diseases scenarios to respondents in a controlled environment. They found evidence of loss aversion in gains and risk aversion for

losses, a violation of monotonicity, and dominance axioms of EUT. Massin et al. (2018) compared lottery to scale based tools of risk elicitation and established that domain specific risk attitude measures have better predictive power compared to general risk attitude measures.

Happich et al. (2009) investigated whether preferences of people not affected by a disease can be used to make decisions for those affected using 210 tinnitus (sound in the head) patients and 210 non-patients. They elicited risk preference (preference for accepting treatment for tinnitus) using the standard gamble and time trade-off approaches. The non-parametric analysis which they used established that the non-affected were more risk-averse than those affected. This implies that risk preferences cannot be generalised but need to be informed by the affected groups. This means that youth's risk preferences elicited in this chapter can be used to inform uncertain ASRH interventions in the future.

In relation to empirical estimates of CPT parameters in the health domain, Lim and Bruce (2015) established risk aversion in losses and gains ranging between 0.43 and 0.93 and loss aversion ranging between 1.93 and 2.09 in a weight gain or loss choice study. Bleichrodt et al. (2007) determined the utility of two hypothetical health states and established a loss aversion parameter ranging from 1.53 to 2.13. Attema et al. (2013) established loss aversion ranging between 0.76 and 1.83 whilst Attema et al. (2016) obtained a loss aversion parameter of 1.88 and 1.97. These findings are all consistent with parameters estimated in the theoretical papers, although lower than those obtained in the monetary domain (Tversky and Kahneman, 1979). Bleichrodt and Pinto (2000) examined the probability weighting parameter comparing linear approximation to power approximation. They established a probability weighting range of 0.25 to 0.71 for linear approximation whilst power approximation ranged from 0.22 to 0.68. Bleichrodt et al. (2007) later established higher estimates ranging from 0.35 to 1. These are in line with those established by Tversky and Kahneman (1992). This suggests that probability weighting in the health domain also lies somewhere between 0 and 1, although both extreme ends of the spectrum are rare.

The probability weighting parameter explains how individuals react to small and large probabilities of losses and gains that could be derived from ASRH interventions. The

probability weighting parameter value less than one established in the literature indicates a person who places more importance on outcomes than their likelihood (Nguyen and Leung, 2009). In the ASRH context, such individuals will be more sensitive to HIV infection than its likelihood. They adopt safe sexual practices and consume ASRH services that reduce HIV and STI infections such as circumcision for males (McGillen et al., 2018) and screening for HPV-induced precancerous lesions for females (Looker et al., 2018). A risk-taking youth will not bother taking up any of these ASRH services despite an active sexual life. Taking up ASRH interventions to reduce the risk of contracting HIV, such as male circumcision and cervical cancer screening, is consistent with loss aversion in contrast to someone who does not take any safety measures (Simianu et al., 2016).

Both parametric and non-parametric techniques in bivariate and multivariate form have been applied to study the variation of risk parameters across different groups of participants. Rouyard et al. (2018) used Mann-Whitney U tests and chi-square tests to explain differences in risk parameters amongst patients with chronic disease. They found the parameters differing by age, but gender and education had no effect. Attema et al. (2016) used ordinary least squares (OLS) regression techniques and established that loss aversion increased with income. Goudie et al. (2014) established that subjective well-being is a predictor of risky health behaviour such that better-off individuals are more likely to be risk-averse. They also found that females, especially those married, are more risk-averse.

The variation of risk-taking by gender is also confirmed in other literature (Croson and Gneezy, 2009). Lundborg and Andersson (2008) established that females view the risk of mortality from smoking as higher than males. Other researchers, however, found females more risk-taking than males. Eckel et al. (2012) conducted a field experiment with students from a variety of high schools in the USA and found that girls are less risk-averse whilst taller youths are more risk-taking. Gruber and Machamer (2000) found that economic incentives and macroeconomic conditions can be used to reduce ASRH risk-taking among female teens.

Evidence on the effect of socioeconomic factors on risky sexual and reproductive health in Zimbabwe exists but not within the prospect theory framework. Using survey

data from students enrolled at two universities in Zimbabwe, Nkomazana and Maharaj (2014) established that male students recognised high chances of HIV transmission from their partners than female students. The authors suggest that this is due to the perceived higher risk of female students by their male counterparts who view them as risk-taking when it comes to sexual activity. Gwede et al. (2001) also used multivariate regression techniques to analyse cross-sectional data collected from secondary school students for determinants of risky youth behaviour in Zimbabwe. They found that gender was a predictor of early sexual debut, with males reporting earlier sexual initiation. Shumba et al. (2011) assessed the risk of multiple sexual partners using a convenient sample of students at the University of Zimbabwe. They established that female students engaged in risky sexual behaviour for financial benefits from sexual partners whilst males did it for enjoyment. Kranzer et al. (2018b) assessed the role of fixed and uncertain incentives on the uptake of HIV testing in Zimbabwean adolescents. Results from logistic regressions show that both fixed and lottery incentives had a positive effect on the uptake of HIV testing. This finding implies that prospects of financial benefits from the health intervention increases risk avoiding behaviour.

Using qualitative data collected from interviews and focus group discussions, Mapfumo et al. (2012) investigated on the risk of multiple sexual partners amongst female students at the University of Zimbabwe. The determinants of risky sexual behaviour that they established include poverty, the need for financial benefits from sexual partners and, living far away from spouses. Financial well-being has been found to reduce risky SRH behaviour and outcomes in Lesotho (Björkman Nyqvist et al., 2018) and Kenya (Thirumurthy et al., 2016). While evidence from Lesotho showed that even uncertain prospects of financial well-being effectively reduce risk taking (Björkman Nyqvist et al., 2018), findings from Kenya showed that uncertain prospects of financial well-being were less effective (Thirumurthy et al., 2016).

While the studies above are related to the inquiry of this thesis, this essay elicited risk preferences for ASRH interventions- VMMC and cervical cancer screening- and socioeconomic factors underlying these preferences. The socioeconomic factors reviewed so far have also been identified as barriers to circumcision and cervical cancer screening, as evidenced in other studies. Ortblad et al. (2018) assessed

predictors of male circumcision in South Africa and found that proximity to a health facility, knowledge of HIV status, and negative HIV test results were associated with higher uptake service uptake. Skolnik et al. (2014) investigated barriers to VMMC amongst Lesotho men aged above 18 using focus group discussions. They found that Lesotho men feared the discomfort stemming from the procedure being invasive, anaesthetic injections, stich removal, and a lengthy period in pain and abstinence. This fear contributes to men taking the risk of infection by foregoing circumcision. Other barriers identified include the fear of HIV testing, which is compulsory before circumcision, indirect costs such as transport, and lack of comfort with female medical staff. These barriers are also confirmed for south African men (George et al., 2014).

With respect to cervical cancer screening, several studies have established socioeconomic determinants of cervical cancer screening. For example, Ackerson and Preston (2009) applied decision theory to investigate why women do not seek cancer screening when the service is available. They found fear of cancer and knowledge of its risks associated with reduced uptake of cancer screening. Chorley et al. (2017) reviewed the literature on experiences and barriers of cervical cancer screening in researches conducted in the UK, Australia, Sweden, and Korea. They found that some women considered the probability of getting cervical cancer as remote due to their current self-assessed sexual risk behaviour and age. Respondents tended to ignore their past sexual behaviour. Self-assessed health status also determined screening as respondents highlighted that they would seek screening if they observed symptoms such as vaginal discharge. Some of those who had been screened described the procedures as painful, uncomfortable, and causing side effects like pain and bleeding. Others cited negative encounters with poor communication given as the reason. Jia et al. (2013) assessed barriers to the uptake of cervical cancer screening using a conveniently drawn sample of women above 26 years old in China. Using chi-square, students' t-test, and logistic regression analysis, they found that lack of knowledge about cervical cancer screening benefits is a barrier to the uptake of the service. The current research will thus assess whether risk aversion and loss aversion parameters differ between those who have been exposed to comprehensive ASRH knowledge and those who have not.

In literature, risk preference has been elicited using either Dohmen et al. (2011) self-assessed risk tolerance scales or Holt and Laury (2002) lottery tasks. Massin et al. (2018) found no difference in the Dohmen scale and lotteries' performance in eliciting risk but did find that domain-specific measures predict risk taking better than general risk-taking measures. This was also supported by Verschoor et al. (2016), who found risk preferences obtained from economic experiments mirroring real-life choices but only in the same domain.

Lottery tasks themselves can be presented as certainty equivalences (Attema et al., 2016) or series of lottery tasks (Tversky and Kahneman, 1979). Difficulty in lottery stimuli and framing has led to health economics researchers opting for certainty equivalence (Attema et al., 2016), and this is largely due to the hypothetical nature of the scenarios presented to research participants. However, this chapter used a series of lottery tasks on health interventions that the participants were already familiar with. These are male circumcision and cervical cancer screening procedures that are offered to youth as part of the national ASRH strategy.

Prior application of PT relied on hypothetical choices by students asked to act as strategic investors (Tversky and Kahneman, 1979, Tversky and Kahneman, 1992), managers (Sebora and Cornwall, 1995) and, patients (Happich et al., 2009, Attema et al., 2013). Massin et al. (2018) used hypothetical scenarios involving participants having to imagine being critically ill at old age and choosing between two therapies with uncertain outcomes. Li et al. (2017) asked participants to imagine having a disease and choosing between two different treatments with uncertain outcomes in additional life years lived. They stated additional life years up to 50 which they acknowledged as unrealistic. This use of hypothetical life years was adopted in adapting research tools for the present study as presented in appendix 6.5 and 6.6. The present study thus follows the approach of hypothetical interventions to the population of interest. Although research participants for this chapter were familiar with male circumcision and cervical cancer screening interventions, the uncertainty associated with their outcomes will be hypothetical to elicit risk taking behaviour.

The challenge with experimental data, especially involving students, lies in the seriousness of study participants under such conditions compared to a real-world

scenario. For the current research, participants were offered $5 each to compensate for their time and to promote commitment and concentration. Although this reward is small in monetary terms, it is equivalent to ten days' lunch at the university cafeteria. Such a payment is common in risk elicitation experiments (Attema et al., 2016, Attema et al., 2018, Massin et al., 2018) but mostly to only compensate for the time taken to undertake the tasks.

The use of students and the hypothetical choices offered raises concerns over external validity. While this study takes the same approach, its strength is that the students are actually the targeted population from which the study results can be generalised. Furthermore, Sebora and Cornwall's (1995) justification for the approach stems from its acceptance as a methodological procedure in previous groundbreaking studies (Tversky and Kahneman, 1979, Tversky and Kahneman, 1992); scientific evidence of similarity in behaviour between students and practising strategy managers (Bateman and Zeithaml, 1989), and from evidence that students whenever they differ, provide a more conservative test of the phenomenon under investigation (Greenberg, 1987, Fredrickson, 1985).

This literature review has shown that prospect theory has been applied to study decision-making around health interventions with uncertain outcomes. The literature review showed prospect theory parameter ranges, which also vary with context as well as socioeconomic factors. The parameters determine the curvature of the youths' risk-taking function, which in turn highlights risk-taking behaviour. This chapter's contribution is to establish ASRH specific prospect theory risk parameters that are missing in the literature despite the need to reduce risk-taking among youths. Such parameters are needed so that effective ASRH interventions are designed and implemented to reduce risk-taking. Although socioeconomic factors associated with risk-taking are known in Zimbabwe, they were not researched within the prospect theory framework despite the weaknesses of EUT. Another contribution of the chapter is that unlike reviewed literature that used participants not linked to the interventions, this study's participants belong to the targeted population for which the study results can be generalised.

4.3 Methodology

4.3.1 Research Design

In line with the chapter's objectives to: 1) establish sexual and reproductive health risk preference parameters of youths in tertiary education, and; 2) identify their socioeconomic determinants, this section describes the study design. The focus on university students was a result of the nature of the data required to estimate the utility parameters. The data collection instruments consist of lotteries and probabilities. Youths with advanced education such as university level can better appreciate probability concepts compared to those with basic education. Students' use in research eliciting prospect theory risk preferences in a lab setting instead of the general population was pioneered by Tversky and Kahneman (1979), and more recently adopted by (Ahern et al., 2014, Attema et al., 2013, Li et al., 2017). The major criticism labelled against this approach is that the students are not acquainted with real-life situations, and thus research results do not represent the population's actual behaviour (Guala, 2005). For this study, university students considered for the research were aged between 19 and 24 which is within the WHO definition for adolescents and youths (Aarø et al., 2014).

4.3.2 Study site and sample

Two hundred and fifty students were offered the chance to participate in the study out of a population of 4,000 undergraduate students at the Bindura University of Science Education in Zimbabwe (BUSE). The university was selected due to convenience as the researcher was based at the university, and sampling from all the universities in the country would be costly. The use of students at the researcher’s institution of affiliation is also a common practice adopted by prospect theory pioneers (Tversky and Kahneman, 1979) as well as recent researchers (Ahern et al., 2014, Attema et al., 2013, Li et al., 2017). The students are familiar with the ASRH interventions as they are already offered the same interventions through the university clinic. University students are also familiar with probabilities, through quantitative courses, which make up the majority of the risk elicitation tool.

A large representative sample size selected using random sampling is normally considered the best approach to determining parameters that can be generalised to a whole population. The nature of pairwise lottery choice data required for the study and the laboratory setting in which participants need to avoid disturbance and interference make large sample surveys difficult. Prior studies reviewed thus far have used small samples that are easy to manage and accommodate (Tversky and Kahneman, 1979, Barberis, 2013). The limitation of this study's small sample from one institution not randomly sampled limits generalizability of findings to the population of interest spread throughout the country. In mitigation, the student population enrolled at BUSE comes from different areas of Zimbabwe and as such, is expected to reflect the features of youth from different parts of the country.

The researcher used convenient and snowball sampling in inviting university students, who are based on campus and could get to the Economics Laboratory without extra costs. The students were approached in their classes. Convenient sampling is less time-consuming and inexpensive compared to probability sampling approaches, though it, admittedly, lacks generalizability (Bornstein et al., 2013). Snowball sampling involved asking the students who actually turned up to participate in the research to invite their friends and acquaintances (Emerson, 2015). The sample size of 250 was considered appropriate from benchmarking with current literature in the application of prospect theory experimental literature ranging from 25 to 250 (Tversky and Kahneman, 1979, Lipman and Attema, 2019, Arrieta et al., 2017).

4.3.3 Data collection

Data collection involved collecting two types of data in relation to the objectives of the chapter. The first type of information consisted of risk preference data, while the second type of data was the participants' socio-economic information. Questions on elicitation of risk preferences, reference points, and incentives (or stimulants) were adapted from experiments conducted by Nguyen and Leung (2009) and Tanaka et al. (2010). Socioeconomic and behavioural data was obtained using a questionnaire developed by John Cleland for the World Health Organisation for use in ASRH surveys (Cleland, 2001). These research instruments are presented in appendix 4.4 to 4.6.

4.3.4 Pre-Testing

Pre-testing helps identify problems that the questionnaire might cause during actual implementation (Presser et al., 2004). Firstly, the research tools were shared with two members of the teaching staff, two members of clinical professionals, and two professional counsellors in June 2017. Contributions from these professionals led to a revision in the content of the instruments, which were then pilot tested on 15 students to revise for the second time. The researcher described the study for the pilot study, explained the socioeconomic questionnaire, the hypothetical risky choice tasks procedure, and the informed consent procedure in 15 minutes. The research participants were asked to complete the socioeconomic questionnaire and lottery choice tasks. The pretesting and pilot testing led to a revision in the length of the socioeconomic questionnaire and the time allowed to two hours.

On implementing the final research tools, research participants were allowed into the lab in groups of 15. The researcher described the study, explained the socioeconomic questionnaire, the hypothetical risky choice tasks procedure, and the informed consent procedure in 15 minutes. Afterwards, the students were given 15 more minutes to browse through the questionnaire and lottery tasks and their instructions as well as the informed consent form and sign it if they were willing to proceed. Students who wanted more time were given the documents and encouraged to return the next day. Students who required further clarity engaged the researcher physically and via Whatsapp. The questionnaires were only available in English because that is the language of delivery for all their courses. In addition to that, the students already have a course in health education which focuses on ASRH utilisation and consequences. Nevertheless, students were free to communicate with the researcher in any language for clarity. Seventeen students, representing 6.8% of the participants, showed inconsistence errors, which suggested they were not focused on the tasks. The researcher reoriented the students and informed them of the risk they posed in contaminating the study and they complied.

Students were given 1 hour to fill in the questionnaire and an additional 30 minutes for the pairwise lottery tasks. The students were supervised and assisted with direction and clarifications by the researcher. Whilst students were allowed to take small breaks and return, others were more familiar with utility elicitation and took less time to complete the tasks. The whole process was set for 2 hours but ranged between 1 hour 30 minutes and 2 hours 30 minutes. As indicate earlier, students were paid a US$5 participation fee, and it was explained that this was to compensate for their opportunity cost of time and that the participation in the study carried no other incentives beyond the paid amount. The data was collected between 1 June 2018 and 28 June 2018.

To clarify the procedure for lottery choice questions, panels in table 4.1 labelled Series 1, the first row, for example, shows the two options over which the respondent had to make a choice. Option A involves not accepting the ASRH intervention, which is either circumcision for males or cervical cancer screening for females.

Taking this option is hypothetically associated with surviving 15 additional years from current age with a probability of 30% in the best-case scenario or 7 additional years in the worst-case scenario, which has a probability of 70%. Option B entails accepting the intervention with condition that one gets an additional 20 years in the best case scenario with a probability of 10% or an additional seven years in the worst-case scenario with a probability of 90%.

The research participant weighs the two options, picks one which suits their risk preferences, and repeats the same exercise over 13 more choices in series 1. The difference in these choices is the increasing hypothetical years in option B's best-case scenario, increasing expected life years. Series 2 also has 14 pairwise lottery tasks whilst series 3 has 7 tasks. Some respondents would choose one option throughout the choice tasks while some would switch at some point later. The information on switching, as shown in table 4.3 was used to establish risk preference parameters.

Table 4.1: Three series of pairwise lottery choices in life years

Series 1

Option A		Option B		Expected Life
Additional life years (p=0.3)	Additional life years (p=0.7)	Additional life years (p=0.1)	Additional life years (p=0.9)	years difference (B-A)
15	7	14	7	-1.7
15	7	16	7	-1.5
15	7	19	7	-1.2
15	7	22	7	-0.9
15	7	25	7	-0.6
15	7	29	7	-0.2
15	7	34	7	0.3
15	7	40	7	0.9
15	7	47	7	1.6
15	7	55	7	2.4
15	7	64	7	3.3
15	7	74	7	4.3
15	7	86	7	5.5
15	7	100	7	6.9

Series 2

p=0.9	p=0.1	p=0.7	p=0.3	B-A
15	12	18	8	0.3
15	12	20	8	1.7
15	12	22	8	3.1
15	12	25	8	5.2
15	12	28	8	7.3
15	12	31	8	9.4
15	12	35	8	12.2
15	12	39	8	15
15	12	44	8	18.5
15	12	49	8	22
15	12	55	8	26.2
15	12	62	8	31.1
15	12	69	8	36
15	12	77	8	41.6

Series 3

p=0.3	p=0.7	p=0.1	p=0.9	B-A
25	-4	30	-21	-6
4	-4	30	-21	4.5
1	-4	30	-21	6
1	-4	30	-16	8.5
1	-8	30	-16	10.5
1	-8	30	-14	11.5
1	-8	30	-11	13

Source: Author's own work

4.3.5 Ethical matters

Gatekeeper clearance to use research facilities and students at BUSE was obtained from the university Deputy Registrar for Academic Affairs, as presented in appendix 4.1. The study protocol was approved by the University of KwaZulu Natal Human Research Ethics Institutional Review Board, as presented in appendix 4.2. Study participants were required to fill in the consent form shown in appendix 4.3, and were informed that the participation into the study was voluntary and that the participants could withdraw from the study anytime should they deem it necessary.

4.3.6 Data Analysis

4.3.6.1 Estimating Prospect Theory Parameters

This study evaluated decision making in the case of two outcomes, and as such, prospect theory is appropriate. As indicated above, the study adopted the utility function

$$\text{PT}(x, y; p) = \text{pv}(x) + (1 - p)v(y) \qquad (4.3)$$

as presented in Nguyen & Leung (2009) where the value function:

$$v(x) = \begin{cases} x^{\alpha} & \text{for } x \geq 0 \\ -\lambda(-x^{\alpha}) & \text{for } x < 0 \end{cases} \qquad (4.4)$$

and the probability weighting function:

$$w(p) = e^{[-(-\ln p)^{\gamma}]} \qquad (4.5)$$

In equations (4.3) to (4.5), $\text{PT}(x, y; p)$ is the expected prospect value over binary prospects with outcomes (x, y) with corresponding probabilities $(p, 1 - p)$. The factor $(x, y; p)$ was specified for both available options in all scenarios. The value function $v(x)$ in equation 4.5 was examined with x^{α} for $x > 0$ or $-\lambda(-x^{\alpha})$ for $x < 0$. The parameter α represents risk aversion as highlighted by the value function's concavity, λ represents the degree of loss aversion, γ in equation (4.4) represents a proxy for probability weighting. Parameter estimates of values $\gamma = 1$ and $\lambda \neq 1$ would lead to the utility model collapsing to expected utility (Liu, 2013). This research sought to estimate the prospect theory parameters α, λ, and γ for tertiary education students.

