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EXPLORING THE RELATIONSHIP BETWEEN ORPHANHOOD STATUS, LIVING ARRANGEMENTS AND SEXUAL AND REPRODUCTIVE HEALTH OUTCOMES AMONG FEMALE ADOLESCENTS IN SOUTHERN AFRICA

(Thesis format: Divided Block)

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A Thesis submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy.

Johannesburg, 2024

DECLARATION

I Mercy Shoko declare that this Thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



Dedication

To Tanaka, my entire family and circle of friends.

Presentations/publications

Presentations/publications arising from this study.

i. Shoko, M. Exploring adolescent fertility inequality in Southern Africa *(In Press)*

ii. Shoko, M., Ginsburg, C., Levin, J., Nieuwoudt, S., & Kahn, K. (2019). Orphanhood, access to information and HIV knowledge among female adolescents in Malawi. Vulnerable Children and Youth Studies, 14(4, 322-337.

iii. Shoko, M., Ibisomi, L., Levin, J., & Ginsburg, C. (2017). Relationship between orphanhood status, living arrangements and sexual debut: Evidence from females in middle adolescence in Southern Africa. Journal of Biosocial Science, 50(3), 380-396.

The paper was accepted for an oral presentation at the 2nd Statistics Korea (KOSTAT) Summer Seminar on Population, Daejeon (Statistical Training Institute), South Korea, 27th July – 28th August 2015.

iv. Shoko, M. & Ibisomi, L. (2017). Orphanhood Prevalence, Living Arrangements and Orphanhood Reporting in Lesotho, Malawi, and Zimbabwe. Child Indicators Research, 10, 929–943.

An oral presentation on this research was made at the 5th Conference of the International Society for Child Indicators: From Welfare to Well-being: Child indicators in research, policy & practice, held at the University of Cape Town, South Africa, 2nd – 4th September 2015.

Other presentations/publications and activities arising during the course of the PhD.

Below is work on socio-demographic issues that affect adolescents' orphanhood status and living arrangements, done outside the thesis but relevant to this research.

i. Machemedze, T., Shoko, M., Collinson, M.A., Wittenberg M. Measuring rural households and electricity access: A comparison of national census data and small-area health and demographic surveillance system (HDSS) data. Cape Town: Southern Africa Labour and Development Research Unit, University of Cape Town. (SALDRU Working Paper Number 290).

ii. Stats SA. (2019). Estimating completeness of adult mortality data at sub-national level. Pretoria.

iii. Can CRVS and Survey data provide insight into maternal deaths in South Africa? Oral presentation at the 8th African Population Conference (APC), in Entebbe, Uganda, 18th – 22nd November 2019.

iv. Shoko, M., Lefakane, L., Chisumpa, V., Nyakudya, A., & Khoza, C. Estimating the completeness of infant deaths from South African vital registration and vital statistics systems data (CRVS) using census data. An oral presentation at The XXVIII International Population Conference (IUSSP) in Cape Town, South Africa, from 29th October – 3rd November 2017.

v. Shoko, M. (2018). New Approaches to Measuring Ageing in South Africa. Systems Analysis Approach for Complex Global Challenges. P. Mensah, D. Katerere, S. Hachigonta and A. Roodt. Cham, Springer International Publishing: 315-329.

The research was completed under the auspices of the South African chapter of the International Young Scientists Summer Program (YSSP), held at University of Free State, Bloemfontein, South Africa, 24th November 2013 – 22nd February 2014.

vi. Stats SA (2018). Grandparenthood in the context of ageing in South Africa. Pretoria.

vii. Shoko, M., Collinson, M.A., Lefakane, L., Kahn, K., & Tollman, S.M. (2016). What can we learn about South African Households by comparing the national Census 2011 with the Agincourt Health and Demographic Surveillance System data in rural northeast Mpumalanga? African Population Studies, 30(2): (Suppl).

An oral presentation on this research was made at the 7th African Population Conference (APC), in Johannesburg, South Africa, 30th November – 4th December 2015.

viii. Stats SA (2013). Census 2011: Estimation of Mortality in South Africa. Pretoria.

This was also an oral presentation at the 7th African Population Conference, in Johannesburg, South Africa, 30th November – 4th December 2015.

ix. Secured reviewership for a PLoS One journal paper on orphanhood and added the record to my Open Researcher and Contributor ID (ORCID) profile.

Report (ii) investigates the completeness of adult mortality data in a broader context, shedding light on the overall challenges faced in this regard. Presentation (iii) is dedicated to addressing issues related to the measurement of maternal mortality, making a significant contribution to understanding of this specific aspect of mortality statistics. The evaluation of the completeness of potential deaths among both "parents" and "mothers" is important, as it allows for robust estimates of adult mortality, which, in turn, are directly linked to the levels of orphanhood. Both studies were conducted in South Africa, recognised as the only "data-rich" country in Sub-Saharan Africa - SSA (UNECA, 2017).

Furthermore, for orphanhood measurement, the prerequisite is that children, defined here consistently with the Convention on the Rights of the Child as those aged 17 or younger, should have outlived their parents. Report (iv) investigates the completeness of childhood deaths, a crucial step towards estimating child mortality, particularly in regions with inadequate CRVS systems.

Report (viii) leverages on Census household death data from South Africa to derive the widely used morbidity and mortality indicators. In the absence of biological parents, grandparents have emerged as key primary caregivers, and children sometimes express a preference for grandparents over other caregivers, irrespective of the grandparents' capacity and competence (Mann 2002). Issues related to the measurement of aging, the timing of grandparenthood, and grandparent caregiving patterns are explored in reports (v) and (vi). Overall, the definition and measurement of households play a central role in research related to adolescent living arrangements, and this topic is discussed by triangulating data from various sources in reports (vii and i).

Abstract

Adolescent Sexual and Reproductive Health (ASRH) is high on the global development agenda. Among the respective research conducted is the various social contexts that may contribute to adverse SRH outcomes, including the overlapping issues of orphanhood and living arrangements. These are crucial given that the presence or absence of parents emerges as critical for the sexual and reproductive well-being of adolescents. While orphanhood, particularly in the context of the HIV epidemic in Southern Africa, receives considerable attention, this study highlights a noteworthy gap in the literature – the limited focus on living arrangements and its influence on ASRH, often overshadowed by orphanhood.

This research is important given the evidence suggesting that the African traditional kinship care systems offer support for orphans. However, recent research also highlights the crucial role of biological parents in providing effective care and support for adolescents. The study aims to contribute by exploring the relationship between orphanhood status, living arrangements, and ASRH in Southern Africa.

Utilising cross-sectional Demographic and Health Survey (DHS) data, the analysis delves into key dimensions of SRH, including sexual debut, HIV knowledge, and adolescent fertility, which are all critical links to HIV risk. The findings underscore a significant association between non-coresidency with parents, whether due to orphanhood or separate living arrangements, and a heightened risk of adverse SRH outcomes. This suggests that interventions aimed at addressing adolescent SRH in Southern Africa should encompass a holistic understanding of parental presence or absence.

The study emphasises the complex interplay between orphanhood, parental absence, and various individual, household, and geographic factors that collectively contribute to the vulnerability of female adolescents in the context of ASRH. Despite that the results suggest that the data on orphanhood and living arrangements may be of acceptable quality, the study recognises the potential for detailed insights through future research employing longitudinal data. Such an approach could offer a more nuanced and comprehensive understanding of ASRH over time, subsequently informing targeted policies and interventions in the unique socio-cultural context of Southern Africa.

Organisation of study

The thesis seeks to contribute to the emerging research on parental absence because of orphanhood or parents living elsewhere, separately from their adolescent children. The geographic location of the study is Southern Africa, a region with the highest levels of parental absence. Incidentally, Southern Africa has the worst HIV epidemic profiles, a situation that exacerbates parental absence. Given that the subregion is not entirely homogenous, nationally representative research is key to meaningful cross-country comparisons.

There are seven chapters altogether in the study. Chapter 1 serves as a general introduction and provides essential background and an overview of the entire study. It discusses the research premises concerning women's SRH broadly, with a specific focus on female ASRH in Southern Africa. In this chapter, the rationale for concentrating on parental absence, encompassing both categories of parents—those who are deceased and those who are alive but living separately from their children is presented. Also provided is the concise literature review and the conceptual framework for the research.

The study methodology is outlined in Chapter 2. The thesis is structured around four papers, either already published or soon to be published. These papers can be found in Chapters 3, 4, 5, and 6, referred to as papers 1, 2, 3, and 4, respectively. These four papers are designed to be both self-contained for publication and to be read cohesively when considered together. Permission to include material from published works in the thesis was granted by the respective journals, and the standard citation format specified by each journal has been included.

Paper 1 explores the context of orphan enumeration in Lesotho, Malawi, and Zimbabwe. Paper 2 examines the association between orphan status, living arrangements, and the timing of sexual debut among females in middle adolescence in eligible Southern African countries. Paper 3 uses both community and individual-level variables, focusing on HIV knowledge as the ASRH behavior, and within the same cohort, but limited only to Malawi. In Paper 4, adolescent childbearing, now extending to older adolescents, is examined with a particular emphasis on household composition, measured by parents' presence in the household and the presence of children whose one or both parents have died. The paper expands the study to

include additional countries for which data became available later. The study concludes with Chapter 7, where the findings are synthesized, and a discussion and conclusions are presented.

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I would like to express my gratitude to the following individuals and groups who have played a pivotal role in making this work possible, and I did "not want to leave anyone":

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List of Abbreviations

ASRH: Adolescent Sexual & Reproductive Health

AU: African Union

CRVS: Civil and Vital Registration System

ECA: Economic Commission for Africa

GBV: Gender Based Violence

IR: Individual Recode

LMICs: Low-and Middle-Income Countries

PR: Person Recode

SSA: Sub Saharan Africa

SRH&R: Sexual and Reproductive Health and Rights

UN: United Nations

ICPD-PoA: International Conference on Population and Development Programme of Action

Definition of terms

Child: Is an individual aged 17 years or younger using UN agencies definition.

Child marriage: Is marriage constituted by one or both partners who are younger than 18 years (UN 2012).

Female genital mutilation (FGM): A cultural practice of alteration of the external female genitalia (WHO 2022).

GBV: "means any act … that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty..." (UN, Resolution 48/104, Article 1). It constitutes child abuse, non-intimate/intimate partner violence, child marriages, FGM etc. (Grose et al. 2021).

Kinship care: "Family-based care within the child's extended family or with close friends of the family known to the child, whether formal or informal in nature." (UN 2010: p6). This definition aligns with local African usage, which describes kinship care as extending through various degrees of familial relationships, spanning multiple generations, and often involving reciprocal obligations (Foster & Williamson, 2000).

Orphaned adolescents: Adolescents whose one or both parents are dead. Other writers prefer "adolescents with orphanhood" (Mpofu et al. 2015).

Sexual and Reproductive Health and Rights (SRH&R): Constitutes efforts aimed at reduction of adverse sexuality and reproduction morbidity and mortality, for addressing SRH needs, gender-based violence, and SRH services quality (Temmerman et al. 2014).

Perinatal transmission: also known as vertical transmission is mother onward transmission of HIV to the child (WHO 2014)

CRVS: Are national systems that connect vital event registration with health information systems to produce timely population-level statistics (UN 2014).

CHAPTER 1: GENERAL INTRODUCTION

1.1 Background

The chapter provides an overview of ASRH, initially within a global context before narrowing its focus to Sub-Saharan Africa (SSA) and the Southern African subregion. The specific focus on ASRH stems from the slow progress, inequalities, and limited research in this area (Azzopardi et al. 2019, Bearak et al. 2020, Schoumaker, and Sánchez-Páez 2022). The discourse on adolescence and related health, particularly ASRH, has gained attention recently (Ameratunga and Rasanathan 2017), and research remains limited due to data gaps (Sheehan et al. 2017), in part because of the relatively recent recognition of adolescence as a distinct life stage (Furstenberg 2000, AbouZahr 2013, Morris and Rushwan 2015).

Adolescence, ages 10-19 years (approximately), is characterised by a complex and transformative physical, cognitive, and emotional growth and development, intertwined with equally important and dynamic social determinants (Viner et al. 2012). Furthermore, adolescents are exquisitely vulnerable, as psychosocial maturation is likely to lag behind biological maturation, potentially impeding full comprehension of the consequences of their behaviours (Kleinert 2007).

Adolescent health impacts current well-being and future life trajectories. The global adolescent population is estimated to be 1.2 billion, and the SSA region notable for its uniquely rapidly increasing adolescent population (UN 2020), faces unique challenges, including health and socio-structural transitions that render adolescents vulnerable (Bearinger et al. 2007, Blum 2007, Juárez et al. 2008, Patton et al. 2018, Azzopardi et al. 2019, Naidoo et al. 2019). Factors such as early menarche, urbanization, and globalization contribute to prolonged adolescence and increased ASRH risks (Bearinger et al. 2007, Blum 2007, Juárez et al. 2008). Education, while beneficial, also presents paradoxes as it is linked to both positive and negative ASRH outcomes (Ikamari 2005, Smith et al. 2012, Goldberg 2013, Dominique 1994, Gage and Meekers 1994, Blum 2007).

The SSA region not only grapples with high HIV prevalence among adolescent females but also faces various other SRH challenges (UNAIDS 2020). The disproportionately high HIV prevalence, particularly among females, significantly contributes to the global burden of adolescent HIV infections and infections in the general population (UNAIDS 2020). The HIV epidemic further exacerbates challenges for adolescents by intricately affecting households

(Zagheni 2011, DeSilva et al. 2013, Mejia-Pailles et al. 2020, Santelli et al. 2021), creating a ripple effect on their broader SRH outcomes.

1.2 Sexual and reproductive health historical context

The present state of Adolescent Sexual and Reproductive Rights (ASRH&R) globally, can be traced back to the 1994 International Conference on Population and Development (ICPD) in Cairo, Egypt. The resultant ICPD Programme of Action marked a pivotal shift towards a holistic approach, emphasizing ASRH&R and the role of parents (IISD, 1994). Ongoing efforts to address ASRH globally, particularly in SSA, are reflected in various global initiatives and declarations, including the sustainable development goals (SDGs) agenda.

1.3 Adolescence on the life course

Defining adolescence is a complex task, ideally encapsulating physiological, psychological, and social transitions, with age serving as a convenient but primary delimiter. A debate persists regarding extending the upper age cut-off from 19 to 24 years (Sawyer et al., 2018), proposed to better capture the timing of adolescence. However, there is a counterargument to maintain the current age range of 10 to 19 years, to align with existing policies and the social, cultural, and functional constructs of adolescence (UNICEF, 2018). Advocates of this position also aim to avoid potentially "infantilising" young people over 19 years (Ledford, 2018; McDonagh et al., 2018) and is in recognition of adolescence as a distinct phase (WHO, 2020). Consequently, although the 10-19 years range is the one recognised by UN agencies (UN 2011) and widely used, some research employs the 24 upper age cut-off.

1.4 Adolescent sexual and reproductive behaviours and outcomes in SSA

Adolescents in SSA face SRH risks, including early, unprotected, and transactional sex, which are associated with adverse outcomes such as unplanned pregnancies, maternal mortality, and HIV infections (Germain et al., 2009). The highly prevalent child marriages, deeply rooted in poverty and culture, along with policy challenges, present obstacles for eradication efforts (Cousins 2020, The Lancet 2022), particularly in SSA, which bears a significant global burden (Indira et al., 2023). Data scarcity, arising from incomplete abortion records and a lack of vital statistics, hampers comprehensive research, especially for younger adolescents (10-14 years) (Starrs et al., 2018). Studies therefore rely on periodic cross-

sectional surveys, with limitations in capturing dynamic changes (Chandra-Mouli et al., 2021). The detailed exploration of ASRH behaviors and outcomes for adolescents in SSA is found below.

1.4.1 Adolescent sexuality

For many adolescents, initial sexual experiences are frequently unplanned, often coerced or sold (Rice 2000, Carmichael 2015), and occur in an environment of unmet contraceptive needs and social vulnerability (Darroch et al. 2016). Consequently, addressing both primary abstinence (delaying sexual debut) and secondary abstinence (abstaining from subsequent sexual activity after the debut) becomes a central focus of ASRH in SSA (Ali and Cleland 2018).

1.4.2 Adolescent childbearing

Adolescent fertility rates in SSA are higher than the global average and show stark inequalities (Schoumaker, and Sánchez-Páez 2022). Adolescent childbearing in SSA is problematic due to associated high overall fertility levels, poor maternal health, and unfavorable socio-economic conditions (Grant and Hallman 2008), Timaeus and Moultrie 2015, Chandra-Mouli et al. 2021).

1.4.3 Gender based violence (GBV)

Gender based violence is pervasive among adolescents in SSA (WHO 2021), with research suggesting associations with adverse ASRH outcomes (Grose et al. (2021).

1.4.4 Adolescent HIV epidemic

The adolescent HIV epidemic is a public health priority in high HIV settings, and particularly in recent times due to the maturation of the HIV epidemic and the ageing into adolescence of individuals infected as children (UNAIDS 2014). Although the majority of HIV transmissions are vertical transmissions - mother-to-child HIV transmission (MTCT) (Luseno et al. 2015, Kidman and Anglewicz 2017), – variability in adolescent HIV infection rates by sex suggests substantial sexual transmission (Petroni and Ngo 2018). Limited adolescent-friendly services impact access to antiretroviral therapy (WHO 2021).

1.5 Orphanhood, parental co-residence, and ASRH

Orphanhood and parental co-residence are interconnected concepts that can have a negative impact on ASRH. Extensive research has been conducted on parental absence and its effects on ASRH, with a particular emphasis on orphans in the SSA region, especially southern Africa, where there is a disproportionate prevalence of HIV-related orphanhood (Martin and Zulaika, 2016). The research has raised global awareness of the SRH vulnerabilities among orphaned adolescents and has contributed to the development of various interventions. However, the focus on orphans faces two main criticisms, stemming from its perceived narrow focus. This criticism is linked to its potential oversight of parental absence resulting from the separation of parents and their children, which is a widespread phenomenon in SSA, as well as the shared vulnerabilities experienced by both orphaned and non-orphaned adolescents. Meintjes and Giese (2006) argue that orphanhood may not necessarily lead to a distinct life trajectory that exclusively and negatively impacts orphans.

However, orphaned adolescents may indeed face distinct challenges that can impact their SRH and are worth noting. The vulnerability of orphans in general and paternal orphans, in particular, holds significance in various cultural and historical contexts, and they have been symbolically used to represent hardship and ostracism. In certain contexts, the communities are called upon to defend and support “fatherless” children (Bremner 1983).

Socio-economic adversities faced by orphans are widely considered to be determinants of psychological distress (Nyamukapa et al. 2008). This may be explained by the findings that children who are orphans (or not co-residing with parents) have membership to households that are likely to experience worse poverty than their non-orphan counterparts (Lekobane and Roelen 2020).

However, the effect may not be unidirectional, as household absorption of orphans may contribute to poverty or there may be a selection of orphans into already poorer households (Smith-Greenaway and Heckert 2013). The socio-economic effects of orphans household membership can also be complex (Weinreb et al. 2008; Bachan 2014) in part because some of the negative consequences may be offset by the contribution of orphans (fostered children) to the household’s wealth production (Hedges et al. 2019).

It is noted that orphaned children in general "… will miss the interpersonal investments of knowledge, guidance, practical, and emotional support from deceased parents" (Goodman et al. 2022: 249). For adolescents specifically, parental presence is widely considered to be important for healthy sexual development (UN 1994, Romer et al. 1999, Ruck et al. 2014), including good sexual decision-making (Rice 2000, WHO, 2001), reduced sexual risk-taking behaviours (van Hoorn et al. 2018) and positive health-seeking behaviours (Lindstrom et al. 2019). The impact of the mother/father death on the surviving children is likely to be linked to societal cultural norms related to individual family roles, for example mothers are linked to social and emotional security and fathers with financial security (Goodman et al. 2022), discipline and behaviour control (Mmari 2011). Therefore, mother/father death can disrupt these roles and distinctly affect the well-being and development of adolescents. One such area to receive widespread attention is educational outcomes.

Education is considered to be an HIV "social vaccine" for young people (Baker et al., 2008). Orphaned adolescents typically have the school as their main source of SRH-related information, but they may not leverage on this advantage because of limited access to schools (Alan Guttmacher Institute 2007). Hampshire et al. (2015), suggest that the broader social and economic context in which fostering, and orphanhood occur explains the inconsistencies observed in the relationship between orphanhood and educational outcomes across different studies.

1.5.1 Adolescent orphanhood and parental co-residence

The context of orphanhood and various indicators of adolescent well-being are intricately linked to the research design, which in turn can influence the extent of vulnerability observed or the effectiveness of related interventions. The socio-contexts within which research is conducted play a crucial role in shaping the outcomes and understanding the complexities of orphanhood and adolescent well-being. Research results on orphanhood can also differ depending on the disaggregation done, e.g., timing of orphanhood, sex of the child, age range, parental sex, geographical location, and cause of orphanhood. This is discussed in more detail in 1.5.2. Research designs also vary from qualitative studies – that include ethnographic observations, focus group discussions, and single person case studies, to quantitative studies, and to hybrid analyses of both qualitative and quantitative data. Quantitative studies are on the full population or on representative or non-representative samples, employing primary or secondary data sources or both – see Appendix 1.

The ICPD-PoA and the Beijing Declaration and Platform for Action highlighted earlier, recognised the importance of "… the rights, duties and responsibilities of parents" for ASRH (UN 1994: para 7.45, UN 1995). Parents are defined by WHO (2007) as all those acting *in loco parentis* and not paid. This includes child kinship care in efforts to address the protection and well-being of children without or at risk of being without parental care (UN 2010). This is indeed the case for SSA where childcare is not exclusively by the primary caregiver, and childcare arrangements extend from biological parents to the rest of the kinship network through child fosterage, a widespread informal practice where children live apart from their parents and with other people particularly members of the kin network (Isiugo-Abanihe 1985, Cotton 2021). The saying “it takes a village to raise the children” has become a truism.

The strength of kinship ties determines the availability of kinship care for orphans (Foster and Williamson 2000), and orphans' vulnerability (Case et al. 2004, Hedges et al. 2019). It remains true however, that the “best arrangement” for children as espoused in the Convention on the rights of children and as validated by research, is living with the biological parent/s because without parental care, research suggests that children are quintessentially vulnerable (Marteleto et al. 2016, Sherr et al. 2017). The child kinship care may also be in a state of flux – characterised by the recognition of the importance of parental care but also recognising that parents may not be available to ensure continuous co-residence with their children (Imoh, 2012).

The epidemics, HIV, Ebola, (Evans and Popova 2015) and the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COVID-2 popularly COVID-19), as well as armed conflicts (Wagner et al. 2019) have exacerbated orphanhood (Hillis et al. 2021). A study by Mejia-Pailles et al. (2020) exploring orphanhood across childhood and adolescence, confirms previous research using limited data, that orphanhood is highest in adolescence. Premature adult mortality, conventionally termed adult mortality, is defined as death before age 50 or 60 years, and is associated with mortality in younger parents, resulting in orphanhood. In the absence of epidemics and armed conflicts, and when considering established demographic mortality age patterns, adult mortality and the associated orphanhood levels are expected to be lower.

Therefore, the aim has been to reduce adult mortality (Lewis 2005). In the context of HIV it has been largely through the promotion of the antiretroviral therapy (ART) as a treatment for

HIV to increase the infected individuals' survival prognosis and to reduce the risk of onward transmission (Johnson et al. 2019, Santelli et al. 2022). The COVID-19 pandemic has resulted in renewed interest in the reduction of adult mortality, and in the orphanhood research (Kidman 2021).

1.5.2 Orphanhood definition and prevalence

Estimates for 2021 show that globally there were approximately 147 million orphans, 10 percent of whom were due to AIDS. In SSA, orphans due to HIV were almost three times the global average (UNICEF 2022).

The above estimates provide details of the nature and cause of orphanhood. The total orphans are based on children < 18 years who have lost one or both parents, and are the widely used for enumeration of orphans, including by the UN agencies. The age definition is consistent with the ages for childhood as outlined in the 1989 Convention on the Rights of the Child (CRC) and the 1990 African Charter on the Rights and Welfare of the Child (ACRWC). It is notable that the definition, was only adopted at the meeting of the Reference Group for "Estimates, Modelling and Projections" in 2002. Prior to this, various age cut-offs were used. The definition inherently includes the disaggregation into mutually exclusive categories - maternal (mother dead), paternal (father dead) - single (either maternal or paternal)- and double/dual/full orphanhood (both parents dead). Disaggregation of orphans by cause is also another dimension.

Given the interdependence of the orphan categories, disaggregation is important as it shows the shared and related socioeconomic exposures and mortality risks for parents. In the context of HIV/AIDS, where heterosexual sexual transmission is a common mode of infection, the categorisation based on the cause of orphanhood shows the interlinkages between HIV and sex (Stover et al., 2010). Orphanhood disaggregation by cause has also included orphans due to Ebola, or COVID-19, as a response to the, Ebola, and COVID-19 epidemics, respectively. While the concept of orphanhood disaggregation is supported by research (Belsey and Sherr 2011), it is however at odds with the "colloquial" usage of "orphans" for double orphans only, in some settings (Grassly and Timæus 2003, UNICEF 2017). Another criticism levelled against the orphan definition is that it exaggerates the prevalence of orphanhood because most orphans are single orphans (Bray 2003, Meintjes and Giese 2006, Drah 2012, Cheney and Rotabi 2015, Ansell 2016). There is no direct equivalent of the concept of single orphans in

the local SSA context either (Chirwa 2002, Cheney 2010). The international definition of orphanhood has also been criticised for emphasising static chronological age and biological kinship in contexts where, conventionally orphans are socially defined within a kin care network by a totality of experiences that include death of parents and unavailability of adults to act in *loco parentis* (Chirwa 2002). Nevertheless, an acceptable age cap for orphanhood as with that for adolescence acknowledged earlier, is important for a recognised standard over time and across and across different geographical locations.

Other disaggregation of orphans includes "Orphan and Separated Children (OSC)," coined to denote children whose biological parents are dead or separated from their biological parents, the latter is regardless of duration (Huynh et al., 2019). Another operational terminology, "Orphans and vulnerable children (OVC)", initially used to capture children who were orphaned or were at risk of being orphaned by AIDS (Cheney and Rotabi 2015, UNICEF 2017), but later on was used to extend the scope of child vulnerability beyond orphanhood to parental presence/absence - to include children who were among other things orphaned, fostered, or living within the same household with an orphaned and/or fostered counterpart in a blended household etc. (Gillespie et al. 2005, UNICEF 2017).

1.5.3 Orphanhood and ASRH

Qualitative and quantitative research in Kenya, all by Juma et al. (2013, 2014 and 2015) suggest that orphanhood per se is not the primary determinant of ASRH behaviors and outcomes, but the lack of parent-adolescent communication on SRH matters. Interestingly, a systematic review on mainly quantitative studies by Bastien et al. (2011) and a qualitative review and thematic synthesis by Usonwu et al. (2021) suggest that in-SSA parent- adolescent ASRH communication is limited in scope and quality.

A study by Mmari et al. (2016) on adolescents aged 15-19 years in both the United States and South Africa showed that adolescents in South Africa recognised their biological parents as potentially important sources of SRH information. However, given the high rates of parental absence, the biological parents were mostly unavailable to provide the crucial SRH information their children needed. The study also showed that other caregivers, in comparison to biological parents, had protective effects against risky sexual behavior for female adolescents.

Except for the limited number of studies cited above, it is widely accepted that orphanhood and parental absence are (independently) associated with ASRH disadvantage, for female adolescents in particular - see Appendix 1. This has led to the growing interest in potential mitigating factors and associated interventions which include the widely implemented cash transfers and educational interventions that have, regrettably provided inconclusive results (Hallfors et al. 2017, Pozuelo et al. 2020).

One of the earliest studies on orphanhood and ASRH in recent history is a cross-sectional study of females aged 13-49 year in Kinshasa, in the now Democratic Republic of Congo, that suggested that double orphanhood by age 15 was associated with early sexual debut, and maternal orphanhood with a delayed transition to sexual debut and first marriage (Tambashe and Shapiro 1996). Furthermore, a nationally representative study of females aged 15–17 in 10 SSA countries, by Palermo and Peterman (2009), found that orphanhood was associated with early sexual debut but not early marriage or early childbearing. In a non-representative sample study for girls in peri-urban Harare, Zimbabwe, maternal orphans were more likely to be sexually active, to have started childbearing, and to have been infected with STIs including HIV (Kang et al. 2008). Subsequently, a systematic and meta-analysis of 10 studies of young people under 25 years from 12 countries, all from SSA region (except one from Russia), showed that female orphans, compared to their non-orphan counterparts, had higher odds for risky sexual behaviours, HIV infection and early childbearing (Operario et al., 2011).

Subsequent studies were mainly focussed on the expansion of research on orphanhood HIV risk including accounting for the elevated risk. These include cross-sectional multi-country studies of male and female adolescents aged 15-17 years by Kidman and Anglewicz (2016; 2017) who concurred that orphaned adolescents were at a higher HIV risk. Kidman and Anglewicz (2017) also concurred with a longitudinal study by Eaton et al (2013) and a cross-sectional health facility-based survey of adolescents aged 10 – 18 years by (Ferrand et al. (2010), both from Zimbabwe. These studies suggest that vertical transmission explained the bulk of the HIV infection.

Some studies also explored the timing of orphanhood and orphanhood type, and in some cases, results were disaggregated for males and female adolescents. One of these is a cross-sectional nationally representative survey of adolescents aged 12-19 years in four SSA countries - Burkina Faso, Ghana, Malawi, and Uganda, which showed that regardless of timing of orphanhood (defined as mother/father death before age 10), parental death was

associated with early sexual debut for females across the countries. However, timing of father death was associated with early marriage only in Uganda (Chae 2013).

Some longitudinal studies also explored the association between ASRH and mother/father death, also with separate analyses for female and male adolescents. One study of individuals aged 17-23 years in Kagera region of Tanzania, suggests that paternal orphanhood was associated with early transition to marriage (Beegle and Krutikova 2008). Another one is the 2007 to 2013 study of females aged at least 14 years at baseline survey in Machinga and Balaka districts in Malawi that suggests that maternal orphanhood was associated with marital dissolution that was incidentally linked to socio-economic vulnerability (Grant and Pike 2019). Another one is a study of adolescents aged 15-19 years in rural KwaZulu-Natal province of South Africa, by Nyirenda et al. (2010), that found that for the risk of early sexual debut and HIV infection, maternal orphanhood was important for female adolescents and paternal orphanhood, for both male and female adolescents.

1.5.4 Living arrangements and ASRH

Research on living arrangements and ASRH investigates various aspects, including current parental co-residence, household transitions, parental separation/divorce, migration, death, or child fosterage.
One of the earliest studies was a cross-sectional study of female adolescents aged 12-19 years in a slum in Nairobi, Kenya. It found a significant association between current father co-residence and reduced likelihood of sexual debut, recent sexual activity, or unwanted pregnancy (Ngom et al. 2003). Another cross-sectional study but for both males and females aged 15-24 years in the previously Kigali Ville, Butare, Kibuye and Umutara provinces in Rwanda, showed that current father presence delayed sexual debut among females (not for males) (Babalola et al. 2002). In a similar study later, but for Cote d'lvoire cities; Abidjan, Korhogo et al. (2005), found that father co-residence during childhood was associated with delayed sexual debut for females (also not for males).

