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Tatenda P. Zinyemba

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ISBN: 978-94-6423-535-7

Cover design pictures provided by Mashambanzou Care Trust, Zimbabwe

Published by ProefschriftMaken

EFFECTS OF HIV ON CHILDREN AND YOUTH'S EDUCATIONAL ATTAINMENT

Dissertation

to obtain the degree of Doctor at Maastricht University,

on the authority of the Rector Magnificus, Prof. Dr. Rianne M. Letschert

in accordance with the decision of the Board of Deans,

to be defended in public on 6th December 2021, at 16:00 hours

by

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Acknowledgements

Sango rinopa waneta. This is a Shona proverb from Zimbabwe that loosely translates to "hard work pays off". My PhD journey has been an adventurous journey, to say the least, and I am truly grateful for this achievement. While I've been able to make some contributions to the research topic, I have indeed gained a lot more than I expected from this experience. Overall, this journey has been challenging, exhilarating, and fulfilling. Though it may sound cliché, it really did take a village for me to get this far.

I would like to start by thanking my supervisors Prof. dr. Wim Groot and Prof. dr. Milena Pavlova. You've both been supportive since the day I approached you to supervise my thesis. I appreciate your professionalism, consistency, supportiveness, poise, calm demeanor, and the respect you had for me as a young researcher. I felt comfortable to present my ideas. Some were not so good at the time, but I never left a meeting feeling any less. It is not surprising that you were highly recommended by many colleagues, even those who didn't work with you. I have so much respect and admiration for you. Dank u wel!

To the assessment committee of this thesis: Prof. dr. Kristof de Witte, Dr. Willa Friedman, Prof. dr. Franziska Gassmann, Dr. Webster Mavhu, and Prof. dr. Hein de Vries, thank you for taking the time to read the thesis and for providing constructive feedback and comments that significantly improved the quality of the thesis.

To my professors and instructors in my undergrad and graduate studies, thank you. Professor Asiedu, thank you for believing in me when I wanted to end my goal of pursuing my PhD. You believed in me when I didn't believe in myself, I am thankful for that. Prof. William A. Barnett, Prof. Ginther, Prof. Simon for all the support as I was transitioning from Kansas to Indiana and to Europe. I would like to thank the following UNU-MERIT professors and researchers: Dr. Konte, Dr. Tirivai, Prof. dr. Azomahou, Dr. Nimeh, Prof. dr. Gault, Dr. Vanore, Prof. dr. Nillesen for their support, advice, collaboration, and encouragement. To the UNU-MERIT staff and administrators, thank you for all your help through my journey. Eveline, thank you for everything you've done throughout this journey. I am glad that I have completed this journey with your support.

Dr. Mindel van de Laar and Prof. dr. Bartel van de Walle, thank you for helping me with financing the rest of my PhD. To Sarah Röder, Dr. Julieta Marotta, and all the MPP and SBE staff, thank you for the teaching and research work experience. To Prof. dr. Robin Cowan and Dr. Tatiana Skripka, thank you for all you did to ensure that all was well during my journey. I am especially grateful for financial support I had during my studies. Susan, Marc, Lisbeth, Monique, Meike, Myrthe, Ad, Sueli, Howard, Diego, Herman, Ingrid, and Ingeborg, thank you for the administrative, media, accounting, and all the other support you provided.

My thesis would not have a befitting qualitative component had it not been for the collaboration with Mashambanzou Care Trust in Zimbabwe. I would like to thank the director Mr. T.

Chigodora, Mr. C. Hera (the evaluation manager), the late Mai Makuyana, the administrative, and the rest of the medical staff for ensuring that the qualitative study ran smoothly. I would like to thank the research assistants H. K. Maridzo (Kudzi) and T. Chikumbirike (Tari) for your expertise, thoroughness, and professionalism. Dr. F. Machingura, thank you for being the local supervisor on this project. Lastly, I would like to sincerely thank all the participants who were at the heart of this study. Thank you for your honesty and for enriching the academic world with your voices. I look forward to partaking in projects that address some of the issues you highlighted during the interviews. I would also like to thank Dr. Tirivai and Grace Igweta (WFP) for the consulting project in Madagascar that help to finance aspects of this study.

I also want to thank my Zimbabwean friends and family that I spent a lot of time with in Maastricht, especially Chipo, Rumbi, Rutendo, Tari, Thando, Jane K., and Christabel. Thank you for making Maastricht memorable and for Whatsapp chats that always brought joy and laughter. Chipo, you came to Maastricht at times I needed the support and adventures. You also gave me so much guidance through this PhD journey, thank you! To my fellow cohort members (classmates) Bisrat, Lika, Anny, Anne-Lore, Racky, Michelle M, Michelle A, Gideon, Caio, Solomon, Flavia, and Dachi, you guys are the best! I thank you for the gatherings, outings, candid talks, rant sessions, and the assistance you all gave me with my academic and social needs. I hope that we will continue to keep in touch. To my officemates Mohammed, Flavia, Bisrat, Jemal, Francesca, Cho, and Rumbi, Cintia, and Lalaine, thank you for the chats, for being considerate, and for the advice.

To the UNU-MERIT family, thank you for the advice, help with my research, parties, dinners, gatherings, and outings. Eveline, thank you for being there for me since my arrival in Maastricht. To Alison, Mary, Ibrahima, Gintare, Muid, Shivani, Cristina, Alex, Francesco, Paris, Eyole, Hiwot, Musa, Negash, Eleni, Halefom, Kaleab, Hassen, Tigist, Elise, Guilia, Bea, Victor, Elvis, Chuks, Godsway, Davina, Emanuel, Bruhan, Tamara, Robert, Nga, Rose, and many others, thank you for the advice, support, talks, and encouragement.

To my friends and family in Europe, Jane C., Tine, Rumbi, Ruvimbo, Esther, John M., Letshani and Steve, Bruna, Geoffrey, thank you for the times were spent together and for being there for me during this journey. To my family and friends in the US Jill, Pai, Rumbi, The Chinyadza's, Debbie, Simbai, Fadzi, Doucette, Rue, Nankie, Nyari, Mooya, Akua, Harriet, Adijat, Peris, John F., Gopie, The Yembas, Sekuru Praise, The Shaw's, The Sylvester's and The Ntuli-Sithole's, I appreciate the support you have given me through my academic journey and personal life. To my friends all over the world, especially Theresa, The Chipembe's, The Chikoto's, Ellen, Liz, Tsigi, you all rock, thank you!

Above all, I would like to thank my parents for loving me, investing in my education, and encouraging me to achieve my goals. I wouldn't be where I am without their love and guidance. Though my dad passed away over 20 years ago, his presence in my life (until I was 14 years old) is one of the major reasons why I have accomplished this goal. My dad emphasized the importance of education ever since I could remember. He was the first feminist I encountered in

my life, and above all, he made me feel like I could conquer anything. I know I've made him proud. Mom, thank you so much for all the love and support you give me. You have given me EVERYTHING a mother could possibly give to their child. I am truly grateful. To my siblings, you have been my lifeline at every single step.

To my sister Pamela, you have no idea how your love, comfort, and support has got me through every disappointment and accomplishment. You listen to my rants, laugh at my jokes, and put up with some of my nonconformist opinions! You were one of the first people to tell me about my good traits as a child and those words have stuck with me along the way, I really appreciate you. To my brother Tendai, you basically took the role of being a father figure since dad passed. I am very privileged to have an older brother who looks out for me in the manner that you do. My gratitude goes beyond the level words can articulate. To my younger brother Tadiwa, you are the personification of dad in many ways. I thank you so much for visiting me in Europe during a time I needed it the most. Thank you for making me laugh, and all the other ways you have supported me. I love you all!

I have been fortunate enough to have close family in Europe. Zviko and Chris Tsoto, you have made your home my home as well. I never really felt homesick during holidays because I had a home to. Babamudiki (uncle) Felix and Mainini (aunt) Liliosa Zinyemba, you have showered me with so much love and you always constantly checked on me. The fact that I could takeoff to Ireland whenever I needed a break, meant the world to me during this journey. I want to thank The Makunda's, The Madzikanda's, The Muzvidziwa's, my mother-in-law Mrs. S. Madzikanda, The Mpofu's, and my aunts (Mainini Lizzie, Mainini Loice, Mainini Claire, Mainini Flo, Mainini Barbara, Mainini Sylvia) for their love and support. To my cousins Middy, Sharon, Roddy, Carol, Sandro, Panashe, Rumbi, Kuda, Tino, Trisha, Tapiwa, William and many more for every single moment we shared together during this journey. I would also like to thank my nephews, and nieces who bring and joy and laughter when needed. To everyone else in the Zinyemba and Mudhara family, and everyone who's ever supported me, thank you.

Finally, I would like to thank my dear husband and best friend Takura. You have always cheered me on, even when I felt defeated. I appreciate the way you have supported me throughout this journey. Thank you for your patience and understanding, I know it wasn't easy at times. However, you understood the importance of this journey and stood by me through it all. I love you mudiwa.

Acronyms

AIDS	Acquired Immunodeficiency Syndrome
A Level	Advanced Level
ART	Antiretroviral Therapy
ARVs	Antiretroviral Drugs
ATE	Association of Teacher Educators
BEAM	Basic Education Assistance Model
DHS	Demographic and Health Surveys
EAs	Enumeration Areas
ECD	Early Childhood Development
ELISA	Enzyme-Link Immunosorbent Assay
ERCIC	Maastricht University Ethics Review Committee for Inner City Faculties
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
ID	Identification Document
ISCED	International Standard Classification of Education
IVs	Instrumental Variables
MCT	Mashambanzou Care Trust
MDG	Millennium Development Goal
MRCZ	Medical Research Council of Zimbabwe
MMAT	Mixed-Methods Appraisal Tool
NAC	National Aids Council

NGO	Non-profit Organization
O Level	Ordinary Level
OLS	Ordinary Least Squares
PEPFAR	President`s Emergency Plan for AIDS Relief
PLWHIV	People Living with HIV
PMTCT	Prevention of Mother to Child Transmission
PRISMA	Preferred Reporting Items for Systematic Reviews
P2SLS	Probit Two-stage Least Squares
RCTs	Randomized Controlled Trials
SDG	Sustainable Development Goals
SSA	Sub-Saharan Africa
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children`s Emergency Fund
UPEP	Universal Primary Education Program
VMMC	Voluntary Medical Male Circumcision
WoS	Web of Science
ZDHS	Zimbabwe Demographics and Health Surveys
ZIMSTAT	Zimbabwe National Statistics Agency
ZNHASP	Zimbabwe National HIV and AIDS Strategic Plan

Chapter 1

General Introduction

1.1 Background

One of the targets of the third Millennium Development Goals (MDG) of the United Nations (UN) was to achieve gender equality in education by 2015. This is because education is a pathway of empowering individuals economically and socially (Aslam, 2013). In particular, MDG 3.A targeted the elimination of gender disparities in primary and secondary education by 2005, and in all levels of education by 2015. Significant strides towards meeting these targets have been made because about two thirds of countries that ratified the MDGs reached gender parity in primary education by 2005 (UNICEF, 2007). However, in Sub-Saharan Africa (SSA), the disparity between boys' and girls' primary school attendance remains large (UNICEF, 2015). Thus, the elimination of gender disparities in education has been again included as a target in the new Sustainable Development Goals (SDGs) and is deemed to be achieved by 2030. Similar to MDG 3, SDG 4.5 seeks to eliminate gender disparities in education and ensure equal access to all levels of education (pre-primary, primary, secondary, and tertiary).

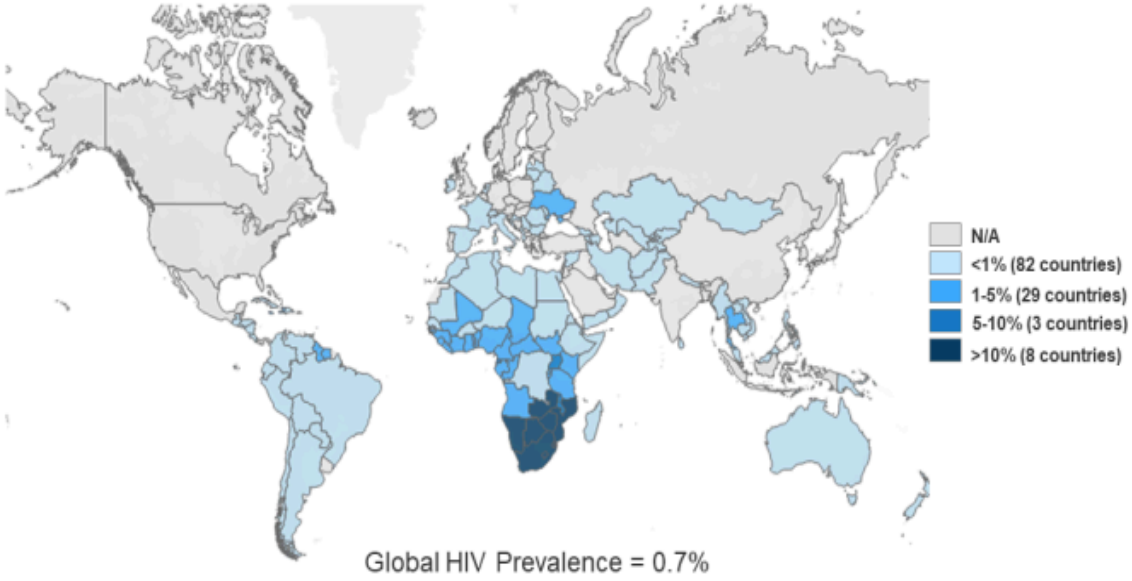
In order to achieve gender parity in education, it is important to investigate the issues that hinder the attainment of this goal. One of the issues that may hinder educational attainment is health. This is because health is strongly associated with educational attainment (Behrman, 1996). HIV/AIDS is one of the health impairments that may hamper enrolling in school, attending school and/or achieving desired educational outcomes. In SSA, HIV/AIDS is not only a health issue; it is also an economic issue, particularly in the education sector. In fact, HIV/AIDS affects the supply and demand side of education. In Eastern and Southern Africa, providers of education (e.g., teachers) miss school days due to treatment and illness-related issues (Grassly et al., 2003). For example, in 2015, 58,000 teachers tested positive in South Africa, which is a 2.6 percentage point increase from the 2004 rates (Cole, 2017). On the other hand, children and adults seeking education may miss school days due to illness and treatment or may stay at home or even drop out of school to take care of sick parents or family members (Grassly et al., 2003).

More than half (54%) of people living with HIV (PLWHIV) live in Southern and Eastern Africa (UNAIDS, 2020). Figure 1.1 shows the global HIV prevalence in 2019 and Figure 1.2 shows the HIV prevalence in 2017 and the percentage point change in HIV prevalence in SSA from 2000 to

2017. Figure 1.1 shows that the global HIV prevalence in 2019 was 0.7% (KKF, 2019). Both figures show that most of the high prevalence countries are in Africa, and Southern Africa is disproportionately affected with prevalence rates that are above 10%. Therefore, due to this disproportionate share of HIV prevalence, Southern African countries may experience the socioeconomic effects of HIV-related issues more than countries that have a lower prevalence. Figure 1.2 shows that Zimbabwe and Malawi had the largest percentage change decrease in HIV prevalence (above 10 percentage points). On the other hand, countries like Angola, Mozambique, Namibia, and South Africa experienced an increase in HIV prevalence.

The high HIV prevalence in Southern Africa has mainly affected the health sector, (total factor) productivity and human capital accumulation (Haacker, 2002). For example, a study conducted on the economic costs of HIV on formal sector enterprises in South Africa and Botswana revealed that the loss of human capital brought about by HIV has led to an increase in the cost of labor (Rosen et al., 2004). This makes it difficult for Southern African countries to attract industries that rely on cheap labor from foreign countries, leading to a reduction in foreign direct investment (ibid). While significant strides have been made towards ensuring that PLWHIV have access to treatment, many people in SSA still do not have access to this treatment. Hence, the economic issues related to HIV are still persistent in many (Southern) African countries.

Figure 1.1: Global HIV Prevalence (2019)



Source: Kaiser Family Foundation https://www.kff.org/global-health-policy/fact-sheet/the-global-hivaids-epidemic/

Figure 1.2*a*: HIV Prevalence in within sub-Saharan Africa (2017)

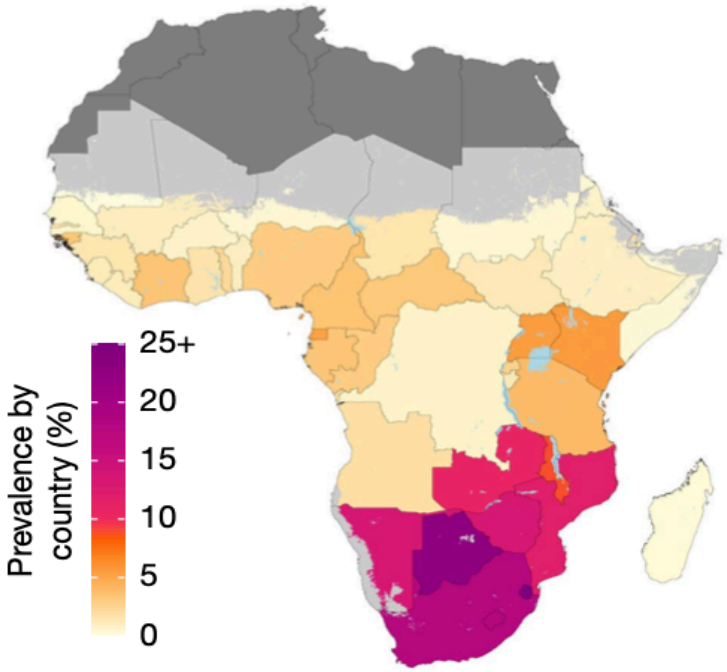
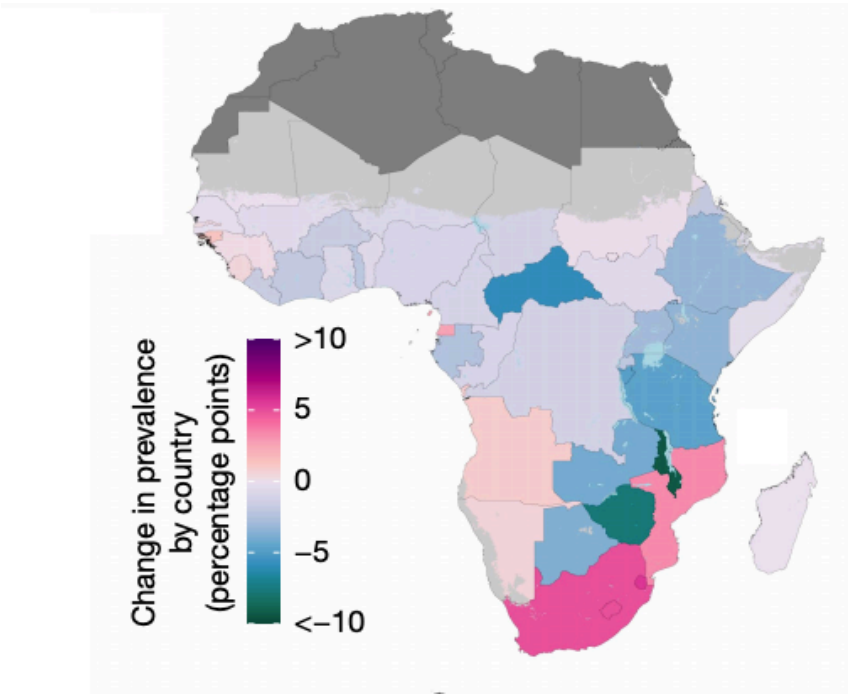


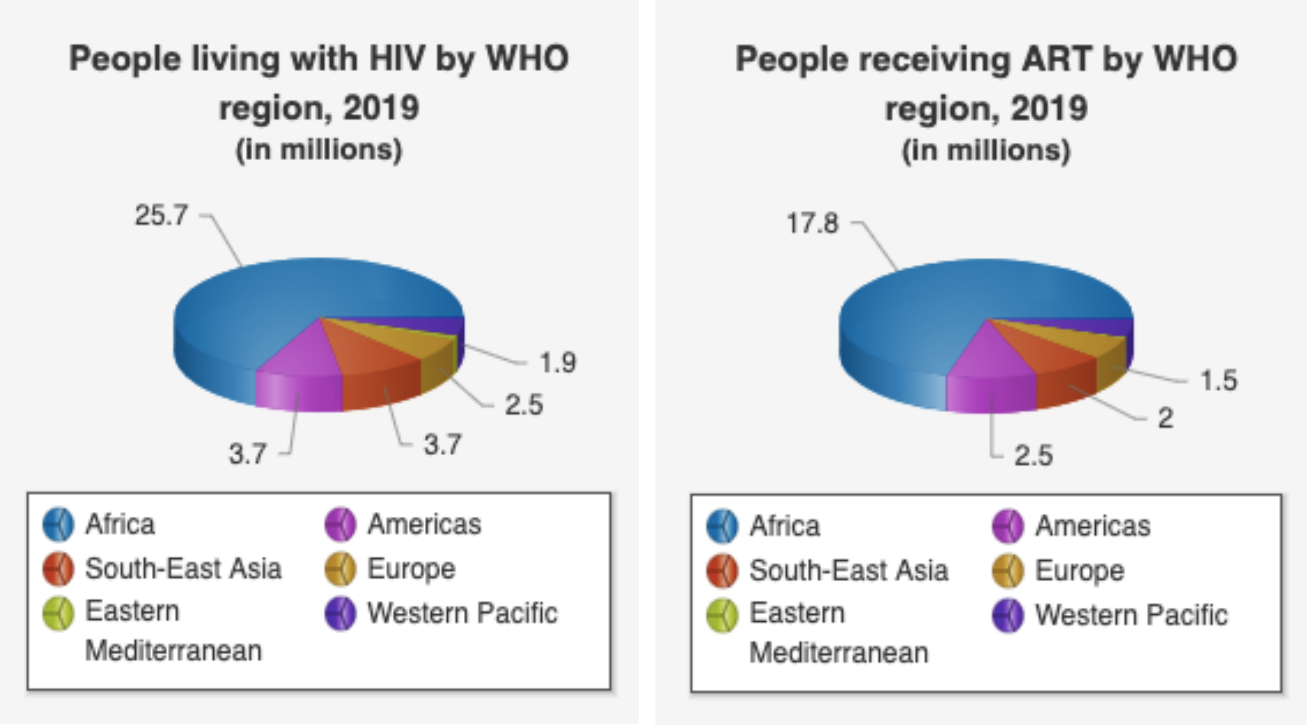
Figure 1.2b: Changes in HIV Prevalence within sub-Saharan Africa (2017)



Source: Dwyer-Lindgren et al. (2019). Mapping HIV prevalence in sub-Saharan Africa between 2000 and 2017. *Nature*, *570*(7760), 189-193.

The availability of medicines and therapies has led many countries and people with access to treatment to classify HIV as a chronic disease (Mahungu et. al, 2009). However, many people do not have access to treatment. Figure 1.3 shows the number of PLWHIV and those on antiretroviral therapy (ART) (or HIV treatment) worldwide. The figure shows that currently, there are about 38 million PLWHIV and most of them (68%) reside in Africa (WHO, 2020). This makes a case for examining the effects of HIV in the context of Africa. The figure also shows that 70% of PLWHIV in Africa are currently receiving ART. This rate is similar to that of the Americas (68%), lower than the Western Pacific (78%) and higher than that in Europe (60%). Despite the progress made in HIV prevention and treatment, due to the disproportionate share of PLWHIV in SSA, the number of individuals who are not on treatment in SSA is significantly larger than in any other part of the world. Therefore, the issues that are related to HIV/AIDS illness and death still persist within the continent

Figure 1.3: Global Prevalence of People Living with HIV and People on ART (2019)



Source: World Health Organization (2020) <https://www.who.int/hiv/data/en/>

1.2 HIV/AIDS in Zimbabwe

This thesis focuses on Zimbabwe, a Southern African landlocked country with a population of about 13 million. In addition to political and economic turmoil that has plagued the country since the early 2000s, Zimbabwe is ranked sixth in global HIV prevalence (see Figure 1.2). The current HIV prevalence rate is about 13%, which is a significant decline from a peak of 29.7% in 1997 (Gregson et al., 2010). Figures 1.4a and 1.4b show HIV prevalence in Zimbabwe for individuals aged 15-49 years by province (or region) in 2005-06 and in 2015. The national HIV prevalence rates for these two periods were 18% and 14%, respectively. The figures show that the largest decrease in HIV prevalence were in Manicaland (9 percentage points), Mashonaland Central (7 percentage points), Mashonaland West (6 percentage points), and in the capital city Harare (5 percentage points).

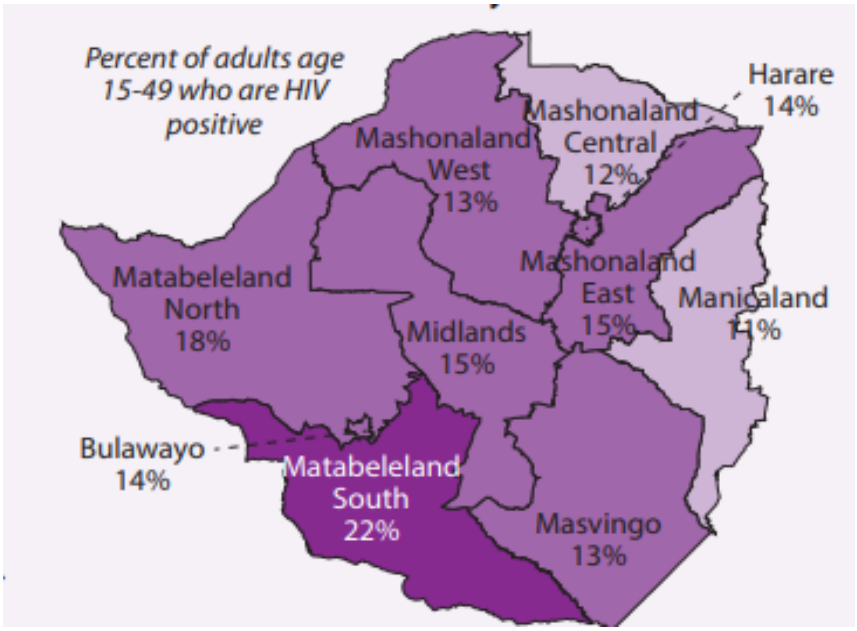
This is a significant reduction in prevalence rates compared to some Southern African countries that have either had an increase or a slight decrease in HIV prevalence rates. For instance, South Africa had a prevalence rate of 19.9% in 2000 and the rate rose to 20.4% in 2018 (UNAIDS, 2000; UNAIDS, 2018). Malawi, on the other hand, had a decrease from 10% in 2000 to 9.2% in 2018 (Muula, 2002; UNAIDS, 2018). As noted by Lopman et al. (2007), continual decrease in HIV prevalence in Zimbabwe can be attributed to a reduction in risky sexual behaviors and high mortality rates that occurred in the previous periods when ART was not available to most individuals. In addition, compared to other countries, there were extensive HIV prevention measures that took place and worked in Zimbabwe. These were conducted through mass media, churches, workplaces, schools, universities and other places that facilitated interpersonal activities (Halperin et al., 2011). However, as exhibited by the figures, there was an HIV prevalence increase in Matabeleland South (1 percentage point).

Compared to other regions, Matabeleland Provinces (North, South, and Bulawayo) have been disproportionately affected by HIV. This is partially due to ethnic-specific differences in sexual behavior, sex work, and gender inequality in relationships (Sibanda and Khumalo, 2017). Although Zimbabwe is one of the countries that has managed to reduce HIV prevalence by over 10 percentage points within a couple of decades, the current prevalence rate of 13% is relatively high. It is therefore possible that economic issues related to HIV remain persistent, particularly for groups that do not have access to medicine and in regions that have not experienced a decrease in prevalence rates (Azomahou et al., 2016).

Figure 1.4: HIV Prevalence in Zimbabwe by Region in 2005-06 and 2015

1.4a: 2005-06

1.4b: 2015



Source: Demographic and Health Surveys Data Zimbabwe (2005/6 and 2015)

1.3 HIV and gender equality in human capital investment

Women and girls constitute more than half (52%) of all HIV infections in the world (UNAIDS, 2020). While HIV prevalence rates among children in SSA are generally low, in Southern Africa, younger women are particularly at a higher risk of contracting HIV. In 2017 alone, 79% of new HIV infections in Southern Africa were among girls aged 10-19 years (UNAIDS, 2019). In Zimbabwe, the HIV prevalence among girls and young women aged 15-24 years, is twice as high as their male counterparts (Schaefer et al., 2017). This is quite devastating because an increase in HIV rates among girls may widen existing gaps in educational attainment between boys and girls. Ensuring that girls are able to achieve their educational goals and investing in girls' education is beneficial mainly in a few ways. For instance, it leads to their empowerment and also leads to higher returns in economic growth as well as healthier and more educated families (Herz et al., 2004). Additionally, having more educated girls and women may lead to fewer HIV infections and more positive attitudes towards PLWHIV (Zarei et al., 2018).

Gender equality in education is important for economic growth (Minasyan et al., 2019). While there are more educated women today on a global scale than there were 50 years ago, women still lag behind men. Evans, Akmal & Jakiela (2020) examined gender gaps in education in 126 countries (excluding many high-income countries) using data for 1960-2010. They found that in 1960, women had an average of 2.6 years of education and by 2010, the average was 7.7 years of education. This increase is not surprising given the fact that most developing countries committed to the aforementioned MDG 3 and were consequently encouraged to achieve gender parity in primary school education (UN, 2020). However, gender gaps still persist in secondary education in SSA (ibid). Gender parity in secondary and higher levels of education help close gender gaps in income and may also help reduce harmful practices such as gender-based violence and child marriage (UNICEF, 2020). While there are no studies that have examined gender gaps in secondary education on a national scale in Zimbabwe, a qualitative study conducted in Masvingo province indicated that lower-income boys drop out of school at a higher rate (Mtemeri & Chikukwa, 2019). Diseases such as HIV have a gender dimension, which may inadvertently increase existing gender gaps in education. A study on the contribution to female human capital

in Zimbabwe showed that school enrolment contributed to economic growth (Dube, Xie & Osei, 2019). To the extent that HIV-related illness and deaths affect human capital investment and ultimately economic growth, it is important to examine whether there are gender-related differences in the effects of HIV on educational attainment.

In general, due to illness-related reasons, PLWHIV are less likely to be employed full time compared to their HIV-negative counterparts (Mauslby et al., 2020). However, HIV-positive individuals who are on early treatment, have a lower risk of workplace absence (French, Brink & Bärnighausen, 2018). Similarly, children who are not on ART are less likely to attend school and experience behavioral problems at school (Joshi et al., 2017). Currently, it is not clear whether HIV exacerbates inter- and intragender gaps in human capital investment. That is, do HIV-positive girls obtain less schooling than HIV-positive boys? Secondly, do female or male HIV-positive children or youths obtain less education compared to their HIV-negative counterparts within the same gender group? If so, this further perpetuates the educational attainment skills gap and the income gap brought about by existing gender and socioeconomic differences. HIV may affect human capital investment through illness, taking care of a sick family member, or through socioeconomic issues associated with the disease, such as poverty, stigma, and gender disparities. This dissertation examines these mechanisms by using different methods and data sources.

1.4 Socioeconomic issues related to HIV infection

On the one hand, being of a low socioeconomic status is correlated with being HIV-positive (Hargreaves et al., 2002; Bunyasi and Coetzee, 2017). On the other hand, being of a low socioeconomic status is also a major barrier when it comes to accessing education. Thus, a combination of HIV-related illness and socioeconomic issues may present compounded barriers to education access. Without having access to ART, (low-income) HIV-positive individuals have a higher risk of death (McMahon, 2011). This mortality risk presented by HIV has had a significant impact on human capital investment in SSA (Forston, 2011). In addition, HIV-related stigma could also affect human capital investment. HIV-related stigma may come in the form of

community, maternal (or paternal), and self-stigma (Bauman et al., 2002; French et al., 2015; Demirel et al., 2018). Violence against HIV-infected women plays a role as well. A systematic literature review of 20 qualitative and quantitative studies showed that HIV-positive women experience high physical, sexual, and emotional violence (Tenkorang et al., 2020). This is devastating because women are generally the primary caregivers of children. Therefore, a combination of these socioeconomic issues can significantly affect human capital accumulation. It is thus important to examine the extent to which socioeconomic issues and the aforementioned mechanisms contribute to the effects of HIV on human capital investment (i.e., educational attainment). In addition, it is important to examine the relationship between HIV and human capital accumulation in order to determine whether HIV infection does lead to less educational outcomes *ceteris paribus*.

1.5 Aims of the dissertation

This dissertation seeks to examine effects of HIV on inter- and intragender gaps in educational attainment in SSA using a combination of research methods. It is important to examine these gaps separately because the results can help understand whether HIV, gender, or a combination of both affects educational outcomes. There is a research gap in studies that examine whether HIV affects educational outcomes of males and females differently and whether this varies by age or educational level (see Chapters 1, 2 and 3). The overall goal of the dissertation is to provide an understanding of how HIV affects educational attainment and how it influences gender gaps in education. It is crucial to identify groups that are more affected and to what extent HIV affects human capital investment, which may ultimately affect economic growth. The dissertation mainly focuses on Zimbabwe because investigating this issue from various angles within one country provides country-specific evidence and allows for the formulation of policy prescriptions and interventions that are suitable for the population of HIV-positive individuals in Zimbabwe. Overall, this study helps inform policies that target groups that are vulnerable and mainly affected by the disease.

To achieve the overall goal stated above, the following aims are defined:

Aim 1: To systematically review studies that examined the effects of HIV on educational attainment of school-going children globally and identify evidence gaps.

Educational attainment of school-going children is measured by different outcomes (e.g., grades, attendance, enrollment, etc.). In addition, HIV may affect children from various countries (or regions) as well as boys and girls differently. Given the innovation of ART and efforts from governments and actors in the humanitarian sector, the number of children orphaned by HIV has significantly decreased (Fawzi et al., 2012). Therefore, HIV is not only a threat to orphaned children's education but to HIV-positive children and those with HIV-positive parents. A systematic review of studies that analyze how HIV affects educational outcomes of different groups of children in various countries is presented in Chapter 2. This chapter provides insights on the evidence and the work that has been done on examining the effects of HIV on educational attainment and identifies the literature gaps that are to be filled.

Aim 2: To quantitatively examine intergender and intragender gaps in school attendance of HIV-positive children in Zimbabwe.

There is a dearth of literature that examines inter- and intragender gaps in educational outcomes of children (Guo Li & Sherr, 2012). It is therefore unclear whether HIV-positive children obtain less education compared to HIV-negative children or whether HIV-positive girls are different from HIV-positive boys (intergender). Also, given that young girls have higher HIV incidence rates in SSA, there are no studies that have extensively examined whether HIV affects educational outcomes of HIV-positive girls and HIV-negative girls differently (intragender). Gender gaps in educational attainment of HIV-positive children are generally underexplored in Zimbabwe. However, there are a few studies that have examined gender gaps in HIV-positive children (Guo, Li, & Sherr, 2012; Chapter 2). Most of the studies that examined this issue have focused on orphans (ibid). Moreover, there are no studies that have examined intragender gaps (e.g., HIV-negative girls vs. HIV-positive girls). It is important to do so in order to assess whether the schooling of children at the intersection of being HIV-positive and female is significantly affected. Given the increase in HIV rates among younger girls in SSA, it is important to examine whether

school attendance of HIV-positive girls is different compared to HIV-positive boys (intergender) as well as HIV-negative girls (intragender). This issue is explored in Chapter 3 of this dissertation.

Aim 3: To quantitatively examine the effects of HIV on educational outcomes of male adolescents and youths in Zimbabwe.

In general, there are no studies that have examined effects of HIV on educational attainment of males using nationally representative observational data. Moreover, there are currently no studies that have addressed endogeneity issues such as reverse causality and selection bias in studies that examine effects of HIV on educational outcomes using nationally representative data in Zimbabwe. Chapter 4 provides analysis of the effects of HIV on a different education variable, i.e., years of education and level of education (primary, secondary and tertiary) in a cohort of young boys and youths aged 15-29. This study is important because in some cases, HIV may not have an effect but may have an effect in other cases (see Chapter 3). In particular, HIV may differently affect individuals who contracted it in their youths compared to those who contracted it at birth. In addition, HIV may have a different effect at different levels of education (e.g., primary, secondary, tertiary). Chapter 4 explores this issue and highlights the stage at which HIV affects human capital accumulation, thereby highlighting areas that need interventions.

Aim 4: To qualitatively analyze effects of HIV on intergenerational transmission (mother-to-child) of education in Zimbabwe

Most studies that have analyzed effects of HIV on intergenerational transmission of HIV have typically focused on the relationship between grandparents and their grandchildren (see Chapter 2). This is because before ART was widely available, many grandparents had to raise their orphaned grandchildren. However, more PLWHIV are now on treatment and have school-going children. Given that mothers are generally the primary caregivers for their children, examining how their HIV status affects their children's schooling provides a new lens at examining intergenerational transmission of education. Multi-country studies have shown that children with HIV-positive mothers have less school attendance (Akbalut-Yuksel &Turan, 2013). However, the mechanisms that influence this result have not been examined. To fill the gap in studies that examine how parental HIV affects children's educational attainment, Chapter 5

qualitatively examines this issue in the context of Zimbabwe to reveal systematic and socioeconomic factors that underline this problem.

1.6 Data

This dissertation uses quantitative data from the 2015 Zimbabwe Demographic and Health Surveys (ZDHS). This dataset is unique in that it contains HIV test results for over 43,000 individuals aged 0-49 years for females and 0-54 for males. This dataset also contains demographic data that is not limited to education, area of residence, wealth, children (if any), employment, and marital status. The data are collected through household interviews using a two-stage cluster design. In the first stage, enumeration areas are drawn using census files and in the second stage, households are drawn from these enumeration areas. This is the only dataset that contains nationally representative HIV results in Zimbabwe, which makes most of the studies in the dissertation novel in the context of Zimbabwe. The DHS HIV testing protocol provides for informed, anonymous, and voluntary testing of women and men, usually age 15-49. The testing protocol undergoes a host country (in this case Zimbabwe)'s ethical review. The method of testing that is adopted by the DHS is the commonly used enzyme-linked immunosorbent assay (ELISA). The ELISA tests a patient's blood sample for antibodies. The HIV testing process is anonymous. Therefore, survey respondents cannot be provided with their results. However, during testing, all respondents are given educational materials and offered referrals for free voluntary counseling and testing.

