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Use of Mobile Phones for HIV Prevention and Testing Information Needs By Emerging Adult Male Population in Rural Kenya. A Qualitative Study

Augustine Boswony Kiplagat
University of Wisconsin-Milwaukee

USE OF MOBILE PHONES FOR HIV PREVENTION AND TESTING INFORMATION NEEDS BY EMERGING ADULT MALE POPULATION IN RURAL KENYA. A QUALITATIVE STUDY

by

Augustine Boswony Kiplagat

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ABSTRACT

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Augustine Boswony Kiplagat

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Human Immunodeficiency virus (HIV) and Acquired Immunodeficiency disease syndrome (AIDS) among young people in Sub-Saharan Africa (SSA) is a serious public health issue which needs urgent cost-effective interventions locally, regionally, and internationally. HIV and AIDS is currently the leading cause of death among young people in SSA, calling for strategic HIV prevention approaches applicable to emerging adults. While most studies have focused on young women, studies focusing on emerging male adults are lacking. The purpose of this dissertation study was to develop an in-depth understanding of the needs, barriers, and facilitators of using mobile phone to access HIV prevention and testing information by emerging male adults in rural Kenya.

A qualitative descriptive study design was used. Sixty emerging male adults in rural Kenyan setting participated in the study. Thirty in-depth interviews and three Focus Group Discussions (FGDs) were conducted. Interviews were audio recorded, transcribed verbatim and coded using the software MAXQDA. Attention was focused on the readability, credibility, dependability, confirmability, transferability, and thus, trustworthiness of the findings.

The findings derived from interviews centered around two major themes major theme: (i) N*eeds of emerging male adults in HIV prevention; and* (ii) *facilitators and barriers to the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings.* The results outlined emerging male adults in the rural setting are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. Findings also showed that most of the emerging adults in rural settings own a smartphone and this mobile technology can be tapped as a cost-effective intervention in creating awareness in HIV prevention and testing among the young people.

The study underscore that HIV is still the greatest threat among emerging adults in SSA and mobile health and they were receptive and acknowledge several benefits of use of mHealth technology for creating awareness about HIV prevention and testing, but they also described many barriers. The findings and recommendations of the dissertation study have a great potential to inform the public health policy and healthcare informatics on cost-effective use of mobile phones in HIV prevention not only to this age group but also to other age groups faced with similar challenges as we work to reach and sustain an AIDS-free generation.

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LIST OF ABBREVIATIONS

AIDS- Acquired Immunodeficiency Syndrome

AYA- Adolescent and Young Adult

COVID-19- Coronavirus Disease of 2019

eHealth-electronic Health

FGDs-Focus Group Discussions

HIV- Human Immunodeficiency Virus

HIVST- HIV Self Testing

HSV- Herpes Simplex Virus

ICTs- Information and Communication Technologies

IRB- Institutional Review Board

mHealth-mobile Health

MSM-Men having Sex with men

MTRH- Moi Teaching and Referral Hospital

NACOSTI- National Commission for Science, Technology, and Innovation

NASCOP-Kenya National AIDS and STI Control Program

OVC- Orphans and Vulnerable Children

PHC- Primary Health Care

PI- Principal Investigator

PID- People who inject drugs.

PrEP- pre exposure prophylaxis

PRISMA- Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SMS-Short Message System

SRB- Sexual Risk Behavior

SSA-Sub-Saharan Africa

STI-Sexually Transmitted Infections

UNAIDS- United Nations Programme on HIV/AIDS

UNICEF- United Nations Children's Fund, formerly (1946–53) United Nations International Children's Emergency Fund

UWM- University of Wisconsin

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CHAPTER 1: INTRODUCTION AND BACKGROUND

Chapter Summary

The dissertation study is a descriptive qualitative study of emerging adults' use of mobile technology in HIV prevention in emerging adults in Sub-Saharan Africa. Chapter one gives an introduction and background of HIV burden in emerging adults in Sub-Saharan Africa and how mobile phones can be explored as a cost-effective intervention in HIV prevention and testing information by emerging male adult population. This chapter is arranged in the following order: Statement of the Problem, Significance of the Study, Purpose and Specific Aims, Definition of Terms, and Assumptions. At the end of this chapter will be an overview of the format for the remaining chapters of the dissertation.

The Statement of the Problem

HIV and AIDS is currently the leading cause of death among young people in sub-Saharan Africa, with up to 79% of new HIV infections occurring in young people aged 15-24 years (Odaga, 2012; Odaga, 2012; Prado, Lightfoot, & Brown, 2013; Schnall, John, & Carballo-Dieguez, 2015; UNICEF., 2011). Globally an estimated 5 million young people aged 15–24 live with HIV and about 66% are in sub-Saharan Africa (UNAIDS, 2018). This is a serious public health issue which need urgent interventions locally, regionally, and internationally to save the emerging adults from the HIV pandemic. In 2001 the heads of State and government, and ministers from more than 100 nations under the umbrella of UNAIDS declared HIV and AIDS a global crisis requiring global action and participated in an intensive discussion on HIV/AIDS and committed to strategies to increase young people's access to essential prevention information, skills and services so as to reach 95 per cent of those in need by the same date(UNAIDS 2018).

UNAIDS Strategies to Reduce HIV Infection

The strategies outlined by the UNAIDS 2018 report includes to ensure that people everywhere particularly the young know about HIV testing and prevention, Prevention of mother to child transmission of HIV, provide care and treatment for infected and affected including orphans and vulnerable children, increase funding in HIV research including search for HIV vaccine (UNAIDS, 2018). The report outlines the need to reduce new HIV infections and AIDS related deaths by 90% by 2030, compared to 2010 levels. To achieve this, the Fast-Track strategy sets out targets for prevention and treatment, known as the 90-90-90 targets and revised recently to 2025 AIDS targets. The 2025 targets place far greater emphasis on the removing societal and legal impediments to service delivery, and on linking or integrating the provision of HIV services with the other services needed by people living with HIV and communities at risk to stay healthy and build sustainable livelihoods (UNAIDS, 2020a).

In 2014, UNAIDS set the ambitious targets that, by 2020, 90% of people living with HIV should know their HIV status, 90% of people who know their HIV status should receive treatment, and 90% of people on treatment should be virologic ally suppressed (UNAIDS, 2014). This includes, reducing new annual HIV infections globally to fewer than 500,000 by 2020 and to fewer than 200,000 by 2030 effectively ending AIDS as a public health threat (UNAIDS, 2020b). The UNAIDS 2018 report further outlined that at least 95 per cent of young men and women aged 15 to 24 particularly in sub-Saharan Africa have access to the information, education, including peer education and youth specific HIV education and services necessary to develop the life skills required to reduce their vulnerability to HIV infection in full partnership with young persons, parents, families , educators and healthcare providers.(UNAIDS, 2018).

Irrespective of all these strategies outlined in the UN head of states general assembly in 2001, 17 years later (in the year 2018), only 36% of young men and 30% of young women (ages 15-24) in sub-Saharan Africa have comprehensive and correct knowledge of how to prevent HIV infection (UNAIDS, 2018). Reducing HIV prevalence especially among the youth requires not a single intervention but a continuum of HIV prevention that provides information, support and services to adolescents and young people throughout the life cycle, from very young adolescents (aged 10–14) through older adolescents (aged 15–19) to young adults (aged 20–24) (UNAIDS, 2015;(Poushter, 2016) UNICEF., 2011)

In the year 2017, the sub-Saharan Africa, particularly eastern and southern Africa, is home to 53% of the world's people living with HIV (UNAIDS, 2018). Kenya has the joint third-largest HIV epidemic in the world (alongside Mozambique and Uganda) with 1.6 million people living with HIV in 2018 (UNAIDS, 2019). More than half (51%) of all new HIV infections in Kenya in 2017 occurred among adolescents and young people (KNACC, 2018).The latest findings indicates that all new HIV infections reported in 2019 occurred among adolescents and young people aged between 15-24 years as per the National AIDS and STI Control Program (NASCOP) Kenya. (Mureithi, 2019). A number of factors contribute to the increasing rate of HIV infection among young people including incorrect perception of HIV risk; and having unprotected sexual intercourse under influence of alcohol or drugs (KDHS, 2014; Human Development Indicators, 2013)

Use of mHealth Among Emerging Adults in SSA

The HIV prevention research gaps for young and emerging adults in the assessment of the utilization of technology particularly cell phones interventions still persist (Feroz et al., 2021; Pettifor et al., 2013; WHO, 2018). Research on HIV health information using mHealth has

primarily focused on the adherence and the needs of adults living with HIV or other chronic illnesses (Cahill & Valadéz, 2013; Pop-Eleches et al., 2011; Scanlon & Vreeman, 2013; UNICEF., 2011). The youth particularly the emerging adults are the greatest users of Internet and mobile devices globally with high usage reported even in developing countries (Pettifor et al., 2013). The emerging adult cell phone owners aged 18 to 29 universally prefer text messaging otherwise referred to as Short Message Service or SMS over other communication forms, such as Facebook, WhatsApp, email, or talking on a mobile phone (Yan et al., 2015).

In SSA, three-quarters of the population have a cellphone connection, that translates to 747 million people (Poushter, 2016). The smartphone ownership is increasing across much of the developing world, including in SSA and in terms of age groups emerging adults in SSA, are the greatest owners of mobile phones and mainly smartphones due to increased affordability to easy access from Chinese made smartphone brands. Also, the emerging adults are more likely to own smartphones than people ages 50 and older (Poushter, 2016). Even as mobile phones and smartphones have become more ubiquitous across much of sub-Saharan Africa, important educational, financial and generational divides in ownership remain (Aker & Mbiti, 2010; Poushter, 2016). For example, in Kenya, 95% of more-educated people meaning those with a secondary education or more – own mobile phones, compared with 74% of people with less than a secondary education (CAK, 2020).

Use of mHealth Among Emerging Adults in Kenya

In Kenya, the number of mobile subscriptions in 2018 grew by 3.0 percent to stand at 44.1 million from 42.8 million subscriptions reported during at the beginning of the year (CAK, 2020). As a result, the mobile penetration level rose to 95.1 per cent from 94.3 per cent. On average, Kenya has a 95% penetration of mobile subscriptions compared to Africa's 80%. In

smartphone ownership, Kenya is leading the continent in terms of smartphone penetration and internet usage (Business Today Kenya, 2019).

Mobile money has also contributed greatly to the rise of mobile operators' population across Kenya. Kenya stands out as a country where even a large majority of basic phone owners (79%) report using their device to send or receive money, along with 88% of smartphone owners (Mbiti & Weil, 2015; Nyambura Ndung'u & Waema, 2011). These similarly high rates of mobile money-transferring could be due to the massive popularity of the M-Pesa service in Kenya. This service allows mobile users – whether on a basic phone or smartphone – to use text messages to pay for goods and services or to receive money from other users (Mbiti & Weil, 2015). As of 2017, M-Pesa had about 20 million registered users in Kenya, and its transactions amounted to almost half of the country's gross domestic product (Business Today Kenya, 2019).

The Current Situation of use of Mobile Phones in HIV Prevention Among the Youth in SSA

There is limited research on HIV prevention and testing needs of adolescents and emerging male adults and the use of mobile technology for meeting those needs and the few available target the young people living in urban towns and cities(Brown et al., 2013; Pettifor et al., 2013; UNICEF., 2011). The HIV infection in emerging adult male population is underreported because they have lower rate of HIV testing compared to female counterparts and therefore more HIV testing and prevention awareness need to be conducted on this population. Encouraging men to get tested and treated is a major challenge, but one that is poorly recognized. (Galdas, Cheater, & Marshall, 2005; Mills, Beyrer, Birungi, & Dybul, 2012).