Later, a nationally representative cross-sectional study of 12-24-year-old males and females in Uganda, found current presence of both parents to be associated with a delayed sexual debut, but not the number of sexual partners or contraceptive use (Karim et al. 2003). In another nationally representative study of males and females but for ages 15-19 years in Burkina Faso, Ghana, Malawi, and Uganda, Biddlecom et al. (2009) showed contextual variation in the

association between parental co-residence and sexual activity, as well as contraceptive use. In Uganda, co-residence with both parents was associated with reduced likelihood of sexual activity in the year preceding the survey, for females, not for males. Also, for females, co-residence with a father only was associated with increased likelihood of contraceptive use in Uganda, while the reverse was true for co-residence with a mother only in Ghana. It is important to note that the study highlighted coverage issues for the Ugandan sample that may have introduced bias into the results.

Exploring the history of parent-child coresidence transitions, including timing, sequencing, and frequency, was a representative cross-sectional study of 12–24-year-olds in semi-urban Bandjoun, in Cameroon, by Defo and Dimbuene (2012). The research found that current co-residence with both parents was associated with delayed sexual debut, and early timing of family (household) transitions in parental co-residence was associated with earlier sexual debut for females, not males. Furthermore, both the history of change in parental co-residence as well as an increasing frequency of changes in parental co-residence were also associated with earlier sexual debut for females only.

A longitudinal study of individuals aged 14-22 years in Cape Town, South Africa, showed that a change in parent co-residence before the age of 15 was associated with early childbearing for both males and females (Goldberg, 2013). Using the same data, but in a separate study by Marteleto et al. (2016), parental absence during the life course was associated with early sexual debut for females, but results were varied by adolescent race and whether it related to mother or father death.

1.5.5 Living arrangements, orphanhood, and ASRH

Emerging research encompasses the multiple causes of parental absence in the study of ASRH. This includes a study of female adolescents aged 15-17 years using seventeen nationally representative surveys in 13 SSA countries by Kidman and Palermo (2016). It suggests that father death or father non-co-residence (living elsewhere) was associated with heightened risk of sexual abuse.

A study of male and female adolescents aged 13 and 19 years in Moyamba and Bombali districts in Sierra Leone, exploring living arrangements and orphanhood, showed that co-residence with mother or both parents was associated with lower risk of adolescent sexual

activity and indirectly with lower childbearing risk (Stark et al. 2015). A cross-sectional study of male and female adolescents aged 16 – 19 years in Morogoro in Tanzania, showed that maternal orphanhood, or absence of one or both parents were associated with a higher risk of sexual debut for males and females, while paternal orphanhood was associated with a higher risk of sexual debut for male adolescents only (Mmbaga et al. 2012). Two studies by Pilgrim et al. (2014; 2015) used longitudinal data for female adolescents aged 15-19 years in the rural Rakai district in Uganda. The results showed greater likelihood of early sexual debut for female adolescents who had non-co-resident parents (because both parents died or were living separately), or non-co-resident father (regardless of the mother co-residency status) (Pilgrim et al. 2014). Furthermore, father non-co-residence was associated with multiple sexual partnerships, but only for adolescents who were not in school (Pilgrim, et al. 2015).

1.5.6 Summary - orphanhood, living arrangements, ASRH disadvantage, potential mediating factors and interventions

Research suggests that SRH vulnerability among orphaned adolescents can be attributed to a complex interplay of three interconnected factors: structural disadvantage, substitution effects, and perverse consequences (Koch & Schulpen, 2018). Structural disadvantage refers to the socio-economic and environmental adversities that make orphans more vulnerable than their non-orphan counterparts. Substitution effects occur when orphaned adolescents turn to alternative sources as a compensation strategy for parental death void. Perverse effects are dominant unintended or unexpected, undesirable perverse (paradoxical) consequences of an intervention program aimed at promoting healthy SRH or designed as a substitute for adverse SRH behaviours among orphaned adolescents (Koch & Schulpen, 2018).

Structural disadvantage is often cited as an explanation for orphanhood ASRH disadvantage and informs intervention programs to mitigate the respective vulnerabilities. These include poverty (although linked but may not exclusively explain orphans school access disadvantage (or health care access) and limited social support networks (Case et al. 2004). Therefore, several studies have explored the relationship between orphanhood, structural disadvantage, and ASRH.

A study in Malawi by Mkandawire et al. (2013) found that factors mediating between orphanhood and early sexual debut included social support, such as the proximity of siblings and relatives, as well as household structure. In South Africa, a longitudinal study by Albert et

al. (2021) showed that the orphanhood risk to pregnancy and HIV disappeared with adult male presence in the household. In Zimbabwe, research by Mpofu et al. (2015) suggested the role of kinship and religious support in enhancing orphaned adolescents' resilience to adversity.

Moreover, there is substantial evidence associating risky sexual behaviors and orphanhood with the exposure to depressive symptoms (Nyamukapa 2008; Gray et al. 2016). These findings are the result of a cross-sectional study involving individuals aged 12-24 from 21 selected districts in Zimbabwe, and a longitudinal study with individuals aged 6–12 at baseline, conducted across five research sites in five LMICs. Importantly, psychological distress has also been reported in cases of parental absence due to migration (Fellmeth et al. 2018).

Also linked, is the widely explored role of education in the relationship between orphanhood and ASRH. A cross-sectional study of female adolescents aged 15-19 in the capital Harare, Zimbabwe showed that education did not explain the elevated HIV and herpes simplex virus 2 (HSV-2) infection risk among orphaned adolescents (Birdthistle et al. 2009). The authors, however, suggest that the lack of association could be explained by the already heightened levels of education attendance in that country. Also exploring the role of education is a process evaluation of clinical trials in various parts of SSA that produced several analyses of school interventions to mitigate the orphanhood disadvantage. The results suggested increased educational outcomes for educational interventions but weak association with HIV or HSV-2 infection (Hallfors et al., 2017).

In relation to substitution effects, a Malawi study by Kidman & Anglewicz (2014) argued that adolescents who were orphans were not inherently more vulnerable than their non-orphan counterparts, but they had higher fertility desires, resulting in comparatively higher fertility.

A classic example of research related to the perverse consequences of an intervention program can be found in a study conducted in Botswana (Koch & Schulpen, 2018). This study found that the targeted interventions, rather than achieving their intended goal of alleviating the impact of poverty and reducing risky behaviors among orphans, had the unintended effect of encouraging orphans to pursue age-disparate sexual partnerships. Notably, research on social protection interventions has generally yielded inconclusive findings (Thomas et al. 2020, Stoner et al. 2021).

1.6 Current research

This section provides the conceptual framework, problem statement, aim and objectives of the study and justification of the study.

1.6.1 Conceptual framework

Figure 1.1 shows the conceptual framework for the thesis, which is rooted in the systematic proximate determinants framework for HIV/AIDS by Boerma and Weir (2005) – see Figure 1.2. Aligned with classic demographic and public health models (Hill 2003), the proximate determinants framework integrates epidemiological and demographic perspectives, offering a comprehensive understanding of the factors influencing health outcomes related to HIV/AIDS (Boerma and Weir, 2005). The framework emphasizes the complex interactions between proximal biological factors, mediating proximate factors, and distal underlying factors, influencing demographic and health outcomes.

In this study, the framework serves as a valuable tool for exploring the intricate relationships between living arrangements, orphanhood, and ASRH within the constraints of available secondary data. The primary focus is on examining selected factors along the pathway of ASRH behaviors and outcomes in the female adolescent subgroup, chosen for their heightened vulnerability to adverse ASRH outcomes. These factors are identified as relatively distantly located on the pathway to ASRH.

The current framework is based on the following premises:

i. The emerging global focus on the social inequalities that explain SRH vulnerability in specific adolescent subgroups (Chandra-Mouli et al. 2021).
ii. Increasing recognition of the importance of upstream factors in improving population-level health (Gleason and Grantz 2021). The proximate determinants of adolescent SRH are well-established. However, the background social determinants linked to the systemic approach to understanding and addressing social health disparities and therefore the relatively easily modifiable (in part because of the changing context), have important implications for SRH interventions (Wellings et al. 2006).

iii. Orphanhood and living arrangements, factors beyond adolescent control (Plourde et al. 2016), warrant further exploration in understanding their associations with ASRH.

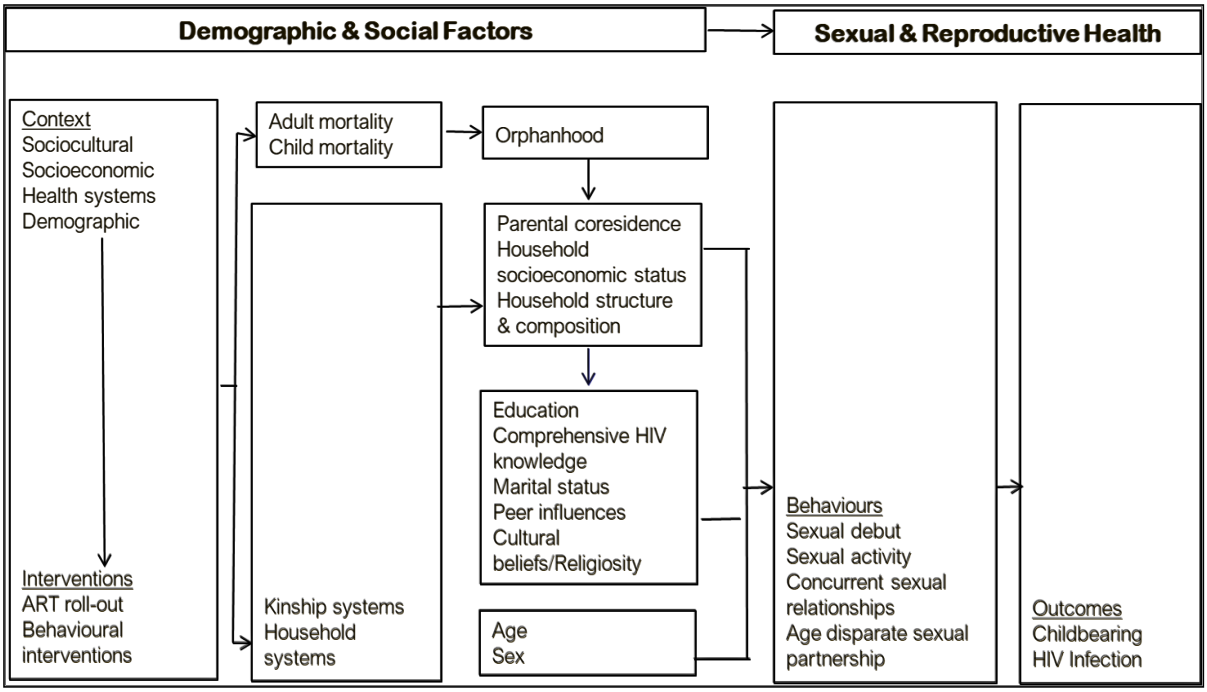


Figure 1.1: Features and pathways for ASRH

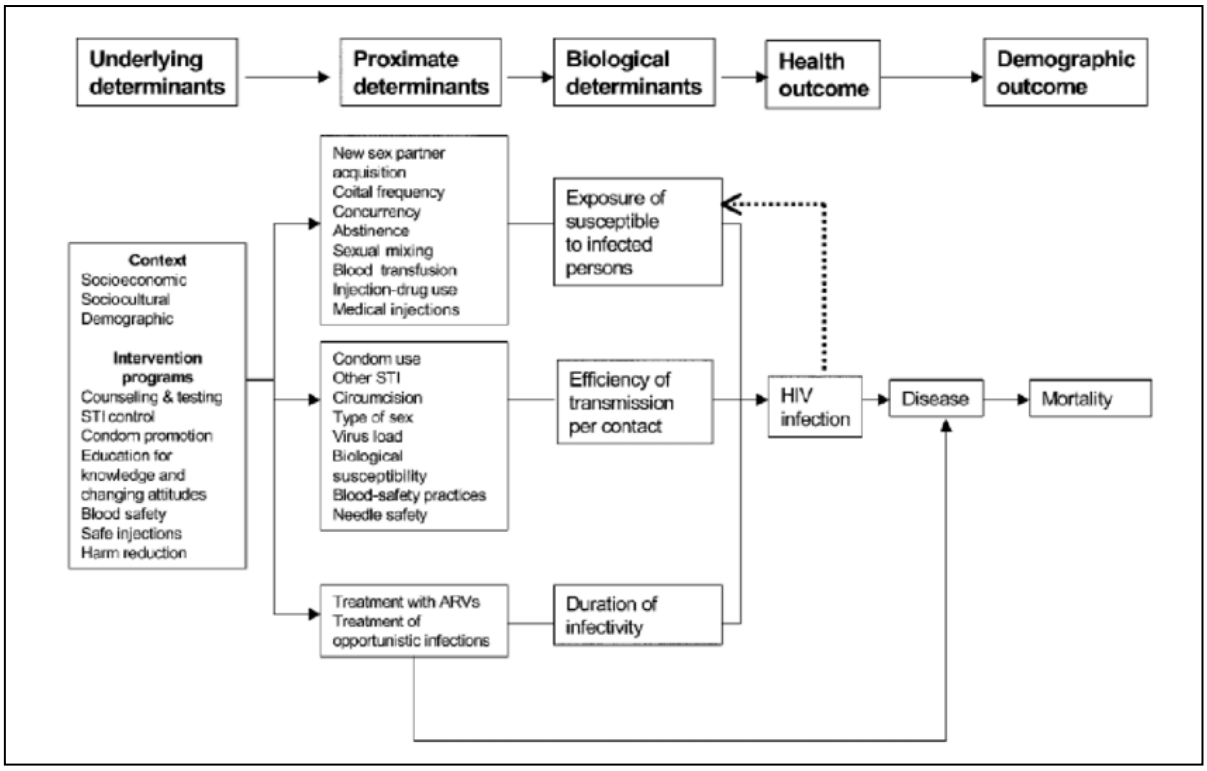


Figure 1.2: Proximate determinants framework for HIV/AIDS

1.6.2 Problem statement

Previous research has often focussed solely on either orphanhood or the broader concept of general parental absence, potentially leading to a misrepresentation of adolescents' living arrangements. This has neglected to explore the intricate connections between orphanhood and parental absence, especially in the context of SRH. The study seeks to explore these factors, including their potential spill-over effects on adolescents' SRH outcomes. The research aims to contribute to a more comprehensive understanding of SRH determinants, recognising and exploring factors beyond adolescents' control—a dimension that is not commonly addressed in the existing literature.

1.6.3 Aim and objectives of the study

The aim of this study is to explore the association between orphanhood status, living arrangements and SRH among female adolescents aged 15-19 years in Southern Africa. The objectives are to provide the context of orphanhood and living arrangements and to assess the association between orphanhood, living arrangements and SRH, and specifically to:

i. explore orphanhood patterns and trends, children's living arrangements, and data quality using multiple data sources for Lesotho, Malawi, and Zimbabwe.
ii. establish the relationship between orphanhood status, living arrangements and timing of sexual debut among females in middle adolescence in Eswatini, Lesotho, Malawi, Mozambique, Namibia, Zambia, and Zimbabwe.
iii. establish the relationship between individual orphanhood status, community-level orphanhood prevalence, and HIV knowledge among females in middle adolescence in Malawi.
iv. estimate the patterns in childbearing for middle and older adolescents in Angola, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe.

1.6.4 Justification of study

Research on the relationship between adolescent orphanhood status and living arrangements, orphanhood status and SRH outcomes, and general living arrangements and SRH outcomes has gained impetus with the surge in orphanhood levels in recent history. The concern for this study emanates from the importance that is attached to biological parents in ASRH. Although growing, there is limited literature on adolescent SRH and parental absence, which includes adolescents who are orphaned and those with parents who are alive but are living elsewhere.

While orphanhood and parental absence are interlinked, previous research has largely focused on one or the other, along with the age limitations associated with parental absence data in surveys, has constrained the comprehensive analysis of various within-adolescent age groups. This is the gap that this research attempts to fill.

This thesis will add to existing knowledge by exploring differential SRH outcomes among female adolescents by orphanhood and parental absence status. This research could inform policy and programs on the care of children and strategies to promote positive adolescent SRH.

CHAPTER 2: DATA AND METHODS

2.1 Introduction

This chapter provides an overview of the study setting, data and methods employed in the thesis. More detailed analytical methods for each publication are presented as part of each paper in chapters three to six.

2.2 Study setting

The study location is Southern Africa, which along with East, West, and Central Africa, constitute SSA region, which is distinctly separated from North Africa (coloured black in Figure 2.1) by the Sahara Desert, and by other important geographical and contextual differences (Tapon 2015). The study uses the African Union [AU] (2020) and UNAIDS (2010) scheme of Southern Africa subregion which constitutes the countries of Angola, Botswana, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. However, Botswana did not meet the inclusion criteria, which will be discussed in detail later in the study.

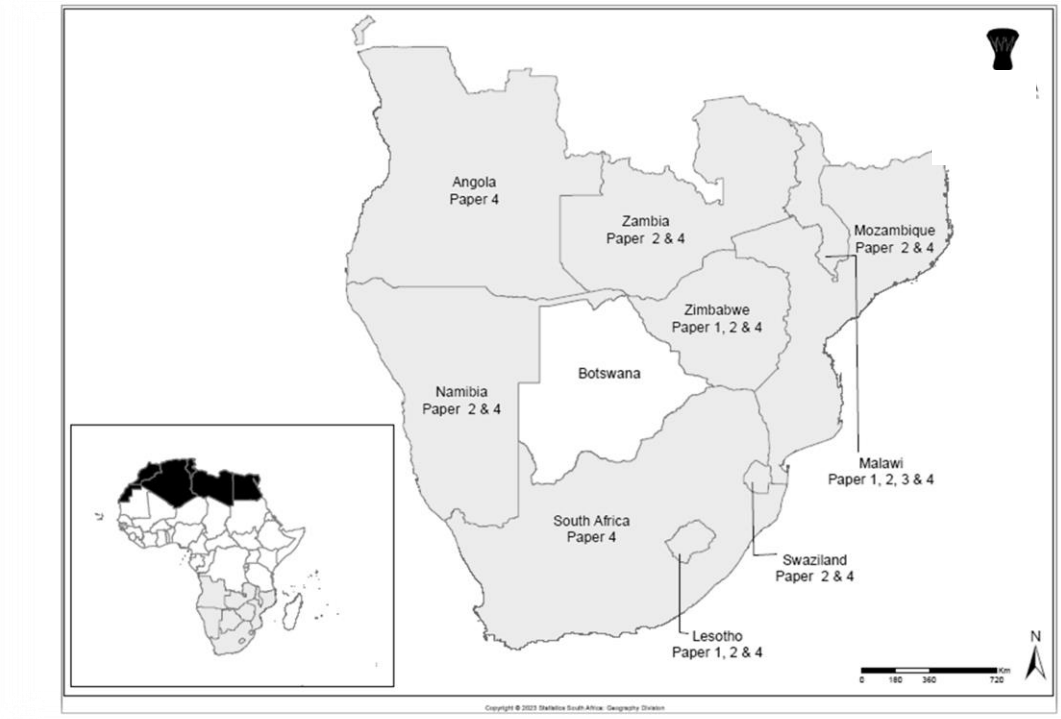


Figure 2.1: Location of Southern African countries in relation to the SSA region, and corresponding thesis papers

2.2.1 Status of ASRH across SSA subregions of Central, East, West and southern Africa

The status of ASRH research in Sub-Saharan Africa (SSA), encompassing its Central, East, West, and Southern Africa subregions, presents three main challenges. The region has one of the poorest ASRH profiles globally, marked by stark inequalities in terms of ASRH state (Mouli et al. 2021), and research efforts within and across the subregions. Despite increased efforts, research levels remain relatively low, with some countries conducting limited or no ASRH research (Ajayi et al. 2021).

Research focus varies across subregions, influenced by prevalent ASRH challenges. For instance, Southern Africa, with a disproportionate HIV burden among female adolescents, has seen extensive research on HIV, prompting calls to balance this with exploration of other SRH dimensions. West and Central Africa tend to experience higher child marriage rates compared to Eastern and Southern Africa, alongside the highest levels of unmet contraception needs in adolescents (Ajayi et al. 2021).

While general regional patterns can be identified, stark country-level differences within subregions exist. Research efforts often involve selection of specific countries to represent the entire region or subregions due to data scarcity in other areas. The scarcity of data prompts reliance on diverse sources, including non-generalisable data, complicating generalisability across countries and impeding cross-country and subregional comparisons.

2.2.2 Southern African subregion context

Southern Africa presents an important context for the study of SRH among female adolescents. The subregion is highly homogenous, sharing common but distinctly diverse geography, history, political, social-economy, and demography - See Table 2.1. This is in part because although the countries have their own unique contexts, but share proximity, with bounds mainly because of mostly indiscriminate old colonial-era delineations (SADC Parliamentary Forum 2018).

South Africa plays a key role in the interconnectedness of the subregion, particularly as a main south-south migration corridor (World Bank 2018). Lesotho is an enclave of South Africa, and eSwatini is one of the few remaining absolute monarchies globally, bounded by South Africa and Mozambique. Namibia's colonial history was intricately connected to that of

South Africa, particularly during the period when South Africa was under British control (Binns et al., 2012). Nyasaland (Malawi) and Rhodesia (Zambia and Zimbabwe) also share unique ties, as they were part of a federation under Britain during the era of their shared colonial history. Angola including its exclave province of Cabinda, and Mozambique, were the only Portuguese colonies in the sub-region - the rest were British colonies.

Southern Africa is also characterised by record high inequality levels. The subregion constitutes six of the ten most unequal countries in SSA, and three of the ten most unequal countries globally (UNECA 2017). Among the key economic indicators, the purchasing power parity (PPP) percentage ranges between 22 and 70 for South Africa and Malawi respectively (World Bank, 2021).

The subregion diversity is also in terms of the respective countries' population sizes, from respectively small, middle-sized to large populations. One of the results of the demographic and epidemiological transitions in Southern Africa is the relatively young population characterised by a youth bulge which is evident in the expansive (broad based) population pyramids – see Figure 2.3. South Africa's distinct population structure characterised by pronounced dips in certain age groups is a subject of intensive study by demographers (Dorrington 2013). Notably, Eswatini, Lesotho, and Namibia rank among the smallest in terms of population size.

The HIV burden in the subregion is substantial as indicated by the prevalence exceeding 1 percent in the general population, as per the standard by Tanser et al. (2014). The epidemic has also had an impact on the epidemiological transition in the subregion.

Table 2.1: Demographic, health, and socio-economic data by country

Country	Population (1)		Child protection (2)	Urbanisation (3)	Poverty (4)	HIV-related indicators (5)		
	Density (km^2)	Size (in 000)	Child marriage (females) (%)	Urban (%)	Purchasing power parity (%)	Total infections (in 000)	Prevalence (Adult)	Orphans (%)
Angola	26.4	32 866	30	67	53	340	2	1
eSwatini	67.5	1 160	5	24	30	200	27	23
Lesotho	70.6	2 142	16	29	31	340	23	19
Malawi	202.9	31 255	42	17	69	1 100	10	12
Mozambique	39.7	19 130	53	37	64	2 200	12	16
Namibia	3.1	2 541	7	51	22	210	13	13
South Africa	48.9	59 309	4	67	22	7 500	17	16
Zambia	24.7	18 384	29	44	61	1 200	12	12
Zimbabwe	38.4	14 863	34	32	50	1 400	13	11

Sources: 1 - UN 2020, 2 - UNICEF 2021, 3 - UN 2020, 4 - World Bank 2021, 5 - UNAIDS 2020

However, the HIV epidemics vary greatly across and within countries, characterised by differences in their history (Pineda-Peña et al., 2016), extent (Dwyer-Lindgren et al., 2019), and the scale of related antiretroviral (ART) roll-out. The latter is both due to variations in HIV burden and treatment gaps (Dutta et al. 2015).

In the pre-HIV epidemic era, the subregion experienced falling adult mortality levels, the pattern which was subsequently reversed with the advent of the epidemic, followed by mortality gains once again – see Figure 2.2. Therefore, the HIV epidemic has had consequences for adults' survival and subsequently for surviving children's vulnerability, particularly affecting the well-being and SRH among female adolescents in the subregion. However, the picture for ASRH is mixed, with variations observed both within the subregion (representing the starkest within-sub-region differences) and compared to other subregions (Melesse et al. 2020). The adolescent HIV infections in southern Africa are the highest globally (Birdthistle et al. 2019, Cane et al. 2021. The subregion also has one of the lowest and highest child marriages rates in the region (Budu et al. 2021). In Lesotho child marriages are almost 20 percent, 30 percent in Angola, Zambia and Zimbabwe, over 40 percent in Malawi, and over 50 percent in Mozambique (Table 2.1). In eSwatini, Namibia and South Africa, child marriage rates are below 10 percent. However, the three countries stand out as exceptions in the entire region for the relatively high childbearing almost completely occuring outside marriage, which is a possible indicator of unwanted childbearing (Patton et al. 2012).

Orphanhood and parental absence due to a range of factors; migration, parent demise, divorce, or separation, are crucial considerations for promoting healthy SRH transitions among female adolescents in the subregion. Previous research has contributed to a substantial body of knowledge that allows for a concurrent examination of both orphanhood and parental absence in the context of ASRH. This is in the context of the relatively high levels of parental absence (McDaniel & Zulu, 1996; Monasch & Boerma, 2004), occuring across the matrilineal and patrilineal lineage systems in the subregion (Grant and Yeatman 2014, Belt et al. 2016). For example, in a study of adolescents aged 15–17 years in 10 nationally representative surveys in SSA, Robertson et al. (2010), suggests that the association between orphanhood and adverse ASRH outcomes can vary based on HIV prevalence in the respective countries.

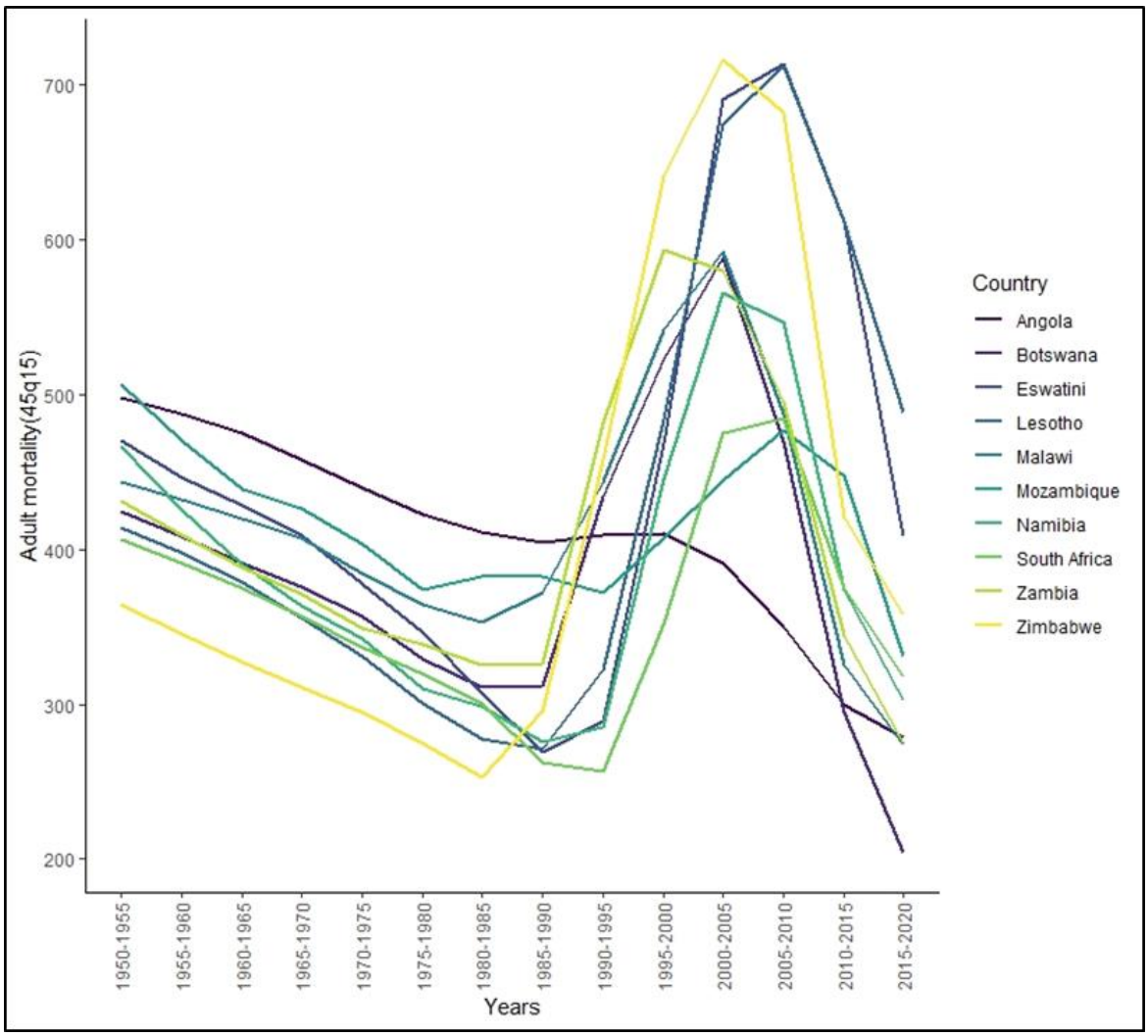


Figure 2.2: Own plot of the probability of dying between age 15 and age 60 (45q15) – males and females combined, based on the UN (2020) population projections.