The study went further to establish the socio-economic determinants of these parameters using maximum likelihood estimation techniques. To estimate the prospect theory parameters in equations 4.4 and 4.5, the study adopted the random utility model developed by Nguyen and Leung (2009):

$$U_i^{A:j} = PT_i^{A:j}\left(X_i; Z^j\right) + \varepsilon_i^{A:j} \qquad (4.6)$$

where $U_i^{A:j}$ is the utility that participant i receives from option A for scenario j. If the utility fits the prospect theory framework, utility becomes $PT_i^{A:j}$ which is a function of characteristics about the individual X_i such as gender and income, and information about probabilities and payoffs for each scenario Z^j. $\varepsilon_i^{A:j}$ is the error term representing the unobservables and follows a normal distribution $f(\varepsilon)$. The functional form would be similar for option B:

$$U_i^{B:j} = PT_i^{B:j}\left(X_i; Z^j\right) + \varepsilon_i^{B:j} \qquad (4.7)$$

The probability that the research participant chooses option A over B is obtained by:

$$Pr(A) = Pr\left\{PT_i^{A:j}\left(X_i; Z^j\right) + \varepsilon_i^{A:j} \; - \; PT_i^{B:j}\left(X_i; Z^j\right) \; - \; \varepsilon_i^{B:j} \geq 0\right\}$$

which gives:

$$Pr(A) = \Phi\left\{PT_i^{A:j}\left(X_i; Z^j\right) \; - \; PT_i^{B:j}\left(X_i; Z^j\right)\right\} \qquad (4.8)$$

where

$\Phi(x) = \int f(\varepsilon)d\varepsilon$ is a cumulative distribution function of the error term ε.

Equation (4.8) can be expressed as a function of a latent index $I_i^{A:j}$ such that

$$Pr(A) = \Phi\left\{I_i^{A:j}\right\}$$
$$Pr(B) = \Phi\left\{I_i^{B:j}\right\}$$

Parameters in equation (4.4) and (4.5) can be estimated using the maximum likelihood technique (MLE) using the function:

$$lnL^i\left(\alpha, \lambda, \gamma; y^j, X_i; Z^j\right) = \sum_{j=1}^{35}\left\{\left[ln\Phi\left(I_i^{A:j}\right)|y_i^j = 1\right] + \left[ln\Phi\left(I_i^{B:j}\right)|y_i^j = 0\right]\right\} \qquad 4.9$$

where $y_i^j = 1$ if the participant chooses option 1 and zero otherwise. To establish the extent to which the prospect theory parameters α, λ, and γ change with respect to variations in socioeconomic factors, this study estimated equations 4.10 and 4.11 using OLS and interval regression techniques:

$$\alpha = \alpha_0 + \beta X + \eta \qquad (4.10)$$

$$\lambda = \theta_0 + \beta X + v \qquad (4.11)$$

Harrison et al. (2007) developed a Stata module to estimate these MLE parameters. This, however, requires huge computational power not available to the researcher. An alternative approach was developed by Tanaka et al (2010) and explained in more detail by Liu (2013) and Bocqueho et al. (2020). This approach uses the participant's switch point from lottery A to B on the 14 series of questions for each of the first two sets. Switching at row *s* means that the prospect value of lottery A is greater than that of lottery B before that switch:

$$\text{PT}(A) > \text{PT}(B_{s-1}) \quad (4.12)$$

and

$$\text{PT}(A) < \text{PT}(B_s) \qquad (4.13)$$

after the switch.

Substituting equation 4.4 into 4.1 and 4.2 where probabilities are replaced by the probability weighting function presented in equation 4.5 gives a prospect value function defined by:

$$\begin{cases} y_A^\alpha + \left(e^{[-(-\ln p_A)^\gamma]}\right)(x_A^\alpha - y_A^\alpha) > y_B^\alpha + \left(e^{[-(-\ln p_B)^\gamma]}\right)\left(x_{B_{s-1}}^\alpha - y_B^\alpha\right) \text{ for equation 4.12 and} \\ y_A^\alpha + \left(e^{[-(-\ln p_A)^\gamma]}\right)(x_A^\alpha - y_A^\alpha) < y_B^\alpha + \left(e^{[-(-\ln p_B)^\gamma]}\right)\left(x_{B_s}^\alpha - y_B^\alpha\right) \text{ for equation 4.13.} \end{cases}$$

Mathematically solving these inequalities simultaneously at the switchpoints of the first two sets of pairwise lotteries produces estimates for α and γ parameters. These solutions, however, come in intervals with minimum and maximum values. Tanaka et al. (2010) published a matrix of the midpoints of these values for each switch point as presented in appendix 4.7 for the risk aversion parameter and 4.8 for the probability weighting parameter. If a respondent switched preference from option 1 to option 2 on the seventh question in series 1 and switched on question 10 on the second series, then the value of the risk aversion parameter is 0.55 as shown in appendix 4.7.

4.3.6.2 Variable Definition

The respondent's age, family monthly income, and the student's monthly budget are continuous variables. The dummy variable sex takes a value of 1 for males and zero otherwise. Residence of origin takes the value one if the place of family residence is urban and zero otherwise. Early sexual debut takes the value of 1 if the respondent initiated sex before 18 years and 0 otherwise. Multiple sexual partners take the value 1 if the student has multiple sexual partners at the same time since college enrolment and 0 otherwise. HIV test takes the value of 1 if the respondent ever had an HIV test or 0 otherwise. An ASRH intervention would take the value of 1 if the respondent had already undergone cervical cancer screening for females and circumcision for males in real life and 0 otherwise. Poverty takes the value of 1 if the respondent's family income was less than sample median income and 0 otherwise. Alcohol takes values 1 if student drinks at least once a week and 0 otherwise. ASRH knowledge takes the value of 1 if the student has heard any ASRH package information, which consists of interventions including HIV, circumcision or cervical cancer links, and 0 otherwise. Religion takes the value of 1 if the student values it as important in their life decisions and 0 otherwise.

4.3.6.3 Bivariate Analysis

Once the risk parameters α for risk aversion, and γ for probability weighting and λ for loss aversion were established, they were assessed for their relationship with socioeconomic factors. The Wilcoxon rank-sum test was used to examine differences in risk parameters by gender, wealth status, region of origin, and religious affiliation. This is important to see whether there is scope for encouraging risk aversion by acting on socio-economic variables.

4.3.6.4 Multivariate Analysis

Ordinary least squares and interval regression techniques were used to analyse the relationship between socio-economic determinants and the risk aversion parameter

and the loss aversion parameter, respectively, as shown in equations (4.10) and (4.11). The analysis on determinants of the risk aversion parameter provides information on socioeconomic variables that can be targeted to promote risk and loss aversion among youth.

4.3.7 Data Reliability and Validity

Researchers have debated how best to design economic experiments to ensure external validity so that findings are useful for decision making. Viceisza (2016) suggests framing the experimental instructions and the phenomena to contexts familiar with subjects. Hill and Viceisza (2012) and Menapace et al. (2015) have shown that lottery tasks framed in agricultural contexts predict farmers' risk behaviour better than generalised risk elicitation instruments. This is also verified by Dohmen et al. (2011). This study framed lottery questions around sexual and reproductive health prevention interventions that the students are familiar with for two reasons. Firstly, the students have a course called HIV and AIDS, which explains SRH issues and interventions. Secondly, the students are already offered the same interventions through the university clinic and town hospital.

Prior application of PT (Kahneman and Tversky, 1979, Tversky and Kahneman, 1992, Sebora and Cornwall, 1995) relied on hypothetical choices by students asked to act as strategic investors (Kahneman and Tversky, 1979, Tversky and Kahneman, 1992), managers (Sebora and Cornwall, 1995), patients (Happich et al., 2009, Attema et al., 2013). The use of students and the hypothetical choices offered raises concerns over external validity. While this study takes the same approach, its strength is that the students are the targeted population on which it is hoped the study results can be generalized. Furthermore, Sebora & Cornwall's (1995) justification for the approach stems from its acceptance as a methodological procedure in previous ground-breaking studies (Kahneman and Tversky, 1979, Tversky and Kahneman, 1992); scientific evidence of similarity in behaviour between students and practising strategy managers (Bateman and Zeithaml, 1989) and from the evidence that students, whenever they differ, provide a more conservative test of the phenomenon under investigation (Greenberg, 1987, Fredrickson, 1985).

The study on risk preferences is carried out at a single university since it enrolls students without geographic restrictions, as indicated above. As such there is no reason to believe that the study excludes certain regions in the country. In addition to that, the university shares the same attributes as other universities in the country in terms of its location in an urban setting (yet accommodating both rural and urban populations), as well as operating under government grants.

4.4 Results

Table 4.2 shows the socio-economic characteristics of the study participants. Forty-eight percent of the participants were male. The median age of participants was 22, which is comparable to studies that used similar research participants (Lim and Bruce, 2015, Lipman and Attema, 2019, Arrieta et al., 2017). The median income for the student's family was US$700, and the median family size was 5 people, while the students reported a median food and subsistence allowance of US$100 per month.

Table 4.2: Socioeconomic characteristics

Characteristics	**Median**	**IQR**
Age (median)	22	21- 22
Family monthly income (median)	$700	$500-$1,000
Own monthly budget (median)	$100	$60-$150
Household size	5	4-6
	Frequency	**%**
Sex (male)	121	48.40%
Residence (urban)	174	70.16%
Early Sexual debut (adolescent sex)	75	30.61%
Ever had more than one partners at a time since college	74	31.90%
Ever had HIV test	181	76.05%
Ever had Cervical cancer screening (female)	21	16.80%
Males circumcised (male)	22	19.13%
Poverty (less than median income)	92	39.83%
Drinks alcohol	82	33.06%
Religion is more important in the respondent's life	214	85.60%
Research participants (N)	250	

Source: Author's own work

From the sampled participants, 70% indicated that they come from an urban background. Thirty-one percent of the participants debuted sexual activity during adolescence. Although 76% had taken an HIV test, circumcision was low for males at 19% and cervical cancer screening for females at 17%. The proportion tested for HIV, circumcised, and screened for cervical cancer mirror those for the national level (ZIMSTAT and ICFI, 2016). Respondents from households below the median income were 40%, 33% drank alcohol regularly, while 86% considered religion an important aspect of life.

4.4.1 Prospect Theory Parameters

Prospect theory parameters were obtained using a combination of lottery choice question switch pints and midpoints of the intervals estimated using probability midpoint technique as described above. Table 4.3 shows the number of participants switching at different points in series 1, 2, and 3. Switching at points 2 to 13 implies that participants switched from option A to option B on those questions. Switching point 1 and never represents participants who never switched their choices in a particular series.

Table 4.3: Number of subjects switching by points

	Number of subjects making the switch		
Switching points	Series 1	Series 2	Series 3
1	56	163	160
2	3	16	27
3	2	15	2
4	3	2	13
5	5	3	1
6	2	1	14
7	48		
8	56	5	
9	18		
10	5	3	
11	6	2	
12	6	1	
13		2	
14	4	1	
Never	36	36	33

Source: Author's own work

The risk parameters extracted using these switch points were heterogeneous to the study participants. The average risk aversion parameter α was 0.7 IQR [0.5-1.05], which is less than 1, which means that the average student had a more risk-avoiding attitude when it comes to accepting sexual and reproductive health interventions with uncertain outcomes. Such youths would prefer interventions with less uncertain outcomes. As such, the youth would be more inclined to avoid interventions associated with fear of the unknown and pain or discomfort, such as circumcision and cervical cancer screening. Discomfort or fear can also come from who provides the intervention and the place of provision. As such, youth would be more inclined to avoid services delivered by the opposite gender, older clinic staff, or services delivered in places where the youths are likely to be stigmatised.

The probability weighting parameter was 0.8 IQR [0.25-0.95], which means that the youths pay more attention to outcomes than their likelihood since it is less than 1. If there is a likelihood that an ASRH intervention can be harmful, such as male circumcision, then these youth are more likely to focus on the pain and suffering associated with the failed circumcision procedure than the fact that such an event is unlikely. If staff who deliver an ASRH intervention are likely to embarrass patients reporting with an STI, or if there is a chance that their condition is likely to be availed to other clinic visitors, the youth decline seeking the health intervention despite the lower probability of that occurring. The issue of privacy of the youths' STI status, for example, was a big concern leading to the Zimbabwean ASRH strategy to consider youth-friendly clinics where youths could be attended away from general outpatient wards. The unfriendliness of clinic staff was also seen as a likely impediment of ASRH service seeking, and the government realised the need for peers manning the youth-friendly rooms at health centres to reduce discomforts associated with older personnel.

The study found evidence of loss aversion since the estimated parameter 2.26 IQR [1.69- 3.69] was positive. In prospect theory, losses loom larger than gains. This means that when faced with prospects of a gain or loss of the same probability, individuals give more consideration to the loss. In the ASRH context, this means the youths who participated in the study would give more weight to the prospect of a circumcision procedure going wrong than being a success even though scientific evidence points out that this would be rare. In terms of a clinic environment, these

youths are more likely to fixate on the likelihood of their STI condition being leaked to the community despite that clinic staff are sworn, ethical professionals. In overall, the parameter estimates did not satisfy the condition $\gamma = 1$ and $\lambda \neq 1$ for which the utility model would reduce to expected utility (Liu, 2013).

4.4.2 Bivariate Analysis of the Effect of Socioeconomic Factors

The risk aversion, probability weighting, and loss aversion parameters presented above were for the whole sample. Table 4.4 shows differences in medians of these parameters by characteristics of the participants in the first column to show if these parameters differ by risk-taking variable. Regular alcohol drinkers, youth from poor households, those who debuted sexual activity early, and those with multiple sexual partners exhibited higher risk-taking. Males and youths from urban areas were also more risk-taking, but their female and rural counterparts were statistically insignificant.

Table 4.4: Wilcoxon rank-sum test

Socio-economic variables	**Rank sum**		
	Risk aversion α	**Probability function** γ	**Loss aversion** λ
Alcohol: non-drinker	0.6***	0.80	2.66
drinker	0.85	0.80	2.89
Sex: male	0.70	0.85**	2.71
Female	0.65	0.75	2.70
Poverty: worse off	0.75**	0.90	2.76
better off	0.70	0.98*	2.74
Residence of origin: urban	0.70	0.80	2.48
Rural	0.68	0.83	2.81
Religion: more important	0.65	0.80	2.76
less important	0.83	0.80	2.71
Early Sexual Debut: before 18 years	0.75*	0.75	2.75
after 18 years	0.65	0.80	2.75
Multiple Sexual Partners: no	0.65**	0.80***	2.89*
Yes	0.98	0.88	2.54

Source: Author's own work ; *** p<0.01, ** p<0.05, * p<0.1

The median probability function parameter was less than one for all the variables, which suggests an inverted S-shaped value function for the average youth. This means that the participants did not put much importance on the likelihood of outcomes

but were more focused on the outcomes themselves. Females showed more risk aversion tendencies than males as well as youths who delayed sexual debut. Only multiple sexual partners were associated with differences in loss aversion with youths without multiple sexual partners showing higher loss aversion than those with multiple partners.

4.4.3 Multivariate correlation with socio-economic variables

Table 4.5 shows the multivariate regression results of socio-economic characteristics on risk aversion and loss aversion parameters for the entire group in column 1 and by gender in columns 2 and 3. A positive coefficient means the student was more risk-taking, but a negative means less risk-taking and thus more risk-averse. Alcoholism, multiple sexual partners, and poor family backgrounds were associated with high risk-taking. Alcohol takers had a risk-taking parameter of 0.15 units higher than non-drinkers. Youths reporting multiple sexual partners had a risk-taking parameter of 0.12 units higher than those non-sexually active or those with single sexual partners at a time. Youths from a poor background had a risk-taking parameter of 0.16 units more than their better-off counterparts.

Respondents with recent ASRH knowledge exposure had a risk aversion parameter 0.04 units higher than those without current ASRH information. Alcoholism had a positive correlation with risk-taking for both male and female participants, while multiple sexual partnerships and poorer background had an increasing effect on risk aversion for females. Participants who had received ASRH information more recently exhibited less risk-taking, especially females.

For the loss aversion estimates, a positive sign implies less aversion of losses, while a negative sign implies more loss aversion. Alcohol and poverty were associated with less aversion of health losses. Alcohol taking had a loss aversion parameter 1.63 units less than their non-drinking counterparts. Poor youths had a loss aversion parameter of 1.39 units lower than non-alcohol takers. ASRH knowledge, having accepted the ASRH intervention in real life and religiosity were associated with higher loss aversion.

Table 4.5: Multivariate regression results on determinants of risk and loss aversion

VARIABLES	(1) Risk aversion	(2) Male risk aversion	(3) Female risk aversion	(1) Loss aversion	(2) Male loss aversion	(3) Female loss aversion
Sex	-0.01			0.40		
	(0.05)			(0.74)		
Age	0.01	0.00	0.02	0.06	-0.02	0.20
	(0.01)	(0.01)	(0.01)	(0.13)	(0.15)	(0.23)
Household size	0.00	0.03	-0.03	0.01	0.27	-0.20
	(0.01)	(0.02)	(0.02)	(0.19)	(0.23)	(0.31)
Alcohol	0.15***	0.13*	0.17**	1.63**	-0.07	3.58***
	(0.05)	(0.08)	(0.08)	(0.73)	(0.88)	(1.25)
Early sexual debut	0.07	0.08	0.09	0.65	1.47	-0.29
	(0.06)	(0.08)	(0.08)	(0.76)	(0.93)	(1.26)
ASRH knowledge	-0.04*	-0.01	-0.08**	-2.39***	-2.95***	-1.94***
	(0.02)	(0.03)	(0.03)	(0.34)	(0.45)	(0.51)
Multiple sexual partners	0.12**	0.04	0.23**	0.89	0.58	0.61
	(0.06)	(0.08)	(0.11)	(0.82)	(0.92)	(1.64)
ASRH intervention	-0.03	-0.03	-0.09	-2.09**	-3.19***	-1.35
	(0.06)	(0.09)	(0.09)	(0.91)	(1.15)	(1.46)
urban residence	-0.03	0.03	-0.09	0.10	0.19	0.00
	(0.06)	(0.08)	(0.08)	(0.78)	(0.96)	(1.21)
Religion importance	0.01	0.01	0.03	-1.58*	-2.04*	0.03
	(0.07)	(0.09)	(0.12)	(0.95)	(1.05)	(1.87)
Poverty background	0.16***	0.09	0.20**	1.39*	1.01	1.15
	(0.05)	(0.08)	(0.08)	(0.73)	(0.89)	(1.21)
R-squared	0.14	0.09	0.31			

Source: Author's own work; Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Respondents with recent ASRH knowledge exposure had a loss aversion parameter 2.39 units higher than those without recent ASRH information. Youth who accepted ASRH intervention in real-life exhibited a loss aversion parameter 2.09 units higher, while for more religious youths, it was 1.58 units higher. Sub analysis by gender shows that females who took beer more often had 3.58 units lower loss aversion. ASRH knowledge was associated with 2.95 more units and 1.94 more units of loss aversion for both male and female participants, respectively. Having accepted the ASRH intervention and religiosity were associated with 3.19 more units and 2.04 more units of loss aversion among males.

4.5 Discussion

Despite the government's efforts to improve adolescent and youth sexual and reproductive health through the ASRH policy, Zimbabwean youth continue to engage in risky sexual behaviour. Simultaneously, uptake of ASRH services is low, leading to poor ASRH outcomes (ZIMSTAT and ICFI, 2016, MOHCC, 2017, Musizvingoza and Wekwete, 2018, McGillen et al., 2018, Gonese et al., 2020). As a result, youth face a disproportionate burden of high HIV incidence, STI incidence and prevalence, as well as early childbearing. Knowledge of youth risk preferences can be used to design a more effective ASRH strategy. To this end, the study sought out to establish sexual and reproductive health risk preference parameters of youths in a tertiary education setting and their determinants. The aim was to assist policymakers with an analysis alternative to expected utility theory that brings another perspective to understanding ASRH service uptake.