Owing to the wider access and acceptance of mobile phones among the youth in Sub-Saharan Africa, this technology has an untapped cost-effective potential for HIV prevention

(Aker & Mbiti, 2010; Brown et al., 2013; Wesolowski, Eagle, Noor, Snow, & Buckee, 2012). Use of such methods should easily and cost-effectively reach a large youth population using tailored programs to make messages relevant to each recipient (Bull, 2010). In general, mHealth projects demonstrate positive health-related outcomes and their success is based on the accessibility, acceptance and low-cost of the technology (Aranda-Jan, Mohutsiwa-Dibe, & Loukanova, 2014).

According to the International Telecommunication Union (ITU), mobile-phone subscriptions reached almost 7.2 billion globally in 2015, driven mainly by an increase of subscribers from developing countries particularly in sub-Saharan Africa which added more than 80% of the new subscriptions during that year (Highlights, 2012). The use of mHealth services can have the potential to improve affordability of interventions for health promotion, increase health education and disease prevention. Moreover, telecommunication technologies may also reduce time, distance and cost of information delivery, and support health providers to offer cost-effective services. In developing countries like Kenya, mHealth could offer solutions for healthcare systems challenged like inadequate finances, poor health information systems, scarce resources and limited trained staff, particularly in countries with a rapid-growing number of mobile phone subscriptions (Aranda-Jan et al., 2014).

To summarize, mobile phones have a great potential for HIV prevention resource and healthcare in general. It is crucially important to work in partnership with young people, who are often at the forefront of emerging practices and who know better than anyone else what these might mean for them. The potential for m-health to transform formal healthcare provision, especially in geographically remote areas in Sub-Saharan Africa is huge. We therefore need to

think urgently about how young people might be facilitated to use mobile phones effectively and safely in relation HIV and other diseases prevention.

The Kenya's General Profile

Kenya lies astride the equator on the eastern coast of Africa. It is a medium-sized country by continental standards, covering an area of about 586,600km square, is around the same size as state of Texas in USA. Kenya is bordered by Somalia and the Indian Ocean to the east, Ethiopia to the north, Sudan to the northwest, Uganda to the west and Tanzania to the south. The coastline, about 550km long, faces the Indian Ocean (Fordham & Kinyanjui, 1967; Human Development Indicators 2013)

Kenya was a British colony and protectorate from the late 1890s until independence in December 1963. Jomo Kenyatta, the country's first president, ruled the country until his death in 1978. He was succeeded by President Daniel Moi (1978-2001), followed by Mwai Kibaki (2002-2013) and then the current President Uhuru Kenya (2013-date). Elections in August 2017 returned President Uhuru Kenyatta to office for a second term, but were nullified in September by Kenya's Supreme Court, paving the way for another presidential election in October against his main rival, Raila Odinga. In the end, Odinga boycotted the second election (saying it would not be run fairly) and Kenyatta was sworn into office on November 28, 2017. Kenya has been a relatively peaceful country except for some post-election violence and boycotts usually witnesses after competitive election between rival candidates (Fordham & Kinyanjui, 1967; Human Development Indicators 2013; Yin & Kent, 2008).

A key regional player in East Africa, Kenya is a major communications and logistics hub, with an important Indian Ocean port and strategic land borders with Ethiopia, South Sudan, Uganda, Tanzania, and Somalia. It has a population of about 48.5 million (2016). A new

constitution in 2010 introduced a tenured judiciary and bicameral legislative house. It also devolved county government a move that has had a largely positive impact on service delivery in rural areas (World Bank 2018).

After faltering in 2008, economic growth has resumed, reaching 5.8% in 2016 to place Kenya as one of the fastest growing economies in Sub-Saharan Africa. This expansion was boosted by a stable macroeconomic environment, low oil prices, a rebound in tourism, strong remittance inflows, and government-led infrastructure development initiatives. Looking ahead, near-term GDP growth is expected to decelerate to 5.5% in 2017 because of drought, weak credit growth, security concerns, and a rise in oil prices (UNDP, 2013; World Bank, 2018).

Kenya has at least 42 different ethnic African groups (including the Kikuyu, Luhya, Kalenjin, Luo, Kamba, Somali, Kisii, Meru & Embu, Mijikenda, Turkana and Maasai) who speak a variety of mother tongues. The different languages in Kenya fall into three categories – Bantu (Niger-Congo) languages which are spoken by around 65% of people, the Nilo-Saharan group of languages spoken among another third of the population and the Cushitic language, an Afro-Asian tongue spoken in the north by around 3% of the population (Abdelaziz & Samper, 2021).

The most widely spoken language is Swahili which is essentially Bantu infused with Arabic, Asian and European elements. Swahili is mainly used as the national language in Kenya along with English, the official language. Belief systems among some remote tribes also remain indigenous. Across Kenya two-thirds of people are Christian. With the centuries-old influence of Arabic and Islamic traders and settlers (particularly along the coast), around 15% of Kenyans are Muslim (Abdelaziz & Samper, 2021; Fordham & Kinyanjui, 1967).

Figure 1 The Map of Africa with Kenya shown by the black arrow

Adapted from WorldAtlas.com

Kenya Demographic Profile

The total enumerated population of Kenya as per 2019 Population and Housing Census is 47,564,296 of which 23,548,056 are Males and 24,014,716 are Females (Kenya National Bureau of Statistics, 2019). The population has grown to 47.6 Million in 2019 from 37.7 Million in 2009 The intercensal growth rate has declined to 2.2% in 2019, from 2.9% in 2009. The Average Household Size has declined to 3.9 in 2019 from 4.2 in 2009 and the median age in Kenya is 19.1 years (Kenya National Bureau of Statistics, 2020).

Table 1 Kenya Population by Age Structure

Age group	**Percentage (%)**	**Estimate Total Males (KPH Census 2019)**	**Estimate Total Females (KPH Census 2019)**	**Sex ratio Male/Female**
0-14 years	39.03%	9,557,274	9,497,870	1.01
15-24 years	20.3%	4,552,448	4,567,894	1.00
25-54 years	33.67%	8,170,264	7,976,751	1.02
55-64 years	4%	856,092	1,009,075	0.84
Above 65 years	3%	614,751	813,320	0.77

The proportion of Kenya's youth to the population is among the highest globally, the Kenya's ratio of youth (aged 15-24) to the population stands at 20.3 per cent, above the world's average of 15.8 per cent and 19.2 per cent for Africa (Kenya National Bureau of Statistics,

2020).The youth bulge could, however, breed runaway crime, drug abuse and HIV transmission among other socio-economic challenges. The 15-24 age bracket, known as millennials, largely comprises high-schoolers, school dropouts, college goers and fresh graduates (Awiti & Scott, 2016). A World Bank report released recently shows that Kenya leads the region in youth unemployment at 17.3 per cent compared to only six per cent for neighboring Uganda and Tanzania each (World Bank, 2018). Kenya's unemployment crisis has been blamed on sluggish growth of formal sector jobs even as the country continues to produce thousands of university graduates every year (Omolo, 2012).

The HIV and AIDS Profile in Kenya

In Kenya, the first case of HIV was detected in 1984 and, by the mid-1990s, it was one of the major causes of mortality in the country, putting huge demands on the healthcare system as well as the economy. The HIV prevalence peaked at 10.5% in 1996 and had fallen to 4.7 % by 2018 and this is mainly due to the rapid scaling up of HIV treatment and care number of people living with HIV, which was 1.6 million people in 2018. Roughly 36,000 people died from AIDS-related illnesses in the same year, although it is steadily declining from its total of 51,000 in 2010 (UNAIDS, 2019)

In Kenyan context, some studies have explored underlying factors for emerging adults in Sexual Risk Behavior (SRB). For example in western Kenya, socio-cultural factors such as funeral ceremonies, boy child preference, early marriage, and widow inheritance are among reported factors for SRB while studies from Central rift valley regions of Kenya describe peer pressure, low risk perception, lack of parental supervision, lack of school attendance, family dysfunction, alcohol and drug use, delinquent behavior, and gender norms as some predisposing factors for youth SRB (Ssewanyana et al., 2017). Generally, in Kenya, individual sexual risk

behaviors such as young age at sexual debut, multiple partners and commercial sex work have been associated with increased risk of HIV acquisition among young adults (Rositch et al., 2012).

HIV and AIDS education has been part of the school curriculum in Kenya since 2003. However, the 2014 Kenya Demographic and health Survey found that only 54% of young women and 64% of young men (aged 15-24) had comprehensive knowledge about HIV prevention (KDHS, 2014). Teaching young people about HIV and sexual health remains controversial. The KDHS 2014 found around 60% of both men and women to be in favor of educating young people about condoms, with the remaining 40% against it. Many cited fear of encouraging young people to have sex as a reason for being against the promotion of condoms (KDHS, 2014; KNACC, 2014).

In Kenya, the situation of Orphans and Vulnerable Children (OVCs) is an issue of concern. Currently it is estimated that there are over 3 million Orphans in the country, 47 percent orphaned as a result of HIV and AIDS (Concern Kenya, 2019). The fact that these children do not have parents predisposes them to exploitation through adolescent and young adulthood years. Orphanhood has been associated with risky sexual behaviors such as early sexual debut and engaging in sex with negative health outcomes including higher incidences of HIV, STI and teenage pregnancy according to studies conducted in Kenya, South Africa and Zimbabwe (Juma et al., 2014).

Most of the young people who have been living as orphans usually live alone, with grandparents or other households usually have a higher risk of first sex compared with those who lived with both biological parents. Much of this advantage, however, could be attributed to parental monitoring and household wealth (Tenkorang & Adjei, 2015). Because of increased risk

for HIV in young people who have been living as orphans, the use of mobile phones in HIV awareness and prevention will benefit this group.

Significance of the Study

In Kenya, new cases of HIV infections occurred mainly in the adolescent and emerging adults aged 15 to 24 years (NACC, 2019). There is paucity in the current literature about use of mobile or Internet-based programs in HIV prevention for the emerging adults in sub-Saharan countries including Kenya, yet they are wide adopters of internet and cell phone technology and face ongoing highest risk for HIV infection (Lenhart, Maddenn, & Hitlin, 2005). Several studies have been conducted on feasibility of mobile phones usage in HIV prevention and testing in adolescent and older adults in SSA including Kenya, however there is paucity of literature about barriers and facilitators for accessing HIV prevention and testing information through mobile phones by emerging male adults in the age of 18-25 years who are at greatest risk of new HIV infection (Pettifor et al., 2013; UNICEF., 2011; Ybarra & Bull, 2007)

In Sub-Saharan Africa, the focus of the epidemic has historically been on women and children. Women are particularly vulnerable to HIV infection in this setting because of biological factors, their reduced sexual autonomy, and men's sexual power and privilege over them. This understanding has led HIV/AIDS public health prevention and treatment campaigns to focus on women and children in this setting. As a result, men have received considerably less attention in the epidemic and receive less targeted HIV prevention and treatment programs (Mills, Beyrer, Birungi, & Dybul, 2012), UNAIDS 2018) The HIV response in Sub-Saharan Africa has been far less successful for the treatment of men: there is less Antiretroviral treatment (ART) coverage of men than women in Africa, and men typically have higher mortality. Men also tend to present at

clinic with advanced disease and are more likely to be lost to follow-up (Mills, Beyrer, Birungi, & Dybul, 2012).