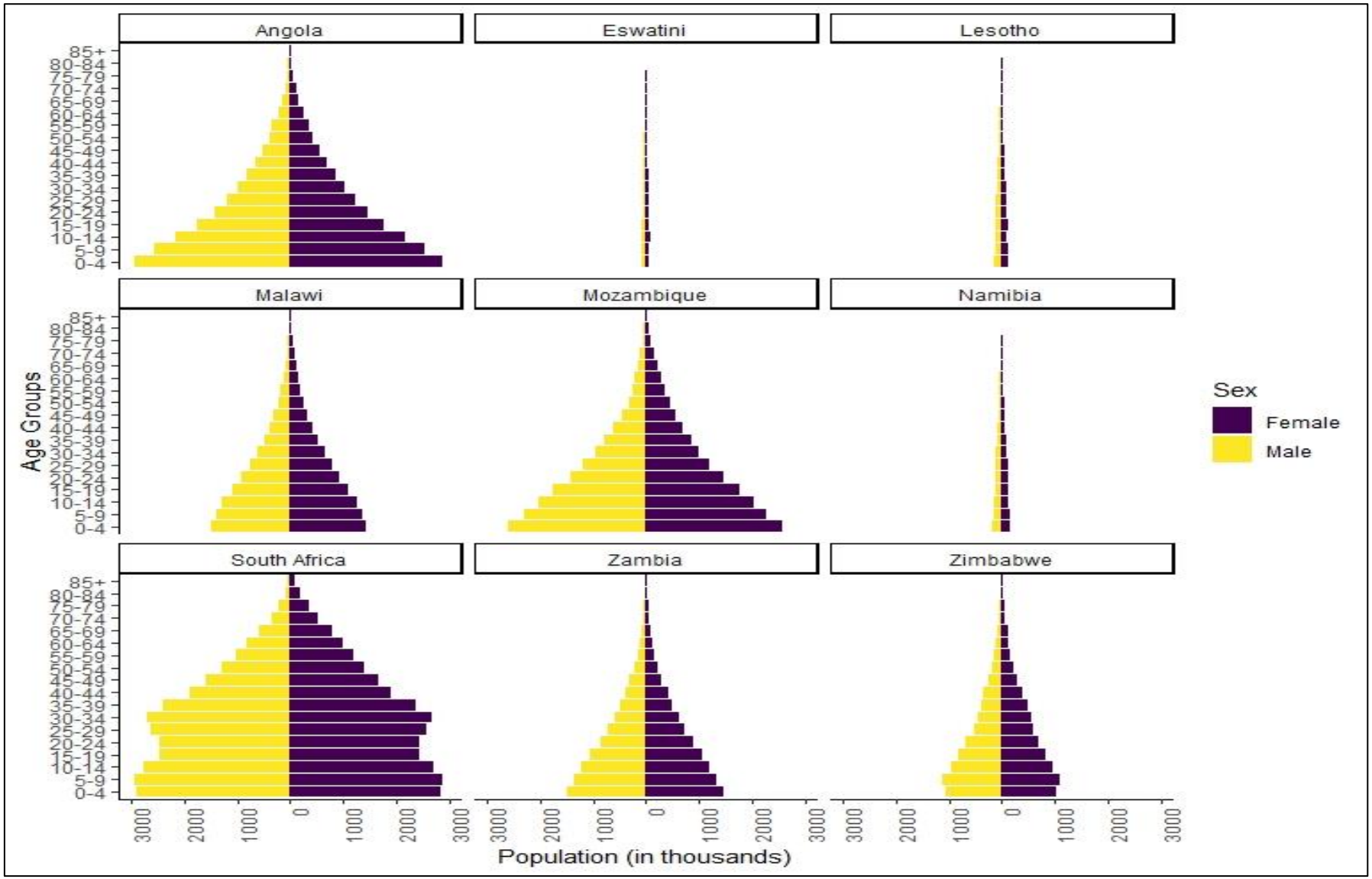


Figure 2.3: **Own plots of population pyramids by country, based on the UN (2020) population projections.**

2.3 Sources of data

The primary data source for the thesis is the Demographic and Health Surveys (DHS), together with supplementary data from the national population and housing censuses (PHC) (census in short), and the UNAIDS mathematical model estimates. The census and DHS data are broadly categorised as survey data, the distinction being in the design and scope. The census provides universal coverage within a specified geographic area, whereas the DHS is sample based. Therefore, unlike the DHS, the census design allows for the collection of demographic and socioeconomic data with a high level of granularity, which can help unmask potential inequalities within a population (Masquelier and Soura 2014). However, censuses are not typically designed for detailed SRH questions, because of the logistical requirements emanating from the scale of data collection, and the associated costs. Therefore, specialised surveys like the DHS providing nationally representative data are used. However, together the DHS and censuses, as independent data sources provide alternative data useful for triangulation which also constitute complementation (Patton 1999). For example, while census and DHS do not capture the parent/s' cause of death, UNAIDS model estimates typically do disaggregate orphan estimates into HIV-related and non-HIV-related causes. The model estimates are also annualised; therefore, they can be compared with periodic survey estimates by selecting timing that aligns with that of the census or DHS data collection. While comparison of model and empirical data consistently show discord for orphanhood estimates (Robertson et al. 2008, Rutstein 2008, Belsey and Sherr 2011, Silhol et al. 2017), related research on HIV projections suggests both consistency and discrepancies (Eaton et al. 2015). This is in part because orphanhood data from surveys are potentially affected by respondent bias and model estimates are as accurate as the underlying assumptions made, including of the HIV epidemic and other factors. The DHS are also prone to sampling errors.

2.3.1 Demographic and Health Survey data

The study employs the Household member (PR) data files from the household schedule/roster, the Individual (IR) files from the individual interviews with females of reproductive ages (ages 15 to 49 years) and Geographic Data (GE) from routinely collected data. These data are from the 15 DHS surveys conducted between 2004 – 2016 in the 9 countries – see Table 2.2 for summary of surveys.

The DHS surveys are co-ordinated at the international level by a selected organisation, in collaboration with participating LMICs through their National Statistics System (NSS) structures. The program is primarily funded by the USAID, with support from UN agencies and respective national governments (Fabic et al. 2012). The DHS has a long history, evolving in the mid-1980s from the international World Fertility Survey (WFS) and the Contraceptive Prevalence Survey (CPS) programs that both originated in the early 1970s. Therefore, at the start the DHS survey program was modelled around its predecessors, before evolving into a complex and multi-module program that is now recognised as the main source for quality demographic and health data in LMICs.

DHS surveys are flagship surveys for the international DHS program, designed in five-year rounds/phases, employing standardised methodologies to allow cross-country, in-country, and temporal comparisons. While ensuring comparability, the DHS program also recognises the importance of adapting to evolving individual country needs, as well as the unique contexts and evolving priorities of individual countries (Boerma and Sommerfelt, 1993). This is reflected in the periodic methodological updates based on program experiences and wide stakeholder consultations at the outset of each round (DHS, 2019).

Currently in its 8th round, the DHS program has conducted more than 400 surveys in over 90 countries, resulting in a data repository with over 12,000 datasets (Watson, 2019).
Among other things, the DHS surveys have transitioned from Paper-and-Pen Personal Interview (PAPI) employed for data collection in the program's 1st 30 years, to computer-assisted personal interview (CAPI) mode using handheld computer devices. The advantages and disadvantages of PAPI and CAPI modes of data collection are well documented (D 2009; Ali and Cleland 2018).

Table 2.2: Synopsis of the DHS data for the countries under study

Country	Country/Year	Phase	Dates of fieldwork	Overall response rate for women	Papers
Angola	Angola 2015-16	DHS-VII	11/2015- 02/2016	95.4	Paper 4
eSwatini	Eswatini 2006-07	DHS-V	07/2006- 02/2007	89.6	Papers 2 & 4
Lesotho	Lesotho 2014	DHS-VII	09/2014- 12/2014	95.7	Paper 4
	Lesotho 2009	DHS-VI	10/2009- 01/2010	95.6	Paper 1 & 2
	Lesotho 2004	DHS-IV	09/2004- 01/2005	89.8	Paper 1
Malawi	Malawi 2015-16	DHS-VII	10/2015- 02/2016	96.9	Paper 3
	Malawi 2010	DHS-VI	06/2010- 11/2010	95.1	Papers 1, 2 & 4
	Malawi 2004	DHS-IV	10/2004- 01/2005	93.6	Paper 1
Mozambique	Mozambique 2011	DHS-VI	06/2011- 11/2011	98.9	Paper 2 & 4
Namibia	Namibia 2013	DHS-VI	05/2013- 09/2013	88.7	Paper 2 & 4
South Africa	South Africa 2016	DHS-VII	06/2016- 11/2016	71.9	Paper 4
Zambia	Zambia 2018	DHS-VII	07/2018- 01/2019	95.6	Paper 4
	Zambia 2013-14	DHS-VI	08/2013- 04/2014	94.2	Paper 2
Zimbabwe	Zimbabwe 2015	DHS-VII	07/2015- 12/2015	95.1	Paper 4
	Zimbabwe 2010-11	DHS-VI	09/2010- 03/2011	89.5	Paper 2

Information available in the respective reports available: https://dhsprogram.com/Countries/Country-List.cfm

The DHS surveys are cross-sectional and household-based, achieved through a complex sample design, aimed at representativity at national, and selected sub-national administrative tiers. The sample sizes are large and vary by the respective countries' population sizes and the detail required at the subnational levels (district or regional/provincial levels) (DHS 2012). The sampling procedure involves at the 1st stage, sampling the primary sample units (PSUs), from a preexisting frame, mainly the most recent census, employing the probability proportional to population size (PPS). The typically decennial censuses are likely to be already outdated (Udjo 2015). Therefore, at the 2nd stage, a predetermined sample of households, is selected systematically from the lists in each PSU, obtained from a listing process, involving updating the households or dwelling units through a compilation of the same in the selected PSU boundaries (DHS 2012). The sample design allows for sample

weights to be determined; these permit the results to be extrapolated to the selected hierarchies to reduce non-response bias (DHS 2012).

The different country contexts and their influence on the in-country DHS surveys, are important to consider in relation to the study, and are therefore discussed below:

2.3.1.1 Variability in the availability of data across countries and over time

Countries do not necessarily conduct surveys in all phases, and when they do, the surveys may not be concurrent. As a result, data do not become available at the same time across different countries, and some countries may not have conducted the same number of surveys. During the study, new data became available, and the goal was to utilise recent and relatively contemporaneous data for the respective countries, with the aim of covering as much of the subregion as possible. Additionally with the evolving program, the study inclusion criterion for individual countries was availability of eligible data.

The initial analyses included Lesotho, Malawi, and Zimbabwe, as they were the only countries at that time with relevant data from multiple surveys, a requirement for the specific analyses. Eswatini had only one survey, conducted much earlier in 2006-7. Angola conducted its first DHS in 2015-16 and was included in the study much later in the study. South Africa has conducted three surveys to date. The 1998 South African Demographic and Health Surveys (SADHS) does not have eligible data for the study. The 2003 survey is not publicly available. The 2016 survey became available later in our study, and South Africa was only included then.

2.3.1.2 Variability in response rates across countries and over time

The response rates vary across countries (Table 2.2), partly due to the different country dynamics including the hard-to-count populations e.g., in high-walled and gated communities. The low response rates for South Africa specifically are mainly because of dwellings that are unoccupied for extended periods, households located in dangerous neighbourhoods and therefore, pose a security risk for the field staff, and households that decline to participate in the survey, (South Africa National Department of Health and Macro 2002). Nevertheless, the response levels are within the acceptable range.

2.3.1.3 Variability in the levels at which data are representative at, across countries and over time.

Within countries, the subnational levels at which DHS data are representative remain consistent over time. However, for some countries, the way in which aggregation is done at a given tier has evolved over time. A classic example is Malawi, where the samples were consistently representative up to the district level (the 2nd administrative tier) across different survey years. However, the sample was drawn to be representative at each of the 28 districts only for the 5th DHS survey (2015/6 DHS). In previous surveys, the disaggregation at this level varied from one survey to the next. As a result, direct comparisons over time are not possible. In this study, when utilising multiple district-level data for Malawi, the data were aggregated to ensure comparability.

Another example is South Africa, where the DHS data are representative up to provincial level i.e., the 1st administrative tier, and the 1st DHS was conducted soon after attainment of democracy. However, the respective geography hierachy has since changed. This includes name changes. Furthermore, although the provincial boundaries are largely stable over time, they are affected by the regular redetermination of boundaries at the lower municipal level to the extent that in some cases they straddle corresponding provincial boundaries and result in change in provincial delimitations (Mavungu 2016). This in spatial analysis poses a challenge referred to as Modifiable areal unit problem (MAUP). This however does not pose a challenge in the study because only one data point is used, and no subnational analysis is done.

2.3.1.4 Definitional differences

Defining the concept of a "household" is crucial for understanding DHS survey data, as households serve as a key demographic unit for data collection. A household is characterized by shared living arrangements and resources, with a focal point being either a dwelling or housing unit (Block 2016). In alignment with international standards, the DHS adopts a *de facto* or a combination with *de jure* methodology, collecting information on usual residents and visitors present on the night preceding the interview date (Croft et al., 2018). This approach aims for external comparability and prevents double-counting, consistent with the UN definition (UN 2017). Notably, there is a high overlap of de facto and de jure populations in DHS surveys.

Due to high migration levels, Lesotho DHS methodology is designed to include household members away for >6 months, deviating from the typical DHS approach (DHS Program User forum 2015). While DHS guidelines recommend analyzing de jure household members for orphanhood and parental co-residence estimation, Lesotho's unique situation may introduce some variation. However, it's important to note that this divergence is not expected to significantly impact estimates, unless there is a distinct selection of the excluded population.

2.3.1.5 Variation in the sampling units and sampling frames across countries

There is a difference in the sampling units for the sampling frames, which emanates from the unit of listing and enumeration in the respective censuses. For all the countries except South Africa using the dwelling frame (SANDoH et al. 2019), households constitute the sampling units. A dwelling frame is a register of all dwelling units (DUs) – that for South Africa constitute 95 percent of all the structures in the country (Udjo 2015). The deviation for South Africa is based on the decision by the respective National Statistics Office (NSO), considering the highly mobile population. Hence the South African DHS (including all its sample surveys) use immovable DUs in its listing, with households present during the survey reference period, eligible for interviews. The effects on the results are also expected to be minimal.

2.3.1.6 Variables not directly comparable across countries

There are variables that are not directly comparable across countries. One is the wealth quintile that is an index constructed based on ownership of assets and aimed at reflecting relative standards of living in a given country, and therefore is designed to reflect the specific country context. The other one is the urban-rural dichotomy whose definition is fluid and currently being harmonised internationally (European Union, FAO, UN-Habitat, OECD, The World Bank, 2021). Consequently, this is factored in the two studies that use pooled data for analyses. Individual country-level analyses are done first in paper two, and then in paper 4, an appropriate model is used in the analyses to factor in the inter-country differences.

2.3.1.7 Variability in response bias across countries

Apart from the “actual” differences that exist across the countries, part of the differences in survey responses observed across countries may be linked to respondent bias. Interviewer bias i.e., potential interviewer influence on respondents’ survey responses, may also account for

cross-country differences (Neal and Hosegood 2015). Respondent bias is defined as influence on the survey responses due to social desirability bias, wherein respondents provide responses that they deem contextually acceptable or desirable (Dare and Cleland 1994, Boerma et al. 2004, Zaba et al. 2009). For example, during adolescence there is evidence of higher reported age at 1st sex (Zaba et al. 2004), age at 1st marriage or age at 1st birth, but lower reported ages with subsequent surveys for the he same cohort of females when they get older. The extent of this varies across countries (Neal and Hosegood 2015).

2.3.2 Supplementary data and estimates

The supplementary data employed in this thesis include census and model estimates for Lesotho, Malawi, and Zimbabwe – Table 2.3.

Table 2.3: Census and model estimates and corresponding DHS survey, and respective papers used

Country	Census (year)	Model estimate (year)	Papers	DHS survey
Lesotho	2006	2009	Paper 1	2004 & 2009
Malawi	2008	2010	Paper 1 & 3	2004 & 2010
Zimbabwe	2012	2011	Paper 1	2005/6 & 2010/1

The census data used in the study were collected as part of the 2010 round of censuses (UN 2008), that locally, was vigorously promoted by the Africa Symposium on Statistical Development (ASSD) (Kiregyera 2015). The main reports and accompanying excel files, for Malawi (NSO Malawi, 2009b, 2009a, 2014), Zimbabwe (ZIMSTATS 2013) and Lesotho (LBOS, 2009, 2011) available on the respective countries' NSO website constitute part of the data for the thesis.

Originally designed in the late 1960s for ingenious methods of adult mortality estimation, where the main CRVS data were inadequate (Blacker 1977), the census parental survival data for children remain an untapped data source for orphanhood estimation (Masquelier and Soura 2014). The census orphanhood questions are comparable across countries (and are comparable with DHS survey questions) (IPUMS, n.d). However, only a minority of censuses in southern Attica include the parental co-residency question – the equivalent of that found in the DHS survey data (UN 2017).

The mathematical model estimates for orphanhood are obtained from Avenir Health, formerly Futures Institute. The organisation works closely with UNAIDS Reference Group on Estimates, Modelling and Projections to provide HIV/AIDS-related estimates. The estimates used in this study are projections of the number of orphans made using the Spectrum/AIDS Impact Module (AIM) and the UN Demography Projections (DemProj) or Easy Projection (EasyProj) models. These models are based on UNAIDS adult HIV prevalence estimates and assumptions about the progression of HIV infection to death, and associated assumptions of the main demographic parameters - adult and "child" mortality and fertility (Stover 2004). The respective projection method follows the methodology detailed by Grassly and Timæus (2005) and later updated by Timaeus (2008) and by Stover et al. (2010). The assumptions for the Spectrum models are also regularly updated based on the availability of new empirical data and advancement in the related knowledge (Stover, Johnson et al. 2010, Stover, Andreev et al. 2014, Stover, Glaubius et al. 2019).

According to Grassly and Timæus (2005), estimates of maternal and paternal orphans are computed from data on female/male adult mortality and mortality in children, and fertility. Double orphan estimates are obtained by fitting a regression model to DHS data on selected variables (which over time have been revised, and currently are only ages for children and adult HIV prevalence (Timaeus 2008).

The DHS surveys provide empirical population-based HIV estimates – unlike the commonly available antenatal health facility-based surveillance from pregnant women (WHO/UNAIDS 2003). The district level estimates are more localised and therefore more variable than the regions. Furthermore; district level estimates are desirable, driven as they are by the district development model (Boerma and Sommerfelt 1993). However, the lowest level at which the HIV estimates are available is at the region or province because lower district level estimates would require a bigger sample (Gutreuter et al. 2019).

Therefore, the additional model estimates are district level HIV estimates, obtained by employing spatial analysis on published DHS HIV data and UNAIDS model HIV estimates at a tier higher than the district (Larmarange & Bendaud, 2014). This was The Subnational Estimates Working Group of the HIV Modelling Consortium of the UNAIDS multi-country initiative that formed part of a pool of initiatives for estimation of district-level HIV estimates using DHS data (Manda et al. 2015, Dwyer-Lindgren et al. 2019, Gutreuter et al. 2019).

2.4 Analytical strategy

The research is quantitative in nature; therefore, it employs relevant analytical techniques to explore relationships, differences, and associations between selected variables. Different analytic strategies were used for the different “sub-research” to address a set of research objectives within the broader scope of the thesis and culminated into four papers (see Table 2.4). The initial paper was designed to be a descriptive study to serve as a methodological paper to provide an anchor for the thesis. In addition, descriptive analysis was used in each of the remaining three papers to provide the context for each sub research. For paper two, descriptive and multivariable survival analyses were used to analyse time-to-sexual debut, and for paper three and four, logistic regression was employed to model HIV knowledge and adolescent fertility, respectively.

The presentation of papers in the thesis follows the order in which they were written. The order also shows the progression of the set of thesis objectives.

2.5 Study variables

The explanatory variables include key indicator variables "orphanhood" and "living arrangements" whose selection aligns with the thesis objectives and are used consistently across the four papers at individual, household, and community levels. The selection of other independent variables that are detailed in Table 2.4, is guided by previous research and their availability in the datasets. All the explanatory variables are available in the household member recode.

Orphans are defined as female adolescents aged 15-17 years whose one or both parents have died. Orphanhood prevalence is measured as the percentage of children aged 17 years or younger, whose one or both parents have died, examined at national and district levels. Disaggregation is also into maternal, paternal, and double orphans.

The variable “living arrangements” encompasses a range of scenarios, incorporating living with both parents (non-orphan), with one parent (either non-orphan or single orphan), and living without either parent (double orphan, non-orphan, or single orphan). The variable can also be represented as a binary variable, signifying the presence or absence of parents in the

household for the index female adolescent, as well as the presence or absence of orphaned children in the household.

"Comprehensive HIV knowledge" and sexual debut serve as both explanatory and outcome variables. Comprehensive HIV knowledge is a binary variable, with responses “Yes or No”. As an independent variable, sexual debut is defined as “ever had sexual encounter”, and as an outcome variable is measured as timing of sexual debut. Adolescent fertility defined in the study as “ever given birth”, is also included as an outcome variable, all located in the Individual recode. The spatial data are available in the geographic data file.

2.5 Ethical clearance

The DHS surveys protocols and systems are reviewed and approved by the Institutional Review Boards (IRB) for the United States of America and that of the respective host countries. For the study specifically, approval was granted by the University of the Witwatersrand Human Research Ethics Committee (Medical) - M140443 – later updated to M220548 see Appendix 2. The DHS data are publicly and freely available at https://www.dhsprogram.com/data/available-datasets.cfm

Table 2.4: Analysis plan including resultant papers

Title of paper	Countries under study	Data Source	Ages	Unit of analysis	Analysis methods	Explanatory variables							Outcome/ Descriptive variables
						Orphanhood & parental co-residency	Schooling	Urban-rural residency	HV knowledge	HIV prevalence	Wealth score/*quintile*	Age-sex distribution	
1. Orphanhood prevalence, living arrangements & orphanhood reporting in Lesotho, Malawi, and Zimbabwe.	Lesotho Malawi Zimbabwe	DHS PR & IR Census & Model orphan estimates	All ages	Aggregated population level	Descriptive demographic methods							X	Internal consistency Orphanhood prevalence Age ratios
2. Relationship between orphanhood status, living arrangements & sexual debut: Evidence from females in middle adolescence in Southern Africa	eSwatini Lesotho Malawi Mozambique Namibia Zambia Zimbabwe	PR & IR files	15-17 years	Individual level	Survival analyses	X	X	X	X		X		Sexual debut
3. Individual & community orphanhood & HIV knowledge among female adolescents in Malawi	Malawi	PR, IR & GE Model HIV prevalence estimates						X		X	X		HIV knowledge
4. Adolescent fertility inequality in Southern Africa	Angola eSwatini Lesotho Malawi Mozambique Namibia South Africa Zambia Zimbabwe	PR & IR	15-19 years		Logistic regression								Adolescent fertility

2.6 Summary

Chapter 2 provides an overview of the study setting, data sources, and methods employed in the thesis. The study focusses on all countries in the Southern Africa subregion: Angola, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. The only exception within the subregion is Botswana, as it did not meet the inclusion criteria for the study.

The subregion's homogeneity, despite unique country contexts, arises from geographical proximity and historical ties. Southern Africa, marked by high inequality levels, has a diverse population with variations in demographics, economics, and health indicators. The prevalence of HIV adds complexity to the epidemiological landscape, impacting mortality rates and affecting the well-being of adolescents.

Data for the study are primarily sourced from Demographic and Health Surveys (DHS), supplemented by national censuses and UN generated mathematical model estimates. The study involves analysis of household, individual, and geographic data from 15 DHS surveys conducted between 2004 and 2016 in the nine countries under study. Supplementary data from censuses and model estimates contribute additional insights, particularly for Lesotho, Malawi, and Zimbabwe. The analytical strategy employs quantitative techniques, including descriptive analysis, survival analysis, and logistic regression, with each paper addressing specific research objectives.

CHAPTER 3: ORPHANHOOD, LIVING ARRANGEMENTS AND ORPHANHOOD REPORTING IN LESOTHO, MALAWI, AND ZIMBABWE

3.1 Introduction

The dependence between the living arrangements of orphans and non-orphans can be attributed to a higher probability of shared living situations, primarily driven by elevated rates of foster care arrangements (Monasch and Boerma 2004, Hosegood et al. 2007). Scaffolding on previous studies, this paper sets out to provide the context of orphanhood, which is key to analyses that consider orphanhood status. The study entails the investigation of how children's living arrangements might affect orphanhood reporting which in turn may affect orphanhood estimates. In the process, the study shows patterns and trends of orphanhood in the selected countries, which is key to understanding the scale and trajectory of the orphanhood problem, which has implications for evidence-based decision-making. It also allows data quality assessment, which is a subject of previous research (Robertson et al. 2008, Rutstein 2008), and remain important with increasing contextual changes (Palloni and Lee 1992, Mejia-Pailles et al. 2020). The assessment of the respective orphanhood data and indirectly parental absence data, to an extent also test the credence of results and conclusions drawn from such research. These findings have significant implications for evidence-based decision-making and the development of targeted interventions and policies.

However, trends are better observed for longer intervals to provide more measurable and stable estimates, and clearer patterns, given that demographic phenomena unfold over time (Hill 2004). Therefore, in addition to the dynamics of the respective HIV epidemics over time, the timing of the census and the two DHS surveys in terms of the calendar years and intervals between surveys, for the respective countries (which is between 2004 – 2012), could have implications for the study results.

3.2 Research paper

Orphanhood Prevalence, Living Arrangements and Orphanhood Reporting in Lesotho, Malawi, and Zimbabwe[1]

Mercy Shoko & Latifat Ibisomi

Abstract

This study explores the relationship between orphanhood prevalence, living arrangements and orphanhood reporting. Research on children's orphanhood status and living arrangements is well established, but not so much in the context of orphanhood data quality assessment. The study provides a historical context of the measurement of orphanhood, the assessment of data quality, and concludes that in the context of sub-Saharan Africa, where child fostering is common, parental coresidency may be more inclusive and may provide a better understanding of children's vulnerability than the survival status of parents. Exclusively focusing on orphans may overlook a substantial number of children whose biological parents are not coresident, impacting interventions aimed at mitigating parental absence among children.

Introduction and Background

This study is an assessment of orphanhood[2] data quality in three Southern African countries, Lesotho, Malawi, and Zimbabwe. Although considerable research has explored children's orphanhood, living arrangements and various other well-being indicators in this region, research on the quality of orphanhood data, particularly its relationship with living arrangements, has rarely been explored. Knowledge of the magnitude of orphanhood, living arrangement patterns and the reliability of the data thereof provide a context for research, which links orphanhood status to child well- being indicators, general health, education, and sexual and reproductive health outcomes. This is important considering the controversial discourse on whether orphans are a specifically vulnerable group.

1 "The final publication is available at Springer via http://dx.doi.org/[10.1007/s12187-016-9404-0]".

2 **Orphans are defined as children under 18 years who have at least one parent dead; and further disaggregated into maternal, paternal and double orphans** for biological mother dead, biological father dead and both biological mother and biological father dead respectively (UNAIDS, UNICEF and USAID 2004).

The Status of Orphanhood and Living Arrangements in Southern Africa

The bulk of global research on orphanhood has been conducted in sub-Saharan Africa and specifically in Southern Africa[3], where the HIV/AIDS epidemic is most severe. Southern Africa is home to just over two percent of the global population (UN 2015a) but has almost 40% of global HIV/AIDS infections (UNAIDS 2016). HIV/AIDS has a disproportionate effect on adults due to its heterosexual transmission, resulting in an upsurge in adult mortality associated with a parallel rise in orphanhood levels (Palloni and Lee 1992; Robertson et al. 2010). This high adult mortality is posited to result in the change in children's living arrangements for both the orphaned and non-orphaned children given that adults are conventionally the custodians of children, including their own and those of the wider kin network/extended family through fosterage (Lloyd and Desai 1992). Fosterage entails rearing of children by kinship members in the absence of parents for strategic reasons and continues in the event of parental death (Oni 1995). Extended families involve a large network of connections among people extending through varying degrees of relationships, including multiple generations, over a wide geographic area and involving reciprocal obligations (Foster and Williamson 2000: S278). In Southern Africa, only 50% of children under 15 years with both parents alive are co-resident with both parents compared to over 60% for sub-Saharan African region (Monasch and Boerma 2004). Fosterage in Southern Africa is a function of marriage, migration, adult mortality patterns (Hosegood et al. 2007) and kinship resiliency (Foster and Williamson 2000), factors which are not static and therefore may vary across place and time.

Sources of Orphanhood Data in Lesotho, Malawi, and Zimbabwe

Sources of national orphanhood data in Lesotho, Malawi and Zimbabwe are broadly demographic-epidemiological models and surveys available for ages 0–17 years. Model projections are entirely from the Joint United Nations Programme on HIV and AIDS (UNAIDS) in collaboration with Avenir Health (formerly Futures Institute) and other stakeholders. In addition to internationally defined orphanhood categories, model projections provide the number of orphans due to AIDS, as well as new orphans, available at yearly

3 **Southern Africa comprises Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe according to the** Joint United Nations Programme on HIV and AIDS (UNAIDS 2010) and the African Union (African Union 2014).

intervals. In the past, models have produced implausible estimates (UNAIDS 2007), but both the assumptions and the software used undergo continual updates based on new empirical evidence (Stover et al. 2014).

The census is a count of the entire population and allows data to be available at lower levels of disaggregation, but because the three countries conduct decennial censuses, it takes long to get updated orphanhood data. The Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS) are two unique sample surveys that provide nationally representative and detailed sample data that are comparable over time and across countries and are conducted at frequent intervals. DHS program was established in 1984 and MICS in 1995 and are conducted every 5 years for DHS and since 2009 every 3 years for MICS. The DHS and MICS boast high standards in fieldworker training, data collection and data processing. However, they exclude the non-household population, including individuals who are homeless and in institutions, who are more likely to be vulnerable in terms of orphanhood and living arrangements. Nonetheless, according to the recent censuses, the non-household population is estimated to be 3.5% or less of the total population (Malawi National Statistical Office 2009; Lesotho Bureau of Statistics 2011; Zimbabwe National Statistics Agency 2013), and therefore not expected to have any material effect on the orphanhood estimates.

Orphanhood and Living Arrangements Estimates from Survey Data

To derive survey orphanhood estimates, children's parental survival status is ascertained using two separate questions on whether the index persons' biological mother/father was alive at the time of the survey. In Africa, the first inclusion of parental survival questions in surveys was in the 1960s for the purpose of indirect estimation of adult mortality in the absence of adequate empirical data that allows the direct estimation of adult mortality (Blacker 1984). Although, parental survival reports yield high response rates, they are potentially affected by parental survival misreporting referred to in literature as the adoption effect and absenteeism effect (Blacker 1984; Grassly et al. 2004; Udjo 2005; Robertson et al. 2008). One of the earliest references to the potential bias in survey orphanhood estimates due to parental survival misreporting was in the mid-1900s in the United States by Woofter (1945).
The term adoption effect refers to either deliberate or inadvertent substitution of dead biological parents by foster parents particularly for children younger than 15 years (Blacker 1984; Udjo 2005; Robertson et al. 2008). Adoption effect seems to be more pervasive than absenteeism effect and results in an under-statement of adult mortality levels and, by

extension, orphanhood estimates and fosterage levels. The adoption effect is potentially exaggerated by the "AIDS effect" due to excess adult mortality (Bah 1999). The absenteeism effect is commonly associated with social desirability bias where long absent parents, particularly fathers, largely due to marital circumstances, are reported to be dead, overstating the number of orphans (Grassly et al. 2004; Udjo 2005; Urassa et al. 1997). Absent fathers may also be regarded as good as dead. Traditionally, the terms "mother" or "father" are loosely defined to include other individuals, not necessarily biological parents (Chirwa 2002). The bias may therefore be perpetuated long before the survey.

Living arrangements because of orphaning is well documented in literature (Drah 2012; Embleton et al. 2014; Grant & Yeatman 2012; Masquelier & Soura, 2014; Oni 1995). Research suggests that non-orphaned children's living arrangements are an important indicator for orphaned children's living arrangements. For instance, where child–parent co-residency is high, there is a higher likelihood that children will be co-resident with the surviving parent when one parent dies (Monasch and Boerma 2004, Hosegood et al. 2007). Additionally, children's living arrangements may affect orphanhood reporting and vice versa. The adoption effect can be linked to children's living arrangements, firstly, because of the greater likelihood in young children (whose biological parents are dead) to be fostered and to have surviving foster/adoptive parents, whom they erroneously report as biological parents (Blacker 1984). Also, children are more likely to be co-resident with their mothers or another female (whom they erroneously report to be their mother), than fathers or males in general (Monasch and Boerma 2004). This may partly explain the absentee effect in fathers' and the adoption effect in mothers' reports. Additionally, fieldworkers may instinctively capture adults on the household schedule as "parents" without confirming with the respondent whether they were indeed biological parents of the children in question (Blacker 1984), or the household proxy may be less knowledgeable about the parental survival status of all children in the household (Rutstein 2008).