To complement the results from the qualitative studies, this dissertation also uses qualitative data of HIV-positive mothers with school-going children collected at Mashambanzou Care Trust (MCT), an HIV treatment facility in Harare Zimbabwe. The data were collected through in-depth individual interviews with HIV-positive mothers and for comparison, HIV-negative mothers. The interviews were conducted in the native language (Shona) and were translated and transcribed in English. Ethical approval for the qualitative study was obtained at Maastricht University Ethics Review Committee for Inner City Faculties (ERCIC) and the Medical Research

Council of Zimbabwe (MRCZ). Each participant provided written consent before the data collection and was compensated for the time spent on the study.

1.7 Dissertation Outline

In addition to the Introductory Chapter, this dissertation is comprised of six chapters. The dissertation is structured such that each chapter presents one part of the analysis. In each chapter, there is an introduction, literature review, methods section, results section, a discussion and conclusion section. These chapters investigate the issues outlined in this introductory chapter and target to achieve the aims presented above.

The next chapter of the dissertation, **Chapter 2**, presents a systematic literature review of studies that have examined effects of HIV on children's educational attainment. This chapter focuses on papers that examine children that were either tested for HIV, have confirmed HIV status, have their parents' status is confirmed, or have parents who are known to have died of AIDS-related illnesses. This is important because some literature reviews have included papers that analyze the educational attainment of orphans in high prevalence countries without confirming whether their parents died of AIDS-related diseases (e.g., Guo, Li & Sherr, 2012). This is problematic because it is difficult to distinguish how children orphaned by AIDS are different from children orphaned by other diseases or casualties, given the socioeconomic issues associated with HIV (e.g., stigma). This chapter reviews global quantitative, qualitative, and mixed-method studies published from 1990 to 2019.

Chapter 3 quantitatively decomposes intergender and intragender gaps in school attendance for HIV-positive boys and girls as well as HIV-negative and HIV-positive boys and girls in Zimbabwe. This chapter seeks to distinguish whether HIV-positive girls attend less school compared to HIV-positive boys and HIV-negative girls. The chapter uses a large sample of school-aged children using the nationally representative ZDHS data.

In order to examine effects of HIV on total years of schooling, **Chapter 4** uses ZDHS data for young boys and youths in Zimbabwe and quasi-experimental designs. Given the increase in

circumcision rates in Zimbabwe, the study is able to exploit this variable to address confounding issues related to reverse causality and selection bias in the relationship between HIV and educational attainment.

Chapter 5 seeks to fill the gaps identified in the quantitative studies examined in Chapter 2 by using primary interviews with low-income HIV-positive and HIV-negative mothers in Zimbabwe to discuss the difficulties they face in transmitting education to their children. This study complements the quantitative studies by examining mechanisms that drive the relationship between parental illness and intergenerational transmission of education. In addition, the chapter reveals the socioeconomic issues that drive the results in the quantitative studies in Chapter 3 and Chapter 4.

Finally, **Chapter 6** presents the general discussion of the key study findings. The chapter synthesizes these key findings in the form of statements and discusses them to outline their implications for the study setting, and to provide policy recommendations and areas of future research.

Chapter 2

Effects of HIV/AIDS on Children's Educational Attainment: A Systematic Literature Review

This chapter is published as:

Zinyemba, T.P., Pavlova, M., & Groot, W. (2020). Effects of HIV/AIDS on children's educational attainment: A systematic literature review. *Journal of Economic Surveys*, *34*(1), 35-84.

Abstract

Over the last three decades, 35 million people have died of AIDS. As a result, HIV/AIDS has brought about a significant reduction in human capital, especially in SSA. Several studies have examined the effects of HIV/AIDS on human capital, in particular, educational attainment. These studies have examined different countries, datasets, and educational outcomes. This systematic literature review provides a comprehensive up-to-date overview of peer-reviewed papers published in English by focusing on the main mechanisms that influence effects of HIV/AIDS on educational outcomes. These are sickness of the child, orphanhood, and sickness of parents. The results show that educational outcomes of HIV-infected children, AIDS orphans, and children with HIV-infected parents are affected differently. HIV-infected children mainly miss school days due to illness and medical appointments, orphans mainly face financial problems and lack motivation in their education, while children with HIV-infected parents may take care of their sick parents or face financial problems that affect their education. Distinguishing these groups of children could help to formulate policies that adequately improve schooling outcomes of these vulnerable children.

Keywords. children; education; HIV/AIDS; human capital investment; intergenerational transmission

2.1. Introduction

About 17 million children have lost one or both parents to HIV/AIDS since the eruption of the epidemic (USAID, 2016). Most of these children (about 90%) reside in SSA. An estimated 3.4 million children under 15 years are currently living with HIV (USAID, 2016). HIV-infected children, AIDS-orphaned children, and children with HIV-infected parents may be deprived of opportunities that lead them to become economically productive adults (UNAIDS, 2016). In particular, HIV/AIDS may impede children's schooling through childhood illness, orphanhood, and parental illness. The effects may further differ by gender, thereby inducing a gender gap in schooling among children affected by HIV. Given the various ways in which HIV disrupts children's schooling, it is important to know the impact of HIV/AIDS on life chances of boys and girls, specifically, educational attainment, enrollment, and attendance.

The literature on the educational attainment of orphans and children living with HIV-infected adults has been reviewed before by Guo, Li & Sherr (2012). They include 23 quantitative studies that analyzed the impact of HIV/AIDS on educational attainment of children affected by HIV. Most of the literature in this review analyzed educational attainment of orphans only. The review showed that educational attainment of children differed by type of orphan (i.e., double orphan, maternal orphan, or paternal orphan). However, results on gender gaps in educational attainment were mixed and also varied by type of orphan. This review study excluded qualitative papers that capture issues that may not be identified by quantitative studies. These include pathways through which HIV affects children's education.

Goldeberg & Short (2016) conducted a systematic review that included 45 articles. The study examined physical and emotional health as well as schooling of children living with HIV-infected or AIDS-ill adults. The studies highlighted factors that influence these outcomes, including poverty, transmission of opportunistic diseases, caring for sick adults, stigma, and lack of support. Only 10 out of 45 studies (nine quantitative and one qualitative) reported results on educational outcomes. This left out many important and relevant studies on educational attainment of HIV/AIDS-affected children. This review showed that children who live with HIV-

infected parents and adults attended school less frequently and had deficits in grade progression. Other important forms of educational attainment such as dropout, enrollment, and years of schooling were not discussed in this review.

From the literature, three main underlying mechanisms by which HIV affects educational attainment of children can be identified. These are: sickness of the child, orphanhood, and HIV infection of parents (UNICEF, 2006). These mechanisms may have different effects on educational outcomes of children. By systematically reviewing peer-reviewed English language publications, we examine the extent to which HIV affects children's schooling differs by these three mechanisms. We focus on three main effects:

1) Effects on children: Due to illness, HIV-infected children may miss school days and perform academically less than HIV-negative children. Correspondingly, orphans - even when they are not sick themselves - generally obtain less schooling compared to nonorphans (Case et al., 2004, Evans & Miguel, 2007; Ardington & Leibbrandt, 2010). Hence, it is important to further analyze the effects of HIV on various educational outcomes so as to identify the most vulnerable groups.

2) Effects of HIV on gender gaps in educational outcomes: Because of HIV, women and girls are more likely to lose jobs, lose income, miss school, and primarily take care of sick people due to patriarchal norms that subordinate women (Madiba & Ngwenya, 2017). In addition, women and girls are the majority of the HIV-affected population (UNWOMEN, 2016); therefore, they are more likely to suffer from the effects of this disease.

3) Intergenerational (parent-to-child) transmission of education in case of HIV/AIDS: Children with HIV/AIDS-ill parents may observe their parents physically deteriorate from the disease and may experience both parents' deaths, sometimes in quick succession. This may lead to posttraumatic stress syndrome, depression, poverty, and stigma (Cluver et al., 2012; Anabwani et al., 2016; UNAIDS, 2016). To the extent that children's educational

attainment is highly correlated with parental education (Becker and Tomes, 1986; Björklund and Salvanes, 2011), HIV may interfere with intergenerational (parent-to-child) transmission of human capital. Without parental human capital investment, chances of experiencing upward social mobility may decrease (Spiegler, 2018).

This chapter adds to the aforementioned reviews by: (i) including papers that examine sick children, AIDS-orphaned children, children living with HIV-infected parents or caregivers, or children living with an HIV-infected family member; (ii) distinguishing three pathways through which HIV/AIDS affects children's educational attainment; (iii) focusing on direct effects of HIV on educational attainment by only including studies that have information on HIV/AIDS infection or confirm AIDS deaths of the parent/guardian; (iv) analyzing results based on the type of educational outcome; (v) including quantitative, mixed-methods, and qualitative studies that discuss educational attainment of children affected by HIV; and (vi) updating and expanding the literature in the aforementioned reviews. The review increases our knowledge and insight on the underlying mechanisms and is relevant for future studies and policymakers.

2.2. Methodology

This literature review follows the guidelines of the Preferred Reporting Items for Systematic Reviews (PRISMA). PRISMA guidelines were developed using an evidence-based approach. They consist of a 27-item checklist and a four-phase flow diagram of items that are deemed essential for a thorough and transparent systematic review (Moher et al., 2009).

The search of relevant articles was conducted in six databases, namely EconLit, ERIC, PubMed, SocINDEX, Web of Science (WoS), and Google Scholar. The search and review of the articles were conducted between December 2017 and July 2018 and were also updated in June 2019. Table 2.1 shows the exact search terms that were used in each database. In each column, the table shows: (i) terms for HIV; (ii) terms for schooling and socioeconomic outcomes; and (iii) terms for children and gender. In some cases, truncations were used to ensure that all relevant papers were included. To optimize the results, the searches in EcoLit, and ERIC were performed in the title

and abstract, the searches in PubMed, WoS and SocINDEX were performed in the title. Searches in Google Scholar used similar terms as in the other databases. A university librarian verified and approved the combinations used.

2.2.1 Inclusion and Exclusion Criteria

Papers were included in the review if they analyzed the direct relationship between HIV and schooling outcomes. There were no time or language restrictions imposed in the search. Articles were excluded if they were nonempirical, discussed the relationship between HIV and psychological or cognitive issues, only focused on perceptions of HIV risk, if there was no HIV-testing done on either parent or child, or if there was no confirmation of AIDS-related death of parent or guardian. Books, working papers, conference papers/abstracts, and meeting papers/abstracts were also excluded. We only included peer-reviewed papers because the peer review process adds to the quality of the studies reviewed. As in the other databases, papers found in Google Scholar were included if the title and abstract discussed the relationship between HIV and educational attainment and if they were peer-reviewed. Papers were excluded if there was no information on HIV infection or no confirmed AIDS deaths (see Figure 2.1).

Table 2.1: Search Terms Used in Each Database

Database	HIV Terms	Education and Socioeconomic terms	Child and Gender terms
EconLit, ERIC, SocINDEX and Web of Science	HIV OR HIV/AIDS OR AIDS OR HIV-affected OR HIV-infected OR AIDS-ill OR HIV-positive OR AIDS-affected OR Parental-AIDS OR Parental-HIV OR Maternal-AIDS OR Maternal-HIV OR Paternal-HIV OR Paternal-AIDS	Education* OR School* OR Learn* OR "Human Capital" OR "Drop-out" OR Dropout OR Truancy OR Enro$l* OR Absenteeism OR Absence OR "School leaving" OR Intergenerational OR Parental-education OR maternal-education OR Paternal-education or Socio-economic OR Socioeconomic OR Economic	Child* OR Adolescent OR Infant* OR Youth* OR Orphan* OR "Vulnerable Children" OR Boy* OR Girl* OR Gender-gap* OR Gender-difference*
PubMed	HIV [Title] OR HIV/AIDS [Title] OR AIDS [Title] OR HIV-affected [Title] OR HIV-infected [Title] OR AIDS-ill [Title] OR HIV-positive [Title] OR AIDS-affected [Title] OR Parental-AIDS [Title] OR Parental-HIV [Title] OR Maternal-AIDS [Title] OR Maternal-HIV [Title] OR Paternal-HIV [Title] OR Paternal-AIDS [Title]	School [Title] OR Schooling [Title] OR Education [Title] OR Dropout [Title] OR "Drop-out" [Title] OR Learning [Title] OR "Human Capital" [Title] OR Truancy [Title] OR Absenteeism [Title] OR Absence [Title] OR "School leaving" [Title] OR Enrollment [Title] OR Enrolment [Title] OR Educational [Title] OR "Educational Attainment" [Title] OR Intergenerational [Title] OR Parental-education [Title] OR maternal-education [Title] OR Paternal-education [Title] OR Socio-economic [Title] OR Socioeconomic [Title] OR Economic [Title]	Child [Title] OR Children [Title] OR Adolescent* [Title] OR Infant* [Title] OR Youth* [Title] OR Orphan* [Title] OR "Non-orphan*" [Title] OR "Vulnerable Children" [Title] OR Boys [Title] OR Girls [Title] OR Gender-gap* [Title] OR Gender-difference* [Title]

2.2.2 Selection Process

The selection process consisted of several phases. Once all papers were extracted from the databases, duplicates were removed in EndNote. The first selection was based on the title and the abstract. Two reviewers independently screened the papers to be included in the review. The independently screened lists were compared and discussed, leading to a final selection of papers to be included in the review. The remaining papers were fully reviewed by one researcher. The results were discussed with all researchers to assure consistency in the selection process. The reference lists of the selected papers and previous reviews were then screened for relevant publications applying the same inclusion and exclusion criteria.

Again, the results were discussed with all researchers to make sure that no relevant papers were left out. The final list of the 62 publications included in the review can be found in Appendix 1.

2.2.3 Analysis

The selected papers were categorized into quantitative, mixed-methods, and qualitative studies. We applied the method of directed qualitative content analysis (Hsieh and Shannon, 2005) for the analysis of the papers selected for the review. Specifically, we extracted information related to the key themes identified in the introduction (i) HIV-affected versus HIV-unaffected children; (ii) gender gaps in educational attainment; and (iii) intergenerational transmission of education. During the data extraction phase, all interim results were reviewed by all researchers and discussed to ensure the quality of data extraction.

From the quantitative papers, the following information was extracted: country of analysis, children's level of schooling of children, education variables used, HIV status, gender and age of the child, income and education of the parents, income and education information of caregivers, type of orphan, information on intergenerational transmission of education, type of data, number

of observations, method of analysis, comparisons made in the analysis, and summary of the results. From the qualitative papers, the following information was extracted: country of analysis, HIV status method of data collection, type of individuals interviewed, education outcome analyzed, and summary of results. From the mixed-methods papers, a combination of information from quantitative and qualitative results was extracted. The results were synthesized and were presented in the form of tables and narrative descriptions (see Appendix 2).

2.2.4 Assessment of Publication Quality

The quality of the papers selected for the review, was assessed using the Mixed-Methods Appraisal Tool (MMAT) (Pluye et al., 2011). The MMAT is used for complex systematic literature reviews that include quantitative, mixed-methods, and qualitative studies. It accounts for five common methodologies, qualitative (section 1), quantitative randomized (section 2), quantitative non-randomized (section 3), descriptive (section 4), and mixed (section 5). Each section is composed of three to four questions related to data sources, data collection, and outcome data. A quality score between 0% and 100%is assigned for each study component. An answer of "yes", "no", or "I can't tell" is assigned for each question in the corresponding study component (see Appendix 3). Papers of good quality met all criteria (i.e., had a score of 100%) and papers of poor quality did not meet any criteria (i.e., had a score of 0%). We also checked the quality of our review by using the PRISMA 2009 checklist (see Appendix 4).

2.3. Results

Figure 2.1 shows a flow chart of the selection process as per PRISMA guidelines. Using the search terms in Table 2.1, a total of 5961 papers were extracted from EconLit, ERIC, PubMed, SocINDEX, WoS, Google Scholar and references of selected papers. Afterwards, duplicates were removed, the exclusion criterion was applied, and full texts were read. This left 62 papers (46 quantitative, 7, mixed-methods, and 9 qualitative). Of these 62 papers, there were seven mixed-methods papers that were included in both the quantitative and qualitative groups distinguished in the analysis.

2.3.1. General characteristics of the selected papers

Table 2.2 shows the characteristics of 52 selected quantitative papers (45 were purely quantitative and 7 were mixed–methods papers). The papers used randomized, nonrandomized, and descriptive methods. These studies were published between 1994 and 2019. About 60% (31 out of 52) of these papers reported studies conducted in Southern and Eastern Africa. Most of the papers used attendance, enrollment, correct grade for age, and years of schooling as measures of schooling. In some cases, studies used multiple educational outcomes. Regression analysis was the most common form of analysis applied in these papers (51 out 52). Table 2.3 shows the characteristics of the 16 papers that reported qualitative results (nine were purely qualitative and seven used mixed methods). The papers were published between 2005 and 2017. All of the studies were conducted in Southern and Eastern Africa. Almost all (14 out of 16) of the studies included various forms of interviews and focus group discussions. The main education variables were attendance and dropout.

The quality of the quantitative, qualitative, and mixed-methods papers is assessed and presented in Appendix 3. In short, the assessment tool provides a score based on the data and methodological quality of quantitative, qualitative, and mixed-methods papers. Approximately 52% (24 out of 46) of the purely quantitative papers had a score of 100% (i.e., they met all four criteria), followed by about 20% (9 out of 46) that met three criteria, 13% (6 out of 46) met two criteria, 11% met one criterion, and about 3% met none. Only one out of seven papers (14%) of the mixed-methods papers met all criteria, 57% (4 out of 7) met two, and 29% (two out of seven) met one. For the purely qualitative papers, about 33% (three out of nine) met all four, 44% (four out of nine) met three, and 22% (two out of nine) met two criteria.

Figure 2.1: Flow Chart of the Selection Process

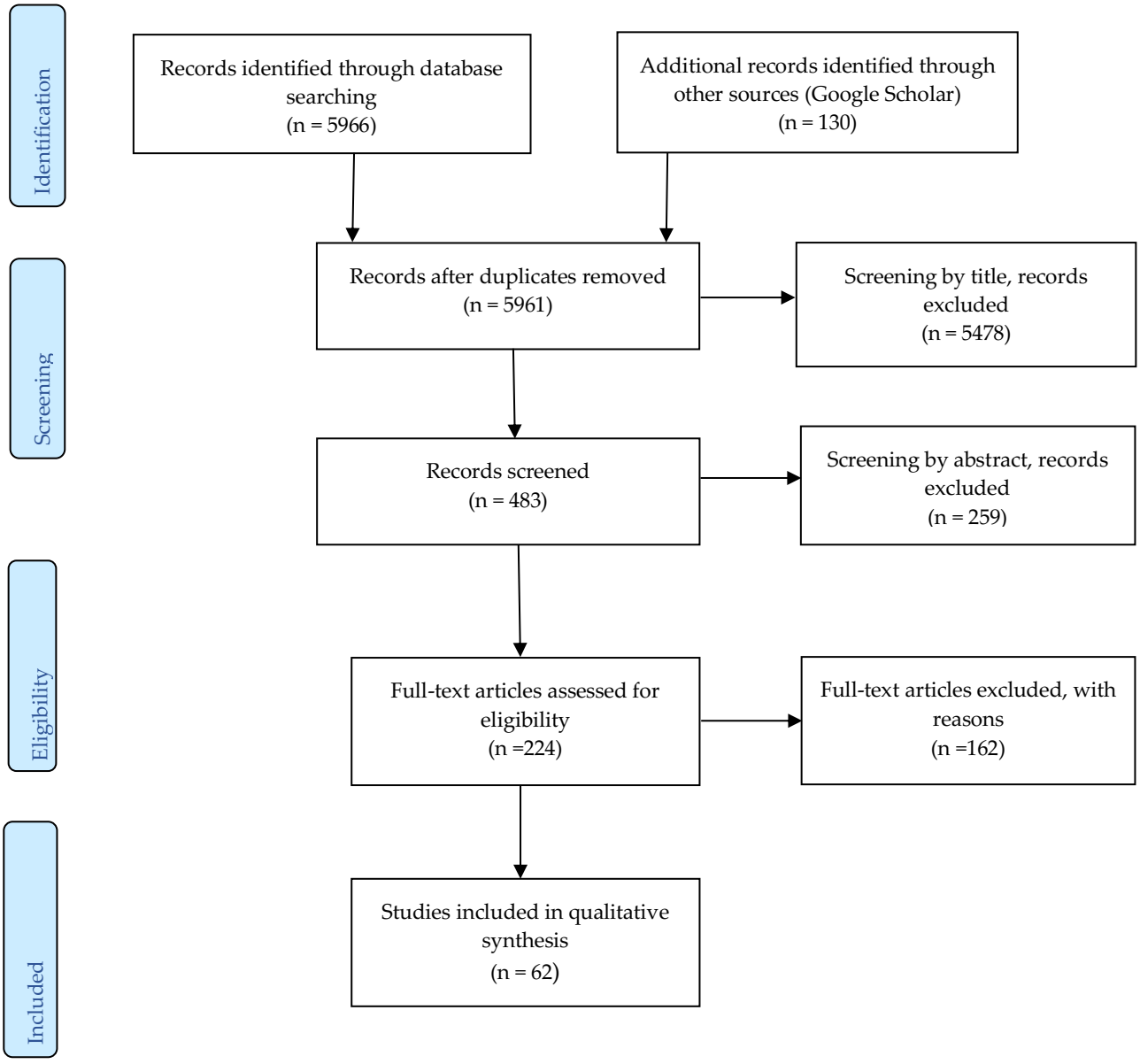


Table 2.2: General Characteristics of the Quantitative and Mixed-Methods Papers

	Number of Publications	Publication reference in Appendix 1
Year of publication		*N*=52
2015-2019	16	2, 16, 20, 21, 23, 24, 25, 35, 36, 40, 42, 45, 46, 51, 55, 56
2010-2014	21	1, 4, 5, 7, 8, 10, 15, 18, 26, 29, 31 ,34, 41, 44, 48, 49, 53, 58, 59, 60
2005-2009	9	6, 11, 14, 17, 39, 54, 57, 61, 62
2000-2004	2	12, 38
1995-1999	3	3, 9, 37
1990-1994	1	50
Region/Country of Study		*N*=52
Multiple African countries (more than 1 country)	3	1, 25, 51
Southern Africa		
East Africa	19	2, 4, 7, 8, 14, 16, 17, 29, 32, 33, 35, 36, 40, 42, 44, 48, 49, 50, 55
West Africa (Guinea)	12	3, 6, 10, 23, 24, 31, 34, 39, 45, 54, 55, 62
East Asia (China)	2	11, 15
South Asia (India)	8	20, 21, 26, 57, 58, 59, 60, 61
Latin America (Brazil)	4	5,18, 41, 46
North America (USA)	1	53
	4	9, 12, 37, 38
Sample size		*N*=52
0-10	1	12
10-50	1	53
50-100	6	3, 9, 18, 37, 38, 50
100-200	1	60
200-500	17	5, 10, 11, 15, 26, 29, 32, 34, 40, 42, 45, 46, 54, 58, 59, 61, 62
500-1000	10	2, 7, 20, 21, 23, 25, 36, 41, 44, 51,
1000+	16	1, 4, 6, 8, 14, 15, 17, 24, 31, 33, 35, 39, 48, 49 55, 56, 57
Analytical Model/Statistical Methods		*N*=52
RCT	5	20, 21, 45, 54, 55
Regression (GLM/random effects/fixed effects, logit, Maximum Likelihood,)	31	1, 4, 6, 7, 8, 10, 11, 14, 15, 16, 17, 23, 24, 25, 26, 31, 33, 36, 39, 42, 44, 46, 48, 49, 51, 56, 57, 58, 62
Statistical tests (Chi-square, T-test/F-test, Pearson's correlation, ANOVA, Fisher's exact test, Mann-Whitney *U* test)	11	2, 3, 5, 12, 29, 32, 37,41, 50, 53, 59, 61
Descriptive statistics	5	9, 18, 38, 40, 60
Education variables analyzed		*N*=89 (Some studies analyzed multiple outcomes)
Enrollment, dropout, years of schooling	25	1, 3, 5, 7, 15, 16, 18, 29, 31, 33, 35, 37, 41, 44, 46, 48, 49, 51, 53, 54, 58, 59, 60, 61
Attendance, absenteeism, truancy	27	1, 2, 5, 7, 11, 12, 14, 15, 18, 24, 29, 39, 40, 41, 44, 45, 46, 48, 49, 51, 53, 56, 58, 59, 60, 61, 62
Grades, correct grade for age, highest grade level, grade repetition, grade progression	25	1, 2, 5, 10, 12, 14, 16, 20, 21, 23, 35, 36, 37, 38, 42, 46, 48, 49, 51, 53, 54, 56, 57
Other	4	6, 22, 29, 30

Table 2.3: General Characteristics of the Qualitative and Mixed-Methods Papers

	Number of Publications	Publication reference in Appendix 1
Year of publication		*N*=16
2015-2018 2010-2014 2005-2009	3 6 7	2, 13, 24 4, 7, 19, 28, 29, 32 17, 22, 27, 30, 43, 47, 52
Region/Country of study		*N*=16
Multiple Countries (Swaziland and South Africa) Southern Africa East Africa	1 10 5	47 2, 4, 7, 13, 17, 22, 29,32, 43 19, 27, 28, 30, 52
Method of data collection		*N*=17 (Ref. #32 used both methods)
Interviews (interviews, semi-structured interviews, focus group discussions, in-depth interviews, exit interviews, informal interviews) Other (letter writing, case studies)	14 3	2, 4, 7, 13, 17, 19, 4, 2, 27, 28,29, 30, 32, 43, 47 22, 32, 52
Education variables analyzed		*N*=28 (Some papers analyzed multiple variables)
Attendance Absenteeism Dropout Enrollment Other	12 3 6 1 6	2, 4, 7, 13, 17, 19, 22, 24, 27, 30, 32, 47 19, 29, 32 7, 13, 29, 30, 32, 52 17 2, 27, 28, 29, 43, 52

2.3.2 Relevant Findings Reported in the Papers Reviewed

Table 2.4 shows the main findings of the 52 quantitative studies. There were seven mixed-methods studies included in this group that were also included in the qualitative study group. The three main results categories are (i) HIV-affected and HIV-unaffected children; (ii) gender comparisons in schooling outcomes; and (iii) and intergenerational transmission of education. The table lists the effects of HIV on five main educational outcomes and indicates whether effects or no effects were found.

There were 16 papers included in the qualitative study group. This included nine purely qualitative papers and seven mixed-methods studies that are also found in the quantitative study group. Of these studies, 14 studies conducted interviews. Individuals who participated in the

qualitative studies included HIV-infected children, HIV-infected parents, non-HIV parents, adult caregivers, child carers, teachers, and pupils.

Table 2.4: Main Findings of Selected Quantitative Papers

	Category 1 HIV-affected and HIV-unaffected			**Category 2 Gender comparisons in schooling outcomes**			**Category 3 Intergenerational transmission of education**		
	Positive Effect	Negative Effect	No Effect	Positive Effect	Negative Effect	No Effect	Positive Effect	Negative Effect	No Effect
Attendance		2, 8, 9, 14, 15, 32, 37 48, 56, 62	2, 49		11	24		1, 8, 9	24, 39,44, 48,
Enrollment		3, 8, 31, 41, 46			33		35	3, 8	17, 33, 44
Dropout		5, 15, 41, 46, 50, 53						7	50
Correct grade for age		4, 8, 23, 31, 38, 46, 49,	48	48				1	33, 44
Years of schooling			49						
Other	6	53	12, 14, 33, 53	10, 25	6, 20, 21, 44		57	42	14, 17, 42, 44

- Summary of educational outcomes of HIV-affected children

Twenty out of the 28 quantitative studies on HIV-affected children (Category 1 in Table 2.4) found that HIV-infected children and AIDS orphans attained less education than HIV-unaffected children. This is in comparison to one paper that found a positive effect and four papers that found no effect. Bhargava (2005) found that AIDS orphans were more likely to participate in school than children with parents who died of non-AIDS-related illnesses. However, Pufall et al. (2014a and 2014b) found no relationship between being HIV-positive and educational outcomes. Some studies (e.g., Bandason et al., 2013) showed that being HIV-infected delayed schooling. However, studies listed in the table went further by comparing different groups of HIV-affected children. For example, Cohen et al. (1997) comparing different groups of HIV-infected children with mild, moderate and severe symptoms, and found that children with severe symptoms

missed more school. Mayes et al. (1996) compared 66 American boys diagnosed with hemophilia, of which 18 were HIV-positive.

The results showed that HIV-positive boys missed more school days than non-HIV boys. However, there were no differences in academic grades. On the other hand, Delva et al.`s (2009) comparison of AIDS orphans and non-AIDS orphans to nonorphans, showed that AIDS orphans in Guinea missed more school than nonorphans and other orphans. Kidman et al. (2012) went further by examining different types of orphans found that double orphans and maternal orphans in Malawi experienced more educational deprivation compared to nonorphans. However, Orkin et al. (2014) found that HIV/AIDS orphanhood was not associated with non-enrollment or non-attendance in South Africa. They found that HIV/AIDS affected educational outcomes indirectly via orphanhood and parental/caregiver illness through poverty and internalization of problems.

Among the qualitative studies, Anabwani et al. (2016) found that HIV-infected children in Botswana reported no major problems in school performance. Other studies showed that HIV-infected children were missing school days due to illness and parental illness (Poulsen, 2006; and Skoval & Ogutu, 2009; Harms et al., 2010; Cluver et al., 2012; Bandason et al., 2013; Anabwani et al.,2016).

- Summary of gender comparisons of all children affected by HIV

Table 2.4 shows that only 6 out of 10 (60%) papers found negative effects of HIV on gender differences in educational attainment within the group of HIV-infected children and children with HIV-infected parents. The results were mixed. The study by Devla et al. (2009) presented an analysis of different types of orphans in Guinea and showed that regardless of orphan status, boys were significantly more likely to attend school on a daily basis than girls. Similarly, Harrison et al. (2017) found that HIV-affected girls in China reported lower grades and had less interest in school. However, Henning et al. (2016) found that gender did not affect school attendance in Zambia.

Orkin et al. (2014) showed that HIV-affected boys in South Africa reported difficulties with grade progression. Pufall et al. (2014 a) also showed that girls were more likely to be in correct grade for age compared to boys in Zimbabwe. Hensels et al. (2016) found that being a girl was significantly associated with better educational functioning and being a boy was associated with more educational risks. Zivin et al. (2009) presented one of the few studies that analyze effects of antiretrovirals (ARVs) on children's education. They found that ARV treatment effects were and significant for Kenyan girls in early ARV treatment stages, and not significant for boys.

Only two qualitative study reported on gender gaps in educational attainment. Jepkemboi and Aldridge (2009) found that HIV-affected boys performed better in math and science. However, Jepkemboi and Aldridge (2014) found that HIV-affected girls were more persistent and had a more positive attitude towards school than HIV-affected boys

- Summary of intergenerational (parent-to-child) transmission of education

Category 3 in Table 2.4 shows that 8 out of 16 quantitative papers that examined how HIV-infected parents transmit education to their children found that HIV had negative effects. Akbulut-Yuksel and Turan`s (2013) comprehensive analysis of 11 countries in SSA showed that children with HIV-positive mothers attained 30% less education than the general population. Additionally, Cluver et al. (2013) and Mishra et al. (2007) showed that children with AIDS-ill parents had low attendance. Orkin et al. (2014) found that caregiver HIV/AIDS illness was associated with concentration problems via poverty and internalization of problems among South African adolescents. Zivin et al. (2009) found that children in early-stage ARV households and children in later-stage ARV households had a similar increase in school attendance. Comparison between orphans and children with HIV-infected parents by Tu et al. (2009) revealed that Chinese orphans have lower grades compared to children with HIV-infected parents. Ryder et al. (1994) also found that Congolese maternal orphans withdrew from school more often than children with HIV-positive mothers. On the contrary, the study of Floyd et al. (2007) in Malawi found no evidence of low grades among male and female children of HIV-positive individuals.

Similarly, Grant (2008) found no differences in school enrolment between children with HIV-positive mothers and HIV-negative mothers.

Grant's mixed-methods study of mothers who were tested for HIV found that these parents were dedicated to ensuring that their children obtained their schooling, while they were still in control of their children's matters. Additionally, qualitative studies showed that caregivers (such as relatives and grandparents) reported that children were frequently out of school due to financial problems (e.g. Kakooza & Kimuna, 2006; and Nyasani et al., 2009; Kembo, 2010; Fauk et al., 2017)

2.4. Discussion

Guo et al. (2012) and Goldberg and Short (2016) produced systematic literature reviews similar to this study. Our study adds to these earlier reviews by distinguishing three mechanisms through which HIV affects children's educational attainment. These are sickness of the child, orphanhood, and parental illness. Our study also adds to the literature by distinguishing three main effects of HIV on educational attainment of children: effects on sick children and orphans, effects on gender gaps, and effects on the intergenerational transmission of education. This study employed more databases than the previous reviews that resulted in the inclusion of additional studies, including additional quantitative studies some of them published recently, as well as qualitative and mixed-methods studies. Results from these latter studies complemented the results of quantitative studies by providing explanations of the three mechanisms through which HIV affects educational attainment. In addition, papers were included in this review if there was confirmation of HIV/AIDS infection of the child, HIV/AIDS infection of the parent, AIDS death of the parent, or AIDS-illness in the family. This helped establish the direct effects of HIV on educational attainment of children.

The results from this systematic literature review show that all three mechanisms have different effects on different types of children and educational outcomes. However, in some cases, certain groups of children face similar issues. For example, HIV orphans and children with HIV-positive parents may be living with grandparents or other relatives. These two groups of children are likely to face similar problems with their education. One of the mechanisms that affect children's

schooling is HIV-related sickness. Studies included in this review showed that HIV-infected children attended fewer school days (Mayes et at., 1996; Cohen et al., 1997; Anabwani et al., 2016), dropped out of school more frequently (Bele et al., 2011; Parchure et al., 2016), were more likely not to be in the correct grade for their age or to have repeated a grade (Bandason et al., 2013; Henning et al., 2018), and had low grades (Ellis, 2004). These results indicate that physical illness is the main barrier to HIV-infected children's schooling. Anabwani et al. (2016) found that HIV-infected children's absenteeism from school was mainly due to frequent medical appointments and illness. One solution to this issue may be to increase access to ARV treatment and extra lessons for HIV-infected children. Souza et al. (2010) found that about 90% of Brazilian adolescents who were on highly active antiretroviral therapy were attending school. Voluntary teaching programs in some African countries (e.g. Zambia, Uganda, and Malawi) could also be a viable solution to the issue of absenteeism and attendance among HIV-infected children.

The results also showed that orphans were more likely to dropout or not be enrolled in school (Aaspas, 1999; Bele et al., 2011), experience grade delay (Kasirye & Hisali, 2010; Cluver et al., 2013), and have low attendance (Delva et al., 2009). This is in contrast to the fact that HIV-infected children faced delays in their education mainly due to illness. These results were complemented by qualitative results that showed that AIDS orphans' education is interrupted due to financial problems (Nyasani *et al*., 2009; Kembo 2010; Fauk *et al*., 2017), lack of motivation (Jepkemboi and Aldridge, 2014), and disciplinary issues (Nyasani *et al*., 2009). These qualitative studies were based on interviews with AIDS orphans, their teachers, and their caregivers. This provided an overview of the issues faced by AIDS orphans. The studies showed that issues faced by orphans are complex and that the mere provision of food and shelter is not necessarily sufficient. They also may also need assistance with school fees and school supplies. Some international organizations such as SOS Children's Villages have initiated programs that meet the educational needs of orphans. Their programs provide comprehensive services to orphans by building family environments and providing a holistic approach to child-centered education. Collaboration with such organizations may ensure that orphans and children at risk have the comprehensive care needed to achieve their educational goals. Free universal education may also help. For example,

the Universal Primary Education Program (UPEP) in Uganda provides tuition assistance to all eligible primary school children. However, with such programs, many children may need further assistance with school supplies and uniforms (Kakooza and Kimuna, 2006).

School children with HIV/AIDS-ill parents may miss school or may not be in the correct grade due to the need to provide care to parents (Harms et al., 2010; Cluver et al., 2012; Pufall et al., 2014a; Pufall et al., 2014b;). ARV treatment has been shown to reverse HIV-related adult morbidity and mortality (Zivin et al, 2009; Wang et al., *2016*). Zivin et al. (2009) found that providing Kenyan children with HIV-positive parents ARV treatment led to a significant increase in weekly hours of schooling. Scaling up ARV treatment for parents living with HIV could help them remain healthy and economically active, thereby avoiding delays to their children's education (Delva et al., 2009). As in the case of orphans, children of HIV-positive parents are also likely to live with their grandparents (Floyd et al., 2007). This is supported by the qualitative study conducted by Harms et al. (2010) who found that HIV/AIDS orphans stated that their orphanhood status started with the illness of their parents as opposed to the death of their parents. Children living with sick adults, particularly girls, face the burden of providing care and performing adult chores (Yamano &Jayne, 2005). In addition, they are also more likely to be living with their grandparents or other relatives. Grandparents are likely to have only limited resources and may be too frail to work. Therefore, children living with grandparents, even when their AIDS-ill parents are alive, may face similar issues as AIDS orphans living with their grandparents. Floyd et al. (2007) suggested that foster carers (including grandparents) should be supported regardless of age and relationship to the child. Projects such as the Young Carers South Africa that help governments identify children who live in AIDS-sick homes and provide them with social welfare grants, home visits, and free school meals may help reduce these problems.

Most of the papers in this study examined effects of HIV on sick children, orphans, and children with HIV/AIDS-ill parents. A few studies (5 out of 57) mainly discussed on effects of HIV on gender gaps in educational attainment (Bhargava, 2005; Poulsen, 2006; and Zivin et al., 2009; Kitara et al., 2013; Hensels et al., 2016). Most of the studies that discussed gender issues controlled

for the gender variable or gender of the household head. Bhargava (2005) found that girls who were maternal orphans were less likely to participate in school. On the other hand, Hensels et al. (2016) found that girls had better educational outcomes than boys. Kitara et al. (2013) examined nonorphaned, non-HIV orphaned and HIV -orphaned girls. They found that nonorphaned and non-HIV orphaned girls had a more positive attitude towards school compared to HIV orphaned girls. These few studies indicate that results on intergender and intragender issues among children affected by HIV are complex and remain underexplored. Examination of gender gaps and gender issues among children affected by HIV requires attention, given the fact that HIV-affected girls are also likely to experience the effects of patriarchal norms and stigma that could significantly affect their education (Cluver et al., 2013; Madiba and Ngwenya, 2017).