The epidemiological evidence is accumulating, and indicates that males in sub-Saharan Africa are not accessing HIV services as often as their female counterparts, and as a result, men have worse outcomes of care, including mortality (UNAIDS, 2018: Mills, Beyrer, Birungi, & Dybul, 2012). Funding and research organizations need to recognize the social and health impacts associated with not engaging men in primary and secondary HIV prevention campaigns (Mills, Beyrer, Birungi, & Dybul, 2012). Programmatic efforts should account for this disparity, and recognize that it may be necessary to seek out men for HIV testing, care, and ART in variety of settings, and mobile heath care can be a cost-effective intervention in HIV prevention and care in males in African setting.

Broader scholarship on mHealth and HIV prevention has been primarily quantitative and positivist in nature; little of the existing work on mHealth explores their qualitative dimensions from user perspective (Chen, 2018). A qualitative research to identifying factors associated with effective use of mobile phones in creating HIV prevention awareness by emerging adult male population in Kenya has a potential to inform the public health policy on effectiveness use of mobile phones in HIV prevention and further research and theory development not only to this age group but also to other marginalized groups faced with similar problems.

Why Emerging Male Adults.

In Sub-Saharan Africa, the focus of the epidemic has historically been on women and children. Studies have outlined that women are particularly vulnerable to HIV infection in this setting because of biological factors, their reduced sexual autonomy, and men's sexual power and privilege over them. (Higgins et al., 2010) This understanding has led HIV/AIDS public health

prevention and treatment campaigns to focus on women and children and leaving out men in prevention and treatment programs in Sub-Saharan setting (Mills et al., 2012; UNAIDS, 2020b).

The HIV response in Sub-Saharan Africa has been far less successful for the prevention and treatment of men and there is less Antiretroviral treatment (ART) coverage for men compared to women in Africa, also evidence shows that men typically have higher mortality. Additionally, men also tend to present at clinic with advanced disease and are more likely to be lost to follow-up (Mills et al., 2012). The efforts to understand men's health seeking behavior in Africa including Kenya is poorly understood in the AIDS epidemic, and encouraging men to get tested and treated is a major challenge, but one that is poorly recognized(Farrar, 2013; Mills et al., 2012; UNAIDS, 2016). Engaging men in HIV in HIV Prevention and Treatment including using mHealth in HIV prevention and seeking their opinions on facilitators and barriers in use of mHealth in HIV prevention will be crucial in HIV prevention across both genders.

The epidemiological evidence is accumulating, and indicates that males in sub-Saharan Africa are not accessing HIV services as often as their female counterparts, and as a result, men have worse outcomes of care, including mortality (Mills et al., 2012; UNAIDS, 2018). Funding and research organizations need to recognize the social and health impacts associated with not engaging men in primary and secondary HIV prevention campaigns (Mills et al., 2012). Programmatic efforts should account for this disparity, and take into consideration that it might be necessary to seek out men for HIV testing, care, and referral to ART treatment in variety of settings, and mobile heath care can be a cost-effective intervention in HIV prevention and care in males in African setting.

Many of our current evidence-based interventions will require adaptations to make them affordable and sustainable for communities, schools systems, and community-based

organizations (Prado et al., 2013). Computer technologies involving the Internet (eHealth) and mobile phones (mHealth) provide major opportunities to develop adaptive behavioral interventions that fit the needs, preferences, and lifestyle of the emerging adults (Brown et al., 2013; Lester et al., 2010).

Broader scholarship on mHealth and HIV prevention has been primarily quantitative and positivist in nature; little of the existing work on mHealth explores their qualitative dimensions from user perspective (Chen, 2018). A qualitative research to identifying factors associated with effective use of mobile phones in creating HIV prevention awareness by emerging adult male population in Kenya has a potential to inform the public health policy on effective use of mobile phones in HIV prevention and further research and theory development not only to this age group but also to other marginalized groups faced with similar problems.

Purpose of the Study

The purpose of the dissertation study is to develop in-depth understanding of the HIV testing and prevention needs, barriers, and facilitators of using mobile phone applications/technology for accessing HIV prevention and testing information by emerging male adults in Eldoret, Kenya. A research to assess factors associated with effective use of mobile phones in creating HIV prevention awareness by emerging adult male population in rural Kenya has a great potential to inform the public health policy on cost-effective use of mobile phones in HIV prevention not only to this age group but also to other age groups faced with similar challenges. This study also has a potential for leading to further research, practice, and theory development specifically in mobile health interventions or generally in healthcare informatics.

Research Aim

To understand the needs, barriers, and facilitators of using mobile phone applications/technology for accessing HIV prevention and testing information by emerging adults in rural setting.

Research Questions

i. What are the HIV prevention and testing needs for emerging male adults in rural Kenya? (Answered in Manuscript #2 findings and discussions)

ii. What are the factors that facilitate the use of mobile phones in HIV prevention and testing awareness among emerging male adults? (Answered in Manuscript #3 findings and discussions)

iii. What are the barriers in the use of mobile phones in HIV prevention and testing awareness among emerging male adults? (Answered in Manuscript #3 findings and discussions)

Assumptions

This dissertation is based on the following assumptions:

- Emerging adulthood is the period from the late teens through late twenties which is marked by the formation of identity, the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infections.
- Owing to the wider access and acceptance of mobile phones among the youth, this technology has an untapped cost-effective potential for HIV prevention and use of such methods should easily and cost-effectively reach a large emerging adult population in limited resource setting experiencing high burden of HIV infection.

Conceptual Definitions

AIDS: Stands for Acquired Immune Deficiency Syndrome, AIDS is the most severe phase of HIV infection. People with AIDS have such badly damaged immune systems that they get an increasing number of severe illnesses, called opportunistic illnesses. Without treatment, people with AIDS typically survive about 3 years. Common symptoms of AIDS include chills, fever, sweats, swollen lymph glands, weakness, and weight loss. People are diagnosed with AIDS when their CD4 cell count drops below 200 cells/mm or if they develop certain opportunistic illnesses. People with AIDS can have a high viral load and be very infectious". (CDC, 2016)

Emerging adults: refers to the period from the late teens through the twenties, with a focus on ages 18-25, although it can extend longer to up to 29 years which is marked by the formation of identity, the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infections (Arnett, 2000)

Electronic health: commonly referred as eHealth is the cost-effective and secure use of information and communication technologies (ICTs) for health and health-related fields. (WHO, 2016)

HIV: Stands for Human Immunodeficiency Virus, it is a virus that gradually destroys the immune system by attacking and killing CD4 cells. CD4 cells are a type of white blood cell that play a major role in protecting the body from infection. HIV uses the machinery of the CD4 cells to multiply (make copies of itself) and spread throughout the body. This process, which includes seven steps or stages, is called the HIV life cycle. HIV medicines protect the immune system by blocking HIV at different stages of the HIV life cycle' (NIH, 2015).

HIV prevention: refer to practices done to prevent the spread of HIV/AIDS. HIV prevention practices may be done by individuals to protect "their own health" and the health of those in their community or may be instituted by governments or other organizations as "public health policies" (CDC, 2021).

Mobile Health: Is the use of mobile and wireless devices to improve health outcomes, healthcare services and health research (Kay et al., 2011).

Summary in Chapter One

- Highlights HIV prevalence among the young people in sub-Saharan Africa and strategies to increase young people's access to essential prevention information, skills and services as part of 90% reduction in new HIV infections and deaths from AIDS-related illness by 2030 (UNAIDS, 2018).
- Kenya is one of the HIV high burden countries in the world with majority of new cases of HIV infections occurred mainly in the adolescent and emerging adults s aged 15 to 24 years
- Due to the wider access and acceptance of mobile phones among the youth, this technology has an untapped cost-effective potential for HIV prevention
- A research to identifying factors associated with effective use of mobile phones in creating HIV prevention awareness by emerging adult male population in rural Kenya has a potential to inform the public health policy on effectiveness use of mobile phones in HIV testing and prevention.

What to Expect in the Subsequent Chapters

The dissertation is organized using the non-traditional manuscript format; therefore, some ideas may be repeated out of necessity for the manuscript-ready chapter to stand alone. Chapter two is a literature review synthesis manuscript exploring the factors which put the emerging adults at increased risk to HIV and AIDS which is already published by the *International Journal of Health Promotion and Education.* A synthesis of the current literature, gaps in the research, and suggestions for future studies will be outlined. Chapter three outlines the theoretical and conceptual framework, Materials and Methods is described in chapter four while chapter five is two non-tradition manuscripts for findings and discussions while chapter six is the synthesis of the findings and discussions.

CHAPTER 2: REVIEW OF THE LITERATURE (MANUSCRIPT 1)

Chapter Summary

This chapter is a manuscript providing a synthesis of literature exploring the factors which put the emerging adults at increased risk to HIV and AIDS. The social and structural drivers of acquisition and transmission of HIV with specific focus to emerging adults in sub-Saharan Africa and specifically Kenya will be explored. The current gaps in understanding HIV prevention in emerging adults in the African context will also be reviewed. Finally, the current state of mHealth in Sub-Saharan Africa and how this innovative approach can be tapped in HIV awareness and prevention among the emerging adults. A synthesis of the current literature, gaps in the research, and suggestions for future studies will be outlined.

Table 2 Manuscript # 1 and the Publishing Journal

Manuscript	Title	Publishing Journal
Review of Literature	The HIV Transmission Risk Factors and Opportunities for use of mHealth in HIV Prevention Among Emerging Adult Population in the Sub-Saharan Africa Context: A Review of The Literature	International Journal of Health Promotion and Education

TITLE:

The HIV Transmission Risk Factors and Opportunities for use of mHealth in HIV Prevention Among Emerging Adult Population in the Sub-Saharan Africa Context: A Review of The Literature

To cite this article: Augustine B Kiplagat, Peninnah M Kako, Lucy Mkandawire-Valhmu, Dinah Chelagat, Seok Hyun Gwon, Jake Luo & Morgan V Dixon (2021): The HIV transmission risk factors and opportunities for use of mHealth in HIV prevention among emerging adult population in the Sub-Saharan Africa context: a review of the literature, *International Journal of Health Promotion and Education*, DOI: 10.1080/14635240.2021.1995464

The purpose of this literature review was to understand the current practices and gaps in HIV prevention for the emerging adult population in Sub-Saharan Africa (SSA) and to review the current state of mHealth in SSA and how this innovative approach can be tapped into to enhance HIV awareness and prevention among emerging adults. Peer reviewed articles about HIV prevention in emerging adults in SSA were searched in PubMed, Global Health, CINAHL, PsycInfo and Web of Science databases. Specific criteria for eligibility included studies that were published over the last decade spanning from 2009 to 2019. A total of 114 articles were found which meet the preliminary search criteria, which was then followed by a quality check, and finally, 20 articles were synthesized. The review followed the scientific process of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Four themes were identified included factors that place emerging adults at increased risk for HIV, the social and structural drivers of acquisition and transmission of HIV, current gaps in understanding HIV prevention in emerging adults, and the current state of mHealth in SSA. Our discussion includes how mHealth can be tapped into to enhance HIV awareness and prevention among emerging adults. HIV is still the leading cause of morbidity and mortality among SSA emerging adults. Addressing this burden will require renewed efforts to implement effective prevention strategies across multiple sectors, including educational, information technology, social, policy, and health care systems that influence prevention knowledge, services, and treatment options for emerging adults. mHealth is a useful tool that has not been maximized in its utility for HIV prevention purposes particularly among emerging adults in SSA.

Key Words: Emerging adults, HIV and AIDS prevention, mHealth, eHealth, mobile phones, Sub-Saharan Africa (SSA), Adolescent and Young Adults (AYA's).