Model Estimates

Model orphanhood estimates are derived using Spectrum's Estimation and Pro- jection Package modules (EPP), Demographic Projection (DemProj) and AIDS Impact Model (AIM) and uses available empirical data. They are based on a method advanced by Grassly and Timæus (2005) later developed by Timaeus (2008) and based on recommendations by the Joint Program on HIV/AIDS and World Health Organisation (UNAIDS/WHO) Reference

group on estimates, models, and projections (Stover et al. 2014). Projections of age-sex population distribution, fertility, adult mortality, child survival, and HIV prevalence are used to estimate new orphans, and maternal, paternal, and double orphans due to HIV/AIDS specifically, and due to all other causes in general (including HIV/AIDS). Fertility projections are used to estimate the number of children born to mothers/fathers, and adult mortality projections to estimate the probability of mothers/fathers' death, and that for child survival to estimate the number of children who survive to be counted as orphans (Grassly and Timæus 2005).

Aim of the Study

The aim of this study is to assess the orphanhood data quality in Lesotho, Malawi and Zimbabwe, a region characterised by high orphanhood and high fosterage, using multiple data sources. The objectives of the study are to appraise the relationship between orphanhood reporting and living arrangements, orphanhood levels, patterns and trends, data internal consistency and the age data.

Data and Methods

Design

The study uses secondary household and individual women's data collected as part of the DHS program in Lesotho, Malawi, and Zimbabwe between 2004 and 2011 to explore orphanhood prevalence, children's living arrangements and the ensuing quality of this data across the three countries. The study also uses orphanhood estimates from UNAIDS model projections and from the most recent census data for these countries - (2006 – Lesotho; 2008 – Malawi; and 2012 – Zimbabwe).

The Demographic and Health Surveys

The DHS program is primarily funded by the United States Agency for International Development (USAID) and implemented by DHS with other partner organisations and the respective countries in which the surveys are conducted (Fabic et al. 2012). Demographic and Health Surveys are the main source of demographic and health data for LMICs (Corsi et al. 2012).

Parental survival questions were included in the DHS model household questionnaire in the 1990s and seemed to be primarily for orphanhood measurement (Masquelier and Soura 2014). The upper age limit for the parental survival questions was then 14 years but was extended to 17 years around 2004/5, in tandem with the international pronouncement of 17 years as the upper age limit of orphans.

The DHS program's flagship household-based surveys include the household schedule, which have details of every household member, and allows identification of eligible males and females for separate individual interviews by the fieldworker. DHS samples are drawn using a stratified two-stage cluster design, with the respective countries' recent census enumeration areas as the sampling frame. Eligible individuals are part of the sampled households and are aged 15–49 for women and 15–54 for men in Malawi and Zimbabwe, and 15–59 for men in Lesotho. However, the interviews with men are limited in scope. For example, birth histories, the only information from individual datasets used in this study, are only available for women and not for men, hence the exclusion of men's datasets in the study. Apart from the availability of multiple phases of DHS with parental survival data for children aged 0 to 17 years at the time of the study, which was the inclusion criterion, Lesotho, Malawi, and Zimbabwe have significant similarities, but are also diverse enough to enable drawing conclusions broadly for the Southern African region.

Research Context: Lesotho, Malawi, and Zimbabwe

This section discusses factors that potentially affect orphanhood levels and fosterage patterns in the three countries. Lesotho, Malawi, and Zimbabwe's populations are young with children under 15 years making up 34, 41 and 46% respectively (Malawi National Statistical Office 2009; Lesotho Bureau of Statistics 2009; Zimbabwe National Statistics Agency 2013). The three countries have an estimated urban population of 23, 15, and 33% in Lesotho, Malawi, and Zimbabwe respectively (ibid). According to Foster and Williamson (2000), rural populations tend to be more resistant to change, and tend to have strong kinship ties, reflected in high child fosterage. The levels of migration are uncertain, but in Southern Africa; Lesotho, Malawi, and Zimbabwe, can be classified into migration-origin countries (Tevera 2015), and South Africa, the leading migration destination (UN 2015). Lesotho which is an enclave of South Africa, has an estimated population of 2.1 million and 363 000 emigrants, which is higher than the 302 000 emigrants for Malawi with a population of 17.2 million (UN 2015). Zimbabwe has a population of 15.6 million and 856 000 emigrants (UN 2015).

According to the latest DHS, marriage is quasi-universal although there is high marital dissolution due to divorce, separation, and widowhood, particularly for females, which may affect children's co-residence with one or both of their parents. Migration may play a role for those who are married or in unions because men migrate leaving their families in their place of origin, although migration is increasingly including females.

In 2013, Malawi had an adult HIV prevalence of 10%, while Lesotho had one of the highest in the world – estimated to be a quarter of the adult population (UNAIDS 2013). Zimbabwe is regarded as a success story of HIV/AIDS diminution from approximately 28% in 2001 to 15% in 2013 (UNAIDS 2013).

The DHS methodology uses the de jure population (usual members) for orphanhood (and living arrangements) estimation (Rutstein 2008). Although this methodology captures the typical living arrangements, it potentially affects the statistics relative to living arrangements. Malawi and Zimbabwe DHS surveys capture both de facto and de jure population, i.e., usual household members and visitors present the night preceding the household interview. However, in Lesotho, members of the household who were neither de facto nor de jure members (i.e., members who were absent for 6 months or more, the DHS standard for usual membership) were captured to consider the high migration (DHS 2015), and these constituted approximately 20% of the two samples (Table 1). There is a difference in sample size between the two Malawi surveys (Table 1), mainly because the earlier survey was drawn to be representative of a selected number of districts and the later of all the 28 districts (with two districts, Likoma and Nkhata Bay, combined).

Ethics Considerations

Ethics clearance for the DHS was granted by the respective countries' review boards and the DHS International Institutional Review Board. DHS International, which keeps the archived data, provided access to the data. Ethics approval for the study was granted by the University of the Witwatersrand's Human Research Ethics Committee (Medical) (Number: M140443).

Analysis

This section describes the variables and the data analysis techniques used in the study. All analyses are conducted on aggregated data.

The question, “Is (name of household member)’s natural mother/father alive?” was asked of everyone on the household schedule younger than 18 years with response options of “Yes”, “No” or “Do not know”. If the response was affirmative, the respondent was asked to identify the mother/father using their respective line number on the household schedule or was coded “00” if the parent/s were not on the household schedule. The line number was generated from the list of household members on the household schedule and was used as reference to individuals throughout the questionnaire, and to link individuals to their respective households during individual interviews. The information on the mother’s survival status and location, and the parallel questions on the father, were used to establish maternal orphanhood and child-mother co-residence, and paternal orphanhood and child-father co-residence, respectively. It is expected that children who did not know their parental survival status indicated as such, but the respondent would not have known the option exists because the response categories are strictly not “read out” to avoid leading the respondent (DHS 2011). During the individual interviews with women, respondents were asked to provide their full birth history, including details of their surviving children, and to locate them using their respective household line numbers if listed on the household schedule, or coded “00” if not. The line numbers of children whose mothers were successfully interviewed[4] from the household schedule and that from the women’s datasets should be congruent, and therefore the total numbers should compare well. Any differences were therefore due to reporting errors, i.e., either children declaring individuals as their mothers but the mothers not declaring them as their children or vice versa. Also available in the household dataset is the line number of the mother from the women’s dataset for children younger than 5 years, which should be comparable to the mother’s line number as reported by children.

Table 3.1: Descriptive statistics (percentages) of study population: DHS data

Country	Survey Year	Households	Females aged 15-49	*De jure* population* (%)	Children
Lesotho	2004	8 592	7 095	84	17 944
	2009	9 391	7 624	77	19 190
Malawi	2004	13 664	11 698	98	32 545
	2010	24 825	23 020	98	65 786
Zimbabwe	2005/6	9 285	8 907	98	21 597
	2010/1	9 756	9 171	97	20 458

4 The response rate for individual interviews for three countries ranged between 93 and 98 % for the latest DHS surveys.

Only the latest DHS datasets were used for the calculation of age ratios, for descriptive statistics, and for assessment of dependency between orphanhood status and living arrangements. The assumption was that data quality has improved over time. The respective country's weights were applied to adjust for the complex survey design. For descriptive statistics, calculation of the fraction of children who are orphaned, and children's living arrangements was restricted to the de jure population, consistent with the DHS methodology. The percentage of data with indeterminate parental survival information (include missing and unknown parental survival status) was calculated to check for any potential bias in the orphanhood estimates. In the study, 10% or less was assumed too low to cause a significant effect on the estimates. Orphanhood levels, patterns and trends were also examined. The definition of orphanhood employed in the current study was consistent with international standards. All orphanhood categories were expressed as a percentage of the total number of children in the respective countries for comparability over time and across countries. The total number of orphans is equal to the sum of paternal and maternal orphans, minus double orphans, because paternal and maternal orphan categories are not mutually exclusive (UNAIDS/UNICEF/USAID 2004). Total orphan estimates from the two DHS surveys together with that from the respective census allow assessment of orphanhood trends for individual countries for years 1, 2 and 3 in order of year of data collection. The intervals of 5–6 years exist between the years 1 and 3. The orphanhood estimates from DHS were derived using the household files for the respective countries, while those from the census were obtained from the respective countries' reports (Malawi National Statistical Office 2009; Lesotho Bureau of Statistics 2011; Zimbabwe National Statistics Agency 2013), adapted to the methodology used in the current study. The model estimates for new orphans, and maternal, paternal, and double orphans due to AIDS and due to all causes (including AIDS) were default estimates from Spectrum version 5.03 and correspond to the year for data collection of the final DHS to allow comparison. The numbers from each orphan category and for children aged 0–17 years provided in Spectrum software were used to calculate the percentages for the orphanhood categories.

Orphanhood age patterns were assessed to check whether they conformed to established patterns. In the study, the conventional 5-year demographic age groups of 0–4 years and 5–9 years were included to represent early and middle childhood respectively, and 10–14 and 15–17 to represent early and middle adolescence respectively (Dixon-Mueller 2008). The four stages are assumed to be distinct developmental milestones, and, in the current study, it is

expected that age variations exist in terms of the orphanhood prevalence, in terms of the effect of parental death and of the quality of orphanhood reporting.

Children's living arrangements patterns were provided as part of the descriptive statistics. In addition, the association between reported maternal/paternal orphan- hood and child co-residency with the mother/father was explored using the Pearson chi-squared test. According to Grassly et al. (2004), the association between child co-residency and orphanhood reports can be used to investigate systematic misreporting of orphans i.e., a tendency of children not co-resident with their mother/father to report their mother/father as dead.

Quality of the age data has a potential knock-on effect on the quality of orphanhood data. In the DHS, where age is the eligibility criterion for detailed individual interviews, Pullum (2006) and Johnson et al. (2009), have reported possible deliberate age displacement through outright omission from the household schedule, or incorrectly recording ages of respondents who were eligible for interviews as a load reduction strategy by fieldworkers. In the study, age ratios for all ages disaggregated by 5-year age groups were used for the assessment of age data quality. Age groups compared to single ages have a smoothing effect but are advantageous in that they allow better assessment of possible selective under-enumeration or displacement of ages outside the boundaries for eligibility of individual interviews. Age ratios which should approximate 100, are conventionally disaggregated by sex, because of the established survival and migration sex differentials.

The following formula for computing age ratios from Hobbs (2004) is used:

$$ {}_5AR_x = 100 * \frac{{}_5P_x}{1/3({}_5P_{x-5} + {}_5P_x + {}_5P_{x+5})} $$

Where:

${}_5AR_x$ = age ratio for ages x to $x+5$

${}_5P_x$ = population at ages x to $x+5$

${}_5P_{x-5}$ = population at adjacent lower age groups,

${}_5P_{x+5}$ = population at adjacent higher age groups.

For consistency checks, the total number of children reported by mothers is compared to the total number of mothers reported by children. Similar consistency checks were done by Blacker (1984). However, in the study, the analysis is restricted to the de facto population to

eliminate migration as a probable reason for the differences. Additionally, the line numbers of the mothers as reported by the children and that from the women's datasets are compared to assess the direction of errors, if any. We are aware that, due to systematic errors, potential bias cannot be ruled out even when women and children's reports are consistent, concealing the inconsistency between the two.

Results

The findings show that the fraction of children with indeterminate parental survival information was between one percent and five percent (Table 3.2). At least one in four children in Lesotho, one in every five children in Zimbabwe and one in every ten in Malawi are orphans. In Malawi, maternal, paternal, and double orphans are approximately 5, 10 and 3% respectively, which is approximately 50% of that for Lesotho and Zimbabwe (Table 3.2).

Table 3.2: Characteristics of children by selected variables, country, and data source

Variables	Lesotho		Malawi		Zimbabwe	
	DHS	**Model**	**DHS**	**Model**	**DHS**	**Model**
Orphanhood status:						
Paternal orphan	22.8	14.6	10.0	10.5	17.6	14.2
Maternal orphan	10.8	11.1	5.0	7.1	9.1	11.7
Double orphan	6.8	5.5	2.5	3.3	6.0	6.1
Indeterminate	4.8		0.6		3.3	
Total orphans	26.7	20.2	12.5	14.3	20.7	19.8
Other orphan disaggregation						
New orphans		8.4		9.7		7.9
Orphans due to AIDS		68.6		62.7		80.0
Orphans by age category						
0-4	9.7		3.2		5.0	
5-9	22.1		10.1		16.9	
10-14	37.4		22.7		31.9	
15-17	44.4		18.8		40.7	
Co-residence with parents						
Both parents	23.7		56.4		41.8	
Father only	5.3		2.1		3.4	
Mother only	33.9		22.7		25.6	
None of the parents	37.1		18.8		29.2	
N	**19 190**		**64 806***		**20 029***	

*Numbers exclude the non-usual resident members as per the methodology, unlike for Lesotho, due to previously mentioned reasons

DHS and model estimates align across the countries, except for paternal orphans in Lesotho. There are differences between maternal and paternal orphanhood estimates in the three countries for both model and survey estimates, but the difference is more pronounced in the latter, where paternal orphans are twice as many as maternal orphans.

Orphanhood increases with age: orphanhood in children aged 0–4 years was 3 to 10% but was 26 to 44% among adolescents aged 15–17 years (Table 2). Approximately 10% of the total orphans are new orphans and between 60 and 80% are due to HIV/AIDS (Table 2). The analysis of orphanhood trends indicates a decline or stabilisation in the proportions of maternal, double, and paternal orphans in Malawi. Zimbabwe recorded decreases, whereas Lesotho experienced an increase in maternal and double orphans alongside a decline in paternal orphans (Fig. 1).

In Lesotho, an estimated 24% of children are co-resident with both parents, compared to 42 and 56% in Zimbabwe and Malawi, respectively. This suggests that the high non-child-parental co-residence is not due to parental death – because double orphans are extremely low and range between 2.5 and 6.8%. The percentage of children co-resident with fathers only is markedly lower than with mothers: five per cent or less in all three countries compared to co-residency with mother which is 34% in Lesotho, 23% in Malawi and 26% in Zimbabwe.

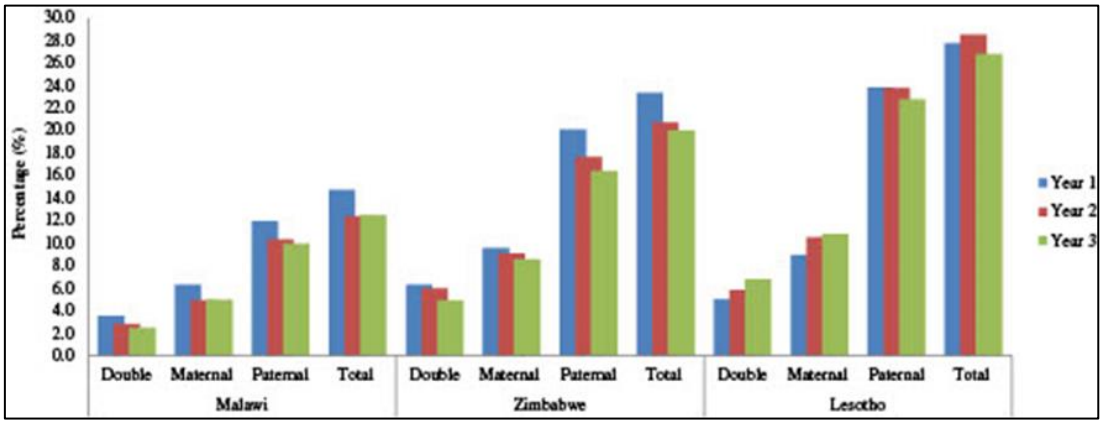


Figure 3.1: Orphan categories by year and country

Age ratios were close to 100, except for some ages, particularly ages 10–14 years which were much higher than the preceding and subsequent age groups, and age groups 50–54 for females and 55–59 for males in Zimbabwe, and 60–64 for males in Lesotho that have higher age ratios for preceding ages (Table 3). These ages were associated with eligibility for individual interviews.

The table plays a crucial role as a precursor to subsequent analyses, specifically focusing on female adolescents aged 15–19. The observed age ratios, particularly deviations in certain age groups such as 10–14 years, suggest a displacement of the specific adolescent subgroup into ages 10-14, where they are not eligible. Understanding these patterns is essential for interpreting subsequent analyses and recognizing potential age-related discrepancies that may influence eligibility criteria and data interpretation.

Table 3.3: Age ratios by sex and country: DHS data

Age	Lesotho		Malawi		Zimbabwe	
group	Male	Female	Male	Female	Male	Female
0-4						
5-9	99	96	105	105	97	97
10-14	113	113	105	107	112	110
15-19	98	94	96	86	93	91
20-24	96	102	91	98	94	102
25-29	100	98	102	107	105	104
30-34	98	99	99	97	96	98
35-39	96	97	106	100	104	103
40-44	91	94	88	90	98	87
45-49	104	96	101	96	88	93
50-54	97	111	98	109	91	116
55-59	100	99	95	93	118	92
60-64	105	101	112	106	93	104
65-69	96	84	91	95	105	90
70-74	96	106	93	99	80	103
75-79	106	98	95	88	100	78
80+						

(−) Line shows the border ages for eligibility for detailed individual questionnaires for males and females.

Pearson chi-squared test expected counts for mother/father dead and mother/father non-co-resident did not approximate the observed counts across the countries (not shown). However, the total number of mothers reported by children and that of children reported by mothers were similar– only about one percent was inconsistent (Table 4). This was also true for the line numbers of mothers as reported by children in the household schedule and from women's datasets for children under 5 years - 6% or less was inconsistent. These findings show that there are women who may not have reported a child as their biological child, and yet were reported by the child as the biological mother or vice versa - this however was only a small

proportion. This illustrates the consistency between the total number of mothers reported by children and the number of children reported by mothers, providing additional insights into potential data reporting issues.

Table 3.4: Comparison of mothers' and children's reports by country: DHS data

Country	All children			Children under 5 years		
	Children's reports	*Mothers' reports*	*Ratio*	*Total*	Consistent	*Ratio*
Lesotho	9 161	9 061	1.01	2 351	2 222	1.06
Malawi	46 420	46 428	1.00	5 514	5 514	1.00
Zimbabwe	11 703	11 613	1.01	5 809	5 809	1.00

Discussion

This study set out to assess the orphanhood data quality in three southern African countries, namely Lesotho, Malawi, and Zimbabwe. The DHS, census and model orphanhood estimates suggest plausible patterns and trends, and data show internal consistency, which suggests that it is tenable to utilise the orphanhood data. These data sources can therefore be viewed as complementary, i.e., research can benefit from the lower-level disaggregation possible with census data, useful particularly for targeted interventions in resource-limited settings, the breadth of sample surveys to explore orphaned children's vulnerability or lack thereof on various well-being domains. The model projections provide estimates at regular intervals and can give insight into the extent of the children's perinatal exposure to HIV, and the trends in orphanhood incidences from the proportion of orphans due to AIDS and new orphans, respectively.

The results from the study are consistent with previous research. Parental survival questions yielded remarkably high response rates, and so were less likely to have biased the orphanhood estimates. Orphanhood increased with age. There were also more paternal orphans than maternal orphans. A substantial number of children also lived apart from their biological parents. We expected that there would be no major variations in orphanhood over time, due to the limited intervals between the survey years.

Inconsistent with findings by Grassly et al. (2004), who used the then available orphanhood data for children younger than 15 years, the current study suggests, albeit to a small extent, a potential bias in orphanhood reporting, as some children with non-co-resident mothers may have had other individuals in the household identified as their mothers. The bias may partly

explain the exaggerated difference between maternal and paternal orphanhood survey estimates. Nonetheless, survey orphanhood estimates provide an insight into children's living arrangements. Children may be "virtual" paternal orphans because they are not co-residing with their biological father or any father figure, while, although children's mothers may be dead, they have a "maternal substitute" … the fuzziness which may be an advantage for policy (McCaa et al. 2005). This is important in this context, considering the feminisation of poverty and the fact that female household heads' ability to provide for their children's basic needs or disciplining their children may be compromised (Mmari 2011), which may be linked to limited educational and health access, and risky behaviours.

The results on age ratios suggests age displacement. It is difficult to estimate the effect of the apparent age displacement on orphanhood estimates because of other confounding factors. However, because ages 15 and the contiguous upper ages seem to have been pushed to ages 10–14 years, the latter's orphanhood estimates may be exaggerated because older respondents whose parents' mortality is expected to be higher than that of the genuinely younger respondents are combined.

However, it is important to remain cognisant of the fact that the lack of contemporaneous data potentially affects the comparison of patterns and trends across countries. In addition, the model-based estimates are also affected by the quality of the input data available to them. So, there is a lack of a "gold standard."

Conclusions

The study suggests that the three orphanhood data sources under consideration are usable and can therefore complement each other to provide the orphanhood magnitude, pattern of living arrangements and an understanding of children's well-being. This study, although limited to three countries, can inform research on the rest of Southern Africa and sub-Saharan Africa. The study is consistent with research that the majority of orphans are adolescents, attributed to a cumulative increase of orphans with age and the high likelihood of death for older children's parents (Fisher 1950; Grassly et al. 2004; Hosegood et al. 2007; UNAIDS/UNICEF/USAID 2004). Parents of older children are expected to have a higher mortality risk due to any cause, including AIDS, compared to their counterparts with younger children. This is because of the general increase in mortality with increasing age, and extended period of potential exposure to

various health risks and conditions. This may also be partly because older children's orphanhood reports may be more reliable than those of younger children.

This paper recommends the extension of the parental survival questions to ages beyond 17 years, including questions on the timing of parental death. This will allow retrospective analysis of the vulnerability of orphans, as orphanhood reports at older ages are likely to be more reliable. However, the recommendation is made with the intention of improving data quality and research outcomes, and empirical evidence supporting this specific recommendation is an area for further investigation.

The difference in orphanhood levels seems to be explained by the different HIV/ AIDS trajectories in the three countries. The role of high HIV/AIDS-related adult mortality in the decline of the HIV/AIDS prevalence in Zimbabwe (Reniers et al. 2010) cannot be ignored. This is considering the estimated 80% of orphans due to HIV/AIDS. The findings in the study of the high incidences of orphans suggest that the "orphan problem" can be expected to persist into the future, in a region also plagued by other challenges, e.g., poverty that may affect children's well-being, orphans and non-orphans (Meintjes & Giese, 2006).

The issue of orphaned children's care is of vital importance. Research shows that many orphans are in kinship care, which is viewed as positive, but this only provides a guarded hope because caregivers tend to make greater investment in the health and education of their biological children compared to the non-biological children with whom they live (Case et al. 2004; Oni 1995).

The higher orphanhood in adolescence is particularly disconcerting, as adolescence is increasingly seen as a 'window of hope' to contain the HIV/AIDS public health threat and the endemic poverty and inequality. However, it is only among adolescents that HIV/ AIDS burden remains unabated, and this is primarily due to HIV perinatal infections (UNAIDS 2016; Eaton et al. 2013), which may counter this hope. Although not conclusive, there is evidence of greater educational and sexual vulnerability of orphaned children, compared to non-orphaned children (Case et al. 2004, Monasch and Boerma 2004; Robertson et al. 2010). In sub-Saharan Africa, where child fostering is common, parental coresidency may be more inclusive and may provide a better measure of children's vulnerability than the survival status of parents and allow analysis of how children fare in the array of care arrangements available. For example, a substantial number of children may not have been co-resident with the

deceased parent/s, due to migration for work, absent parents, or fosterage and these may have different effects on children. Further research on how the use of the de jure population in DHS orphanhood and living arrangements estimation, particularly for Lesotho where migration is high, may contribute to the high child–parent non-co-residency, can be explored. The age displacement in the study in DHS data, also highlighted in previous research, is potentially a data artefact because it seems to be systematic, and the age patterns do not conform to established demographic patterns. Survey programs can invest in training and innovative fieldwork supervision strategies to curb the practise.

CHAPTER 4: RELATIONSHIP BETWEEN ORPHANHOOD STATUS, LIVING ARRANGEMENTS AND SEXUAL DEBUT: EVIDENCE FROM FEMALES IN MIDDLE ADOLESCENCE IN SOUTHERN AFRICA

4.1 Introduction

Sexual health is within the rights of individual adolescents (Petroni et al. 2019), but it is the context in which it occurs that may constrain the respective rights (Wellings et al. 1999). For this reason, the focus of the study is timing of sexual debut.

4.2 Research paper

Relationship between orphanhood status, living arrangements and sexual debut: evidence from females in middle adolescence in Southern Africa[5]

Mercy Shoko, Latifat Ibisomi, Jonathan Levin and Carren Ginsburg

Summary

This study examined the relationship between orphanhood status, living arrangements and sexual debut. The study is important in the context of southern Africa, where a substantial number of children live apart from their parents because the parent is dead or living elsewhere, and where female adolescents face disproportionate sexual and reproductive health risks. Data for female adolescents were taken from Demographic and Health Surveys conducted in seven southern African countries. Unadjusted and adjusted hazard ratios of sexual debut were estimated using Cox Proportional Hazard models. The results from multivariate analyses showed that non-co-residence with biological parents was significantly associated with higher risk of sexual debut in five of the seven countries. Using pooled data, the results showed that father absence was associated with higher risk of sexual debut – whether the father was deceased or living elsewhere. Interventions to delay sexual debut among female adolescents should seek to promote father–adolescent co-residence and improve access to education.

[5] "The final publication is available at Cambridge at doi:10.1017/S0021932017000475.

Introduction

Adolescence spans ages 10–19 years, although there are developmental variations for early, middle, and late adolescence, defined as ages 10–14, 15–17 and 18–19 years, respectively (Dixon-Mueller, 2008). Adolescence is an intricate transitional period from childhood to adulthood characterized by physiological and psychological maturity, various external influences, and exposures and experimentation that can enhance sexual risk (WHO, 2001). According to UNICEF/WHO/UNFPA definitions, the stage overlaps with other youthful stages: childhood and youth (UNDESA 2011).

Adolescent sexuality is discussed as part of the broader sexual and reproductive health and rights entrenched by the 1994 International Conference on Population and Development's Programme of Action (ICPD-PoA), which provided the historic sexual and reproductive health and rights framework, spelled out the population–health–development synergy and addressed the age-driven health needs of adolescents (UN, 1994). Healthy adolescent sexual development is critical for health and socioeconomic well-being (ibid). It is well established that adolescent sexual and reproductive health, and timing of sexual activity, are intricately linked to several outcomes, namely: pregnancy and childbearing, maternal health and HIV and other sexually transmitted infections (Zaba et al., 2002; Ghebremichael et al., 2009; Louie et al., 2009; Stockl et al., 2013). Early sexual debut is also linked to cervical cancers (Louie et al., 2009). In the context of structural, socio-cultural and financial barriers to adolescents accessing sexual and reproductive health services (Chandra-Mouli et al., 2015), sexual deferment is a tenable option.

Adolescents in sub-Saharan Africa are especially affected by adverse sexual and reproductive health outcomes associated with early sexual activity, and this exists against the backdrop of the HIV pandemic, mostly transmitted through heterosexual contact (UNAIDS, 2016), child marriages (UNFPA, 2012), unmet need for contraceptives (Chandra-Mouli et al., 2014) and restrictive abortion laws (Sedgh et al., 2012). Sub-Saharan Africa also has a substantial and rapidly growing adolescent population (UNICEF, 2012), which currently constitutes almost a quarter of the total population of the region (UNICEF, 2015). Female adolescents are disproportionately affected, largely because being female and young poses high sexual and reproductive health risks (Fathalla, 1994). Female adolescents experience early childbearing, which creates a substantial morbidity and mortality burden among adolescents (UNFPA,

2012). HIV infections among adolescent girls continue to be markedly higher than in adolescent boys in sub-Saharan Africa (UNAIDS, 2016).

There has been substantial research on the socio-cultural risk factors associated with adverse adolescent sexual and reproductive health, one of which is parental absence (Ngom et al., 2003; McGrath et al., 2009; Mmari, 2011; Pilgrim et al., 2014). Parental presence is known to be protective against early sexual debut, sexual activity, and pregnancy (Ngom et al. 2003; McGrath et al., 2009; Pilgrim et al., 2014).

There are myriad pathways through which parental absence may influence children's sexual and reproductive health. Parents provide primary sexual socialisation, i.e., impart to their children social, cultural, and religious values regarding sexuality (Shtarkshall et al., 2007). Parents are well placed to play this role because of their huge stake in the welfare of their children. Involvement of parents in their adolescent children's lives is also argued to influence adolescents' self-esteem, which is linked to health-related behaviours (WHO, 2001). Parental absence during the critical adolescence stage may therefore be detrimental to adolescent sexual and reproductive health.

Research on the association between orphanhood status and sexual and reproductive health outcomes seems to have taken centre-stage with the advent of HIV (Robertson et al., 2010; Mojola 2011; Chae, 2013; Mkandawire et al., 2013). In sub-Saharan Africa, an estimated 52 million (out of the global 140 million children) aged 0–17 years are orphans, defined as children aged 0–17 years whose parent or parents are dead (UNICEF, 2015). Research has consistently shown that universally most orphans are adolescents (Fisher, 1950; UNAIDS/UNICEF/USAID 2004; Hosegood et al., 2007; Shoko & Ibisomi, 2017). Sub-Saharan Africa has the most severe HIV epidemic in the world, estimated to be 70% of global HIV prevalence and of AIDS-related deaths (UNAIDS, 2016). The effect of HIV/AIDS is severe for adults in their prime years resulting in high adult mortality, producing a parallel rise in the number of orphans (Palloni and Lee, 1992; Robertson et al., 2010).

Upon parental death, adolescents' living arrangements mostly change (Mojola, 2011). The transition to other households in the event of parental death disrupts interpersonal relationships, requiring children to build new relationships with their new caregivers, with varying degrees of success (Foster, 2004; Juma et al., 2007; Mojola, 2011; Puffer et al., 2012). This transition may affect children's social and emotional development and has a

bearing on their sexual development and sexual and reproductive health (Juma et al., 2007). The characteristic and culturally sanctioned living arrangements for orphans is to seek care from kin networks, although orphans are increasingly living outside of family care (Foster, 2004). Research in sub-Saharan Africa on the effects of orphanhood status on sexual and reproductive health outcomes such as early sexual debut, pregnancy, marriage and HIV infection and other sexually transmitted infections, although substantial, has not produced completely consistent findings. For example, a study by Palermo and Peterman (2009) found no evidence that orphanhood was associated with marriage or pregnancy, but with sexual debut. A study by Robertson et al. (2010) suggested that the association between orphanhood and sexual debut existed for countries with high orphanhood levels and not those with low orphanhood prevalence. The association also varies by category of orphans, i.e., maternal, paternal, or double orphans, and sex of the adolescent (McGrath et al., 2009), in some cases existing for female adolescents only (Robertson et al., 2010; Chae, 2013). A study by Magadi and Uchudi (2015) did not find orphans to have a higher risk of sexual debut than their non-orphan counterparts.