Despite the advantages of our review design, there are also a few limitations that need to be acknowledged. Specifically, we only included studies that confirmed HIV infection of the child or parent/guardian and HIV/AIDS death of a parent. This leaves out studies that examined effects of orphanhood on educational attainment. Additionally, our systematic literature review includes quantitative, mixed-methods, and qualitative papers, which makes it difficult to standardize the comparisons among the papers. Despite these limitations, we were able to have a comprehensive set of studies that provided insight on issues faced by children affected by HIV.

2.5. Conclusion

The results of our systematic review showed the mechanisms that influence the relationship between HIV/AIDS and children's education. Differences were observed between HIV-infected and uninfected children, between HIV-affected boys and HIV-affected girls, and children with HIV-infected parents and other groups of children groups. HIV-infected children mainly miss school days due to illness, orphaned children mainly because of a lack of financial means and motivation, and children with HIV-infected parents may care for their parents and or face similar issues as orphans. It is important to distinguish these mechanisms and groups of children so as to adequately formulate policy prescriptions (Evans and Miguel, 2007). Orkin et al. (2014) is the only study that conducted path analyses between familial HIV/AIDS and educational outcomes.

They found that HIV/AIDS affected educational outcomes indirectly via orphanhood and parental/caregiver illness through poverty and internalization of problems. Therefore, it is advisable to focus on interventions that reduce stigma rather than targeting individual families (Orkin *et al*., 2014). More studies on path analyses are needed so as to further inform policy.

Only a few studies examine gender gaps in educational attainment among children affected by HIV. Therefore, there is no conclusive evidence on whether HIV-infected girls, female AIDS-orphans, or girls with HIV-positive parents face more delays in schooling compared to their male counterparts. Additionally, because issues faced by children affected by HIV are complex, more mixed-methods and qualitative studies are needed to further understand the pathways that influence the relationship between HIV/AIDS and educational attainment of children. In particular, qualitative studies (through interviews and focus groups) could provide insight into these mechanisms by highlighting stories of different groups of children and caregivers.

Chapter 3

Effects of HIV on gender gaps in school attendance of children in Zimbabwe: A non-linear multivariate decomposition analysis

This chapter is published as:
Zinyemba, T., Pavlova, M., & Groot, W. (2021). Effects of HIV on gender gaps in school attendance of children in Zimbabwe: a non-linear multivariate decomposition analysis. *Education Economics*, 29(5), 471-485
https://doi.org/10.1080/09645292.2021.1914000

Abstract

We examine the effects of HIV infection on school attendance in Zimbabwe using a 2015 nationally representative dataset of 11,673 children aged 6-18 years. We employ a non-linear multivariate decomposition approach to examine how HIV affects intergender and intragender gaps in school attendance. We find gaps in school attendance between HIV-positive boys and girls and between HIV-negative and positive girls. About 44% of the attendance gap in both cohorts is attributed to differences in observable characteristics. About 56% of this gap is attributed to differences in the effects of these characteristics. The results indicate that HIV mainly affects girls' school attendance.

Keywords: HIV, children, education, gender gap

3.1. Introduction

Despite efforts aimed at ending the HIV/AIDS epidemic, the disease remains a major global public health concern. In 2017, about 940,000 people died of AIDS and about 1.8 million people were newly infected globally (WHO, 2018). With less than 4% of the world's population, Southern Africa contains nine countries with the highest HIV prevalence rates in the world (see Chapter 1, p. 14). As mentioned in Chapter 1, Zimbabwe is ranked sixth with a national prevalence rate of 13.3% (UNAIDS, 2018). An estimated 1.3 million individuals are currently living with HIV in Zimbabwe, and about 77,000 (6%) are children under 14 years (UNAIDS, 2018).[1] HIV is not only a health concern in Zimbabwe, it also has economic consequences. Due to HIV/AIDS-related mortality and morbidity, families, employers, and the country at large lose productive members (Matshe and Pimhidza, 2008). The loss of human capital can be traced back to the time an HIV-positive child starts missing school. Examining the extent to which HIV-positive children lag behind in schooling adds to the literature that examines the human capital loss brought about by HIV in SSA.

HIV can affect children's schooling through (i) a child missing school days due to illness- or treatment-related issues (Anabwani, Karugaba, & Gabaitiri, 2016); (ii) HIV-positive parents not being able to facilitate their children's schooling (Akbulut-Yuksel & Turan, 2013); and (iii) socioeconomic issues related to the disease, given the interplay between HIV and poverty (Lopman et al., 2007, Chapter 2). These issues can vary by gender. That is, HIV-positive girls may be more likely to drop out of school due to early marriage while boys are more likely to drop out to seek employment (Mpofu & Mhenga, 2016). In addition, HIV-positive girls may be stigmatized more than their male counterparts (Chikovore, 2009). However, there is a dearth of literature that analyzes the direct effects of HIV on intergender and intragender gaps in schooling (see Chapters 1 & 2).

Data that contain biomedical information about HIV test results of children is scant. Hence, most of the studies that examine the effects of HIV on children's educational attainment have focused

[1] Please note that estimates about HIV prevalence vary and depend on the entity that is reporting them.

on orphans (Guo, Li, and Sherr, 2012; Chapter1). Biomedical information on HIV infection allows distinguishing whether HIV-positive children are different from HIV-negative children. Evaluating these direct effects of HIV infection on educational attainment can highlight the extent to which HIV affects human capital accumulation. This study uses data with biomedical information on HIV of children in Zimbabwe to examine whether there are intergender differences (HIV-positive boys vs. HIV-positive girls) and intragender differences (HIV-negative girls and HIV-positive girls) in how HIV affects school attendance.

3.2. Literature Review

Chapter 2 shows that while there are studies that examine effects of HIV-related parental illness and death, a small number of studies have examined the direct effects of HIV infection on children's educational attainment. Some of these studies include Anabwani, Karugaba, & Gabaitiri (2016) who examined HIV-infected children aged 6-17 years in Botswana and found that about 60% reported having missed at least one day of school in the preceding month. Similarly, Parchure et al. (2016) found that compared to HIV-affected children (e.g., children with HIV-positive parents), HIV-infected children aged 6-16 years in India were seven times more likely to be out of school. Henning (2018) found that children between 10-17 years in Rwanda were twice as likely to not be in the correct grade for their age compared to their HIV-negative counterparts. However, for Zimbabwe, the results are mixed. On the one hand, Bandason et al. (2013) found that HIV-infected children aged 11-13 years were more likely to be behind by one or more grades. On the other hand, Pufall et al. (2014) found that HIV was not associated with educational outcomes for children aged 6-17 years in the eastern province of Zimbabwe (Manicaland).

These two studies for Zimbabwe had some shortcomings. First, Bandason et al. (2016) only conducted a bivariate analysis. Conducting a multivariate analysis helps to identify variables that have a statistically significant effect on the outcome (school attendance) after controlling for other determinants. Secondly, Pufall et al. (2014) only focused on one region in Zimbabwe (Manicaland), which leaves out nine other regions, including the three "hotspots", i.e., regions that had high mother-to-child transmission rates (McCoy et al., 2016) and regions with the highest

prevalence rates.[2] Thirdly, none of these studies examined effects of HIV on intragender differences. For example, girls affected by HIV may have poor educational outcomes compared to unaffected girls (Kitara et al., 2013).

Chapter 2 showed that the results of studies that examine the relationship between HIV and gender differences in educational attainment, are mixed. Some authors have found that HIV-affected girls obtain less education compared to HIV-affected boys. For example, Bhargava (2005) studied AIDS orphans in Ethiopia and found that following the death of a mother, girls were less likely to participate in school. Similarly, Delva et al. (2009) examined girls and boys orphaned by AIDS in Guinea and found that boys were more likely to attend school. In a more recent study, Harrison et al. (2017) showed that girls who had a biological parent with HIV or were orphaned by AIDS reported lower grades and less interest in school. Other studies found that HIV-affected boys obtain less education than HIV-affected girls or found no gender differences. For instance, Floyd et al. (2007) found that there was no difference in mean grade average between boys and girls with HIV-positive parents in Malawi. Another study by Kidman et al. (2012) showed that being a maternal orphan has a stronger effect on boys compared to girls. Similarly, Orkin et al. (2014) found that orphaned boys in South Africa reported concentration problems and difficulties with grade progression. The results from these studies confirm that most studies that examine gender differences in schooling in HIV-affected children focus on orphans. In addition, the results vary by country. One potential reason is that education, gender, and HIV policies differ by country and evolve over time. Hence, the use of country-specific data allows for contextual interpretations that stem from cultural differences (about gender roles) and enables the recommendation of relevant policies.

This chapter examines the effects of HIV and gender on educational attainment using a nationally representative survey from Zimbabwe. This is the first study to use a nationally representative sample that contains biomedical information on HIV infection of children aged 0-18 years. The chapter also examines the effects of HIV on intergender and intragender differences in

[2] The 'hotspots' in McCoy's study are Zimbabwe's capital Harare, Mashonaland West, and Mashonaland Central. The regions with highest HIV rates are Matabeleland North and Matabeleland South (ZDHS, 2015; Chapter 1).

educational attainment by decomposing gaps in school attendance between various groups of HIV-positive and HIV-negative boys and girls. This is the first study to perform this type of analysis in an HIV context in SSA. Specifically, the contributions of this chapter are three-fold. First, we examine whether HIV and/or gender have an effect on school attendance for a nationally representative sample of school-aged children in Zimbabwe. Second, we analyze whether there are (inter and/or intra) gender differences in how HIV affects school attendance. Third, we examine the factors that contribute to any existing gender gaps in school attendance. Given that young girls in Zimbabwe are more vulnerable to HIV, we expect that girls are more affected by the disease (Schaefer et al., 2017).

3.3. The education system of Zimbabwe

Zimbabwe is a landlocked country and a former British colony with a population of about 16 million and a GDP of $3,281 per capita PPP (World Bank, 2018). The Education Act (25:04) of Zimbabwe states that children of school-going age have the right to primary education. This Act does not specify what it means to be a child of school-going age.[3] However, in 2016, the Ministry of Primary and Secondary Education (Ministry) published a document that outlined the levels of education in Zimbabwe. [4] These levels of education follow the International Standard Classification of Education published by UNESCO in 2011. According to the Ministry, the education system of Zimbabwe starts with 4 years of infant education which are comprised of two years of Early Childhood Development for children aged 4 and 5 years, and two years of formal primary education (grade 1 and grade 2) for children aged 6 and 7 years. This is followed by 5 years of junior education (grade 3 to grade 7). At the end of grade 7 (typically at 12 years), students take a national exam which marks the completion of primary school. Secondary education in Zimbabwe typically starts at age 13. After four years of secondary school, children write Ordinary level (O level) exams at 16 years. Up to this point, the Ministry classifies this as the level of "basic education". At age 18, some children proceed to write Advanced level (A

[3] The Education Act (25:04) of Zimbabwe defines a school-going child as "a child of an age within such limits as may be prescribed".
[4] This was noted in the Ministry's strategic plan for 2016–2020.

level), which is comprised of two years of post-secondary education. As in the British system, A level results mostly determine whether an individual is able to enter university.

3.4. Data

This chapter uses the Zimbabwe Demographic and Health Surveys (ZDHS) described in Chapter 1. We use four ZDHS datasets, i.e., Household Listing, Individual Women's, Men's, and HIV Test datasets. The Household Listing dataset contained 43,706 observations and was used to identify 11,673 children whose blood specimens for HIV tests were collected. The HIV Test dataset contains 32,192 observations that were used to obtain HIV test results for these individuals (children, mothers and fathers) included in our study. During the HIV data collection process, an anonymously linked protocol was used to allow for the merging of test results with socio-demographic factors. The Individual Women's and the Men's datasets were used to identify demographic and HIV data for mothers and fathers of the 11,673 children in the household dataset. Both the Men's and Women's surveys contained information of school-going children aged 15 to 18 years. However, the women were asked to provide health and demographic information about all children they gave birth to. Men were not asked about their children's health and demographic data. Therefore, we were only able to link fathers to their children if they were the head of the household. The four datasets were linked using unique cluster, household, and individual identifiers.

3.5. Empirical analysis

We anchor the analysis by adopting multivariate logit regressions and the calculation of their marginal effects on the full sample of boys and girls, a sample of boys only, a sample of girls only, a sample of HIV-negative children, and a sample of HIV-positive children. The dependent variable is school non-attendance. The survey question is as follows: "Did you attend school at any time during the [previous] school year?" This variable takes the value of 1 if a child did not attend school in the previous school year and is zero otherwise. The independent variables

include gender, HIV status, age, parental, household, and wealth-level characteristics. These variables help us examine the aforementioned mechanisms that influence school attendance. To make a comparison with HIV, we also included anemia as a control variable for children aged 15 years and above. Anemia is a disease that develops when the blood is deficient in hemoglobin. This disease may cause fatigue, headaches, and shortness of breath. Therefore, anemic children's school attendance may be affected (Ayoya et al., 2012). Children are classified as anemic if they have a hemoglobin level adjusted by altitude of less than 11.0 g/dl (ZDHS, 2015). The Women's and Men's data contain biomedical data of anemic levels of individuals aged 15 years and above who consented to testing. We also include dummy variables for employment status and marriage for analyses that only include children aged 15 years and above. There is no employment or marriage data for children under 15 years because these variables are only available in the Men and Women's surveys. We also disaggregate the analyses by age. That is, we provide regression results for all children aged 6-18, primary school-aged children 6-12, secondary school children aged 13-18, and older children aged 15-18 years. The results from the regression analyses set the basis for the decomposition analysis to examine intergender and intragender gaps in school attendance.

To analyze gender gaps in school non-attendance, we use the multivariate decomposition method by Blinder (1973) and Oaxaca (1973). This analysis allows for the decomposition of the outcome variable into two groups in a counterfactual manner. These two groups are differences in characteristics (endowments) and differences in the effects of these characteristics (coefficients). Fairlie (2005) and Powers, Yoshioka & Yun (2011) extended this method to non-linear models. We use the extension by Powers, Yoshioka & Yun (2011) because it overcomes issues associated with identification and path dependence. We first decompose school attendance by gender to examine intergender differences in educational attainment. Second, to examine effects of HIV on intragender differences in educational attainment, we separately decompose non-attendance for the group of boys and the group of girls by HIV status. The goal is to examine whether there is an unexplained gap in non-attendance between boys and girls, HIV-negative boys and HIV-positive boys, HIV-negative girls and HIV-positive girls, HIV-negative boys and girls, and HIV-positive boys and girls.

The decomposition is as follows:

$$\Delta Y^{boy-girl} = \left(X^{boy} - X^{girl}\right)\beta^{boy} + X^{girl}\left(\beta^{boy} - \beta^{girl}\right) + \left[(X^{boy} - X^{girl})(\beta^{boy} - \beta^{girl})\right]$$

Where ΔY is the difference in mean school attendance, $X_i \ldots X_k$ are the characteristics, and $\beta_i \ldots \beta_k$ are estimated coefficients. The first part of the equation, $\left(X^{boy} - X^{girl}\right)\beta^{boy}$ represents differences due to endowments, the second part,$X^{girl}\left(\beta^{boy} - \beta^{girl}\right)$ represents difference due to coefficients, and the third part, $\left[(X^{boy} - X^{girl})(\beta^{boy} - \beta^{girl})\right]$ is the difference in interaction between endowments and coefficients.

3.6. Results

Table 3.1 provides summary statistics of child, parents, household, and wealth for 11,673 children aged 6 to 18 years in Zimbabwe. These children were all tested for HIV. Children with an undetermined HIV test result were omitted from the sample. Only 12 children had undetermined HIV tests. The summary statistics are split by gender and HIV status. The number of boys and girls in the sample is almost equal (5,908 boys and 5,705 girls). About 3% (298) of the sampled children were HIV-positive. This is proportional to the population of HIV-positive children in Zimbabwe (UNICEF, 2019). Of these, 48% (about 144) were boys and 52% (about 154) were girls. The education variable that is used in this study, is school non-attendance. This is the only educational variable available for children aged 6-18 in the survey and represented by a dummy variable that is coded 1 if a child did not attend school in the previous school year and is zero otherwise. About 13% (1,507) of the children in the complete sample did not attend school in the previous school year. Boys and girls aged 6-18 years had similar non-attendance rates (12.7% and 13.1%, respectively). The attendance of HIV-positive boys is similar to that of the full sample. About 12.5% of HIV-positive boys did not attend school in the previous school year. However, the number of HIV-positive girls who did not attend school was more than double that of their HIV-negative counterparts. About 27% of HIV-positive girls did not attend school in the previous school year. This calls for further examination of this gap. The group of HIV-positive boys and

girls had a higher percentage of children living in female-headed households (about 55% and 58%, respectively) compared to that of the main group of boys and girls (about 44% and 43%, respectively).

We estimate the association between school non-attendance and child, parental, household, and wealth characteristics with logit regressions. Table 3.2 shows logit regression and average marginal effects results for all children aged 6 to 18 years.[5] The dependent variable is a binary variable 'non-attendance' that takes the value of 1 if a child did not attend school in the previous school year. There are four specifications in this table. The first column shows the effects of HIV and gender on school attendance without the interaction term (i.e., without the HIV-gender interaction) and without covariates. The second column shows the effects of HIV and gender on school attendance with the interaction term and without covariates. The third column shows the effects of HIV and gender on school attendance without the interaction term and with covariates. Column four shows the effects of HIV and gender on school attendance, including both the interaction term and covariates.

[5] Results for the marginal effects are shown in square brackets

Table 3.1: Main Summary Statistics of Children Aged 6-18 In Zimbabwe

	All (N=11,673)	Boys (N=5,908)	Girls (N=5,765)	Boys HIV+ (N=144)	Girls HIV+(N=154)
VARIABLES	Mean (Std. dev)	Mean (Std. dev)	Mean (Std. dev)	Mean (Std. dev)	Mean (Std. dev)
Child characteristics					
HIV-positive	0.026 (0.158)	0.024 (0.154)	0.027 (0.161)		
Did not attend school*	0.129 (0.335)	0.127 (0.333)	0.131 (0.337)	0.125 (0.332)	0.266 (0.443)
Age of child**	11.64 (3.659)	11.61 (3.657)	11.67 (3.662)	12.08 (3.523)	12.79 (3.738)
Orphan***	0.209 (0.407)	0.206 (0.405)	0.212 (0.409)	0.521 (0.501)	0.500 (0.502)
Parental Characteristics					
Mother has primary education or less	0.175 (0.380)	0.179 (0.384)	0.171 (0.377)	0.0903 (0.288)	0.143 (0.351)
Father has primary education or less	0.111 (0.314)	0.115 (0.319)	0.108 (0.310)	0.0833 (0.277)	0.065 (0.247)
Mother education/HIV missing	0.515 (0.500)	0.506 (0.500)	0.525 (0.499)	0.639 (0.482)	0.656 (0.477)
Father education/HIV missing	0.586 (0.493)	0.575 (0.494)	0.597 (0.491)	0.764 (0.426)	0.773 (0.420)
Mother HIV-positive	0.088 (0.283)	0.090 (0.286)	0.086 (0.280)	0.299 (0.453)	0.286 (0.453)
Father HIV-positive	0.043 (0.203)	0.041 (0.198)	0.045 (0.198)	0.097 (0.297)	0.104 (0.304)
Household characteristics					
Rural	0.709 (0.454)	0.727 (0.445)	0.690 (0.462)	0.729 (0.446)	0.708 (0.456)
Mother living in household	0.612 (0.487)	0.616 (0.486)	0.609 (0.488)	0.458 (0.500	0.494 (0.502)
Father living in household	0.427 (0.495)	0.437 (0.496)	0.418 (0.493)	0.257 (0.438)	0.312 (0.465)
Female-headed household	0.442 (0.497)	0.427 (0.495)	0.458 (0.498)	0.549 (0.499)	0.584 (0.494)
Number of people in the household**	6.061 (2.610)	6.042 (2.635)	6.080 (2.584)	5.681 (3.069)	5.857 (2.716)
Age of household head**	47.05 (15.31)	47.43 (15.24)	46.67 (15.37)	48.83 (15.93)	48.34 (17.41)
Household wealth					
Poorest	0.205 (0.403)	0.204 (0.403)	0.205 (0.404)	0.278 (0.449)	0.201 (0.402)
Poor	0.205 (0.403)	0.213 (0.410)	0.196 (0.397)	0.201 (0.402)	0.162 (0.370)

Middle	0.210 (0.407)	0.220 (0.414)	0.200 (0.400)	0.194 (0.397)	0.273 (0.447)
Richer	0.192 (0.394)	0.182 (0.386)	0.202 (0.401)	0.160 (0.368)	0.214 (0.412)
Richest	0.189 (0.391)	0.180 (0.384	0.198 (0.398)	0.167 (0.374)	0.149 (0.358)
Manicaland	0.119 (0.323)	0.124 (0.330)	0.113 (0.316)	0.083 (0.277)	0.136 (0.344)
Mashonaland Central	0.111 (0.314)	0.113 (0,316)	0.108 (0.311)	0.111 (0.315)	0.058 (0.235)
Mashonaland East	0.089 (0.285)	0.083 (0.276)	0.096 (0.294)	0.132 (0.340)	0.123 (0.330)
Mashonaland West	0.108 (0.310)	0.108 (0.311)	0.107 (0.309)	0.083 (0.277)	0.097 (0.297)
Matebeleland North	0.105 (0.306)	0.105 (0.307)	0.104 (0.305)	0.174 (0.380)	0.169 (0.376)
Matabeleland South	0.010 (0.300)	0.105 (0.306)	0.095 (0.293)	0.125 (0.332)	0.130 (0.337)
Midlands	0.108 (0.311)	0.110 (0.313)	0.106 (0.308)	0.132 (0.340)	0.091 (0.288)
Masvingo	0.117 (0.321)	0.117 (0.321)	0.117 (0.322)	0.069 (0.255)	0.058 (0.235)
Harare	0.073 (0.260)	0.067 (0.251)	0.078 (0.268)	0.021 (0.143)	0.104 (0.306)
Bulawayo	0.072 (0.258)	0.067 (0.250)	0.077 (0.266)	0.069 (0.255)	0.033 (0.178)

*Child did not attend school in previous school year.

** All the other variables were binary except for age of child, number of people in the household, and age of household head.

***Child is a maternal orphan, paternal orphan or both.

Table 3.2: Logit Estimations and Average Marginal Effects for all Children Aged 6-18

*Dependent variable: non-attendance (1 if child did not attend school in previous year, 0 otherwise)

**Marginal Effects in square brackets

	Model 1	Model 2	Model 3	Model 4
Interaction term included	No	Yes	No	Yes
All covariates included	No	No	Yes	Yes
VARIABLES				
Girl	0.031	-0.001	0.013	-0.014
	(0.055)	(0.056)	(0.065)	(0.066)
	[0.004]	[-0.000]	[0.001]	[-0.001]
HIV-positive	0.525***	-0.021	0.344*	-0.134
	(0.148)	(0.255)	(0.180)	(0.291)
	[0.059***]	[-0.002]	[0.029*]	[-0.011]
Girl*HIV-positive		0.933***		0.838**
		(0.316)		(0.372)
		[0.105***]		[0.071**]
Anemia			0.238	0.244
			(0.153)	(0.153)
			[0.020]	[0.021]
Anemia missing			-1.547***	-1.545***
			(0.125)	(0.125)
			[-0.130***]	[-0.130***]
Age of child			0.142***	0.142***
			(0.020)	(0.020)
			[0.012***]	[0.012***]
Orphan			-0.072	-0.070
			(0.084)	(0.084)
			[-0.006]	[-0.006]
Mother no education			0.674***	0.673***
			(0.133)	(0.133)

	[0.057***]	[0.057***]
Father no education	0.583***	0.586***
	(0.177)	(0.177)
	[0.049***]	[0.049***]
Mother education missing	1.249***	1.246***
	(0.141)	(0.141)
	[0.105***]	[0.105***]
Father education mission	0.696***	0.701***
	(0.156)	(0.156)
	[0.059***]	[0.059***]
Mother HIV-positive	0.281*	0.279*
	(0.162)	(0.162)
	[0.024*]	[0.023*]
Father HIV-positive	-0.471*	-0.462*
	(0.247)	(0.247)
	[-0.040*]	[-0.039*]
Rural	0.029	0.030
	(0.146)	(0.146)
	[0.002]	[0.002]
Mother living in household	0.152	0.150
	(0.113)	(0.113)
	[0.013]	[0.013]
Father living in household	0.210*	0.210*
	(0.117)	(0.117)
	[0.018*]	[0.018*]
Female headed household	-0.322***	-0.322***
	(0.075)	(0.075)
	[-0.027***]	[-0.027***]
Number of people living in household	0.020*	0.020*

	(0.012)	(0.012)
	[0.002*]	[0.002*]
Age of household head	-0.012***	-0.012***
	(0.002)	(0.002)
	[-0.001***]	[-0.001***]
Poorest	1.471***	1.468***
	(0.177)	(0.177)
	[0.124***]	[0.124***]
Poor	1.128***	1.123***
	(0.175)	(0.175)
	[0.095***]	[0.095***]
Middle	0.813***	0.805***
	(0.173)	(0.173)
	[0.069***]	[0.068***]
Richer	0.736***	0.730***
	(0.127)	(0.127)
	[0.062***]	[0.061***]
Manicaland	-0.616***	-0.610***
	(0.168)	(0.168)
	[-0.052***]	[-0.051***]
Mashonaland Central	-0.306*	-0.294*
	(0.166)	(0.166)
	[-0.026*]	[-0.025*]
Mashonaland East	-0.507***	-0.498***
	(0.175)	(0.175)
	[-0.043***]	[-0.042***]
Mashonaland West	-0.557***	-0.552***
	(0.169)	(0.169)
	[-0.047***]	[-0.046***]

Matabeleland North			-0.366**	-0.359**
			(0.170)	(0.170)
			[-0.031**]	[-0.030**]
Matabeleland South			0.033	0.034
			(0.168)	(0.168)
			[0.003]	[0.003]
Midlands			-0.241	-0.235
			(0.165)	(0.165)
			[-0.020]	[-0.020]
Masvingo			-0.644***	-0.637***
			(0.170)	(0.170)
			[-0.054***]	[-0.054***]
Bulawayo			-0.056	-0.049
			(0.180)	(0.180)
			[-0.005]	[-0.004]
Constant	-1.941***	-1.925***	-4.673***	-4.661***
	(0.039)	(0.040)	(0.364)	(0.364)
Observations	11,673	11,673	11,673	11,673
r2_p	0.00131	0.00234	0.265	0.272
chi2	11.72	20.98	2384	2439

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 3.1: Predictive Margins of Logit Estimations for the Interaction between Gender and HIV

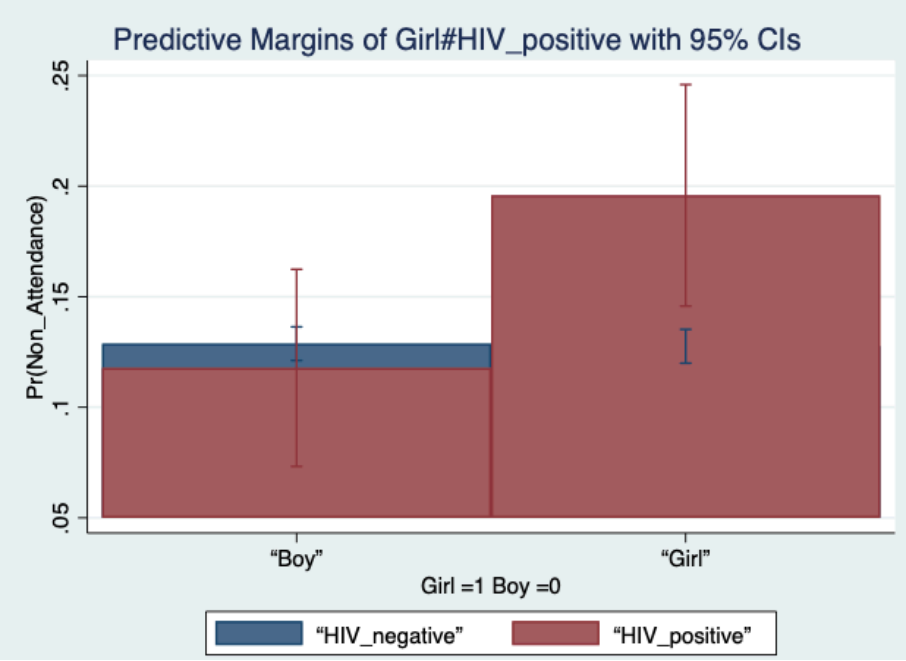
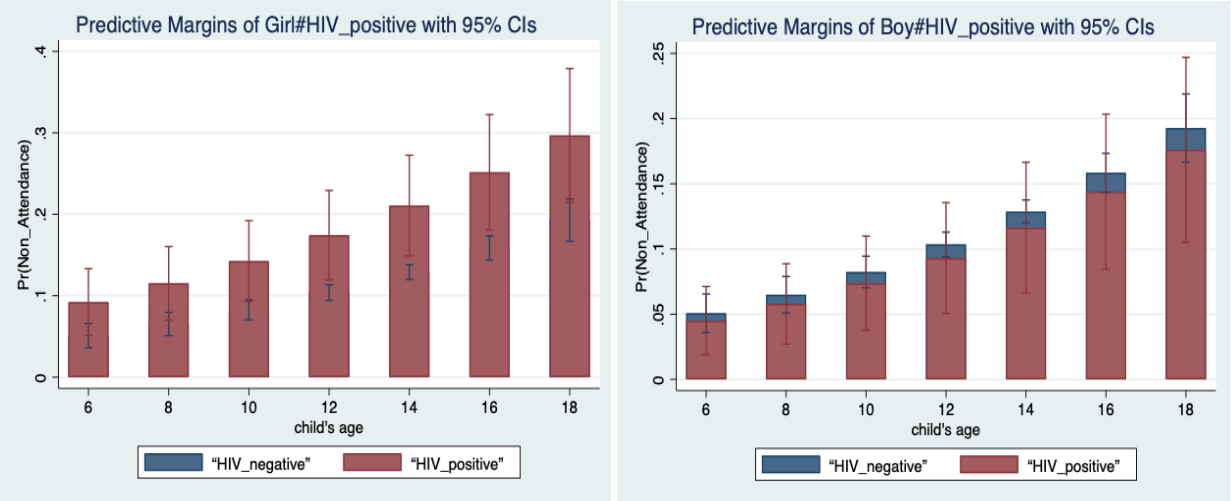


Figure 3.2: Predictive Margins of Marginal Effects for the interaction between Gender and HIV



The major advantage of using the decomposition method is that we are able to examine factors that contribute to gaps in schooling attendance by HIV status and by gender. We are also able to examine the explained and unexplained differential in school attendance between boys and girls. The explained differential shows the gender gap to be related to the observed (child, parental, household, wealth, and regional) characteristics. The unexplained differential in school attendance highlights the gender gap in school attendance that exists due to the effects of these characteristics. This unexplained gender gap shows that a portion of the gender gap in school attendance is due to factors not observed in the data. The factors may only be unique to the group of HIV-positive girls.

A summary of the decomposition results is shown in Table 3.3. The table shows the effects of differences in endowments (explained), differences in coefficients (unexplained), and partly explained by the interaction of the differences. This analysis uses the same child, parental, household, wealth, and regional characteristics as in the logit regressions. The first column of Table 3.3 shows that there is a statistically significant non-attendance gap between HIV-positive boys and girls (statistically significant at the 1% level). About 56% of the gap is attributed to the differences in coefficients, while 44% is attributed to differences in characteristics.

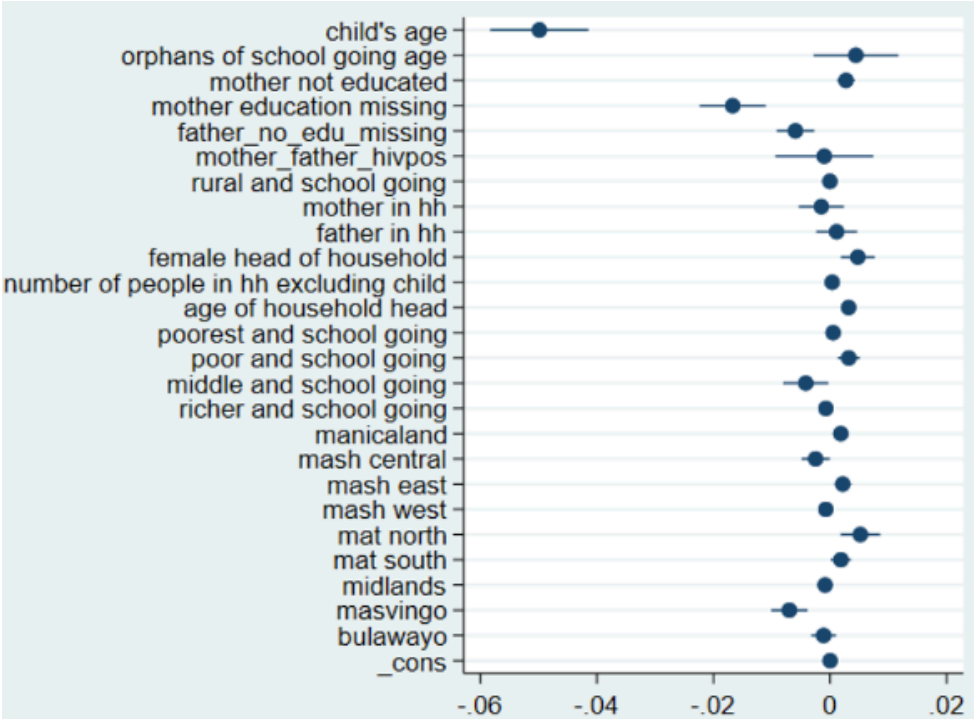
Results for girls by HIV status are shown in column 2. The differences in the effects of the characteristics and effects of the characteristics are negative and statistically significant at the 1% level and 5% level, respectively. This implies that HIV-negative girls are endowed with characteristics that allow them to attend more school and that the effects of these endowments are larger than HIV-negative girls. Similar to the case of HIV-positive children, about 44% of the non-attendance gap between HIV-negative and HIV-positive girls is attributed to differences in observable characteristics between HIV-negative and HIV-positive girls. About 56% of this gap (statistically significant at the 1% level) is attributed to differences in the effects of these characteristics (coefficients), with differences in age accounting for most of these gaps. Figure 3.3 shows the coefficient plot for the decomposition of the cohort of girls. The figure shows that variables 'age of child' explains most of these gaps. This is consistent with Figures 3.1 and 3.2 that visually show that older HIV-positive girls attend less school compared to their HIV-negative counterparts.

Table 3.3: Multivariate Decomposition Results for all Children, Boys, and Girls Aged 6-18

	HIV-positive children		**Girls**	
Decomposed by	Gender: Boys as comparison		HIV status: HIV-negative girls as comparison	
Endowments (E)	-0.062* (0.033)	44%	-0.061*** (0.005)	44%
Coefficients (C)	-0.079* (0.023)	56%	-0.078** (0.023)	56%
Interaction (E+C)	-0.141*** (0.033)	100%	-0.139*** (0.023)	100%
N	298		5,765	

Dependent variable: non-attendance (1 if child did not attend school in previous school year, 0 otherwise)

Figure 3.3: Coefficient Plot for Decomposition among Girls



3.7. Discussion

We have estimated the effects of HIV on school non-attendance in Zimbabwe because HIV-infected children are expected to be less likely to attend school due to illness (Anabwani et al., 2016; Pufall et al., 2014; Parchure et al., 2016), their parents not being able to facilitate their schooling (Akbalut-Yuksel and Turan, 2013), stigma or discrimination (Henning et al., 2018; Anabwani et al., 2016; Campbell et al., 2014), and financial issues (Hong et al., 2011 and Poulsen, 2006). This is the first study to examine the effects of HIV on intergender and intragender gaps in school attendance using nationally representative data. That is, we analyze school attendance gaps between HIV-positive boys and HIV-positive girls; HIV-positive and HIV-negative boys; as well as HIV-positive and HIV-negative girls. The results show that, in general, there is no direct effect of being HIV-positive on school attendance. We also do not find parental HIV to have a direct effect on the school attendance of children. However, we find that (older) HIV-positive girls attend less school than HIV-negative girls. After decomposing school attendance gender gaps (Table 3.1), we find a statistically significant school attendance gap between HIV-positive girls and HIV-positive boys. We also find a school attendance gap between HIV-positive girls and HIV-negative girls. Results for the full sample (Table 3.2) are in concurrence with Pufall et al. (2014), who found that HIV infection alone did not affect children's educational outcomes in (Eastern) Zimbabwe. In addition, as mentioned earlier, previous studies have mainly focused on examining how orphanhood affects children's education (Guo, Li & Sherr, 2012). Results from these studies have shown that the effects of (HIV) orphanhood on schooling are mixed. In our study, we do not find effects of orphanhood on school attendance. This result is similar to that of studies such as Harrison (2017).

It is not surprising that we do not find schooling gaps between boys and girls in general. This is because there is gender parity in school enrollment in Zimbabwe (Mawere 2013, UNICEF, 2011). However, the fact that we do not observe the same result for HIV-positive boys and girls is quite puzzling. This is compounded by the fact that there is a dearth of literature that solely investigates HIV-related issues between school-aged boys and girls. Although it is not clear why we only find

schooling gaps among girls. We conjecture that school non-attendance among girls can be explained by a few factors discussed below.

Given that the age of the child constitutes a larger share of the unexplained gaps in our study, older girls may be experiencing disease-related symptoms more than boys. HIV-related outcomes for children are affected by caregivers' willingness to invest in children's access to care, which translates to better (schooling) outcomes for children (Ferrand et al., 2017). While there are currently no studies that have examined gender differences in healthcare access among HIV-infected children in Zimbabwe, Ferrand et al. (2017)'s study highlights that caregivers' investment in children's health does affect children's schooling outcomes. The schooling gaps we observe could indicate that HIV-positive girls attend less school due to lower investment in their health, thereby affecting their school attendance. About 89% of HIV-infected children in Zimbabwe have access to Antiretroviral drugs (ARV's) (UNAIDS, 2018). It is therefore important to focus on ensuring that the remaining 11% have access to ARV's as well as it may affect HIV-infected children's mortality/morbidity and may lead to a further loss of human capital.