Background

HIV continues to be a major public health concern for emerging adults in SSA. Emerging adulthood is a phase in the life span between late adolescence and early adulthood, through the twenties. Although the focus is on the ages of 18-25, this period can extend up to 29 years of age (Arnett, 2000). This period of life is critical when it comes to sexuality because it is marked by the formation of identity and the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infection (Arnett, 2000, 2007). Recent demographic data indicate that AIDS related illness is currently the leading cause of death among young people in SSA, with up to 79% of new HIV infections occurring in emerging adults aged 18-25 years (Koenig et al., 2016; UNAIDS, 2021). Current data indicates that only 36% of young men and 30% of young women (ages 15-24) in SSA have comprehensive and correct knowledge of how to prevent HIV infection (UNAIDS, 2021).

Despite the progress made in the past 10 years, with a 46% decline in new HIV infections among young people (15–24 years), SSA is still behind on achieving the targets set for young people (UNAIDS, 2021). Progress is uneven, with steep reductions in new HIV infections among young people in some countries. Despite these declines, HIV incidence rates remain unsatisfactorily high with the largest number of new infections coming from South Africa (23%), Nigeria (15%), Uganda (10%), Mozambique (8%) and Kenya (7%) (UNAIDS, 2019b).

Methods

Design

This systematic review was conducted using peer reviewed articles published in the 10-year timeframe between 2009-2019. A systematic search was conducted from PubMed, Global Health, CINAHL, PsycInfo and Web of Science databases using terms and key words including HIV risks, emerging adults, youth, Sub-Saharan Africa, mHealth and HIV prevention. The systematic review was performed based on the PRISMA guidelines. (Liberati et al., 2009).

Search Approach

Specific criteria for eligibility included studies that were published over the last decade spanning from 2009 to 2019. These studies were written in English and focused on risk factors for HIV transmission and preventive approaches by youth or emerging adults in the SSA context. The studies had to have been published in a peer reviewed journal and have documentation on the methodology used in data collection. We considered five main data bases including PubMed, Global Health, CINAHL, PsycInfo and Web of Science. Direct to our search key word combinations such as "HIV" AND "prevention" AND "risk factors" AND "preventive approaches" AND "Sub-Saharan Africa" AND (emerging adults OR young adults OR youth).

We employed the electronic search of relevant articles. For example, "HIV prevention in emerging adults in Sub-Sahara Africa" or “risk” factors for HIV transmission in emerging adults in Sub-Saharan Africa" or "HIV risks and prevention among youth in Sub-Saharan Africa". Reference search on articles was used to facilitate the process of identifying additional relevant articles. Based on the options displayed on the databases, keywords were sought in the entire text and not only in the titles or abstracts.

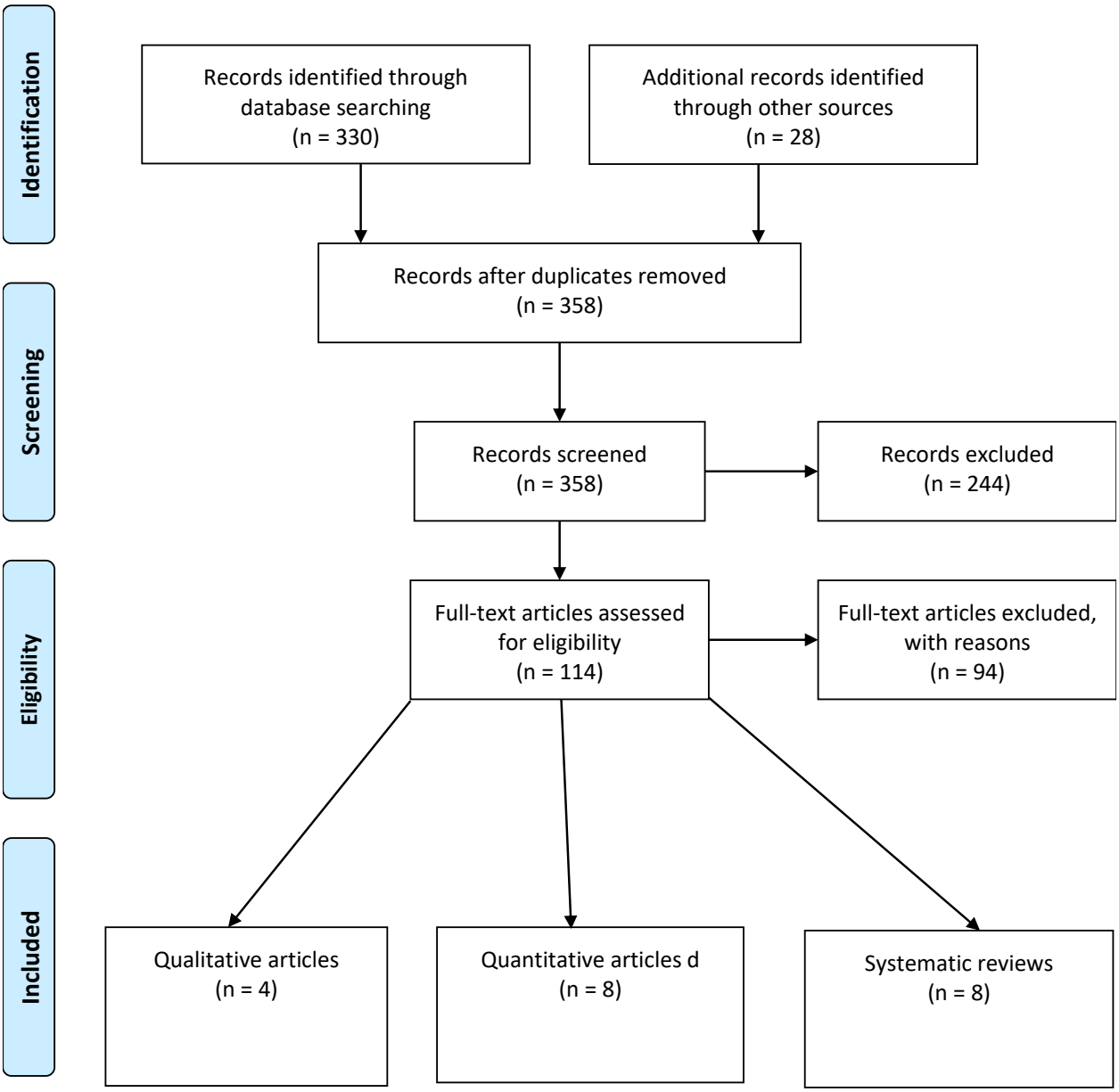
Articles Selection Procedure

By applying the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009), we first identified and gathered all the articles from the five databases. This yielded a total of 358 published articles. The eligibility criteria for inclusion were: (1) Research articles conducted in SSA countries; (2) Discuss or document HIV risk factors and preventive approaches for emerging adults; (3) The utilization of mobile phone technology in HIV prevention in emerging adults; (4) Peer-reviewed original publications; (5) English-language articles.

After screening the 358 articles, 244 articles were excluded because they fell outside the SSA region. The resultant number was 114 articles left for the eligibility assessment stage. Out of the 114 articles, five of them were not written in English; 85 were deemed not eligible due to lack of focus on HIV risks and prevention in emerging adults or merely addressed HIV epidemiology in the general population in SSA countries. We further conducted a duplication analysis and removed three duplicated studies. Finally, 20 studies that focused on HIV risk factors and preventive approaches by emerging adults were synthesized for the purpose of this review. After employing inclusion criteria above, the numbers of articles that met the inclusion criteria were 20. Out of the 20 articles selected for review, four were qualitative, eight were quantitative and 8 were systematic reviews. Finally, all the papers were fully read and assessed for quality and appropriateness to the study. Figure 1 is the PRISMA flow chart indicating how the articles were selected.

Details of the 20 articles selected for the review are catalogued by year, author, country, research question or hypothesis, design, and findings as shown in Appendix I.

Figure 2 The PRISMA Flow Diagram



Quality Assessment

The quality of each article was assessed and deemed to have met the following conditions: (1) Appropriateness of research design; (2) Appropriateness of overall method and analysis procedure; (3) Generalizability of research findings to the target population from which the sample was drawn; (4) Relevance of the study's purpose in addressing questions raised in this study; (5) Trustworthiness of study findings in relation to the focus of our review.

Results

The review of literature included the following themes: (1) Risk factors for HIV transmission in emerging adults in SSA; (2) Social and structural drivers for acquisition and transmission of HIV; (3) Combination HIV prevention with focus on emerging adult population from SSA; (4) Using new tools and technology in HIV prevention.

Risk Factors for HIV Transmission in Emerging Adults in SSA Context

Currently, over 33% of all new HIV infections in SSA are estimated to occur among youth ages 15 to 25 years. Understanding their perspectives on HIV transmission risk is important for targeted HIV prevention (UNAIDS, 2019a). In Kenya for example, 51% of new adult HIV infections were in this age group of 18-24 in 2016, a sharp increase from 29% in 2013. The latest findings indicate that all new HIV infections reported in Kenya in the year 2019 occurred among Adolescent and Young Adult (AYA) aged between 15-24 years as per the National AIDS and STI Control Program (NASCOP) report (Mureithi F, 2019). Studies since 2013 in SSA showed that it is also the only age group that has recorded an increase in new infections. As there might be many factors contributing to increase infection rate among the young people, one of the factors reported by a number of authors is that young people tend to

have little knowledge about the virus and engage in risky sexual behaviors that increase their chances of infection (Kharsany & Karim, 2016; Kibel et al., 2019; Ssewanyana et al., 2017).

Pettifor et al., (2013) reported that the alarming rise in infection rates among emerging adults likely reflects several challenges in healthcare access and delivery. First, AYA historically have poor utilization of healthcare and prevention services, which affects individual outcomes and decreases the effectiveness of HIV treatment as prevention. The poor utilization barriers in young people may include inconvenience of clinic visiting hours and including weekend and evening hours might help address this challenge. Other barriers may include lack of health insurance, peer pressure, lack of youth friendly tailored services, unwelcoming attitude from healthcare providers, long wait-time for appointments, or lack of information on how to access after-hour care and perception that they are always healthy and do not need to go for health checkups (Lau et al., 2014). Secondly, unidentified HIV-infected AYA are a significant source of secondary HIV transmission, with higher transmissibility during the acute phase of infection.

Several articles reviewed found that risk factors which includes low rates of comprehensive knowledge of HIV in young persons aged 15-24 years, cultural issues for example sexual initiation rites that promote liberal approaches to sexuality , early marriage and coital debut, widow inheritance and sexual cleansing rituals, female genital cutting (FGC) and some traditional male circumcision practices. Other risk factors include poverty, unemployment and low condom use (Odaga, 2012; Pettifor et al., 2013; Riley et al., 2011; Stroud et al., 2015; UNAIDS, 2019b). Young people's risk of becoming newly infected with HIV is closely correlated with age of sexual debut (Odaga, 2012). In another article by UNAIDS, participants believed that having transactional sex in exchange for food, living expenses, or drugs was a frequent practice among young people from low income settings in SSA (UNAIDS, 2019c).

The Social, Behavioral, and Cultural Drivers for Acquisition and Transmission of HIV with Specific Focus to SSA Emerging Adults

Several studies reviewed outlined that at the social, behavioral and cultural drivers of adolescent risk to HIV include poverty, discrimination, gender and power inequities, criminalization of same-sex relationships, stigma, and environments that are not youth-friendly (Campbell et al., 2013; Harling et al., 2018; Naidoo et al., 2015; Pettifor et al., 2013). HIV transmission also occurs within the context of gender-based violence therefore approaches that tackle HIV prevention within the broader setting of gender inequity must therefore be implemented (Closson et al., 2018; Hardee et al., 2014; Rogan et al., 2010).