The study found the average risk aversion parameter α of 0.7. This finding implies that the average youth is risk-averse when faced with uncertain outcomes. ASRH interventions that are associated with clinical uncertainties like circumcision are likely to be avoided as they are considered risky. Other ASRH interventions might not have risky outcomes in the conventional sense but pose fear and discomforts to such as the leaking of STI ailments to the community, stigmatisation by clinic staff or unfriendly clinic staff leading to youth avoiding ASRH services.

The study found a probability weighting parameter γ of 0.8, which is less than one. It implies that these youths are more concerned with ASRH outcomes than the likelihood of their occurrence. Despite the low probability of a male surgical circumcision going wrong, the findings indicate that youths are more likely to focus on the outcome than the small probabilities, which reduces uptake of such services.

The overall loss aversion parameter was 2.26, which suggests that the average youth is loss averse. In prospect theory, losses loom larger than gains; meaning that individuals give more weight to the prospect of a loss or discomfort even if the probability of a gain or comfort is similar. Such youth would not visit a health facility when faced with discomforts such as unfriendly staff, stigma from patients and staff, or lack of privacy.

These findings are consistent with prospect theory parameters established in prior studies (Tversky and Kahneman, 1979, Tversky and Kahneman, 1992, Tanaka et al., 2010, Lobel et al., 2017, Nguyen and Leung, 2009). Parameter estimates in current literature range 0.11 to 1.24 for risk aversion, 0.13 to 1 for probability weighting, and 0.42 to 3.47 for loss aversion. In the health domain, the range for the risk aversion parameter is 0.43 to 0.93 and the loss aversion parameter is between 0.76 and 2.13 (Bleichrodt et al., 2007, Attema et al., 2013, Lim and Bruce, 2015, Attema et al., 2016). The fitting of these parameters within existing literature implies that the prospect theory framework is fit for analysing risk-taking for the health domain, as argued by Attema et al. (2013). Prospect theory thus has a number of implications on future designing on ASRH services.

The second significant finding of the study relates to socio-economic determinants of the risk parameters. The study found risk aversion and loss aversion lower among alcohol takers, the poor, early sexual debutants, and youth with multiple sexual partners. On the other hand, ASRH knowledge and religiosity were found associated with risk aversion and loss aversion. These risk factors are similar to those found in recent literature. Francis et al. (2019) recently found alcohol correlated with risky sexual behaviour amongst youth in South Africa, but religiosity having mitigating effects. Poverty has also been found influencing risk-taking amongst youths (Orihuela

et al., 2020). Multiple sexual partners were associated with high-risk sexual and reproductive health in Ghana (Ganle et al., 2019).

This study used male circumcision and cervical cancer screening for females. For policy-making purposes, the study was necessary as it produced preferences of the relevant population, which can be used to improve utility from ASRH services. The parameters established in this study confirm prospect theory predictions, thus suggesting the need to make ASRH services more comfortable for youths and the clinic environment more hospitable to reduce fear. The idea of addressing the clinic environment's comfort and friendliness is well documented in the ASRH literature (Ippf, 2012, Thomée et al., 2016). However, the link to improving utility within a formal economic framework has been missing, which has been addressed by this chapter. On the other hand, the fact that youth behaviour fits prospect theory can actually be used to promote risk avoidance when it comes to risky sexual behaviour.

Firstly, the risk avoiding behaviour exhibited in this chapter implies the need to identify and address all risks and discomforts faced by youths as they visit the health centres. As chapter 3 showed, despite more resources being utilised to improve ASRH utilisation in provinces such as Manicaland, no significantly higher outcomes were observed when compared to provinces receiving lower resources such as Mashonaland East. The current finding that youth avoid the ASRH services due to uncertainties on interventions and discomforts can help explain the inefficiency in resources used. The issue of the unfriendliness of health facilities in Zimbabwe has been documented before (Marimo et al., 2015, Blum et al., 2015b). This implies that ASRH service providers need to improve on the attractiveness of the health services, the hospitality of health centre environments, and staff attitudes to the youths. They need to increase the privacy of treatment seekers as well as to involve youths in peer counselling since they have reasoning of the same wavelength. The risk-avoiding finding among the university students contrasts with the finding on risk-seeking for a health intervention established by (Lim and Bruce, 2015). This difference could be attributed to the lack of understanding of the health benefits of the intervention among Zimbabwean students. The health intervention by (Lim and Bruce, 2015) was weight loss, which is easy to understand compared to probabilities of reduced HIV infection for circumcised males and cervical cancer screening benefits for female students.

Secondly, the findings that youths give more consideration to health outcomes than their likelihood, as well as the concept of losses looming larger than gains were also confirmed by Attema et al. (2016) in a study on health-improving interventions among the general Dutch population. The finding has an implication on the marketing of ASRH interventions. There is a need to increase the sharing of success stories of the interventions using electronic media, peer education, as well as incorporating ASRH into the education curriculum. Several concerns have been noted that affect the utility and uptake for male circumcision. These include fear of pain, fear of the compulsory HIV testing, indirect costs such as transport and discomfort with female medical staff (Skolnik et al., 2014, George et al., 2014). Furtrher, there have also been rare cases where circumcision was not successfully done and ended up adversely affecting the patient (Skolnik et al., 2014, George et al., 2014). It appears these cases, rare as they are, may influence youths' perception about the safety of the procedure. For cervical cancer screening, women have been found to be afraid or psychologically uncomfortable with medical examinations, tests, and procedures, or with those who conduct them (Ackerson and Preston, 2009). The sharing of success stories using electronic media, peer education as well as incorporating ASRH as part of the education curriculum could be handy in countering the perceived risks of these ASRH interventions.

The result of an association between ASRH knowledge and risk aversion and loss aversion implies scope for ASRH information awareness targeting youth to promote uptake of ASRH services. In addition to that, the finding that youth-focused more on outcomes than probabilities means that the ASRH information campaigns should focus on outcomes instead of their likelihood. Furthermore, the fitting of the research findings in prospect theory predictions means that ASRH information campaigns have to focus on positively framed messages about interventions such as circumcision, cervical cancer screening, HIV testing, and contraceptive use. This way, they can promote the ASRH services' uptake, notwithstanding their associated risks of pain and discomfort. The same argument can be used to manipulate youths to reduce risky sexual behaviour. These youths' minds can be conditioned using positively framed messaging so that the youth make decisions in the gain domain, in which they would be risk-avoiding (Tversky and Kahneman, 1992). The effectiveness of positively

framed messages in promoting uptake of a similar ASRH intervention was illustrated in a study of British college students (Niza et al., 2014).

Prospect theory includes the role of a reference point in making decisions in the face of uncertain outcomes. The economic crisis occurring in Zimbabwe can be impactful on reference points at which youths base their decisions. The formal unemployment rate has been above 85% for over a decade, which presents gloomy economic prospects for youth, even in higher education (Rusvingo, 2015). Prospect theory thus predicts that most of the Zimbabwean youths perceive their current economic status in the loss domain. McDermott (1998) suggests the design of effective intervention programmes that can push youths into the gain domain where they avoid risky sexual behaviour on the one hand and where they increase health capital investment by increasing ASRH service utilisation on the other hand. A revival of the Zimbabwean economy, such as reindustrialisation and better wages, can improve prospects of a better life and move youths from the loss domain into the gain domain. Providing youths with loans to start their businesses is also an alternative given that their families can hardly raise finances required for sustainable start-ups.

The study was conducted at one institution which can potentially affect generalisability of results. However, the ability of the university to attract students from all over the country can be considered in mitigation. Although the use of university students in prospect theory risk preference research is common, the parameters established in such environments might not be generalised beyond the study setting. Future studies with better funding could be expanded to cover a wider population. Future studies could investigate other SRH interventions as well as investigating the effects of ASRH message framing.

4.6 Conclusion

The study concludes that youth sexual and reproductive health risk can be explained by prospect theory. Policymakers should reduce perceived risks of ASRH services, improve youth friendliness of health service centres, and staff attitudes. On average, youth are more sensitive to positively framed outcomes and less about the

probabilities of uncertain outcomes. There is also a need to design different youth strategies as risk aversion and loss aversion differ by income status, prior sexual experience, and current ASRH knowledge.

Chapter V

Effects of early child bearing on socio-economic and health outcomes

5.1 Introduction

Low utilisation of ASRH services by Zimbabwean youth is attributed to many health problems in HIV, STIs, and early child pregnancies. While the previous chapter established youth preferences for ASRH interventions, which can be useful in aligning service provision with targeted populations, there is a need to emphasise the effects of the current low uptake of ASRH services. These effects, such as lower productivity for pregnant girls and school dropping out, are likely to have long term socio-economic effects and to become detrimental to the achievement of the global Sustainable Development Goals (SDGs). To provoke urgent action on the part of the policymaker, this essay analysed medium to long-term effects of the non-utilisation of ASRH services by Zimbabwean female youth in order to provide evidence on the gravity of the matter. The essay adopted Wilkinson et al's (2006) definition of medium term as three to 10 years and long term as more than 10 years.

Although empirical literature on the consequences of non-utilisation of ASRH services covering international and sub-Saharan Africa settings exist, there is limited evidence of their existence in Zimbabwe. The country has notably high levels of poverty, high prevalence of HIV/AIDS, and limited access to social benefits. The essay estimated costs and consequences of non-utilisation of ASRH services for Zimbabwe which, to the researcher's best knowledge, is missing in scientific literature. The existing cost estimates from grey literature are only from the government's programmatic perspective as an ASRH service provider. The economic consequences from an individual and household level as estimated in this essay are missing from literature. Furthermore, even the financial costs from grey literature are outdated and require updating to reflect current ASRH usage patterns.

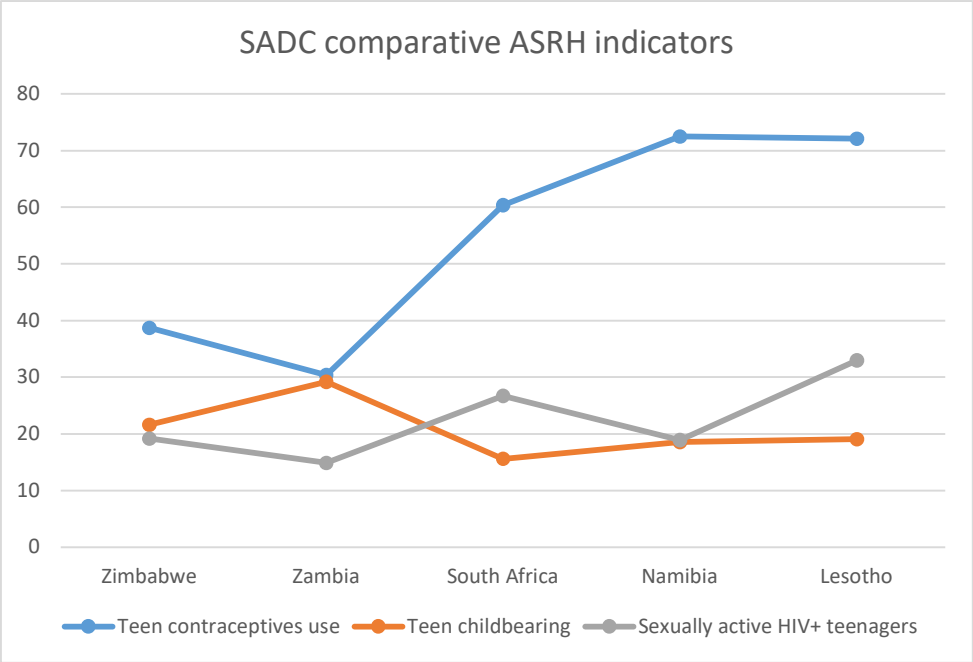
The ASRH challenges with Zimbabwean youths are not peculiar. Adverse sexual and reproductive health outcomes characterise adolescents and youths all over sub-Saharan Africa (Toska et al., 2017, Dellar et al., 2015). At least 80% of the world's HIV-positive population resides in this region, most of whom consist of youth (Kharsany and Karim, 2016). Early sexual activity, teen pregnancies, and early child marriages driven by poverty and patriarchal cultures are also highest in this region (Marindo, 2017, Siplon, 2018, Beattie et al., 2015, Efevbera et al., 2019). These sexual and reproductive health outcomes, which signify the non-utilisation of adolescent sexual reproductive health (ASRH) services such as condoms and contraceptives, have resulted in life-long economic and health consequences at the individual, household, and national level (Beattie et al., 2015, Bengesai et al., 2018, Wand et al., 2018). The effect is particularly marked for females whose educational and career progress is directly affected in the case of pregnancies (Bengesai et al., 2018, Berthelon and Kruger, 2017a, Toska et al., 2017, Shpiegel and Cascardi, 2018, Bekker et al., 2018b). Teen pregnancies are associated with school dropout, delayed school completion, limited human and health capital investment, as well as lower future income (Becker, 1962). These consequences also spill over to at least two generations (Becker and Tomes, 1986).

In Zimbabwe, the context also suggests issues with ASRH service utilisation. The 2015 Zimbabwe Demographic Health Survey (ZDHS) reported that the uptake of ASRH services, particularly amongst female youth, remains below the ASRH policy expectations (ZIMSTAT and ICFI, 2016). It was further pointed out that only 21.2% of sexually active unmarried women were using contraception methods (Ngome and Odimegwu, 2014). Another report suggested that 21% of female adolescents were already found in childbearing (Chikovore et al., 2013), while 19% of sexually active teenagers tested HIV positive (ZIMSTAT and ICFI, 2016).

Relative to Southern African Development Community (SADC) neighbours except for Zambia, Zimbabwe has the least contraceptives utilisation coverage, as shown in figure 5.1 (Zimbabwe National Statistics and International, 2016, ZSA et al., 2019, MoH and ICFI, 2016, MoHSS and ICFI, 2014, NDoH et al., 2019). Lastly, Zimbabwe has the third-highest proportion of sexually active teenagers who contracted HIV.

These issues highlight the non-utilisation of ASRH services offered in Zimbabwe, such as contraceptives, condoms, and HIV testing.

Non-utilisation of ASRH services is against universal access to ASRH, which is considered crucial to attaining improved economic and health outcomes for Zimbabwean youth in line with Sustainable Development Goal (SDGs) targets. Indeed, SDG 1 and 2 seek the eradication of hunger and poverty. In this respect, empirical studies have shown that teen access to ASRH services facilitates more years of schooling and better chances of formal employment, which are pathways to the eradication of hunger and poverty (Azevedo et al., 2012a). SDG 3 refers to healthy lives and wellbeing. The uptake of ASRH services such as contraceptives relates to SDG3 in that it leads to delayed childbirth, which in turn reduces high-risk pregnancy associated with high morbidity and mortality at early childbirth (Ardington et al., 2015, Conde-Agudelo et al., 2005).



Sources: (Zimbabwe National Statistics and International, 2016, ZSA et al., 2019, MoH and ICFI, 2016, MoHSS and ICFI, 2014, NDoH et al., 2019)

Figure 5.1: Comparative ASRH indicators for select SADC countries (period 2013-2018)

In line with SDG 5, which relates to equality and empowerment, ASRH services utilisation can increase women empowerment through increased educational opportunities. In this perspective, the empirical literature has shown that, on one hand educated women are less likely to be abused by their husbands; whilst on the other hand, these women play a significant role in society (Fedina et al., 2016, Hof and Richters, 1999, Silverman et al., 2004). SDG 8 refers to decent work and economic growth in line with the evidence that ASRH services allow youths to pursue uninterrupted education, which potentially leads to decent employment in the formal sector of the economy (Azevedo et al., 2012a). ASRH services thus facilitate women's participation in economic development. SDG 10 reinforces SDG 5 in its quest for the reduction of inequalities.

While the above discussion has pointed out the possible adverse outcomes of the non-utilisation of ASRH services, the magnitude of these effects on an individual, household, and the Zimbabwean public health system are not well understood. As far as the researcher is aware, this is the first attempt to estimate the effects of the non-utilisation of ASRH services in Zimbabwe. The investigation was conducted using the propensity score matching approach and structural equation modelling to produce relevant estimates.

Zimbabwe government has been contemplating to provide an essential ASRH package since 2010 (GoZ, 2009). However, due to limited fiscal space, the authorities reprioritised the allocation of available resources to other competing services (Blum et al., 2015b). Thus, this study's findings can be of great relevance to Zimbabwe policymaking; firstly in that findings can be used to justify the reprioritisation of public expenditure towards ASRH service provision and promotion. Secondly, the findings can also be used in persuading Zimbabwean youths to take up ASRH services to avoid negative consequences that have befallen older women who missed the opportunity to utilise these services. Thirdly, the findings can act as 2015 baseline data for assessing the country's ASRH programme performance on SDGs when new demographic health datasets are collected in the future. Lastly, the findings of this study represent missed opportunities by the government to reduce poverty, unemployment as well STIs and HIV infections and prevalence.

The study utilised childbearing before the age of 18 as an indicator of failure to utilise ASRH services successfully as it suggests unsafe sex, lack of contraceptive use, and early sexual engagement. The research sought to establish the extent to which early childbearing affects schooling, poverty, and asset ownership. Furthermore, the study determined how early childbearing predicts STIs and HIV infection later in women's lives.

5.1.1 Hypothesis

The following hypotheses guide the study:

1. Early childbearing does not affect years of schooling, poverty, employment, and asset ownership.
2. Early childbearing does not affect STI and HIV infection.

5.2 Literature Review

5.2.1 Theoretical Literature

The economics of ASRH utilisation and its immediate and future consequences are grounded in the rational choice theory, the theory of interest or the human impatience theory, the intertemporal consumption theory, and the behavioural economics theory. The rational choice theory explains how individuals recognise the options available and how they choose among these options using a consistent criterion (Simon, 1955, Takemura, 2019, Bernoulli, 1954). The theory assumes that individuals make life choices that are consistent with their preferences. According to rational choice theory, individuals exhibit constant preferences over a range of possible outcomes. Unlike the rational choice theory, the expected utility theory attaches weights to preferences. These weights imply that individuals can comprehend different potential outcomes (Simon, 1955) by choosing outcomes with the highest weighted benefit. Under these two theories, youths are expected to be able to comprehend the choices available to them and make a rational choice. Therefore, as the expected utility theory, the rational choice theory assumes completeness, transitivity, monotonicity, and independence (Moscati, 2016).

Transitivity consists of the assumption that an individual's ranking between two alternative options will not be affected by the introduction of a third choice. However, the assumption is often violated in the health domain (Attema et al., 2013, Cohen, 1996). Individuals are observed continuously making context-dependent decisions such that the ranking of two different options differs for the same individual in different situations. Prospect theory was developed to capture context-dependent decision making (Tversky and Kahneman, 1979). For example, marketing efforts can change the way individuals perceive costs, benefits, and alter their preferences. Another limitation of rational choice and utility theory is the assumption that individuals can comprehend choices available to them, their consequences as well as their likelihood. The adolescents, for example, are still developing cognitively, and as such, cannot be expected to effectively carryout rank-ordering in line with expected utility theory.

Prospect theory is part of a broader framework for analysing economic behaviour called behavioural economics. Behavioural economics theory explains economic behaviour using psychology theories (Simon, 1955, Loewenstein et al., 2012). It explains individual behaviour beyond rational choice theory, particularly internalities- a term defined to explain long-term costs that people impose on themselves (Loewenstein et al., 2012, Gruber and Köszegi, 2001). Behavioural economics scholars believe that internalities arise due to mistakes in decision-making, making people put more weight on costs and benefits in the present period and less on those in the future period (Loewenstein et al., 2012). As such, behaviour previously thought irrational is consistent with expected utility optimisation theory (Gruber and Köszegi, 2001). Sexual activity, for example, is taken as irrational but impulsive behaviour because it is not planned in the early teenage years. Teen pregnancies are thus an example of youth mistakes in decision making. Behavioural economics theory can, therefore, help understand and estimate the risk-seeking behaviour of youth, its welfare consequences on themselves, and externalities to society (O'Donoghue and Rabin, 2001). As a departure from the standard rational decision model, behavioural economics considers the youth as making decisions not in their best interests due to factors such as knowledge, and cognition (Gruber, 2000, Igra and Irwin, 1996), which is termed bounded rationality.

Another theory that considers context-dependency is Fisher's theory of interest (Fisher, 1930), which considers that both present and future benefits have an influence on a decision made now. The theory of interest explains how individuals take courses of action today, given how they relate to benefits to be realised at present, relative to the value benefits that will come. The theory also suggests that, depending on personal preferences, some youth might heavily discount health and other human capital benefits to be enjoyed in the future, but instead place more value on the pleasures of the present period. These youths might be impatient over future benefits, preferring present-day enjoyment. We can generalise this reasoning for all perceived resources for our study population. In this instance, resources can be health, friends in general, intimate partnership(s), intimate and sexual pleasure, cohesiveness of social grouping, as well as some financial rewards that come with some early sexual relationships. Intimacy or sexual pleasure may be viewed to be abundant in the future when the youth get married, and as such, they discount it heavily to have intimate and sexual encounters at the present moment. Early intimacy and teen sexual debut are usually experimental and unprepared in terms of protection and contraception (Bengesai et al., 2018, Wand et al., 2018).