The variation is partly due to the diverse control variables used in multivariate models, age cut-offs, geography, and research design. The age criterion used in data collection often introduces restrictions on the ages that are to be considered in research using secondary data. For studies using the publicly available Demographic and Health Survey (DHS) data, the age range for analysis of sexual debut is 15–17 years because these are the only ages with available data for both parental survival status and sexual and reproductive health outcomes (Palermo & Peterman, 2009; Robertson et al., 2010). For longitudinal studies and studies using primary or other sources of data, ages range from early adolescence to mid-20s (McGrath et al., 2009; Chae, 2013; Mkandawire et al., 2013). Although the relationship is less conclusive, but there is evidence to suggest that orphanhood is a key factor for adverse ASRH among females (Operario et al., 2011). This relationship is likely to be influenced by demographic and socioeconomic factors, age, rural–urban residence or care arrangements for the orphan (Operario et al., 2011; Magadi & Uchudi, 2015; Embleton et al., 2017). Research also suggests the aforementioned factors may be important not only as confounding factors, but also in their own right (Mkandawire et al., 2013). Nevertheless, the highlighted inconsistency between orphanhood and sexual and reproductive health outcomes may also be because the longstanding patterns of fosterage in the region are rarely considered.
Parental absence is not exclusively due to parental death and may be prompted by other circumstances (Meintjes et al., 2010; Gaydosh, 2015), so the orphaned children may not have

been living with the deceased parent to begin with. Children may be 'virtual orphans' when parents are living elsewhere (Case et al., 2004). While parental non-co-residence may not always imply child–parent non-contact, frequency of contact is likely to vary, and to affect the extent of parental influence. There is emerging research considering the effect of adolescents' living arrangements on sexual and reproductive health, considering orphanhood status, but this research is sparse and geographically restricted.

A longitudinal study in a district of Uganda showed that parental absence, particularly of fathers, whether due to death or otherwise, resulted in early sexual debut among female adolescents (Pilgrim et al., 2014). A cross-sectional study of male and female adolescents in two districts of Sierra Leone found that living with a surviving parent, a mother, father or both parents, delayed sexual debut (Stark et al., 2015). A study using a two-phased global Well-Being of Adolescents in Vulnerable Environments (WAVE) study data, suggested that in Johannesburg, South Africa, there was no association between parental absence and sexual debut for male adolescents (Mmari et al., 2016). Contrary to other studies, female adolescents who were raised by other persons besides their parents were less likely to have sex compared with their counterparts who were raised in households in which both their biological parents were present. In addition, the risk of sexual debut was higher for maternal and double orphans, but lower for paternal orphans. For males who were paternal orphans, the risk of sexual debut was higher than for their counterparts who were non-orphans (ibid).

It is against this background that the present study sought to contribute to the discourse by focusing on female adolescents' sexual debut and parental presence/ absence, considering parental survival status. The study used nationally representative and comparable data from seven southern African countries. The study has two primary aims:

1. To investigate the timing of sexual debut among female adolescents in selected Southern Africa countries.
2. To explore the association between orphanhood status, living arrangements, and the timing of sexual debut among female adolescents.

The following are the study hypotheses: 1) orphans have a higher risk of sexual debut compared with non-orphans, and 2) female adolescents who are living with both parents have reduced risk of sexual debut than their counterparts who do not. The objectives of the study were first to estimate the timing of sexual debut across the countries, second, to examine whether there was a significant difference in sexual-risk behaviour across an array of living

arrangements and third, to estimate the association between orphanhood status, living arrangements and timing of sexual debut.

Methods

Data and study sample

The study used data from adolescents aged 15–17 collected as part of the DHS programme from seven of the ten southern African countries. The seven countries were Lesotho, Malawi, Mozambique, Namibia, Swaziland, Zambia, and Zimbabwe. Relevant data were not available for Angola, Botswana, and South Africa. The surveys employed in the study were conducted between 2006 and 2014 for each country as follows: Lesotho 2009/10, Malawi 2010, Mozambique 2011, Namibia 2013, Swaziland 2006/7, Zambia 2013/4, and Zimbabwe 2010/1. The sample sizes in the study ranged from approximately 700 female adolescents in Swaziland to 2900 in Malawi (see Table 1).

Female adolescents aged 15–17 years were selected from the women of reproductive ages identified from the sampled households to participate in detailed individual interviews. Interviews with women included questions on sexual and reproductive health, and parental survival information was obtained from the household schedule. This study was restricted to females because of their heightened sexual and reproductive health risks. The study was also restricted to usual household residents to capture typical living arrangements. Adolescents were classified as either never married, or ever married. The latter category excluded female adolescents whose sexual debut occurred within marriage, i.e., where age at sexual debut was higher than the age at first union. Child/early marriages, defined as marriages where one or both partners are aged 17 years or younger, are widespread in the seven countries (UNFPA, 2012). In Lesotho, Malawi, Mozambique, Zambia, and Zimbabwe, 20–50% of girls are married by age 18 (UNFPA, 2012).

Contextual factors

Southern Africa provides an important context for research on adolescents' sexual and reproductive health outcomes. The sub-region is characterised by high parental absence and complex and fluid households due to high child fosterage, labour migration and non-marital fertility (Hosegood et al., 2007). The sub-region is by far the worst affected by the HIV

epidemic (UNAIDS, 2016). Several adolescents may be infected through postnatal HIV transmission (Eaton et al., 2013).

Demographic and Health Surveys

The DHS programme undertakes cross-sectional surveys in LMICs every 4–5 years dating back to the mid-1980s (Corsi et al., 2012). Key advantages of the DHS include high response rates, high-quality interviewer training, national coverage, almost consistent content over time and procedures standardized to allow for data comparability across countries and over time (Corsi et al., 2012, p. 1602). Samples are drawn using a two-stage stratified sampling design, are household based, and predominantly include the de facto population, i.e., usual residents and visitors present the night preceding the household interview.

Variables

The outcome variable in the analyses was 'sexual debut,' defined as age at first sexual intercourse, and coded '0' if the respondent had not initiated sexual intercourse. Legal age of consent for sex is 16 years in the seven study countries. In the study, adolescents whose age at first sexual intercourse was inconsistent with related events, e.g., age at conception of current pregnancy or age at first birth, who constituted less than 1% of the sample, were excluded.

The key explanatory variable was 'living arrangement,' derived from adolescents' co-residency with biological parents considering parents' survival status. Parental survival information was obtained from questions on whether the index person's biological mother/father was alive at the time of the interview. In the study, female adolescents with indeterminate responses for parental survival status were excluded, to consider only adolescents that affirmatively reported their orphanhood status. Maternal and paternal (which make up single orphans), double and non-orphanhood were mutually exclusive categories. The departure from the international definition for orphans, which includes double orphans for maternal and paternal orphans was deliberate. This was to capture separately the effect of mothers, fathers, and both parents' deaths on the timing of sexual debut for female adolescents.

Co-residency information was obtained from questions that sought to identify the adolescent's mother/father using the respective parent's identification number on the household schedule,

coded ‘0’ if not listed on the household schedule. In the study, co-residency was coded ‘1’ if a parent was present on the household schedule or ‘0’ otherwise. Parental co-residency was combined with orphan status as follows, to categorize female adolescents’ living arrangements: 1) both parents; 2) one parent, non- orphan; 3) one parent, single orphan; 4) neither parent, non-orphan; 5) neither parent, single orphan; 6) neither parent, double orphan.

Further disaggregation to identify the specific parent (mother or father) would have been informative but this was not possible due to small numbers in some categories in the models performed by country.

Potential confounding factors were schooling, wealth quintile, residency, and comprehensive HIV knowledge. These variables are theoretically associated with sexual debut and were common across the datasets. Using age-for-grade analysis in the respective countries, adolescents aged 15–17 years should be enrolled in secondary school. Thus, a variable for school attendance was derived by identifying adolescents who attended school in the current year (coded ‘1’ if was in school and ‘0’ otherwise). Residency was coded ‘1’ if the adolescent resided in a rural area and ‘0’ if the place of residence was urban. Country- and survey-specific relative wealth indices were available in the datasets (Rutstein & Staveteig, 2014). In the study, wealth quintiles that accounted for rural and urban differences were derived from the ones available in the datasets. Comprehensive HIV knowledge among young people was on the list of indicators for monitoring the United Nations Declaration of Commitment on HIV/ AIDS, and was defined in relation to responses to the following questions that were all to be correctly answered (UNAIDS, 2002), also adopted in the study: 1) Can having sex with only one faithful, uninfected partner reduce the risk of HIV transmission? (Yes); 2) Can using condoms reduce the risk of HIV transmission? (Yes); 3) Can a healthy-looking person have HIV? (Yes); 4) Can a person get HIV from mosquito bites? (No); 5) Can a person get HIV by sharing a meal with someone who is infected? (No).

Analysis

The analyses included descriptive statistics, and unadjusted and adjusted models that considered the surveys’ complex design. The DHS data were weighted to allow for nationally representative estimates. The Cox regression-based test for equality of survival curves was used for the key explanatory variable ‘living arrangements,’ to test for equality of survivor functions for sample-weighted data. For descriptive statistics, the characteristics of the

population were reported using percentages and Kaplan–Meir survival curves plotted to estimate the timing of sexual debut. The analyses (unadjusted and adjusted regression models) were performed separately by country after merging individual women and household datasets. It would have been less cumbersome, and interesting, to use pooled datasets to model country effects. However, there are concerns around the reliability of estimates from analysis involving pooled datasets for few countries (Bryan & Jenkins, 2016). In the study, pooled data were used to increase the sample size to enable disaggregation of co-residency with one parent to co-residency with mother or father, and to differentiate between maternal and paternal orphans for single orphans. Cox proportional hazard models were fitted to estimate the risk of sexual debut, where female adolescents who were sexually naïve at the time of the survey were censored.

Ethics statement

Written permission to use the data was provided by the Inner-City Fund International (DHS), which keeps the archived data. The University of the Witwatersrand's Human Research Ethics Committee (Medical) granted ethical approval for the study (No. M140443).

Results

The results showed that orphanhood levels ranged from 26% to 44% (Table 1). Lesotho and Zimbabwe, with over 40% orphans, were the worst affected. Approximately 20–30% of female adolescents were single orphans. The largest proportions of orphans across the countries were paternal orphans – more than double that of maternal orphans. Between 20% and 40% of adolescents were co-resident with both parents. Approximately 25–40% were not co-resident with either parent, although at least one of their parents was alive.

Table 4.1: Descriptive statistics (percentages) of study population

Covariates	Lesotho	Malawi	Mozambique	Namibia	Swaziland	Zambia	Zimbabwe
N	**933**	**2 903**	**1 517**	**941**	**718**	**1 920**	**989**
Age							
15	34.6	39.4	41.6	35.8	33.7	36.8	34.6
16	32.0	35.3	32.5	34.2	35.5	37.1	38.4
17	33.4	25.3	25.9	30.0	30.8	26.1	27.1
Ever had sex	28.3	23.8	40.1	26.6	24.6	29.2	10.8
Orphan status							
Non orphan	56.4	74.3	74.2	72.1	63.2	74.2	57.7
Paternal orphan	24.2	14.7	15.1	16.5	21.0	14.9	20.4
Paternal orphan	5.7	4.7	6.2	7.3	7.2	4.8	5.9
Double orphan	13.7	6.3	4.5	4.2	8.6	6.1	16.0
Total orphan	43.6	25.7	25.8	28.0	36.8	25.8	42.3
Single orphan	29.9	19.4	21.3	23.8	28.2	19.7	26.3
Coresidency with							
both parents	37.0	40.6	33.3	20.8	18.5	42.6	27.6
one parent, non-orphan	6.2	14.4	18.0	22.6	23.9	12.0	13.5
one parent, single orphan	18.7	10.6	10.0	10.8	16.2	9.8	13.6
neither, non-orphan	13.2	19.3	22.9	28.7	20.8	19.6	16.7
neither, single orphan	11.2	8.8	11.2	13.0	12.0	9.9	12.6
neither, double orphan	13.7	6.3	4.5	4.2	8.6	6.1	16.0
Neither with at least one parent alive	24.4	28.1	34.1	41.6	32.9	29.5	29.3
Wealth quintile							
Poorest	16.7	18.8	17.5	20.3	15.2	17.2	17.5
Poorer	19.3	17.9	19.3	19.2	19.1	18.1	18.6
Middle	18.7	19.2	21.0	20.1	20.2	20.1	21.3
Richer	20.8	21.3	20.4	18.1	21.0	22.5	21.8
Richest	24.5	22.8	21.8	22.3	24.5	22.1	20.8
Schooling	81.4	74.3	59.9	87.7	79.3	74.8	67.5
Rural residence	73.1	81.2	60.2	57.8	82.9	52.2	63.6
Comprehensive HIV knowledge	31.4	40.5	26.0	52.1	52.0	37.2	44,3

Percentages may not add up because of rounding.

The median age at sexual debut could not be estimated for the seven countries as approximately 10–40% had experienced sexual debut. Kaplan–Meir curves started descending before adolescence (before age 10), although the survival rates were remarkably high at this

stage (Fig. 1). The survival curves descended very gradually, except for Mozambique where the survival curve descended sharply, although the results are different from those shown in Table 1. Results from the Cox regression-based tests for equality of survival curves showed that there were significant differences in the relative hazards across the living arrangements categories for all countries, except for Swaziland and Namibia (results not shown).

The results showed that living arrangements were associated with the risk of sexual debut (Tables 2 and 3). This was in five of the seven countries studied. This was particularly the case for female adolescents who were co-resident with neither of their parents. The pooled analyses showed that non-co-residency with the father (regardless of the father's survival status or mother's co-residency status) was associated with higher risk of sexual debut (Table 4). In addition, the sexual debut risk for female adolescents who were co-resident with the father only was lower or similar to that of adolescents co-residing with both parents – but was not statistically significant. The adjusted models for all countries indicated that current enrolment in school was significantly associated with lower risk of sexual debut.

Lesotho

In the unadjusted model, co-residency with neither of the parents for double and single orphans was associated with approximately 70% and 80% higher sexual debut risk, respectively. In the adjusted model, co-residency with neither parent for double orphans was associated with 60% higher risk of sexual debut and with 50% higher sexual debut risk for co-residency with one surviving parent.

Malawi

In the unadjusted model, co-residency with one parent, for single orphans and for non-orphans, was associated with approximately 1.5 and 1.7 times the risk of sexual debut, respectively, compared with co-residency with both parents. In addition, non-co-residency with either parent for double orphans, single orphans and non-orphans was associated with approximately 1.6, 1.9 and 2.1 times higher sexual debut risk, respectively. This persisted in the adjusted model, although slightly attenuated.

Mozambique

In the unadjusted model, female adolescents who were not co-resident with either of their parents had a higher risk of sexual debut (Hazard Ratios (HRs) were 1.7, 2.3 and 2.8 for double orphans, single orphans, and non-orphans respectively). In the adjusted model, the HRs were 2.1 for single orphans and 2.6 for non-orphans.

Namibia and Swaziland

There was no evidence that co-residency with parents was associated with sexual debut risk in either country.

Zambia

In the unadjusted model, co-residency with neither parent when one nor both parents were alive was associated with 1.5 and 1.3 times the risk of sexual debut, respectively.
In the adjusted model, the risk was approximately 1.6 times for both.

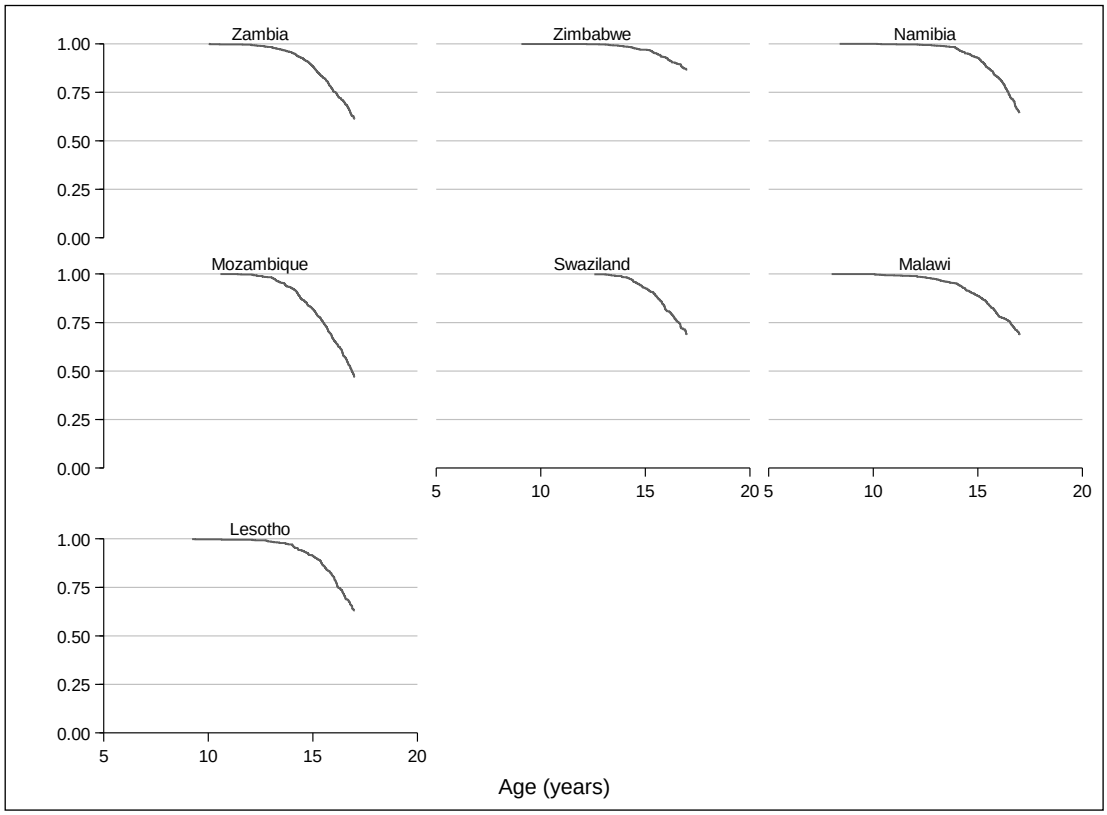


Figure 4.1: Kaplan-Meier survival curves of time to sexual debut by country

Table 4.2: Unadjusted models for timing of sexual debut by orphanhood status and country

Covariate	*Lesotho*	*Malawi*	*Mozambique*	*Namibia*	*Swaziland*	*Zambia*	*Zimbabwe*
	HR (SE)	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*
Coresidency with both parents is reference							
one parent, non-orphan	1.64 (0.533)	1.66 (0.245)**	1.37 (0.212)	1.13 (0.234)	1.05 (0.262)	1.34 (0.219)	2.67 (1.159)*
one parent, single orphan	1.47 (0.311)	1.45 (0.244)*	1.32 (0.247)	0.86 (0.256)	1.30 (0.368)	1.16 (0.190)	1.75 (0.788)
neither, non-orphan	1.56 (0.406)	2.07 (0.269)**	2.79 (0.375)**	1.29 (0.251)	1.44 (0.391)	1.33 (0.176)*	6.63 (2.273)**
neither, single orphan	1.79 (0.405)*	1.94 (0.334)**	2.32 (0.349)**	0.88 (0.228)	1.39 (0.398)	1.53 (0.239)**	7.00 (2.751)**
neither, double orphan	1.69 (0.360)*	1.61 (0.305)*	1.68 (0.421)*	1.17 (0.434)	1.39 (0.546)	0.94 (0.238)	5.07 (1.833)**

Table 4.3: Adjusted models for timing of sexual debut by country

Covariate	*Lesotho*	*Malawi*	*Mozambique*	*Namibia*	*Swaziland*	*Zambia*	*Zimbabwe*
	HR (SE)	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*	*HR (SE)*
Coresidency with both parents is reference							
one parent, non-orphan	1.63 (0.511)	1.60 (0.244)**	1.31 (0.223)	1.14 (0.234)	1.17 (0.313)	1.31 (0.218)	2.52 (1.139)*
one parent, single orphan	1.52 (0.332)*	1.37 (0.230)*	1.17 (0.238)	0.73 (0.273)	1.24 (0.348)	1.16 (0.208)	1.97 (0.978)
neither, non-orphan	1.44 (0.364)	1.87 (0.245)**	2.60 (0.366)**	1.14 (0.246)	1.29 (0.374)	1.55 (0.208)**	7.36 (2.482)**
neither, single orphan	1.44 (0.376)	1.80 (0.307)**	2.13 (0.325)**	0.84 (0.206)	1.18 (0.362)	1.64 (0.249)**	7.08 (2.534)**
neither, double orphan	1.64 (0.331)*	1.46 (0.282)*	1.51 (0.408)	0.90 (0.327)	1.23 (0.483)	1.11 (0.265)	4.73 (1.665)**
Wealth: Poorest is reference category							
Poorer	0.76 (0.189)	1.02 (0.155)	0.89 (0.173)	0.81 (0.170)	0.91 (0.227)	0.78 (0.122)	0.88 (0.274)
Middle	0.93 (0.208)	0.97 (0.147)	0.98 (0.185)	0.65 (0.140)	0.63 (0.155)	0.71 (0.114)*	0.57 (0.191)
Richer	1.01 (0.230)	0.92 (0.140)	0.94 (0.166)	0.64 (0.136)*	0.58 (0.154)*	0.57 (0.108)*	0.71 (0.223)
Richest	0.88 (0.190)	0.73 (0.131)	0.96 (0.167)	0.30 (0.067)*	0.61 (0.168)	0.64 (0.106)*	0.46 (0.164)
Rural residency: urban is reference category							
	1.17 (0.230)	0.95 (0.135)	0.78 (0.089)*	1.48 (0.226)	1.03 (0.227)	2.18 (0.252)**	2.49 (0.603)**
Comprehensive HIV knowledge: No knowledge is reference							
	1.44 (0.232)*	1.64 (0.154)**	1.24 (0.117)*	0.80 (0.114)	0.82 (0.151)	0.90 (0.098)	0.85 (0.175)
Schooling: not schooling is reference category							
	0.34 (0.053)**	0.39 (0.037)**	0.48 (0.056)**	0.19 (0.033)**	0.22 (0.041)**	0.55 (0.056)**	0.18 (0.046)**

Table 4.4: Unadjusted and adjusted models for time to sexual debut: pooled data

Variable	Univariate model HR (SE)	Full model HR (SE)
Coresidency with both parents is reference		
Non-orphan, living with mother only	1.49 (0.125)* *	1.45 (0.121)**
Non-orphan, living with father only	0.85 (0.140)	0.96 (0.168)
Paternal orphan, living with surviving mother	1.33 (0.122)**	1.34 (0.121)**
Maternal orphan, living with surviving father	0.92 (0.190)	1.04 (0.251)
Non-orphan, living with neither parent	1.97 (0.134)**	1.85 (0.128)**
Paternal orphan, living with neither parent	1.80 (0.173)**	1.63 (0.164)**
Maternal orphan, living with neither parent	1.99 (0.226)**	1.86 (0.209)**
Double orphan, living with neither parent	1.61 (0.151)**	1.51 (0.147)**
Wealth: Poorest is reference category		
Poorer		0.90 (0.067)
Middle		0.86 (0.067)
Richer		0.79 (0.060)**
Richest		0.75 (0.060)**
Rural residency: urban is reference category		0.75 (0.060)*
Comprehensive HIV knowledge: No knowledge is reference category		0.86 (0.067)
Schooling: not schooling is reference category		0.79 (0.060)**
Country: Swaziland is reference		
Lesotho	1.29 (0.142)*	1.40 (0.153)*
Malawi	1.14 (0.108)	1.12 (0.109)
Mozambique	2.19 (0.206)**	1.82 (0.179)**
Namibia	1.07 (0.112)	1.28 (0.130)*
Zambia	1.44 (0.139)**	1.43 (0.141)**
Zimbabwe	0.43 (0.046)**	0.40 (0.044)**

***P-value<0.05, ** P-value<0.01, HR: Hazard Ratio, SE: Standard Errors**

Zimbabwe

In the unadjusted model, non-co-residency with both parents increased the risk of sexual debut amongst adolescents, which persisted in the adjusted model (HR ranged from 2.7 to 7.0 in the unadjusted model and from 2.5 to 7.4 in the adjusted model).

Pooled data

Adolescents who were co-residing with a mother and not a father because of death of the latter or because the father was living elsewhere, had higher sexual debut risk (HR: 1.3 and 1.5, respectively, for the unadjusted model, and which persisted in the adjusted model). Higher risk of sexual debut was also present in all instances where an adolescent was not co-residing with either parent (HR: 1.6–2.0 for the unadjusted model and 1.5–1.9 in the adjusted model).

Discussion

The study set out to examine the relationship between orphanhood, living arrangements and risk of sexual debut among female adolescents aged 15–17 years in southern Africa. Results showed that across the seven countries orphanhood was high, but could be a diminishing problem, perhaps because of the ART roll-out, seen in Zambia and Uganda (Makumbi et al., 2012; Rathod et al., 2014). Although the data were from a short interval between 2006 and 2014, the period saw dramatic changes in adult mortality levels, so orphanhood prevalence across countries should be understood in the context of adult mortality levels at the different reference periods for the data used in the study. Parental absence was also high and, consistent with research by Martin and Zulaika (2016) and Monasch and Boerma (2004), could not be explained completely by orphanhood.

A substantial number of female adolescents had initiated sexual activity – just over 10% to 40% of the female adolescents had had their sexual debut. The results suggested that 'living arrangements' was associated with higher sexual debut risk in five of the seven countries in the study. The pooled analyses showed that father absence was associated with higher risk of sexual debut, while co-residency with only the father was associated with lower or equal sexual debut risk to non-orphans co-residing with both parents. The expectation was that co-residency with one parent would be associated with higher risk of sexual debut compared with co-residency with both parents, and the complex picture could be explained by the influence that fathers may exert over children's behaviour, while mothers may experience problems disciplining their children when their husbands have died (Mmari, 2011). Living with neither parent was nevertheless found to be associated with a higher risk of sexual debut amongst female adolescents in this study. This was consistent with the hypothesis that co-residency with parents is associated with lower risk of early sexual debut.

Interestingly, and contrary to the study's hypotheses, i.e. (1) orphans have a higher risk of sexual debut compared with non-orphans and (2) female adolescents who are living with both parents have lower risk of sexual debut than their counterparts who do not, double orphans did not seem to be the worst disadvantaged. This is probably because female adolescents who are double orphans are more likely to get support from members of their kinship network compared with their counterparts whose parents are living elsewhere. In an African context, relations get together to arrange the care of surviving children after the death of parents (Mann, 2002).

Although control factors were included to estimate the net effect of living arrangements on the timing of sexual debut, they also provided important insights. The results suggested that schooling was the only factor that was universally associated with sexual debut across the countries. The study also showed that school attendance was high in all the countries, although not universal. In the adjusted model, the reduction in sexual debut risk was between approximately 45% and 80% for female adolescents who were attending school, compared with their counterparts who were not. Also noteworthy was that adolescents in higher wealth quintiles had lower sexual debut risk in Namibia and Zambia, and those resident in rural areas had higher risk of sexual debut in Zambia and Zimbabwe, and lower risk in Mozambique. In Lesotho, Malawi and Mozambique, comprehensive HIV/AIDS knowledge was associated with risk of sexual debut; in all three countries sexual debut risk was higher among female adolescents who possessed comprehensive HIV/AIDS knowledge, compared with those who did not. This result is counterintuitive – the expectation is that sound HIV knowledge should translate into HIV-avoidant behaviours, one of which is postponement of sexual initiation (UNAIDS, 2002). However, the relationship between knowledge and behaviour is complex – knowledge alone is insufficient for behaviour change, which poses a challenge for health promotion in general. In this context, sexually active adolescents may have better HIV knowledge than their non-sexually active counterparts, partly because they tend to actively seek HIV information (Van Rossem et al., 2010). Further research is required to understand these pathways.

The study had certain limitations, which need to be considered when interpreting the results. The study used cross-sectional data, so even the potential time-varying explanatory variables were included at fixed points in time and therefore the temporal sequence of events could not be established. Sexual debut was self-reported and therefore could have been under-reported, the extent of which may vary across countries. In addition, the study excluded adolescents

who were living on the streets or in institutions, who with respect to orphanhood status, living arrangements and sexual debut, may be the worst disadvantaged (Hillis et al., 2012). The study also did not account for the complexity of African households, e.g., possible vacillation of adolescents between households resulting in multiple household memberships, which is difficult to ascertain using cross-sectional data. Other factors not considered included whether sexual activity was coerced, which may explain the timing of sexual debut.

In conclusion, this study helps to extend the knowledge of risk factors associated with sexual debut and to shape future interventions and research on sexual and reproductive health outcomes among female adolescents in southern Africa. The results suggest that the absence of parents, particularly fathers, is associated with early sexual debut among female adolescents. However, this is against the backdrop of lower co-residency with fathers as compared with mothers (Monasch & Boerma, 2004; Martin & Zulaika, 2016). Universal access to education may help delay the timing of sexual debut. Ultimately, access to age-appropriate sexual health information and services is critical for healthy sexual development, as outlined in the 1994 report on the International Conference on Population and Development (UN, 1994).

CHAPTER 5: ORPHANHOOD AND HIV KNOWLEDGE AMONG FEMALE ADOLESCENTS IN MALAWI

5.1 Introduction

Central to the fight against the HIV pandemic at the turn of the century, was the HIV prevention efforts geared towards "[promoting] widespread knowledge and awareness of how HIV is transmitted and how infection can be averted' (UNAIDS 2005:23), making general education and HIV-specific education important (Vandemoortele and Delamonica 2000). This is anchored on the social learning/cognitive theory, a theoretical framework that postulates that behaviour is largely regulated antecedently through cognitive processes which makes knowledge a prerequisite for behaviour change (Foster et al. 1988). It was also because the predominant mode of HIV transmission is sexual transmission across generations, therefore knowledge of its prevention was seen as central to the interventions to curb its spread by breaking the infection cycle. The early years into the epidemic were characterised by a lot of myths regarding the transmission of HIV, which acted as potential barriers to active HIV prevention. Therefore, correct knowledge about misconceptions was regarded as important as that of accurate knowledge, (UNAIDS 2002, WHO 2020).

Comprehensive HIV knowledge has steadily increased over time, but among adolescent girls and young women in Southern Africa, there has been slow progress compared to their male counterparts in the subregion or other female adolescents in the rest of SSA region. This is despite that they need HIV knowledge the most because of their disproportionate risk of HIV infection (UNAIDS 2020).

Previous research has sought to understand why some women in general, "know more [about HIV] than others" (Jesmin and Chaudhuri 2013). However, research at levels beyond individuals e.g., community or neighbourhood levels is limited, and it is one of the aspects that the study sought to explore.

Malawi provides an important context to explore comprehensive HIV knowledge. The country has recorded one of the highest increases in comprehensive HIV knowledge in SSA (Chan and Tsai 2018), but this did not make a big enough dent in the prevalence of HIV knowledge, in part because the knowledge was extremely low at baseline (Fedor 2014, Chan and Tsai 2018, Chirwa 2020). Furthermore, from the previous paper (Chapter 4 above),

wherein comprehensive HIV knowledge was one of the selected control variables, out of the seven countries under study, comprehensive HIV knowledge was unambiguously associated with hazards for sexual debut in Malawi only. Orphanhood and fosterage are also prevalent in Malawi, although the respective rates are comparatively lower than for other countries in the subregion (Hosegood et al. 2007).