Low socio-economic status also plays a major role in increasing vulnerability to HIV infection especially among young girls and women. Poverty and lower socio-economic status is associated with early sexual relationships, coercive sex, transactional sex, and a higher probability of having sex with older men by young women (UNAIDS, 2021). Poverty and low socioeconomic status are associated with coercive sex in men. For example, a study in Malawi found that unemployment was strongly associated with coercive sex in young men in Blantyre, whereas material deprivation only was strongly associated with coercive sex in young women (Thiabaud et al., 2020). The structural factors may include including poverty, lack of employment opportunities and limited health care access (Pettifor et al., 2013). The structural barriers to accessing care need to be addressed for emerging adults in SSA, for example youth-friendly reproductive health services can attract and retain youth in the context of HIV prevention service provision (Naidoo et al., 2015; Pettifor et al., 2013).

The use of mobile phones can also be explored and utilized in addressing and breaking the structural barriers and challenges in rural settings. For example, ART adherence is noted to

be increasing among emerging adults (15-24 years), which are arguably the most dynamic and challenging group of populations living with HIV (Ivanova et al., 2019; John et al., 2016). A study in Kenya found that ART adherence improved in all young adult participants after 3 months of mobile phone messages (Ivanova et al., 2019). As access to the internet and smartphones in SSA is growing, these types of interventions hold great potential and warrant further research grounded in solid theoretical frameworks.

Combination HIV Prevention with Focus on Emerging Adult Population from SSA

The UNAIDS defines combination HIV prevention as rights, evidence, and community-based programs that promote a combination of biomedical, behavioral, and structural interventions designed to meet the HIV prevention needs of specific people and communities (UNAIDS, 2010). Its goal is to reduce the number of new infections through actions, with a greater sustained impact. A well-designed combination prevention programs should be tailored to national and local needs, based on epidemiological information. Programs should also concentrate resources on combining activities where they are most needed (Kurth et al., 2011; UNAIDS, 2015; UNICEF., 2011). No single HIV prevention intervention offers a complete solution; therefore, effective HIV prevention programs require a combination of behavioral, biomedical, and structural interventions.

For the past 10 years several articles have repeatedly indicated the importance of innovative and cost-effective HIV prevention mobile technologies as key to achieving an HIV and AIDS free generation (Aranda-Jan et al., 2014; Fauci & Folkers, 2012; Mechael et al., 2010; UNAIDS, 2021). To reach and sustain an AIDS-free generation, those who are already infected or at risk of infection must faithfully practice recommended treatment and/or prevention strategies, including: complying with antiretroviral drugs prescribed; pre exposure

prophylaxis(PrEP); using a condom every time they have sex; and, for those who inject drugs, always using a clean needle and syringe (Fauci & Folkers, 2012; Joint United Nations Programme on AIDS, 2015; UNAIDS, 2015).

As reported by three studies reviewed, few countries have consistently applied a combination HIV prevention approach, which provides packages of services including behavioral, biomedical and structural component tailored to priority population groups within their specific local contexts, also referred to as 'combination prevention' (Auerbach et al., 2011; Degenhardt et al., 2010). For example, young people in the high prevalence countries in SSA need more than condoms and behavior change communications (Lubega et al., 2015). They also require comprehensive sexuality education and unlimited access to effective HIV, sexual and reproductive health services without discrimination or economic barriers, such as prohibitive costs, or structural barriers, such as parental consent laws (Auerbach et al., 2011; Baral et al., 2013; Lubega et al., 2015; Parkhurst, 2013).

Evidence suggests that people-centered combination approaches for HIV prevention works. A study conducted in South Africa suggested that, in combination, test and treat programmes could reduce HIV transmission among sex workers and their clients by 40% over a 10-year period (Bekker et al., 2015). The AYA's in SSA needs not only the free and consistent availability of condoms but also empowered with behavior change communications strategies (UNAIDS 2016). A combination package for MSM with men. For example, would include easy accessibility to condoms, lubricant and PrEP, as well as efforts to address homophobia (Kharsany & Karim, 2016, UNAIDS 2016).

Several countries in the SSA region have conducted large-scale prevention programmes in an effort to contain and reduce their HIV epidemics. In 2015, Ethiopia, Malawi, eSwatini and

Zimbabwe looked at how to revitalize their national prevention programmes using combination approaches (UNAIDS, 2016; Remme et al., 2016). In the same year, government representatives of Kenya, Zimbabwe and South Africa met to plan the development of a regional roadmap to accelerate scale-up of combination HIV prevention services at local levels and increase investments for combination HIV prevention (Bekker et al., 2015; UNAIDS, 2016).

Using New Tools and Technology

Mobile phone health interventions are increasingly being used for the prevention and care of HIV in SSA. Although phone-based interventions have typically used the voice or text-based Short Message Service (SMS) features of mobile phones, the increasing popularity of smartphones and smartphone applications (apps) has greatly expanded the possibilities for phone-based HIV interventions in SSA (Holloway et al., 2017; Mangone et al., 2016; Njoroge, Zurovac, Ogara, Chuma, & Kirigia, 2017). The mobile health interventions are critical for reversing the HIV epidemic particularly in emerging adults who carry the highest burden for HIV infection and at the same time constitute the highest rate of users of mobile and smartphones in SSA (Holloway et al., 2017; Mangone et al., 2016; Njoroge, Zurovac, Ogara, Chuma, & Kirigia, 2017).

Muessig, Pike, LeGrand, & Hightow-Weidman, (2013) reported that providing HIV/STI prevention and care services through mobile phone applications shows great potential for growth, both in improving the acceptability and adoption of existing apps, and creating new HIV/STI apps. The study concluded that the principles of social marketing could inform future HIV/STI app development to build appropriately tailored, interactive apps targeting emerging adults in rural settings or other disadvantaged settings faced with a disproportionately high risk of HIV infection. As biomedical developments in antiretroviral treatment are conveying the

prevention of onward HIV transmission within our reach, we can use the powerful, prevalent technologies offered through mobile phone apps to explore behavioral interventions for risk reduction and close the gaps in HIV/STD prevention, testing, care and treatment.

Teleconsultation has also been noted to benefit the patient care in rural areas and also helpful to the healthcare workers because it facilitated greater equity and efficiency in healthcare delivery, specifically facilitating equitable access to care, improving referral mechanisms, reducing healthcare delivery cost and time, and increasing access to data for decision-making (Fry et al., 2020). In a study in rural settings in Kenya, teleconsultation and text messaging is reported to facilitate management of not only HIV but also other chronic diseases complications like diabetic and hypotensive complications in rural settings where accessing a healthcare provider is usually difficult (Kurji et al., 2013; Nanji et al., 2020).

Discussion

In our literature review, we found that risk factors for HIV transmission in emerging adults in SSA include high rates of risky sexual practices, living in HIV endemic areas, substance/alcohol abuse, multiple sexual partners and transactional sex (UNAIDS, 2018; Stroud, Walker, Davis, & Irwin, 2015). In Kenya for example, the latest findings indicates that all new HIV infections reported in Kenya in 2019 occurred among AYA aged between 15-24 years (Mureithi, 2019). This is largely because young people tend to have little knowledge about the virus and the risky sexual behaviors that increase their chances of acquiring HIV (Kharsany & Karim, 2016; Kibel et al., 2019; Ssewanyana et al., 2017).

Addressing social and structural risks for HIV transmission in SSA will lead to sustainable change in individual behavior among the emerging adults at most risk. Other reviews of school-based interventions specific to SSA have found a greater intervention impact on HIV-

related knowledge and attitudes than on reported sexual behaviors, a finding reinforced by two recent large-scale trials in Tanzania, the Mema kwa Vijana (MkV) Project, and Zimbabwe, the Regai Dzive Shiri (RDS) Project (Cowan et al., 2010; Hayes et al., 2005).

The disproportionately high HIV prevalence throughout SSA among emerging adults suggests the lack of appropriate interventions to protect young men and women and to meet their sexual and reproductive health needs as they prepare for adulthood (Mojola & Wamoyi, 2019; Odaga, 2012). Furthermore, multiple sexual partners, low condom use and sexually transmitted infections contribute to emerging adults' vulnerability to HIV infection in the region (Kharsany & Karim, UNAIDS, 2016). Young people are deprived of the freedom to make informed decisions about their sexual health, with most lacking the knowledge to protect themselves from HIV. The impact of these barriers is strongest in high-prevalence settings, predominantly in eastern and southern Africa (Baral et al., 2013; Kreniske et al., 2019; Mhalu, Leyna, & Mmbaga, 2013; Okonofua, 2012).

All combination prevention programs require a solid community empowerment element and specific efforts to address legal and policy barriers, as well as the consolidation of health and social protection systems, plus actions to address gender inequality, stigma, and discrimination (UNAIDS, 2016). Young people and emerging adults in high prevalence countries in SSA need more than condoms and behavior change communications. They also require all-inclusive sexuality education and access to effective HIV and sexual and reproductive health services without economic barriers, such as unaffordable costs, or structural barriers, such as parental consent laws (UNAIDS, 2016; Kurth et al., 2011; UNAIDS, 2010). A combination package for MSM or female sex workers should include easy access to condoms, lubricant and Pre Exposure

Prophylaxis (PrEP), as well as efforts to address homophobia (Bekker et al., 2015; Kurth et al., 2011; UNAIDS, 2015).

Over the past decade, several new tools have emerged that increase the effectiveness of HIV prevention and services. For example, even in low income SSA countries, mobile phone ownership and internet access have grown considerably in emerging adults and have changed how people interact and receive information, these interventions are often described as 'mobile health' or 'm-health' intervention (Betjeman et al., 2013). From a heath informatics perspective, the use of mobile phones in HIV prevention in low resource settings in SSA utilizes both information science and public health to support disease prevention which are important pillars of community and population health practices (Betjeman et al., 2013; Kraft & Androwich, 2012).

In an age of advancing technology and increased mobile phone use, mHealth (use of mobile phones for health supported interventions) is a popular vehicle for a variety of health interventions (Betjeman et al., 2013; Boulos et al., 2011). The mHealth intervention may be useful for bringing multifaceted HIV prevention strategies that are cost-effective compared to other interventions particularly in resource limited settings (Betjeman et al., 2013; Noar, 2011). Existing mHealth HIV interventions have used mobile technology using short message service (SMS) texting to provide HIV risk-reduction messages and to improve adherence to highly active antiretroviral treatment. Many of these SMS-based interventions have been demonstrated to be effective (Forrest et al., 2015; Goldenberg et al., 2014; Lester et al., 2010).

Research on HIV health information using mHealth has primarily focused on the adherence and the needs of adults living with HIV or other chronic illnesses (Cahill & Valadéz, 2013). The emerging adult cell phone owners aged 18 to 29 universally prefer text messaging otherwise referred to as Short Message Service or SMS over other communication forms, such as

Facebook, email, WhatsApp, twitter or talking on a mobile phone (Yan et al., 2015). The youth, particularly emerging adults, represent the "digital generation" and are the greatest users of Internet and mobile devices globally with high usage reported even in low-income countries, thus, technology has untapped potential for HIV prevention (Brown et al., 2013; Holloway et al., 2017). Use of such mobile device methods should easily and cost-effectively reach a large youth population and enable the development of tailored programs to share messages relevant to each recipient (Bull, 2010).