On the other hand, the youth could view the abundance of friends of the same age and the happiness derived from these social groupings to decline after they have left school, especially at boarding schools. Fisher (1930) saw poverty affecting human impatience both in the present and future periods. In the present day, a female youth, for example, has to meet financial needs for life to continue, which unfortunately some males take advantage of. This part is rational decision making, but when the needs of the present moment blind a person to future needs, it becomes irrational (Becker and Mulligan, 1997). This means that for Fisher, poor people cannot separate utility by time periods because of the urgent need to satisfy today's needs. Later economic scholars referred to this phenomenon as heavy discounting in the present period (Becker and Mulligan, 1997).

Fisher reckons income determines human impatience. An individual who expects high income in the future will sacrifice more of the future income to receive a lower income today. It means we can expect a high discount rate for individuals with high future expected incomes but less so for those expecting lower incomes in the future than the

present. Levine (2001) relates early sexual behaviour and teen pregnancies, for example, to be consistent with rational choice but differing with adult choices in the sense that youth highly discount the future for the present. This understanding is also consistent with O'Donoghue and Rabin (2001), who present a rational choice model explaining youth engaging in unprotected sexual activity despite its future cost consequences.

Becker and Mulligan (1997) developed a model of patience formation, explaining rationality, frailty, and future utilities. The overconsumption of resources in the present moment may not necessarily be irrational since individuals might be trying to overcome their frailties. In this thinking, a boarding school youth who comes from a conservative household might overcompensate the loss of freedom once at home by experimenting with sex in the present moment in the boarding environment. Becker and Mulligan (1997) outline the following conditions in their model:

1. People are not equally patient. This statement should explain why some individuals engage in sexual activity early as well as partake in unprotected pre-marital sex.
2. The differences in time preferences are explainable through income, development, culture, and education.
3. Impatience also differs in different periods for the same person.
4. Heavy discounting of the future is undesirable.
5. People may spend resources to overcome their frailties.

Becker and Mulligan (1997) presented an individual future utility valuation model as:

$$V = f_0(c_0) + \beta(S) \cdot f_1(c_1) \qquad (5.1)$$

where c_0 and c_1 represent consumption in present and future periods whilst $f_0(\bullet)$ and $f_1(\bullet)$ represent present and future utility functions, and $\beta(\bullet)$ represents the discount function, and S is the level of resources such as time, knowledge, and effort spent imagining the future. Time invested by a youth listening to adults' advice on sexuality education can help them imagine and comprehend future consequences of their present actions, which is part of their time preference formation, which feeds into the discounting function $\beta(\bullet)$. General schooling plays a role in cognitive development,

which also leads to a better capacity to simulate future consequences of present-day actions.

5.2.2 Empirical Literature

The Becker and Mulligan (1997) model of patience formation suggests that indicators of non-utilisation such as early childbirth are explained by background socioeconomic factors such as income, culture, and education. It follows that the literature on socioeconomic determinants of early childbearing is crucial to this study. The chapter also reviews research that has explored reverse causality between early childbirth. Whilst current early childbirth can result from the prior unfavourable socioeconomic background, and early childbirth also determines socioeconomic indicators in a woman's later life. Different studies use different cut off points for early childbearing but ranging between 15 and 20 (Berthelon and Kruger, 2017b, Diaz and Fiel, 2016, Ardington et al., 2015, Arceo-Gómez and Campos-Vázquez, 2014). The term early childbearing is also used interchangeably with teen childbearing, teen motherhood, teen pregnancy, which all imply the non- utilisation of ASRH services.

Empirical evidence from developed countries in Europe and North America points towards the negative consequences of early motherhood on economic outcomes such as schooling, employment, and earnings. Amendah (2007), for example, researched on labour market outcomes of teen motherhood in the United States using propensity score matching and found that teen childbearing negatively affected employment and earnings. Similar findings were reported in Hair et al. (2009), who found high unemployment amongst such youths using OLS regression of late-life outcomes data in the United States and in Francesconi (2008) in Great Britain. In contrast, Azevedo et al. (2012b) found positive effects of early childbirth on employment in Mexico. However, further analysis from this study showed that these women had high participation in social benefits programmes, which indicates that the non-utilisation of ASRH services such as contraceptives was more costly to society than to the individual. Angelini and Mierau (2018) found that teen motherhood was associated with poor health outcomes in late motherhood using longitudinal data for 13 European

countries. McIntyre et al. (2017) revealed the existence of reverse causality with household poverty related to early childbearing in Canada.

Evidence about the reverse causality between early childhood and socioeconomic outcomes is not unique to developed nations. A study from Latin America, for example, supported the existence of a reverse relationship between early childbearing, education, and poverty (Azevedo et al., 2012a). Similar findings were also reported in Galindo Pardo (2012) in Colombia, where teenagers from poor households were more vulnerable to early childbearing. Analysing the causality from socioeconomic status to reproductive health outcomes among the youth, Berthelon and Kruger (2017b) reported that teen pregnancy in Chile was negatively related to years of education using propensity score matching on household survey data.

In sub-Saharan African countries, evidence on early childbearing affecting economic and health outcomes and the reverse has also been reported. Studies using longitudinal data in Madagascar found that teen childbearing was related to employment into low-quality jobs (Herrera et al., 2019) and lower education attainment (Almanza and Sahn, 2018). Health effects of early childbearing were also reported by Ardington et al. (2015), who used HIV/AIDS mortality as an outcome on longitudinal data for South Africa. They specifically found that the risk of dying for teen mothers was higher than that of non-teen mothers. Masuda and Yamauchi (2018) support these findings using data from Uganda, adding that women who gave first birth after 18 years had lower child mortality but found no effect on labour force participation of early childbearing. Branson and Byker (2018) found teen childbearing negatively affecting even their offspring's health outcomes in South Africa. Reverse effects discovered in sub-Saharan Africa include lack of education determining adolescent childbearing in Ethiopia, poverty influencing teen pregnancy in South Africa (Lambani, 2015), and poverty linked child marriages resulting in teen childbearing in Malawi (Chirwa et al., 2019a, Kaphagawani and Kalipeni, 2017) and Ethiopia (Mekonnen et al., 2018). In Uganda, Makate and Makate (2018) found that an additional year of schooling results in a lower probability of early childbirth by 8.2 to 9.5%.

Munjoma et al. (2010a) found that teenage mothers reported a high incidence of HIV in a study that followed up HIV negative women for 6 years after childbirth in

Zimbabwe. HIV incidence for teen mothers was three times higher compared to the incidence among women who had delivered after the age of 25. This study, however, did not control for self-selection and endogeneity. Berg and Mamhute (2013) found that early childbearing was associated with difficulties in completion of tertiary education due to lack of support from family, peers, teachers, and college administration in Zimbabwe. Gregson et al. (2005b) found teen pregnancies higher amongst poor orphans and vulnerable children in Eastern Zimbabwe. Similar findings were also established by Chemhuru et al. (2011) among school-going teenagers in rural Zimbabwe.

Propensity score matching seems to be the most common method of analysing early childbearing effects in reviewed studies due to its ability to control self-selection (Lee, 2010, Azevedo et al., 2012a, Kane et al., 2013). Other studies have used Binary outcomes models such as the limited probability model (Azevedo et al., 2012a) and logistic regression techniques (Dehlendorf et al., 2010) as well as the ordinary least squares for continuous dependent variables (Ardington et al., 2015). Azevedo et al. (2012a) identified endogeneity problems, whereby factors that affect teen childbirth may also be caused by childbirth itself. The instrumental variable (IV) technique is a popular tool to control endogeneity in cases of longitudinal data (Herrera et al., 2019, Herrera Almanza and Sahn, 2018, Angelini and Mierau, 2018). The absence of perfect instruments and non-availability of panel data are the reasons the IV technique will not be used for our study, which instead addresses endogeneity using simultaneous equation modelling. It is also notable that most studies on the effects of teen childbearing use more than one estimation technique, and this is due to each method having different strengths and limitations resulting in under or overestimation of the effects of early childbirth. The use of multiple methods is thus relevant for robustness checking (Kane et al., 2013).

Despite evident incidence of early childbearing, which is an indicator of non-utilisation of ASRH services likely to imposing economic and health costs later in life, no study has been undertaken to establish the extent of these costs for Zimbabwe. This study thereby contributes to literature in the in this field in several aspects. First, this study is conducted in a country with notably high levels of poverty, high prevalence of HIV/AIDS, high literacy, and limited access to social benefits. In countries with social

benefits such as Mexico and South Africa, early childbearing women appear to be better off in terms of employment opportunities and financial support. In other countries, and most likely in Zimbabwe, early childbearing could arise from young females and their families seeking early marriages as a strategy to escape abject household poverty. Secondly, this is one of a few studies, to the best of the author's knowledge, which approaches the estimation with a simultaneous equation to tackle possible endogeneity and as a way of robustness checks. Most studies have used IV to control for endogeneity, which could not have been a good instrument. The estimates of costs and consequences can help in reprioritising public health resources as well as in persuading youth to increase their uptake of ASRH services by showing them the dire outcomes that await them later in life.

5.3 Methodology

5.3.1 Data

This chapter used the latest Zimbabwe Demographic Health Survey (ZDHS) data conducted in 2015 (ZIMSTAT and ICF., 2016). The ZDHS data is collected every five years and was collected in 2005, 2010, and 2015. The current essay merged the individual women's dataset with the HIV dataset from the nine datasets resulting from the surveys. The women's dataset had 9,955 observations on women of reproductive age ranging from 15 to 49. After merging one to one with the HIV dataset and limiting the study to women aged 20 years and above, the observations fell to 6,254. Data on women aged 20 to 30 years who had early childbirth represent medium term effect of non utilisation of ASRH services while data of women older than 30 years represent long term effects.

5.3.2 Survey Design Features

The ZDHS is a two-stage survey involving stratification into rural and urban areas of provinces and then cluster sampling using census enumeration areas from which households are randomly selected (ZIMSTAT and ICFI, 2016). Consequently, samples are not selected with equal probability as they would in the case of simple random sampling. Each sampling unit is thus allocated a sampling weight in the dataset. In this study, the regression models were controlled for stratification and

cluster sampling and thus the reported standard errors were appropriately adjusted using Stata 15 hierarchical cross sectional data settings.

5.3.3 Model Specification

Because of the reverse causality referred to in the literature, the effect of early childbirth (ECB) on socioeconomic outcomes was investigated using the simultaneous equation model following Kane et al. (2013).

$$Y_{ij}^{*} = \alpha ECB_{ij} + \boldsymbol{X}_{ij}\boldsymbol{\beta}_{j} + \boldsymbol{\varepsilon}_{ij} \quad (5.2)$$

$$ECB_{ij}^{*} = \boldsymbol{X}_{ij}\boldsymbol{\beta}_{j} + \boldsymbol{\varepsilon}_{ij} \quad (5.3)$$

Equation (5.2) regresses early childbirth ECB and socioeconomic variables $\boldsymbol{X}$ on the outcome variable Y. Alpha, α, is a parameter to be estimated for the early childbirth variable. ECB is a binary variable taking value of 1 if a woman had child birth before 18 and 0 otherwise. Equation (5.3) takes cognisance of the observation that early childbirth could be determined by socio-economic variables, some of which are also in vector $\boldsymbol{X}$ in equation (5.2). The vector of socio-economic variables $\boldsymbol{X}$ has to be different across the two equations by at least one variable to ensure statistical identification (Kane et al., 2013). $\boldsymbol{\beta}$ is an unobserved parameter vector to be estimated from the system of equations. Subscripts *i* and *j* represent the observation and the equation number, respectively.

With the specified model, the chapter's first hypothesis was verified by estimating the effects of early childbirth (ECB) on outcomes (Y), notably schooling, poverty, asset ownership, and occupation. Similarly, the second hypothesis was verified by the impact of ECB on STI and HIV infection. To verify the third hypothesis, the chapter estimated the costs of non-utilisation ASRH services by assuming that youth who have teenage pregnancies do not utilise the services and youth who have no teenage pregnancies utilise the services. The chapter then applied unit costs of HIV treatment to either group and the difference produced the additional HIV treatment costs of not using the ASRH services. Differences in STI treatment costs were not pursued due to a very small proportion of respondents reporting STI infection in the sample.

The parameters in the simultaneous equations (5.2) and (5.3) have been estimated using different econometric models in the literature to address hypotheses 1 and 2, each with its strengths and limitations. The econometric models include structural equation modelling, ordinary least squares (Makate and Makate, 2018), instrumental variables (Fletcher and Padrón, 2016, Herrera Almanza and Sahn, 2018), fixed and random effects models (Urdinola and Ospino, 2015), and propensity score matching (Diaz and Fiel, 2016).

This chapter used propensity score matching (PSM), a treatment effects technique whose strength lies in addressing selection by matching women who had early childbirth (treatment group) to those who did not (control group) (Zito, 2016). PSM allows the comparison of outcomes in education, employment, asset ownership, as well as STIs, and HIV infection to be compared between the treatment and control groups to test hypotheses 1 and 2. The PSM has the advantage of fewer parametric assumptions relative to alternative models (Diaz and Fiel, 2016). Because PSM has its weaknesses, such as the use of observable factors, which may be reasons for self-selection, as is the case for alternative models, the robustness of the findings is checked by also reproducing the results using structural equation models and the ordinary least squares and its variants. Sibling fixed effects and instrumental variable techniques are not considered as they lack the generalisability of results (Diaz and Fiel, 2016).

5.3.4 Propensity Score Matching

In the absence of randomised control data, the chapter used observational data. This requires the conditional independence assumption which posits that after conditioning on covariates, the treatment (ASRH utilisation) is as good as randomly assigned. The lack of randomised experimental data on this subject due to the cost involved in running an experiment and following up over a sufficient period of time. In addition to that, a randomised experiment in this instance would pose ethical questions in that certain participants would have to be allocated to the non-treatment group when it is known that it would not produce any beneficial outcomes. The challenge with observational data is that treatment is not randomised (Austin and Stuart, 2017). In addition to that, there is no guarantee that treatment and outcome are independent

from each other. Stata's *teffects* module is used to handle treatment effects in the absence of randomised experiment data. The *teffects* estimators use covariates to make treatment and outcome independent conditional on the covariates. Treatment effects are thus estimated within the potential outcomes framework where we compare the actual outcome to a counterfactual for that particular subject since both cannot be observed at the same time (Rubin, 2005, VanderWeele, 2016).

5.3.4.1 Estimating Treatment Effects

Besides PSM, two more estimators can be used to determine treatment effects using the teffects module namely regression adjustment (RA) and inverse probability of weighting (IPTW). All these estimators all require specification of covariates so that the effect of treatment are independent of potential outcomes after conditioning on the covariates. The RA adjustment method uses a regression model to estimate covariate adjusted potential outcomes. The RA estimator is however inefficient when treatment effects are heterogeneous (Negi and Wooldridge, 2021). The IPTW method uses weighted means to adjust ensure that covariates are independent of treatment (John et al., 2019). The IPTW method is affected by a lack of comparability of the treated and control groups in the weighted sample (Austin and Stuart, 2015). PSM involves matching treated and untreated subjects using propensity scores (Austin, 2011). PSM treatment effects are estimated by comparing treated to untreated subjects. The PSM estimates the average treatment effect for the treated (ATT), whereas IPTW assesses the average treatment effect (ATE) (Allan et al., 2020). The ATE depicts the treatment's effect in the case whereby each patient in the population is given the treatment. The ATT, on the other hand, represents the treatment's effect solely of those that were eventually treated.

Propensity score matching is a three-step process. Firstly, covariates are used to estimate propensity scores, which indicate the probability of treatment using logistic regression analysis, as in equation (5.4).

$$ln\left(\frac{p(D=1)}{1-p(D=1)}\right) = \alpha + \beta \boldsymbol{X}_i + \varepsilon_i \qquad (5.4)$$

where $p(D=1)$ represents the treatment, which is the probability of early childbirth and $\boldsymbol{X}_i$ are the covariates.

Secondly, observations from the treatment and control groups are matched into pairs using the propensity scores. Thirdly, the effect of treatment is derived from the average paired difference in outcomes in education, employment, asset ownership, as well as from STIs, and HIV infection. This chapter uses the *teffects psmatch* estimator for balance and estimation. The *teffects psmatch* estimator quantifies the additional outcome in years of schooling, poverty, asset ownership, and STI and HIV prevalence that is attributable to the treatment variable early childbirth. These estimations were carried out using Stata 15.

5.3.5 Multivariate Regression analysis

For robustness checks, appropriate regression models were used for equation (5.2), depending on the nature of the socioeconomic and health outcomes. Thus, various models include regressions for continuous dependant variables, logistic regression for binary outcomes, and ordered logit for ordered outcome variables. These models estimate the effect of early childbearing on outcomes stated in hypotheses 1 and 2 based on observable explanatory variables.

The multivariate techniques often assume that unobservable factors captured in the error terms $\boldsymbol{\varepsilon}_{ij}$ are not related across the two equations. Such an approach ignores endogeneity and regresses only equation (5.2), which produces misleading estimates of differences in outcomes stated in the hypotheses. Studies using OLS analysis, for example, have been found to overstate the effect of early childbearing due to selection issues (Zito, 2016, Diaz and Fiel, 2016). The multivariate techniques have the advantage of accounting for survey design features such as clustering and sampling weights using Stata's svyset setting. The PSM *teffects psmatch* estimator does not control for these, subjecting the estimates to inefficiency and failure to scale back estimates from sample to population level.

5.3.6 Simultaneous equation modelling

The socio-economic vector $\boldsymbol{X}$ contains variables that are similar for both equations with statistical identification requiring them to differ by at least one variable. The

existence of the same $\boldsymbol{X}$ explanatory variables in both equations gives rise to the possibility of correlated error terms. Estimation using OLS yields inefficient parameter estimates (Greene, 2012). While the two equations seem unrelated, the correlation in the error terms makes them related. Structural equation models such as seemingly unrelated regression, structural equation model, and generalised structural equation models structural equation modelling allow for correlated errors. The effects of early childbirth on years of schooling, poverty, asset ownership, STI prevalence, and HIV prevalence are thus estimated using both equations (5.2) and (5.3).

Given the variance of the error term Ω of a single equation, the covariance matrix for the multiple seemingly unrelated equations is denoted by

$$\Omega = \sum \otimes \mathbf{I}$$

where

$$\Omega^{-1} = \sum^{-1} \otimes \mathbf{I}$$

the Generalised Least Squares Estimator becomes

$$\hat{\beta} = \left(X'\Omega^{-1}X\right)^{-1}X'\Omega^{-1}y = \left(X'\sum^{-1}\otimes \mathbf{I}X\right)^{-1}X'\left(\sum^{-1}\otimes \mathbf{I}\right)y \qquad 5.5$$

According to (Greene, 2012), efficiency gains from using the GLS over the OLS are higher if the correlation between the error terms of the seemingly unrelated equations is high. Feasible GLS is required in the case where $\sum\otimes$ is unknown. Maximum likelihood estimation techniques can also be used by iterating the FGLS procedure. This is more appropriate when the dependent variable is binary, which is better handled by logistic regression. The maximum likelihood estimator of $\boldsymbol{\beta}_j$ thus quantifies the additional outcome in years of schooling, poverty, asset ownership, STI prevalence, and HIV prevalence that is attributable to early childbirth whilst allowing for covariance in error terms of equations (5.2) and (5.3). Structural equation modelling techniques also have the advantage of accounting for survey design features using Stata's *svyset* setting, unlike the *teffects psmatch* estimator.

5.3.7 Definition of Variables

5.3.7.1 Treatment Variable

This chapter focuses on the effects of early childbirth (ECB) on socioeconomic outcomes later in a woman's life and is thus considered the treatment variable. Women who did not have early childbirth are considered the control group. Early childbirth can potentially delay a girl to complete studies, slow her studies, or to drop out completely. This does affect her income earning potential. Furthermore, it can potentially condemn her to low paying jobs if the young mother has no additional support. Early childbirth captures several issues indicating the non-utilisation of ASRH services. Firstly, it implies there was early sexual intercourse. At that age, especially if it was with an older man, it implies the girl does not have much control over safe sex practices. It also directly implies that there was no protection, which implies high chances of STI infection and HIV. Early childbirth is the treatment that takes a value of one if the respondent gave birth before 18 years and zero otherwise. Twenty-two percent (22%) of the respondents had childbirth before the age of 18.