HIV-positive girls may experience internalized stigma (Simbayi et al., 2007), bullying (Campbell et al., 2014), and/or mental health issues (Vreeman et al., 2015). For example, Kitara et al. (2013) found that HIV orphaned girls in Uganda had the most negative attitude towards education and were less assertive compared to non-orphaned girls. These differences in mental health or internalized stigma have not been extensively studied between HIV-positive/orphaned boys and girls. Results on gender differences in mental health or internalized stigma are mixed and vary by country. Therefore, there is no evidence as to whether HIV-positive girls in Zimbabwe experience more stigma and/or mental health issues compared to boys. This is a topic that needs to be further investigated.

HIV-positive girls may experience gender-related stigma. HIV-positive girls may be missing school due to being female and HIV-positive. The intensity of HIV-related stigma may be compounded by gender (Sangaramoorthy, Jamison, & Dyer, 2017; Logie et al., 2011). Intersectional effects brought about by the status of being HIV-positive and being female may contribute to the reasons why HIV more strongly affects girls' school attendance. New studies

that examine gender-related stigma are needed in order to draw more definite conclusions as to why HIV-positive girls attend less school in Zimbabwe (Mbonu, van den Borne & De Vries, 2009). In addition, older girls may engage in age-desperate sexual relationships, which may increase the risk of contracting HIV and pregnancy, which may interfere with their schooling.

We also find that in general, poor children, employed boys and married girls are less likely to attend school. Due to poverty, some adolescent boys may start working and adolescent girls may get married. This is not surprising given that these issues have been found to affect school attendance in SSA (Walker, 2012; Moyi, 2011). Given the relationship between HIV and poverty (Lopman et al., 2007), studies in Zimbabwe have shown that HIV-positive adolescent girls are frequently either married to or in a relationship with men who are at least 3-5 years older (Schaefer et al., 2017). In addition, household power dynamics may have an influence on children's school attendance. We found varying results about the gender roles of parents/guardians. Specifically, our results show that boys and girls who live in female-headed households are likely to have less non-attendance. Similarly, Nyamukapa and Gregson (2005) found that Zimbabwean orphans who reside in female-headed households, particularly girls, were more likely to complete school.

We also found that boys, who live in the same household as their mothers, are less likely to attend school. This result was not found for girls, and it is not clear why this is the case. One potential explanation could stem from the fact that a mother's presence in the household does not necessarily mean that the mother is the decision-maker in the children's schooling. These results may signify that power dynamics in the household may have an influence on children's educational attainment (Lloyd and Blanc, 1996). That is, a mother's presence in the household does not necessarily mean that the mother can enable education for her child, especially when the child is male. This is a topic that needs further investigation as well. We were only able to link a small fraction of HIV-tested fathers who were head of household and reside in the same household as the children. However, we find that HIV-negative children with HIV-positive fathers are less likely to not attend school. This contrasts with Akbulut-Yuksel and Turan (2013), who found that children of HIV-positive fathers experienced 0.13 fewer years increase in

schooling compared to children with HIV-negative fathers. Our results could reflect that HIV infection of a parent may not have a statistically significant impact on school attendance, as shown by the results of the other groups of children.

This study has some limitations. We are only able to analyze school attendance in the previous school year as it is the only educational variable available for school-going children. Therefore, we cannot fully determine whether a child dropped out of school permanently. In addition, we cannot extensively contrast this chapter with Pufall et al. (2014) and other papers that examine orphans' schooling attainment. We are limited to only one wave of data, since this is the first DHS dataset that contains information on HIV infection among children. Therefore, we are limited to analyses that only allow us to examine the association between HIV status (an endogenous variable) and educational outcomes. Hence, we cannot draw causal inferences. Lastly, we were only able to link HIV-tested fathers to their children if they were the head of the household and resided in the household. This resulted in fewer observations for this variable.

3.8. Conclusion

We find a gap in school attendance between HIV-positive girls and HIV-negative boys, and between HIV-positive girls and HIV-negative girls. In both cases, the major contributor to this gap is age (i.e., being an older HIV-positive girl). Specifically, while the marginal effect results initially show that HIV-positive girls are less likely to attend school, the results from the decomposition analysis show that this result is influenced by older girls. These results can be explained by the fact that adolescent girls are at a higher risk of contracting HIV in Zimbabwe. Recent studies have highlighted that age influences the intergender and intragender gaps in school attendance (e.g., Anabwani, Karugaba, & Gabaitiri, 2016). This result may be due to some adolescent girls in Zimbabwe entering early marriages or relationships with older men as a way of escaping poverty. These girls may already be HIV-positive or may acquire HIV from their older husbands or romantic partners (Mavhu et al., 2018). However, it is not clear whether marriage/partnership with an older man alone, HIV infection alone, or both lead to non-attendance (or possibly dropout) among girls. Future research should further examine this in

order to determine what actually causes this gap. Due to the age difference with older partners and the power dynamics between men and women, some girls feel that they are unable to negotiate for condom use (Mavhu et al., 2018). It is therefore important to continue to implement programs that educate men (and women) about the importance of condom use. It is also important to continue to address issues related to violence against women as it contributes to the issues related to power dynamics in relationships in Zimbabwe (Mavhu et al., 2018). Until this study, there had not been studies that have examined how HIV contributes to intergender and intragender gaps in schooling in Zimbabwe. More studies are needed to further examine whether HIV-positive girls acquired HIV from their romantic partners and whether they are aware of their health status. This helps clarify whether HIV, early marriage, or any other reason leads to non-attendance or dropout. Future studies should also qualitatively examine whether older HIV-positive adolescent girls (who are not in school) are willing to attend school and provide solutions to this issue in order to inform HIV and education policies that target adolescent girls.

Chapter 4

Effects of HIV on Human Capital Investment in Zimbabwe: An Average Treatment Estimation

This chapter has been submitted for publication.

Abstract

We examine the effects of HIV on total years of schooling while addressing endogeneity issues. We use data that contains sociodemographic characteristics and HIV test results for 4,130 male adolescents and youths aged 15-29 years in Zimbabwe. We estimate average treatment effects (ATE) by exploiting early circumcision as an instrumental variable (IV) to address endogeneity issues. That is, we estimate a probit two-stage least squares (P2SLS) model to address reverse causality and a Heckman selection model to address selection bias. To examine whether HIV has an effect at disaggregated levels of education (i.e., completion of primary education, completion of secondary education, and having some tertiary education), we estimate a seemingly unrelated bivariate probit model. While the ATE estimates show that on average, HIV-positive individuals obtain about 5 years less education, the results for the P2SLS are not significant and the Heckman results are significant. The difference in the level of significance levels in the two models could indicate that more and better IVs may be needed in the P2SLS case to address the endogeneity issues. The bivariate probit results show that HIV mainly has an effect at the tertiary level. We explain this by the fact that compared to younger boys, older youths may have benefited less from HIV prevention measures such as circumcision, prevention of mother-to-child transmission and HIV-related educational resources.

Key words: Education, Health, Welfare, Gender

4.1. Introduction

HIV/AIDS is still the leading cause of death in Zimbabwe (CDC, 2019). Morbidity and mortality issues brought about by this global pandemic have led to a reduction in economic growth within the country (Roy, 2014). In addition to morbidity and mortality issues, this disease can have a negative impact on educational attainment through caring for sick family members, financial, socioeconomic, and psycho-social problems related to illness and treatment. However, these negative effects can be curbed by human capital investment (Weil & Collin, 2020).

Chapter 1 shows that from 2005 to 2015, the HIV prevalence rate in Zimbabwe decreased from 18% to 14% (ZDHS 2005-06 and 2007). This reduction can be attributed to holistic measures and concerted efforts implemented by various actors such as the Ministry of Health, the National AIDS Council, UNAIDS and PEPFAR. These measures include increased testing, education, access to circumcision and condom use. Consequently, economic activities that are hindered by HIV may have increased. These include labor force participation and human capital investment, which have a significant impact on economic growth (Levinsohn et al., 2013; Fortson, 2011).

Chapter 2 and 3 have shown that to a larger extent, the causal effects of HIV on educational attainment remain unexplored. This is because issues related to omitted variables and selection bias can be difficult to overcome. Especially when longitudinal data is unavailable (see Chapter 3). For example, the relationship between educational attainment and HIV can be influenced by unobservable traits such as (cognitive) ability and risk aversion. In addition, studies that examine HIV-related issues may be distorted by issues related to selection bias brought about by characteristics that influence HIV incidence and transmission (Carlson et al., 2014; Irwing et al., 1994). A precedented solution to addressing these issues is the use of instrumental variables. For example, studies such as Forston (2011) and Ahuja et al. (2009) used circumcision rate as instruments while examining the relationship between HIV and educational attainment at a macroeconomic level. However, there are no studies that have examined this issue at a microeconomic level.

While there are several advantages to using RCTs for examining the relation between education and HIV, RCTs can be very expensive and logistically difficult to execute, or sometimes even unethical. In addition, quasi-experimental designs that mainly rely on the use of observational data (e.g., propensity score matching), present methodological issues when selection is also due to unobservable characteristics. Finding valid instrumental variables (IVs) to examine this relationship based on surveys is generally challenging. Hence, only a few studies have been able to examine causal effects using observational data. For example, Zivin et al. (2009) examined causal effects of HIV on school attendance in Zambia by exploiting available data on HIV treatment as an instrument. Lucas et al. (2019) conducted a similar study in Zambia using a triple difference specification to identify effects of adults ARV treatment on children's schooling outcomes. There are no other studies that have used observational data with confirmation of HIV status to examine causal effects of HIV on educational outcomes. These studies are needed in sub-Saharan Africa (SSA) because most HIV-infected individuals reside within the continent. Hence, this study focuses on Zimbabwe as it has one of the largest HIV prevalence rates in the world with a rate of 13.3% (UNAIDS, 2018, Chapter 1).

As aforementioned, there are only a few studies that have addressed endogeneity problems when examining effects of HIV on educational attainment, and there are currently no such studies that have been conducted in Zimbabwe. Therefore, the extendit is generally unknown how HIV affects educational attainment in Zimbabwe, particularly after addressing some endogeneity issues. This chapter seeks to examine this issue by exploiting the binary nature of the treatment variable (HIV) and an IV (early circumcision) to obtain average treatment effects under the hypotheses of selection on observable and unobservable characteristics.

4.2. Voluntary Medical Male Circumcision and HIV Prevention

Since 2008, more than 11 million adolescent boys and men have received voluntary male circumcision VMMC in Southern Africa (WHO, 2016). This is mainly because VMMC has shown to be a highly cost-effective way of preventing the spread of HIV (WHO, 2016). Scientific evidence reports that VMMC significantly reduces the risk of contracting HIV by 60% (Prodger & Kaul,

2017; Auvert et al., 2005; Sharma et al., 2018). Hence, in 2007, the Zimbabwean government adopted a VMMC program and began the implementation of this program in 2009. As a result, VMMC averted 2,600-12,200 male and female HIV infections by the end of 2016 (McGillen et al., 2018). Historically, Zimbabwe has had low male circumcision rates. However, there has recently been an increase in the demand for VMMC among adolescent boys (Njeuhmeli et al., 2014). The ZDHS shows that of the sampled 8,396 men aged 15-54 years in Zimbabwe, about 15% are circumcised. Boys and men aged 10-29 years were mainly targeted for circumcision because they experienced the largest increase in HIV incidence and deaths in Southern Africa (WHO, 2016). Major barriers to circumcision among (older) men included fear of pain, myths and misconceptions, as well as a lack of partner support (Hatzold et al., 2014).

At the same time, circumcision is credibly unrelated to education, except through its effect on HIV infection (Fortson, 2011). Ochalek et al. (2017) is the only study that uses circumcision as a binary IV to examine causal effects of HIV on a binary human capital variable – employment in Uganda. Due to the binary nature of the endogenous HIV variable, the IV (circumcision), and the outcome variable (whether an individual is employed or not), Ochalek et al. (2017) adopted a seemingly unrelated bivariate probit model. Levinsohn et al., 2013 examined the same issue in South Africa using propensity score matching to address the endogeneity issues. Both studies found that HIV affected labor force participation and acknowledged the reverse causality between HIV and education. However, the authors only examined the relationship between HIV and labor supply.

4.3. Data and methods

We use the Man's Survey of the ZDHS data (see Chapter 1 & Chapter 3). Similar to Chapter 3, three data sets, i.e., Man's survey, Biomarker (HIV) survey and the Household member survey) were merged using unique cluster, household and individual identifiers and 7,420 males aged 15-54 years were matched. As aforementioned, the study focuses on boys and young adults aged

15-29 years who have been tested or HIV. Hence, the final dataset contains 4,130 adolescents and men in that age group.

We firstly use an ordinary least squares (OLS) model to examine the relationship between HIV-infection (binary variable) and total years of education (a continuous variable), while controlling for other demographic factors, including circumcision. Although we are able to examine the association between HIV and years of education with an OLS model, we cannot address endogeneity issues related to the relationship between HIV and education. That is, there may be omitted variables that are not available in the dataset that could bias the results. In addition, the relationship between HIV and education can be influenced by self-selection (or behavioral) issues. To address the omitted variable bias, we employ a probit two-stage-least-squares (P2SLS) model and to address selection bias, we employ a Heckman selection model. Lastly, we examine whether HIV has an effect at various levels of education (primary, secondary, and tertiary) using a seemingly unrelated bivariate probit model. It is important to do so because we are able to examine whether HIV affects various educational cohorts differently.

To address the endogeneity issues using the P2SLS and the Heckman model, we rely on the use of an instrumental variable. The identification strategy mainly relies on imposing an exclusion restriction using an IV that influences the selection process and not the outcome itself. Selection into treatment depends on certain idiosyncratic factors (that influence the outcome) and an instrument that influences the (continuous) outcome variable only through the (binary) endogenous variable (Cerulli, 2014). We use early circumcision (i.e., circumcision before 15 years) as an IV for total years of education (i.e., the continuous outcome variable). The binary endogenous variable is the individual's HIV status.

As previously stated, circumcision has been used as an IV in previous studies (Forston, 2011; Levinsohn et al., 2013; Ochalek et al., 2017). The mechanism behind this relationship is that circumcision is proved to reduce HIV (Auvert et al., 2005; Prodger & Kaul, 2017; Sharma et al., 2018) and in turn, HIV may affect human capital investment (Fortson, 2011). We specifically use the variable "circumcised before 15 years". This is because due to high HIV incidence rates and deaths, younger boys and men are the main targets for VMMC (WHO, 2016). Additionally, there

is a low circumcision rate among older men because adult circumcision is more technically demanding and requires longer time for wound healing (Lawal & Olapade-Olaopa, 2017). Lastly, in Zimbabwe, there is a perception that circumcision is for younger men or boys who are not yet married (Chikutsa & Maharaj, 2015).

For the main specification, we estimate a binary treatment model with heterogeneous average treatment effect under selection-on-unobservables (Cerulli, 2014). The specified model provides consistent estimation of average treatment effects by using IVs and a generalized two-step Heckman selection model.

As in Cerulli 2014, we have the following structural system of two equations:

$$y_i = \mu_0 + w_i ATE + \boldsymbol{x_i}\boldsymbol{\beta} + u_i \quad (1)$$

$$w_i^* = \eta + \boldsymbol{q_i}\boldsymbol{\delta} + \varepsilon_i \quad (2)$$

$$w_i = \begin{cases} 1 if w_i^* \geq 0 \\ 0 if w_i^* < 0 \end{cases} \quad (3)$$

$$\boldsymbol{q_i} = (\boldsymbol{x_i}, \boldsymbol{z_i}) \quad (4)$$

Equation (1) is the outcome equation with y_i representing years of education, w_i represents the binary endogenous variable HIV, z_i represents the binary IV (circumcised before 15 years), and x_i represents the vector of control variables listed in Table 4.1 that are assumed to drive heterogeneous response to treatment. The estimation introduced by Cerulli (2014) allows for the model to separately estimate a P2SLS and a Heckman two-step selection model. Both methods provide consistent estimation of the average treatment effect (ATE), average treatment on the treated (ATET), and the average treatment in the untreated (ATENT). In addition, due to the binary nature of the endogenous and instrumental variable, P2SLS and the Heckman approach incorporate steps that allow to obtain the most optimal instruments and parameters, to be used in each model, respectively.

Operationally, P2SLS is carried out in four steps. The first step is to apply a probit of w on $\boldsymbol{q_i}$ to the predicted value of w obtain p_w. The second step is to run an OLS of w on (1, $\boldsymbol{x}$,p_w) to obtain fitted values $w_{2fv,i}$. The next step is to run an OLS of y on {1, $w_{2fv,i}$,$w_{2fv,i}(x - \boldsymbol{\mu}_x)$}, where $\boldsymbol{\mu}_x$ is the sample mean $\boldsymbol{x}$. The final step is to plug the estimated parameters into the sample formulas, recover all other causal effects and obtain standard errors for the ATET and the ATENT via bootstrap. This method exploits the binary nature of the endogenous variable w_i by first applying a probit of w on $\boldsymbol{x}$ and z to obtain the predicted value of w. Then, it applies a least-squares estimation with predicted probabilities as instruments for w. $E(w|\boldsymbol{x}, \boldsymbol{z}$), which is the most optimal instrument for w and is the orthogonal projection of w in the vector space for ($\boldsymbol{x_i}, \boldsymbol{z_i}$). The probit equation: $E(w|\boldsymbol{x}, \boldsymbol{z}) = \boldsymbol{P}(w = 1|\boldsymbol{x}, \boldsymbol{z})$means that the propensity scores (or predicted values) that are estimated are the best instruments for w (Windmeijer & Santos Silva, 1997; Wooldridge 2010; Cerulli, 2014). The Heckman selection option (Heckit) is a three-step process. We first apply a probit of w_i on (1, $\boldsymbol{q_i}$) to obtain the estimated parameters of the density and cumulative standard normal distribution function, i.e., $\hat{\varphi}_i$ and $\hat{\phi}_i$ which are to be used to obtain the Heckman correction terms. The second step is to run an OLS of y_i on {1, w_i, $\boldsymbol{x_i}$, $w_i(x - \boldsymbol{\mu}_x)$, $w_i\, \hat{\varphi}_i\, /\hat{\phi}_i$, $(1 - w_i)\, \hat{\varphi}_i\, /1 - \hat{\phi}_i$}. As in the case of P2SLS, the obtained estimates from step two, are then used to estimate the ATET and the ATENT via bootstrap. The main difference between the two methods is that in the PS2LS case, the predicted values of w are used as instruments in the second stage to address the endogeneity issue of reverse causality (and possibly some unobserved bias). The Heckit model relies on the inverse Mills ratios $\hat{\varphi}_i\, /\hat{\phi}_i$ and $\hat{\varphi}_i\, /1 - \hat{\phi}_i$ are used as predictors in the second stage to address section bias.

While it is important to examine effects of HIV on total years of education, it is also important to examine whether all levels of education (primary, secondary, and tertiary) are affected differently. To examine whether HIV has an effect are significant at the primary, secondary, and/or higher education level, we estimate a seemingly unrelated bivariate probit model with IVs. We use this method mainly because the dependent variables complete primary, complete secondary and some tertiary education are binary variables and due to the binary nature of the treatment variable HIV (see Ochalek et al., 2017). This method helps address the endogeneity that arises from the potential correlation between unobservable characteristics that affect health and

education. We also use this method instead of a linear model because it produces more robust estimators (Bhattacharya et al., 2006) and adopting a 2SLS model in this case would lead to a bias (Terza et al., 2008). The equations are as follows:

$$y_i^* = x_i'\beta_1 + \gamma\beta_i^{HIV} + \lambda_i \quad (5)$$

$$\beta_i^{HIV} = x_i'\beta_2 + \alpha Z_i + \mu_i \quad (6)$$

Where y_i^* is the binary variable that represents whether an educational outcome (completed primary education, completed secondary, some higher education). β_i^{HIV} is an individual's HIV status, x_i is the vector of controls listed in Table 4.1, and Z_i is a vector of binary IV early circumcision.

4.4. Results

Table 4.1 shows the summary statistics of the variables included in our analysis. The results show that the average years of education for males aged 15-29 years in Zimbabwe is about 9.4 years. About 4.2% of the young boys and young men are HIV-positive. This considerably low compared to that of their female counterparts (aged 15-29 years) who have a prevalence rate of 10.1% and the national average of 13.3% (ZDHS 2015; UNAIDS, 2018). The HIV prevalence rates within the group of youths and adolescents are aged males aged 15-19 years, 20-24 years and 25-29 years 2.6%, 3.7% and 7.6%, respectively (results not shown). About 5.8% of the boys have been circumcised before they reached 15 years. We also examine circumcision rates among youths and adolescents aged 15-19 years, 20-24 years and 25-29 years (results also not shown). The rates are 9.4%, 2.1% and 3.3%, respectively. The table also shows that about 3.2% are double orphans and about 5.4% had sex before 15 years. The average age is 20.8 years and about 34% live in female-headed households.

Table 4.1: Summary Statistics of Variables used in the Analysis

VARIABLES (N=4,130)	Mean	Standard deviation	VARIABLES (N=4,130)	Mean	Standard deviation
Total years of education	9.412	2.752	Traditional	0.016	0.126
HIV-positive	0.042	0.200	Catholic	0.072	0.259
Circumcised before 15 years	0.058	0.233	Protestant	0.162	0.368
Double Orphan	0.032	0.176	Pentecostal	0.196	0.397
Maternal Orphan	0.051	0.219	Apostolic	0.307	0.461
Paternal Orphan	0.092	0.289	Other Christian	0.083	0.275
Age of first sex before 15 years	0.054	0.227	Muslim	0.005	0.069
Age	20.81	4.312	Not religious	0.159	0.366
Female-headed household	0.343	0.475	Other religion	0.001	0.027
Son of household head	0.389	0.488	Manicaland	0.114	0.318
Head of household	0.217	0.412	Mashonaland Central	0.115	0.319
Married	0.211	0.408	Mashonaland East	0.082	0.274
Rural	0.638	0.481	Mashonaland West	0.109	0.312
Number of living children	0.312	0.709	Matabeleland North	0.092	0.289
Poorest	0.142	0.349	Matabeleland South	0.090	0.287
Poor	0.169	0.374	Midlands	0.109	0.312
Middle	0.205	0.404	Masvingo	0.094	0.291
Richer	0.245	0.430	Harare	0.103	0.304
Richest	0.239	0.427	Bulawayo	0.091	0.288

The IV (circumcised before 15 years) is binary and is uncorrelated with years of education, which is the outcome variable (see Appendix 9). In addition, the instrument is correlated with HIV (the endogenous binary variable), conditional on the aforementioned control variables x_i (see Appendix 10). The instrument has an effective F-statistic of 30.06 which is above the critical value of the weak IV test (Stock &Yogo, 2005). In addition, the endogeneity test for HIV is significant. The first stage regression (Appendix 10) shows that adolescents and young men who were circumcised before 15 years are less likely to be HIV-positive (significant at the 10% level only). Compared to non-orphans, double orphans (i.e., those who lost both parents) are more likely to contract HIV (significant at the 1% level). Young boys and men who started having sex before 15 years are also less likely to contract HIV (significant at the 10% level). The results in Appendix 9

also show that older males, those who live in female-headed households, and those who have more children are more likely to be HIV-positive (significant at the 1%, 1%, and 5% level, respectively). Sons of the household head and married young males are less likely to be HIV-positive (significant at the 1% and 10% level, respectively). Maternal orphans are less likely to be HIV-positive as well (significant at the 5% level). Appendix 10 shows that circumcision is negatively correlated with HIV (significant at the 5% level)

Table 4.2 shows the results from the estimations of the OLS, first stage, P2SLS and Heckman selection models. The results for the P2SLS and Heckman models are exhibited in Appendix 11. The variables age, married, and rural were used to determine heterogenous selection into treatment because, according to Asiedu (2012), these variables are determinants of HIV in Zimbabwe. We also checked whether any of the control variables could be included but they did not influence selection into the treatment. HIV is negative and significant at the 5% level in the OLS model. As expected, early circumcision is negative and significant at the 5% level in the first stage but is not significant in the OLS regression. The results show that, on average, HIV-positive males obtain 5 years less education, but the significance level of the results (P2SLS and Heckit) are mixed. The average treatment ATE, ATET and ATENT in the P2SLS model are not significant, whereas the results of the Heckman selection model are significant. However, unlike the case of P2SLS, the ATENT estimate for the Heckman model is much larger than the ATE. This is indicative of the presence of selection bias. The ATE and ATET are expected to be distant when there is selection due to unobservables as well (see Bascle,2008). The fact that P2SLS results are not significant could indicate that while early circumcision captures some of the endogeneity, more instruments may be needed to address any remaining endogeneity. This therefore produces results that have larger standard errors, which leads to a decrease in the chances of obtaining statistically significant results (which may in fact exist). To check whether the inverse Mills ratios address selection bias, we test whether the Heckman correction terms (see _wL0 _wL1 in Appendix 3) are equal to zero in the second stage. The F test is significant at the 1% level, so we reject the null that the correction terms are equal to zero. Figure 4.1 shows the ATE, ATET and ATENT graphs that correspond to the P2SLS and Heckit results in table 4.2.

Table 4.3 shows results for the seemingly unrelated bivariate probit regressions with instrumental variables for primary secondary or higher education. Specifically, the dependent variable is 1 if an individual completed, is attending, or dropped out at the stage of primary secondary and higher education. The first row shows results for the HIV coefficient, the second column shows the relationship between the error terms on equations (5) and (6). i.e., ρ and the corresponding chi-square value. The results show that while the HIV coefficient is positive and significant at the 10% for completed primary education, there is no correlation between the error terms of the two bivariate probit equations. The coefficient for secondary education is not significant. However, the HIV coefficient for higher education is significant at the 1% level and the chi-square reflects that the error terms of the two equations are correlated, showing that there is a relationship between HIV and higher education. The table of the full results for the regressions is exhibited in Appendix 12.

Table 4.2: Results from OLS, First Stage, Probit 2SLS and Heckit Estimations

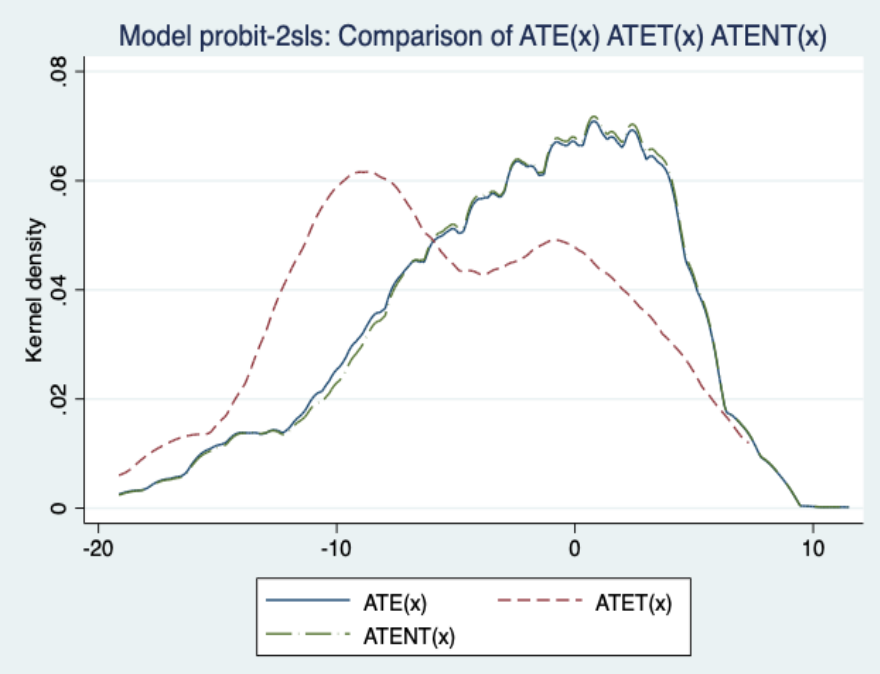
*Complete results are in Appendix 9,10, and 11

	Regressions without addressing endogeneity	**Regressions related to addressing endogeneity**		
	OLS	**First stage probit**	**Probit 2SLS**	**Heckit**
Dependent variable	Total years of education	HIV-positive	Total years of education	Total years of education
HIV coefficient/ATE	-0.408** (0.166)		-5.079 (3.446)	-4.718**** (1.370)
Early circumcision coefficient	-0.113 (0.142)	-0.448** (0.225)		
Bootstrapped Standard errors for treatment effects			Yes	Yes
ATET			-6.902 (5.034)	-13.822*** (4.164)
ATENT			-5.000 (4.514)	-4.323** (1.474)
Control Variables included	Yes	Yes	Yes	Yes
Number of observations	4,130	4,130	4,130	4,130

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 4.1: ATE, ATENT, ATET Results for Average Treatment Effect Models



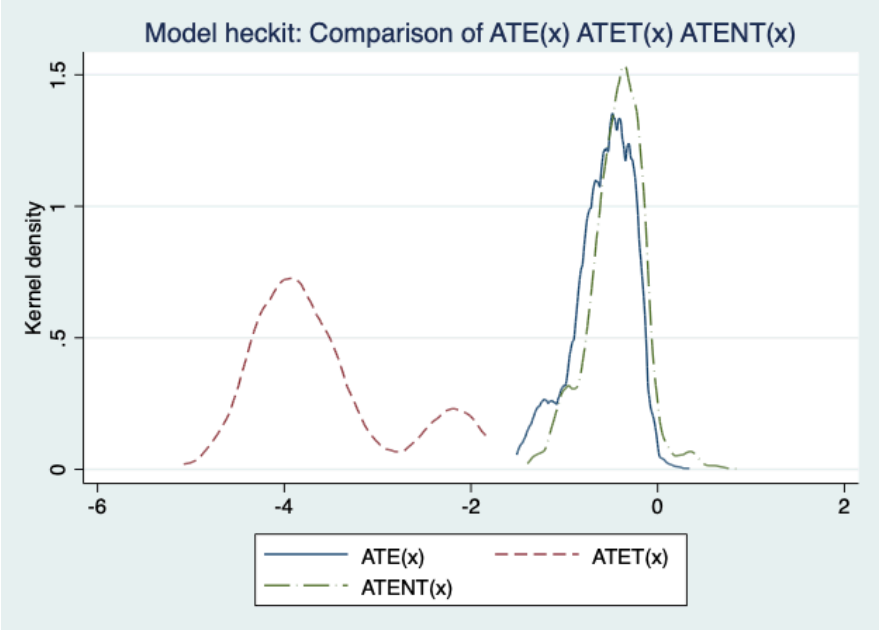


Table 4.3: Seemingly Unrelated Bivariate Probit Results

*Complete results in Appendix 12

	Completed primary education	**Completed secondary education**	**Higher education**
HIV coefficient	1.255* (0.666)	- 0.222 (1.225)	--1.759*** (0.187)
ρ (Correlation between error terms) (chi-square)	0.604 (0.368)	0.058 (0.557)	1.289*** (0.398)
Control variables included	Yes	Yes	Yes
Number of observations	4,130	3,336	2,240

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5. Discussion

We examined the relationship between HIV and total years of education and disaggregated levels of schooling for male adolescents and youths aged 15-29 years in Zimbabwe while addressing endogeneity issues related to the HIV variable. We estimated a treatment model with heterogeneous response to treatment under observable and unobservable selection. The P2SLSL model showed that, on average, HIV has no effect on total years of education. This could be due to the fact that in addition to early circumcision, other instruments may be needed to address other endogeneity issues in this model. However, after addressing selection bias related to HIV infection using the Heckman selection method, we find that HIV has a negative and significant relationship with total years of education. The ATET estimation is larger than the ATE and this is likely due to unobserved heterogeneity that is addressed in the ATET estimation. We also estimated seemingly unrelated bivariate probit regressions with the same IVs to examine whether

HIV affects the primary, secondary, or higher education level and found that HIV only affects higher education attainment.

This chapter is the first study that uses nationally representative data to provide evidence on effects of HIV on education in Zimbabwe whilst addressing the endogenous nature of the HIV variable. The results of this study echo those of studies that examine the effects of HIV on human capital investment in SSA (Akbulut-Yuksel & Turan, 2013; Fortson, 2011). However, our study is unique in that we perform a country-specific analysis. Similar to other studies conducted in Zimbabwe, we do not find a relationship between HIV and primary or secondary school completion (Chapter 3, Birdthistle et al., 2009).

There are a few reasons that could explain this result. First, we are maybe observing this result because children in primary and secondary school may experience disease progression (Pufall et al., 2014). There are three stages of HIV infection. The first stage is the acute stage (2-4 weeks after infection), second is the chronic/latency stage (about 10 years or longer), and third is AIDS (about 3 years) (National Institute of Health, 2020). Hence, some HIV-positive individuals may be in the chronic phase during primary and secondary school, i.e., they may not experience HIV-related illnesses in this phase. Second, the entry standards into higher education in Zimbabwe are high (Mapuranga et al., 2015). Zimbabwe has a British-based education system, therefore as in the UK, passing O- and A- level studies is a main prerequisite for university entrance. Therefore, the physical and psychosocial issues associated which the illness may prevent HIV-positive children in high school from performing at an optimal level. Third, higher education is relatively expensive for most Zimbabweans. The tuition and accommodation for the University of Zimbabwe is about $200 USD per semester (Mashininga, 2020). This is a considerable amount, given that the GDP per capita PPP is about $3,281 (World Bank, 2018). Given the relationship between HIV and poverty in Zimbabwe (Kembo, 2010), it is not surprising that fewer HIV-positive youths enter or obtain higher education.

These results help with the implementation of policies that target HIV-positive men's health and educational attainment in Zimbabwe. In particular, the Zimbabwe National HIV and AIDS Strategic Plan of 2015-2018 mainly focused on HIV prevention and education among youth in

higher education. Indeed, since the endemic started, Zimbabwean youth in higher education have been vulnerable to the disease. Therefore, most of the efforts implemented by the government and its partners, were aimed at reducing the spread of the disease in secondary schools and institutions of higher learning. These policies helped in reducing direct effects of the disease such as infection, illness and mortality. Nonetheless, the disease may present 'second-order effects' that potentially affect individuals socially as well as the economy in the long-run. These second-order effects include a reduction in higher education human capital investment. Given that income-gaps are related to access to and success in higher education, effects of HIV on human capital investment may increase the social inequality between HIV-positive and HIV-negative individuals (Haveman & Smeeding, 2006).

Higher education is a modality for social transformation in Zimbabwe (Mpondi, 2009). While many Zimbabweans are still experiencing effects of the mid-2000s financial crisis, HIV-positive individuals may be in a precarious position in that they are likely to be experiencing an economic crisis and a health crisis. Therefore, HIV-positive individuals are not able to live 'regular' lives as their HIV-negative counterparts. Given that the results show that HIV is a barrier of entry or retention in higher education, policies and efforts that target human capital investment among HIV-positive individuals are needed. These policies will help give HIV-positive individuals the 'boost' they need to match their HIV-negative counterparts in higher education.

This study has limitations. The study only has one instrument (early circumcision). Additional instruments may be needed to address all the endogeneity issues related to the HIV variable in this case. In addition, we were not able to perform a heterogeneous analysis by subgroups (by age) because there were too few circumcised individuals in each group. Despite these shortcomings, we were able to use this instrument to address some endogeneity issues by using the instrument in different methods and various cohorts.

4.6. Conclusion

The HIV rates in Zimbabwe have decreased over time. The goal of this study was to examine whether HIV (still) has an effect on human capital investment. The seemingly unrelated bivariate

probit results show that HIV may have an effect on higher education for young Zimbabwean men. This result could be due to lower circumcision rates among older youths 20-29 years, making them more vulnerable to HIV infection. About 60% of the circumcised youths in our data were aged 15-19 years. Moreover, older youths have higher HIV rates. This may be due to the fact that older youths may also have not benefited from PMTCT and other HIV prevention efforts as their younger counterparts. It could also be that younger boys experience slow disease progression; therefore, effects of the disease on education will be experienced at a stage where they are to be in higher education. This is the first study to examine this issue in Zimbabwe. More studies that examine effects of HIV on human capital investment are needed in Zimbabwe. In particular, studies that examine these issues among women and older men are needed to examine whether these results are universal. With more studies that examine causal effects of HIV on human capital investment, policymakers will be able to make decisions that are based on multiple sources of evidence that ensure robust outcomes.

Chapter 5

Effects of Parental HIV on Children's Education: A Qualitative Study at Mashambanzou Zimbabwe

This chapter is under review for publication and is currently under review.

Abstract

We use a qualitative design to investigate mechanisms that influence the effects of parental HIV on the schooling of children. The study was conducted in collaboration with Mashambanzou Care Trust in Harare, Zimbabwe – a facility that provides care to HIV-positive individuals. We purposively sampled 16 low-income HIV-positive and HIV-negative mothers whose age was above 18 years. The mothers had a total of 71 children in their care. All HIV-positive mothers were on treatment and all women in the sample had at least one school-going child. We use a framework that describes the channels that influence the direct and indirect effects of the HIV status of a parent on investments in their children's education. We find that the main reported mechanisms that influence this relationship are financial barriers exacerbated by HIV, children taking care of sick parents or siblings (child carers), and gender differences in how parental illness affects children. In particular, through the framework, we illustrate that children with HIV-positive mothers may experience difficulties in providing (good) education to their children due to the following: a) reduced availability of parents due to the illness-related issues; b) the association between parental health and offspring health through vertical transmission of HIV and children caring for sick parents; and c) intergenerational transmission of socioeconomic status including financial problems, and gender differences related to sociocultural dynamics. In addition, we find that children of HIV-positive mothers do not always have birth certificates, which is a major barrier to school and exam registration in Zimbabwe.