Emerging Challenges in the HIV Prevention Among Adolescents and Young Adults During the COVID-19 Pandemic

As novel coronavirus disease of 2019 (COVID-19) has emerged and disrupted activities of daily living, social distancing and limited access to contraceptive and other reproductive health services is affecting the sexual and reproductive health of AYA leading to increased risk for HIV infection and transmission (Lindberg et al., 2020). Lockdowns implemented in many SSA countries to slow the spread of COVID-19 have led to massive challenges for AYA including school closures, interruption of their normal trajectory towards independence, and working for a living wage. These COVID-19 related changes may have also led to increased sexual activity and limited access to contraceptives which might lead to increased HIV transmission and unplanned pregnancies (Daily Nation, 2020; Lindberg et al., 2020).

In Kenya for example, it was reported in June 2020 that more than 150,000 school going adolescent and young girls had been impregnated during the coronavirus pandemic school closures and the incidents occurred between January and May 2020 and affected girls ages 10-19, according to survey by Kenya Health Information Systems (Catholic News Agency, 2020; Daily Nation, 2020). While social disruption resulting from the COVID-19 pandemic has

affected the young adults' sexual and reproductive health, one positive aspect is that young adults are digitally connected and mobile phones and other online platforms and social media are helping to remain connected and get needed help and support from schools or other resources (Catholic News Agency, 2020; Daily Nation, 2020; Lindberg et al., 2020).

Limitations and Future Work

Despite the inclusion of the following themes in the literature search: (1) Risk factors for HIV transmission in emerging adults in SSA; (2) Social and structural drivers for acquisition and transmission of HIV; (3) Combination HIV prevention with a focus on the emerging adult population in SSA; and (4) Using new tools and technologies in HIV prevention, there may be a bias of not including other papers published in other journals (not available in PubMed, Global Health, CINAHL, PsycInfo and Web of Science databases) which may add useful insights to this review. In addition, countries from other parts of Africa, especially north of the Sahara, were not included in this study. This study did not look at non peer reviewed journals, grey literature and textbooks which might have added more insight on HIV prevention in emerging adults in SSA. Last but not least the emergence of COVID-19 pandemic will bring unique challenges in access of sexual and reproductive health including HIV prevention by the young people particularly in Africa which were not covered fully in this literature review.

Based on these limitations, it is suggested that future reviews should consider the inclusion of other articles published irrespective of the status of the journal to provide a comprehensive and unbiased view of the state of HIV prevention in youth and emerging adults in SSA. Countries north of the Sahara could also be included in the study and even further analysis provided on the differences and/or similarities in HIV interventions particularly for young people comparing the two regions. Finally, a meta-analysis could be conducted in future to provide

more information on the use of technology in HIV prevention among the emerging adult population.

Conclusion

Our review of the literature on risk factors for HIV transmission and preventive approaches such as mHealth in the emerging adult population in SSA showed that HIV is still the greatest threat to AYA compared to any other age group in SSA. It is also the leading cause of death among emerging adults in SSA. The largest percentage of new infections occurs among those aged between 18 and 24 years. Young adults are least likely to experience the health and prevention benefits of treatment. Almost half of young people with HIV are not diagnosed. Among those diagnosed, nearly a quarter are not linked to care, and three quarters are not virally suppressed. Mitigating this burden will require renewed efforts to implement effective prevention strategies across multiple sectors, including technology, educational, social, policy, and health care systems that influence prevention knowledge, service use, and treatment options for youth.

List of Abbreviations

AIDS- Acquired Immunodeficiency Syndrome

AYA- Adolescent and Young Adult

COVID-19- Coronavirus Disease of 2019

eHealth-electronic Health

FGDs-Focus Group Discussions

HIV- Human Immunodeficiency Virus

HSV- Herpes Simplex Virus

ICTs- Information and Communication Technologies

mHealth- mobile Health

NASCOP- Kenya National AIDS and STI Control Program

PID- People who inject drugs

PrEP- pre exposure prophylaxis

PRISMA- Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SMS-Short Message System

MSM-Men having Sex with men

SSA-Sub-Saharan Africa

STI-Sexually Transmitted Infections

UNAIDS- United Nations Programme on HIV/AIDS

UNICEF- United Nations Children's Fund, formerly (1946–53) United Nations International Children's Emergency Fund

Declarations

Ethics Approval and Consent to Participate

Not applicable

Consent for Publication

Not applicable

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Competing Interests

The authors declare that they have no competing interests.

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CHAPTER 3: THEORETICAL AND CONCEPTUAL FRAMEWORK

Chapter Summary

This chapter provides a review of the conceptual, theoretical, and philosophical foundations underpinning the dissertation study. The theoretical and conceptual framework for the study is guided firstly by Modified Social Ecological Model (MSEM) to help visualize multi-level domains of HIV infection risks and guide the development of prevention strategies in emerging adults. Successful and sustainable HIV prevention strategies for emerging adults in Sub-Saharan Africa require effective integration of evidence-based biomedical, behavioral, and structural interventions. The MSEM builds on existing frameworks of socio-ecological model by examining multi-level risk contexts for HIV infection and situating individual HIV infection and transmission risks within wider network, community, and public policy contexts as well as epidemic stage (Baral, Logie, Grosso, Wirtz, & Beyrer, 2013). Secondly the concepts from theory of development of emerging adults from the late teens through the twenties proposed by Arnett (2000) was utilized.

Modified Social Ecological Model (MSEM)

The MSEM is a modification of the Socio-Ecological Model to suit individual needs of diverse age group, which recognizes the intertwined relationship existing between an individual and their environment (Chimphamba et al., 2013). The HIV infection is an epidemic with an individual, social and structural risk factors and therefore no one model can describe all risk factors across these diverse domains (Baral et al., 2013; Dyson, Mobley, Harris, & Randolph, 2018; Khuzwayo & Taylor, 2018; UNICEF, 2018). To adequately describe and address the complexity of an epidemic such as HIV, a modification of socioecological model can be developed for specific populations to measure relevant risks and risk contexts based on specific

setting (Baral et al., 2013). For example, factors influencing HIV Transmission in emerging male adults is Sub-Saharan Africa are completely different from other parts of the world.

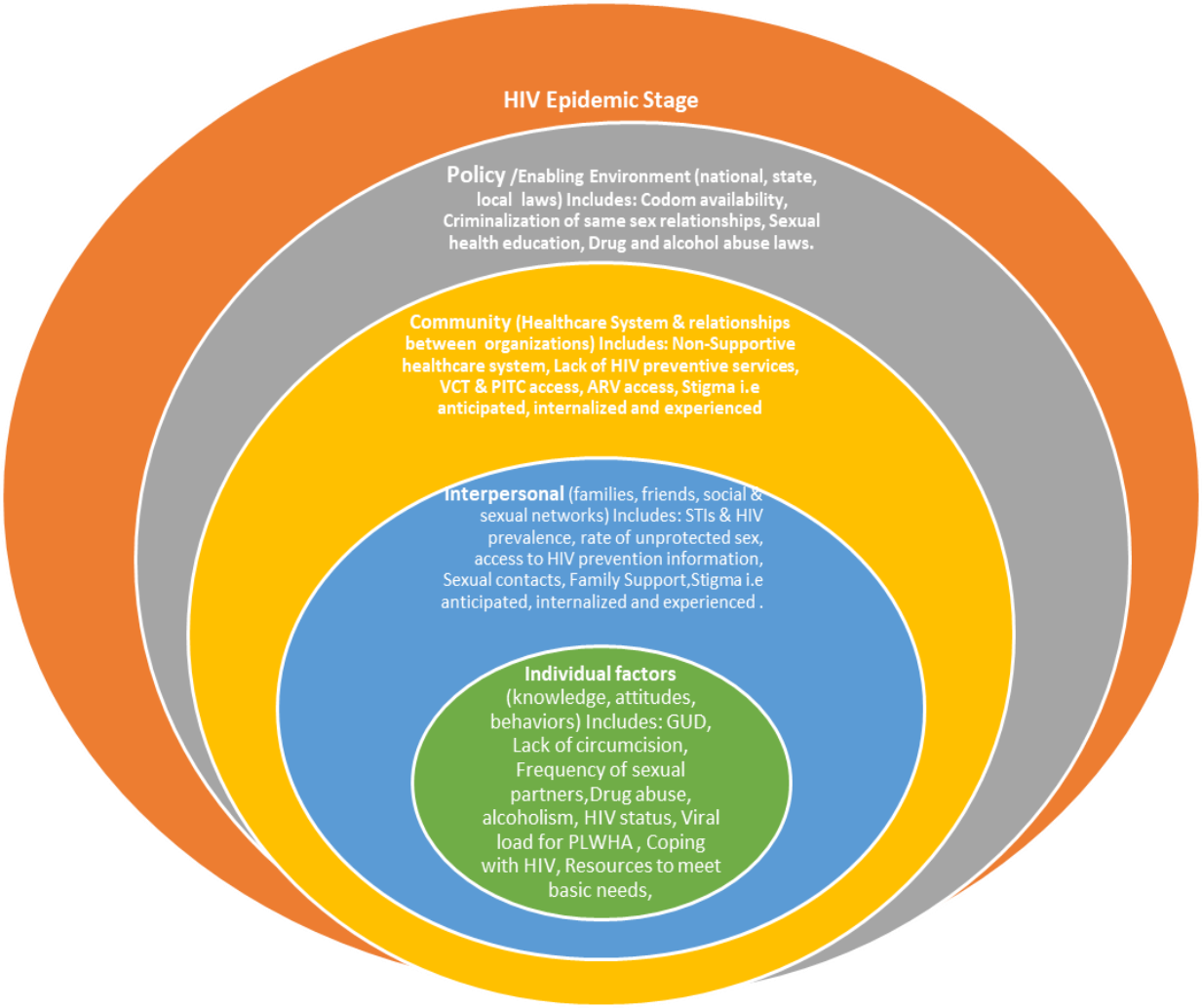
To address HIV prevention the specific communities, an ecological action plan that targeted both individual and broader determinants of HIV in the local community (Moore et al., 2010). The action plan must be based on community needs and resources, with a particular focus on building sustainable solutions (UNICEF, 2018). The MSEM is crucial in visualizing multi-level domains of HIV infection risks and guide the development of prevention strategies in emerging adults (Baral et al., 2013). Successful HIV prevention strategies for emerging adults in Sub-Saharan Africa require unique effective integration of evidence-based biomedical, behavioral, and structural interventions (Chimphamba, Fjeld, Chirwa, Sundby, & Maluwa, 2012; Naidoo, Chirinda, Mchunu, Swartz, & Anderson, 2015; UNAIDS, 2010). HIV is transmitted by specific practices among individuals and groups that occur in a social context.

The MSEM builds on existing frameworks by examining multi-level risk contexts for HIV infection and situating individual HIV infection risks within wider network, community, and public policy contexts as well as epidemic stage (Auerbach et al., 2011; Baral et al., 2013; Fawcett & Ellenbecker, 2015), as illustrated in the figure 3 below. For example, emerging male adult's HIV awareness and HIV testing behavior can be influenced by peers and family (interpersonal) as well as attitudes toward HIV testing on his community (social/community). We used the MSEM as a lens to explore factors associated with effective use of mobile phones in creating HIV testing, prevention, and awareness by emerging adult male population in western Kenya

Guided by this model the dissertation research is uniquely situated to identify factors predisposing young adults to HIV and recommend appropriate interventions relevant to this age

group, thus contributing to the development of science of Nursing specifically in HIV prevention with emerging adults in Kenya rural context.