5.2 Research paper

Orphanhood, access to information and HIV knowledge among female adolescents in Malawi[6]

Mercy Shoko, Carren Ginsburg, Jonathan Levin, Sara Nieuwoudt & Kathleen Kahn

Introduction

Three decades on, the human immunodeficiency virus (HIV) epidemic is still a widespread public health threat, and the global commitment is to eradicate the epidemic by 2030 (UNAIDS, 2017). Targeting the adolescent HIV epidemic and controlling the spread of HIV to subsequent generations is acknowledged as central to eradicating the global epidemic (Laga et al. 2001; UNAIDS, 2017; UNICEF/UNAIDS/WHO, 2002). The importance of HIV knowledge in achieving this aim has long been recognised (UNICEF/UNAIDS/WHO, 2002; UNICEF, 2004). The youth bulge has resulted in greater numbers of adolescents and young people who are at risk of HIV infection, while in many settings the level of prevention services has remained static (UNAIDS, 2018). HIV is predominantly spread through sexual transmission and given that sexual activity is largely initiated during adolescence, there is a vital need to equip adolescent girls in particular with comprehensive HIV knowledge to enable them to protect themselves and to prevent secondary transmission (UNAIDS, 2018; UNICEF, 2004).

Research suggests that female orphans are a subpopulation of adolescents with increased HIV vulnerability, both through perinatal and non-vertical modes of transmission (Birdthistle et al., 2008; Gregson et al., 2005). Adolescent girls and young women in sub-Saharan Africa, the

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region worst affected by the HIV epidemic, are thought to be particularly vulnerable to HIV infection because of their biological, socio-economic and health disadvantages (Dellar, Dlamini, & Karim, 2015; UNICEF, 2004). They consistently have higher incidence of HIV than their male counterparts and also get infected five to seven years earlier (Dellar et al., 2015), which underscores non-vertical HIV transmission (WHO/UNICEF/UNAIDS, 2011). Onward transmission and reinfection risks are also public health concerns with the increased survival of adolescents who are perinatally infected (Lowenthal et al., 2014); perinatal infections are higher among orphaned children (Kidman & Anglewicz, 2017). Challenges regarding HIV status disclosure, undiagnosed infections, and non-adherence to antiretroviral therapy (ART) are all associated with the growing HIV infections among adolescents, particularly in sub-Saharan Africa (Kim, Gerver, Fidler, & Ward, 2014; Lowenthal et al., 2014). Therefore, HIV knowledge becomes important in the context of advancing adolescent sexual and reproductive health and rights on one hand, and the world's quest for epidemic control on the other.

While knowledge alone is rarely sufficient to bring about behaviour change (Airhihenbuwa & Obregon, 2000; Kelly & Barker, 2016), there is established evidence that HIV knowledge shapes the understanding of individual HIV risk and influences attitudes that support making healthy and informed sexual and reproductive choices (Dinkelman, Levinsohn, & Majelantle, 2006). Studies conducted in sub-Saharan Africa have reported a positive association between HIV knoweldge and HIV testing (Berendes and Rimal, 2011; Peltzer, Matseke, Mzolo, & Majaja, 2009). In a study of 122 countries, HIV knowledge in part explained the association between country-level HIV prevalence and country- level HIV stigma – the latter serves as a barrier to HIV prevention efforts and could have fuelled the generalised and hyperendemic HIV epidemic seen in sub-Saharan Africa (Du, Chi, & Li, 2018). Only 31% of male and 27% of female adolescents in sub-Saharan Africa have comprehensive HIV knowledge (UNICEF, 2017). This falls considerably short of the global commitment to ensure that 90% of youth have sufficient HIV knowledge by 2020 (UNAIDS, 2017).

The HIV epidemic has exacerbated orphanhood and research has brought to the fore orphaned adolescents' HIV vulnerability. Even with the recent gains in AIDS related mortality with the ART roll-out (Johnson et al., 2019), orphanhood prevalence is still relatively high in sub-Saharan African countries that are worst affected by the epidemic (using the 8% orphan prevalence standard specified in the Demographic and Health Survey (DHS)) (DHS, 2008), and orphanhood is consistently highest in adolescence (Shoko & Ibisomi, 2017).

This study aims to contribute to the limited evidence on the relationship between orphanhood, access to HIV-related information and HIV knowledge. The study further aims to explore the association between community and individual-level factors, which have received little attention in previous investigations. The study explores the variation in orphanhood and HIV at the community level and examines whether community orphanhood prevalence and individual orphan status (orphan status only and orphan status controlling for parental co-residency) are associated with access to information and HIV knowledge amongst female adolescents in Malawi. The study also explores whether there are orphan/non-orphan differences in HIV knowledge with increasing community-level HIV prevalence.

The study builds on the premise that the distribution of HIV and orphans can affect related demographic and socio-economic factors (Smith-Greenaway & Heckert, 2013; Taiwo, 2012), in this case, access to information and HIV knowledge. A study of 34 sub-Saharan African countries has shown that living in provinces with high concentrations of orphans is associated with children's school enrolment, with the relationship operating in different directions across the regions because of variations in the HIV burden (Smith-Greenaway & Heckert, 2013). However, little is known about the relationship between orphanhood and comprehensive, accurate HIV knowledge.

Pathways for HIV knowledge acquisition

Orphanhood prevalence is a community-level factor that can potentially affect individual HIV knowledge, irrespective of individual orphan status. High HIV prevalence is associated with higher levels of HIV knowledge (although low HIV knowledge may have been associated with high HIV prevalence earlier in the epidemic) (Du et al., 2018). In a study of 10 sub-Saharan African countries, HIV prevalence was shown to be also positively associated with orphanhood prevalence (Robertson, Gregson, & Garnett, 2010). In this study, the expectation is that HIV prevalence, orphanhood and HIV knowledge are related and, as is the case for HIV prevalence (Robertson et al., 2010), orphanhood prevalence is associated with HIV knowledge. This is premised on the notion that HIV knowledge is acquired through learning (UNICEF, 2004) and, borrowing from psychological theories, is learnt through observation (from one's environment) and instruction (Encyclopedia of Education, 2002). Therefore, high orphanhood prevalence is expected to be associated with high HIV knowledge in part due to increased exposure to the epidemic because HIV is common and/or increased HIV

interventions targeted at worst affected areas. The mechanism of learning here may be informal or formal.

One of the most common channels through which adolescents acquire HIV knowledge is schools. School-based interventions have long been recognised as an important medium for sharing HIV knowledge, particularly for girls (UNICEF, 2004). A recent systematic review and meta-analysis of curricular interventions has confirmed their positive impact (Fonner, Armstrong, Kennedy, O'Reilly, & Sweat, 2014). School teachers, who ideally have sound HIV knowledge themselves, are responsible for the curriculum and in many instances are seen as mentors or 'significant others' for children (Alan Guttmacher Institute, 2007). In sub-Saharan Africa, orphans may be disadvantaged in terms of access to education as compared with non-orphans, as studies by Case, Paxson, and Ableidinger (2004) and Lopus (2017) have shown. The school setting may provide a conducive environment for informal transfer of HIV knowledge between peers, both orphaned and non-orphaned in addition to formal education on the topic.

Parents, as the primary socialisation agents, also have a potential to foster comprehensive HIV knowledge (Haney & Singh, 2012; Perrino, Gonzalez-Soldevilla, Pantin, & Szapocznik, 2000). This can be especially beneficial for adolescents outside of the school system. However, parents may not possess adequate knowledge themselves or they may feel uncomfortable discussing sexuality matters with their children (Bastien, Kajula, & Muhwezi, 2011; Dimbuene, 2015). Furthermore, a parent's death can affect or aggravate their children's human, social and material capital (Mojola, 2011). Even if children are not orphaned, they may not be residing with one or both parents and their household composition or care structure might impact on their HIV knowledge. In many sub- Saharan Africa countries, alternative care for children, orphans, and non-orphans alike, is undertaken by members of the kinship network through fosterage which may also foster proximity and interaction between orphans and non-orphans (Grant & Yeatman, 2012). Caregivers tend to communicate less about HIV and sex, and this is worse for orphans compared to non-orphans (Haney & Singh, 2012).

Methodology

Data

The study uses nationally representative cross-sectional data from the 2015/6 Malawi Demographic and Health Survey (MDHS) and the HIV prevalence estimates derived from the Malawi 2010 DHS, the country's 4th (and most recent) and 3rd such surveys, respectively. Although the window of time between the two surveys affects HIV pre- valence, the pattern of HIV prevalence across the districts remained largely consistent. According to research by Cuadros, Branscum, and Mukandavire (2018), in Malawi, the subnational areas with already low prevalence are the ones that experienced sharp declines and those with high prevalence remained almost stable.

The survey samples were drawn using a two-stage stratified household-based design to provide estimates at the 1st tier (region) and selected indicators at the 2nd administrative tier (district). In the 2010 Malawi DHS, the small exclave Likoma district was combined with Nkhata Bay making up 27 districts, instead of the country's 28. In the study, the number of districts in 2015/6 survey is made comparable with the 2010 survey – by combining Likoma and Nkhata Bay districts in the analysis. No differences exist for orphanhood and HIV prevalence estimates at this level when either combined or separated.

The study population is 2 934 females aged 15–17 years who were de-jure (usual) household members, to capture typical residency. The analysis centers on the age group 15–17, as it is the only adolescent subgroup for which data on key variables—namely, HIV knowledge, access to information, and orphanhood—are available. The study sample is extracted from the sample of women of reproductive ages who participated in detailed interviews on sexual and reproductive health and related issues. Males are excluded from the study because unlike females who are drawn from the full sample of households, males comprise only a sub-sample and therefore, in some categories, constitute few cases resulting in unstable results.

Context

Malawi provides an important setting for the study. Malawi has a population of 19 million and is one of the most densely populated countries in Africa (UN, 2018), which could be important for the spread of HIV information. The population is predominantly rural (UN, 2018), and its Human Development Index (HDI) value (measured in the following dimensions: life expectancy, education, and poverty) is one of the lowest globally (UNDP, 2016).

Malawi is situated in Southern Africa, the region of sub-Saharan Africa with a disproportionately high HIV burden globally. Although a success story of HIV decline, the 9% national HIV prevalence is high by global standards (UNAIDS, & WHO, 2013; UNICEF, 2017) and there is a substantial geographic variation in HIV prevalence and orphanhood (Cuadros et al., 2018; Masquelier & Soura, 2014). Female adolescents in Malawi face additional HIV risk factors since nearly half are married and have begun childbearing by age 18 (National Statistical Office (NSO) [Malawi] and DHS, 2017). In Malawi, an estimated 110,000 children aged 0–14 out of the 1.9 million, and 90,000 adolescents aged 10–19 out of the 1.7 million in sub-Saharan Africa were living with HIV in 2016 (UNICEF, 2017). Orphans constitute 12% of the total population for children (National Statistical Office (NSO) [Malawi] and DHS, 2017).

Attempts to address HIV vulnerability by increasing HIV knowledge have been implemented in Malawi through schools as well as mass media, community interventions and the health system. Mass media interventions such as radio listener groups have managed to shift misperceptions like fear of casual contact, but not measures of HIV knowledge (Creel et al. 2011). UNICEF has set up community-based spaces, called Children Corners, with a specific aim of providing support to orphans and vulnerable girls, including adolescents, including discussion about HIV (Malawi Government – Ministry of Gender, Children, Disability and Social Welfare, 2018). The health-care setting has focused more on supporting adolescents already diagnosed with HIV, who may benefit from tailored counselling to prevent reinfection or onward transmission. Although remaining relatively low, comprehensive HIV knowledge in Malawi has increased over time through such efforts, with almost the same pattern for adult males and females; HIV knowledge tends to be higher among older, urban, and educated individuals (Fedor, 2014).

Variables

Variables in this study, detailed in Table 1, are included at three levels: individual, household and community. Comprehensive HIV knowledge and access to information are individual-level outcome variables. Access to information is measured by access to school and mass media. Comprehensive HIV knowledge is derived from five HIV prevention and local HIV misconception knowledge questions designed to establish knowledge about the spread and prevention of HIV infection adopted by DHS at the behest of international organisations as part of the 2001 and subsequent United Nations Political Declarations on Ending HIV and

AIDS (UNAIDS 2017). Other individual-level variables include orphan status, co-residency, school progression (appropriate age for school level) and an indicator of sexual debut (ever had sex). Age for grade information in Malawi informs school progression cut-offs used in the study. Internet exposure was excluded from the access to mass media variables as only 4.1% of female adolescents reported ever using the internet in the 12 months preceding the survey (National Statistical Office (NSO) [Malawi] and DHS, 2017).

The following household-level explanatory variables are analysed: urban versus rural residency and relative wealth. The community-level variables are measured at the district level and include HIV prevalence and orphanhood prevalence, both of which are aggregated individual-level variables. The community orphanhood rates are from children under 18 years whose mother or father (or both) are dead. This is consistent with international definitions (UNAIDS/UNICEF, 2004), and are presented as a percentage to account for the different populations for children across the districts. The HIV prevalence estimates are obtained from a UNAIDS initiative to calculate district-level HIV estimates for adult men and women aged 15–49 years, using the Malawi 2010 DHS calibrated to the UNAIDS estimates. The estimates, methodology and the evaluation thereof are detailed elsewhere (Subnational Estimates Working Group of the HIV Modelling Consortium et al., 2016; UNAIDS, 2014).

Analysis

The analyses, which all account for the complex survey design by using StataCorp (2017)'s svy suite of commands, include descriptive statistics to provide characteristics of the population under study (Table 2). For better visualisation, maps are provided for district-level indicators (Figure 1). The logistic regression models employ a 5% p-value cut-off for statistical significance.

Table 5.1: Variable descriptions

Variable	Variable Definition	Variable coding
Individual- level variables		
HIV knowledge	Individuals who have heard about HIV are asked questions: on: (1) HIV prevention - i) can a person reduce the risk of getting HIV by consistent condom use during sexual encounters and ii) having one faithful uninfected sex partner, and iii) can a healthy-looking person have HIV (2) HIV misconceptions – i) HIV is transmissible by mosquito bites or ii) by witchcraft or other supernatural means	Coded 1 if all 5 answers are correct, otherwise 0.
Orphan status	Biological father/mother survival status	Coded 1 if either mother/father (or both) is dead, otherwise 0
Orphan status and co-residency	Biological father/mother survival status & father & mother's respective presence on the household schedule	Coded 1 if co-resident with both parents, 2 if non-orphan co-resident with one parent, 3 single orphan co-resident with surviving parent, 4 non-orphan co-resident with neither parent, 5 single orphan co-resident with neither parent, 6 if double orphan
Information: Access to school and mass media	Educational level during current school year with responses: no education or preschool, primary, secondary, or higher	Composite: Coded 1 for "Access to neither school nor mass media", 2 "Access to school and mass media", 3 "Access to school only", 4 "Access to mass media only " where:
	Mass media access - frequency of reading newspapers or magazines/listening to radio/watching television with responses: not at all, less than once a week and at least once a week	School attendance is coded 1 if current educational level is primary, secondary, or higher, otherwise 0 & Mass media access is coded 1 if at least one of the three media platforms accessed once a week or more, otherwise 0
Correct age for school level	Educational level during current school year with responses: no education or preschool, primary, secondary, or higher	Coded 1 if correct age for level of school (secondary or higher), 2 for lower (primary), and 3 for not in school
Ever had sex	Age at first sex if ever had sex	Coded 1 if ever had sex, otherwise 0
Household-level variables		
Urban residency	Urban or rural residence	Coded 1 if urban, otherwise 0
Wealth score	Wealth scores are calculated from the number and kinds of goods households own and are based on urban/rural location	The square root of the available wealth scores was used to address data skewness.
Community– level variables		
HIV prevalence	HIV prevalence	HIV prevalence by district
Orphanhood prevalence	Biological father/mother survival status for both male and female children	Orphanhood prevalence by district

Table 5.2: Descriptive statistics - characteristics of the sample

Variable	Mean (Percentage/Score)	Confidence interval (CI)
N	2 934	
Heard about AIDS	95.8	94.66 - 96.76
Comprehensive HIV knowledge	37.5	35.08 - 39.90
Orphan status and parental co-residency		
Living with both parents	38.5	36.24 - 40.86
Non-orphan living with one parent	16.7	15.02 - 18.58
Non-orphan living with neither parent	22.3	20.64 - 24.12
Single orphan living with one parent.	8.7	7.525 - 10.10
Single orphan living with neither parent	9.1	7.80 - 10.60
Double orphan	4.6	3.72 - 5.66
Orphan status (ages 15 -17 years)	22.4	20.59 - 24.37
Access to mass media	34.6	32.19 - 37.09
Access to HIV information		
Access to school and mass media	27.0	24.93 - 29.15
Access to school only	45.9	43.46 - 48.3
Access to mass media only	7.6	6.33 - 9.14
Access to neither school nor mass media	19.5	17.61 - 21.61
Correct age for school level		
Correct	20.9	18.98 - 22.88
Lower	52.0	49.36 - 54.62
Not in school	27.1	24.92 - 29.49
Had sexual debut	34.5	32.18 - 36.79
Urban residency	17.4	15.7 – 19.4
Wealth score	0.03751	0.01573 - 0.05929

Four logistic regression models were run to investigate whether individual orphan- hood and co-residency are associated with access to HIV information (measured through access to school and mass media), controlling for individual-level and house- hold-level variables). Model 1 looks at orphanhood and co-residency while Model 2 looks at orphanhood status, and similarly for Models 3 and 4.

Thereafter, logistic regression analyses were performed to analyse the HIV knowledge outcome variable and explanatory variables: individual orphan status considering parental co-residency (Model 5), individual orphan status only (Model 6), orphanhood prevalence (Model 7) and HIV prevalence (Model 8), controlling for the selected individual-level and household-level covariates. Model 9 (full model) considers orphan status as well as community orphanhood and HIV prevalence, also controlling for individual-level and household-level

variables. The parental co-residency variable was dropped from the full model because it was not significantly associated with HIV knowledge, and there was no clear pattern across the co-residency categories (see Table 4). In Model 10, the interaction term for orphan status and HIV prevalence is introduced to the full model. This is done to test whether there is a difference between HIV knowledge for orphans and non-orphans with increasing HIV prevalence.

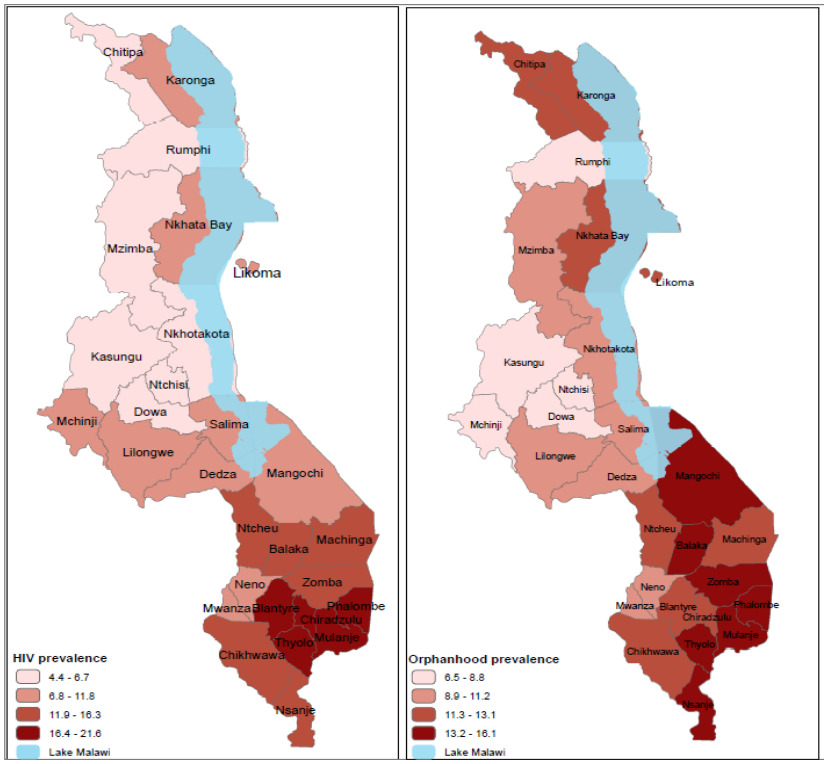


Figure 5.1: Community HIV prevalence and orphanhood in Malawi

Results

The analyses reveal that less than half (38%) of female adolescents aged 15 to 17 years had comprehensive HIV knowledge (Table 2). Over 60% lived with one or both parents. Just over 20% of female adolescents were orphans. District orphanhood prevalence ranged from approximately 7% to 16%, with higher orphanhood and HIV prevalence concentrated in Malawi's Southern region (Figure 1).

Seventy percent of female adolescents were in school, but only 20% were at the correct education level for their age. Approximately 35% of female adolescents reported sexual debut, and the same percentage had access to at least one form of mass media at least weekly.

The results of the logistic regression models presented in Table 3 reveal a significant association between access to information– access to school and mass media – and orphanhood. In the models of orphanhood status combined with parental co-residency, the odds of access to school for non-orphaned female adolescents living with neither parent, were 0.5 and for single and doubles, 0.4 times the odds of school access among female adolescents living with both parents (Model 1). In the models with the binary indicator of orphanhood status, the odds of access to school and mass media for orphans were 0.7 and 0.6 times the odds of access among non-orphans respectively (Model 2 and Model 4). In all four Models, sexual debut, wealth score and urban residency were significantly associated with access to information.

Table 5.3: Access to information

Covariates	**Access to school - Model 1**		**Access to school - Model 2**		**Access to mass media - Model 3**		**Access to mass media - Model 4**	
	OR	P-value	OR	P-value	OR	P-value	OR	P-value
Orphan type: Non-orphan is reference			0.66	0.002			0.63	0.001
Orphan type: Non-orphan co-resident with both parents is reference								
With one parent, non-orphan	0.70	0.029			0.92	0,559		
With one parent, single orphan	0.64	0.038			0.80	0,294		
With neither, non-orphan	0.49	0.000			0.98	0,905		
With neither, single orphan	0.39	0.000			0.54	0,003		
With neither, double orphan	0.42	0.003			0.44	0,002		
Sexual debut: Not had sexual debut is reference	0.16	0.000	0.14	0.000	1.24	0,063	1.24	0.066
Urban residency: Rural is reference	1.80	0.008	1.77	0.009	3.11	0.302	3.11	0.000
Wealth score	2.27	0.000	2.17	0.000	2.26	0.020	2.24	0.000

The results of the logistic regression models in Table 4 reveal little evidence of an association between individual orphanhood status (and parental co-residency) and HIV knowledge (Models 5, 6, 9 and 10). Nevertheless, community orphanhood was positively associated with HIV knowledge (Model 7 and 9, OR 1.1).

The interaction term between HIV prevalence and orphan status indicates that for non-orphans a 1% increase in HIV prevalence is associated with a 4% increase in the odds of having comprehensive HIV knowledge, while for orphans a 1% increase in HIV prevalence is associated with a 1% decrease (1-0.99) in the odds of having comprehensive HIV knowledge (Model 10). This suggests that despite evidence that indicates that higher HIV prevalence is associated with higher HIV knowledge, this was only the case for non-orphans in this study. The variables related to access to information show striking and consistent results in all models (Models 5 to 10). Access to school alone or combined with mass media and correct age for school level were all significantly associated with HIV knowledge. Female adolescents who attended school and had access to mass media had approximately 3 times the odds of comprehensive HIV knowledge as compared with those who did not have access to both sources of information. The odds of comprehensive HIV knowledge for females who attended school and did not have access to mass media were slightly lower, between 2.5 and 2.6 times the odds of females with no access to information. The relationship between comprehensive HIV knowledge and access to mass media only was not statistically significant. Female adolescents who were in lower levels of school for their age were less likely to have comprehensive HIV knowledge than their counterparts who were in the correct school level for their age (OR 0.5) (the category ‘not in school’ was dropped from the models because of collinearity). The odds of comprehensive HIV knowledge for female adolescents who had sexual debut were approximately 50% higher than that of their counterparts who did not report sexual debut– this was also consistent across the models. There was no statistically significant difference in comprehensive HIV knowledge by wealth score, or rural or urban residency.

Table 5.4: Results of the logistic regression models for comprehensive HIV (Females)

Covariates	Model 5		Model 6		Model 7		Model 8		Model 9		Model 10	
	OR	P-value	OR	P-value	OR	P-value	OR	P-value	OR	P-value	OR	P-value
Orphan type: Non-orphan co-resident with both parents is reference												
With one parent, non-orphan	1.07	0.663										
With one parent, single orphan	0.73	0.093										
With neither, non-orphan	1.03	0.829										
With neither, single orphan	0.89	0.493										
With neither, double orphan	1.11	0.680										
Orphan status: Non-orphan is reference			0.84	0.162					0.81	0.078	1.57	0.176
Community orphanhood					1.08	0.000			1.09	0.008		
HIV prevalence							1.03	0.009	1.00	0.934	1.04	0.001
Interaction (Orphan#HIV prevalence)											0.95	0.029
Access to information: Access to neither school nor mass media is reference												
Access to school and mass media	3.10	0.000	3.05	0.000	3.02	0.000	3.00	0.000	2.94	0.000	2.93	0.000
Access to school only	2.64	0.000	2.61	0.000	2.53	0.000	2.54	0.002	2.49	0.003	2.52	0.000
Access to mass media only	1.22	0.369	1.21	0.397	1.29	0.275	1.25	0.326	1.26	0.315	1.24	0.345
Correct age for grade: Correct age for grade is reference												
Lower	0.50	0.000	0.49	0.000	0.50	0.000	0.50	0.000	0.50	0.000	0.50	0.000
Sexual debut: Not had sexual debut is reference	1.57	0.000	1.56	0.000	1.47	0.001	1.50	0.000	1.47	0.001	1.49	0.000
Urban residency: Rural is reference	0.89	0.540	0.89	0.535	0.92	0.649	0.87	0.468	0.93	0.720	0.88	0.517
Wealth score	1.09	0.553	1.09	0.542	1.11	0.465	1.10	0.493	1.11	0.470	1.09	0.546

Discussion and conclusion

The study investigates whether individual orphan status and parental co-residency in female adolescents aged 15–17 years are associated with access to information in the form of school and mass media, and comprehensive HIV knowledge, controlling for selected variables. The study further explores whether there is variation in orphanhood levels across districts in Malawi and whether orphanhood prevalence explains HIV knowledge variation in the population under study.

The percentage of female adolescents aged 15–17 who were orphans in the study sample (22.4%) is comparable to the 23.5% Malawian national average for both males and females (National Statistical Office (NSO) [Malawi] and DHS, 2017). Orphanhood prevalence ranged between 6.5% and 16.1% by district. As expected, orphanhood was concentrated in the Southern region of Malawi, the region with higher HIV prevalence. This pattern is consistent over time (Doctor, 2004; Masquelier & Soura, 2014).

Being an orphan was associated with having less access to both school and mass media. The finding in relation to lower school enrolment is consistent with other studies conducted in the region (Case et al., 2004; Lopus, 2017). Mass media consumption patterns of orphans and their caregivers have been explored qualitatively, high- lighting gaps (Mnubi–Mchombu, 2013), but no studies were identified that explore the relationship between mass media access and orphanhood status.

Higher orphanhood prevalence at the community level was associated with slightly higher HIV knowledge. However, at the individual level, no meaningful pattern in terms of orphan status and parental co-residency was observed. This may indicate a lack of parents' involvement in their children's HIV education, as such their absence makes little or no difference to their children's HIV knowledge, or the effect of being an orphan on HIV knowledge operates through access to school. However, with increasing HIV prevalence, there was a slight increase in HIV knowledge among non-orphans and reduced HIV knowledge among orphans. This may be explained by the potential lack of access to HIV information, through school or mass media access, for orphans relative to non-orphans, as shown in the study.

There was generally low HIV knowledge among adolescents in the region; 37% of female adolescents aged 15–17 years had comprehensive HIV knowledge in Malawi. This is about 10 percentage points lower than the sub-Saharan African average for adolescents aged 15–19 years (UNICEF, 2017). There is a concern that HIV knowledge levels have remained largely static over the past two decades, and that progress in achieving the SDG set target of ending HIV by 2030 is off track (Bekker et al., 2018; UNAIDS, 2018).

The 37% comprehensive HIV knowledge in this sample of female adolescents should be more than doubled to achieve universality. The strong association between a mix of school and mass media with HIV knowledge suggests that access to both channels and more targeted HIV messaging therein could be used to increase knowledge.

The higher likelihood of HIV knowledge observed among adolescents who had sexual debut, compared to their counterparts who had not, is consistent with other research. Individuals who have initiated sexual intercourse may be more likely to actively search for sexuality and HIV information (van Rossem et al. 2010). An important intervention therefore relates to the provision of sexual and reproductive health services to support all adolescents, as opposed to relying on young people to proactively seek support after sexual debut. Another concerning finding is that female adolescents who had sexual debut have reduced odds of access to school, pointing to the need for interventions that support their continued enrolment in school. From this study, it is clear that school attendance and progression are important in facilitating HIV knowledge; this also has been observed in other research (Butts et al., 2018). Overall, there is a need to promote timeous school enrolment, education retention and progression (to ensure correct school level for age) to address the inadequacy in HIV knowledge.

The study makes an important contribution to understanding the association between orphanhood, access to information and HIV knowledge in female adolescents in Malawi. Nevertheless, some limitations should be acknowledged. The DHS type HIV knowledge questions employed in this study are self-reported, with potential respondent bias and do not constitute a validated scale (Burke, Fleming, & Guest, 2014; Chan & Tsai, 2018). Further, the study excludes visitors and non-household populations, such as children who live on the street or in institutions. The DHS did not measure exposure to specific HIV interventions, such as Children's Corners, that might influence HIV knowledge. In addition, the DHS data do not allow establishment of temporal sequence of events, i.e., whether status in the explanatory variables considered in the study preceded access to information status or acquisition of

comprehensive HIV knowledge or vice versa. While there is evidence of similar HIV knowledge levels between male and female adolescents in Malawi (National Statistical Office (NSO) [Malawi] and DHS, 2017), more research is needed on the relationships between orphanhood, access to information and HIV knowledge among adolescent males, as highlighted by Robertson et al. (2010).

The present study adds to the body of regional investigations of female adolescents in sub-Saharan Africa and provides evidence to guide potential HIV prevention strategies. The association of HIV knowledge with sexual debut also lends support to developing tailored interventions for adolescent females. The strong association between HIV knowledge and access to information through education and mass media also points to the use of multiple channels to enhance HIV knowledge. Past efforts that focused only on increasing school attendance in Malawi did not report improved HIV outcomes among adolescent females (Baird, Garfein, McIntosh, & Ozler, 2012). HIV knowledge should therefore be addressed as part of multi-pronged interventions that target other forms of HIV vulnerability, such as gender-based violence and early marriage. Further, qualitative studies would be useful to understand the causes of persistent low HIV knowledge levels to inform more targeted interventions.

CHAPTER 6: EXPLORING ADOLESCENT FERTILITY INEQUALITY IN SOUTHERN AFRICA

6.1 Introduction

The study explores the vulnerability of adolescents using the OVC definition, which includes individuals with absent parents and living in households where orphans are present (Gillespie et al., 2005; UNICEF, 2017).