5.3.7.2 Outcome variables

The chapter evaluated the effect of early childbirth on years of schooling, poverty, and asset holding as well as health indicators STI prevalence and HIV prevalence. The chapter provides a sub-analysis into young adults between ages 20 and 29 to capture medium term effects; middle adulthood ages 30 to 39, and late adulthood 40 to 49 years old capturing the long term effects. This is done to see the trend of the effect of childbirth on years of schooling, poverty, asset ownership, STI prevalence, and HIV prevalence. The dataset is limited to 49 years for women within the reproductive age range. The split into three is motivated by Becker (1993), who developed a model for the demand for health services across young adulthood, middle adulthood, and late adulthood. The rationale was that these different generations have different priorities in terms of families, economic activity, and bequests.

Years of schooling: the respondents indicated how many years of schooling they had completed and ranged from 0 to 21. This study expects a negative relationship between early childbirth and years of schooling.

Poverty: the respondents disclosed asset holdings that are combined to form a wealth index in the dataset. The wealth index has five values, namely; very poor, poor, middle, rich, and very rich. Early childbirth inhibits capital development, which makes us expect a negative relationship between early childbirth and the wealth index.

Occupation: respondents indicated their current occupation in the dataset. 37.82 percent indicated that they do not work; 15.0 percent indicated engagement in low paying sectors like domestic work and menial agricultural employment and other unskilled labour; 34.52% indicated work in services or sales whilst 11.94 percent indicated employment in skilled and professional employment. A negative relationship with early childbirth is thus expected.

Asset ownership: respondents indicated if they owned a house or not. We created a dummy variable taking value one if the respondent owned a house independently or jointly and zeroed otherwise. 52.09% did not own a house. A negative relationship with early childbirth is also expected.

STI prevalence: respondents indicated whether they had contracted an STI in the last 12 months preceding the survey. About two and half percent (2.56%) of the remaining sample had an STI. We created a dummy variable taking the value one if they had an STI and zero otherwise. A positive relationship with early childbirth is expected.

HIV prevalence: respondents were offered an HIV test, and the dataset captured the result. 24.4 percent of the remaining sample was HIV positive. We created a dummy variable taking the value one if the respondent test came out positive and zeroed otherwise. A positive relationship with early childbirth is expected.

5.3.7.3 Covariates

Covariates are required to match respondents who had early childbearing to those who did not have. Guided by reviewed literature, the research included age; wealth status for outcomes other than poverty and asset holding; place of residence which is either rural or urban; the province of residence; religion and marital status.

5.4 Results

Table 5.1 shows the sample profile for the treatment variable, outcome variables, and covariates. The mean age of respondents was 35. The proportion of women who had early childbirth in the sample was 22.33%. The mean number of years of schooling for women who had early childbirth was 7.45, which is 2.54 years lower than their counterparts who bore children after 18 years of age. This disadvantage also manifests itself in the wealth index, which shows that the treatment group outnumbers the control group in the poorest and poor wealth quintiles, but the pattern overturns for the rest of the wealth quintiles. These women also tend to be more unemployed and more unskilled, but as the quality of jobs improves, women who had children after 18 years tend to dominate.

The variable current marital status shows that 72.91% of the respondents are currently married and that 72.95 of those who had early childbirth are currently married. Asset ownership, as measured by the ownership of a house jointly or independently, seems to suggest that women with early childbirths are better off. Previous research with similar findings seems to suggest that teen childbearing gives youth a responsibility which can have transformative effects, making them refocus towards better life aspirations in education, careers, and financial wellbeing (O'Brien Cherry et al., 2015, Azevedo et al., 2012b, Seamark and Lings, 2004). The same literature, though, seems to point out that the quality of their career achievements is of poor quality compared to their counterparts who did not have early pregnancies (Azevedo et al., 2012a). Lastly, STI prevalence and HIV prevalence appears higher amongst the treatment group in contrast to the control group.

Table 5.1: Outcomes and covariates of treatment and control groups

Variable	Birth before 18 years	Birth after 18 years	Total
Early childbirth %	100	0	22.33
Education years mean (sd)	7.45 (2.76)	9.98 (3.13)	9.54 (3.29)
Poverty (percent)			
Poorest	24.35	14.40	15.94
Poorer	20.68	13.40	14.47
Middle	17.02	15.88	15.71
Richer	24.17	26.59	26.01
Richest	13.79	29.73	27.87
Occupation (percent)			
Unemployed	42.49	38.17	38.51
Unskilled	20.09	13.92	15.03
Services/sales	32.36	35.10	34.52
Skilled/Professional	5.07	12.82	11.94
Asset possession (index)	53.14	48.82	47.91
STI	3.41	2.29	2.56
HIV	28.45	23.49	24.40
Covariates			
Age mean (sd)	35 (6.72)	35 (6.46)	35 (6.55)
Rural %	70.33	53.54	55.60
Province			
Manicaland	10.47	10.16	10.12
Mashonaland Central	14.22	10.11	10.86
Mashonaland East	10.21	8.73	8.85
Mashonaland West	16.14	9.96	11.09
Matabeleland North	10.82	8.38	8.84
Matabeleland South	7.24	7.90	7.68
Midlands	9.95	10.46	10.07
Masvingo	8.12	11.89	11.02
Harare	8.46	12.87	12.22
Bulawayo	4.36	9.53	9.26
Religion (Apostolic %)	53.41	61.29	60.78
Current Marital status (%)			
Married	72.95	76.44	72.91
Widowed	7.94	7.05	6.96
Divorced	8.29	6.25	6.56

Source: Author's own work

Table 5.2 presents the effects of early childbirth on the full sample of women of reproductive age ranging from 20 to 49 years of age. Years of education obtained by women of early childbearing are 1.830 years lower in the PSM model, 1.55 years lower in the OLS multivariate regression model, and 1.4 years lower in the SEM model. All estimates are statistically significant at the 1% level. Whilst we do not have data to infer on incomes, we can borrow from findings on studies on returns to education such as Becker (1993) that early childbirth leads to lower productivity.

Table 5.2: Effects of early childbirths on the full sample

Variable	PSM	Regression	SEM
Education	-1.830***	-1.550***	-1.400***
	(0.162)	(0.125)	(0.247)
Wealth	-0.040	-0.036 (0.092)	-0.034
	(0.059)	0.005[+] -0.002[+]	(0.042)
Asset Ownership	0.000	-0.035	-0.010
	(0.033)	(0.130)	(0.030)
Occupation	-0.096***	-0.084***	-0.056
	(0.021)	(0.446) [&]	(0.200)
STI	0.008	0.005 [&]	0.005
	(0.008)	(0.230)	(0.006)
HIV	0.030	0.013 [&]	0.010
	(0.022)	(0.200)	(0.014)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[+]Ologit marginal effects

[&] Logit marginal effects

Source: Author's own work

The other statistically significant outcome is career occupation, whose probability is 9.6% lower for early child-bearers in the PSM model and 8.4% lower for the logistic regression model. This suggests that youth who delay childbearing have better chances of career opportunities, which brings better incomes. Probabilities of early child-bearers being richer and owning material assets are lower than their counterparts who did not have early childbearing but statistically insignificant. The probability of

contracting HIV and STIs is higher for early child-bearers, but the estimates are also statistically insignificant. Table 5.3 presents the sub-analysis for women aged 20 to 29. The expected signs remained the same as for the full sample. Whilst years of education obtained by women of early childbearing were 1.058 years lower than their counterparts in the PSM model, multivariate regression and SEM estimates were a bit higher and closer at 1.398 and 1.384 years fewer, respectively.

Table 5.3: Effects of early childbirths (20-29 years)

Variable	PSM	Regression	SEM
Education	-1.058***	-1.398***	-1.384***
	(0.230)	(0.157)	(0.153)
Wealth	-0.078	-0.250 (0.161)	-0.250
	(0.076)	0.043[+] -0.012[+]	(0.004)
Asset Ownership	-.015	0.032	-0.856
	(0.021)	(0.174)	(0.853)
Occupation	-0.015	0.000	-0.008
	(0.021)	(0.467)	(0.016)
STI	0.014	0.016	0.016
	(0.010)	(0.299)	(0.014)
HIV	0.051**	0.026	0.026
	(0.022)	(0.181)	(0.018)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[+]Ologit marginal effects

Source: Author's own work

HIV status was also statistically significant at the 1% level in the PSM model, were the probability of contracting the virus was 5.1% higher for early child bearers. The effects in the other models were the same as the probability of contraction being 2.6% higher. The probability of contracting an STI was also higher for early child-bearers by between 1.4% and 1.6%, albeit statistically insignificant. Probabilities of economic

progression by attaining higher wealth status, assets, and career occupation were lower for women of early childbearing but statistically insignificant.

Table 5.4 presents the sub-analysis for women aged 30 to 39. The expected signs remained the same as for the full sample. Years of education obtained by these women were lower by between 1.755 years to 1.854 than their counterparts. All three models had statistically significant estimates at the 1% level. This suggests that the gap in human capital investment increases with age when comparing results of table 5.3 and table 5.4.

Table 5.4: Effects of early childbirths (30-39 years)

Variable	PSM	Regression	SEM
Education	-1.854***	-1.762***	-1.755***
	(0.133)	(0.159)	(0.199)
Wealth	-0.078	-0.250 (0.161)	-0.147
	(0.076)	0.043[+] -0.012[+]	(0.103)
Asset Ownership	-0.051	-0.058*	-0.827***
	(0.077)	(0.149)	(0.237)
Occupation	-0.122***	-0.126***	-0.571***
	(0.028)	(0.389)	(0.079)
STI	0.029	0.002	0.001
	(0.014)	(0.357)	(0.009)
HIV	0.032	0.035	0.030
	(0.028)	(0.163)	(0.025)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[+]Ologit marginal effects

Source: Author's own work

The probability of asset ownership for women aged 30-39 was lower in the logit regression and SEM models statistically significant at the 10 percent and 1 percent levels, respectively. This also suggests an increase in the cost of non-utilisation of ASRH services with age. The same pattern is observed for career occupation whereby

early child bearers' probability of economic progression was lower by between 12.2% and 57% and statistically significant at the 1 percent level. STI and HIV contraction probabilities were still higher for early child-bearers but not statistically significant.

Table 5.5 presents the sub-analysis for women aged 40 to 49 who are in their late parenthood. The expected signs remain the same as for the full sample. Years of education obtained by women of early childbearing are lower by between 1.762 years to 2.515 than their counterparts. All three models have statistically significant estimates at the 1% level.

Table 5.5: Effects of early childbirths (40-49)

Variable	PSM	Regression	SEM
Education	-2.515*** (0.309)	-2.067 *** (0.319)	-1.762*** (0.421)
Wealth	-0.173** (0.076)	-0.481 (0.158)*** 0.066[+] -0.030[+]	-0.255*** (0.082)
Asset Ownership	-0.051 (0.077)	-0.058* (0.149)	-0.0187* (0.103)
Occupation	-0.159*** (0.048)	-0.130*** (0.518)	-0.101*** (0.029)
STI[+]			
HIV	0.038 (0.031)	0.009 (0.201)	0.015 (0.035)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[+]Not estimated due to a negative correlation between STI and early childbirth.

Source: Author's own work

Comparing tables 5.3 to 5.5 presents a clear pattern that of a widening human capital investment gap. Our data does not have income earnings, but taking from empirical studies in returns to education, our results imply significantly lower earnings for early child bearers. This is collaborated by indicators of economic progressions, such as wealth status, asset ownership, and career occupation. The probability of progression from poverty to higher economic wealth status by between 17.3% to 25.5% using

logistic regression and SEM, respectively. The logit estimates suggest that the probability of the poorest early bearer dropping from their current wealth status is higher by 6.6% whilst the probability of progressing from poor to richer wealth status is lower by 3%. The probability of contracting HIV is lower by between 0.9% and 3.8% for early child-bearers but statistically insignificant. Estimates for STIs could not be obtained due to smaller incidence across both early and non-early child bearers.

5.5 Discussion

Non-utilisation of ASRH services remains high in Zimbabwe despite government efforts in developing a national ASRH strategy. Current data shows that 22% of female youth gave birth in their teenage years (ZIMSTAT and ICFI, 2016), which indicates the non-utilisation of services such as contraceptives and condoms. The costs of non-utilisation of such ASRH services later in a woman's life have not been given much attention in Zimbabwe. This chapter sought to determine later life consequences of the non-utilisation of ASRH services by Zimbabwean young women.

The findings indicated that early childbirth condemns females to lower educational attainment , with the effect widening with age. PSM and regression estimates showed that the negative effect on attaining a professional career also widens with age. Early childbearing had an adverse effect on asset ownership, which was visible from middle adulthood; whilst the effect on wealth was visible in late adulthood. The adverse effect of higher HIV infection was statistically significant during young adulthood.

This chapter showed that early childbearing is associated with lower levels of schooling and that the effect increases as women get older. This finding corroborates results from studies conducted elsewhere in Africa (Bengesai et al., 2018, Makate and Makate, 2018), Latin America (Azevedo et al., 2012a), and Europe (Francesconi, 2008, Hair et al., 2009). Whilst in other countries such as South Africa, teenage mothers receive financial support (Ardington et al., 2015, Branson and Byker, 2018), countries like Zimbabwe with limited resources to provide similar safety nets will have these teenagers having poorer educational outcomes. Most of these youths even drop out of school to earn incomes to support the born child (Makate and Makate, 2017a,

Mudzuru & Another v Minister of Justice 2014, Hof and Richters, 1999). The growth in the effect of early childbearing on education with age suggests two observations. Firstly, opportunities were much gloomier for teen mothers in older cohorts than present. This would imply that the current education system has improved in favour of narrowing the gap between teen and non-teen mothers. Such changes include the judgment made by the Supreme Court of Zimbabwe in 2002 in which ruled that students falling pregnant should not be expelled from school since the male counterparts where not subject to similar punishment (Berg and Mamhute, 2013). The other argument would be that even presently, women who delay childbearing have better opportunities to increase education than teenage mothers. The extension of this advantage into old age corroborates evidence from Guilkey and Jayne (1997) who found teenage mothers and those who have lower than secondary education having high fertility in Zimbabwe. As such, women grow older, higher responsibility from their many children gives further limits the time available to pursue further studies.

The finding that early childbirth is associated with lower prospects of employment or better occupation, asset ownership, and poverty is consistent with findings by Finlay and Lee (2018). In a review of published literature, they find that sexual and reproductive health service uptake lead to economic empowerment through higher decision-making power in the household, labour force participation, and better wages.

The findings of this study have several policy implications. The negative effects of early childbearing negative effects require the government to intensify the distribution of contraceptives to reach universal coverage. Furthermore, the government must facilitate continued education for those who have early childbirths in pursuit of inclusive education, as stated in SDG4. Reforms to school laws in Zimbabwe, for example, are still in progress to ensure pregnant students are not discriminated against (Berg and Mamhute, 2013, Chaduka v Mandizvidza 2002).

The higher effect of early childbirth on education on the older cohort of mothers relative to the younger cohort calls for the government's need to explore adult education to reduce the effects that widen with age. The government also ought to mobilise resources for conditional cash transfers as an incentive for continuing education. These social protection measures have been found, reducing the effects of early

childbirth and actually helping the mothers focus on continuing education in South Africa (Ardington et al., 2015, Bengesai et al., 2018).

The finding that early childbirth reduces chances of employment or better occupation, asset ownership, and poverty requires that the government consider preferential treatment in its public sector employment and procurement policies to emancipate women who had early childbirths. Such support is for a shorter period compared to the current approach by the government of supporting education for the poor and farm inputs (Chipenda, 2019). These social protection measures have been found, reducing the effects of early childbirth and actually helping the mothers focus on continuing education and seeking employment in Latin America (Azevedo et al., 2012a).

The research suggests early initiation of comprehensive sexuality education as well as intensifying the current efforts. In addition to that, the country's education laws need reforming to facilitate safe sex. Condoms, for example, are not allowed to be distributed in schools (Bhebhe, 2018), and this is partly related to the age of sexual consent is 18, yet sexual debut before 18 stands at 40% (ZIMSTAT and ICFI, 2016). As a result, teenage scholars have limited access to contraception in the schooling environment, which they spend most of their time. This is in contrast to South Africa, for example, which recognises that minors below 16 years can engage in consensual sex amongst themselves as early as 12 years of age (Singh et al., 2017, Strode and Essack, 2017, Khampepe, 2013). As such, condom access is provided for in the South African national education policy for all learners (Strode et al., 2011, SADBE, 2015).

The study has added to the existing literature in two ways. Firstly, it established the effects of the non- utilisation of ASRH services on education, occupation, asset ownership, poverty, HIV, and STI infection for Zimbabwean women. Despite national-level data showing low uptake of ASRH services (ZIMSTAT and ICFI, 2016), the consequences of non-utilisation of ASRH services have not been investigated. Evidence exists for other countries such as Latin America (Azevedo et al., 2012a), Europe (Angelini and Mierau, 2018), South Africa (Ardington et al., 2015) and Madagascar (Almanza and Sahn, 2018, Herrera et al., 2019). Although Zimbabwe implemented an ASRH policy to encourage ASRH service utilisation and improve ASRH outcomes in 2010, the effects of ASRH service utilisation had not yet been

quantified. Secondly, the chapter disaggregated the effects by age group to show patterns into late life. This expands on current empirical knowledge, which focuses on early adulthood.

This chapter was limited in terms of analysing the impact of ASRH service utilisation on adult economic well-being. The chapter only focused on one indicator of the non-utilisation of ASRH services, which is teen childbearing. It thus presents minimum costs resulting from low uptake of ASRH services such as condoms and contraceptives. Further, the chapter did not analyse the effects of non-utilisation by males, consequences of their actions as well as of other population subgroups. The data available in ZDHS datasets, which are the most comprehensive datasets on health information at the micro-level, do not elicit financial rewards from work. The chapter could thus not conclude on whether there are differences in adult earnings. The chapter used the wealth index, which is readily available in the ZDHS datasets. Future studies could elicit wages earned by respondents and settle the question on differences in earnings. Furthermore, future studies could collect longitudinal data prospectively. Longitudinal data also allows studying intergenerational effects of the non-utilisation of ASRH activities on offspring. Longitudinal data is not prone to the recall bias limitation associated with the dataset used for the present study.

5.6 Conclusion

The essay concludes that there are huge benefits associated with the effective use of ASRH services in a woman's adulthood. It is in the best interest of each teenager to utilise these services to secure a future with better education, better occupation, improved wealth status as well as lower chances of contracting STIs and HIV. It is in the state's best interest to promote ASRH service utilisation to save costs on treating HIV/AIDS in the public health system. Consequences established on the effects of early childbearing on education, wealth, employment, and HIV can be used as baseline statistics for tracking progress towards SDGs 1-10. The study recommends that comprehensive sexuality education be intensified as well as started earlier in life. The study also recommends reforms to education and health policies so that they

promote timeous contraceptive use and assist young pregnant mothers in completing their studies.

Chapter VI

Conclusion

6.1 Introduction

Zimbabwe implemented an ASRH strategy in 2010 to improve sexual and reproductive health outcomes for adolescents and youths. The strategy was developed to address several challenges that required policy intervention such as information asymmetry, cultural and religious barriers, quality of services, limited coverage, and gender disparities. Despite the implementation of the ASRH strategy at the national level between 2010 and 2015, evidence on the success of the intervention is limited. Findings from scientific and survey reports indicate persisting negative ASRH outcomes, low service utilisation and high-risk sexual behaviour.

Evidence of poor ASRH outcomes include HIV prevalence among adolescents and youths in the country ranked the third highest in Southern Africa. It is higher among female youth than male youths by 1.6 times, which means that females have a disproportionate economic burden of HIV, such as lower productivity, higher treatment costs, and morbidity. STI prevalence increased from 2.1% to 2.7% in the last decade, which suggests emerging risky sexual behaviour, which is manifested through unprotected sex (ZIMSTAT and ICFI, 2016, MOHCC, 2017). Another poor ASRH outcome is adolescent childbirth, which is considered the highest globally (UN, 2020). It increased from 99 births per 1000 live births to 110 in 2015. Early pregnancy and childbirth expose the adolescent and young female to higher morbidity and mortality. For females, this often results in permanent or temporary discontinuation from formal education.

Evidence on underutilisation of ASRH services includes the decline in the treatment of the STI infections from 85.3% to 52% over the past two decades, which exposes the youth to health consequences such as reproductive disorders, infant infections,

liver failure, cancer, nervous system disease and higher chances of HIV infection (Chesson et al., 2017). There are also economic consequences, including the cost of treatment as well as the cost of managing the health consequences of STIs. Cervical cancer is emerging as a dangerous carcinoma amongst females (MOHCC, 2016). Furthermore, utilisation of preventative interventions targeted for youths, including male circumcision and cervical cancer screening, is still below national targets.