Figure 3 The Diagram of Modified Socio-Ecological Model for HIV Risk and Transmission in the Emerging Adults



Adapted from: Baral, S., Logie, C. H., Grosso, A., Wirtz, A. L., & Beyrer, C. (2013). Modified social ecological model: a tool to guide the assessment of the risks and risk contexts of HIV epidemics. BMC public health, 13(1), 482.

Legend:

VCT-Voluntary Testing and Counselling, PITC-Provider Initiated Testing and Counselling, ARVs-Antiretrovirals, HIV-Human Immunodeficiency Virus, STIs-Sexually Transmitted Infections, GUD-Genital Ulcer Diseases, PLWHA-People Living with HIV and AIDS

The MSEM is a modification of the Socio-Ecological Model to suit individual needs of diverse age group, which recognizes the intertwined relationship existing between an individual and their environment (Chimphamba et al., 2013).The MSEM is composed of five layers of risk for HIV infection: individual, network, community, policy, and stage of the HIV epidemic (Baral et al., 2013). The MSEM modifies the social ecological model by modifying the levels of risk as well as adding the stage or level of the HIV epidemic to the social ecological model and is based on the premise that while individual level risks are necessary for the spread of disease, they are insufficient to explain population level epidemic dynamics (Baral et al., 2013). The MSEM is a health promotion model, which focuses attention to both the individual and the social environmental factors as targets for health promotion and disease prevention(Njoroge et al., 2010). The MSEM model above (see Figure 3) illuminates the complex interaction of individual and social contexts and actors comprising of intra- and inter-relationships, institutions or organizations, community, social and public policy levels.

The intra-personal (individual) and interpersonal are usually within the control of an individual while the higher 3 level factors (community networks, , policy environment and the stage of epidemic) represent risk factors outside of the control of any individual person (Baral et al., 2013). The MSEM can be adapted to contextualize HIV transmission risk among vulnerable populations especially emerging adults in Sub-Saharan African context. The MSEM framework outline a guideline to describe and analyze the dynamic interactions across individual, dyadic, network and community levels in the society that place young people at increased risk for HIV acquisition (K. Njoroge et al., 2010). Factors can span levels and therefore the boundaries between levels may be understood as porous rather than separate (Baral et al., 2013; Grau et al., 2017). Guided by the MSEM framework, the development of effective HIV prevention programs

for young people in rural Kenya, must be understood within the specific socio-cultural contexts that influence these young people.

Individual factors include factors affecting HIV risk such as emerging males beliefs, feeling , perceptions and attitudes towards sexuality and risk factors towards HIV acquisition and transmission (Poundstone et al., 2004). Other individual characteristics that influence behavior change, includes self-efficacy, developmental history, gender, age, religious identity, ethnic identity, sexual orientation, economic status, financial resources, values, goals, expectations, literacy, stigma and existence of sexually transmitted diseases from previous sexual relationships(UNICEF, 2018).In an effort to prevent HIV infection, the individuals are usually provided with education on HIV emphasizes the concept of self-empowerment and the importance of prevention and safe behaviors to prevent the infection and transmission of HIV (Johnson et al., 2015; Ramjee et al., 2016).

Social and sexual networks: increasing evidence in HIV research has noted that risk behaviors and the probability of becoming infected with HIV depend upon sexual networks as well as larger social networks (Dolwick Grieb et al., 2012). The social and sexual networks involves interpersonal relationships including family, friends, neighbors and others that directly influence health and health behaviors in multiple ways (Baral et al., 2013). Formal and informal social networks and social support systems that can influence individual behaviors, including family, friends, peers, co-workers, religious networks, customs or traditions (Fawcett & Ellenbecker, 2015; UNICEF, 2018).

The individual decision-making, including sexual partner selection, occurs within socially and environmentally structured parameters (Dolwick Grieb et al., 2012). Networks is not bound by geography, socioeconomic status, or cultural, racial, or religious lines and may include

the webs of human relationships (including dyadic, familial, social, sexual, and drug use) through which social exchange occurs and social norms are displayed (Baral et al., 2013). Since social network members have been shown to have strong influences on a person's behavior, social networks have been used to examine HIV risk behaviors in addition to sex networks(Dolwick Grieb et al., 2012).

The increased risk for HIV transmission in young adults has been associated with social and sexual network issues such as multiple partners and sexual concurrency among persons living in defined geographic areas (Frew et al., 2016). In a network where people engage in concurrent sexual partnerships, and if one person is infected with HIV then it can spread much more rapidly among the other partners in the network, making a larger number of individuals connected through the sexual network to be susceptible of becoming infected and then transmitting the infection to other multiple sexual partners (de Walque, 2014).

Community environments or healthcare system including associated social services can either promote health and well-being or be a source of ill-health. Community and healthcare environment ensures availability and location of resources that promote health, social networks, and social norms (UNICEF, 2018). The definition of who and/or what constitutes a 'community' is contested but generally includes: network ties; relationships between organizations and groups, geographical/political regions and informational networks within defined boundaries, including the built environment (e.g., parks), village associations, community leaders, businesses, and transportation (Fawcett & Ellenbecker, 2015; K. Njoroge et al., 2010; UNICEF, 2018).

Themes at the health care systems level occurred internally within a given organization as well as across organizations and agencies (Lauretta et. al). The efficiency of a healthcare system are thought to influence HIV prevention services, voluntary testing and services, treatment,

linkage, and retention for emerging adults living or at risk of HIV (Grau et al., 2017). Other factors influence the utilization of healthcare services in HIV prevention and testing, these includes; the organization's environment such as the services that are available, its physical location and layout, and hours of operation, communications and coordination of services(Baral et al., 2013; Grau et al., 2017).

Rural, neighborhood, or community deprivation and disadvantage can increase vulnerability to HIV (Rhodes et al., 2005). Socio-cultural norms and values, social cohesion and network structures are shaped by larger social-structural forces and influence interpersonal processes and individual behaviors (Auerbach et al., 2011; Wellings et al., 2006). Stigma and discrimination affecting populations at risk for the acquisition and transmission of HIV often manifest at the level of the community leading to limitation in provision and/or uptake of HIV prevention, treatment, and care services (Parker & Aggleton, 2003).

Laws and policies is the 4th level of the MSEM, and it includes laws and policies which form the general framework for shaping the risk of marginalized populations as well as the general population(Baral et al., 2013). Public policy involves the local, state, national, regional and global laws and policies, including policies regarding the allocation of resources for youth and emerging adults and access to healthcare services, restrictive policies (e.g., high fees or taxes for health services), or lack of policies that mitigate unemployment particularly for the youth and emerging adult population(UNICEF, 2018).

In Kenya as part of HIV prevention policy among the sexually active, the government aims at providing condoms to all those sexually active (KDHS, 2014). This has not however been a reality in terms of access by young people in rural settings, although male condom promotion has been a vital element in HIV prevention (Kenya Ministry of Health/National Aids

Control Council, 2016; K. Njoroge et al., 2010). Policies determine allocation of economic resources to education, health care and HIV prevention services and therefore play a substantial role in shaping structural contexts of HIV risk (Baral et al., 2013; Houle et al., 2018; K. Njoroge et al., 2010).

The stage of the epidemic will influence the risk of HIV disease acquisition for the individual (Mayer & Beyrer, 2007; Wellings et al., 2006). No behavior, policy or law, community determinant, network attribute, or individual characteristic can create infectious disease; rather these can only create conditions which either increase or decrease the probability of acquisition or onward transmission of an already prevalent disease (Baral et al., 2013; Wellings et al., 2006). The stage of the epidemic can be expressed in terms of HIV incidence and prevalence. In the context of populations with high prevalence of HIV, mean and total community HIV rate has been used as a marker of population-level transmission of HIV (Mondal & Shitan, 2013; Poundstone et al., 2004). In sub-Saharan Africa context, HIV and AIDS is currently the leading cause of death among the emerging adults (Odaga, 2012; UNICEF., 2011). Globally an estimated 5 million young people aged 15–24 were living with HIV and about 66% are in sub-Saharan Africa (UNAIDS, 2018). This is a serious issue which need urgent interventions locally, regionally, and internationally to save the emerging adults from the HIV pandemic.

Strengths of the MSEM

The Modified Social Ecological Model (SEM) is a theory-based framework for understanding the multilevel effects of personal and environmental factors that determine behaviors, and for identifying behavioral and organizational leverage points and intermediaries for health promotion and disease prevention within organizations and communities (Baral et al.,

2013). The MSEM is a flexible framework for guiding epidemiologic studies among populations at risk for HIV in diverse sociocultural contexts. Successful HIV prevention strategies for emerging adults require effective integration of evidence-based biomedical, behavioral, and structural interventions (Naidoo et al., 2015; UNAIDS, 2010).

While the focus of epidemiologic studies has traditionally been on describing individual-level risk factors, the future necessitates comprehensive epidemiologic data to show multiple levels of HIV risk and exploring technology for example mobile health as an innovative approach to HIV awareness and prevention(Aranda-Jan et al., 2014; 2016; Mechael et al., 2010). Ensuring that every epidemiologic study for HIV also characterizes social and structural factors that underlie high risk practices will likely result in far more actionable data in furthering the HIV prevention sciences (Baral et al., 2013).

Limitations of the MSEM

There is no major limitation of the model; however, it needs to be customized to meet the population and context under which the participants live. Another shortcoming is that there are no extensive published studies because the model has not been used widely and tested in HIV prevention programming. One of the unique challenges of conceptualizing a model for transmittable diseases including MSEM is the porous nature of these levels. However, the flexibility of the model was demonstrated by describing two contemporary HIV epidemics: HIV risk among young PID and MSM, though the model could be adapted to understand risks faced by other populations. Like social ecological model, MSEM has some practical limitations; incorporation of multilevel analyses proved to be cumbersome and complex (Baral et al., 2013; Chimphamba Gombachika et al., 2012).

The Theory of Development of Emerging Adults

The concepts from the theory of development of emerging adults from the late teens through the twenties proposed by Arnett (2000) guided the dissertation study. Emerging adulthood is proposed as the period from the late teens through the twenties, with a focus on age range of 18-25, although it can extend up to 29 years (Arnett, 2000). The emerging adulthood is neither adolescence nor young adulthood but is theoretically and empirically distinct from them. They seem to see themselves in-between adolescent and adulthood so emerging adulthood captures better their sense of where they are-on the way to adulthood, but not there yet (Arnett, 2000).

Emerging adulthood is distinguished by relative independence from social roles and from normative expectations (Arnett, 2000). Five features make emerging adulthood distinctive: identity explorations, instability, self-focus, feeling in-between adolescence and adulthood, and a sense of broad possibilities for the future (Arnett, 2014).The theory describes emerging adults in five distinctive characteristics as follows;

Age of identity exploration: Perhaps the most distinctive characteristic of emerging adulthood is that it is the age of identity explorations. That is, it is an age when people explore various possibilities in love and work as they move toward making enduring choices (Arnett, 2014). Through trying out these different possibilities, they develop a more definite identity, including an understanding of who they are, what their capabilities and limitations are, what their beliefs and values are, and how they fit into the society around them. Erik Erikson (1950), who was the first to develop the idea of identity, proposed that it is mainly an issue in adolescence; but that was more than 60 years ago, and today it is mainly in emerging adulthood that identity explorations take place(Erikson, 1950).