6.2 Research paper

Mercy Shoko

Abstract

Background

Globally, adolescent fertility rates (AFR) vary widely. Southern African subregion stands out for its stark inequality as a subregion and internally among the countries that constitute it. Notably, orphanhood and the broader parental absence are key social contexts that have been explored in relation to adolescent fertility, particularly within the Southern African context. However, research specifically focused on the conventional demographic cohort of females aged 15 to 19 years is constrained by the international age cap of 17 years for collecting direct orphanhood and living arrangement data.

Objectives

This study seeks to characterise fertility among adolescents largely excluded from research because of age restrictions in the data. This is by circumventing the age-related data restrictions by employing the largely untapped intrahousehold data to capture adolescents' household living arrangements.

Methods

The study uses the cross-sectional household-based DHS data for Southern Africa, defined according to both local and international geoschemes. This is to model parental absence and intrahousehold effects on fertility for adolescents between 15 and 19 years old, using the fixed effects logistic regression, and adjusting for inter-country differences.

Results

Results from the fixed logistic model underscore the complex interplay between orphanhood, parental absence, and the specific country context in shaping adolescent childbearing rates. The results suggest that the absence of at least one parent for adolescents was associated with a higher likelihood of childbearing (Adjusted Odds Ratio (AOR): 3.07, $p < 0.05$). Conversely, the presence of orphaned child(ren) in the adolescent household was associated with a 36 percent lower likelihood of childbearing, although this association did not reach statistical significance. Compared to South Africa, all the countries in the study showed significantly higher odds of adolescent fertility (AOR: 1.4 - 5.4, $p < 0.05$). Using the marginal probabilities, the probability of an adolescent giving birth was generally lower in most Southern African countries for adolescents residing with orphaned children in the household, compared to those who were not. Angola, Malawi, and Zambia show the highest differences, and South Africa the smallest difference.

Conclusions

The study underscores the critical role of household living arrangements and parental absence in explaining and addressing adolescent fertility in Southern Africa. Addressing adolescent fertility in Southern Africa requires a dual-pronged approach. This includes interventions that encompass adolescents in general, and specifically those with absent parents, as they show higher likelihood of childbearing. Future research could replicate similar methodologies to examine living arrangements of adolescents or even consider expanding the scope of orphanhood and living arrangement data collection through surveys or alternative data sources.

Introduction and background

The study focuses on adolescent fertility inequality in the context of orphanhood/fosterage and their potential spill-over effect in Southern Africa. This research is particularly important given the contemporary global focus on addressing inequalities, including disparities in adolescent fertility[1], as highlighted by the interconnected and inclusive development goals of the 2030 Sustainable Development Goals agenda (SDGs)[2].

Although drastically reduced in recent years, adolescent fertility is still very common[3]. Typically measured in ages 15-19 years, which although considered generally old enough, adolescent fertility continues to be a major issue[4]. As a public health issue, adolescent fertility is both a key determinant and consequence of health and wellbeing. This is because it intersects with various other factors; HIV prevalence[5], child marriage[6] and general socio-economic development[7]. Adolescent fertility is also an important demographic indicator linked to overall fertility[3], and therefore is potentially affected by living arrangements[8]. The interconnections between adolescent childbearing and underlying socio-economic inequalities are well-documented[10]. For example, the selection effects in adolescent childbearing are closely intertwined with socio-economic inequalities[11,1]. This underscores adolescent fertility as a particular concern, particularly in the female subpopulations that are disproportionately affected.

Research on general orphanhood, also long recognised as a demographic issue[9] and the associated parental presence [12–16] has gained traction largely with the growing causes linked to adult mortality [3] resulting in a parallel rise in orphanhood. However, research specifically addressing the link between these factors and adolescent fertility remains limited. The research gap is partly attributed to the limited availability of data on orphanhood and fosterage for 'older children/adolescents' (ages 18-19). This limitation arises from the international standard definition of 17 years as the upper age limit for orphanhood and fosterage, a definition adhered to by the widely used, DHS surveys program.

However, notably adolescents aged 18-19, while technically outside the standard orphanhood definition, often face distinct vulnerabilities[17]. For example, adolescent orphanhood in this age group is estimated to reach true orphanhood in both its extent and experiences. Demographically, adolescents aged 18-19 constitute the majority of orphans and may be less likely to be understated in surveys, a feature associated with the younger cohorts[18]. Older

adolescents also experience disproportionate adverse well-being outcomes[19]. This arises from the kinship networks preference for fostering younger orphans, often on the pretext that younger orphans may be more vulnerable or adaptable[20]. Older orphans may also not be retained within the kinship networks, especially in contexts where child fosterage is incentivised[19]. Notably, the fosterage of older female orphans may be motivated by benefits received by the households, such as securing bride prices or assistance with household chores[21]. In situations where entire households consist of orphans, they may be left to their own devices if an older adolescent is present, leaving older adolescents assuming a de facto household headship status[20].

Methodology

The study uses the DHS data for Southern Africa to conduct a multi-country analysis of adolescent fertility among females aged 15-19 years. To define the geographical scope, the study employs both a local and international classification framework for the subregion[22,23]. This includes the ten countries that are geographically contiguous and located in the southernmost part of the African continent: Angola, Botswana, eSwatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe.
The decision to use the DHS surveys is based on the availability of nationally representative data. Although the individual country surveys may not be conducted concurrently, the fundamental design of these surveys facilitates cross-country and cross-temporal comparisons. DHS surveys are typically cross-sectional surveys that are conducted by participating LMICs at approximately five-year intervals. However, not all countries consistently carry out DHS surveys in each round, and the DHS program itself is continually evolving. The variation in survey frequency impacts the data availability for different countries, as illustrated in Figure 1, which presents AFR trends for countries using DHS data.

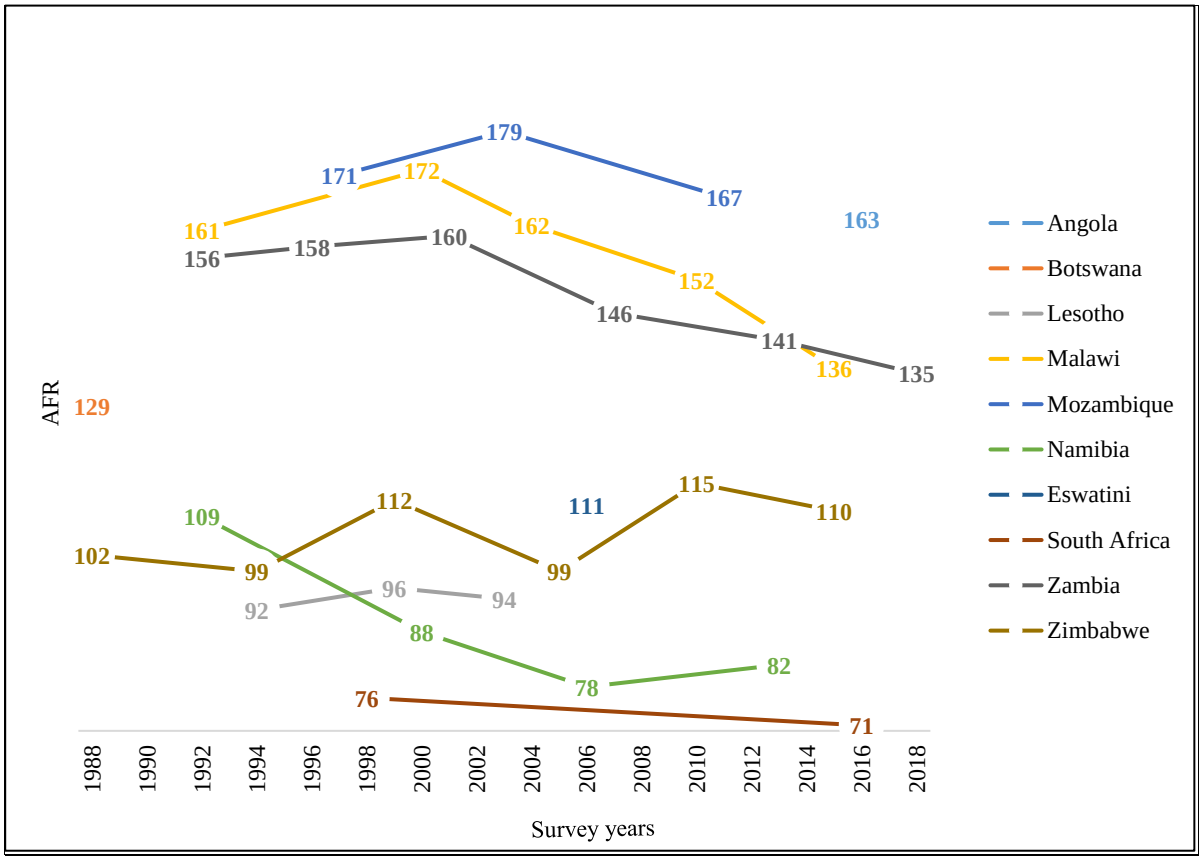


Figure 6.1: Adolescent fertility rate (AFR) for the three years preceding the survey per 1 000 females aged 15-19 years, by country and survey years: source of data – ICF (2021)

Furthermore, the variability in availability of DHS survey data for countries informs the inclusion criteria for the current study. For example, Botswana's only participation in the DHS program was in the late 1980s. The key data definitions used in that survey have since become outdated, rendering the data ineligible for inclusion in the current study. The survey did not include questions on orphanhood, and only covered parental co-residency for children aged 14 years and younger, who are ineligible for the detailed individual interviews, from which ASRH outcomes data are obtainable.

Table 1 shows the respective DHS survey years used in the study, covering the period from 2006 to 2016, and represents the most recently available data from the respective countries.

Table 1: DHS data by country and year of collection

Country	Survey Year
Angola	2015/16
Eswatini	2006/7
Lesotho	2014
Malawi	2015/6
Mozambique	2011
Namibia	2013
South Africa	2016
Zambia	2018
Zimbabwe	2015

The choice to focus the study on Southern Africa is because of the subregion's distinctive characteristics, notably its pronounced global and internal disparities when compared to other regions and countries worldwide[27]. These factors are intricately connected to the fundamental determinants of adolescent fertility and are discussed below.

Despite undergoing an advanced fertility transition overall[3], adolescent fertility remains an issue in the subregion – see Figure 1 for AFR levels and trends[24]. The subregion also has a disproportionate adolescent HIV epidemic that predominantly affects the female subpopulation. This mirrors the broader HIV burden within the subregion and holds a direct link to adolescent fertility, given the heterosexual nature of HIV transmission[25]. The HIV epidemic has also had adverse consequences at the household level[3], exacerbating the already prevalent issues of orphanhood and parental absence. These challenges stem from long-standing labor migration patterns, which, in turn, contribute to prevailing marriage, childbearing, and child-rearing practices[26]. Additionally, factors such as armed conflicts[14], the more recent impact of the COVID-19 epidemic[16], and orphanhood resulting from cancer-related mortality[13] all play a role in shaping the landscape of orphanhood within the subregion. This underscores the importance of research on adolescent fertility.

The methodology used for this analysis was adopted from two previous studies: Taiwo[28] and Jayatillake et al.[29]. The study by Taiwo explored the potential spill-over effect of orphan fosterage on fertility across all women of childbearing ages, while Jayatillake et al.'s study focused on accounting for inter-country effects within a multi-country analysis. The results from the study by Taiwo suggest an independent association between fostering of orphans and

a reduction in fertility for women of childbearing ages in the receiving households. However, in the current study, the focus is narrowed to female adolescents in the quinquennial 15 to 19 ages.

The main underlying assumption is that female adolescents may revise their fertility goals based on their household circumstances. Previous research using longitudinal data for ages 15 – 25 years, has shown that orphaned adolescents may have higher fertility compared to their non-orphan counterparts, either because of their increased vulnerability or higher fertility desires[30].

For the analysis, the data used were generated by merging the household member (PR) and individual recodes (IR) obtained from representative samples of households and women of reproductive ages, respectively. To ensure representativity, enable inter-country comparisons, and achieve a substantial sample size, the merged data were consolidated into a single aggregated data file. Subsequently, households were tagged to create the orphan index variable, identifying individuals aged 17 years and younger with at least one parent dead as orphans. The methodology is consistent with the established methodology outlined by the DHS[31]. The parental presence variable was derived using the "relationship to the household head" question, with a focus on usual residents within the household to establish typical living arrangements. For instance, parental presence could be identified when the index individual is listed as a biological son or daughter of the household head, or if they themselves are the head of the household, and their parent is part of the household. Alternatively, if the head of the household is the grandparent and their son or daughter, along with their child(ren), are listed on the household schedule, this indicates parental presence.

Furthermore, the research utilises other readily available variables from the DHS datasets, such as country-specific wealth quintiles and rural-urban residence. These variables are specifically designed to measure subnational disparities and are included as control variables in the study. Additionally, the study includes the survey country variable.

Weighting was applied using a combination of the standard individual recode and the population distribution of female adolescents aged between 15 and 19 within the respective individual countries in the study. These population estimates were obtained from the United Nations Population Division World Population (WPP) estimates[32]. A fixed effects logistic model was then employed to account for the complex sample design across the aggregated

datasets. In cases where strata consisted of single units, the analysis assumed that the strata shared the same variance as the average variance of strata from multiple sampling units. Additionally, the analysis adjusted for cluster effects to account for inter-country differences, utilizing a method developed by Jayatillake et al.

The following is the resultant logistic model used:

$$logit(b^{i*}) = \theta + \alpha b^{i} + \beta b^{f} + \theta p + \mu d + \delta c + \gamma c * b^{f} + \varepsilon_{c}$$

Where:

b^{i*} represents the probability of adolescent ever giving birth,

b^{i} , represents the type of residence,

b^{f}, presence of an orphan in the household,

d, the wealth index of the household,

p, presence/absence of parents in the household for the index adolescent,

c, the country, and

ε_{c} represents the country cluster effect.

Patient and Public Involvement statement

The article will be shared with the DHS program facilitating its dissemination and circulation, in accordance with the stipulated conditions for data access. The study did not involve direct patient or public participation.

Ethics Approval Statement

The DHS surveys protocols are reviewed and approved by the relevant bodies in the US where the DHS program is based, and in the respective host countries where the surveys are conducted. For the study specifically, ethical clearance was granted by the University of the Witwatersrand Human Research Ethics Committee (Medical) – Reference: M220548.

Results

The sample sizes for the study were as follows: approximately 1,500 each for Lesotho, Mozambique, and South Africa; 1,700 for Namibia; around 2,000 for Zimbabwe; 2,500 for

Eswatini and Malawi; and 3,000 for Angola and Zambia (as shown in Table 2). The chi-squared tests results showed variations in adolescent births across the selected Southern African countries based on household circumstances; parental presence, rural-urban residence, and wealth quintiles. The findings show that parental presence was significantly associated with lower likelihood of adolescent childbearing across all nine countries. This was also true for the presence of an orphan in the household for Angola, Lesotho, Malawi, Mozambique, Zambia, and Zimbabwe.

The findings from the fixed logistic model suggested that the presence of orphans in the household was associated with a 36 percent lower likelihood of childbearing, although this result did not reach statistical significance. Conversely, the absence of at least one parent for the index adolescent was statistically associated with a higher likelihood of childbearing (AOR: 3.07, $p < 0.05$). While the extent of this association varied across countries, all countries showed higher odds of adolescent fertility compared to South Africa which was the reference (AOR 1.4 - 5.4, $p < 0.05$).

Table 6.1: Percentage of adolescent girls aged 15-19 years, by country, according to birth outcomes and selected household characteristics

		Adolescent birth (%)		
Country	**(N)**	**Yes**	**No**	**Chi²**
South Africa	**(1 497)**			
Resides with orphan child(ren)		15.91	84.09	0.954
Does not reside with orphan child(ren)		15.58	84.42	
Parent present		10.81	89.19	0.000
Parent absent		23.22	76.78	
Rural Residence		17.57	82.43	0.126
Urban Residence		13.87	86.13	
Poorest		22.46	77.54	0.000
Poorer		26.29	73.71	
Middle		18.18	81.82	
Richer		8.33	91.67	
Richest		6.32	93.68	
Mozambique	**(1 527)**			
Resides with orphan child(ren)		30.36	69.64	0.069
Does not reside with orphan child(ren)		42.58	57.42	
Parent present		20.92	79.08	0.000
Parent absent		47.50	52.50	
Rural Residence		44.12	55.88	0.000

Urban Residence		31.75	68.25	
Poorest		56.99	43.01	0.000
Poor		46.90	53.10	
Middle		52.82	47.18	
Richer		45.86	54.14	
Richest		27.13	72.87	
Zimbabwe	**(2 088)**			
Resides with orphan child(ren)		9.84	90.16	0.007
Does not reside with orphan child(ren)		24.88	75.12	
Parent present		11.14	88.86	0.000
Parent absent		30.19	69.81	
Rural Residence		27.95	72.05	0.000
Urban Residence		10.92	89.38	
Poorest		37.28	62.72	0.000
Poor		28.98	71.02	
Middle		30.14	69.86	
Richer		21.46	78.54	
Richest		7.04	92.96	
Zambia	**(2 987)**			
Resides with orphan child(ren)		9.52	90.48	0.001
Does not reside with orphan child(ren)		33.36	66.64	
Parent present		23.57	76.43	0.000
Parent absent		38.42	61.58	
Rural Residence		37.81	62.19	0.000
Urban Residence		20.96	79.04	
Poorest		50.36	49.64	0.000
Poor		44.63	55.37	
Middle		37.85	62.15	
Richer		22.88	77.12	
Richest		7.88	92.12	
Malawi	**(2 589)**			
Resides with orphan child(ren)		10.84	89.14	0.000
Does not reside with orphan child(ren)		34.16	65.84	
Parent present		13.80	86.20	0.000
Parent absent		38.45	61.55	
Rural Residence		22.37	77.63	0.023
Urban Residence		36.67	63.33	
Poorer		52.50	47.50	0.000
Poor		43.05	56.95	
Middle		37.83	62.17	
Richer		31.60	68.40	

Richer		17.34	82.66	
Namibia	**(1 783)**			
Resides with orphan child(ren)		20.00	80.00	0.846
Does not reside with orphan child(ren)		21.62	78.32	
Parent present		16.49	83.51	0.010
Parent absent		22.07	77.93	
Rural Residence		21.33	78.67	0.000
Urban Residence		17.18	82.82	
Poorest		30.64	69.36	0.000
Poor		31.25	68.75	
Middle		24.37	75.63	
Richer		18.66	81.34	
Richest		7.04	92.96	
Lesotho	**(1 526)**			
Resides with orphan child(ren)		6.15	93.85	0.002
Does not reside with orphan child(ren)		22.15	77.85	
Parent present		12.03	87.97	0.000
Parent absent		29.83	70.17	
Rural Residence		23.45	76.55	0.000
Urban Residence		12.74	87.26	
Poorest		30.13	69.87	0.000
Poor		24.34	75.66	
Middle		23.44	76.56	
Richer		16.84	83.16	
Richest		5.33	94.67	
Eswatini	**(2 442)**			
Resides with orphan child(ren)		16.67	83.33	0.132
Does not reside with orphan child(ren)		24.49	75.51	
Parent present		19.93	80.07	0.014
Parent absent		28.09	71.91	
Rural Residence		24.83	75.17	0.094
Urban Residence		19.86	80.14	
Poorest		34.38	65.63	0.000
Poor		27.78	72.22	
Middle		28.32	71.68	
Richer		22.00	78.00	
Richest		15.29	84.71	
Angola	**(3 261)**			
Resides with orphan child(ren)		26.53	61.52	0.016
Does not reside with orphan child(ren)		38.48	73.47	
Parent present		25.08	74.92	0.000

Parent absent	54.31	45.69	
Rural Residence	48.88	51.12	0.000
Urban Residence	32.46	67.54	
Poorest	46.35	53.65	0.000
Poor	56.24	43.76	
Middle	44.27	55.73	
Richer	25.12	74.88	
Richest	13.82	86.18	

Table 3 shows the results from the logistic regression. The model shows that adolescents were 68 percent less likely to have had a birth if they had at least one of the parents present in the household compared to their counterparts with neither of their parents present ($p < 0.01$). Adolescents residing with at least one orphan/foster child were 66 percent more likely to have experienced childbirth compared to those who were not residing with any orphan/foster children. However, this result was not statistically significant. Figure 2, which shows the marginal probabilities focusing on the variability in the effect of orphanhood/fosterage on adolescent fertility, the probability of an adolescent giving birth was lower in most Southern African countries for adolescents residing with orphan/foster children in the household compared to those who were not. Angola, Lesotho, and South Africa were the only exceptions with higher adolescent fertility in this case. Another exception was Mozambique, where there was no difference between the two groups. Lesotho, Malawi, and Zambia show the largest differences in adolescent births between adolescents co-resident with orphan/foster child/(ren) and those without.

Table 6.2: Logistic model for adolescent birth

Adolescent birth	**AOR***	**Std. Err.**	**P>t**	**[95% CI]**
Orphan child(ren) in household				
No (ref)	_	_	_	_
Yes	0.64	0.31	0.350	[0.61-3.76]
Parent/s presence in the household				
No	3.07	0.30	0.000	[2.53-3.71]
Yes (ref)	_	_	_	_
Area of Residence				
Urban (ref)	_	_	_	_
Rural	0.87	0.09	0.191	[0.71-1.07]
Wealth index				
Poorest	6.60	0.89	0.000	[5.07-8.59]
Poor	5.02	0.65	0.000	[3.90-6.46]

Middle	4.26	0.53	0.000	[3.34-5.44]
Richer	2.55	0.28	0.000	[2.06-3.16]
Richest (ref)	_	_	_	_
Country				
South Africa (ref)	_	_	_	_
Mozambique	5.39	0.80	0.000	[4.03-7.21]
Zimbabwe	2.03	0.31	0.000	[1.50-2.73]
Zambia	3.09	0.45	0.000	[2.31-4.11]
Malawi	3.41	0.50	0.000	[2.56-4.55]
Namibia	1.44	0.23	0.021	[1.06-1.96]
Lesotho	1.84	0.31	0.000	[1.32-2.56]
Eswatini	1.99	0.33	0.000	[1.43-2.76]
Angola	3.43	0.40	0.000	[2.72-4.31]
Country*presence of orphan child(ren) in the household				
South Africa*yes (ref)	_	_	_	_
Mozambique*yes	0.83	0.52	0.761	[0.24-2.83]
Zimbabwe*yes	0.45	0.30	0.227	[0.13-1.64]
Zambia*yes	0.27	0.20	0.080	[0.06-1.17]
Malawi*yes	0.28	0.19	0.055	[0.07-1.03]
Namibia*yes	1.22	1.02	0.811	[0.24-6.30]
Lesotho*yes	0.17	0.17	0.016	[0.04-0.71]
Eswatini*yes	0.57	0.87	0.829	[0.23-3.19]
Angola*yes	0.33	0.18	0.048	[0.11-0.98]

AOR: Adjusted Odds Ratio, Std. Err.: Standard Error, P>t: P-value

Figure 1 shows the marginal probabilities to show the variability in the effect of orphan presence in the household, on adolescent fertility amongst the nine countries studied. The probability of an adolescent giving birth was generally lower in most Southern African countries for adolescents residing with orphaned children in the household, compared to those who were not. Angola, Malawi, and Zambia show the highest differences, and South Africa the smallest difference.

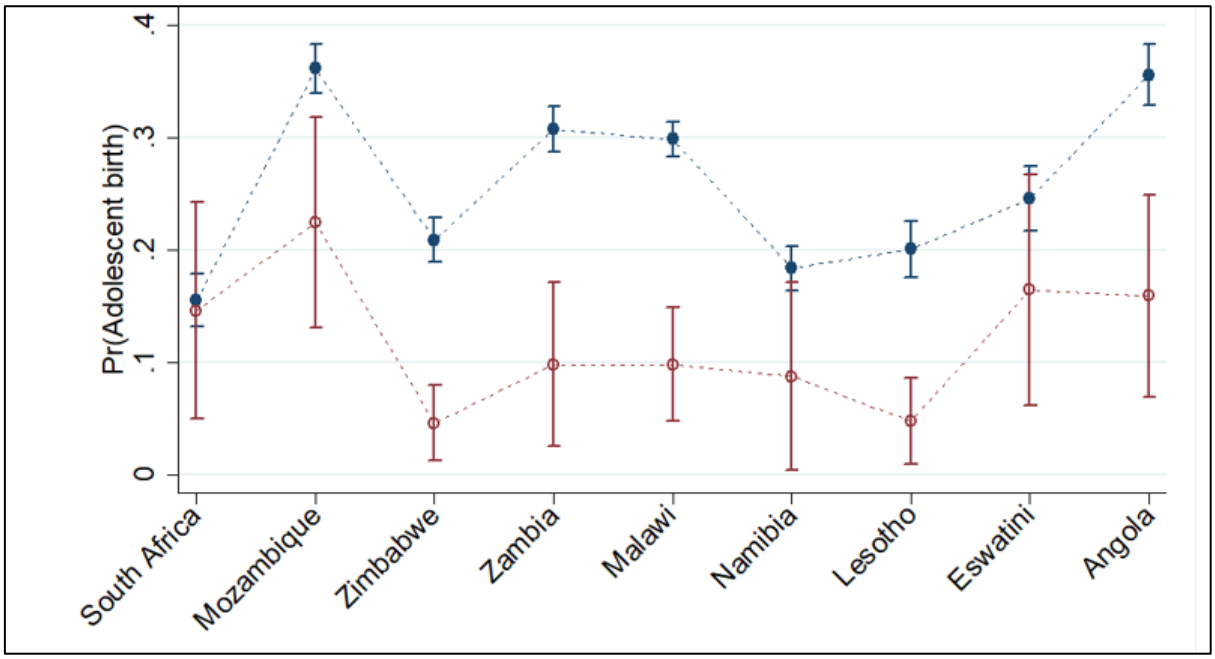


Figure 6.2: Marginal probabilities for an adolescent birth (Pr) for each country in the study, relative to the presence of an orphan/foster child(ren) in the household (-o- No -•- Yes)

Discussion

The findings suggest very interesting but highly complex findings. The research highlights the value of household relations variables in understanding child-parent co-residence, an aspect that has been largely underutilised in previous studies.

In the study, the absence of parents for the index adolescent was associated with a higher likelihood of adolescent fertility. Potential protective role against adolescent fertility for parents' presence, is supported by a recent study conducted in the Philippines, which also used DHS data and the "relationship to the household head" variable to examine parent-adolescent co-residency. The study results, similarly, suggest that female adolescents aged 15-19 years who lived without either parent were more likely to become pregnant[37].
The intercountry disparities shown in the study is also notable. This underscores the need to consider country-specific contexts when addressing adolescent fertility and related policies. For example, the study confirms the established knowledge that South Africa has the lowest fertility rates among adolescents relative to that of the rest of the countries in the subregion, and the broader SSA region[3]. This conclusion also holds independently when applying Kisambira's standard[33]. However, the low adolescent childbearing in South Africa should be seen in the context of high unwanted premarital adolescent fertility in the country[34], and

the record high parental absence globally[38]. This is shown by the AOR greater than 1 for each country in comparison with South Africa. However, the low adolescent childbearing in South Africa should be seen in the context of high unwanted premarital adolescent fertility in the country[34].

The results also appear to underscore the existing disparities within the Southern Africa subregion, but with a notable convergence within its southernmost part. For example, there is relatively lower adolescent childbearing levels for the five southernmost countries, which also constitute “Southern Africa” using alternative definition - namely, South Africa, Namibia, Lesotho, eSwatini, and Botswana[35]. Angola, Mozambique, Malawi, and Zambia, globally, have some of the highest fertility overall[3]. Zimbabwe has experienced a complex fertility transition, with one of the earliest transitions, one of the longest stalls, and consistently and relatively high premarital fertility[3,36]. Zimbabwe is categorised within the “southern Africa” group, characterised by medium overall fertility levels[3]. In the study, results suggests that adolescent childbearing in Zimbabwe is also relatively low.

Some results from the study seemed counterintuitive. This includes possible protective effects of orphan presence on adolescent fertility. This seemingly paradoxical finding aligns with a previous study using data collected from cities in the USA and South Africa, that found that living with other people who are not biological parents may be protective of adolescent sexuality[38]. Likewise, results from a longitudinal study in Ouagadougou also showed a lower risk of premarital pregnancy for females who lived with neither their parents, compared to their counterparts who did[39]. These results may be indicative of the complex interplay of living arrangements, parental presence, and adolescent fertility.

Notwithstanding, the study results should be understood in the context of the important limitations. This includes temporal issues. This relates to the sequence of events and the relatively wide window for the data, spanning from 2006 to 2016. This may have affected comparisons across countries because of the expected decline in adolescent fertility over time. This is particularly for temporal variations in the broader trends of orphanhood and fosterage, as well as the dynamics of household absorption over time.

The research has delved into the complex relationship between adolescent fertility, a common demographic phenomenon, and previously unexplored yet increasingly emphasised socio-economic factors—specifically, orphanhood and parental absence. Challenges related to the

utilisation of surveys in this context have also been identified[40]. For example, the household-based samples, exclude non-household populations that may be at a disproportionate risk of adolescent fertility. The household typology also affects household constitution and intra-household relationships as other “members” may be excluded. In the DHS surveys, a household typically constitutes usual members and visitors at a designated reference time[31]. This potentially excludes individuals who are away for extended periods, e.g., migrant populations, who may still contribute to their children's lives through remittances and periodic visits. This is exacerbated by the complex African household dynamics that may be relatively difficult to decipher using the “relationship to household head”, e.g., multiple household membership.

Further research using longitudinal data may unpack some of the results presented here. This underscores the importance of functional civil registrations and vital statistics systems (CRVS) systems that allow better tracking of progress in reducing adolescent fertility.

In conclusion, despite the limitations, the study presents findings with important policy implications. The study explored the potential spill-over effect of orphanhood or fosterage on adolescent fertility across countries in Southern Africa. Tailored approaches are necessary to address adolescent fertility within the unique contexts of individual countries, considering factors such as orphanhood, parental presence, and broader socio-cultural and economic influences. Additionally, the study showcases the utility of household relations variable to identify child-parent co-residence, an aspect that is largely underutilised.

I declare no competing interests.

CHAPTER 7: SUMMARY, DISCUSSIONS AND CONCLUSIONS

7.1 Introduction

The thesis set out to explore the SRH of female adolescents who are either orphaned or living apart from parent/s, in the context of high parental absence and orphanhood in Southern Africa. This is a departure from most studies that focused on either one of them in isolation. However, the twin approach is interestingly emerging as a topical approach. The novelty of this study is that it goes beyond the individual adolescent to understanding ASRH, by including household and community-level orphanhood and parental co-residency variables. In this chapter, the focus is on discussing the findings of the study, drawing conclusions based on those findings, and suggesting potential areas of future research. The main objective of this study was to assess the association between orphanhood, living arrangements and ASRH. The initial analyses of orphanhood and parental absence data provided the context in Southern Africa specifically and SSA more broadly. This analysis culminated in a background and methodological article – (see Chapter 3). The section commences with a synthesis of the four papers, followed by summaries, discussions, and conclusions.

7.2 Synthesis of the four papers

The thesis is structured around four papers, each designed to contribute to the exploration of ASRH among females in Southern Africa. Paper 1 evaluates the quality of orphanhood data, examining potential influences of living arrangements on orphanhood reporting and assessing the reliability of orphanhood estimates derived from triangulated data sources. This evaluation is crucial for subsequent research utilising orphanhood and living arrangements as key independent variables.