Besides the increasing STI infection highlighted above, further evidence of high-risk behaviour among youths includes the high number of tertiary students with multiple sexual partners at 60% (Mbanje, 2013), which is significantly higher than that of the average population of 10.6% (UNFPA, 2016). In addition to that, the uptake of HIV and STI preventative measures such as male circumcision and cervical cancer screening is low and lagging national targets by over 50%. While sexual activity among adolescents increased over the past two decades, contraceptive use declined and, consequently, unplanned pregnancies amongst adolescents soared up. Unwanted pregnancies result in abortions, which themselves are unsafe and in many cases, result in complications and increased mortality (Chikova and Chikova, 2019, Ganatra et al., 2017, Riley et al., 2020).

This dissertation set out to analyse ASRH service utilisation and outcomes in Zimbabwe. The dissertation consists of an introduction chapter, four empirical essays (in chapter 2, 3, 4, and 5), and this concluding chapter. This chapter summarises each essay's key findings and consolidates them in relation to the overall dissertation objectives presented in chapter one. Secondly, it proceeds to conclude the dissertation's overall objectives and each essay's specific objectives. Thirdly, the chapter consolidates each essay's recommendations into practical and policy-relevant remedies. The chapter proceeds to explore the limitations of the study and mitigatory measures that were explored. Lastly, the chapter suggests areas of extension and further research.

6.2 Summary of Methodology Applied

The dissertation relied on ZDHS data for three chapters and primary data for one chapter. Chapter two used three ZDHS datasets collected in 2005, 2010, and 2015. Data were analysed using logistic regression to identify key determinants, while the concentration index was used to determine disparity in ASRH services usage and outcomes. Chapter three analysed the impact of the ASRH strategy on health outcomes using the 2015 ZDHS dataset with the 2010 dataset as a baseline. The chapter combined the difference in difference and propensity score matching methods. Young people aged 15-19 years at baseline in 2010, who were exposed for the entire five-year strategy, were designated as the treatment group and young adults aged 25-29 at baseline as the control. Chapter four estimated youths' risk preference parameters using primary data collected from 250 students enrolled at Bindura University in Zimbabwe. Prospect theory parameters were established from a combination of lottery question switch points and parameter intervals estimated using probability midpoint analytical technique. The variation of the parameters with socioeconomic factors was investigated using the Wilcoxon rank-sum test as well as ordinary and interval regression techniques. To assess the effect on the non-utilisation of ASRH services, chapter five used data from the 2015 ZDHS women's dataset. Data were analysed using propensity score matching logistic regression and structural equation modelling.

6.3 Summary of Findings

While most of the previous literature generalised SRH issues for the whole population, chapter two investigated ASRH specific socio-economic determinants and disparities and how they evolved prior to the ASRH strategy implementation, at implementation and post-implementation. It also analysed the distribution of service utilisation and outcomes across different socioeconomic groups and assesses how the distribution changes with time. The essay updated existing literature by providing recent evidence on adolescent and youth specific socio-economic determinants of reproductive health service use, outcomes and their equity connotations. Evidence on whether progress has been made in increasing ASRH service utilisation, improving ASRH outcomes and

reducing ASRH inequalities over time has been missing in literature. Chapter 2 thus occupied this knowledge gap by analysing changes in ASRH service utilisation, outcomes and inequalities over the past 15 years where ASRH policy reforms have been implemented together with the allocation of substantial resources that could have been spent elsewhere. The research identified socio-economic factors influencing ASRH service utilisation and outcomes such as wealth, education, gender, information access, and place of residence. The chapter found decreasing socio-economic inequalities in HIV testing, STI treatment, contraceptives use, and early childbearing. Increasing socio-economic inequalities were found in STI treatment, condom use, and HIV infection.

The implementation of the ASRH strategy in 2010, coupled with the seemingly worsening ASRH indicators, gave rise to the need to evaluate progress in the strategy's implementation. Chapter 3 evaluated the impact of the ASRH strategy. The essay's contribution was its quantitative insight into whether the ASRH strategy, implemented as a multi-pronged approach, improved ASRH utilisation and outcome variables. The analysis of the multiple complementary ASRH interventions as implemented in Zimbabwe is the first such attempt in scientific literature, to the researcher's best knowledge. It contrasts previous approaches which evaluated select geographic areas or interventions due to data limitations, failure to define treatment and control groups, and failure to control for spill over effects. In addition to that, the essay provided an insight into whether the problem with ASRH programming was funding or allocative efficiency by comparing different provinces that obtained different resources. The chapter also added to the literature: subgroup analysis by gender, wealth and place of residence to establish equity in ASRH services, which is missing from most ASRH evaluations. Findings in this chapter show that the ASRH strategy improved the utilisation of services such as HIV testing and STI treatment. Another success story came in the reduction of HIV infection as an ASRH outcome. The ASRH impact differed by education status and place of residence. The research also revealed that there might have been inefficient allocation of ASRH resources as provinces that received more resources did not attain better ASRH outcomes.

Chapter 4 investigated sexual and reproductive health risk preferences using youths in a university setting. The chapter established that ASRH service uptake fits the

prospect theory framework. More specifically, results establish prospect theory parameters for ASRH risk-taking. The essay found an average risk aversion parameter of 0.7 and a probability weighting parameter of 0.8. A loss aversion parameter of 2.26 was found which indicates the need to reduce loss-framed messages in favour of positively framed awareness campaigns. Bivariate and multivariate regression analyses showed that income, prior sexual and reproductive health knowledge, and alcoholism were associated with risk and loss aversion. The research attempted to establish prospect theory risk parameters specific for youths in the sexual and reproductive health domain. The decision to choose prospect theory was informed by research evidence that assumptions of expected utility theory, a gold standard for risk preference elicitation, were violated for the health domain. Another contribution of the chapter was that unlike reviewed literature that used participants not linked to the interventions, this study's participants belong to the targeted population for which the study results can be generalised.

To show the magnitude of the economic consequences of non-utilisation of ASRH services, Chapter 5 estimated differences in ASRH outcomes between women who had early childbirth and those who delayed. To the researcher's best knowledge, this is the first study to estimate the added economic burden attributable to non-utilisation of ASRH services. The chapter established that early childbirth condemns a woman to lower education attainment, lesser chances of career development, as well as greater chances of poverty, STI, and HIV infections.

6.4 Conclusion

This research's overall objective was to analyse sexual reproductive health utilisation and outcomes among the youth in Zimbabwe. The dissertation pursued this objective in four empirical essay chapters, each covering the following specific objectives by order:

1) To determine socio-economic factors that influence the utilisation of ASRH services and outcomes, how their influence has evolved over time, and the equity connotations

2) To assess the effects of the 2010-2015 government ASRH programme on improving service utilisation and outcomes.

3) To analyse and characterise their risk preferences using an alternative to the expected utility theory, the prospect theory

4) To assess the economic costs of failure to utilise reproductive health services to an individual, household, and health system.

Chapter two concluded that the influential socio-economic determinants of ASRH service utilisation and outcomes are wealth status, education, place of residence, gender, and access to ASRH information. It concluded that the ASRH strategy led to a decline in ASRH service utilisation and outcomes in socio-economic disparities. Socio-economic inequities still exist and are widening for services such as STI treatment, contraceptives use, and condom utilisation. Inequities are also widening in outcomes such as adolescent childbirth and HIV infection. To the best of our knowledge, no study has evaluated the evolution of disparities in ASRH outcomes as established in chapter two.

Chapter three concluded that the ASRH strategy resulted in improvements in HIV testing, STI treatment, and reduced HIV prevalence trajectory. The reduction in HIV prevalence trajectory led to the conclusion that HIV incidence went down. The reduction in HIV incidence with no significant change in condom use leads to the conclusion that other behaviour changing components of ASRH had a dominant effect on reducing new infections. The lack of significant differences in ASRH outcomes of provinces with more resources leads to the conclusion that allocative inefficiency leaves room for reallocation of resources and improvement of the quality of services. The essay analysed multiple complementary ASRH interventions, in contrast to previous piecemeal approach studies limited to particular regions or interventions. It can thus be concluded that the essay's analytical approach successfully provided a non-abstract picture of the effects of the ASRH intervention, which had been missing from past literature.

Chapter four concluded that youth sexual and reproductive health risk-taking can be explained by prospect theory. The risk parameters estimated in the essay are consistent with prospect theory, which has not yet been considered to study ASRH risk-taking behaviour. The essay also concluded that to increase service utilisation among youth facing uncertainty in ASRH interventions, healthcare providers need to

remove discomforts at the point of care. Characteristics of youths such as family income, level of ASRH knowledge, and history of alcohol consumption can be targeted to promote ASRH service utilisation.

Chapter five concluded that the non-utilisation of ASRH services has long-lasting adverse effects. Women who venture into early motherhood lose out in terms of higher education, better occupation, improved wealth status, and also stand increased chances of contracting STIs and HIV. Thus, this essay established the long-term effects of the non-utilisation of ASRH services unlike previous literature that showed short-term consequences.

6.5 Recommendations

To counter the widening inequities in ASRH services such as STI treatment, contraceptives use, and condom utilisation. The research recommends balanced service provision across all socio-economic groups and increased efforts towards enhanced service delivery in rural areas and in targeting the poor. Another recommendation refers to the use of economic incentives such as conditional cash grants to promote contraceptives and condoms in hard-to-reach areas and among the poor. Furthermore, the study recommends reallocating public health resources from urban to rural areas and that engaging the private sector to supply ASRH services in urban areas might be prudent.

To reduce the widening inequities in outcomes such as adolescent childbirth and HIV infection, the research recommends more investment in community health workers for ASRH education. Conditional cash transfers to promote contraceptives use can be remedy for teen childbearing.

The decline in HIV infection without significant improvements in condom uptake provokes the recommendation for promotion of risk-reducing behaviour namely extramarital affairs, commercial, and casual sex relations complemented by CSE, mass media, scale-up of voluntary counselling and testing. Removal of legal barriers to the distribution of condoms to teenagers is also required in order to promote condom

utilisation. The research also recommends allocating more resources for STI management to consolidate gains made so far and stocking hard-to-reach health facilities with medicines and HIV testing kits.

The unexpected increase of HIV prevalence in Matabeleland South necessitates targeting HIV hotspots such as artisanal mining areas and border towns in the province. Health facilities and mobile units need to be well-stocked with pre and post-exposure prophylaxis and also ensuring high adherence monitoring in these places. To reduce STIs and HIV prevalence in identified HIV hotspots, the chapter recommends scaling up pre and post-exposure prophylaxis together with increased adherence monitoring. HIV hotspots like mining areas are also characterised by sexual violence against women, which hinders the adoption of safe sexual practices. Thus, the research recommends that law enforcement agents enforce human rights in general, and sexual and reproductive health rights in particular in these HIV hotspots. To reduce STI prevalence, particularly in rural areas, the ASRH programme design can be improved by equitably differentiating the approaches used to deliver services for youths in school relative to those out of school, to reach at-risk populations in HIV hotspots relative to those in less risky locations, as well as those in urban versus those in rural areas. Furthermore, delivering ASRH services through youth-friendly centres needs more monitoring to avoid them being dominated by male youths at the expense of females.

The lack of impact in regions with more intense ASRH programmes suggests technical and allocative inefficiency. The chapter recommends minimising costs for ineffective interventions as well as refining the interventions so that they are more appropriate for the targeted groups. The research further recommends developing a coordination framework to ensure that the efforts of implementers of the different components of the ASRH strategy complement each other to avoid duplication of roles that waste resources that could be useful elsewhere. Such a framework has to guide implementers as they design their workplans. In addition, there is a need to align government policies from the status quo where on the one hand, the ASRH strategy promotes the uptake of contraceptives while, on the other, the government policy prohibits the distribution of condoms in schools. Without such changes, some

components might, in fact, play a deleterious role, with the likelihood of cancelling the effect of the overall combination.

The fitting of youth risk-taking tendencies within prospect theory predictions means that ASRH information campaigns have to focus on positively framed messages and education about interventions such as circumcision, cervical cancer screening, HIV testing, and contraceptives use. In addition to that, health facilities can increase uptake of services by addressing elements that bring discomfort to youths, such as lack of privacy, unfriendly staff, and stigma at health facilities. The result of an association between ASRH knowledge and risk and loss aversion implies the scope of ASRH information awareness for youth to ensure better-informed choices. Another suggestion made was economic emancipation of the youths to increase economic prospects, which in turn improves reference points. Resultantly, this changes the viewing of health interventions and outcomes from the loss domain to the gain domain.

The implementation of CSE in early adolescence needs to be intensified. This could help embed ASRH service utilisation in sexual and reproductive health decision making by the onset of sexual activity. To reduce the negative effects of poor ASRH outcomes such as early childbearing, policymakers ought to support adult education and offer cash transfer incentives; offer child support for teenage mothers; promote public sector employment preferential treatment, and review education regulations to support condoms in schools. Inclusive education that facilitates further education even for pregnant school-going youths is required. The higher negative effect of early childbirth on education on the older cohort of mothers relative to the younger cohort suggests that the government considers adult education to reduce the effects that widen with age. The finding that early childbirth reduces chances of employment or better occupation, asset ownership and better livelihoods requires that the government consider preferential treatment biased towards females in its public sector employment and procurement policies. This could emancipate women who had early childbirths.

In addition to that, the country's education laws need reforming to facilitate safe sex practices. Condoms, for example, are not allowed to be distributed in schools and this is partly related to the age of sexual consent is 18, yet sexual debut before 18 stands at 40%. As a result, teenage scholars have limited access to contraception in the

schooling environment, which they spend most of their time. For example, this contrasts with South Africa, which recognises that minors below 16 years can engage in consensual sex amongst themselves as early as 12 years of age.

6.6 Limitations

ZDHS data used in the essays is associated with limitations of retrospective reporting. Recall bias, self-completion, and social desirability of responses cause errors in reporting sexual and reproductive health events. Since recall bias is more common in older respondents, it could only have had minor effects given the age group targeted by this research. Youths can also overstate their current age or age of first birth because it is socially desirable to do so or to avoid legal repercussions. This implies that the estimates of early childbearing and its distribution should be interpreted as the minimum.

The ASRH impact evaluation essay had a limit of a perfect control group to compare with the targeted group since the strategy was implemented across the country. The research utilised the age group closest to the treatment group, with only a difference of five years between them, which was not the ASRH strategy's target. There is a high chance that the post strategy control group could have been contaminated due to ASRH beneficiaries' presence in the household. The research managed this by excluding households that had members targeted by the strategy from the control group.

Data used for chapter four was collected from youths at a single tertiary education institution, which limited the study's geographical coverage. Although university students' use in prospect theory risk preference research is common, the parameters established in such environments might not be generalised beyond the study setting. The findings thus must be interpreted within such a context.

Chapter five was limited in terms of analysis of the impact of ASRH service utilisation on adult economic well-being. It only focused on one indicator of the non-utilisation of ASRH services, which is teen childbearing. The chapter thus presents minimum costs resulting from low uptake of ASRH services such as condoms and contraceptives. The

chapter did not analyse the effects of non-utilisation by males, consequences on their actions as well as other population subgroups. The data available in ZDHS datasets, which are the most comprehensive datasets on health information at the micro-level, do not elicit financial rewards from work. The study could thus not conclude on whether there are differences in adult earnings. The chapter used the wealth index, which is readily available in the ZDHS datasets.

6.7 Areas of Further Study

The possibility of recall bias acknowledged in this research presents scope for future studies to apply computer technology for data collection to eliminate such bias. After accumulating more 5-year datasets, future studies can provide much clearer trends in ASRH service utilisation, outcomes, and their distribution across different socioeconomic classes. Future ASRH strategies ought to collect baseline data, as well as end of strategy data for full impact evaluation. This data can also be used by independent researchers in future studies. Future studies with better funding could be expanded to cover a wider population than at one institution. In addition to that, future studies could investigate other SRH interventions as well as investigating the effects of ASRH message framing. Future studies on long term effects of non-utilisation of ASRH could elicit wages earned by respondents and settle the question on differences in earnings. Furthermore, future studies could collect longitudinal data prospectively. Longitudinal data also allows studying intergenerational effects of the non-utilisation of ASRH activities on offspring. Longitudinal data is not prone to the recall bias limitation associated with the datasets used for the four essays in this dissertation.

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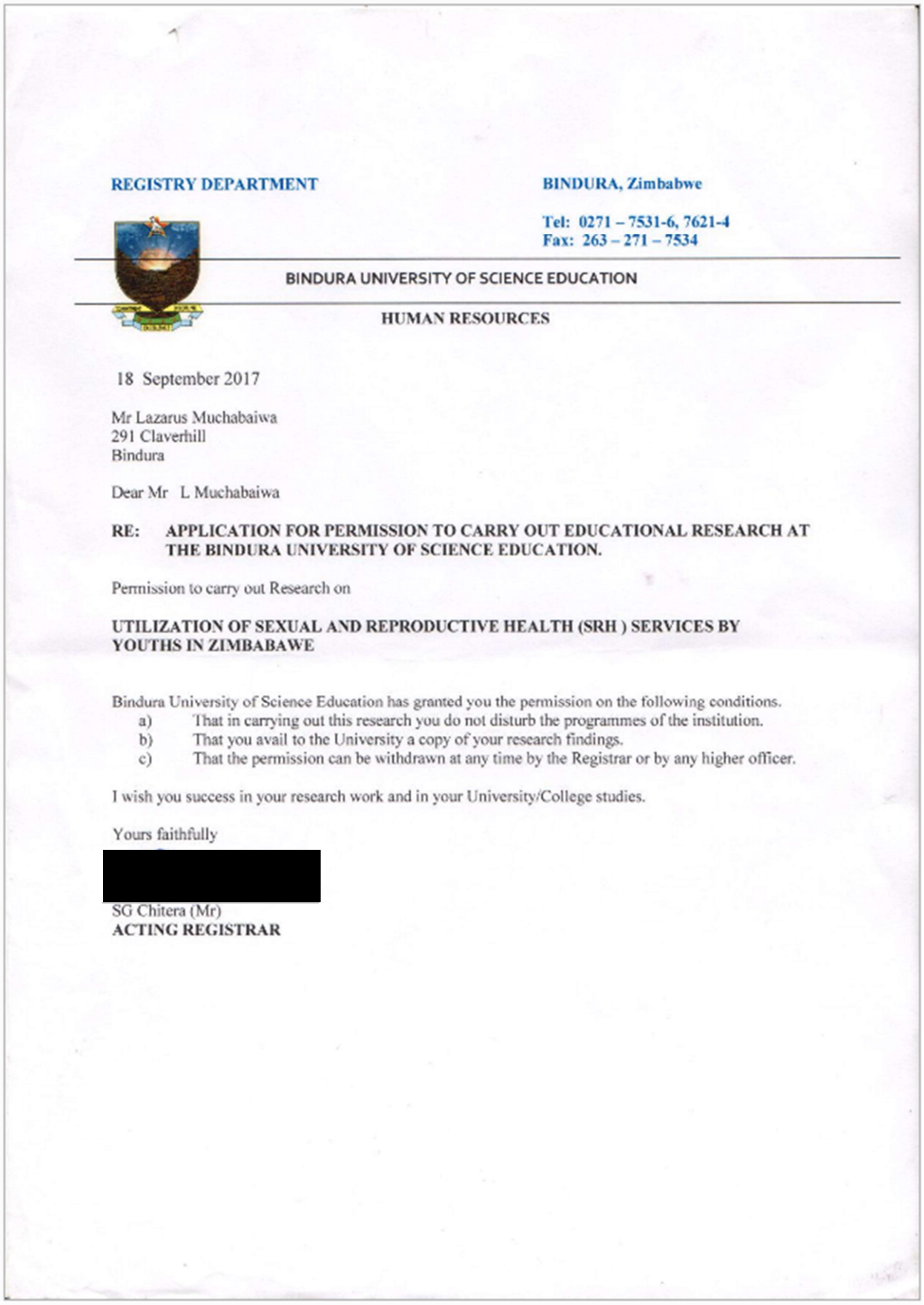
Appendix 4.1: Gatekeeper Clearance

The researcher sought and obtained clearance for carrying out the study from Bindura University of Science Education where the study was conducted.



REGISTRY DEPARTMENT

BINDURA, Zimbabwe

Tel: 0271 – 7531-6, 7621-4
Fax: 263 – 271 – 7534

BINDURA UNIVERSITY OF SCIENCE EDUCATION

HUMAN RESOURCES

18 September 2017

Mr Lazarus Muchabaiwa
291 Claverhill
Bindura

Dear Mr L Muchabaiwa

RE: APPLICATION FOR PERMISSION TO CARRY OUT EDUCATIONAL RESEARCH AT THE BINDURA UNIVERSITY OF SCIENCE EDUCATION.