Key words: Parental HIV, children, gender differences, socioeconomic, poverty

5.1. Introduction

Mother-to-child (or vertical) transmission of HIV is responsible for most infections of children aged 0-14 years (UNAIDS, 2020). In 2011, the Zimbabwean government implemented an accelerated national prevention of mother-to-child transmission (PMTCT) program. As a result, in 2018, 94% of HIV-positive pregnant women had access to antiretroviral (ARV) medicine and 11,000 newborn infections were prevented (UNAIDS, 2018). This is a crucial achievement in HIV prevention in Zimbabwe, given that women constitute 61% (730,000 out of 1.2 million) of the adult HIV population in the country (UNAIDS, 2018). There are about 130,000 children aged 0-19 years currently living with HIV in Zimbabwe, which is about 2% of the total population of children (UNICEF, 2019). In contrast, the adult HIV prevalence rate in Zimbabwe is about 13% (see Chapter 1). Therefore, it is safe to assume that there are more children living with HIV-positive parents than there are HIV-positive children. HIV-positive children face a multitude of issues related to their health, education, and social wellbeing. Hence, several studies have examined the direct effects of HIV on children's education in Zimbabwe (e.g., Bandason et al., 2013; Luseno et al., 2015; Pufall, Gregson, et al., 2014; Pufall, Nyamukapa, et al., 2014). However, not much is known about the educational attainment of children with HIV-positive parents (see Chapter 1). This is an important issue because these children may face educational challenges related to parental illness.

The education of children with HIV-positive parents may be affected through: a) reduced availability of parents due to the illness-related issues; b) the association between parental health and their offspring health through vertical transmission of HIV, and children caring for sick parents c) intergenerational transmission of socioeconomic status including financial problems, and gender differences related to sociocultural dynamics (Chapter 1, Chapter 2, Pedersen & Revenson, 2005; Boardman et al., 2012; Smith 2004, Goudge et al., 2009). If a parent is facing health challenges for which she/he cannot afford treatment, it may be difficult for the parent to provide financial support for the children, including for their educational needs. Following the economic crisis of 2000 to 2008, the Zimbabwean government significantly decreased the expenditure on operational costs for schools. This led public schools to heavily rely on school fees and levies (or

tuition). The average school fee per child each year is about 70 USD (Moyo, 2020). This can be a significant amount for low-income families. Therefore, school fees can be a major source of distress in households in Zimbabwe.[6] Children with parents who cannot afford to pay school fees or buy school uniforms may be sent home until the payments are made (Mpofu & Chimhenga, 2016). This puts children with low-income HIV-positive parents in Zimbabwe in a precarious position because they are on the intersection of poverty and HIV (Duffy, 2005). In general, individuals from lower socioeconomic groups in Zimbabwe, i.e., the poor, are more vulnerable to HIV infection (Lopman et al., 2007).

In some instances, children with HIV-positive parents in Zimbabwe become caregivers for their parents, which can be emotionally and psychologically challenging (Robson et al., 2006). Consequently, girls and boys may be affected by parental illness differently as girls are more likely to be carers for a sick parent (Smith, 2002). This is because, in general, the burden of care for sick family members typically falls on female family members (Olenja, 1999). Also, vertical transmission or exposure to the disease may affect a child's school due to physical or cognitive ramifications of the disease (Bagenda et al., 2006; Nozyce et al., 2014). In general, parental illness may affect or exacerbate physical, psychological, and/or socioeconomic outcomes of children, which also affects their schooling (Ferrand et al., 2007; Floyd et al., 2007; Sieh et al., 2010).

This chapter aims to explore the mechanisms that drive the effects of HIV infections of parents on educational attainment of their children in the context of Zimbabwe. It is important to examine this group of children because there is a strong relationship between mothers' and children's education in Zimbabwe (Pufall et al., 2016). We identify and explain the major drivers of this relationship, which will help inform policies that target educational attainment of HIV-affected children.

[6] According to the World Bank, GDP per capita in Zimbabwe for 2019 is $1,464 USD. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ZW

5.2. Literature review

Chapter 2 mainly showed effects of HIV on intergenerational transmission of education in SSA are mixed. For example, Akbulut-Yuksel & Turan (2013) found that the association between the education of HIV-positive mothers and their children's education was 30% less than that of HIV-negative mothers in 13 SSA countries. Cluver et al. (2012) found that young and adolescent HIV carers in South Africa missed school days, experienced hunger and had concentration problems at school. Similarly, Pufall et al. (2014) found that young carers in Zimbabwe attended less school. On the other hand, Cluver et al. (2013) found that parental AIDS-illness was not directly associated with educational access in South Africa.

Past research has also shown that parental involvement in children's learning has a positive influence on student achievement (e.g., Auerbach, 1989; Desimone, 1999; Hill & Tyson, 2009). A meta-analysis conducted by Wilder (2014) shows that regardless of the definition of parental involvement or the measure of student achievement, the relationship is consistently positive. The relationship between the two was strongest if parental involvement was defined as parental expectations for academic achievement. However, the relationship was weakest if the parental involvement was defined as assistance with homework. In some cases, unhealthy parents were not involved with their children's academic achievement because of being physically, mentally, and/or emotionally incapable. In addition, they may have less time to be involved with their children's academic achievement. Specifically, parents with HIV/AIDS face issues related to physical health symptoms, complex medical regimens, and fear of death (Rotheram-Borus et al., 2001).

Intergenerational transmission of health status can, directly and indirectly, affect children's educational attainment. First, vertical transmission (mother-to-child) of HIV directly affects children's education through the physical, mental, and emotional issues related to the illness. For example, Anabwani et al. (2016) found that HIV-positive children missed school days due to medical appointments (see Chapter 2 also). In addition, HIV-positive children reported having problems at school. Children becoming caregivers for their parents (child carers) mainly show the indirect effects of parental illness on children's academic achievement (Boardman et al., 2012).

Being a child carer may increase stress levels, anxiety and depression (Pedersen & Revenson, 2005).

Parental health may be related to the level of socioeconomic resources available. These resources are subsequently related to the educational outcomes of children. According to Smith (2004), individuals who experience a major illness have lower earnings compared to healthy individuals. Goudge et al. (2009) also highlight that chronically ill adults face financial constraints, limited social networks, interrupted drug supplies, and their livelihoods are exhausted from previous illness and death. In addition, individuals of lower socioeconomic status tend to have worse health outcomes (Smith, 2004). In particular, there is a disproportionately higher HIV incidence rate among individuals of lower socioeconomic status (Bunyasi & Coetzee, 2017).

Most of the aforementioned studies are quantitative. While quantitative studies provide evidence on effects or impact, they are likely to not fully capture the mechanisms that influence relationships. It is therefore difficult to understand the social realities of the participants from quantitative survey studies. The exploratory nature of qualitative studies allows for a better understanding of how and why individuals behave in a particular manner. As such, this study seeks a better understanding of the issues faced by HIV-positive mothers in transmitting education to their children. Qualitative studies that examine how HIV affects the intergenerational transmission of education have mainly focused on the relationship between orphans and grandparents (e.g., Harms et al., 2010; Jepkemboi & Aldridge, 2014). At present, there are currently no qualitative studies that solely focus on HIV-positive parents and their children in Zimbabwe (see Chapter 1). This chapter aims to mitigate this gap by focusing on HIV-positive mothers and contrast their experiences with HIV-negative mothers.

In particular, we use the framework of Boardman et al. (2012), who presented three channels through which parental illness affects educational attainment of children. These are: a) reduced availability of parents due to the illness-related issues; b) the association between parental health and offspring health through vertical transmission of HIV and children caring for sick parents; and c) intergenerational transmission of socioeconomic status including financial problems, and gender differences related to sociocultural dynamics (see Chapter 2 & Chapter 3). Through this

framework, we demonstrate these mechanisms in the context of Zimbabwe. This is the first study to simultaneously examine these mechanisms in SSA using data from participants with and without HIV.

5.3. Methods

This study explores the mechanisms that influence how parental HIV affects education of children in Zimbabwe using a qualitative approach. Interviews were conducted in collaboration with the Mashambanzou Care Trust (MCT) – an interdenominational non-profit organization (NGO) based in Harare (the capital city) that seeks to provide medical care and support to low-income HIV-positive individuals. MCT has direct access to over 5000 HIV-positive individuals in Zimbabwe. Due to ethical reasons, socioeconomic barriers, health-related reasons, and stigma, the identification of HIV-positive individuals can be difficult. The collaboration with MCT allowed for access to HIV-positive respondents.

5.3.1. Study area and sampling

The study was conducted in February 2020 in Harare, Zimbabwe. We employed a purposive sampling strategy by establishing contact with MCT. As explained above, MTC is an NGO that provides treatment, care, and support interventions for HIV-positive individuals of all ages in Zimbabwe. MCT was established in 1989 and had a patient care focus and family-centered approach to HIV response interventions. MCT targets HIV-positive individuals with socioeconomic challenges that inhibit them from obtaining treatment. The organization has a 30 bed-capacity facility and caters to over 5000 people living with HIV of all ages in resource-constrained (urban and rural) communities. There is no other facility that offers such holistic and direct services to people living with HIV in Zimbabwe. Therefore, this link with MCT allowed us to have direct contact with potential respondents who have constant access to treatment and regular counseling related to stigmatization, among other issues. The target group for this study

included women who did not live in the facility but commute to the facility for treatment or to accompany a partner who is receiving treatment at the facility.

Given the stigmatization of people living with HIV in Zimbabwe (Mateveke et al., 2016), it was important to ensure that the recruitment process prioritized the safety and comfort of the participants. Hence, MCT's evaluation manager, social workers, and medical staff facilitated the recruitment process of the respondents. In order to examine how parental HIV affects schooling outcomes of children, non-bedridden HIV-positive mothers who were at least 18 years old and had at least one school-going child, were selected and invited to participate. We targeted mothers because their education strongly influences educational outcomes of children and in general, women are the primary caregivers of children (E. Pufall et al., 2016; Waterhouse et al., 2017). A few HIV-negative women above 18 years with at least one school-going child were targeted and identified by MCT in the same communities. These HIV-positive women and HIV-negative women verbally confirmed their status and their partner's status. It is important to include both HIV-positive women and HIV-negative women of lower socioeconomic status in order to distinguish issues related to belonging to a low socioeconomic status group and issues related to HIV.

5.3.2. Ethical approval

We obtained ethical approval from the Medical Research Council of Zimbabwe and from the Maastricht University Ethical Review Committee Inner City Faculties (see Appendix 16 and 17). Informed consent forms were provided by MRCZ and were available to each participant in Shona (a native language) and English before participating in the study and they were asked to sign the form to be able to participate. At the start of each interview, the participant was reminded and reassured that she had the right to discontinue the interview at any point in time. The data were managed and stored according to Maastricht University's Data Management Code of Conduct.

5.3.3. Data collection and interview guide

Individual semi-structured in-depth interviews were held with 16 participants who met the selection criteria (of women above 18 years with at least one school-going child). Of these, 13 participants were HIV-positive women and three were HIV-negative. The number of participants is relatively small because MCT facilitated the sampling process and only included participants who were physically, emotionally, and mentally capable of participating in the study. In addition, all participants commuted from their respective communities from various parts of the city to the MCT facility, where all interviews were held. MCT targets individuals of a low socioeconomic status; most of the beneficiaries live in densely populated suburbs that are characterized by poor infrastructure, informal employment, long, and costly commutes to most parts of the capital city, and limited utility services (i.e., electricity and water). Hence, most women who met the criteria are difficult to get a hold-off, had limited funds to commute to MCT, or could not take time off their formal/informal work to participate in the study.

The interviews were held over the course of 2 days. Each participant was compensated $15 (USD) for transportation, their time, and other inconveniences related to the opportunity cost of participating in the interviews.[7] The interviews were digitally recorded and averaged 24 minutes. Having an experienced interviewer for HIV-related studies allowed for the women to speak more freely and answer questions directly. The interviews were conducted mostly in Shona and English when necessary (see Appendix 15). An interview guide was used during the interview process; however, discussions were held on burgeoning issues. The questions in the interview guide were motivated by the above-mentioned theoretical framework of Boardman et al. (2012) that presents the pathways that influence the relationship between HIV and intergenerational transmission of education. Specifically, the interview questions were on the challenges that mothers face issues in sending their children to school, whether their children faced challenges at school, whether there were gender-related differences in schooling outcomes of their children, and whether there were any supports available for them to facilitate their children's schooling.

[7] This was a recommendation from the ethical board at Medical Research Council of Zimbabwe.

The interviewer followed up on emergent and relevant issues that were not on the interview guide.

5.3.4. Analysis

The interviews were transcribed in English. We used the theoretical framework of Boardman et al. (2012) described above to conduct a thematic analysis with the help of NVivo 12. We focused on the three mechanisms, namely reduced availability, the association between parental and their offspring health, and intergenerational transmission of socioeconomic problems to identify codes in NVivo. Basic themes related to how these mechanisms exhibited the effects of parental HIV on intergenerational transmission of education were developed based on the data. These basic themes were then grouped into organizing themes. The organizing themes were then categorized according to the global themes, which were predetermined by the theoretical framework of Boardman et al. (2012) used for the analysis. This framework is centered around effects of health and socioeconomic status on educational outcomes of children. The results were then interpreted in light of the research aim.

5.4. Results

In total, 13 HIV-positive mothers and three HIV-negative mothers participated in the study. The age range of the mother is 32-44 years. Of the 16 mothers, eight were married or in partnership and eight classified themselves to be single, separated, or widowed. Three women had completed primary education, two had some high school, eight reached O level stage (basic secondary), one reached A level stage (complete secondary), and two had diplomas. Four women were formally employed, nine women were informally employed, two were sex-workers, and one was unemployed. Only one child was HIV-positive. Appendix 13 shows the characteristics of the mothers, who participated in the study.

The characteristics of the participants are in Appendix 13 and those for children are exhibited in Appendix 14. Appendix 13 and 14 show that of the 16 mothers in our study, there were 61 biological children, which averages to 3.8 children per mother (HIV-negative women average 2.3 children). However, there were 10 additional non-biological children from extended family members who lived in some of the households

(see Appendix 13). Appendix 14 shows that most of the children who were not attending school or dropped out of school are children of HIV-positive participants.

The themes in the theoretical framework used in this study were reevaluated several times and after refining them, 4 global themes and 15 organizing themes were identified by creating theme nodes in NVivo (see Table 5.1). The results are presented according to these global themes.

5.4.1. Availability of the parent

Most HIV-positive mothers indicated that they do not spend time with their children, given that they spend a lot of time on income-generating activities, attending to their own health, or their husband's health. Some of the participants expressed that their partners were not working due to the fact that they are deceased, ill, or unemployed. Like many Zimbabwean households, some participants also had other non-biological children from extended family with whom they live with and support financially. According to them, this makes their families bigger and adds to the financial constraints. Moreover, all participants indicated to have a low income and some stated that they do not have supplementary income from their partner, so it is extremely difficult for them to pay school fees for all their children. This has led some mothers to engage in sex work in order to meet the financial needs of their children. We present some quotes translated from Shona to English below:

> *I am the breadwinner in the family as I provide food for my family, ensure that my children go to school and that my husband gets medical treatment.* (HIV-positive mother)

> *I strongly feel that HIV drew us back a lot when we both worked back then providing for the family... It affected my prospects of securing other better jobs because employers sometimes would tell each other that I was HIV-positive hence that I was prone to get sick anytime.* (HIV-positive mother)

> *Challenges are there because most of the time I get to collect a few bottles because there is a sharp increase in the number of people who collect plastic empty bottles out there. The bottles that I collect per day are getting lesser of which from selling those few I need to pay for my rentals where I stay.* (HIV-positive mother)

Table 5.1: Coding Frame of Themes

Mechanism	Global Theme	Organizing theme	Basic theme
Reduced availability of the parent due to the illness and related financial hardship	Financial issues brought about or exacerbated by HIV presenting barriers to investment in education	Limited income, underemployment, or unemployment	-Parents are informally employed and work long hours. Therefore, they lack time to pay attention to their children's schooling needs. -Late payments from informal employment. -Informal job payments are made in kind.
		Single-income homes	-Children live in single-income households because the father or mother's partner is ill, unemployed, or deceased.
	Financial issues brought about or exacerbated by HIV as a barrier to investment in education	Lack of finances and time for children's schooling	-There is little or no money to pay for school fees and school supplies. Most of income goes to food.
		School dropout or non-attendance	-Parents split their time and financial resources between HIV-related treatment and financial generating activities -Children do not attend school for extended periods of time due to lack of finances to pay for school fees or buy school supplies.
		Enrolment issues	-Children have no birth certificates to register in public school.
		Extended family	-Children live in families with extended family members, which exacerbates the financial constraints within the household.

Mechanism	Global Theme	Organizing theme	Basic theme
Association between parental and offspring health through vertical transmission of HIV status and children caring for sick parents	Vertical transmission of HIV from parent	Physical illness from the disease	- Physical and psychological effects of being HIV-positive will affect schooling.
		Emotional and psychological effects of the disease	- Children distancing themselves from parents, school, and the community in order to not deal with stigma.
	Child carer (i.e., children providing are to their parents and siblings)	Helping with raising siblings	- Older children helping their parents raise their siblings
		Helping parents with informal work	- Children assisting parents with selling goods during school term
		Reminding parents about their healthcare routine	- Children given the responsibility to remind their parents to take their medication
Intergenerational transmission of socioeconomic status	Gender issues (i.e., parental HIV affects boys and girls differently)	Girls caring for sick parents	-Girls dropout to help sick parents.
		Girls helping with household upkeep	-Girls help HIV-positive mothers with chores and raising younger siblings.
		Girls helping parents financially by obtaining employment	-Girls take on employment or help with income generating activities in order to financially assist their parents.
		Girls alleviating parents from financial burden by leaving the household	-Older girls drop out of school to get married

My children are psychologically affected by the fact that their father is sick, each day they are always asking and checking on how their father is doing. At times I end up taking photos for them to see that their father is still alive and how he is doing. I would also get to record some audios for them to hear their father`s voice. (HIV-positive mother)

I ended up earning a living through that (sex work) because it was way better than continuing with part-time work. When I would do part-time work at times I would get paid after a long time or upon completing the given tasks but when I was now into sex work I would my money then and there. (HIV-positive mother)

In some cases, participants reported that their children were not enrolled in government schools or were not able to register for national exams because their parents lacked finances or legal documents that are needed to obtain birth certificates for their children. Participants indicated that some private colleges charge higher fees than government schools and are less lenient towards children who have delays with paying school fees or buying school supplies. Hence, some children do not attend school for periods of time and sometimes are repeatedly sent home for not having school uniforms or school supplies. On the other hand, HIV-negative women did not express that they have difficulties in paying for school fees because they were either employed and/or had a working husband who was able to supplement their income. Additionally, all their children have birth certificates, so they are able to attend government schools and register for national exams. These concerns were expressed, among others, in the following ways:

All my seven children stay at home as none of them is in school right now. Each day of their lives is difficult as in some cases we fail to get some food to eat. After having failed to get food for the family, it then stresses me more as the mother. Given my condition that I am HIV-positive, I end up getting continuous headaches and sometimes I get sick as a result of the stress. (HIV-positive mother)

My children have only been attending school through private college home setups, none of them have set foot on government schools. This has been so because all my children did not have birth certificates. (HIV-positive mother)

She dropped out of school when she was doing her Grade 3 but failed to proceed with school when his father refused to get a birth certificate for her. (HIV-positive mother)

I once went to Mutare to secure birth certificates for my children. I was told to bring my national identification card, which was in Harare during that time. I am yet to go back to Mutare and

collect birth certificates for my children. I am only being stopped from traveling because I am currently sick and receiving treatment. (HIV-positive mother)

He (husband) dropped out of school after finishing his Form 3. He is currently selling bananas at Mbare and the money he is getting is not enough. Most of the time he brings home some food after selling bananas. (HIV-positive mother)

5.4.2. Association between parental and offspring health

Only one participant reported to have a child who is HIV-positive. As explained by the participant, this is an orphaned child of extended family members (i.e., brother and sister-in-law), both biological parents died of AIDS. In this particular instance, the participant reported that the status of being HIV-positive and of being a double orphan has psychological effects on the child, which ultimately affects the educational attainment. This child is likely to not perform well in school after dealing with the trauma of the parent's death while processing own HIV-positive status.

I often got calls that the first-born child Simba was refusing to take his ART treatment from the clinic he was registered. I then talked to him and offered him some HIV counseling using myself as an example of how continuously taking some medication can restore someone`s health. I tried to find out the reason why he was not collecting his medication and if it was because he was failing to get some money for transport. This was after I had heard that he was taking some drugs and dancing at musical shows to get money. (HIV-positive mother)

Children of HIV-positive mothers in our sample have to carry the burden of keeping the status of their parents a secret due to fear of stigma. They also have the burden of reminding their parents about taking their medication (about twice daily). There were no reports of children taking care of sick parents because their family had the support and access to MCT (medical and social) services and staff. However, there were some reports of children experiencing emotional problems related to their parents' mental and emotional issues.

My children are capable of keeping family secrets. They do not share information pertaining my HIV status with outsiders. Each time I would get sick my youngest daughter, who is six years old even check with me to find out if I would have carried my medication with me. Even when I came to Mashambanzou Care Trust for treatment recently, it was my six-year-old daughter who packed my medication for me in the bag I was using. We even developed a unique code known to just us

that even if you were to visit and be in the house, if it is time for me to take my medication, my children will remind me without you knowing anything. (HIV-positive mother)

At times even when we have visitors in the house, when it is time for me to take my medicine, they do not wait till the visitor would have left they remind me to take my pills on time. Even my youngest born son will bring me water when it is time for me to take my medication. (HIV-positive mother)

The interviews with HIV-positive mothers in or study revealed that some children care for their parents. In particular, some children have to help their sick mother or father with daily activities such as eating and toileting. Given that their parents cannot afford to pay for helpers to assist with medical care and there is no government assistance with providing caregiving resources to households in need, children with HIV-positive parents take on the role of providing care for their sick parents.

My children are taking care of him. Suppose if he wanted to use the toilet, he would just use the "pot" that is readily available for him. He will just use the pot and he put it in the bucket after use. I will then dispose of the waste. (HIV-positive mother)

5.4.3. Intergenerational transmission of socioeconomic status

The interviews indicated that children of HIV-positive mothers face socioeconomic issues that are similar to children of HIV-negative mothers. For example, HIV-positive participants indicated that older children take care of their younger siblings while their parents are at work. Participants also indicated that children might also help their parents with informal work after school (e.g., selling goods).

My daughter is very intelligent, she helps me when selling things and she is good at calculating the change. (HIV-positive mother)

My children are currently under the care of my twenty-one-year-old girl. She has been watching over her siblings, given that I am here at Mashambanzou currently receiving treatment. (HIV-positive mother)

The participants in our sample did not show any bias in the education of boys over girls. They expressed that they value the educational attainment of boys and girls similarly. However, some participants reported that older girls drop out of school to find employment, so they help their

parents or to get married. HIV-negative mothers' daughters were all in school and were not helping their parents with income-generating activities. According to our respondents, girls with HIV-positive parents typically take on the responsibility of their parents' health and ensuring that their parents and siblings have a place to live and food to eat. In our interviews, we found that all girls with HIV-negative parents are not married and continue with their education.

> *I do not consider a child`s gender as a yardstick when it comes to schooling opportunities. All my children are equal hence they deserve equal opportunities when it comes to their schooling. Given an option to get financial assistance for a few of my children, I will allow the oldest children the chance to go to school while those younger will wait for their chance to also go to school.* (HIV-positive mother)
>
> *My third born daughter often looks for part-time jobs to help me in taking care of the family.* (HIV-positive mother)
>
> *She [daughter] always tells me of how difficult it is for her to leave me with my condition and starting a family away from me. She feels she has a big part to play in helping me in looking after my family.* (HIV-positive mother)
>
> *My eldest child was the one who took care of me and cooked for me. When I got sick, my daughter stopped going to school. She is the one who took the responsibility of taking care of me.* (HIV-positive mother)

HIV-positive mothers in our sample expressed that they had difficulties with helping their children with social mobility through education. Therefore, their children are likely to inherit the socioeconomic status of their parents. On the other hand, while some HIV-negative mothers of lower socioeconomic status face financial problems regarding their livelihood, they are able to prioritize their children's schooling needs and ensure that they are met. This in turn increases the chances of social mobility for their children.

> *My children face challenges in that at times they go to school without eating, without food to carry to school and at times without books. It is deeply affecting my children a lot as they always wonder why they cannot go to school with all the necessities required by the school while other children can afford to go to school with everything. They got uniforms from a well-wisher for them to wear to school.* (HIV-positive mother)
>
> *I keep receiving encouraging comments from her teachers because they already see a brighter future for if she continues on the path that she is going. She currently the class monitor in her form 4*

class. I hope they will always be good Samaritans out there to continue assisting her so that she continues going to school. She loves school. (HIV-negative mother)

There are some socioeconomic status problems that we found to be common among HIV-positive and HIV-negative women. The main problem is gender-based violence. In both groups, some of the participants reported experiencing intimate partner violence and rape. Their children may be directly affected by witnessing their mother being abused by their father or through their mother experiencing emotional problems related to the trauma of rape or other forms of violence. This affects children's schooling through the reduced availability of their mother due to trauma-related issues and also the child's own physical, emotional, and psychological issues related to witnessing violence or intergenerational transmission of trauma (mother-to-child).

I am still in fear of leaving him with our children as he can possibly harm them, I once feared that he can even deliberately poison them. At times our eldest son is sent away from our living room for no reason. Be it that he is sick or not, my husband has always been abusive to me and my children. (HIV-positive mother)

He was emotionally abusive as he would say hurtful things when he was drunk. After shouting at me he would leave the house. (HIV-positive mother)

I did not have any problems with his family, the only challenge that I faced was that he was abusive, he would physically assault me over petty issues. (HIV-negative mother)

…my first child daughter came as a result of rape when I was coming from church. I do know the father of my child and he is currently in the rural areas. The issue was just handled as a family issue and he never got arrested because they just said that he was known in the community. The rape incident was just covered up by the families. (HIV-positive mother)

The next time he came to where we stayed, that weekend I had not gone home so he came and he raped me. I was about to go for the school holidays at the time and I was nineteen years old at the time. (HIV-positive mother)

5.5. Discussion

Our results indicate similarities and differences in the experiences of HIV-positive and HIV-negative women of lower socioeconomic status in Zimbabwe. Zimbabwe is a developing country. Therefore, a significant portion of households relies on informal work for their livelihood. It is

not surprising that our results show that children of HIV-positive and HIV-negative mothers live in households that are resource and financially constrained. In addition, some issues such as gender-based violence are universal among HIV-positive and HIV-negative women. However, there were burgeoning issues apart from issues related to children's schooling that further emanated from the interviews conducted with HIV-positive women in our localized sample. These include sex work, raising children of (deceased or sick) extended family members, children not having birth certificates, and their children not attending school for long periods (or dropping out).

The mechanisms in the study are interconnected in that some issues presented in one of the mechanisms in the theoretical framework result from another aspect. For instance, due to the fact that some HIV-positive children live in single-income homes due to the fact that their mothers are divorced/separated, widowed or have a sick husband. As a result, their mothers end up working long hours or engaging in sex work in order to make up for the reduced income, thereby spending less time with their children (reduced availability). In turn, some of their children then take care of the sick father or their younger siblings (association between parental and offspring health), and older girls drop out of school to help their mother with work (intergenerational transmission of socioeconomic status). Older girls have the pressure to help their mothers raise their younger siblings. Girls may also find employment, help their mother with informal work, or get married early (like their mothers). These findings corroborate Bauman et al., 2007 who found that girls who had HIV-positive parents (in Mutare, Zimbabwe and New York, USA) had too many responsibilities and had very little time for peer and after-school activities. This could be due to cultural reasons because girls and women play a central role in caregiving in Zimbabwe (Robson, 2006). This gender bias towards child carers being female is persistent in Zimbabwe due to socio-cultural constructions that classify domestic chores, caring responsibilities, and informal domestic work as feminine (ibid). There was no gender role or bias for children who remind their parents to take their medication. Reminding parents about their medication can be quite burdensome on the children because dose mistiming of HIV medications is linked to poorer health outcomes (Gill et al., 2010).

In many Zimbabwean families, the extended family is the basis for orphan care and education (Nyamukapa & Gregson, 2005). Hence, HIV-affected families may also face the burden of raising other children from deceased or ill family members. We found that the issue of extended family was more common with HIV-positive mothers. One of the reasons was that some of the mothers had siblings and close family members who had died of AIDS. In one case, a single HIV-positive mother had three biological children and three children from deceased (extended) family. The HIV-negative women in our sample did not have children from extended family and had at least one consistent source of income within the household. On the other hand, most of the HIV-positive women had even more limited income, had children who were not attending school for long periods and had more members in their household.

Not having birth certificates to register for school was a major barrier to public education and access to public funding for HIV-positive mothers. Birth registration can be a difficult issue for low-income parents due to the strict and rigid requirements needed to register. Specifically, for impoverished parents, it is costly to obtain a birth certificate and it can be difficult to obtain if a parent is divorced or deceased (Chereni, 2016). In some cases, psychological issues related to parental illness and helping their parents with household maintenance as well as finances also affect children's education (Ferrand et al., 2007; Floyd et al., 2007; Sieh et al., 2010). This induces an educational gap between children with HIV-positive parents and children with HIV-negative parents.

Children with HIV-positive parents may end up in the same socioeconomic environment that is similar to that of their parents. In particular, they are likely to experience disruptions in their schooling, which affects their prospects of having a better future. The interviews that we conducted through MCT showed that while many low-income women face socioeconomic problems in Zimbabwe, children with HIV-negative parents remain in school and may not deal with the financial, social, and mental burden of having sick parents, which puts them at an advantage of completing school and live better lives in the future. On the other hand, most children with HIV-positive parents are not enrolled in school, do not attend school, or have dropped out due to financial barriers, being a child carer, and gender roles related to socio-

cultural values (e.g., early marriage). All biological children of HIV-positive mothers we interviewed, are HIV-negative which provides more evidence that PMTCT programs have been successful (UNAIDS, 2018).

This study has some limitations. First, our sample is small relative to the population of HIV-positive and HIV-negative women in Zimbabwe. Second, the sample of women in our study was recruited via MCT. This was done in order to ensure the safety, physical and mental health of our vulnerable respondents. Therefore, our results are localized to the sample of women of lower socioeconomic status who reside in Harare and obtain services from MCT. Other demographic groups in Zimbabwe can experience the issues faced by children of mothers in our study. However, the aim of this study is to highlight what we found from the interviews held in this study. The results from our localized sample corroborate the mechanisms highlighted by the theoretical framework in that we find that HIV-positive mothers are not able to transmit education to their children due to: a) reduced availability of parents due to their parents attending to illness-related issues or working to support the income of a sick spouse; b) association between parental health and offspring health through children providing care to sick parents; and c) intergenerational transmission of socioeconomic status resulting in their children having less chance of social mobility.

5.6. Conclusion

Our study shows that HIV-positive women, particularly those from low-income groups in the city of Harare, have problems with providing education for their children. Many HIV-positive children do not have a birth certificate. As a result, they are not able to attend government schools and benefit from programs that target children whose parents are not able to pay school fees. For example, HIV-affected children are likely to not benefit from the Basic Education Assistance Model, a government program that provides educational assistance to vulnerable children (Ringson, 2020). HIV-positive mothers in our study mentioned that they sought government assistance through BEAM but have not been successful. In order to resolve the issue of birth certificates, there are some policy changes that are required that can help to eliminate the

bureaucratic, financial, and educational barriers that some low-income HIV-positive women face in obtaining birth certificates. There are significant social gaps that are created by the lack of having a birth certificate, including not enrolling at a public school, not having access to public funds, and not being able to write national exams, or obtain a government-issued ID. Although orphans have been and still face challenges in their schooling, government and non-government actors who target vulnerable children in Zimbabwe should also consider children with HIV-positive parents because they are likely to not attend school due to the financial and socioeconomic barriers brought about by their parents' illness.

Previous studies that have examined effects of HIV infections among parents on education of their children have focused on orphans (who are raised by grandparents). Given that more people have access to antiretroviral therapy, more HIV-positive parents are able to raise their children. However, these parents face health and socioeconomic issues that interfere with their children's education. This study provides novel evidence that shows that children with HIV-positive parents are in a vulnerable position that is akin to that of orphans. Particularly when it comes to school enrolment, attendance and retention. Hence, they should also be considered in programs that target educational attainment other HIV-affected children (e.g., orphans).

Chapter 6

General Discussion

6.1. Introduction

This dissertation has examined the effects of HIV on inter- and intragender gaps in educational attainment. The dissertation used a variation of schooling outcomes, i.e., school attendance, total years of schooling, completion of primary school, completion of secondary school and completion of tertiary education. As mentioned in the introductory chapter, the goal is to fill research gaps in the literature that examine effects of HIV on educational outcomes. Previous studies have shown that in general, women (in western countries) are more educated today than before; however, they still lag behind men in terms of years of schooling. International organizations, such as the UN, have introduced policies and measures to help countries mitigate gender gaps in educational attainment. These efforts have led to an average reduction in gender gaps in primary and secondary education globally. However, due to various socioeconomic reasons, some countries are still to achieve gender-parity in education. Generally, health issues affect educational outcomes and may contribute to related gender gaps. Chapter 1 mainly shows that HIV continues to mainly affect countries in SSA, particularly Southern African countries such as Zimbabwe. Given the fact that health plays a significant role in educational attainment, the dissertation, therefore, has focused on Zimbabwe to conduct a country-specific study to examine how HIV affects inter- and intragender gaps in educational attainment.

The dissertation relies on four studies that use data from the existing literature, quantitative data from the Demographic Health Surveys (DHS), qualitative data collected at Mashambanzou in Zimbabwe, and a variety of quantitative and qualitative methods, i.e., the PRISMA method, Blinder-Oaxaca decomposition, probit two-stage least squares, Heckman selection, seemingly unrelated bivariate probit estimations and in-depth interviews. The dissertation includes a systematic literature review that synthesizes studies that have examined the main topic of this dissertation from a global perspective. The review is presented in Chapter 2. It mainly shows that the literature on studies that examine effects of HIV on gender gap in educational attainment, is scant in that there are no studies that have solely examined this issue. The chapter also shows that the literature

that examines this issue has mainly focused on orphans. Given the widespread use of ART and PMTCT in countries like Zimbabwe, studies on HIV-positive children and those with HIV-positive parents are also needed to examine the overall effect of HIV on educational attainment. Chapters 3 and 4 use DHS data to quantitatively examine intergender and intragender gaps among children and youths in Zimbabwe. Chapter 3 decomposes gender gaps in school attendance between HIV-positive boys and girls and (intergender) between HIV-negative girls and HIV-positive girls (intragender) aged 6 to 18 years. The multivariate decomposition allows for the examination of the gender gap by separating the difference in characteristics and the differences in the effects of the characteristics (or coefficients). That is, if the difference in the effects of the characteristics is significant, it highlights an unexplained gender gap that may be attributed to systemic issues such as stigma, discrimination, or any other social issue. The statistical significance of the differences between HIV-positive boys and girls (intergender) and between HIV-negative and HIV-positive girls (intragender) showed that there is an unexplained intergender and intragender gap in school attendance within these groups. Chapter 4 analyzes the effects of HIV on total years of schooling among male adolescents and youths ages 15 to 29 years (intragender) by using average treatment effect estimations. This chapter also investigates whether HIV has an effect on primary, secondary, or tertiary education to analyze whether there is a difference in how HIV affects different levels of human capital investment. The results showed that HIV generally affects total years of education and level of educational attainment (primary, secondary or tertiary). The results of this study also showed that HIV mainly affects educational attainment at the tertiary level. Chapter 5 uses qualitative data collected at Mashambanzou Care trust – a non-profit organization that assists low-income HIV-positive individuals with their healthcare and social needs to examine whether HIV-positive mothers had difficulties ensuring that their male and/or female children obtain their education. For comparison, low-income HIV-negative mothers were also interviewed in this study. The main goal for this comparison was to examine the extent to which parental HIV is a barrier to educational attainment of (low-income) children and whether this varies by gender of the child. The study mainly

revealed that in comparison to HIV-negative mothers, HIV-positive mothers face difficulties in sending their children to school.

The sub-section below provides further details about the findings in each study. These findings are summarized by leading statements that explain the results.

6.2. Main findings

6.2.1. Statement 1: In Zimbabwe, HIV appears to affect girls' educational attainment more than boys

Chapter 2's examination of global literature shows that, in general, HIV has a negative effect on children's educational attainment. That is, most studies found that HIV-positive children's schooling outcomes such as attendance, correct grade for age and dropout were more affected compared to their HIV-negative counterparts. Only a few studies, including one study conducted in Zimbabwe, did not find an effect of HIV on these educational outcomes (e.g., Ryder, 1994; Pufall, 2014; and Anawabi, Karugaba & Gabaitiri, 2016). More precisely, Pufall (2014) found that being HIV-positive had no effect on schooling outcomes in Zimbabwe. In addition, of the 10 studies that examine effects of gender on schooling outcomes of HIV-affected children, only one study conducted in Zambia found that gender had no effect on school attendance between HIV orphans and non-orphans (see Henning et al., 2016).

To address this gap in the literature, Chapter 3 shows that, in general, there are no gender gaps in school attendance between boys and girls aged 6-18 years in Zimbabwe. This could be due to the fact that since Zimbabwe's independence in 1980, several measures, such as subsidized education, were put in place to ensure that that the gender gap in educational attainment is reduced. Moreover, policies such as the National Gender Policy of 2004 were enacted with the goal of promoting gender equality in education (Mawere, 2013). The results in Chapter 3 also showed that the status of being HIV-positive generally does not have an effect on school attendance. However, educational attainment is affected

once HIV intersects with gender. The results showed that HIV-positive girls are less likely to attend school compared to HIV-positive boys (intergender gap) and HIV-negative girls (intragender gap). Chapter 3 also shows that there are no intragender gaps between HIV-positive and HIV-negative boys. These results are quite puzzling given that generally, there is gender parity in primary and secondary education and the fact the proportion of HIV-positive girls and boys is similar. The decomposition results showed that age was the major contributing factor to this gap. That is, older HIV-positive girls are less likely to attend school compared to older HIV-negative girls and older HIV-positive boys.