The subsequent three papers delve into essential ASRH topics. The first paper explores sexual debut, a primary ASRH behavior intricately linked to SRH outcomes. The second paper examines HIV knowledge, while the third addresses adolescent fertility, a central SRH outcome interconnected with various other SRH outcomes, including HIV infection. The sequencing of these papers is guided by their potential interconnections. The operationalisation of living arrangements and orphanhood varies across the four papers, enabling a comprehensive exploration of the different living arrangements dimensions.

Results from Paper 1 suggest that the quality of data are good, allowing for acceptability of conclusions related to ASRH with a high degree of certainty. However, there is a possibility that the numbers for female adolescents in the study may have been understated, highlighting a potential concern related to field staff manipulation of the household schedule.

To provide the context, the household roster is the initial step in a DHS, where all eligible household members are listed by sex and age. The roster serves as the basis for selecting individuals for further detailed individual interviews, where in a CAPI environment, all female household members aged 15-49 are typically automatically selected for the detailed individual interviews. Due to the potential high number of eligible individuals in some households and the time-consuming nature of individual interviews, there is a possibility that some field staff may manipulate the household schedule to reduce their workload. This would involve deliberately displacing some of the respondents of eligible ages to adjacent ineligible ages. While the effect may be negligible, it remains a persistent issue for DHS survey data (Lyons-Amos and Stones 2017).

The results also suggest that orphanhood and living arrangements exhibit connections with ASRH across the three key SRH behaviors and outcomes studied. The variation in linkages between these variables across countries underscores the importance of considering contextual factors. While overall, the results are generalisable to the broader Southern African subregion, this varies across papers, with broader country inclusion in Papers 2 and 4 providing more generalised insights, while Papers 1 and 3 offer more context-specific findings.

7.3 Summary, discussion, and conclusions

The orphanhood prevalence is observed to be relatively high across the countries, although there are noticeable discrepancies between model estimates and survey estimates. The extent of these discrepancies and their implications varies by context. It is crucial to ensure adequate reporting of such differences to alert users and researchers. Additionally, recognising the potential factors driving within-country differences is important for the nuanced interpretation of the data (Mejia-Pailles et al. 2020). This understanding becomes particularly important when considering the use of data from different sources for distinct purposes.

The results further suggest that orphanhood and parental absence are associated with female ASRH. This is consistent with results from previous research done separately on orphanhood and parental absence.

For the seven countries studied, the prevalence of sexual debut among adolescents ranged between 10 and 40 percent. This is significant because ages 15-17 are only a fraction of the adolescent population, moreso, because sexual debut is expected to increase with age. Therefore, sexual debut and sexual activity are expected to be more prevalent for older adolescents – ages 18-19 years, which were not part of the study. The results also suggested that female adolescents who were orphaned and/or whose parent/s lived elsewhere, were at risk of early sexual debut, (except for eSwatini and Namibia). The variability across countries suggests that individual country context is also important for ASRH. Unfortunately, studies on orphanhood, parental absence and ASRH in eSwatini and Namibia are limited, therefore, results from this study cannot be directly compared with other studies in the two countries. In a classic study on ASRH in eSwatini by Reza et al. (2009), orphanhood was included in the study suggesting its importance, but was used as a control variable, with results for orphan status specifically not shown.

In the research using data from Malawi, the findings suggest that individual orphanhood and parental co-residency were not directly associated with individual comprehensive HIV knowledge. However, community-level orphanhood was found to be associated with comprehensive HIV knowledge at the individual level. The results are linked to those from a study conducted by Mathur et al. (2020) in Kenya, Malawi, and Zambia, among females aged 15 to 24 who were out of school. The study identified two distinct HIV infection risk groups: high-risk and low risk, both characterised by a lack of comprehensive HIV knowledge among other factors. Interestingly, individual orphanhood did not appear to differentiate between the two risk groups, suggesting that individual orphanhood may not explain the observed differences in higher and lower HIV risk groups.

The analysis of adolescent fertility in Southern Africa showed that parental absence was associated with higher adolescent fertility. The childbearing difference is also seen across the countries. The results for the analyses of adolescent fertility and orphaned child/ren household presence did not show statistical significance. In this paper, the analysis was different from that of the other two papers in terms of the definitions of orphanhood and parental absence. Specifically, the age cap was extended from 17 to 19 years to include ages 18-19, for which

information on orphanhood or parental co-residence was not directly available. The rationale was to capture the vulnerability of these adolescents to factors such as orphanhood, fosterage, and adverse SRH.

Apart from orphanhood and parental absence, the rest of the other factors included in the conceptual framework were in the study used as independent variables except comprehensive HIV knowledge and sexual debut used as both dependent and independent variables. The independent variables were either interpretable or were used as control variables.

7.4 Current context of the study

The global COVID-19 pandemic as declared by WHO in 2020, occurred while the study was well underway, therefore it is not the thrust of the study. However, it is worth considering the potential impact of the pandemic on the broader context and circumstances surrounding the factors under study in the research. The COVID-19 pandemic impact on orphanhood, bore close resemblance to that of the HIV epidemic and its dominance of the global discourse (Kidman 2021). It is projected that COVID-19 resulted in an estimated 5.2 million children that were orphaned (Unwin et al. 2022). With the benefit of the experience gained from dealing with orphanhood due to a protracted HIV epidemic, there is need to address the associated adverse consequences on orphans due to the COVID pandemic (Kidman 2021). It was also estimated that the COVID-19 pandemic would exacerbate the SRH threats female adolescents already faced and thus reverse the gains made prior in terms of ASRH (Cousins 2020). This is in part because COVID-19 affected the social determinants of health (Cousins 2020) and highlighted and exaggerated the pre-existing social inequalities (Abrams and Szefler 2020). The accompanying COVID-19 health-related protocols, such as social distancing measures, had significant implications for the interactions with other socialisation agents, namely schools, peers, and parents (Cluver et al. 2020).

7.5 Limitations of the study

The study acknowledges several limitations that are worth considering and the extent to which they affect the findings presented. The limitations include those that relate to the general cross-sectional design of the study, the use of DHS and the current study.

The limitations include the existence of intricate links between variables that potentially present challenges in disentangling their individual relationships with health states, and therefore making it difficult to assess the specific impact of each variable on the outcomes of interest (Vart 2022). Linked to this limitation, is the study's reliance on independent secondary cross-sectional data, which limits the ability to establish temporality, the lack of contemporaneity affecting comparability of findings, and the constraints in the availability of variables. While the inclusion of intermediate variables in the analysis is determined by theoretical considerations and contextual factors, it is also limited by the availability of data. Some variables may be completely unavailable, and there may be variations in the presence of certain variables across different countries due to the flexibility of DHS surveys to include contextual variables.

This includes variables that capture quality of parental care, instead of merely parental presence (Sherr et al. 2017). The context of fostering and the consequences thereof also vary widely (Foster and Williamson 2000, Verhoef and Morelli 2007, Archambault and de Laat 2010), so is the extent of parental involvement for the surviving parents who are not coresident with their children. There are different forms for parental absence, including parents that are no longer fulfilling their parental duties – whose children are defined as social orphans (Dillon 2008). This is largely not captured because the study includes only analyses of households, vis-a-vis household membership as central to the establishment of adolescent living arrangements. While there is permanent parental absence for parents who are deceased (for orphans), there are also wide variations for those that are alive but living elsewhere as they do not constitute a homogenous group.

One study that highlighted the importance of disaggregating parental absence data for analysing ASRH outcomes, is a retrospective longitudinal study of females aged 18-40 years in Mozambique by Chae et al. (2016). They disaggregated and explored father absence due to migration and adolescent marriage. Unlike many studies that show the negative impact of parental absence, Chae et al. (2016) showed potential positive returns for adolescent marriage through improved well-being from father remittances.

Also linked to the ability of the DHS surveys to capture vulnerable adolescents and vulnerable adolescent subgroups, is the use of an "outdated" census sampling frame in the DHS surveys which can potentially exclude certain households, particularly in sprouting informal urban settlements that emerge in part due to the unprecedented urbanisation and urbanisation of

poverty (Thomson et al. 2021). The DHS surveys design is also household-based and does not capture non-household-based populations, that are potentially worst affected by orphanhood, parental absence, and adverse ASRH&R (Hillis et al., 2012; Chandra-Mouli et al. 2021). While the impact of the exclusion of some adolescent subpopulations on estimates may be minimal (Hill and Trussell 1977), the lack of representation in the sample, affects the generalisability of the findings to the respective subpopulations. Research on such populations, therefore, remains limited to a few and isolated studies (Sherr et al. 2017; Ayaya et al., 2021.

Previous recommendations have suggested the use of data sources that are not limited to cross-sectional designs (Jackson et al. 2018; Birdthistle et al. 2009).

Limitations relating to the analyses in the study relate to the exclusion criteria. Male adolescents are specifically excluded and is commonly the case across research (Hensels et al. 2016, Batyra et al. 2021). This is because of various reasons that include dearth in the relevant data, comparatively limited adverse SRH outcomes among male adolescents, (De Wet et al., 2018; Mchunu et al., 2012), and a focus on gender-responsive and rights-based approaches that prioritise the specific needs of female adolescents (Meyer, 2013). While the existing inequalities are notable, inclusivity in research would help ensure equity-based approaches (Meyer, 2013).

7.6 Recommendations and future studies

Interventions to address ASRH in southern Africa should consider parental aspects and adolescents affected by parental absence in general, and those orphaned. The following aspects while clearly outside the scope of this study could be seen as recommendations and possible areas of future inquiry: Countries should develop their CRVS systems to address ASRH data needs, although not replacing the different survey and census data. There are isolated longitudinal Surveillance Systems in the subregion that could be utilised to enrich research on ASRH as a start (Arthur et al. 2013, Reniers et al. 2016). These include the Network for Analysing Longitudinal Population-based HIV/AIDS data on Africa study sites (ALPHA Network) – the majority of which are also International Network for the Demographic Evaluation of Populations and their Health (INDEPTH) Network sites (Reniers et al. 2016).

The national CRVS data can provide continuous, and therefore timeous and standard measurement of adolescent SRH to provide a national picture that allows for better cross-country comparison to meet global developmental priorities (Melesse et al. 2020). This will also make available current SRH data for younger adolescents, which are currently largely missing (Blum et al. 2012). However, in the Southern Africa subregion, and indeed, across Sub-Saharan Africa as a whole, South Africa stands out as the only country with usable CRVS data (UNECA, 2017). The implications are that other countries should develop their CRVS systems to address ASRH data needs. For South Africa, different datasets could be triangulated to obtain as much information underlying ASRH as possible. Interestingly, similar efforts have been made in relation to other demographic indicators (Joubert et al., 2014, Shoko et al. 2016, Machemedze et al. 2023). Neal and Hosegood (2015) state that despite the decent quality DHS ASRH data, the CRVS data takes precedence. Additionally, the paper using Malawi data shows that the depth in the data provided by the DHS surveys is not always sufficient.

In addition, the ambit of the definition of household, already shown to be limiting, could be extended so that those outside the "household" as operationalised by the many surveys do not fall through the cracks. The extension of the common household definition would potentially make the data more informative, through addressing the rather too simplistic a definition, not representative of the characteristic complex and multiple household memberships that straddle across space (Hosegood et al. 2005). Efforts are also to be made to include non-household populations. There is also need to address the research gaps that remain for younger adolescents, males, and other adolescents in vulnerable situations (Darroch et al., 2016). If these limitations could be addressed, then that would go a long way along the continuum of constantly refining methods to obtain the best ASRH data possible.

7.7 Conclusion

Despite the limitations cited, the study provides valuable insights. The study is generalisable to the female adolescents in the sub-region as a whole and may help in policy formulation at this level and beyond. The research highlights existing gaps in ASRH research, particularly concerning parental absence and orphanhood. There is also a long way to go to address ASRH in general, also considering geographic heterogeneity from global to subnational levels. The COVID-19 pandemic has also shown the potential effect of sudden societal shocks on ASRH.

Although the study did not test the proximate determinants framework for HIV/AIDS on ASRH, it acknowledges the framework's importance in understanding the upstream factors that influence ASRH outcomes. The factors examined in the study include orphanhood, parental absence, rural-urban residence, schooling, and wealth quintile. However, where feasible, other factors that are not addressed here because of data limitations can be explored in future studies, ideally using longitudinal data.

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APPENDICES

Appendix A: “Turnitin” report

Mercy_Shoko_ Thesis_without publications-3.docx

ORIGINALITY REPORT

14%	12%	11%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	link.springer.com Internet Source	1%
2	core-cms.prod.aop.cambridge.org Internet Source	1%
3	core.ac.uk Internet Source	<1%
4	pubmed.ncbi.nlm.nih.gov Internet Source	<1%
5	Submitted to University of Johannsburg Student Paper	<1%
6	wiredspace.wits.ac.za Internet Source	<1%
7	www.statssa.gov.za Internet Source	<1%
8	www.measureevaluation.org Internet Source	<1%
9	library.oapen.org Internet Source	<1%

Appendix B: Ethics certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Ms M Shoko

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220548

NAME: (Principal Investigator)	Ms M Shoko
DEPARTMENT:	School of Public Health Medical School University
PROJECT TITLE:	*Exploring the relationship between orphanhood status, living arrangements and sexual and reproductive health outcomes amongst female adolescents in Southern Africa*
DATE CONSIDERED:	2022/05/27
DECISION:	Approved unconditionally
CONDITIONS:	Renewal of M14/04/43 - expired on 2019/06/19
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Professor K Kahn
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/09/06

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in May and therefore reports and re-certification will be due in the month of May each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator — Date: 7/9/2022

Appendix C: Selected literature on orphanhood, parental absence, and ASRH

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
1. Albert et al. (2021)	Mpumalanga province, South Africa	Randomized control trial nested in a longitudinal study	School-going individuals aged 13–20 years who were part of the trial from 2011 and 2017.	1. Father and male presence/absence	1. HIV 2. Pregnancy	1. Participants whose fathers were dead had the highest risk of first pregnancy and HIV but was attenuated by having an adult male household member present.
2. Ayaya et al. (2021)	Uasin Gishu County, Kenya.	Longitudinal	<18 years at baseline	2. Orphan status 3. Parental absence	Comparing adolescents in institution, family- and street-based settings over: 1. Sexual abuse	2. Orphaned and separated children (OSCA) in general have higher reported cases of abuse. 3. Higher prevalence of abuse for street-based OSCA compared to their counterparts in family-based care. 4. No difference in abuse observed between OSCA In institutional care and those in family-based care.
2. Babalola et al. (2002)	Kigali Ville, Butare, Kibuye and Umutara, provinces Rwanda (2001)	Cross-sectional	Males Females Ages 15-24	1. Parental coresidence among others	3. Sexual debut 4. Condom use	1. Father co-residence was associated with reduced early sexual initiation for females but no effect on boys
3. Babalola et al. (2005)	Abidjan, Korhogo & Bouake cities in Cote d'Ivoire (2001)	Cross-sectional	Males Females Ages 15-24	1. Parental coresidence during childhood	1. Sexual debut 2. Sexual activity 3. Multiple sexual partners	1. Father coresidence was associated with reduced sexual and fewer sexual partners.
4. Beegle and Krutikova (2008)	Kagera region, Tanzania (1990s – 2004)	Longitudinal	Ages 17 - 23	1. Orphaned <15 years 2. Orphan status	1. Transition to marriage	1. Paternal orphanhood was associated with early marriage for females, but not for males.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
5. Biddlecom et al. (2009)	Burkina Faso Ghana Malawi Uganda	Cross-sectional Nationally representative study	Males Females Ages 12-19 years	1. Parental coresidence	1. Sexually active 2. Contraceptive use	1. Among females, co-residence with both parents was associated with reduced sexual activity compared to those whose none of their parents were co-resident only in Uganda. 2. There was no difference however, for co-residence with mother/father only for either males or females.
6. Birdthistle et al. (2009)	Harare, Zimbabwe (2004)	Cross-sectional	Females Ages 15-19	1. Orphan status	1. HIV and HSV-2 infection	1. Increased behavioural risk for HIV among orphaned adolescent compared to their non-orphaned counterparts. 2. Education did not explain the excess risk among orphaned adolescents.
7. Chae (2013)	National Survey of Adolescents Burkina Faso, Ghana, Malawi, and Uganda (2004)	Cross-sectional	Males and females Ages 12–19	1. Orphan status Orphan timing	1. Sexual Debut Marriage	1. Female adolescents who are double orphans, regardless of orphanhood timing, are more likely to have early sexual debut than their counterparts who are non-orphans. This was not the case for male adolescents (for all orphan types) 2. Only in Uganda are the female adolescents who are double and paternal orphans, and were orphaned before they were aged 10, were more likely to have early marriage. 3. In all the above, education does not explain the orphans' increased risk.
8. Chae et al. (2016)	Four bordering districts in Gaza Province, Mozambique (2009 and 2011 rounds)	Longitudinal	Females Ages 12-19	1. Father migration	1. Transitions out of the household linked to marriage	1. For female adolescents, father's migration delays early marriage – for males, the results are not conclusive. 2. Education does not mediate the relationship between father migration and early marriage.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
9. Dahl (2016)	NGO in south eastern and northern Botswana (2003 - 2013)	Ethnographic	Females Older than 14 years	1. Orphan status	1. Disparate age sexual partnerships	1. Material interventions targeted at reducing female orphans vulnerability had negative unintended consequences of in fact increasing orphans vulnerability.
10. Defo and Dimbuene (2012)	Cameroon Family and Health Survey carried out 2002 (CFHS-2002), semi-rural Bandjoun, West Cameroon (2002)	Cross sectional	Males Females Age 12-24 years	1. Family structure	1. Timing of sexual debut	1. For both males and females, increased number of family transitions was associated with a lower age at sexual debut. 2. Earlier family transitions, compared to transitions later in life, were associated with early sexual debut for females, but not for males.
11. Eaton et al. (2013)	12 diverse study sites in Manicaland province, Zimbabwe. (August 2006 - November 2008)	Longitudinal	Males Females Ages 15 to 17 years in the 4th wave (2008)	2. Orphan type	3. HIV infection	1. Maternal orphanhood and having HIV-infected mother is associated with being HIV-infected among adolescent males and females. 2. HIV-infected adolescents, compared with HIV-infected young adults, were more likely to report illness.
12. Grant and Pike (2019)	Malawi (2007 – 2013)	Longitudinal	Males Females	1. Orphan status 2. General absence	1. Marital stability	1. Maternal orphanhood is positively associated with divorce for young women. 2. Maternal and paternal orphanhood are associated with women's post-divorce living arrangements.
13. Goldberg (2013)	Kisumu city, Nyanza Province Kenya (2007)	Cross-sectional	Males Females Ages 18 - 24	1. Orphan status	1. Sexual debut	1. There is an association between change in caregiver and the risk of sexual debut.
14. Goldberg (2013)	City of Cape town, South Africa (2002-2006)	Longitudinal	Females Ages 15-22	1. Parental coresidence	1. Childbearing	1. Females who experienced changes in parental co-residence before age 15, were more likely to experience adolescent childbearing, compared with their counterparts who did not.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
15. Hallfors et al. (2017)	Western Kenya (2011-2014)	Randomized controlled trial of educational interventions	Males Females Average age was 14.8 years	1. Orphanhood	1. HIV infection	1. Little evidence that educational interventions for orphaned adolescents impacted the HIV infection.
16. Haney and Singh (2012)	Hwange District, Zimbabwe	Cross-sectional	Ages 12-17	1. Orphan status	1. Exposure to HIV messaging 2. Motivation for learning about HIV 3. communication with caregivers about safe sex	1. Orphans aged 12–15 years were more eager acquire HIV knowledge and had higher HIV messaging exposure in school, compared to their non-orphan counterparts. 2. The orphan advantage disappeared at older ages.
17. Juma et al. (2015)	Migori, Kisumu and Homa Bay counties in Western Kenya	Cross-sectional – qualitative study	1. Adults living with child/children aged 10-17 years. 2. Male and female aged 10-17 years	1. Orphan status	1. Parent and adolescents communication on SRH matters.	2. Limited and not effective parent-adolescent communication on SRH.
18. Juma et al. (2014)	Migori, Kisumu and Homa Bay counties in Western Kenya	Cross-sectional – qualitative study	Male and female adolescents aged 14 –17 Caregivers aged 30-72.	1. Orphan status in the context of cultural beliefs and practices	1. Risky sexual behaviours	2. Cultural factors – separate adolescents sleeping arrangements, child/early, forced or arranged marriages, night vigils predispose orphans and non-orphans to risky behaviours – but widow inheritance and male preference affects orphans specifically. 3. For both males and females, orphanhood was not associated with early marriage, but poverty.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
1. Juma et al. (2013)	Migori, Kisumu and Homa Bay counties in Western Kenya	Cross-sectional – quantitative study	Males Females Ages 14 –17	1. Orphan status	1. Risky sexual behaviours	2. Separate adolescents sleeping and night vigils associated with risky SRH behaviours.
2. Kang et al. (2008)	Peri-urban Harare, Zimbabwe	Cross-sectional convenience sample	Females	1. Orphan type	1. Sexually active 2. STI including 3. HIV infections 4. Ever pregnant	1. Maternal orphans were more likely to: i. be sexually active ii. have had an STI including HIV iii. to have been pregnant
3. Karimi et al. (2003)	Nationally representativstudy, Ghana 1998	Cross-sectional	Males Females Ages 12-24 years	1. History of parental absence	1. Sexual debut 2. Number of lifetime sexual partners 3. Condom use	1. There is no association between living arrangements and sexual behaviour and condom use in the study.
4. Kidman and Anglewicz (2016)	Multiple (19) SSA countries	Cross-sectional	Males Females Ages 15-17 years	1. Orphan status	2. HIV infection	1. Male and female adolescents who are maternal or double orphans had higher likelihood of testing positive for HIV. 2. Paternal orphanhood was associated with a higher risk of testing positive for HIV infection for females.
5. Kidman and Anglewicz (2017)	Multiple (17) SSA countries	Cross-sectional	Males Females Ages 15-17 years	1. Maternal and sexual transmission	1. HIV infection	1. Both vertical and non-vertical transmission of HIV infection among adolescents who are orphaned, but the former is the more predominant mode.
6. Kidman and Anglewicz (2014)	Malawi	Longitudinal	Males Females Ages 15-25	1. Orphan status	1. Early childbearing	1. Timing of maternal orphanhood and paternal orphanhood was associated with respondents' desire for children, nor orphanhood per se.
7. Kidman and Palermo (2016)	Multi-country (13) study in SSA	Cross--sectional	Females Ages 15-17	1. Orphan Status 2. Parental absence	1. Sexual abuse	1. Paternal and double orphanhood are associated with higher risk of experiencing

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
						sexual violence in pooled analyses but not in individual countries analyses.
8. Luseno et al. (2015)	Areas around Mutare, Manicaland province, Zimbabwe (2007 – 2012) Zimbabwe Demographic and Health Survey (ZDHS) - 2011	Randomised controlled trial (RCT) Cross-sectional	Females Ages 15-17	1. Orphan status	1. Transition to marriage 2. Pregnant 3. HIV infection 4. Sexual debut	1. Higher risk in HIV and related risk behaviours in ZDHS compared to RCT respondents. 2. The higher HIV risk in orphans compared to their non-orphaned counterparts is primarily linked to vertical transmission. 3. Educational interventions that reduced school drop-out, are not likely to reduce orphans' risk of HIV infection compared to their non-orphan counterparts, but reduce related risk behaviours - early sexual debut, child marriage.
9. Marteleto et al. (2016)	Cape Town, South Africa (2002-2006)	Longitudinal	Males Females Ages 14 - 22 years	1. Parental coresidence stability	1. Sexual debut	1. Transition in maternal and paternal coresidence leads to increased odds of sexual initiation.
10. Mmari et al. (2016)	Baltimore and Johannesburg	Two-phase study	Males Females Ages 15–19 years	1. Orphan status 2. Parental coresidence	1. Sexual debut	1. Parents are an important source of SRH information although they are often not present in their children' lives. Parents absence may result in adolescents feeling a lack of adult support and guidance. 2. In both Baltimore and Johannesburg, female (not male) adolescents, who were raised by other relatives had a delayed sexual compared to their counterparts who were raised by both biological parents.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
						In Johannesburg, paternal orphans compared with non-orphans had less risk of sexual debut among female adolescents – but increased risk for male adolescents.
11. Mmari (2011)	Kisesa ward, Mwanza region, Tanzania	Cross-sectional	Caregivers and orphaned and non-orphaned Male and Female adolescents	1. Focus group discussions on caregiving roles that impact on ASRH.	Caregiving factors that explain orphans' sexual vulnerability	1. Three important caregiving roles that had an impact on ASRH: i. provision of basic needs ii. providing advice on behaviours and monitoring behaviors iii. assignment of household chores.
12. Mkandawire et al. (2013)	Mzuzu, Northern Malawi (2009)	Cross-sectional	Males Females Age 12–18	1. Orphan status	1. Timing of sexual debut	1. Male double orphans experienced sexual debut earlier than their counterparts who are non-orphaned. This is also true for female adolescents who are maternal or paternal orphans. 2. The adolescents vulnerability in this regard was mediated by social support. - peer connectedness, household food security etc.
13. Mmbaga et al. (2012)	Morogoro, Tanzania, 2011	Cross sectional	Males and females Ages 16-19 years	1. Orphanhood 2. Parental presence/absence	1.Sexual debut	1. Maternal orphanhood or not being raised by both parents predicted higher risk of early sexual debut. This was true for paternal orphanhood, but only for male adolescents.
14. Mojola (2011)	Kisumu city, Nyanza Province, Kenya (2005- 2006)	Ethnographic study, qualitative and quantitative study	Females Age 15-19 Attending secondary school – year one to year four	3. Orphan status	1. HIV infection risk	1. Parental demise set in motion multiple social transitions –change in familiar households, access to financial and material resources and selection of risky partnerships that potentially increases adolescents' vulnerability to HIV infection.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
15. Ngomi et al. (2003)	Nairobi slums, Kenya (February-June 2000)	Cross-sectional study.	Females Ages 12-19 years	1. Parental presence/absence	1. Sexual debut 2. Pregnancy 3. Sexually active	1. Father's presence (father only or both parents present in the household) is associated with – less likelihood of having sexual debut, be sexually active, to have ever experienced an unwanted pregnancy.
16. Nyamukapa et al. (2008)	Secondary analyses of data from the Survey on Orphans and Other Vulnerable Children in Rural and Urban High Density, Zimbabwe 2004, conducted in selected districts	Cross-sectional study.	Males Females Ages 12 to 17 years	1. Orphanhood, 2. Psychological distress	1. Sexual intercourse	1. Orphans had more psychosocial distress than their non-orphaned counterparts. 2. Orphans were also more likely to have had sexual debut, which was likely to be explained by heightened distress.
17. Nyirenda et al. (2010)	Hlabisa sub-(Nyamukapa, Gregson et al. 2008)district, KwaZulu-Natal, South Africa (2006)	Longitudinal	Males Females Age 15-19 years	1. Orphan type	2. Sexual debut 3. Pregnancy 4. HIV infection	3. Maternal orphanhood was associated with increased risk for HIV-related behaviors and for HIV infection among female adolescents. This was true for paternal orphanhood but applied to both male and female adolescents.
18. Operario et al. (2011)	Ten studies on Benin, Chad, Congo, Cote d'Ivoire, Lesotho, Malawi, Mozambique, South Africa, Russia, Tanzania Uganda and Zimbabwe.	Systematic review and meta-analysis – studies using nationally representative household-based, targeted or convenience sampling	Males Females Ages 0 - 25	1. Orphan status 2. Orphan type	1. HIV risk 2. Sexual risk behaviours	1. Adolescents and young adults who are orphaned or separated from their parents have higher risk of risky HIV behaviour and HIV infection.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
	The research was pub- lished between.					
19. Palermo and Peterman (2009)	Multiple SSA countries (10) using DHS data	Cross-sectional	Females Ages 15-17 years	1. Orphan status 2. Orphan type	1. Marriage 2. Sexual debut 3. Pregnancy	1. Orphanhood was not associated with early marriage and pregnancy, but with sexual debut.
20. Pilgrim et al. (2014)	Rural Rakai District, Uganda	Longitudinal	Females Ages 15-19 years	1. Orphan types 2. Parental coresidence	1. Sexual debut	1. Female adolescents not co-resident with both biological parents, either due to death or other reasons, have higher risk of early sexual debut, than those who did. 2. The absence of the father was associated with a higher risk of sexual debut, independent of co-residence of the mother.
21. Pilgrim et al. (2015)	Rural Rakai District, Uganda	Longitudinal	Females Ages 15-19 years	1. Parental coresidence	1. Number of sexual partners	1. Co-residence with neither parent was associated with sexual partnerships, but only for female adolescents who were out of school.
22. Popoola and McHunu (2016)	Seventeen studies in eight SSA countries	Literature review	Males Females Ages 10–18 years	1. Orphanhood due to HIV in older adolescents	1. STIs 2. Teenage pregnancy	1. Limited studies on older orphans only. 2. Female adolescents orphaned due to HIV were more likely to be at a higher risk of STIs and early childbearing
23. Stark et al. (2015)	Two districts in rural Sierra Leone	Cross-sectional	Males Females Ages 13 and 19 years	1. Living arrangement s 2. Orphanhood	3. Recent sexual activity 4. Pregnancy	1. Living with the mother or both parents was associated with no recent sexual activity only.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
24. Puffer et al. (2012)	Muhuru Bay, formerly Nyanza Province, Kenya	School-based cross-sectional	Ages 10 – 18 years	1. Orphan status 2. Orphan timing	5. Sexual debut 6. Sex-related self-efficacy and beliefs	2. There was no significant difference on sexuality between orphans and non-orphans.
25. Tambashe and Shapiro (1996)	Kinshasa, formerly Zaire (now Democratic Republic of Congo) (1990)	Cross-sectional	Females Ages 13-49	1. Orphan status	1. Early sexual debut 2. Early transition into marriage 3. Early childbearing	1. Women whose fathers only and mothers only had died when they were aged 15 were less likely to have early sexual debut, than those with both parents alive. However, there was higher likelihood of having early sexual debut if both father and mother were dead. There was a delay in the transition to marriage if the mother only or both parents died. There was also a higher likelihood of early transition to motherhood if the mother only died.
26. Robertson et al. (2010)	Multicountry study - 10 SSA countries - Democratic Republic of Congo, Cote d'Ivoire, Lesotho, Liberia, Malawi, Rwanda, Swaziland, Tanzania, Zambia, and Zimbabwe	Cross-sectional	Males Females Ages 15-17	1. Orphan status	1. Sexual debut 2. HIV status	1. Maternal and double orphanhood for female adolescents (not male adolescents), was highly associated with sexual debut in countries with high HIV burden, but not in low HIV burden countries. This was not explained by household-level factors.
27. Thomas et al. (2020)	Systematic analyses of research of interventions conducted in China, Haiti, Kenya, Malawi, Myanmar, Rwanda, South	Systematic and meta-analysis of pschosocial/behavioral interventions and social protection interventions which	Males Females Ages <25 years	1. Orphan status 2. Vulnerability	1. Sexual debut 2. Sexual risk behaviours and intentions 3. Risky sexual partnership	1. Social protection included financial components to interventions, and psychosocial interventions specifically motivational interviewing had positive effects on health behavior outcomes.

Author	Location (year)	Study design	Sample characteristics	Key independent variable	Outcome variables	Key findings
	Africa, Uganda, the United States, and Zimbabwe.	specifically link with SRH outcomes				

Appendix D: Order of references for paper 4 following the Vancouver referencing style

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