Permission to carry out Research on

UTILIZATION OF SEXUAL AND REPRODUCTIVE HEALTH (SRH) SERVICES BY YOUTHS IN ZIMBABAWE

Bindura University of Science Education has granted you the permission on the following conditions.

a) That in carrying out this research you do not disturb the programmes of the institution.
b) That you avail to the University a copy of your research findings.
c) That the permission can be withdrawn at any time by the Registrar or by any higher officer.

I wish you success in your research work and in your University/College studies.

Yours faithfully

[redacted]

SG Chitera (Mr)
ACTING REGISTRAR

Appendix 4.2: UKZN Ethics Institutional Review Board clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

16 May 2018

Mr Lazarus Muchabaiwa (216076886)
School of Accounting, Economics & Finance
Westville Campus

Dear Mr Muchabaiwa,

Protocol reference number : HSS/0989/017D
Project title: Analysis of Sexual and Reproductive Healthcare utilization among young people in Zimbabwe

Full Approval – Full Committee Reviewed Protocol

In response to your application received 4 July 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr [redacted] Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr Josue Mbonigaba cc Acting Academic
cc.Leader Research: Dr Colette Muller
cc School Administrator: Ms Nondumiso Mfungeni

Appendix 4.3: Informed consent form

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

INFORMED CONSENT RESOURCE TEMPLATE

Information Sheet and Consent to Participate in Research

Date:_____

Greeting: Hello Student.

My name is **Lazarus Muchabaiwa** from Bindura University of Science Education, Economics Department. I am here today, however, in my capacity as a PhD Student at the University of Kwazulu Natal, School of Accounting, Economics and Finance. My phone number is +263773357533 and email address lmuchabaiwa@gmail.com.

You are being invited to consider participating in a research study that seeks to establish risk attitudes and preferences of young people towards prevention from sexual and reproductive health risks through a questionnaire with sociodemographic questions and experimental questions. The study is expected to enroll 300 students at Bindura University of Science Education, in Zimbabwe. It will involve you answering a questionnaire on socioeconomic and demographic questions in the first phase. This questionnaire also seeks to find out about your knowledge, attitudes and utilization of sexual and reproductive health services. The second phase of your participation is an economics laboratory experiment, which involves making choices over a set of hypothetical scenarios on sexual and reproductive health services. This phase requires a high level of concentration and the researcher will explain the experimental procedure, how to record your answers and also take you through an example. You will be given two sets of hypothetical scenarios for different sexual and reproductive health interventions relevant to your gender. Information from this experiment is intended to establish university students risk preferences towards sexual and reproductive health.

The duration of your participation if you choose to enroll and remain in the study is expected to be an hour: (30 minutes on the questionnaire and 20 minutes for two lab experiment sessions and 10 minutes to break anytime during the experiment)

The study may involve the following risks and/or discomforts:

1. Disclosing intimate information
2. Disclosing household information

The study is being conducted to inform policy and programming of sexual and reproductive health promotion packages and not direct benefits to you. The researcher, however, undertakes to pay $5 for completing the questionnaire and completing both experimental sessions to compensate for your time in participating in this research.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number_HSS/0989/017D).

The researcher intends to administer the questionnaires and laboratory experiment scenarios in the computer lab at Bindura University of Science Education. In the event of any problems or queries, raise your hand for assistance or if necessary, contact the researcher at +263773357533 and email address lmuchabaiwa@gmail.com or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Please note that participation in this research is voluntary. You may withdraw participation at any point. In the event of refusal/withdrawal of participation the participants will not incur penalty or loss of treatment or other benefit to which you are normally entitled at Bindura University of Science Education and myself as a Lecturer at the institution.

Please raise your hand anytime you wish to withdraw from the study and notify the researcher that you intend to do so.

The researcher does not anticipate any costs on your part in order to participate, during or after participating in the study. US$5 (or its equivalent) will be given to those completing all the three tasks (completing the questionnaire and attempting both sets of questions for the hypothetical scenarios.

If you indicate your willingness to participate in this study by signing this document, the information you provide on the questionnaire shall be used in strict confidence and your name shall not appear during the analysis of this information. In no way shall the information you provide lead to any follow up on any details you will provide. I will consolidate responses from different questionnaires into a dataset without any names. The data set will be analyzed and only the results will

be published as a dissertation, policy and journal papers. The published dissertation results will be disclosed to examiners at the University of Kwazulu Natal, external examiners, policy makers and academic audience. The questionnaires and hypothetical lab answer sheets will be stored in a secure location by my supervisor for the next 5 years after which they will be destroyed by burning. Any information that is obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission.

CONSENT (Edit as required)

I _____have been informed about the study entitled **"Sexual and Reproductive Healthcare Utilization among young people in Zimbabwe"** by **Lazarus Muchabaiwa**.

I understand the purpose and procedures of the study are to establish risk attitudes and preferences of tertiary education students towards prevention from sexual and reproductive health risks. I understand that I am being asked to fill in a questionnaire with socioeconomic background, knowledge and attitudes as well as utilization of sexual and reproductive health services. I also understand that I will be asked to make choices from hypothetical scenarios related to sexual and reproductive health in a laboratory setting.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

I have been informed about any available compensation or medical treatment if injury occurs to me as a result of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher in person, at phone number +263773357533 and email address lmuchabaiwa@gmail.com.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

_____ _____

Signature of Participant **Date**

Appendix 4.4: Socioeconomic Questionnaire

COLLEGE OF LAW AND MANAGEMENT STUDIES

School of Accounting, Economics & Finance

Doctoral Degree Data Collection Tool Proposal

QUESTIONNAIRE

Researcher:	Lazarus Muchabaiwa
Student Number:	216076886
Email:	lmuchabaiwa@gmail.com
Cell No.:	+263773357533
Supervisor:	Dr Josue Mbonigaba

INSTRUCTIONS

1. If you have accepted participating in the study and signed the informed consent form, please attempt all questions in the questionnaire honestly and consistently. The Questionnaire has two parts including an attachment with experimental questions. Although it is important for the study that you attempt all questions, **it is your right to skip any or all questions** for which you are not comfortable answering.
2. If you have not accepted participating in the study, please do not fill in the questionnaire.
3. Circle the number corresponding to your answer in the second column as appropriate.
4. Insert required details in spaces provided as appropriate.
5. Acknowledgement: This questionnaire has been adapted from Illustrative Questionnaire for Interview-Surveys with Young People by John Cleland (2001). The experimental questionnaire is adapted from Experiment Design and Sample Record Sheets Instructions to Experiment Participants by Nguyen and Leung (2009).

SECTION A1: SOCIOECONOMIC AND FAMILY BACKGROUND	
1.1 Sex of Respondent	Male 1 Female 2
1.2 What day, month and year were you born?	Day Month Year
1.3 Was the A level school that you attended a government or private institution?	Government 1 Private 2 Mission 3
1.4 Was the A level school that you attended for Boys or Girls?	Mixed 1 Boys Only 2 Girls Only 3
1.5 Were you on day schooling or boarder?	Day 1 Boarder 2
1.6 How old were you at your last birthday?	_____years old
1.7 What is your religion?	None 1 Catholic 2 Protestant 3 Apostolic Sect 4 Other Christian 5 Other religion…….. (SPECIFY)
1.8 State average monthly budget allocated by parent/guardian at college	$…….
1.9 How often do you usually attend religious services?	At least once a week 1 At least once a month 2 At least one a year 3 Never 4
1.10 How important is religion in your life?	Very important 1 Important 2 Not important 3
1.11 Is your father alive?	Yes 1 No 2
1.12 If father is alive, does he live in the same household as you?	Yes 1 No 2

1.13 If father is alive, do you find it difficult or easy to talk with your father about things that are important to you?	Very easy	1
	Easy	2
	Average	3
	Difficult	4
	Very difficult	5
	Do not see him	6
1.14 If father is alive, have you ever discussed sex-related matters with your father? If YES Often or occasionally?	Often	1
	Occasionally	2
	Never	3
1.15 Is your mother alive?	Yes	1
	No	2
1.16 If mother is alive, does she live in the same household as you?	Yes	1
	No	2
1.17 If mother is alive, do you find it difficult or easy to talk with your mother about things that are important to you?	Very easy	1
	Easy	2
	Average	3
	Difficult	4
	Very difficult	5
	Do not see her	6
1.18 Have you ever discussed sex-related matters with your mother? If YES Often or occasionally?	Often	1
	Occasionally	2
	Never	3
1.19 Home household size: how many family members live in the same household as yourself.	_____	
1.20 Do you have any older brothers?	Yes	1
	No	2
1.21 Do any live in the same household?	Yes	1
	No	2
1.22 Do you have any older sisters?	Yes	1
	No	2
1.23 Do any live in the household?	Yes	1
	No	2
1.24 Where does your family stay	Urban high density	1
	Urban medium density	3
	Urban low density	4
	Rural less than 100 km from closest town	5
	Rural more than 100 km from closest town	6

1.25 How many television sets does your household own	_____
1.26 How many refrigerators does your household own	_____
1.27 How many phones does your household own	_____
1.28 How many cars does your household own	_____
1.29 How many bicycles/motor does your household own	_____
1.30 household main source of water	bottled water/water piped 1 public tap, protected well, etc; 2 unprotected well, borehole, spring, surface water 3
1.31 household toilet	Family own private flush toilet 1 Shared/public toilet, improved pit latrine 2 Traditional pit latrine 3 Hanging toilet, or no toilet facility 4
1.32 household floor quality	parquet, carpet, tiles, ceramic 1 cement, concrete, raw wood 2 none, earth, dung 3
1.33 Family House owned or rented?	Owned 1 Rented 2
1.34 Number of rooms	_____
1.35 How many times in the last month have you drunk alcohol?	_____
1.36 Do you ever smoke? IF YES. How many have you smoked cigarettes in the last month?	_____
1.37 Has a family member been recently diagnosed with any of the listed diseases (tick where necessary)	HIV 1 Cancer 2 TB 3 STI 4

1.38 Has a close friend been recently diagnosed with any of the listed diseases (tick where necessary)	HIV Cancer TB STI	1 2 3 4
1.39 Has a family member (sister/mother) carried an unplanned pregnancy in the last two years (tick where necessary)	Yes No	1 2
1.40 Circle all states which apply to your biological parents?	Married Separated Single parent Divorced Deceased Widowed	1 2 3 4 5 6
1.41 How much is your household average monthly income combined	_____	
1.42 How much is your household average monthly expenditure combined	_____	

SECTION A2: KNOWLEDGE AND UTILISATION OF REPRODUCTIVE HEALTH

		(1) Most Important	(2) Second most important	(3) Preferred
2.1 Young people learn about **puberty** - I mean the ways in which boys' and girls' bodies change during the teenage years - from many sources. They may learn from teachers at school, parents, brothers and sisters, from friends, from doctors or they may learn from books, films and magazines. What has been the most important source of information for you on this topic? And the second most important? CIRCLE MOST IMPORTANT IN COL 1 AND SECOND MOST IMPORTANT IN COL 2	School teacher	01	01	01
	Mother	02	02	02
	Father	03	03	03
	Brother	04	04	04
	Sister	05	05	05
	Other family members	06	06	06
	Friends	07	07	07
	Doctors	08	08	08
	Books/magazines	09	09	09
	Films/Videos	10	10	10
2.2 From whom, or where, would you prefer to have received more information on this topic? CIRCLE ONE ANSWER IN COL. 3	Other (Specify……)	11	11	11
		……..… ……..	……..…… …….	……..… ……..

		(1) Most Important	(2) Second most important	(3) Preferred
2.3 Now I want to ask you a similar question about sources of information on the **sexual and reproductive systems of men and women** - I mean where eggs and sperm are made and how pregnancy occurs. What has been the most important source of information on this topic? And the second most important? CIRCLE IN COLS. 1 AND 2.	School teacher	01	01	01
	Mother	02	02	02
	Father	03	03	03
	Brother	04	04	04
	Sister	05	05	05
	Other family members	06	06	06
	Friends	07	07	07
	Doctors	08	08	08
2.4 From whom or where, would you prefer to receive (or prefer to have received) more information on this topic? CIRCLE ONE ANSWER IN COL. 3	Books/magazines	09	09	09
	Films/Videos	10	10	10
	Other (Specify……)	11	11	11
		……..… ……..	……..…… …….	……..… ……..

SECTION A3: CURRENT/MOST RECENT HETEROSEXUAL RELATIONSHIP

3.1 Have you ever had a girl/ boy friend to whom you were sexually or emotionally attracted and whom you 'dated'	Yes 1 No 2
3.2 How many girl / boy friends have you had?	Number_____
For your CURRENT (MOST RECENT) girl / boy friend	
3.4 How old is he/she?	_____Years old
3.5 When you started your relationship, was he/she single, married, divorced or separated?	Single 1 Married 2 Divorce 3 Separated 4
3.6 When you started you relationship with him/her, was he/she a full time student, working or neither?	Full time student 1 Working 2 Neither 3
3.7 How many months or years ago did you first 'date' him/her?	_____Months ago or____ Years ago
3.8 Has the relationship ended?	Yes 1 No 2
3.9 How many days/weeks/months did it last? I mean from the first time you 'dated' to the last time?	_____Days Or _____Weeks Or _____Months
3.10 Who decided to end the relationship? You, him/her or both of you.	Me 1 Him/her 2 Both 3 Other 4
3.11 During the time you were/have been 'dating' him/her did you 'date'/have you 'dated' anyone else?	Yes 1 No 2
3.12 How would you describe your relationship with him/her? Was (is) it (a) a casual friendship; (b) a serious relationship but with no intention of marriage; or (c) an important relationship that might lead to marriage?	(a) Casual 1 (b) Serious 2 (c) Important/might lead to marriage 3 (d) Engaged to be married 4
3.13 And how do you think he/she would describe her /his relationship to you? (a) as a casual friendship; (b) a serious relationship but with no intention of marriage; (c) an important relationship that might lead to marriage?	(a) Casual 1 (b) Serious 2 (c) Important/might lead to marriage 3
3.14 Did you and he/she have any physical contact, such as holding hands or hugging?	Yes 1 No 2

3.15 Did you ever kiss him/her on the lips?	Yes 1 No 2
3.16 Did you ever have sex with him/her?	Yes 1 No 2
At what age did you have consensual sexual debut?	(a) before 10 years 1 (b) 10-14 2 (c) 15-19 3 (d) 20-24 4 (e) not yet 5
3.17 How many partners have you ever had consensual sex with?	(a) 0 1 (b) 1 2 (c) more than 1 dated same time 3 (d) more than 1 dated different times 4
3.18 Number of consensual sexual partners since University enrollment	(a) 0 1 (b) 1 2 (c) more than 1 dated same time 3 (d) more than 1 dated different times 4
3.19 Think back the first time you had sex with your current (or just ended relationsip) boy/girl friend, Would you say: (a) I forced him/her to have intercourse against her/his will (b) I persuaded him/her to have intercourse (c) boy/girl friend persuaded me to have intercourse (d) boy/girl friend forced me to have intercourse (e) We were both equally willing	(a) I forced 1 (b) I persuaded 2 (c) persuaded 3 (d) forced 4 (e) Both willing 5
3.20 And would you say it was planned or unexpected?	Planned 1 Unexpected 2
3.21 How old were you at the time you first had sex with him/her?	_____years old
3.22 The last time you had sex, did you do anything to avoid a pregnancy?	Yes 1 No 2
3.23 What method did you use?	Condom 1 Pill 2 Injection 3 Withdrawal 4 Safe period 5 Other…….. 6
3.24 Did you ever discuss contraception with your partner? IF YES Did you discuss contraception before or after you first had intercourse?	Before first intercourse 1 After first intercourse 2 Never 3

3.25 How many times did you and with your partner have full intercourse? (*estimate*)	_____ Once only 1
3.26 Apart from the first time, did you and your partner ever use a method to avoid pregnancy? IF YES Always or sometimes?	Always 1 Sometimes 2 Never 3
3.27 What method did you and with your partner mostly use? (MULTIPE RESPONSES PERMITTED)	Condom 1 Pill 2 Injection 3 Withdrawal 4 Safe period 5 Other…….. 6
3.28 Where did you or your partner get this method? (CIRCLE ONLY ONE)	Shop 1 Pharmacy 2 Govt. Clinic/Health Centre/Hospital 3 Private Doctor/Nurse/Clinic 4 Friend 5 Other…….. 6 Don't know 9
3.29 SEE Q. 3.31 Whose decision was it to use a method always/sometimes/never? Was it mainly your decision, NAME'S decision or a joint decision?	My decision 1 NAME'S decision 2 Joint decision 3
3.30 MALES: Did your partner ever become pregnant by you? FEMALES: Did you ever become pregnant by your partner?	Yes 1 No 2
3.31 What happened to the pregnancy?	Currently pregnant 1 Abortion 2 Miscarriage 3 Live-birth 4 No sure 5
3.32 Were you ever concerned that you might catch AIDS or another sexually transmitted disease from your partner? IF YES Very or somewhat?	Very concerned 1 Somewhat concerned 2 Not concerned 3
3.33 Were you able to do anything to reduce the risk of infection	Yes 1 No 2
3.34 What did you do? *Probe*	Use condoms 1 Take medicines 2 Other (……..) 3
3.35 If you did not have physical contact/kiss/touch etc. with your partner. Think carefully and indicate which of these statements is true. (a) I wanted (more) physical contact but partner refused (b) partner wanted (more) physical contact but I refused	(a) Respondent wanted 1 (b) partner wanted 2

(c) Neither of us wanted more physical contact	(c) Neither wanted	3

SECTION A4: TYPES OF HETEROSEXUAL CONTACT

4.1 Some young people are forced to have sexual intercourse against their will by a stranger, a relative or an older person. Has this ever happened to you?	Yes No	1 2
4.2 How many different strangers, relatives or older perons have forced you to have sex against your will?	No._____	
4.3 Some young people have 'one night stands', perhaps after a party or after drinking? Has this ever happened to you?	Yes No	1 2
4.4 How many 'one night stands' have you had?	No._____	
4.5 Did you or the sexual partner do anything to avoid a pregnancy on these occasions? IF YES Always or sometimes?	Always Sometimes Never	1 2 3
4.6a Some young people pay money or gifts in exchange for sexual intercourse. Has this ever happened to you? 4.6b Some you people receive money or gifts in exchange for sexual intercourse. Has this ever happened to you?	Yes No Yes No	1 2 1 2
4.7 How many women/men have you had sex with for money or gifts?	No.	
4.8 Did you or the sexual partner de anything to avoid a pregancy on these occasions? IF YES Always or sometimes?	Always Sometimes Never	1 2 3
4.9 MALES: Have you ever made a girl or woman pregnant? IF YES How many times? FEMALES: Have you ever been pregnant? IF YES How many times?	No. Never Not Sure	 0 9
4.10 Thinking of the most recent pregnancy, did you want the pregnancy at that time or not want it?	Want Not want	1 2
4.11 What happened to the (last) pregnancy?	Currently pregnant Abortion Miscarriage Live-birth Not sure	1 2 3 4 5

FOR THOSE WHO HAVE NEVER EXPERIENCED SEXUAL INTERCOURSE			
People may have mixed reasons for not having intercourse. Please indicate for each reason whether it applies to you or not.	Applies	Not applies	Don't Know/ Not Sure
4.12 I don't feel ready to have sex.	1	2	3
4.13 I have not had the opportunity.	1	2	3
4.14 I think that sex before marriage is wrong	1	2	3
4.15 I am afraid of getting pregnant	1	2	3
4.16 I am afraid of getting HIV/AIDS or another sexually transmitted infection.	1	2	3

4.17 And now I have a question about your future plans about sexual intercourse. Which of these statement best describes your plans? (a) I plan to wait until marriage (b) I plan to wait until I am engaged to be married (c) I plan to wait until I find someone I love (d) I plan to have sexual intercourse when an opportunity comes along	(a) Marriage 1 (b) Engagement 2 (c) Love 3 (d) Opportunity 4
4.18 Do you feel any pressure from others to have sexual intercourse? IF YES A great deal or a little?	A great deal 1 A little 2 None 3
4.19 From whom do you feel pressure? PROBE CIRCLE ALL THAT APPLY	Friends 1 Relatives 2 Work colleagues 3 Partner/special friend 4 Other …… 5 ……