One of the major contributing factors to HIV-positive girls not attending school is early marriage, typically to an older man. Older girls who are HIV-positive in Zimbabwe are either married or in a relationship with men who are 3-5 years older (Schaefer et al., 2017). However, it is unclear whether HIV-positive girls become HIV-positive before or after being in a relationship/marriage. It is also not clear whether they are aware of their status, given that the DHS does not ask whether an individual is aware of their HIV status during interviews or report back the HIV test results. However, from the interviews conducted with HIV-positive women at Mashambonzou (see Chapter 5), we find that married women became HIV-positive whilst they were in a relationship or married. They would typically find out their status during pregnancy or after their partner tests positive. Given that HIV-positive girls typically are in relationships with older men, they may be less able to negotiate for condom use or ask their partner to get an HIV test due to the power dynamics related to the age gap (Mavhu et al., 2018). Additionally, given the marital responsibilities, which may include bearing and/or raising children, these older girls are likely to drop out of school.

- ***Policy recommendations and future research***

There is a need for policies that target adolescent girls as they are vulnerable to early marriage and subsequently HIV infection, which in turn affects their educational attainment. While early marriage is a deterrent to educational attainment, girls who are

HIV-positive may be worse off, especially when they experience illness, or they have to take care of an ill partner.

As highlighted in this section, it is not clear whether HIV-positive girls were infected before or after marriage. While DHS data do provide nationally representative HIV test results, they do not provide information on whether an individual is aware of their HIV status or not and whether they know how they got infected. Additionally, although the HIV-positive women interviewed at Mashambanzou were able to explain how they contracted HIV, the results are localized to the sample of low-income HIV-positive women who live in Harare. There is therefore a need for nationally representative studies that examine HIV-positive adolescents in Zimbabwe, particularly their educational attainment needs, as they are lagging behind their peers.

6.2.2. Statement 2: There is both a level-of-education effect and a cohort effect in how HIV affects educational attainment among males in Zimbabwe

Chapter 4 shows that HIV may have a negative effect on total years of schooling for male adolescents and youths aged 15-29 years in Zimbabwe. However, in Chapter 3, we found that there is no intragender gap in school attendance among males aged 6-18 years. We, therefore, examined whether HIV has an effect at different levels of education, i.e., completion of primary school, completion of secondary school, and some tertiary education. The results showed that HIV does not have an effect at the primary or secondary level. However, it has an effect at the tertiary level. The results are not surprising given that education is generally cheaper at lower levels of education and younger children and adolescents are typically under their parents' support during primary and secondary school. Therefore, the financial burden of the disease is likely to affect older males. Precisley, education in Zimbabwe is relatively expensive; therefore, some HIV-positive youths may not be able to afford to attend post-secondary education (Mashininga, 2020). Specifically, the interplay between illness and poverty may contribute to the reason why HIV-positive youths do not obtain tertiary education. This result can also be explained by the fact that the HIV illness is likely to affect young men as they are

likely to be at the stage where they are experiencing HIV-related symptoms if they were infected at an earlier stage.

With the expansion of PMTCT programs across Zimbabwe, fewer children have vertical (or peri/postnatal) HIV than there were in the late 1980s and early 1990s when HIV was still a novel disease. Given that the oldest males in this study were born in 1991, it is likely that some of them were unaware of their HIV status until they started experiencing symptoms. The symptoms are likely to occur in the last years of secondary education because the latency period of HIV can be over 10 years. Therefore, the effects of illness can prevent young adults with vertical and non-vertical HIV and from continuing with their higher educational attainment. Moreover, given the VMMC program was implemented in 2011, more adolescent boys can have benefited from circumcision, which is a significant HIV-prevention method that older males did not have access to. Therefore, the fact that HIV affects tertiary educational attainment could be a cohort effect that emanated from the lack of PMTCT and VMMC for older males. That is, we only find that HIV affects educational attainment at the tertiary level, possibly due to the fact that older males in the data did not have access to PMTCT services and had less exposure to circumcision.

- ***Policy recommendations and future research***

Older males (and possibly older females) are also vulnerable to the effects of HIV on educational attainment.[8] There is a need for policy interventions that allow for HIV-positive older adults to continue with their education in the same way that the government social assistance programs such as BEAM facilitate educational attainment of vulnerable children in Zimbabwe. There have been several programs and initiatives that have been initiated to help stop the spread of the disease within Zimbabwe and SSA in general. However, very little attention is paid to the educational attainment of HIV-positive adults. It is important to ensure that HIV-positive adults have the health and

[8] Although we did not examine the causal effects of HIV among females (due to lack of an instrumental variable), we would assume that older females' educational attainment may be also affected in a similar way.

educational resources they need to become productive members of society, which may benefit societies overall. Future research should consider examining causal effects of HIV on educational attainment of older males by education and cohort level. It is also important to examine whether tertiary educational attainment of younger males in the future to examine whether PMTCT and VMMC are indeed the reasons behind the cohort level difference.

6.2.3 Statement 3: There is a discrepancy in what HIV-positive mothers say about gender gaps in children's education and what the results from surveys show.

A segment of Chapter 5 qualitatively examines whether there is a gender gap in schooling among children of HIV-positive mothers. All of the biological children of HIV-positive mothers were HIV-negative and the mothers we interviewed expressed that they had no gender preference when it came to their children's schooling. However, the mothers did mention that girls dropped out of school early in order to get married so as to relieve their parents of the financial burden of raising them or live a better life. In addition, older girls cared for their younger siblings in the absence of their parents due to illness. An explanation of this finding could be that while there have been significant efforts to promote gender equality, there are some gender norms that are still dominant and persistent (Nani & Sibanda, 2019). These gender norms may affect educational choices made by girls. For example, in Chapter 3, we found that in general, having an HIV-positive mother does not have an effect on school attendance. However, we did find that being married negatively affects school attendance. Early marriage and HIV illness have been found to be causes of school dropout in Zimbabwe (Dakwa, Chiome & Chabaya, 2014). However, due to gender norms related to early marriage, parents may not be aware of how it affects their daughters' chances for social mobility. The results in Chapter 5 also showed that parents marry their daughters off (customary or legally) because they may perceive that their daughters are better off securing their future through marriage. As boys are expected to pay a bride price and be breadwinners in the future, marriage is not typically an alternative to a better life. Therefore, boys are likely to continue with their

education, seek employment or other sources of income. This may explain why we find that being employed had an effect on school attendance for older boys in Chapter 3. However, the mothers we interviewed in Chapter 5 mentioned that the older boys were unemployed. This is mainly due to the fact that while there were some youths who are (formally or informally) employed, as found in the DHS data, most youths are unemployed in Zimbabwe (Maulani & Agwanda, 2019).

- ***Policy recommendations and future research***

In Zimbabwe, policies and interventions that target parental HIV have been aimed at orphans. This is understandable because they face parental loss and the disease burden (Mavhu et al., 2020). However, non-orphaned children, particularly girls, also may be vulnerable to the effects of disease because their schooling is interrupted due to caring for their parents and/or siblings and by helping their parents financially. For some girls' marriage is the solution. Policies that target helping families affected by parental HIV, with care work and financial assistance, are needed in order to ensure that their children continue with school. For example, the Disability Grant in South Africa was extended to HIV-positive individuals who are not able to work due to mental or physical health (Govender et al., 2015). There is also a need for qualitative research that investigates how HIV affected vertically and non-vertically infected children's educational attainment. This is because it is unclear whether the effects of HIV on girls' education are due to vertical or non-vertical transmission.

6.2.4. Statement number 4: To a large extent, HIV is a poverty problem in Zimbabwe

In Zimbabwe HIV mainly affects lower-income individuals (Lopman et al., 2007). More than 50% of Zimbabweans live in extreme poverty and this sub-population is more vulnerable to HIV and other socioeconomic issues such as low educational attainment and early marriage (Pascoe *et al*., 2015). Evidence from the studies in this dissertation provides the following explanation. Chapter 3 and Chapter 5 show that younger girls from low-income backgrounds enter early marriages to escape poverty and in search of a life that is

better than the one they grew up in. Some HIV-positive mothers interviewed in the study in Chapter 5 also expressed that they entered early marriages in search of a better life. In some cases, these young women become HIV-positive through their partners and have children as well. It is worth noting that the evidence from the qualitative interviews showed that while marriage is viewed as a way to alleviate poverty for some girls, it does not necessarily lead to a better life (economically). However, it does provide temporary financial relief to the bride's family through the bride price paid by the groom. In fact, the results of this study corroborate studies such as Dakwa, Chiome & Chabaya, 2014, who find that early marriage in Zimbabwe leads to school dropout.

Chapters 3 and 5 show that this cycle is being perpetuated. This is seen in older and younger mothers interviewed at Mashambanzou (Chapter 5) and younger girls in the DHS dataset (Chapter 3) who have opted into early marriages. Children born to these women are likely to inherit the socioeconomic status of their parents. Early marriage makes it difficult for them to obtain higher education in a country like Zimbabwe that does not have enough resources to facilitate the social mobility of individuals born in poverty.

Girls who enter early marriages are vulnerable to HIV infection as they are less able to advocate for themselves in marriages where they are younger and financially inferior (Mavhu et al., 2018). This is in addition to living in a patriarchal society such as that of Zimbabwe that socially and culturally places them in an inferior position upon marriage (Kambarami, 2006). Results from the qualitative interviews conducted in Chapter 5 shows that women in this position are therefore more prone to HIV infection and gender-based violence given their socioeconomic position. Mavhu et al. (2018) also highlight this issue of gender-based violence among adolescent girls who are vulnerable to HIV. In addition to the HIV risk, young girls who enter these early marriages do not have the financial means to continue their education. They instead focus on their marriage and children. Without the financial resources to pursue their education, these young women may be constrained to remain with their partners, which at times can be fatal (Mukananga et al.,

2014). They are therefore caught in the same poverty cycle as the prior generation, which brings about significant risk of HIV, early marriage and school dropout for the next generation (Pascoe et al., 2015).

- ***Policy recommendations and future research***

While there have been extensive prevention measures put in place to reduce HIV in Zimbabwe, more efforts and resources are needed among low-income individuals, particularly girls who are likely to marry young, risk HIV infection, and drop out of school. There are currently no studies that have examined the interplay between poverty and HIV on a national scale in Zimbabwe. Such a study could help understand the extent to which poverty plays a role in HIV infection, especially among women. In addition, national-level studies that examine educational outcomes of children with HIV-positive parents are needed so as to determine the mechanisms that influence or mitigate their educational outcomes.

6.2.5. Statement 5: There are policy and cultural-induced barriers to the educational attainment of HIV-affected children.

Chapter 5 shows that many children with HIV-positive mothers do not have birth certificates and that it is challenging for them to obtain them due to bureaucratic reasons such as not having paternal representation and finances. These children may face difficulties with enrollment, particularly in formal schools and in obtaining identification documents such as a driver's license or passport when they are older, presenting an added layer of their social exclusion and perpetuates the poverty cycle. Another example of a policy-induced barrier is that programs that target vulnerable children only focus on orphans (Yeboah, 2018). However, our results show that children affected by parental HIV also need some assistance, particularly with their education. The mothers we interviewed in Chapter 5 expressed that their major challenge with raising their children, was ensuring that their school fees were paid for. In addition, some children are not enrolled in schools that require birth certificates. The interviews conducted for Chapter 5 revealed that these

(private) schools are typically low-quality and ineligible for the BEAM program. This excludes children who should be benefiting from the program.

The National Adolescent and Youth Sexual and Reproductive Health (ASRH) Strategy II (2016-2020) is a national policy in Zimbabwe that seeks to reduce morbidity and mortality related to sexual and reproductive health among youths and adolescents.[9] One of the issues that the ASRH strategy targets, is early marriage. The strategy points out policy interpretation inconsistencies in the Marriage Act and the Customary Marriage Act. Firstly, the Marriage Act allows for marriage of girls aged 16-18 years with the consent of a guardian or judge. Secondly, the Customary Marriage Act does not specify the minimum age of marriage. Both Acts put many girls who may be unwilling to enter marriage in a position where they do so due to pressure from their parent/guardian or judge. Evidence from the interviews in Chapter 5 with HIV-positive mothers, shows that most of them regret marrying young. As acknowledged by the ASRH strategy, many young girls marry men who are older, which puts them at the risk of contracting HIV and, in many cases, school dropout.

There are cultural issues related to gender that incline girls to care for their parents or siblings. This is because of the burden of care for sick and young people typically falls on girls (Robson et al., 2006). This contributes to the gender gap between HIV-affected boys and girls. When combined with the policy and cultural issues related to early marriage, young girls' education is further disadvantaged. For example, girls can be married off young so that the parents can raise family income through a bride price. As mentioned above, the interplay between HIV and poverty makes them more vulnerable to such situations.

[9] Details about the ASRH can be retrieved at: http://www.znfpc.org.zw/wp-content/uploads/2019/05/National-ASRH-Strategy-II-2016-2020.pdf

- ***Policy recommendations and future research***

The above discussion implies that policy barriers should be removed, and policy interventions are needed to address issues related to early marriage and HIV infection of younger girls as well as the schooling and social mobility of HIV-affected children. For example, access to public education funding and to birth certificates. A solution to these issues is to implement universal primary and secondary education as in the case of Uganda and is to consider birth registration at healthcare centers as suggested for the case of Zambia by Kaping'a, (2020). There are several NGOs that work on addressing issues related to early marriage in Zimbabwe, such as the UNFPA Sista2Sista Girls Empowerment Clubs, Campaign for Female Education-Zimbabwe and Plan International, to mention a few. However, the government only declared child marriage (before 18) unconstitutional in 2016. There are no current government-implemented projects or partnerships to address this issue. Government collaboration can help raise awareness against early marriage in places of public gathering such as schools in the same manner HIV-prevention measures were implemented in all spaces of public gathering. Future research should examine married HIV-positive girls and the extent to which early marriage affects their educational attainment. This is because most research has mainly shown that early marriage increases HIV risk and school dropout. However, there are a few studies that examine HIV-positive girls in early marriages and their educational attainment.[10] Finally, bureaucratic barriers that inhibit birth registration of children are needed as this presents barriers to access to education and social benefits.

6.3. Limitations

This dissertation provides evidence on how HIV affects educational attainment. However, the analyses in this data are limited to the specific setting and dataset. However, the

[10] While Chapter 5 examines some HIV-positive mothers who have been in early marriages, the results are preliminary and local to women who live in Harare and receive care from Mashambanzou.

quantitative data that were used in this analysis are representative of the population in Zimbabwe, therefore the results have external validity. Although the results of the qualitative study have internal validity, they have highlighted novel issues that need intervention further investigation. While we were able to address some endogeneity issues in Chapter 4, we were not able to fully establish causal effects of HIV on educational outcomes due to the possibility of additional underlying endogenous issues. In addition, the dissertation also has not examined the causal relationship between key factors such as poverty and early marriage on educational outcomes. This means that we are not able to interpret the direct impact of these issues on educational outcomes. However, we find a strong negative relationship between these factors and educational outcomes, which corroborates findings from similar studies. Lastly, because Zimbabwe was the country of analysis, it is not clear whether recommended policies that worked in other countries are applicable. However, the country-specific analysis offers an opportunity to design policies that handle some cultural, social, and other contextual issues that were presented. While we were able to fill some knowledge gaps on how HIV affects educational outcomes of young children, adolescents and youths in Zimbabwe, more research is needed to further investigate mechanisms that influence the gender gaps that were observed.

6.4. Concluding remarks

The chapters in this dissertation have used various methods and data sources to examine effects of HIV on educational outcomes of children and youths in Zimbabwe. The studies have extended the existed literature by going beyond previous studies that have shown mixed results in whether HIV has an effect on education. The dissertation examined effects of HIV on inter- and intra- gender gaps in educational attainment. The results have shown that HIV mainly affects older girls and male youths' educational attainment. Although the dissertation has also provided explanations of the results, further research is needed to provide more evidence on how HIV affects educational attainment. The findings of this study have shown that in general, there is gender parity in primary and

secondary education in Zimbabwe. This is encouraging as this is a positive step towards gender equity. Another encouraging finding was that HIV and orphanhood did not affect school attendance. This shows that some of the efforts aimed at removing barriers that affect HIV-affected children's schooling have been effective. However, HIV-positive girls still lag behind in educational attainment. In the same way that we have observed some positive results from previously implemented policies, there is hope that with effective policy interventions, barriers that inhibit HIV-positive girls' education can be eradicated

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Appendix 1: List of Quantitative, Mixed-methods and Qualitative papers (Chapter 2)

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Appendix 2: Summary of Quantitative Results (Chapter 2)

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
1.	Akbulut-Yuksel and Turan (2013)	11 SSA countries	13-17	Years of schooling, progress in school, and attendance	Parents and children were tested during survey	HIV-positive mothers vs HIV-negative mothers	Cross-sectional data, N=8992, fixed effects regression	No	No	Yes	Mother's HIV status has significant effects on inheritability of education. The association between infected mothers' education and their children's education is 30% less than the general population. Children with HIV-positive mothers had decreased school progress and attendance.
2	Anabwani et. al (2016)	Botswana	6-18	Attendance and grades	HIV results for children were documented	HIV-infected children vs children living with an HIV-infected child in the household	Cross-sectional data, N=984, chi-square test, and z-test	Yes	No	No	About 99% of HIV-infected and about 97% of HIV-affected children were attending school. 60% of HIV-infected children missed at least one day of school due to illness or medical appointments. 78% of HIV infected children and 62% of HIV affected children reported facing problems at school.
3	Aspaas (1999)	Uganda	0-17	Enrollment	Households had AIDS orphans	HIV/AIDS orphans vs non-orphans	Cross-sectional data, N=60, t-test	No	No	Yes	AIDS orphans in male-headed households were enrolled at lower rates than orphans in female-headed households.
4	Bandason et al. (2013)	Zimbabwe	11-13	Correct grade for age	Teachers, pupils and their families received HIV testing	N/A	Cross-sectional data, N=4386, logistic regression	Yes	No	No	Being HIV-positive was significantly associated with being behind by at least 1 class grade for age.
5	Bele et al. (2011)	India	5-11	Attendance, dropout, school performance	Children were HIV-infected or had lost a parent to HIV/AIDS	HIV-infected children vs HIV orphans	Cross-sectional, N=387, z-scores	No	No	Yes	The main reason for dropout in the HIV-infected group was illness. The main reason for dropout in the HIV orphan group was financial constraints.

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
6	Bhargava (2005)	Ethiopia	10+	School participation before and after mother's death	Children were AIDS orphans	AIDS orphans vs non-AIDS orphans	Cross-sectional data, N=1053, bivariate logistic regression	No	Yes	Yes	A mother's premature death hindered children's school participation. AIDS orphans were more likely to participate in school than non-AIDS orphans. Following the death of their mothers, girls were less likely than boys to participate in school.
7	Cluver et al. (2012)	South Africa	10-20	Attendance, dropout, and inability to concentrate	Children lived in a household with an AIDS-ill individual	Adolescents in homes with AIDS-sickness vs adolescents in other-sick homes vs adolescents in healthy homes.	Cross-sectional data, N=599, ANOVA, t-test, and multivariate regression	Yes	No	No	Living in a home with an AIDS-sick person was significantly related to missing or dropping out of school. Living in a home with other sickness was also related to dropping out of school but this effect was less than that of living in a home with an AIDS-sick person.
8	Cluver et al. (2013)	South Africa	10-17	Enrollment, attendance, and correct grade for age	AIDS-orphaned children vs children who lived with AIDS-ill parents vs non-HIV/AIDS affected children	Children were AIDS orphans or lived with an AIDS-ill parent	Cross-sectional data, N=6002, maximum likelihood estimation, chi-square test, and ANOVA	No	No	No	AIDS-orphaned children showed more grade delay and those with AIDS-ill parents had low attendance and enrollment.
9	Cohen et al. (1997)	USA (Massachusetts)	5-17	Attendance	Children were infected with HIV	HIV-infected children with mild symptoms vs HIV-infected children with moderate symptoms vs HIV-infected children with severe symptoms	Longitudinal data, N=92, descriptive statistics	No	No	Yes	49% of children missed 2 or more weeks of school, 12% missed more than 8 weeks. Only 3 children missed school because of mother's illness. 75% were absent for less than 2 weeks, compared to 51% of children moderate symptoms and 27% of children with severe symptoms.
10	Curley et al. (2010)	Uganda	13.7	Grades.	Self-identified AIDS orphans	Experimental group orphans vs comparison group orphans	Longitudinal data, N= 274, quasi-experimental design/OLS	No	Yes	No	Children in the experimental group are more likely to have better grades, have positive changes in their

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
											educational plans. Girls are more likely to positive changes in educational plan s than boys.
11	Delva et al. (2009)	Guinea	10-18	Attendance	Self-identified AIDS orphans	AIDS-orphans vs non-AIDS orphan vs non-orphans	Cross-sectional data, N=397, logistic regression	No	Yes	No	Compared to non-orphans, non-AIDS orphans and AIDS orphans were less likely to attend school. A trend of decreased attendance could be observed among AIDS orphans. Boys were more likely to attend school on a daily basis compared to girls.
12	Ellis (2004)	USA (North Carolina)	9 years old	Truancy, and low grades	Children were perinatally infected with HIV.	None	Cross-sectional data, N=9, bivariate analysis, T-test	No	No	No	HIV-related medical factors were not associated with children making low grades. However, poor study habits, disruptive behavior, and peer pressure were found to be associated with low grades.
14	Floyd et al. (2007)	Malawi	6-28	Grades and attendance	Parents were tested for HIV during survey	HIV-positive parents vs HIV-negative parents	Longitudinal Data, N=2525, logistic regression and linear regression	No	No	Yes	There was no evidence that the mean grade was lower among children of an HIV-positive individual, for both girls and boys. Secondary school attendance was lower in maternal and paternal orphans.
15	Fofana et al. (2014)	Côte d'Ivoire	6-14	Attendance	Mothers were HIV-positive	HIV-positive women vs HIV-negative women	Cross-sectional data, N=439, Heckman's two step regression	No	No	Yes	HIV was found to be the main cause of children dropping out of school. In households with HIV-positive people, fewer children go to school.
16	Fotso et al. (2018)	South Africa	10-19	Enrollment and school progression (correct grade for age)	Children were tested for HIV	HIV-positive vs HIV-negative children	Longitudinal data, N=8835, logistic regression, multivariate decomposition	No	No	No	HIV contracted in childhood and early adolescence resulted in a significant school progression gap between HIV-negative and HIV-positive children.

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
17	Grant (2008)	Malawi	6-16	Enrollment	Mothers were tested for HIV during survey	HIV-positive mothers vs HIV-negative mothers	Longitudinal data, N=2308, logistic regression	Yes	No	Yes	A mother's HIV status is not significantly associated with school enrollment of 6-10-year-old children. Women who reported a medium or high likelihood of future HIV infection had children with higher odds of being currently enrolled compared to children of women who reported no chance of future infection. There was no difference in school participation between children with HIV-positive mothers and HIV-negative mothers.
18	Gupta (2012)	India	2-18	Dropout and attendance	Children had lost one or both parents to HIV	Orphans and vulnerable children in institutional care vs those in home-based care	Longitudinal data, N=65, descriptive statistics	No	No	No	About 72% of Orphans and vulnerable children (OVC) in home-based care were going to school, whereas 98% of OVC in institutional care were attending school.
20	Harrison et al. (2017)	China	6-17	Grades	Children had at least one HIV-positive biological parent or were AIDS orphans	Experimental group of HIV/AIDS affected children vs comparison group of HIV/AIDS affected children	Longitudinal data, N=790, RCT, random and fixed effects	No	Yes	No	Child and caregiver interventions displayed improvements in academic performance. Girls reported lower grades and less interest in school.
21	Harrison et al. (2018)	China	6-17	Grades	Children had at least one HIV-positive biological parent or were AIDS orphans	Experimental group of HIV/AIDS affected children vs comparison group of HIV/AIDS affected children	Longitudinal data, N=790, RCT, random and fixed effects	No	Yes	No	The number of HIV infections in the family had a significant negative impact on school satisfaction and on children's school interests. Boys reported more academic interests than girls.
23	Henning et al. (2018)	Rwanda	10-17	Correct grade for age	HIV-positive children and parents were identified through an Electrical Medical	HIV-positive vs HIV-affected vs HIV-negative	Cross-sectional data, N=681, logistic Regression	No	No	No	HIV-positive children experienced higher levels of stigma and were twice as likely to be at least year older than their appropriate grade for age.

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
					Record for registered patients living with HIV						
24	Henning et al. (2016)	Zambia	5-17	Attendance	Children lost one or more parents to HIV/AIDS or had a parent or household member who's been sick for 3 months or more	Orphans and vulnerable children vs non-orphans and vulnerable children	Cross-sectional data, N=1651, logistic regression	Yes	Yes	No	The number of orphans and vulnerable children in a household decreased the likelihood of school attendance. Gender did not affect school attendance. Teachers' support was critical to the attendance of HIV/AIDS-affected children.
25	Hensels et al. (2016)	South Africa and Malawi	4-13	Nonspecific educational outcomes	HIV status was obtained using parental report	HIV (and non-HIV) girls vs HIV (and non-HIV) boys	Longitudinal data, N=989, t-test, chi-squared test, linear regression	No	Yes	No	Results showed that boys and girls differed significantly in educational outcomes. A carer's HIV status had negative effect on children 's educational outcomes. However, after controlling for school attendance, cognitive abilities, and carer HIV status, being a girl was significantly associated with better educational outcomes.
26	Hong et al. (2011)	China	6-18	Grades	Children had lost both parents to AIDS	AIDS orphans living in kinship care (or extended family care) vs AIDS orphans in orphanages, vs AIDS orphans in community-based group homes	Longitudinal data, N=296, linear regression	No	No	No	Children who lived in group homes had the best school grades followed by those in orphanages and those in kinship care (or extended family care).
29	Jere (2012)	Malawi	Standard 6 pupils	Dropout, and absenteeism	Children are HIV-positive, have lost one parent to AIDS, children have an HIV/AIDS-ill parent or guardian, or live in a	Experimental group of HIV/AIDS affected children vs comparison group of HIV/AIDS affected children	Cross-Sectional data, N=259, Mann Whitney *U* test	Yes	No	No	The mean of class dropout of the intervention group was lower than the control group. Pupil promotion was based on performance in school-based end-of-year exams. There was no significance in the difference in mean promotion rates between

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
					household affected by HIV/AIDS						intervention and non-intervention.
31	Kasirye and Hisali (2010)	Uganda	6-17	Enrollment and grade progression	Children were HIV/AIDS orphans	HIV orphans vs non-HIV orphans	Cross-sectional data, N=1244, probit regression	No	No	No	HIV/AIDS orphans were about three years behind their appropriate grade. Poor HIV/AIDS orphans are likely to fall behind their appropriate grade.
32	Kembo (2010)	Zimbabwe	10-18	Dropout, attendance and absenteeism	Children were AIDS orphans or lived with a chronically-ill person	HIV-affected children vs HIV-unaffected children	Cross-sectional data, N=386, t-test	Yes	No	No	About 72% of HIV-affected children were not in school compared to about 29% of HIV-unaffected children. The main reason was lack of money. About 13% of HIV-affected children were not in school because they did not have birth certificates.
33	Kidman et al. (2012)	Malawi	6-14	Enrollment and highest grade level attained	Children living with a parent with an AIDS-related illness were identified	Orphans vs non-orphans	Cross-sectional data, N=13090, logistic and linear multilevel regression	No	Yes	Yes	There is little evidence that living with a chronically ill parent or in a household experiencing a recent adult death negatively impacts children's enrollment or grade attainment. Double and maternal orphans experience more educational deprivation compared to non-orphans. Being a maternal orphan a stronger impact on enrollment on boys compared to girls.
34	Kitara et. al (2013)	Uganda	12-15	Attitude towards education	Children were AIDS orphans	HIV-orphans vs non-HIV-orphans vs non-orphans	Cross-sectional data, N=255, t-test, ANOVA, Pearson's correlation, logistic regression	No	Yes	No	Non-orphans had a more positive attitude towards education. Non-HIV orphaned girls had more positive attitude towards school compared to HIV orphaned girls. This is attributed to HIV/AIDS related stigma.
35	Lucas et al. (2019)	Zambia	7-15	Enrollment and correct grade for age	Children lived in households	Children in households with HIV-positive	Cross-sectional data, N=12,128, Difference in	No	Yes	Yes	Children who live in households with HIV-positive household heads

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
					with HIV-positive adults	heads vs children in households with non-HIV-positive heads	difference regression				were more likely to be attending school.
36	Luseno et al. (2015)	Zimbabwe	15-21	Dropout and years of schooling	Children's HIV status were provided	Orphans vs non-orphans	Cross-sectional and RCT, N=751, logistic regression	No	No	No	Participants of experimental program had lower chances of school dropout compared to orphans from a nationally representative household survey.
37	Mayes (1996)	USA	5-17	Grades and absenteeism	18 boys were HIV-positive	HIV-positive hemophilic boys vs HIV-negative hemophilic boys	Cross-sectional data, N=66, t-test, Pearson's correlation coefficients	No	No	No	All 66 boys who participated in the study were boys diagnosed with hemophilia. HIV-positive boys missed more school days (14.8%) compared to HIV-negative boys (7.9%). Academic grades did not suffer significantly between the two groups.
38	Mialky et. Al (2001)	USA (Philadelphia)	5-18	Grade repetition	Children were found to be HIV-positive	None	Cross-sectional data, N=85, descriptive statistics	No	No	No	About 24% of HIV-infected children repeated at least one grade.13.2% of caregivers described school performance of children as below average. The mean number of absences reported by caregivers was 5.2 times.
39	Mishra et al. (2007)	Kenya	6-14	Attendance	Parents and children were tested during survey	Orphans vs fostered children vs children with HIV-positive parents	Cross-sectional data, N=6928, logistic regression	No	No	Yes	Orphaned children and fostered children are less likely to be attending school than children of HIV-negative parents. Children of HIV-positive parents are less likely to be attending school than children of HIV-negative parents.
40	Mokgatle and Madiba (2015)	South Africa	5-17	Attendance	Children were HIV-infected	None	Cross-sectional data, N=406, Descriptive statistics	No	No	No	96% of non-orphans and 96.7% of orphans were attending school.

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
41	Mon et al. (2013)	Myanmar	6-17	Attendance, dropout, absenteeism and enrollment	Children were AIDS orphans	HIV orphans vs non-HIV related children	Cross-sectional data, N=600, Descriptive statistics, t-tests	No	No	Yes	There were no differences is schooling between in HIV orphans and non-HIV related children. However, there were differences in dropout, absenteeism and enrollment.
42	Nicholson et al. (2015)	Zambia	6-12	Maths and English grades	Mothers were HIV-positive and children were exposed to HIV *in utero*	HIV-exposed children (*in utero*) vs HIV-unexposed children	Longitudinal data, N=390 linear regression model	No	No	Yes	HIV-exposed children had lower math grades than HIV-unexposed children; however, there were no differences in English grades.
44	Orkin et al. (2014)	South Africa	11-25	Attendance, enrollment and grade progression,	HIV/AIDS-related parental deaths required a conservative threshold of three or more HIV/AIDS defining symptoms	None	Longitudinal data, N=723, Maximum Likelihood estimation, Bayesian estimation, standardized regression	No	Yes	No	Neither caregiver HIV/AIDS-sickness nor HIV/AIDS orphanhood was associated with non-enrollment, non-attendance, concentration problems or grade progression. Caregiver sickness was indirectly associated with non-enrollment educational variables through internalizing problems and poverty. Boys reported more concentration problems and difficulties with grade progression.
45	Osuji et al. (2018)	Uganda	13.8 years	Attendance and academic attendance	Children were AIDS orphans	None	Longitudinal, N=346, Multivariate regression analyses	No	No	Yes	Family cohesion, support from classmates was associated with more days of attending school. Support from caregivers, friends and classmates was associated with fewer days of missed school.
46	Parchure et al. (2016)	India	6-16	Enrollment, dropout, and correct grade for age	Children were infected with HIV or had one or both parents infected with HIV (living or dead)	HIV-infected vs HIV-affected	Cross-sectional data, N=472, logistic regression	No	No	Yes	HIV-infected children were 7 times more likely to be out of school compared to HIV-affected children. HIV-infected and maternal orphans were 2.82 and 9 times more likely to not be in the correct grade for age, respectively. Child illness was that most common

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
											reason for low educational attainment.
48	Pufall et al. (2014 a)	Zimbabwe	6-17	Attendance and correct grade for age	HIV tests were conducted on children aged 2-17	Vulnerable children (i.e. HIV-positive, orphans, or had HIV-positive parents) vs non-vulnerable children	Cross-sectional data, N=4577, logistic Regression	No	Yes	Yes	Vulnerable Children are likely to be in correct grade for age but not in regular attendance. Older children were less likely to be in correct grade for age. Females were more likely to be in the correct grade for age compared to males.
49	Pufall et al. (2014 b)	Zimbabwe	6-24	Completion of primary school, attendance, and correct grade for age	HIV tests were conducted on children aged 2-17	HIV-positive children vs children with HIV-positive parents vs orphans vs young carers	Cross-sectional data, N=5520, logistic Regression	No	No	No	Being HIV-positive was not associated with any education measures in youth and children. Young carers were less likely to attend secondary school. Orphans were less likely to be in the correct grade for age.
50	Ryder (1994)	D.R. Congo	0-15	Dropout	Mothers were HIV-positive	HIV maternal orphans vs children with HIV-positive mothers vs children with HIV-negative mother	Longitudinal data, N=78, Yates' corrected chi-square test, and Fisher's exact test	No	No	No	55.6% of maternal orphans were forced to withdraw from school compared 25.0% of children with HIV-positive mothers and 40% children of HIV-negative mothers.
51	Sherr et. Al (2017)	Malawi and South Africa	5-15	Enrollment, attendance andcorrect grade for age	Child HIV status was determined using caregiver reports	HIV-positive children vs HIV-negative children with/without receipt of cash grant	Longitudinal data, N= 854 t-test, chi-square test, logistic regression, and multivariate regression	No	No	No	Among HIV-positive children, receiving a cash grant was associated with much more struggling in school than children who did not receive a grant. No effect was found on attendance, being in correct grade for age, or being a quick learner.
53	Souza et al. (2010)	Brazil	10-19	Attendance, dropout, and failure	Children were HIV-positive	Adolescents with high viral loads vs adolescents with low viral loads	Cross-sectional data, N=49, ANOVA, t-test, chi-square test, and Fisher's exact test	No	No	No	School failure and school dropout were reported by 51% and 28.6% of all participants. However, 30.8% of adolescents with a low viral load and 26.1% of those with high viral load reported school dropout.

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
											46.2% of adolescents with high viral load and 56.5% of children with high viral load reported school failure.
54	Ssewamala and Ismayilova (2009)	Uganda	11-17	Attendance and grades	Adolescents were AIDS orphans	Experimental group orphans vs comparison group orphans	RCT, N=277, analysis of variance	No	No	No	There was a 27-percentage point increase in experimental group's certainty of accomplishing educational plans. The intervention did not have a significant effect on school attendance.
55	Ssewamala et al. (2018)	Uganda	12 years (average)	Dropout andattendance	Adolescents were AIDS orphans	Experimental group orphans vs comparison group orphans	RCT, N=1410, multilevel regression	No	No	No	On average, adolescents receiving both interventions showed lower dropout rates, higher likelihood to take national exam, and score higher on the exam. However, Intervention effects were not statistically significant.
56	Toska et al. (2019)	South Africa	Adolescents <18 years	Absenteeism and correct grade for age	Adolescents were living with HIV	Adolescents living with HIV vs un-infected adolescents	Cross-sectional data, N=1,519, multivariate regression	No	No	No	Having disease burden resulted in more frequent need to miss school to attend clinics.
57	Tu et al. (2009)	China	6-18	Grades	Children were living with HIV-infected parents or lost one or both parents to AIDS	Orphan/children with HIV-positive parent vs non-orphan	Cross-sectional data, N=1625, linear regression model	No	No	No	Orphans had lower grades compared to children with HIV-infected parents and children with HIV-negative parents There was no difference in educational expectation or student leadership.
58	Xu et al. (2010 a)	China	8-17	Attendance dropout and	Children had at least 1 HIV-positive parent or had lost on or both parents to AIDS.	HIV-affected vs HIV-unaffected	Cross-sectional data, N=225, multivariate regression	No	No	No	Children living with grandparents reported higher scores in school functioning. Caregiver spending more time accompanying the child increased school functioning.
59	Xu et al. (2010 b)	China	8-18	Attendance and dropout	Participants were recruited through health	HIV-affected vs HIV-unaffected	Cross-sectional data, N=225, Chi-square test	No	No	No	19% of HIV-unaffected children and 15% HIV

Ref no.	Author (year)	Country	Children's Age(years)	Education Variable	HIV status or testing	Comparisons	Methods	Mixed-methods Study	Gender comparison of educational attainment	Effects of Parental HIV/AIDS on educational attainment	Main Results
					service providers who treat HIV-positive patients.	children and caregivers					affected children dropped out of school.
60	Xu et al. (2010 c)	China	8-18	Attendance and dropout	Children had at least one HIV-positive parent or had lost on or both parents to AIDS.	Orphans vs non-orphans	Cross-sectional data, N=114, Descriptive statistics	No	No	No	75% of non-orphans and 73.4 of orphans were attending school. Whereas 25% of non-orphans and 26.6% of orphans dropped out of school
61	Yang (2006)	China	0-15	Attendance, truancy, and dropout	Rural household members contracted HIV through drug use	Orphans vs non-orphans	Cross-sectional data, N=266, Chi-square test, Fisher's exact test	No	No	No	HIV-infected drug users between 16-50 years old were recruited. Orphans and older children between 6-15 years old were less likely to attend school and skip class compared to non-orphans.
62	Zivin et al. (2009)	Kenya	8-18	Attendance	Parents were on ARV treatment	Experimental group of HIV/AIDS affected children vs comparison group of HIV/AIDS affected children	Longitudinal data, N= 480 Quasi-experimental design, fixed effects	No	Yes	Yes	There is a similar increase over time in school attendance for children in early-stage ARV households, relative to children in later-stage ARV households. Children in later-stage ARV households do not experience any significant change in attendance. ARV treatment effects are large and significant in early stages of ARV treatment for girls and not significant for boys.

Appendix 3: Summary of Qualitative Results (Chapter 2)

Ref no.	Author (year)	Country	Method	HIV-positive Population/HIV-testing	Description	Education Variable	Mixed-methods Study	Results
2	Anabwani (2016)	Botswana	Focus group discussions	Children had documented HIV results	19 HIV infected and 6 HIV affected children	Attendance	Yes	HIV infected children reported no major problem in school. However, some reported missing school for medical reasons.
4	Bandason (2013)	Zimbabwe	Focus group discussions, informal interviews, and exit interviews	Children were HIV-infected	3 teachers,6 pupils (aged 11-13 years), 5 parents, 2 counsellors	Attendance	Yes	HIV infected children missed school.
7	Cluver (2012)	South Africa	Interviews	Children lived in a household with an AIDS-ill individual	659 children and youths (aged 10-20)	Attendance and dropout	Yes	Children missed school or dropped out of school to care for sick adults.
13	Fauk et al. (2017)	Tanzania	In-depth interviews	Children were HIV/AIDS orphans	20 heads of household caring for AIDS-orphaned children, two government staff, two from a non-governmental organization	Attendance, dropout	No	Participants did not send their children to school due to school fees and other school-related expenses.
15	Grant (2008)	Malawi	Interviews	Mothers were tested for HIV	60 adults (aged 25-50 years) who were a parent of at least one child aged 6 to 18 years	Enrollment and Attendance	Yes	Parents were committed to ensure their children were enrolled in school while their children's matters were still in their control.
17	Harms (2010)	Uganda	Interviews	Youth had lost or both parents to HIV/AIDS	13 youth (with mean age of 15) who had lost 1 or both parents to HIV/AIDS who were affiliated with a non-governmental organization providing support to orphans	Attendance and absenteeism	No	Six of the youth were not attending school at the time of the study. The most poignant losses were actual death of parent and loss of educational opportunities. The time of parental sickness was marked by extended periods of absenteeism.

Ref no.	Author (year)	Country	Method	HIV-positive Population/HIV-testing	Description	Education Variable	Mixed-methods Study	Results
20	Henning (2016)	Zambia	Focus group discussions and interviews	Children have lost one or more parents to HIV/AIDS or have a parent or household member who's been sick for 3 months or more	6 focus groups with children (aged 10-18) at 6 different schools (8-10 children per group). 12 key informant interviews	Attendance	Yes	Households with HIV/AIDS affected children were more likely to have all HIV/AIDS affected children attending school if all of the HIV/AIDS affected children were relate to household head. Key informant interviews focused on two key themes connected to school attendance (1) training and (2) stigma. Teachers were overwhelmed by the number of HIV/AIDS affected children.
24	Jepkemboi and Aldridge (2014)	Kenya	Interviews	Children were HIV/AIDS orphans or had at least one HIV/AIDS-ill parent	12 teachers and 8 caregivers from 7 orphanages participated in study	attitude towards school	No	A majority of children don't like to come to school. Teachers noticed that children's attitude towards school improves after two years being in orphanage. Girls were more persistent and had a more positive attitude.
25	Jere (2012)	Malawi	Focus group discussions and interviews	Children are HIV-positive, have lost one parent to AIDS, children have an HIV/AIDS-ill parent or guardian, or live in a household affected by HIV/AIDS	Key informant interviews were performed on teachers and school heads	Dropout, absenteeism, pupil promotion	Yes	Teachers attested children who were targeted for the school-based intervention became more capable and confident learners. Evidence from the interviews showed that this was a result of pupils' perception of their improved competency in English and Mathematics.
26	Kakooza and Kimuna (2006)	Uganda	Focus group discussions	Children were HIV/AIDS orphans	12 focus group discussions were held from 2 sub-counties. Participants were heads of household, grandparents, caring or HIV/AIDS orphans, and were aged 50 years or over	Attendance, dropout	No	Grandparents had difficulty providing for children's education
28	Kembo (2010)	Zimbabwe	Semi-structured interviews and letter writing	Children were AIDS orphans or lived with a chronically ill person	Semi-structured interviews were conducted with children (aged 10-18 years). 12	Dropout, attendance, absenteeism	Yes	Qualitative data shows that some children affected by HIV/AIDS lack money to attend school. They also face

Ref no.	Author (year)	Country	Method	HIV-positive Population/HIV-testing	Description	Education Variable	Mixed-methods Study	Results
					children were asked to write letters to their parents, regardless of their survival status and tell them how they feel about their lives.			hunger which affects their performance in school.
37	Nyasani (2009)	South Africa	Focus group discussions and interviews	Grandparents were registered as foster-carers to orphans affected by HIV/AIDS	Focus group discussions were conducted with a total of 45 participants. The groups were included elderly female foster-carers, community leaders, urban and rural elderly foster-carers. In-depth and key informant interviews were also performed.	Educational needs	No	Rural grandparents were concerned with meeting educational needs of children. The data revealed that the prospects for orphans' tertiary education was disquieting for both rural and urban grandparents.
40	Poulsen (2006)	South Africa and Swaziland	Semi-structured interviews	Children were HIV/AIDS orphans, had parents who were AIDS-ill, or were HIV-infected	Interviews were conducted with head-teachers, teachers, parents and caregivers, school committee members, members of Orphans and Vulnerable Children Committees, members of Child Care Forums, students, and out-of-school children.	Attendance	No	Children affected by HIV/AIDS were missing school or dropping out due to parental illness, abuse, disrupted family lives, lack of money, lack of support from home, living with grandparents, household duties.
45	Skovdal and Ogutu (2009)	Kenya	Case studies	Children provide care for people chronically ill from AIDS	Data collection involved photography and 3 highlighted case studies	Grade repetition and dropout	No	Being a child carer compromised education for example, through grade repetition and dropout. Young carer juggle household duties, caregiving, and education.

Appendix 4: Results from the Mixed-Methods Appraisal Tool (Chapter 2)

The Mixed-Methods Appraisal Tool used in this study can be found on this link:
http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/84371689/MMAT%202011%20criteria%20and%20tutorial%202011-06-29updated2014.08.21.pdf

There are four criteria (in question format) to be met for each qualitative or quantitative study component. A score of 25% is assigned for each criterion met. For mixed-methods study papers, there is an additional mixed-methods study component that contains three criteria. A score of 0 in the mixed-methods study component is equivalent to a score of 1 (or 25%) in the other study components; a score of 1 in the mixed-methods study component is equivalent to a score of 2 (or 50%), etc. (Pluye et al., 2011). The overall quality score for a mixed-methods paper is the lowest score of any of the three (qualitative, quantitative, or mixed) study components. For example, if the qualitative component of a mixed-methods study has a score of 2, the quantitative component has a score of 2, and the mixed-methods component has a score of 0, then overall score will be 25%.

Quality Assessment for quantitative studies using the Mixed-Methods Appraisal Tool

Ref. no	Author (Year)	Type of Study	Methodological quality criteria for randomized/ non-randomized/ descriptive studies				Score
			Is there good description of randomization/ minimum selection bias/ relevant sampling strategy?	Is there clear description of allocation concealment /appropriate measurements/ representative sample?	Are there complete outcome data/ comparable participants/ appropriate measurements?	Is there low dropout rate/ complete outcome data/ acceptable response rate?	
1	Akbulut-Yuksel and Turan (2013)	Non-randomized	Yes	Yes	Yes	Yes	100%
2	Aspaas (1999)	Descriptive	Yes	Yes	Yes	I can't tell	75%
5	Bele et al. (2011)	Non-randomized	I can't tell	Yes	Yes	No	50%
6	Bhargava (2005)	Non-randomized	Yes	Yes	Yes	Yes	100%
8	Cluver et al. (2013)	Non-randomized	Yes	Yes	Yes	Yes	100%
9	Cohen (1997)	Non-randomized	Yes	Yes	Yes	Yes	100%
10	Curley et al. (2010)	Non-randomized	No	Yes	Yes	Yes	100%
11	Delva et al. (2009)	Non-randomized	No	Yes	Yes	Yes	75%
12	Ellis (2004)	Descriptive	No	No	Yes	Yes	50%
14	Floyd et al. (2007)	Non-randomized	Yes	Yes	Yes	Yes	100%
15	Fofana et al. (2014)	Non-randomized	Yes	Yes	Yes	No	75%
16	Fotso et al. (2019)	Non-randomized	Yes	Yes	Yes	Yes	100%
18	Gupta (2012)	Non-randomized	No	No	No	I can't tell	0%
20	Harrison et al. (2017)	Randomized	No	Yes	I can't tell	I can't tell	25%
21	Harrison et al. (2018)	Randomized	No	Yes	I can't tell	I can't tell	25%
23	Henning et al. (2018)	Non-randomized	Yes	Yes	Yes	Yes	100%
25	Hensels et al. (2016)	Non-randomized	Yes	No	I can't tell	Yes	100%
26	Hong et al. (2011)	Non-randomized	No	Yes	Yes	Yes	100%
31	Kasirye and Hisali (2010)	Non-randomized	Yes	Yes	Yes	Yes	100%

Ref. no	Author (Year)	Type of Study	Methodological quality criteria for randomized/ non-randomized/ descriptive studies				Score
			Is there good description of randomization/ minimum selection bias/ relevant sampling strategy?	Is there clear description of allocation concealment /appropriate measurements/ representative sample?	Are there complete outcome data/ comparable participants/ appropriate measurements?	Is there low dropout rate/ complete outcome data/ acceptable response rate?	
33	Kidman et al. (2012)	Non-randomized	Yes	Yes	Yes	Yes	100%
34	Kitara et al. (2013)	Non-randomized	Yes	Yes	Yes	Yes	100%
35	Lucas et al. (2019)	Non-randomized	Yes	Yes	Yes	Yes	100%
36	Luseno et al. (2015)	Randomized and Non-randomized	Yes	I can't tell	No	Yes	50%
37	Mayes et al. (1996)	Descriptive	Yes	Yes	Yes	Yes	100%
38	Mialky (2001)	Descriptive	Yes	I can't tell	No	No	25%
39	Mishra (2007)	Non-randomized	Yes	Yes	Yes	Yes	100%
40	Mokgatle and Madiba (2015)	Descriptive	Yes	No	Yes	Yes	100%
41	Mon et al. (2013)	Non-randomized	Yes	No	No	I can’t tell	25%
42	Nicholson et al. (2015)	Non-randomized	No	Yes	Yes	Yes	75%
44	Orkin et al. (2014)	Non-randomized	No	Yes	Yes	Yes	75%
46	Parchure et al. (2016)	Non-randomized	I can’t tell	Yes	Yes	I can’t tell	50%
45	Osuji et al. (2018)	Randomized	No	Yes	Yes	No	50%
48	Pufall et al. (2014 a)	Non-randomized	Yes	Yes	Yes	Yes	100%
49	Pufall et al. (2014 b)	Non-randomized	Yes	Yes	Yes	Yes	100%
50	Ryder (1994)	Non-randomized	Yes	Yes	Yes	I can't tell	75%
51	Sherr et. al (2017)	Non-randomized	No	No	I can't tell	I can't tell	0%
53	Souza et. al (2010)	Non-randomized	Yes	Yes	Yes	Yes	100%
54	Ssewamala et al. (2008)	Randomized	Yes	Yes	Yes	Yes	100%
55	Ssewamala et al. (2018)	Randomized	Yes	Yes	Yes	Yes	100%
56	Toska et al. (2019)	Non-randomized	Yes	Yes	Yes	Yes	100%

Ref. no	Author (Year)	Type of Study	Methodological quality criteria for randomized/ non-randomized/ descriptive studies				Score
			Is there good description of randomization/ minimum selection bias/ relevant sampling strategy?	Is there clear description of allocation concealment /appropriate measurements/ representative sample?	Are there complete outcome data/ comparable participants/ appropriate measurements?	Is there low dropout rate/ complete outcome data/ acceptable response rate?	
57	Tu et al. (2009)	Non-randomized	Yes	Yes	Yes	Yes	100%
58	Xu et al. (2010 a)	Non-randomized	No	Yes	Yes	I can't tell	75%
59	Xu et al (2010 b)	Descriptive	Yes	No	Yes	I can't tell	25%
60	Xu et al. (2010 c)	Descriptive	Yes	No	Yes	Yes	75%
61	Yang (2006)	Non-randomized	No	Yes	Yes	Yes	75%
62	Zivin et al. (2009)	Non-randomized	No	Yes	Yes	I can't tell	50%

Quality Assessment for mixed-methods studies using the Mixed-Methods Appraisal Tool

Ref no.	Author (year)	Type	Methodological quality criteria for randomized/ non-randomized/ descriptive studies				Methodological quality criteria for qualitative component of mixed-methods studies				Methodological quality criteria for mixed-methods studies			Score
			Is there good description of randomization/ minimum selection bias/ relevant sampling strategy?	Is there clear description of allocation concealment /appropriate measurements/ representative sample?	Are there complete outcome data/ comparable participants/ appropriate measurements?	Is there low dropout rate/ complete outcome data/ acceptable response rate?	Are sources of data relevant to address research question?	Is the process of analyzing data relevant to address research question?	Is consideration given to how findings relate to context?	Is consideration given to how findings relate to researchers influence?	Is a mixed methods research design relevant?	Is it relevant to use qualitative and quantitative data?	Is consideration given to limitation of integrating qualitative and quantitative data?	
2	Anabwani et al. (2016)	Quantitative descriptive and qualitative	Yes	Yes	Yes	Yes	Yes	I can't tell	Yes	Yes	Yes	Yes	No	75%
4	Bandason et al. (2013)	Qualitative non-randomized and qualitative	Yes	Yes	Yes	I can't tell	Yes	Yes	Yes	I can't tell	No	Yes	No	50%
7	Cluver et al. (2012)	Quantitative non-randomized and qualitative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	75%
17	Grant (2008)	Quantitative non-randomized and qualitative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%
24	Henning et al. (2016)	Quantitative non-randomized and qualitative	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	75%
29	Jere (2012)	Quantitative non-randomized and qualitative	Yes	Yes	No	Yes	I can't tell	Yes	Yes	Yes	Yes	Yes	No	75%
32	Kembo (2010)	Quantitative descriptive and qualitative	No	Yes	No	Yes	No	Yes	I can't tell	Yes	Yes	I can't tell	I can't tell	50%

Quality assessment of qualitative studies using the Mixed-Methods Appraisal Tool

Ref no.	Author (year)	Are sources of data relevant?	Is the process of analyzing data relevant?	Is consideration given to how findings relate to context?	Is consideration given to how findings relate to researchers' influence?	MMAT Score
13	Fauk et al. (2017)	Yes	Yes	Yes	I can't tell	75%
19	Harms (2010)	Yes	Yes	Yes	Yes	100%
22	Hartell and Chabilall (2005)	Yes	Yes	Yes	I can't tell	75%
27	Jepkemboi & Aldridge (2009)	Yes	Yes	Yes	No	75%
28	Jepkemboi & Aldridge (2014)	Yes	Yes	I can't tell	No	50%
30	Kakooza & Kimuna (2006)	Yes	Yes	Yes	Yes	100%
43	Nyasani (2009)	Yes	Yes	Yes	Yes	100%
47	Poulsen (2006)	Yes	Yes	I can't tell	I can't tell	50%
52	Skoval and Ogutu (2009)	Yes	Yes	I can't tell	Yes	75%

Appendix 5: PRISMA Checklist (Chapter 2)

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	25
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	23
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	26
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	28
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	29
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	30

Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	30
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	31
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	34
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	35-36
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	

Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	36-39
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	42-43
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	42-43
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Appendix 6: Logit regressions for boys aged 6-18, 6-12, 13-18, and 15-18 years (Chapter 3)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Boys aged 6-18 years	Boys aged 6-12 years	Boys aged 13-18 years	Boys aged 15-18 years	Marginal Effects boys 6-18 years	Marginal Effects boys 15-18 years
HIV-positive	-0.170	-0.302	-0.109	-0.563	-0.012	-0.106
	(0.280)	(0.748)	(0.329)	(0.417)	(0.015)	(0.068)
Anemia				0.283		0.063
				(0.325)		(0.075)
Age of Child	0.303***	-0.224***	0.585***	0.493***	0.019***	0.104***
	(0.016)	(0.047)	(0.042)	(0.075)	(0.001)	(0.016)
orphan	-0.014	-0.398	0.112	0.049	-0.001	0.011
	(0.115)	(0.270)	(0.141)	(0.165)	(0.007)	(0.035)
Ever married				0.361		0.081
				(0.354)		(0.083)
Currently working				1.102**		0.260**
				(0.468)		(0.114)
Mother no education	0.516***	0.533**	0.562**	0.712**	0.038***	0.164**
	(0.173)	(0.256)	(0.243)	(0.292)	(0.014)	(0.071)
Father no education	0.656***	0.471	0.645**	0.762*	0.054**	0.178*
	(0.225)	(0.323)	(0.325)	(0.412)	(0.023)	(0.102)
Mother education missing	1.104***	0.671*	0.946***	1.358***	0.070***	0.247***
	(0.184)	(0.385)	(0.251)	(0.317)	(0.012)	(0.047)
Father education missing	0.443**	-0.337	0.338	1.063**	0.026**	0.189***
	(0.208)	(0.399)	(0.289)	(0.468)	(0.011)	(0.066)
Mother HIV-positive	0.168	0.455	0.002	0.428	0.012	0.097
	(0.219)	(0.331)	(0.308)	(0.362)	(0.016)	(0.086)
Father HIV-positive	-0.510	-0.206	-0.797	-1.643**	-0.027*	-0.232***
	(0.333)	(0.469)	(0.495)	(0.797)	(0.014)	(0.061)
Rural	0.120	-0.944*	0.257	0.190	0.008	0.040

	(0.211)	(0.567)	(0.247)	(0.267)	(0.013)	(0.055)
Mother living in the household	0.423***	0.163	0.267	0.248	0.026***	0.052
	(0.154)	(0.378)	(0.199)	(0.234)	(0.009)	(0.049)
Father living in the household	-0.029	-0.550	-0.294	-0.139	-0.002	-0.030
	(0.162)	(0.370)	(0.210)	(0.247)	(0.010)	(0.052)
Female headed household	-0.298***	-0.355	-0.329***	-0.248*	-0.019***	-0.052*
	(0.104)	(0.232)	(0.124)	(0.138)	(0.006)	(0.029)
Number people living in household	0.015	0.128***	0.007	0.014	0.001	0.003
	(0.016)	(0.035)	(0.020)	(0.022)	(0.001)	(0.005)
Age of household head	-0.004	0.005	-0.003	-0.003	-0.000	-0.001
	(0.003)	(0.007)	(0.004)	(0.004)	(0.000)	(0.001)
Poorest	1.560***	3.999***	1.391***	1.343***	0.150***	0.314***
	(0.260)	(0.814)	(0.300)	(0.328)	(0.035)	(0.077)
Poor	1.342***	3.732***	1.143***	1.008***	0.120***	0.232***
	(0.256)	(0.812)	(0.292)	(0.315)	(0.031)	(0.075)
Middle	1.073***	3.109***	0.929***	0.920***	0.090***	0.208***
	(0.254)	(0.820)	(0.287)	(0.309)	(0.027)	(0.072)
Richer	1.029***	2.378***	0.927***	0.868***	0.088***	0.198***
	(0.204)	(0.649)	(0.231)	(0.246)	(0.022)	(0.058)
Manicaland	-0.402	-1.023**	-0.258	-0.435	-0.022*	-0.086
	(0.261)	(0.505)	(0.315)	(0.334)	(0.013)	(0.061)
Mashonaland Central	-0.032	-0.859*	0.177	0.044	-0.002	0.009
	(0.259)	(0.495)	(0.314)	(0.334)	(0.016)	(0.072)
Mashonaland East	-0.113	-0.586	-0.065	-0.132	-0.006	-0.027
	(0.271)	(0.512)	(0.330)	(0.349)	(0.016)	(0.071)
Mashonaland West	-0.266	-0.691	-0.179	-0.313	-0.015	-0.063
	(0.262)	(0.497)	(0.318)	(0.337)	(0.014)	(0.064)
Matabeleland North	0.128	-2.957***	0.813***	0.796**	0.009	0.184**
	(0.260)	(0.738)	(0.315)	(0.339)	(0.018)	(0.083)
Matabeleland South	0.532**	-0.599	0.986***	1.011***	0.041*	0.238***
	(0.256)	(0.497)	(0.316)	(0.342)	(0.023)	(0.084)
Midlands	0.121	-0.872*	0.388	0.186	0.008	0.040

	(0.256)	(0.506)	(0.308)	(0.328)	(0.018)	(0.073)
Masvingo	-0.125	-0.515	-0.138	-0.197	-0.007	-0.040
	(0.259)	(0.491)	(0.315)	(0.334)	(0.015)	(0.066)
Bulawayo	0.174	-0.082	0.324	0.153	0.013	0.033
	(0.300)	(0.620)	(0.355)	(0.377)	(0.022)	(0.084)
Constant	-8.286***	-3.879***	-12.578***	-12.033***		
	(0.382)	(0.955)	(0.739)	(1.253)		
Observations	5,908	3,452	2,456	1,518	5,908	1,518
r2_p	0.218	0.121	0.208	0.156		
chi2	982.8	144.6	572.8	304.5		

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

Appendix 7: Logit regressions for girls aged 6-18, 6-12, and 13-18 years (Chapter 3)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Girls aged 6-18 years	Girls aged 6-12 years	Girls aged 13-18 years	Girls aged 15-18 years	Marginal Effects girls 6-18 years	Marginal Effects girls 15-18 years
HIV-positive	0.668***	0.523	0.558*	0.696**	-0.106	0.170**
	(0.239)	(0.606)	(0.285)	(0.343)	(0.068)	(0.085)
Anemia				-0.025	0.063	-0.006
				(0.210)	(0.075)	(0.049)
Age of child	0.418***	-0.453***	0.775***	0.733***	0.104***	0.171***
	(0.020)	(0.068)	(0.047)	(0.087)	(0.016)	(0.020)
orphan	-0.152	0.818***	-0.250*	-0.351**	0.011	-0.080**
	(0.119)	(0.286)	(0.142)	(0.177)	(0.035)	(0.039)
Ever married				2.790***	0.081	0.587***
				(0.245)	(0.083)	(0.032)
Currently working				-0.053	0.260**	-0.012
				(0.484)	(0.114)	(0.111)
Mother no education	0.813***	0.675*	0.984***	1.088***	0.164**	0.265***
	(0.202)	(0.347)	(0.263)	(0.324)	(0.071)	(0.077)
Father no education	0.351	-0.010	0.542	0.348	0.178*	0.084
	(0.276)	(0.469)	(0.363)	(0.473)	(0.102)	(0.117)
Mother education missing	1.198***	-0.318	1.158***	0.872**	0.247***	0.188***
	(0.216)	(0.656)	(0.285)	(0.358)	(0.047)	(0.069)
Father education missing	0.802***	0.142	0.511	0.529	0.189***	0.116
	(0.235)	(0.489)	(0.316)	(0.465)	(0.066)	(0.094)
Mother HIV-positive	0.371	0.291	0.474	0.280	0.097	0.067
	(0.236)	(0.432)	(0.306)	(0.391)	(0.086)	(0.096)
Father HIV-positive	-0.425	-0.065	-0.461	-0.313	-0.232***	-0.070
	(0.360)	(0.608)	(0.471)	(0.585)	(0.061)	(0.123)
Rural	-0.009	-0.374	0.096	0.114	0.040	0.026
	(0.204)	(0.638)	(0.233)	(0.269)	(0.055)	(0.062)

Mother living in the household	-0.229	-1.019	-0.531**	-0.663**	0.052	-0.155**
	(0.167)	(0.640)	(0.210)	(0.261)	(0.049)	(0.061)
Father living in the household	0.296*	-0.226	-0.084	-0.089	-0.030	-0.021
	(0.171)	(0.450)	(0.219)	(0.271)	(0.052)	(0.063)
Female headed household	-0.357***	-0.317	-0.437***	-0.369**	-0.052*	-0.086**
	(0.107)	(0.280)	(0.125)	(0.151)	(0.029)	(0.035)
Number people living in household	0.022	0.113***	0.007	0.015	0.003	0.004
	(0.018)	(0.043)	(0.021)	(0.024)	(0.005)	(0.006)
Age of household head	-0.019***	-0.006	-0.017***	-0.013***	-0.001	-0.003***
	(0.003)	(0.009)	(0.004)	(0.004)	(0.001)	(0.001)
Poorest	1.462***	2.903***	1.544***	1.144***	0.314***	0.277***
	(0.248)	(0.828)	(0.288)	(0.341)	(0.077)	(0.081)
Poor	0.959***	2.399***	1.064***	0.650*	0.232***	0.157*
	(0.248)	(0.835)	(0.285)	(0.338)	(0.075)	(0.083)
Middle	0.633***	2.232***	0.556**	0.039	0.208***	0.009
	(0.245)	(0.830)	(0.279)	(0.331)	(0.072)	(0.077)
Richer	0.544***	1.374**	0.545***	0.358*	0.198***	0.085*
	(0.165)	(0.607)	(0.187)	(0.209)	(0.058)	(0.050)
Manicaland	-0.694***	-1.525***	-0.730***	-1.067***	-0.086	-0.212***
	(0.226)	(0.521)	(0.267)	(0.324)	(0.061)	(0.052)
Mashonaland Central	-0.415*	-1.404***	-0.304	-0.578*	0.009	-0.125**
	(0.222)	(0.522)	(0.265)	(0.317)	(0.072)	(0.062)
Mashonaland East	-0.775***	-2.367***	-0.669**	-0.725**	-0.027	-0.153***
	(0.233)	(0.671)	(0.270)	(0.314)	(0.071)	(0.058)
Mashonaland West	-0.694***	-1.593***	-0.698***	-0.838***	-0.063	-0.173***
	(0.225)	(0.536)	(0.265)	(0.311)	(0.064)	(0.055)
Matabeleland North	-0.762***	-2.882***	-0.462*	-0.187	0.184**	-0.043
	(0.233)	(0.660)	(0.274)	(0.315)	(0.083)	(0.070)
Matabeleland South	-0.437*	-2.012***	-0.185	0.179	0.238***	0.042
	(0.232)	(0.590)	(0.275)	(0.316)	(0.084)	(0.076)
Midlands	-0.497**	-1.802***	-0.392	-0.330	0.040	-0.074
	(0.222)	(0.559)	(0.262)	(0.302)	(0.073)	(0.064)

Masvingo	-1.080***	-2.308***	-1.090***	-1.327***	-0.040	-0.252***
	(0.234)	(0.590)	(0.272)	(0.325)	(0.066)	(0.046)
Bulawayo	-0.230	-0.818	-0.175	0.099	0.033	0.023
	(0.229)	(0.659)	(0.263)	(0.287)	(0.084)	(0.068)
Constant	-8.439***	0.017	-13.660***	-13.050***	-0.106	
	(0.396)	(1.167)	(0.771)	(1.362)		
Observations	5,765	3,323	2,442	1,515	5,765	1,515
r2_p	0.308	0.154	0.274	0.297		
chi2	1377	125.2	783.9	602.4		

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

Appendix 8: Logit regression for HIV-positive children aged 6-18 years (Chapter 3)

Dependent variable: non-attendance (1 if child did not attend school in previous school year, 0 otherwise)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Marginal Effects
Girl	0.932***	0.802**	0.973**	1.024**	1.013**	0.064**
	(0.311)	(0.367)	(0.390)	(0.404)	(0.428)	(0.031)
Age of child		0.400***	0.407***	0.424***	0.433***	0.027***
		(0.075)	(0.086)	(0.091)	(0.096)	(0.007)
Orphan		-0.676*	-0.250	-0.382	-0.430	-0.027
		(0.389)	(0.504)	(0.525)	(0.554)	(0.037)
Mother no education		3.378***	3.164***	2.813**	2.994**	0.458*
		(1.179)	(1.186)	(1.168)	(1.205)	(0.241)
Father no education		-0.502	-1.109	-1.020	-1.175	-0.048
		(1.435)	(1.425)	(1.397)	(1.478)	(0.039)
Mother education missing		2.736	2.696	2.507	3.296	0.169*
		(1.680)	(1.739)	(1.736)	(2.018)	(0.101)
Father education missing		-0.549	-0.667	-0.489	-0.134	-0.009
		(1.034)	(1.251)	(1.292)	(1.398)	(0.095)
Mother HIV-positive		0.505	0.629	0.730	1.557	0.134
		(1.374)	(1.446)	(1.435)	(1.720)	(0.195)
Father HIV-positive		-1.099	-1.614	-1.665	-1.282	-0.053
		(1.296)	(1.292)	(1.293)	(1.343)	(0.038)
Rural			0.972**	-1.365	-1.502	-0.129
			(0.465)	(1.360)	(1.491)	(0.171)
Mother living in the household			0.515	0.414	0.207	0.013
			(0.704)	(0.765)	(0.820)	(0.052)
Father living in the household			0.289	0.246	0.334	0.022
			(0.746)	(0.828)	(0.897)	(0.064)

Female headed household	-0.675	-0.838*	-0.745	-0.049
	(0.412)	(0.443)	(0.480)	(0.034)
Number people living in household	0.105*	0.118**	0.131**	0.008*
	(0.056)	(0.058)	(0.064)	(0.004)
Age of household head	-0.009	-0.012	-0.014	-0.001
	(0.011)	(0.011)	(0.012)	(0.001)
Poorest		3.079**	3.447**	0.467
		(1.566)	(1.740)	(0.333)
Poor		2.742*	3.054*	0.427
		(1.522)	(1.682)	(0.347)
Middle		2.401	2.783*	0.340
		(1.531)	(1.683)	(0.309)
Richer		0.472	0.451	0.032
		(0.796)	(0.842)	(0.068)
Manicaland			-0.981	-0.045
			(0.975)	(0.034)
Mashonaland Central			-0.472	-0.025
			(1.079)	(0.048)
Mashonaland East			-2.433**	-0.081***
			(1.205)	(0.029)
Mashonaland West			-0.860	-0.040
			(1.101)	(0.038)
Matabeleland North			-0.929	-0.045
			(1.061)	(0.041)
Matabeleland South			-0.380	-0.021
			(0.989)	(0.048)
Midlands			0.455	0.033
			(1.023)	(0.087)
Masvingo			-0.953	-0.042

					(1.192)	(0.037)
Bulawayo					-0.588	-0.029
					(1.156)	(0.046)
Constant	-1.946***	-9.141***	-10.239***	-10.450***	-11.115***	
	(0.252)	(2.264)	(2.490)	(2.516)	(2.989)	
Observations	298	298	298	298	298	298
r2_p	0.0323	0.317	0.356	0.377	0.413	
chi2	9.580	94.07	105.4	111.8	122.6	

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

Appendix 9: OLS Regression (of IVs and Controls) on Years of Education (Chapter 4)

VARIABLES	Total years of education
HIV positive	-0.408**
	(0.166)
Early Circumcision	-0.113
	(0.142)
Age	0.219***
	(0.0127)
Age of first sex before 15 years	-0.0424
	(0.171)
Head of household	0.766***
	(0.129)
Female headed household	0.282***
	(0.0766)
Son of household head	0.505***
	(0.0775)
Married	-0.420***
	(0.141)
Rural	-0.503***
	(0.131)
Number of children	-0.446***
	(0.0786)
Double Orphan	0.480*
	(0.272)
Maternal orphan	-0.256
	(0.194)
Paternal orphan	-0.439***
	(0.131)
Poorest	-2.794***
	(0.183)

Poor	-1.970***
	(0.170)
Middle	-1.498***
	(0.164)
Richer	-0.846***
	(0.112)
Traditional	-0.384
	(0.269)
Catholic	1.232***
	(0.149)
Protestant	1.074***
	(0.126)
Pentecostal	0.965***
	(0.125)
Apostolic	0.351***
	(0.111)
Other Christian	0.586***
	(0.155)
Manicaland	-0.274*
	(0.144)
Mashonaland Central	-0.546***
	(0.147)
Mashonaland East	-0.173
	(0.153)
Mashonaland West	-0.104
	(0.139)
Matabeleland North	-0.395**
	(0.163)
Matabeleland South	-0.478***
	(0.158)
Midlands	-0.436***

	(0.144)
Masvingo	-0.228
	(0.159)
Bulawayo	-0.306*
	(0.156)
Constant	5.956***
	(0.297)
Observations	4,130
R-squared	0.393

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 10: First Stage Probit Regression Results (Chapter 4)

VARIABLES	HIV-positive
Early circumcision	-0.448**
	(0.214)
Age	0.0697***
	(0.0121)
Age of first sex before 15 years	-0.349*
	(0.192)
Head of household	0.0166
	(0.116)
Female headed household	0.271***
	(0.0863)
Son of household head	-0.207**
	(0.0939)
Married	-0.236*
	(0.137)
Rural	-0.0545
	(0.151)
Number of children	0.135**
	(0.0679)
Double orphan	0.378
	(0.334)
Maternal orphan	0.538**
	(0.254)
Paternal orphan	0.0601
	(0.202)
Poorest	-0.145
	(0.195)
Poor	-0.0108

	(0.186)
Middle	-0.0429
	(0.181)
Richer	-0.157
	(0.119)
Traditional	0.0721
	(0.294)
Catholic	-0.0890
	(0.170)
Protestant	-0.100
	(0.136)
Pentecostal	-0.0898
	(0.128)
Apostolic	0.133
	(0.107)
Other Christian	-0.149
	(0.169)
Manicaland	-0.159
	(0.168)
Mashonaland Central	-0.0747
	(0.164)
Mashonaland East	-0.0812
	(0.182)
Mashonaland West	0.0372
	(0.161)
Matabeleland North	0.0397
	(0.173)
Matabeleland South	0.104
	(0.163)
Midlands	-0.0306
	(0.166)
Masvingo	-0.0929

	(0.181)
Bulawayo	0.154
	(0.161)
Constant	-3.206***
	(0.319)
Observations	4,130

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 11: Probit 2SLS and Heckit Regressions (Chapter 4)

	(PS2LS)	(Heckit)
VARIABLES	Total years of education	Total years of education
HIV-positive	-5.079	-4.718***
	(3.446)	(1.370)
Age	0.332***	0.288***
	(0.0317)	(0.0207)
Age of first sex before 15 years	-0.102	-0.315*
	(0.207)	(0.182)
Head of household	0.704***	0.761***
	(0.175)	(0.129)
Female headed household	0.414***	0.516***
	(0.109)	(0.0920)
Son of household head	0.426***	0.341***
	(0.107)	(0.0865)
Married	-1.275***	-0.729***
	(0.307)	(0.158)
Rural	-0.255	-0.554***
	(0.199)	(0.131)
Number of children	-0.300**	-0.241**
	(0.145)	(0.0965)
Orphan	0.420	1.158***
	(0.423)	(0.328)
Maternal orphan	-0.259	0.195
	(0.257)	(0.229)
Paternal orphan	-0.417***	-0.422***
	(0.139)	(0.131)
Poorest	-2.649***	-2.924***
	(0.256)	(0.187)
Poor	-1.809***	-1.979***
	(0.239)	(0.169)

Middle	-1.446***	-1.538***
	(0.212)	(0.164)
Richer	-0.814***	-0.991***
	(0.143)	(0.117)
Traditional	-0.467	-0.311
	(0.344)	(0.270)
Catholic	1.221***	1.142***
	(0.224)	(0.151)
Protestant	0.881***	0.986***
	(0.169)	(0.128)
Pentecostal	0.856***	0.883***
	(0.167)	(0.127)
Apostolic	0.359**	0.478***
	(0.158)	(0.114)
Other Christian	0.542***	0.457***
	(0.210)	(0.159)
Manicaland	-0.433**	-0.428***
	(0.191)	(0.147)
Mashonaland Central	-0.599***	-0.606***
	(0.196)	(0.146)
Mashonaland East	-0.186	-0.254*
	(0.201)	(0.153)
Mashonaland West	0.00996	-0.0681
	(0.202)	(0.139)
Matabeleland North	-0.490**	-0.375**
	(0.215)	(0.164)
Matabeleland South	-0.410*	-0.380**
	(0.225)	(0.161)
Midlands	-0.376*	-0.462***
	(0.200)	(0.143)
Masvingo	-0.280	-0.311*
	(0.207)	(0.160)
Bulawayo	-0.323	-0.181

	(0.202)	(0.159)
_ws_Age	-1.531***	-0.0118
	(0.490)	(0.0428)
_ws_Married	10.73*	0.218
	(5.887)	(0.459)
_ws_Rural	-8.690**	0.161
	(3.711)	(0.342)
_wL1		1.739***
		(0.607)
_wL0		-6.348***
		(1.663)
Constant	3.840***	5.132***
	(0.587)	(0.346)
Observations	4,130	4,130
R-squared		0.396

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 12: Seemingly Unrelated Bivariate Probit Regressions (Chapter 4)

VARIABLES	(1) HIV-positive	(2) Complete primary	(3) HIV-positive	(4) Complete secondary	(5) HIV-positive	(6) Higher education
HIV-positive		1.255*		-0.222		-1.759***
		(0.666)		(1.225)		(0.187)
Early Circumcision	-0.478**		-0.521*		-0.519*	
	(0.225)		(0.315)		(0.301)	
Age	0.0677***	-0.00686	0.0656***	0.0393**	0.0836***	0.125***
	(0.0122)	(0.00943)	(0.0136)	(0.0154)	(0.0183)	(0.0159)
Age of first sex before 15 years	-0.327	-0.0593	-0.391*	0.0765	-0.315	0.252
	(0.206)	(0.118)	(0.235)	(0.189)	(0.249)	(0.187)
Head of household	0.0241	-0.209**	0.0333	0.195	0.0823	0.463***
	(0.121)	(0.0955)	(0.126)	(0.131)	(0.138)	(0.118)
Female headed household	0.263***	-0.161**	0.282***	0.105	0.325***	0.153
	(0.0906)	(0.0652)	(0.101)	(0.100)	(0.120)	(0.101)
Son of household head	-0.205**	-0.170**	-0.195*	0.345***	-0.145	0.205**
	(0.0938)	(0.0665)	(0.100)	(0.0986)	(0.117)	(0.103)
Married	-0.222*	0.00477	-0.244*	-0.0908	-0.354***	-0.278**
	(0.126)	(0.103)	(0.127)	(0.147)	(0.132)	(0.121)
Rural	-0.0534	0.490***	0.0206	-0.133	0.0126	-0.0265
	(0.150)	(0.126)	(0.157)	(0.134)	(0.173)	(0.133)
Number of children	0.136**	0.119**	0.133**	-0.0297	0.143**	-0.198***
	(0.0586)	(0.0537)	(0.0592)	(0.0807)	(0.0605)	(0.0751)
Orphan	0.410	-0.0466	0.461	0.444	-0.501	-0.868
	(0.338)	(0.258)	(0.570)	(630.1)	(214,316)	(851,907)
Maternal orphan	0.530**	-0.174	0.521	-4.055	-4.610	-5.161
	(0.263)	(0.204)	(0.377)	(498.5)	(15,167)	(65,323)
Paternal orphan	0.0521	0.147	-0.324	-0.348	-0.337	1.238
	(0.206)	(0.109)	(0.393)	(0.450)	(74,052)	(298,832)
Poorest	-0.176	0.804***	-0.149	-1.035***	-0.147	-1.592***
	(0.198)	(0.164)	(0.206)	(0.250)	(0.232)	(0.335)
Poor	0.0157	0.757***	-0.0108	-0.987***	-0.161	-1.403***
	(0.185)	(0.160)	(0.195)	(0.228)	(0.231)	(0.285)
Middle	-0.0482	0.584***	-0.113	-0.775***	-0.101	-1.197***
	(0.181)	(0.159)	(0.193)	(0.195)	(0.222)	(0.226)
Richer	-0.171	0.495***	-0.126	-0.248**	-0.112	-0.518***