SECTION A5: KNOWLEDGE OF HIV/AIDS AND SEXUALLY TRANSMITTED DISEASES

5.1 Have you heard of HIV or AIDS?	Yes 1 No 2		
For the following statements about HIV/AIDS, please indicate whether you think the statement is true, or false, or whether you don't know.	True	False	Don't know
5.2 It is possible to cure AIDS	1	2	3
5.3 A person with HIV always looks emaciated or unhealthy in some way	1	2	3
5.4 People can take a simple test to find out whether they have HIV	1	2	3
5.5 Apart from HIV/AIDS, there are other diseases that men and women can catch by having sexual intercourse. Have you heard of any of these diseases?	Yes 1 No 2		
5.6 What are the signs and symptoms of a sexually transmitted disease in a man? CIRCLE EACH CORRECT QUESTION	Discharge from penis 1 Pain during urination 2 Ulcers/sores in genital area 3 Other…… Other……		
5.7 And what are the signs or symptoms when a woman is infected?	Vaginal discharge 1 Pain during urination 2 Ulcers/sores in genital area 3 Other…… Other……		
5.8 If a friend of yours needed treatment for a sexually transmitted disease, where could he or she obtain such treatment? PROBE Any other places? CIRCLE EACH relevant	Shop 1 Pharmacy 2 Govt. hospital/health centre/clinic 3 Private doctor/nurse/clinic 4 Other (SPECIFY)…… 5		
5.9 Have you ever had a sexually transmitted disease? IF YES Once or more than once?	Once 1 More than once 2 Never 3		
5.10 (On the last occasion) did you seek treatment?	Yes 1 No 2		
5.11 Where did you seek treatment?	Shop 1 Pharmacy 2 Govt. hospital/health centre/clinic 3 Private doctor/nurse/clinic 4 Other …… 5		
5.12 Did your sexual partner (any of your partners) also obtain treatment?	Yes 1 No 2		

SECTION A6: CONDOM KNOWLEDGE AND ATTITUDES			
6.2 Have you or a partner ever used a condom?	Yes 1 No 2		
6.3 Have you ever experienced a condom that split or broke during intercourse?	Yes 1 No 2		
6.4 Have you ever seen a condom?	Yes 1 No 2		
People have different opinions about condoms. Below are some opinions. For each one, I want you to indicate whether you agree or disagree, or whether you don't know	Agree	Don't know/not sure	Disagree
6.5 Condoms are an effective method of preventing pregnancy	1	2	3
6.6 Condoms can be used more than once	1	2	3
6.7 A girl can suggest to her boyfriend that he use a condom	1	2	3
6.8 A boy can suggest to his girlfriend that he use a condom	1	2	3
6.9 Condoms are an effective way of protecting against HIV/AIDS	1	2	3
6.10 Condoms are suitable for casual relationships	1	2	3
6.11 Condoms are suitable for steady, loving relationships	1	2	3
6.12 It would be too embarrassing for someone like me to buy or obtain condoms	1	2	3
6.13 If a girl suggested using condoms to her partner, it would mean that she didn't trust him	1	2	3
6.14 Condoms reduce sexual pleasure	1	2	3
6.15 Condoms can slip off the man and disappear inside the woman's body	1	2	3
6.16 If unmarried couples want to have sexual intercourse before marriage, they should use condoms	1	2	3
6.17 Condoms are an effective way of protecting against sexually transmitted diseases	1	2	3

SECTION A7: USE AND PERCEPTIONS OF HEALTH SERVICES	
7.1 Circle the number corresponding to the services listed if you have you ever visited a health facility or doctor to receive services or information.	Contraception 1 Pregnancy 2 Sexually transmitted Infection 3 HIV Testing 4 Cervical cancer Screening 5 Male Circumcission 6
7.2 Have you been circumcised?	Yes 1 No 2 Not applicable 98
7.3 Have you been screened for cervical cancer?	Yes 1 No 2 Not applicable 98
7.4 Have you ever been tested for HIV?	Yes 1 No 2
7.5 Have you ever contracted an STI?	Yes 1 No 2
7.6 How was the STI resolved?	Received medical attention 1 Treated using home remedy 2 Treated using home remedy 3 Other_____ 4 Not Applicable 98
7.7 How many times have you sought services or information from a doctor or a nurse for these services in the last twelve months?	_____Number of times
7.8 Thinking about your last visit, did you go to a government clinic, health centre or hospital or a private doctor or clinic?	University 1 Government 2 Private 3 Other..... 4
7.9 When you last saw a doctor or a nurse, what was your reason for going?	Contraception 1 STI 2 Gynaecological exam 3 Pregnancy test 4 Male Circumcision 5 Cervical Cancer Screening 6 HIV Test 7 Other..... 8
7.10 Did you feel comfortable enough to ask questions?	1. Yes 2. No
7.11 Were the questions you asked during the consultation answered adequately?	1. Yes 2. No
7.12 Was there enough confidentiality?	1. Yes 2. No

Appendix 4.5: Female lottery tool

SECTION B1: Risk Preferences : Cervical Cancer Screening

ACKNOWLEDGEMENT

This risky choice tool is adapted from Experiment Design and Sample Record Sheets: Instructions to Experiment Participants by Nguyen and Leung (2009).

INSTRUCTIONS

1. The questions that will be posed to you during this risky choice exercise require a high level of concentration.
2. Carefully read the explanation **about the risky choice exercise.**
3. The researcher will also take you through the explanations to shed more light.
4. Feel free to seek clarification as the researcher explains how to respond to the risky choice exercise.
5. The researcher will take you through an example presented below.
6. In this risky choice exercise, there are no right or wrong answers. It is exclusively about your own preferences.
7. Whilst independence is expected as you attempt the questions, feel free to seek clarification at any time from the researcher.
8. You are not allowed to consult a fellow participant.
9. You may also ask for a break anytime.
10. In the section: the risky scenario, the researcher presents the scenario based on which you are requested to choose an intervention you would prefer from two options.

ABOUT THE RISKY CHOICE EXERCISE

This is the risky choice exercise section of my research. This section consists of a risky choice exercise on individual decision making. The risky choice exercise is about your risk attitude. Some people like to take risks while other people like to avoid risks. The goal of this risky choice exercise is to gain additional insight into the risk attitude of young people for sexual and reproductive health. This is very important for both scientists and policymakers. If we get a better understanding of how young people react to situations involving risk, policy can be adjusted to take this into account (for example incentives for young people to utilise curative sexual and reproductive health services; incentives for young people to utilise preventative services; and

better packaging of behavioural change programs). Your cooperation at this risky choice exercise is thus very important and is highly appreciated.

There are three series of questions: Series 1 with 14 questions; series 2 with 14 questions and Series 3 with 7 questions. An example on making a choice is given before series 1. The questions you will encounter in in each series are very familiar to the example question. Go over them in ascending order. You can skip any of these questions and return to them any time during the risky choice exercise. You can also ask for more clarity if you do not understand the question. Attempt all questions. Please note that although the two options, A and B are real, the probabilities and additional life years are hypothetically valid only for this risky choice exercise to establish how you make health decisions involving uncertainty.

THE RISKY CHOICE SCENARIO

Cervical cancer is known to develop over 10 years from the Human Papillomavirus (HPV). Researchers have established that if you get screened for HPV infection earlier, it can be managed and treated before it develops into cancer. If HPV is undiagnosed and develops into a cancer, it is life threatening with around 60 percent of women diagnosed dying within 5 years.

You are offered cervical cancer screening for free at the district hospital in town. You have two options: Option A to ignore the screening offer and Option B to take the screening. Each option has two possible outcomes. For option A, the outcomes are: you proceed with life as usual, the HPV develops into a cancer and you die 10 years from today, OR you do not have HPV and you live your normal life until you reach 52 years (current life expectancy in Zimbabwe is 52 years. For Option B, you get diagnosed with HPV, it gets treated but not successfully. A cancer develops and you die 10 years after college; or it gets treated and you live the rest of your life years cancer free (these vary per question up to 100 cancer free years).

EXAMPLE: How to choose given options

(To be presented and explained by researcher)

Nancy heard that the Ministry of Health Outreach Team would be visiting campus next week to offer Cervical Cancer Screening for free at the University. She has been faithful to her boyfriend and is committed to her relationship and she does not think she is at risk of an STI, like HPV which can lead to cancer. She has decided not to go for screening as indicated by the tick.

	Option A: ignore screening	Option B: Get screening	Choice

	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B
1	80 Years	30	35 Years	95		
	10 Years	70	10 Years	5	✓ 33.75	31

Series 1: Cervical Cancer Screening Questions

Indicate your choice by ticking either column A or B. Note that only additional years are increasing for Option B.

	Option A: ignore screening		Option B: Get screening		Choice	
	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B
1	80 Years	30	16 Years	95		
	10 Years	70	10 Years	5		
2	80 Years	30	18 Years	95		
	10 Years	70	10 Years	5		
3	80 Years	30	20 Years	95		
	10 Years	70	10 Years	5		
4	80 Years	30	22 Years	95		
	10 Years	70	10 Years	5		
5	80 Years	30	24 Years	95		
	10 Years	70	10 Years	5		
6	80 Years	30	27 Years	95		
	10 Years	70	10 Years	5		
7	80 Years	30	30 Years	95		
	10 Years	70	10 Years	5		
8	80 Years	30	33 Years	95		
	10 Years	70	10 Years	5		
9	80 Years	30	36 Years	95		
	10 Years	70	10 Years	5		
10	80 Years	30	40 Years	95		
	10 Years	70	10 Years	5		
11	80 Years	30	44 Years	95		
	10 Years	70	10 Years	5		

12	80 Years	30	56 Years	95		
	10 Years	70	10 Years	5		
13	80 Years	30	71 Years	95		
	10 Years	70	10 Years	5		
14	80 Years	30	100 Years	95		
	10 Years	70	10 Years	5		

Series 2: Cervical Cancer Screening Questions

Indicate your choice by ticking either column A or B. The questions in this series are different from series 1 in terms of probabilities and additional life years. Note that only additional years are increasing for Option B.

No.	Option A: ignore screening		Option B: Get screening		Choice	
	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B
15	60 Years	55	56 Years	90		
	40 Years	45	10 Years	10		
16	60 Years	55	59 Years	90		
	40 Years	45	10 Years	10		
17	60 Years	55	62 Years	90		
	40 Years	45	10 Years	10		
18	60 Years	55	65 Years	90		
	40 Years	45	10 Years	10		
19	60 Years	55	68 Years	90		
	40 Years	45	10 Years	10		
20	60 Years	55	71 Years	90		
	40 Years	45	10 Years	10		
21	60 Years	55	75 Years	90		
	40 Years	45	10 Years	10		
22	60 Years	55	79 Years	90		
	40 Years	45	10 Years	10		
23	60 Years	55	83 Years	90		
	40 Years	45	10 Years	10		
24	60 Years	55	87 Years	90		
	40 Years	45	10 Years	10		

25	60 Years	55	91 Years	90		
	40 Years	45	10 Years	10		
26	60 Years	55	96 Years	90		
	40 Years	45	10 Years	10		
27	60 Years	55	101 Years	90		
	40 Years	45	10 Years	10		
28	60 Years	55	106 Years	90		
	40 Years	45	10 Years	10		

Series 3: Cervical Cancer Screening Questions

Life expectancy in Zimbabwe is 52 Years and let us assume you are 20 years old today. Suppose we could think of someone having an undiagnosed HPV and who dies 10 years after college as having lost the chance to live 22 more years till life expectancy of 52. The second outcome for each option is now presented in this manner. In Question 29, Option A, for example, you either live an additional 25 years after college or you miss out on the life expectancy by dying 4 years earlier. This series asks you to choose between two options, each of which has a gain and a loss. Indicate your choice by ticking either column A or B.

No.	Option A: ignore screening		Option B: Get screening		Choice	
	life years	Probability (%)	life years	Probability (%)	A	B
29	25 Years gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
30	4 Years gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
31	1 Year gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
32	1 Year gained	50	30 Years gained	50		
	4 Years lost	50	16 Years lost	50		
33	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	16 Years lost	50		
34	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	14 Years lost	50		
35	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	11 Years lost	50		

Appendix 4.6: Male lottery tool

SECTION B1: Risk Preferences: Voluntary Medical Male Circumcision

ACKNOWLEDGEMENT

This risky choice tool is adapted from Experiment Design and Sample Record Sheets: Instructions to Experiment Participants by Nguyen and Leung (2009).

INSTRUCTIONS

11. The questions that will be posed to you during this risky choice exercise require a high level of concentration.
12. Carefully read the explanation **about the risky choice exercise.**
13. The researcher will also take you through the explanations to shed more light.
14. Feel free to seek clarification as the researcher explains how to respond to the risky choice exercise.
15. The researcher will take you through an example presented below.
16. In this risky choice exercise, there are no right or wrong answers. It is exclusively about your own preferences.
17. Whilst independence is expected as you attempt the questions, feel free to seek clarification at any time from the researcher.
18. You are not allowed to consult a fellow participant.
19. You may also ask for a break anytime.
20. In the section: the risky scenario, the researcher presents the scenario based on which you are requested to choose an intervention you would prefer from two options.

ABOUT THE RISKY CHOICE EXERCISE

This is the risky choice exercise section of my research. This section consists of a risky choice exercise on individual decision making. The risky choice exercise is about your risk attitude. Some people like to take risks while other people like to avoid risks. The goal of this risky choice exercise is to gain additional insight into the risk attitude of young people for sexual and reproductive health. This is very important for both scientists and policymakers. If we get a better understanding of how young people react to situations involving risk, policy can be adjusted to take this into account (for example incentives for young people to utilise curative sexual and reproductive health services; incentives for young people to utilise preventative services; and better packaging of behavioural change programs). Your cooperation at this risky choice exercise is thus very important and is highly appreciated.

There are three series of questions: Series 1 with 14 questions; series 2 with 14 questions and Series 3 with 7 questions. An example on making a choice is given before series 1. The questions you will encounter in in each series are very familiar to the example question. Go over them in ascending order. You can skip any of these questions and return to them any time during the risky choice exercise. You can also ask for more clarity if you do not understand the question. Attempt all questions. Please note that although the two options, A and B are real, the probabilities and additional life years are hypothetically valid only for this risky choice exercise to establish how you make health decisions involving uncertainty.

THE RISKY CHOICE SCENARIO

Suppose the probability of getting infected with HIV for people in your age group is very high and you are sexually active. Suppose also, that researchers have established that if you get infected, there is no treatment and you can only survive for 7 more years after college with a probability of 70%. If, however, you do not get HIV, there is a 30% probability you will get 15 more years after college.

You are offered option B- Voluntary Medical Male Circumcision, an intervention introduced by the government which reduces chances of contracting HIV and thus has potential to increase life years after college as indicated in option 2. Given options A and B, please indicate the option you would choose with a tick in the last column to your right under either A or B. You are allowed to choose A or B though out the series, or chose A and change to B when you see fit; or choose B and change to A when you see fit. Assume that all discomforts or benefits of circumcision have been adjusted into the life years presented in the tables below.

EXAMPLE: How to choose given options

(To be presented and explained by researcher)

Sam was asked to choose between getting circumcised and not getting circumcised given the potential additional life years after college under each option and their probabilities. Sam heard that there is a surgery to be performed but did not seek more information on this. He is also phobic to surgery and thinks the weighted outcome is not convincing enough for him to consider circumcision and would thus, take his chances. Sam, thus, chooses option A for question 1 as indicated by the tick.

	Option A: Do not get circumcised		Option B: Get circumcised		Choice	
	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B

1	15 Years	30	20 Years	10		
	7 Years	70	7 Years	90	✓ 9.4	8.3

Series 1: Circumcision Questions

Indicate your choice by ticking either column A or B. Note that only additional life years are increasing for Option B.

	Option A: Do not get circumcised		Option B: Get circumcised		Choice	
	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B
1	15 Years	30	14 Years	10		
	7 Years	70	7 Years	90		
2	15 Years	30	16 Years	10		
	7 Years	70	7 Years	90		
3	15 Years	30	19 Years	10		
	7 Years	70	7 Years	90		
4	15 Years	30	22 Years	10		
	7 Years	70	7 Years	90		
5	15 Years	30	25 Years	10		
	7 Years	70	7 Years	90		
6	15 Years	30	29 Years	10		
	7 Years	70	7 Years	90		
7	15 Years	30	34 Years	10		
	7 Years	70	7 Years	90		
8	15 Years	30	40 Years	10		
	7 Years	70	7 Years	90		
9	15 Years	30	47 Years	10		
	7 Years	70	7 Years	90		
10	15 Years	30	55 Years	10		
	7 Years	70	7 Years	90		
11	15 Years	30	64 Years	10		
	7 Years	70	7 Years	90		
12	15 Years	30	74 Years	10		
	7 Years	70	7 Years	90		

13	15 Years	30	86 Years	10		
	7 Years	70	7 Years	90		
14	15 Years	30	100 Years	10		
	7 Years	70	7 Years	90		

Series 2: Circumcision Questions

Indicate your choice by ticking either column A or B. The questions in this series are different from series 1 in terms of probabilities and additional life years. Note that only additional years are increasing for Option B.

No.	Option A: Do not get circumcised		Option B: Get circumcised		Choice	
	Additional life years	Probability (%)	Additional life years	Probability (%)	A	B
15	15 Years	90	18 Years	70		
	12 Years	10	8 Years	30		
16	15 Years	90	20 Years	70		
	12 Years	10	8 Years	30		
17	15 Years	90	22 Years	70		
	12 Years	10	8 Years	30		
18	15 Years	90	25 Years	70		
	12 Years	10	8 Years	30		
19	15 Years	90	28 Years	70		
	12 Years	10	8 Years	30		
20	15 Years	90	31 Years	70		
	12 Years	10	8 Years	30		
21	15 Years	90	35 Years	70		
	12 Years	10	8 Years	30		
22	15 Years	90	39 Years	70		
	12 Years	10	8 Years	30		
23	15 Years	90	44 Years	70		
	12 Years	10	8 Years	30		
24	15 Years	90	49 Years	70		
	12 Years	10	8 Years	30		
25	15 Years	90	55 Years	70		

	12 Years	10	8 Years	30		
26	15 Years	90	62 Years	70		
	12 Years	10	8 Years	30		
27	15 Years	90	69 Years	70		
	12 Years	10	8 Years	30		
28	15 Years	90	77 Years	70		
	12 Years	10	8 Years	30		

Circumcision Question Series 3: Indicate your choice by ticking either column A or B

In this series, suppose Life expectancy in Zimbabwe is 35 Years. A new HIV strain comes which reduces life years by 20 years for those infected. This means if you get infected, you lose 20 years, but the lost years are specified for each question 29- 35. If you do not get the new HIV strain infection, you get to live for the 35 years expected. We can think of this as a gain (say 15 years gained after college if you are 20 years old today). This series asks you to choose between two options, each of which has a gain and a loss.

No.	Option A: Do not get circumcised		Option B: Get circumcised		Choice	
	life years	Probability (%)	life years	Probability (%)	A	B
29	25 Years gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
30	4 Years gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
31	1 Year gained	50	30 Years gained	50		
	4 Years lost	50	21 Years lost	50		
32	1 Year gained	50	30 Years gained	50		
	4 Years lost	50	16 Years lost	50		
33	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	16 Years lost	50		
34	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	14 Years lost	50		
35	1 Year gained	50	30 Years gained	50		
	8 Years lost	50	11 Years lost	50		

Appendix 4.7: Approximations of σ risk aversion parameter

		Switching question in Series 1														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Never
Switching question in Series 2	1	1.5	1.4	1.35	1.25	1.15	1.1	1	0.95	0.9	0.85	0.8	0.75	0.65	0.55	0.5
	2	1.4	1.3	1.25	1.15	1.1	1	0.95	0.9	0.85	0.8	0.75	0.7	0.6	0.55	0.5
	3	1.3	1.2	1.15	1.1	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.55	0.5	0.45
	4	1.2	1.15	1.05	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.5	0.45	0.4
	5	1.15	1.05	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.4	0.35
	6	1.05	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35
	7	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3
	8	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25
	9	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2
	10	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.2
	11	0.8	0.7	0.65	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.15
	12	0.75	0.65	0.6	0.55	0.5	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.2	0.15	0.1
	13	0.65	0.6	0.55	0.5	0.45	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.15	0.1	0.1
	14	0.6	0.55	0.5	0.45	0.4	0.35	0.35	0.3	0.25	0.2	0.15	0.1	0.1	0.1	0.05
	Never	0.5	0.45	0.4	0.4	0.35	0.3	0.3	0.25	0.2	0.15	0.1	0.1	0.05	0.05	0.05

Source: Tanaka et al (2010)

Appendix 4.8: Approximations of α probability weighting parameter

		Switching question in Series 1														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Never
Switching question in Series 1	1	0.6	0.75	0.75	0.85	0.9	0.95	1	1.05	1.1	1.15	1.2	1.25	1.3	1.4	1.45
	2	0.6	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1	1.15	1.2	1.25	1.35	1.4
	3	0.55	0.6	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1	1.15	1.2	1.25	1.3
	4	0.5	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1	1.15	1.2	1.25
	5	0.45	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1	1.15	1.2
	6	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1	1.15
	7	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05	1.1
	8	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05
	9	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
	10	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
	11	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9
	12	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85
	13	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8
	14	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75
	Never	0.05	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.45	0.55	0.55	0.65	0.6

Source: Tanaka et al (2010)

Appendix A1: Turnitin report

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