	(0.120)	(0.134)	(0.127)	(0.107)	(0.134)	(0.102)
Traditional	0.0815	0.296	0.0700	0.126	-0.142	-4.169
	(0.294)	(0.189)	(0.306)	(0.481)	(0.368)	(37,478)
Catholic	-0.0747	-0.519***	-0.0963	0.485**	-0.0797	0.421**
	(0.171)	(0.154)	(0.180)	(0.201)	(0.193)	(0.175)
Protestant	-0.112	-0.286***	-0.201	0.567***	-0.418**	0.394**
	(0.137)	(0.105)	(0.151)	(0.179)	(0.178)	(0.155)
Pentecostal	-0.0751	-0.0983	-0.130	0.358**	-0.234	0.369**
	(0.128)	(0.0964)	(0.136)	(0.176)	(0.151)	(0.147)
Apostolic	0.115	0.0178	0.108	0.476***	0.0790	-0.163
	(0.109)	(0.0762)	(0.114)	(0.172)	(0.127)	(0.160)
Other Christian	-0.143	0.109	-0.179	0.356*	-0.325	0.368**
	(0.169)	(0.109)	(0.181)	(0.216)	(0.212)	(0.185)
Manicaland	-0.194	0.371**	-0.140	-0.182	-0.158	-0.00953
	(0.172)	(0.174)	(0.184)	(0.163)	(0.206)	(0.160)
Mashonaland Central	-0.0686	0.376**	-0.0471	-0.0635	-0.113	-0.0798
	(0.167)	(0.172)	(0.182)	(0.173)	(0.204)	(0.187)
Mashonaland East	-0.0387	0.624***	-0.0524	-0.00594	-0.105	-0.0319
	(0.179)	(0.176)	(0.196)	(0.176)	(0.220)	(0.188)
Mashonaland West	-0.00264	0.392**	0.0793	-0.00743	0.152	-0.144
	(0.167)	(0.175)	(0.176)	(0.161)	(0.191)	(0.174)
Matabeleland North	0.0120	0.832***	0.0601	0.132	-0.0737	0.0418
	(0.178)	(0.175)	(0.191)	(0.180)	(0.222)	(0.190)
Matabeleland South	0.0941	0.634***	0.181	-0.340*	0.202	0.0248
	(0.166)	(0.175)	(0.176)	(0.201)	(0.192)	(0.169)
Midlands	-0.0545	0.579***	0.0369	-0.350*	0.0946	0.104
	(0.168)	(0.173)	(0.179)	(0.182)	(0.195)	(0.160)
Masvingo	-0.0960	0.213	-0.0479	0.0723	-0.178	0.213
	(0.176)	(0.183)	(0.192)	(0.166)	(0.218)	(0.167)
Bulawayo	0.147	0.573***	0.228	-0.232	0.269	0.105
	(0.161)	(0.207)	(0.171)	(0.147)	(0.181)	(0.134)
athrho		-0.604		-0.0577		1.289***
		(0.368)		(0.557)		(0.398)
Constant	-3.150***	-2.329***	-3.158***	-2.618***	-3.538***	-3.926***
	(0.328)	(0.284)	(0.362)	(0.389)	(0.492)	(0.433)
Observations	4,130	4,130	3,336	3,336	2,240	2,240

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

Appendix 13: Participant Demographics (Chapter 5)

ID	Age	HIV Status	Education level	Marital status	Employment status	Partner`s Employment Status	Total Biological Children	Additional Children	# of Children Eligible for School	# of Children not Eligible for School	# of Children Attending School	# of Children Who Dropped Out of School
1	34	Positive	O'level	Married	Informal	Unemployed	5	0	4	1	4	0
2	50	Negative	O'level	Married	Cook	Informal	2	0	2	0	1	1
3	44	Positive	Some high school	Separated	Unemployed	Deceased	9	0	8	1	0	8
4	39	Positive	O'level	Married	Informal	Unemployed	5	0	4	1	3	1
5	37	Negative	O'level	Married	Informal	Informal	3	2	4	1	3	1
6	39	Positive	O'level	Separated	Informal	Informal	3	0	2	1	0	2
7	44	Negative	O'level	Separated	Cleaner	Police Officer	2	0	2	2	2	0
8	32	Positive	Completed Primary	Married	Informal	Unemployed	3	0	2	1	1	0
9	32	Positive	O'level	Married	Informal	Unemployed	4	0	4	0	0	4

ID	Age	HIV Status	Education level	Marital status	Employment status	Partner`s Employment Status	Total Biological Children	Additional Children	# of Children Eligible for School	# of Children not Eligible for School	# of Children Attending School	# of Children Who Dropped Out of School
10	42	Positive	Diploma	Married	Primary Care Counsellor	Unemployed	2	1	3	0	3	0
11	35	Positive	O'level	In partnership	Community Care Giver	Mechanic	3	2	5	0	3	2
12	43	Positive	Completed primary	Widowed	Informal	Security Guard	5	0	5	5	3	2
13	40	Positive	Completed primary	Separated	Sex Worker	Informal	3	3	6	0	3	3
14	46	Positive	Some high school	Separated	Sex Worker	Unemployed	4	2	6	0	3	2
15	36	Positive	A'level	Single	Informal	Mechanic	3	0	2	1	2	0
16	38	Positive	Diploma	Single	Informal	Deceased	5	0	4	1	4	0

Appendix 14: Children's characteristics (Chapter 5)

Participant ID	# of children	Gender		# of eligible children in school *below 19*		# of eligible children not in school *below 19*		# of children behind in school *below 19*		# of children not eligible for school *below 19*		# of children who dropped out *over 19*		# of children *over 19* still in school		# of adult children at home *over 19*		Children HIV status		Birth Certificates	
		Boys	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*+ve*	*-ve*	*Have*	*Don't have*
1	5	2	3	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	5	N/A	N/A
2	2	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2	0
3	9	2	7	0	0	2	4	2	4	0	0	0	3	0	0	0	1	0	9	6	3
4	5	3	2	2	2	0	1	1	1	1	0	0	0	0	0	0	0	0	5	4	1
5	5	4	1	2	1	1	0	0	0	1	0	0	0	0	0	0	0	0	5	4	1
6	3	2	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	2
7	2	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
8	3	1	2	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	3	0	3
9	4	2	2	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4	0	4
10	3	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0
11	5	1	4	0	3	0	1	0	0	0	0	1	0	0	0	1	1	1	4	4	0

Participant ID	# of children	Gender		# of eligible children in school *below 19*		# of eligible children not in school *below 19*		# of children behind in school *below 19*		# of children not eligible for school *below 19*		# of children who dropped out *over 19*		# of children *over 19* still in school		# of adult children at home *over 19*		Children HIV status		Birth Certificates	
		Boys	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*Boys*	*Girls*	*+ve*	*-ve*	*Have*	*Don't have*
12	5	2	3	1	2	0	1	0	0	0	0	1	0	0	0	1	0	0	5	5	0
13	6	4	2	2	1	1	1	0	0	0	0	1	1	0	0	1	1	0	6	6	0
14	6	3	3	1	0	0	0	0	0	1	1	1	2	0	0	1	1	0	6	N/A	N/A
15	3	3	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	2
16	5	3	2	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	5	5	0
Total	***71***	***34***	***37***	***17***	***19***	***7***	***10***	***4***	***6***	***6***	***3***	***5***	***6***	***0***	***0***	***4***	***4***	***1***	***70***	***33***	***22***

Appendix 15: Semi-structured Interview Guide (Chapter 5)

Date:
Name of Interviewer:
Interview code number:
Respondent's age:
Length of interview:
To set the tone with interviewee, introduce yourself and set some "ground rules" for the interview.

1. ***Introduction***

- My name is _____.
- Thank you for talking to us today. Our interview will last about 1 hour.
- This is an independent study for a PhD study. Your participation in this independent study will not affect any services you receive here at Mashambanzou.
- We are going to discuss about your children's schooling and issues related to their performance in school.
- This interview is private and confidential – your name will not be used publicly, so don't hesitate to speak your mind.
- There are no right or wrong answers – it is important to say what you think or feel and not what you think I want to hear.
- You will be recorded but this information will not be distributed.
- Please be reassured that if you feel uncomfortable at any point during the interview, you are free to express this and stop the interview.
- Would you like to participate in this interview?

  Verbal consent given: yes/no:

  Check whether consent form is signed

2. **Questions**

   Use probes as needed

Invite Interviewee to briefly talk about themselves. General information about

- Respondent's highest level of education:
- Respondent's marital status:
- Husband/partner's highest level of education:

- Respondent's profession:
- Number of children:
- Age of children:
- Gender of child(ren):
- Education level of children:

-What challenges do you face in ensuring that your children obtain their schooling?
- What challenges do your children face in obtaining their schooling?
- How does your child's gender influence their schooling?
- How does your husband/partner support you in ensuring that your children obtain their schooling?
-What are your thoughts about school and government support in your children's schooling?
- How do you overcome challenges that you have mentioned to ensure your children obtain their schooling?
- What interventions should be put in place to ensure that your children obtain their schooling?

3. Closing

Do you have any additional comments?

We will analyse the information that you and others provide. We will be happy to provide a copy once the analysis is complete. Thank you for your time.

Appendix 16: Ethical Approval ERCIC (Chapter 5)

Maastricht University Leading in Learning!

School of Business and Economics
Dean
Postbus 616
6200 MD Maastricht

Ethical Review Committee Inner City Faculties

Our reference
ERCIC_150_29_08_2019

Maastricht
12 November 2019

Dear Prof. Møllgaard,

After examination of the research study protocol entitled 'Effects of HIV on Intergeneration Transmission of Education: A Qualitative Study at Mashambanzou Care Trust Zimbabwe' and relevant annexes, submitted by Wim Groot, the Ethical Review Committee Inner City faculties (ERCIC) has concluded that there are no ethical objections to the execution of the research project.

Any changes in the research design require a renewed review by ERCIC.

Yours sincerely,

Prof. Wiebe Bijker
Chair

Dr. Natasja Reslow
Secretary

CC Wim Groot; Tatenda Zinyemba

ERC IC
Chair: W. Bijker
Secretary: N. Reslow

Tel: 043 388 4834
Email: ercic@maastrichtuniversity.nl
URL: https://www.maastrichtuniversity.nl/ercic

Appendix 17: Ethical Approval MRCZ (Chapter 5)

Telephone: 791792/791193
Telefax: (263) - 4 - 790715
E-mail: mrcz@mrcz.org.zw
Website: http://www.mrcz.org.zw

Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

APPROVAL

REF: MRCZ/A/2555

13 January, 2020

Tatenda P. Zinyemba
46A Casino Avenue
Waterfalls
Harare

RE:-Effects of HIV on intergenerational transmission of education: A qualitative study at Mashambanzou Care Trust in Zimbabwe version 2 dated 23 December, 2019

Thank you for the application for review of Research Activity that you submitted to the Medical Research Council of Zimbabwe (MRCZ). Please be advised that the Medical Research Council of Zimbabwe has reviewed and approved your application to conduct the above titled study.

This approval is based on the review and approval of the following documents that were submitted to MRCZ for review:-

1. Protocol version 2 dated 23 December, 2019
2. Informed Consent Forms (English and Shona) version 2 dated 23 December, 2019
3. Data collection tools

- **APPROVAL NUMBER** : **MRCZ/A/2555**

This number should be used on all correspondence, consent forms and documents as appropriate.

- **TYPE OF MEETING** : **Expedited**
- **EFFECTIVE APPROVAL DATE** : **13 January, 2020**
- **EXPIRATION DATE** : **12 January, 2021**

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted three months before the expiration date for continuing review.

•**SERIOUS ADVERSE EVENT REPORTING**: All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices or website.

•**MODIFICATIONS**: Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).

•**TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices or website.

•**QUESTIONS**: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw

Other

- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2020 -01- 13
APPROVED
P.O. BOX CY 573 CAUSEWAY, HARARE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

Appendix 18: Consent Form (Chapter 5)

 MRCZ No. _____

Effects of HIV on Intergenerational Transmission of Education: A Qualitative Study at Mashambanzou Care Trust Zimbabwe

Principal Investigator: Tatenda Zinyemba

Phone number(s) +263 (0)719743268

What you should know about this research study:

- We give you this consent so that you may read about the purpose, risks, and benefits of this research study.
- Routine care is based upon the best known treatment and is provided with the main goal of helping the individual patient. The main goal of research studies is to gain knowledge that may help future patients.
- We cannot promise that this research will benefit you. Just like regular care, this research can have side effects that can be serious or minor.
- You have the right to refuse to take part or agree to take part now and change your mind later.
- Whatever you decide, it will not affect your regular care.
- Please review this consent form carefully. Ask any questions before you make a decision.

- Your participation is voluntary.
- If there are any questions that you feel uncomfortable with, you are not compelled to answer them.

PURPOSE

You are being asked to participate in a research study of how HIV affects how mothers invest in their children's education. The purpose of the study is to provide a platform for mothers to express challenges they face in investing in their children's education. You were selected as a possible participant in this study because you are a woman aged 18-49 years with school going children and you obtain care services at Mashambanzou Care Trust or you reside in Harare. This study will have about 30 participants in total.

PROCEDURES AND DURATION

If you decide to participate, you will undergo an in-depth interview in English or Shona for about 60-100 minutes. The interview will be recorded, translated (if necessary) and stored in a password encrypted university file that belongs to the principal investigator. The audio recordings will be used to produce results for the study. Only the principal investigator will have access to the audio recordings. There will be no way of linking these audio files to the respondent as the data will be anonymised.

RISKS AND DISCOMFORTS

While we do not anticipate this, there are potential risks or discomfort associated with this study. There may be emotional or psychological triggers associated with the questions asked by the interviewer. Please note that you can discontinue the interview at any point. You may also experience physical ailments associated with being ill on the day of the interview. You can stop the interview if you experience any physical, psychological or emotional distress. We also encourage you to speak with your councillor or social worker after the interview. If you need counselling after the interview, a Nurse Councillor (Sister Temba) will be able to available. Please let any of the research staff or Mashambozou staff now. You can call of this number for the request: +263 772216488

[RISKS TO PREGNANT WOMEN]

This research represents a significant risk to unborn children. Therefore, if you are a woman or childbearing potential, you will be given a pregnancy test prior to initiation of research. If you are pregnant and wish to participate in this research study, you will be advised that there are three possibilities: depending upon the stage of your HIV status as well as the stage of your pregnancy, you may delay this research until you have delivered. If you are not pregnant, you will be offered information on reliable contraceptive methods to be used during the course of this research to avoid pregnancy. You will also be advised as to the danger to the foetus should you become pregnant. If you do fall pregnant while in the study, study staff will discuss your options about remaining in the study.

BENEFITS AND/OR COMPENSATION

This study will help participants voice the challenges they experience in investing their children's education. The study will help policymakers make informed decisions about education needs of (HIV-affected) children in Zimbabwe and add the literature gap in studies that examine intergenerational transmission of education. We cannot and do not guarantee or promise that you will receive any benefits from this study. You will be compensated an amount of $15 for your time and participation.

CONFIDENTIALITY

If you indicate your willingness to participate in this study by signing this document, we plan to disclose the results of the study at academic and non-academic conferences and in academic journals. Only researchers involved in this study will have access to the data provided. The data from the interview will be anonymised so that the responses cannot be traced back to the interviewer. Under some circumstances, the MRCZ may need to review patient records for compliance audits.

IN THE EVENT OF INJURY

In the event of injury resulting from your participation in this study, treatment shall be offered by the study.

In the event of injury, contact Casper Hera on 077 404 3141

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you decide not to participate in this study, your decision will not affect your future relations with Mashambanzou Care trust, its personnel, and associated hospitals**.** If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty.

 IRB No. _____

SIGNATURE PAGE

Effects of HIV on Intergenerational Transmission of Education: A Qualitative Study at Mashambanzou Care Trust Zimbabwe

Protocol Version Number/date

OFFER TO ANSWER QUESTIONS

Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

AUTHORIZATION

You are making a decision whether or not to participate in this study. Your signature indicates that you have read and understood the information provided above, have had all your questions answered, and have decided to participate.

_____ _____

Name of Research Participant (please print) Date

_____ _____

Signature of Participant or legally authorized representative Time

_____

Relationship to the Participant

[the above two lines should appear on forms signed by legal representatives of the participant, for example the parents of a minor.]

_____ _____

Name of Staff Obtaining Consent Signature Date

_____ _____

Name of Witness (*if required)* Signature Date

YOU WILL BE OFFERED A COPY OF THIS CONSENT FORM TO KEEP.

If you have any questions concerning this study or consent form beyond those answered by the investigator, including questions about the research, your rights as a research participant or research-related injuries; or if you feel that you have been treated unfairly and would like to talk to someone other than a member of the research team, please feel free to contact the Medical Research Council of Zimbabwe (MRCZ) on telephone (04)791792 or (04) 791193 and cell phone lines 0784 956 128. The MRCZ Offices are located at the National Institute of Health Research premises at Corner Josiah Tongogara and Mazowe Avenue in Harare.

Audio, Video Recording and Photography

The interview will be recorded, translated (if necessary) and stored in a password encrypted university file that belongs to the principal investigator. The audio recordings will be used to produce results for the study. Only the principal investigator will have access to the audio recordings. There will be no way of linking these audio files to the respondent as the data will be anonymised. If you choose to listen to hear the audio recording of your interview before they used for the study, please let the interviewer or principal investigator know.

Statement of Consent to be Audiotaped

I understand that photographs / audio recordings / video recordings will be taken during the study. *(For each statement, please choose YES or NO by inserting your initials in the relevant box)*

- I agree to **being audio recorded** **Yes** ☐

No ☐

_____ _____

Name of Participant (please print) Signature Date

Summary of the Dissertation

It has been 40 years since the first cases of HIV were identified. Since then, an estimated 76 million people have been infected globally and about half of these cases have been fatal. The loss of human capital due to morbidity and mortality issues related to the disease has brought about a significant loss to families and economies overall, particularly in SSA, where 70% of HIV-infected individuals reside. Given that there were 1.7 million new HIV infections in 2019, the eradication of this disease is not in sight. Most of these new infections (over two-thirds) are in SSA. Southern Africa contains at least eight countries with the highest HIV infection rates, making the disease endemic to the region. Therefore, the effects of this disease on human capital (i.e., education) are likely to be prevalent and more severe within this region. HIV may affect educational attainment through illness, medical appointments, stigma, and taking care of sick family members. In addition, due to gender gaps in HIV infection, caregiving, and education in general, the effects of HIV on educational attainment may differ by gender. This dissertation aims to examine the effects of HIV on gender gaps in educational attainment by conducting mixed-method studies in Zimbabwe. This process allows for an in-depth examination of HIV issues within the country and highlights how country-specific socioeconomic and sociocultural factors contribute to how HIV affects gender gaps in educational attainment.

While several strides have been made towards HIV treatment globally, about a third of HIV-infected individuals do not have access to treatment. Therefore, effects of HIV on human capital (i.e., education) and the economy overall may still be persistent, particularly in Southern African countries such as Zimbabwe. In addition to the HIV pandemic, Zimbabwe has had economic and political challenges for over 20 years. The combination of a pandemic and extreme poverty may result in a group of people who are more marginalized than others. Moreover, there other gender-specific issues such as early marriage that may further marginalize low-income HIV-positive women and girls. This dissertation examines whether HIV influences intergender and intragender gaps in educational attainment in Zimbabwe. Specifically, does HIV influence gender gaps in education in Zimbabwe? If so, how do HIV and other factors influence these gender gaps?

Several studies have shown that, in general, HIV affects educational outcomes of different groups of people, such as orphans. However, studies that examine whether there are gender gaps in educational outcomes of HIV-affected individuals are limited and have shown mixed results. This dissertation addresses this gap in the literature by examining intergender and intragender gaps in various educational outcomes (i.e., attendance, total years of schooling, level of education, and dropout) of children and youths in Zimbabwe. The strides that have been made towards HIV prevention and testing have helped reduce the prevalence rates. However, due to limited medical care, some people do not always have access to treatment and prevention options. In addition, HIV mainly affects individuals of a lower socioeconomic status. Hence, this dissertation also examines the role of this disease in exacerbating and perpetuating the poverty cycle, and ultimately human capital accumulation. The thesis is comprised of 6 chapters and the contents of each chapter are described below.

Chapter 1

Chapter 1 presents the introduction and the motivation for the dissertation. The chapter highlights the current statistics related to the prevalence of HIV globally, regionally, and in Zimbabwe. The chapter also presents general statistics about gender gaps in educational attainment and how HIV may contribute to these gender gaps. In addition to the exhibition of HIV and education trends over time, the chapter also shows the proportion of people on treatment. Following an explanation of the importance of examining HIV and gender gaps while taking into account socioeconomic issues related to HIV, the chapter provides the aims of the dissertation. These are:

> *Aim 1: To systematically review studies that examined the effects of HIV on educational attainment of school-going children globally and identify literature gaps.*

The first aim of the dissertation is to conduct a systematic literature review of studies that analyze how HIV affects educational outcomes of different groups of children in various countries. The review also provides insights on the current work that has been done on examining the effects of HIV on educational attainment and identifies the literature gaps that are to be filled.

Aim 2: To quantitatively examine intergender and intragender gaps in school attendance of HIV-positive children in Zimbabwe.

Given the increase in HIV rates among younger girls in SSA, it is important to examine whether school attendance of HIV-positive girls is different compared to that of HIV-positive boys (intergender) as well as HIV-negative girls (intragender). This issue is explored in Chapter 3 of this dissertation.

Aim 3: To quantitatively examine causal effects of HIV on educational outcomes of male adolescents and youths in Zimbabwe.

HIV may differently affect males who contracted it in their youths versus those who contracted it during birth. In addition, HIV may have a different effect at different levels of education (e.g., primary, secondary, tertiary). Chapter 4 examines this causal relationship and highlights the stage at which HIV affects human capital accumulation, thereby highlighting areas that need interventions.

Aim 4: To qualitatively analyze effects of HIV on intergenerational transmission (mother-to-child) of education in Zimbabwe

Multi-country studies have shown that children with HIV-positive mothers have less school attendance. However, the mechanisms that influence this result have not been examined. Chapter 5 examines these mechanisms to fill the gap in studies that examine how parental HIV affects (gender gaps in) children's educational attainment.

Chapter 2

This chapter provides a systematic literature review of global literature that examines effects of HIV on children's educations. The relevant literature was extracted from six databases, namely EconLit, ERIC, PubMed, SocINDEX, Web of Science (WoS), and Google Scholar. The Preferred Reporting Items for Systematic Reviews (PRISMA) method was adopted to conduct the inclusion and exclusion criteria. Papers were included in the review if they were peer-reviewed, published between 1990 and 2018, written in English, and analyzed the direct relationship between HIV and schooling outcomes. Articles were excluded if they were non-empirical, discussed the relationship between HIV and psychological or cognitive issues,

only focused on perceptions of HIV risk, if there was no HIV testing done on either parent or child, or if there was no confirmation of AIDS-related death of parent or guardian. The selected 62 papers were categorized into quantitative, mixed methods, and qualitative studies. The method of directed qualitative content analysis was applied for the analysis of the papers selected for the review. Specifically, we extracted information related to the key themes identified in the introduction (i) HIV-affected vs HIV-unaffected children; (ii) gender gaps in educational attainment; and (iii) intergenerational transmission of education. The quality of the papers selected for the review, was assessed using the Mixed Methods Appraisal Tool (MMAT). The results of the systematic review mainly showed the mechanisms that influence the relationship between HIV/AIDS and children's education. Differences were observed between HIV-infected and uninfected children, between HIV-affected boys and HIV-affected girls, and children with HIV-infected parents and other children's groups. The review also revealed that only a few studies examined gender gaps in educational attainment among children affected by HIV. Therefore, there is no conclusive evidence on whether HIV-infected girls, female AIDS-orphans, or girls with HIV-positive parents face more delays in schooling compared to their male counterparts.

Chapter 3

This chapter analyzes the effects of HIV on inter- and intragender gaps in school attendance of children in Zimbabwe using a recent nationally representative dataset from the 2015 Zimbabwe Demographic and Health Surveys (ZDHS) and a multivariate Blinder-Oaxaca decomposition approach. The goal of this chapter is to generally examine whether there are gender gaps in school in Zimbabwe first and then establish whether there are differences in school attendance between HIV-positive boys and girls (intergender gaps). In addition, the study examines whether there are intragender gaps in school attendance between HIV-positive and HIV-negative girls (and boys as well). This is the first study to use a nationally representative sample that contains biomedical information on HIV infection of 11,673 children aged 6-18 years. This is the first study to perform this type of analysis in an HIV context in SSA. The results of this study showed that, in general, there are no gender gaps in school attendance between boys and girls in Zimbabwe. We also find no school attendance gaps between HIV-negative boys and HIV-positive boys. However, we find that HIV-positive girls attend less school compared to HIV-positive boys (intergender

gap). We also find that HIV-positive girls attend less school compared HIV-negative girls (intragender-gap). These results may be due to the fact that some HIV-positive adolescent girls in Zimbabwe have acquired the disease from husbands or romantic partners. Due to the age difference with older partners and power dynamics between men and women, some girls may be less able to negotiate for condom use. In addition to HIV infection, cultural responsibilities related to marriage and family life may lead adolescent girls to less school attendance among adolescent girls.

Chapter 4

Chapter 4 examines effects of HIV on educational attainment using socio-demographic and biomedical data on HIV infection from ZDHS (2015) for 4,130 male adolescents and youths aged 15-29 years in Zimbabwe. The chapter addresses endogeneity issues related to the HIV variable by exploiting circumcision as an instrumental variable and by relying on a probit two-stage least squares model and a Heckman selection model. There are only a few studies that have examined these effects of HIV on various outcomes educational attainment among males, and there are currently no such studies that have been conducted in Zimbabwe. The chapter examines these effects by exploiting the binary nature of the treatment variable (HIV) and an instrumental variable (IV) to obtain average treatment effect (ATE) under the hypothesis of selection on observable and unobservable characteristics. The IV we use are voluntary medical male circumcision (VMMC). To examine whether the ATE's are significant at the primary, secondary, and/or higher education level, we estimate a seemingly unrelated bivariate probit model with IVs. The results show that HIV has a negative and significant effect on total years of education. The results also reveal that HIV mainly has an effect at the higher education level (or tertiary level). This could be due to older youths may not have benefited from PMTCT and other HIV prevention efforts as their younger counterparts. It could also be that younger boys experience slow disease progression. Therefore, effects of the disease on education are experienced at a later stage when they are old enough to be in higher education.

Chapter 5

This chapter uses a qualitative design to investigate mechanisms that influence the effects of parental HIV on the education of children. The study was conducted in collaboration with the Mashambanzou Care

Trust in Harare, Zimbabwe – a facility that provides care to HIV-positive individuals. The data encompasses 16 purposively sampled low-income HIV-positive and HIV-negative mothers whose age was above 18 years. All HIV-positive mothers were on treatment and all women in the sample had at least one school-going child. We use a framework that describes the channels that influence the direct and indirect effects of the HIV status of a parent on investments in their children's education. We find that the main reported mechanisms that influence this relationship are financial barriers exacerbated by HIV, children taking care of sick parents or siblings (child carers), and gender differences in how parental illness affects children. In addition, we find that children of HIV-positive mothers do not always have birth certificates, which is a major barrier to school and exam registration in Zimbabwe. Not having birth certificates to register for school was a major barrier to public education and access to public funding for HIV-positive mothers. Birth registration can be a difficult issue for low-income parents due to the strict and rigid requirements needed to register. Specifically, for impoverished parents, it is costly to obtain a birth certificate and it can be difficult for single parents.

Chapter 6

The final chapter of the dissertation provides a comprehensive summary of the entire dissertation and synthesizes the findings of all the studies. The chapter starts off by reorienting the problem statement and the motivation behind the dissertation. The chapter then provides a description of the data and methods used in the various chapters. A major contribution of this chapter is the description of the major findings from all the chapters that have been condensed and synthesized. The chapter also provides explanations for the findings and highlights areas of future research. Furthermore, the chapter also presents policy recommendations, limitations, and concluding remarks related to these studies and aggregated findings.
The findings mainly show that in Zimbabwe, HIV appears to affect girls' educational attainment more than boys. The chapter also highlights that there is both a level-of-education effect and a cohort effect in how HIV affects educational attainment among males in Zimbabwe. The findings also show some discrepancies in the findings. For example, there is a discrepancy in what HIV-positive mothers say about gender gaps in children's education and what the results from surveys show. Another major finding from all the studies is that, to a large extent, HIV is a poverty problem in Zimbabwe. Finally, the chapter reveals that there are

policy and culturally induced barriers to the educational attainment of HIV-affected children.

Impact Statement

Although there has been a 60% reduction in AIDS-related deaths since 2004, HIV is still a leading cause of death in low-income countries (UNAIDS, 2020; WHO, 2020). HIV ranks sixth globally on the list of leading communicable deaths in low-income countries after neonatal conditions, lower respiratory infections, diarrheal diseases, malaria and tuberculosis (WHO, 2020). This decrease in deaths can be attributed to the progress brought about by increased access to treatment and preventative measures. Unlike diseases such as malaria and tuberculosis that are concentrated in low- and middle-income countries, HIV affects communities in developing and developed countries, making it a global issue. As of 2019, there are about 38 million HIV-positive individuals globally. Of these, 36.2 million are adults and the rest are children below 15 years. Only about two-thirds of PLWHIV have access to treatment, which leaves a substantial number of adults and children in fatal situations. Aside from these mortality and morbidity issues, it also has socioeconomic consequences. These include stigma, risky sexual behaviors, poverty, unemployment and school absence/dropout.

Education is a basic human right. Therefore, it is important to pay attention to individuals who are excluded from this basic right. Because of various reasons, girls in SSA have been obtaining less education compared to their male counterparts. Although international governments in SSA have taken steps to close gender-gaps in educational attainment, the gender gaps are currently similar to those of developed countries in the 1950's (Barro and Lee, 2013). Gender-gaps in educational attainment affect economic growth because they lower the level of human capital (Klasen, 2002). Hence, when HIV and HIV-related issues are additional barriers to girls' education, the level of human capital may be further reduced. This is reinforced by the fact that HIV disproportionately affects women and girls in SSA (UNAIDS, 2015).

This dissertation examines how HIV affects gender gaps in educational attainment and how it affects intergenerational (parent-to-child) transmission of education. The study uses quantitative and qualitative methods to examine how HIV contributes to inter and intra-gender gaps in educational attainment while focusing on Zimbabwe. There are a few advantages to focusing on Zimbabwe. First, Zimbabwe is ranked sixth in HIV infections. Second, studies have shown that there are gender gaps in schooling among children in Zimbabwe (e.g., Mapuranga and Chikumbu, 2015). HIV can increase these gaps. Third, nationally

representative data with HIV test results of children and adults aged 0-49 years are available. The dissertation also complemented this quantitative data with qualitative data that were used to examine how HIV affects mothers from transmitting education to their children. Finally, focusing on Zimbabwe allows for country-specific contextualization of the results. This is important because HIV, gender and education policies differ by country. In addition, social and cultural responses to HIV, gender and education differ by country as well.

Contributions to researchers

The thesis has contributed to the research community in that two studies have been recently published and cited. One study is under review. Therefore, the studies are available to researchers, scholars and policymakers. The second chapter is a systematic literature review (published in 2020) that examined 62 studies by focusing on three mechanisms through which HIV influences children's education. The study has been published as an open-source article and has been read and cited by scholars from all over the world who work on similar issues. Many scholars who work in HIV are based in developing countries, where it can be difficult to access relevant literature, the fact the study has been published as an open-access article gives these scholars access to not only this study, but the summaries of the other 62 papers analyzed. The third chapter published (2021) focuses on examining effects of HIV on intra- and intra-gender gaps in schooling. This chapter is also available as an open-access article. Given that this is the first paper to examine this issue using nationally representative data and a method that has not been used on this topic, it provides a new lens to scholars who are interested in contrasting the case of Zimbabwe with other countries.

Chapters 3, 4 and 5 have also been shared with the academic community through presentations at various academic conferences such as the Center of the study of African Economies (at Oxford, UK), the Western Economic Association International (Vancouver, Canada), International Association for Feminist Economists (Glasgow, UK) and the University of Arizona (Arizona, USA). As part of the ethical approval process, the qualitative study will be presented to the Medical Research Council of Zimbabwe. The study will also be presented to Mashambanzou Care Trust and its affiliated donors and stakeholders. The dissemination of the studies in this dissertation spans across academic, policy, nonprofit and health

practitioners. This allows for people from all walks of life to have access to these studies, which will ultimately lead to policies and actions that will improve the lives of PLWHIV and HIV-affected individuals.

Relevance to Policymakers

The results of the studies in this thesis can also be useful to policy-makers. Chapter 3 shows that there is an intergender gap in schooling between HIV-positive girls and the groups of HIV-negative girls, HIV-positive boys and HIV-negative boys. To our knowledge, this is the first study to examine these groups using nationally representative data. The results show that this gap is mainly driven by older girls. The study was not able to distinguish whether these girls have actually dropped out of school. In the event that the girls did in fact drop out, it is not clear whether the girls became HIV-positive before or after doing so. The results of the study cement the fact that older girls who are HIV-positive are academically behind their peers. This reduces their productivity and earning potential. Highlighting this problem illuminates the plight of HIV-positive girls' future in Zimbabwe. Policymakers in Zimbabwe are therefore encouraged to enact policies and initiate programs that mainly focus on the retention of HIV-positive girls to ensure that they remain in school or return to school. This is not only beneficial to HIV-positive girls, but to the country as whole because the economy will continue to face human capital losses brought about by HIV.

Chapter 4 also shows that HIV affects men at the tertiary level. Similar to the case of HIV-positive girls in Chapter 3, this creates a social mobility barrier between HIV-positive and HIV-negative men. Policymakers are also encouraged to enact policies and programs that target post-secondary HIV-positive men in order to ensure that they are not left behind their HIV-negative counterparts regarding tertiary-level educational attainment. The results of Chapter 3 and 4 show that although there is gender parity in primary and secondary education, HIV mainly affects older girls' educational attainment. That is, in addition to the social barriers that may prevent girls from completing their secondary education, HIV-related issues present additional barriers to their schooling. Overall, policymakers should ensure that all HIV-positive individuals are able to reach their educational goals and live lives that are equal to their HIV-negative counterparts.

Chapter 5 shows that some children with low-income HIV-positive mothers do not have birth certificates due to various socioeconomic and bureaucratic barriers. This inhibits these children from enrolling in

school and accessing public funds. In addition, birth registration should be a right that is accessible for all children born in Zimbabwe, despite their orphanhood status or their parents' HIV status. In this case, policymakers in Zimbabwe should ensure that these children have access to the human right of basic education and formal birth registration.

This thesis mainly highlights that despite the commendable efforts to increase access to HIV treatment and increased education and medical practice related to HIV prevention, HIV-positive and HIV-affected individuals face social and economic barriers that impede their educational attainment. One of the main economic development issues brought about by HIV is the loss of human capital, particularly in Southern African countries like Zimbabwe, which already have significant economic issues. Ensuring that groups of HIV-positive and HIV-affected communities have adequate access to treatment and social support promotes economic development through increasing their human capital capacity. Indeed, with further research and effective policy implementation, the educational attainment gaps between HIV-affected and none affected communities will decrease.

Curriculum Vitae

Tatenda was born on 23 June 1985 and is a Zimbabwe and US national residing in the Netherlands. She obtained a bachelor's degree in Mathematics from Indiana University-Purdue University Indianapolis in 2009. She then completed a Master's in Economics from University of Kansas in 2012 and a Master's in Public Affairs with an emphasis in Health Policy from Indiana University School of Public and Environmental Affairs in 2016. Tatenda joined the United Nations University/Maastricht University School of Governance in 2016. Apart from her PhD thesis topic, her research interests include inequalities in health, education and gender, analysis of health care systems and policies, contraceptive use, intimate partner physical violence and effects of gender inequality on economic development. In terms of field experience, she has worked on evaluation projects that examined effects of (school) feeding programs on schooling outcomes and emergency preparedness with the World Food Program in Madagascar and Gambia. From 2012 to 2014, Tatenda worked as a teaching assistant for introductory microeconomics and macroeconomics economics courses at the University of Kansas, while taking graduate-level economics and statistics courses. While residing in Bloomington Indiana in 2014-2015, she worked with the Affordable Care Act Volunteers of Monroe Country – a nonprofit organization that focused on enrolling uninsured local residence in the newly implemented Affordable Care Act "Obamacare" health insurance scheme. From 2015-2016, she interned with the Association for the Advancement of Women Economists (AAAWE) where she worked on projects that targeted to build the capacity of African women economists. Tatenda has presented her research at international conferences such as the Center for the Study of African Economies conference, the Western Economic Association International conference and the International Association for Feminist Economists conference.

List of Publications

1. **Zinyemba, T. P.,** Pavlova, M., Groot, W. (2020). Effects of HIV on Children's Educational Attainment: A Systematic Literature Review. *Journal of Economic Surveys*, 34 (1), 34-85.

2. Avenyo, E. K., Francois, J. N., & **Zinyemba, T. P.** (2021). On gender and spatial gaps in Africa's informal sector: Evidence from urban Ghana. *Economics Letters*, *199*, 109732.

3. **Zinyemba, T.,** Pavlova, M., & Groot, W. (2021). Effects of HIV on gender gaps in school attendance of children in Zimbabwe: a non-linear multivariate decomposition analysis. *Education Economics*, 1-19.

Conflict of Interest Statement

None declared