Age of instability: The explorations of emerging adulthood also make it the age of instability. As emerging adults explore different possibilities in love and work, their lives are often unstable. A good illustration of this instability is their frequent moves from one residence to another (Arnett, 2014). Rates of residential change are much higher at ages 18 to 29 than at any other period of life. This reflects the explorations going on in emerging adults' lives. Some move out of their parents' household for the first time in their late teens to attend a residential college, whereas others move out simply to be independent (Goldscheider & Goldscheider, 1999). They may move again when they are on break from college or when they graduate. They may move to cohabit with a romantic partner, and then move out when the relationship ends. Some move to another part of the city, country or the world to study or work (Arnett, 2014; Goldscheider & Goldscheider, 1999). In Sub-Sahara Africa, some emerging adults choose to remain in their parents' home rather than move out or build their own temporary houses in the same homestead with parents; nevertheless, they may still experience instability in education, work, and love relationships (Adams et al., 2016).

Age of self-focus: Emerging adulthood is also a self-focused age. Most American emerging adults move out of their parents' home at age 18 or 19 and do not marry or have their first child until at least their late twenties (Arnett, 2004). However, in Sub-Saharan Africa emerging adulthood is characterized by more stable relationships and possibly marriage at the sometimes focus on jobs and career choices (Adams et al., 2016; Moodley, 2017). Emerging adulthood is a time between adolescents' reliance on parents and adults' long-term commitments in love and work, and during these years, emerging adults focus on themselves as they develop the knowledge, skills, and self-understanding they will need for adult life. In the course of emerging adulthood, they learn to move out of adolescent mentality and make independent

decisions about everything from what to have for dinner to whether or not to get married (Adams et al., 2016; Arnett, 2014; Moodley, 2017).

Age of feeling in between: Another distinctive feature of emerging adulthood is that it is an age of feeling in-between, not adolescent but not fully adult, either. When asked, "Do you feel that you have reached adulthood?" the majority of emerging adults respond neither yes nor no but with the ambiguous "in some ways yes, in some ways no" (Arnett, 2000; Arnett, 2014). It is only when people reach their late twenties and early thirties that a clear majority feels adult. Most emerging adults have the subjective feeling of being in a transitional period of life, on the way to adulthood but not there yet. This "in-between" feeling in emerging adulthood has been found in a wide range of countries, including Sub-Saharan context (Adams et al., 2016; Arnett, 2014; Moodley, 2017).

Age of possibilities: Finally, emerging adulthood is the age of possibilities, when many different futures remain possible, and when little about a person's direction in life has been decided for certain. It tends to be an age of high hopes and great expectations, in part because few of their dreams have been tested in the fires of real life (Arnett, 2014). In one national survey of 18- to 24-year-olds in the United States, nearly all (89%) agreed with the statement, "I am confident that one day I will get to where I want to be in life" (Arnett & Schwab, 2012). This optimism in emerging adulthood has been found in other countries including Sub-Saharan countries as well (Adams et al., 2016; Moodley, 2017; Nelson & Chen, 2007).

The emerging adults instead of entering marriage and parenthood in their very early twenties, most people now postpone these transitions until at least their late twenties, and spend their late teens through their mid-twenties in self-focused exploration as they try out different possibilities in love and work (Arnett, 2000). It is stage of growth and development characterized

by the formation of identity, the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infection (Adams et al., 2016; Arnett, 2014; Moodley, 2017).

The View the Emerging Adults in SSA and Specifically Kenya as Compared to the Counterparts in Developed Countries

In SSA, there tends to be a distinct cultural split between urban and rural areas. Young people from affluent urban neighborhoods are more likely to experience the stage of emerging adulthood like the developed countries counterparts because they marry later, have children later, obtain more education at college level and have a greater range of occupational and recreational opportunities than young people in rural areas(Arnett, 2000; Arnett, 2007). However in poorer urban neighborhoods and rural settings particularly in Sub-Saharan Africa many young people get married and have families in teenage and early adulthood, therefore they do not usually fully experience this distinctive stage of emerging adulthood (Saupe, Gößmann, Catani, & Neuner, 2019).

However as African countries are becoming more integrated into a global economy, there is an increasing number of higher-paying jobs in these countries, jobs that require young people to obtain higher education and have extended period of emerging adulthood like the developed countries counterparts (Arnett, 2007). For many African emerging populations, the transition through early adulthood continues to be fraught with several challenges and difficulties. These include prevailing high rates of poverty, illiteracy, unemployment and underemployment, violence, sexual coercion and exploitation, substance abuse and other deviant social behaviors (Odaga, 2012). On the other hand, this period also comes with opportunities which include high

utilization of mobile technology which can be used to address HIV prevention severely affected by this age group.

The Socio-Cultural view of emerging males' adults in Kenya and association with HIV transmission

The high HIV prevalence rate in the adolescent and emerging adults in rural Kenya is, in part, attributable to the socio-cultural practices surrounding sexuality and gender relations of the male adults (Juma et al., 2014). Cultural practices associated with elevated HIV infection among adolescents and emerging adults in rural area in Kenya include early marriage, sleeping arrangements and funeral ceremonies (KDHS, 2014). However, these studies are quantitative and provide limited understanding of how the factors predispose adolescents and young adults to sexual risks. Such high-risk cultural practices persist despite the increased awareness about HIV/AIDS among the rural communities in Kenya (Fleming et al., 2016; Juma et al., 2014).

The primary drivers of the globally HIV epidemic are social determinants and to achieve the goal of an 'AIDS-free generation,' an improved understanding of the social and cultural factors that amplify or mitigate HIV transmission is critical (Fauci & Folkers, 2012; Kharsany & Karim, 2016). Gender norms, muscularity, patriarchy and power are believed to have a profound effect on the HIV epidemic (KDHS, 2014). Men's sexual behaviors in Kenya are playing an integral part of constructing their masculine and gender identity, furthermore, men's HIV vulnerability and the vulnerability of their sexual partners is primarily associated with those sexual behaviors (Juma et al., 2014).Several studies shows that men's endorsement of these masculine norms is significantly associated with HIV-related behaviors like non-condom use and having a greater number of sexual partners that put themselves and their sexual partners at risk for HIV (Fleming et al., 2016; Juma et al., 2014).

Strengths of the theory of emerging adulthood

The theory explains important concepts in development and vulnerability of young people including emerging adults in developing countries which is important in the dissertation study. Although there might be some variations among groups and cultures, emerging adulthood takes place across racial, cultural, and socioeconomic groups, although the experience of emerging adulthood varies among groups. The theory explains how emerging adulthood as a process and each young person traverses his or her own individual path through this life stage (Arnett, 2014). Emerging adulthood is a process and each young person traverses his or her own individual path through this life stage. The five characteristics of emerging adulthood (self-focus, instability, identity explorations, feeling in-between, and a sense of possibilities) endeavor to describe the way this period is experienced, though not every individual feels all five of the characteristics, at least not all at once.

Limitations of the theory of emerging adulthood

The major disadvantage is that the theory was developed in developed world and it might not fit well in developing countries or emerging adults from cultures and backgrounds with hardship or marginalization (Arnett, 2014; Odaga, 2012). The theory applies well in cultures that allow young people a prolonged period of independent role exploration during the late teens and twenties which might not be the case in most Sub Saharan African countries (Arnett, 2000). Arnett asserts that conceptualizing emerging adulthood as a developmental stage has usefulness that outweighs its limitations (Arnett, 2007).

How the two theories guided and informed the study questions and methodology

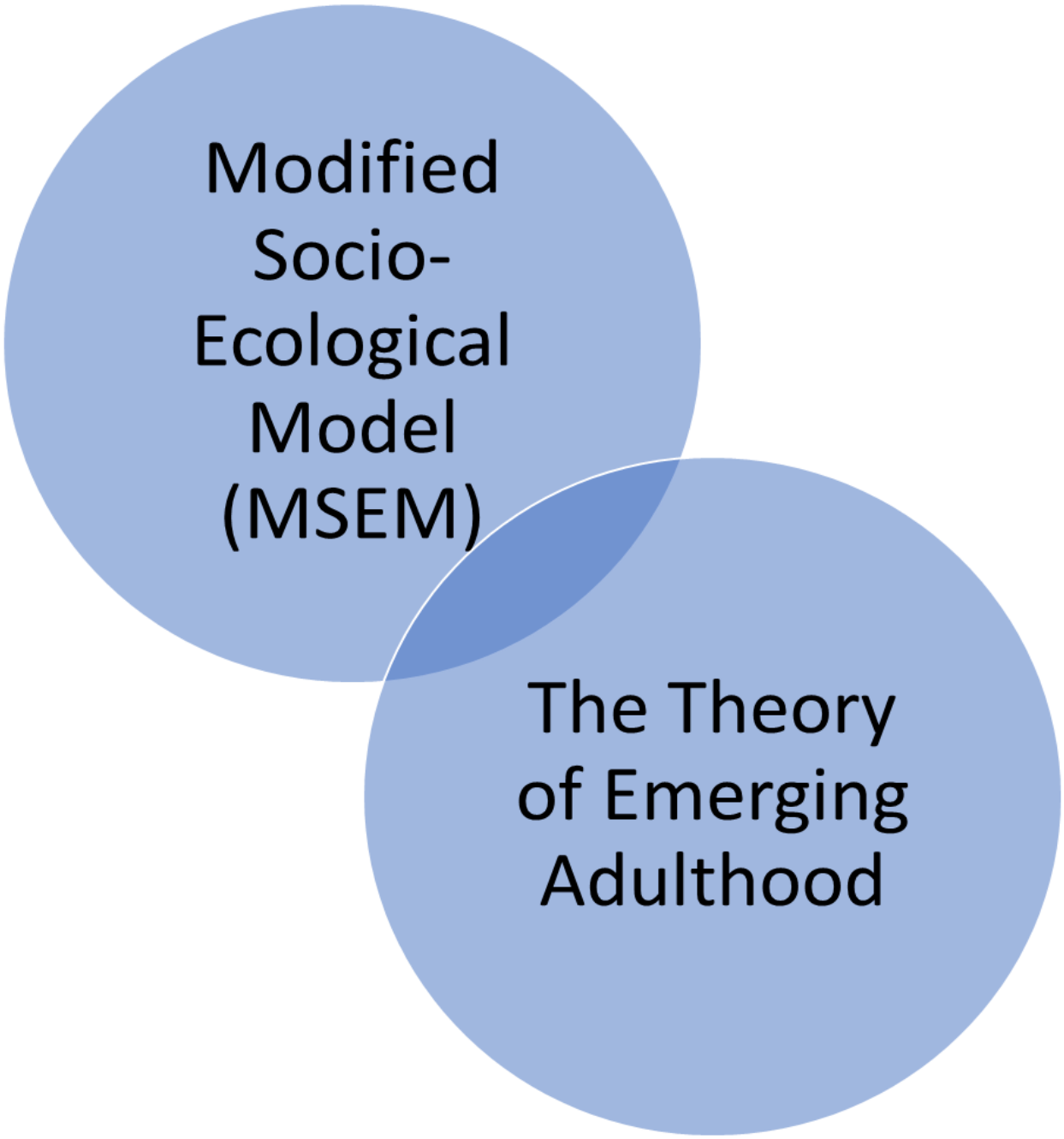
The modified Socio-Ecological Model in regard to HIV prevention in emerging male adult population in rural setting guided the development of questions related to knowledge,

practices, and attitude in HIV prevention. Questions related to the community level include issues around stigma and discrimination, community resources available and cultural norms. Finally, the questions asked at the four levels (individual, interpersonal, community level and HIV epidemic level) were analyzed and lead to recommendation which we look forward to influencing the public policy and ultimately alter the HIV epidemic particularly in the emerging adults in Sub-Saharan Africa context.

Up to date, there is very limited research evidence, within the theoretical framework of emerging adulthood, regarding HIV prevention in SSA. The theory of emerging adulthood guided in the development of age sensitive questions specific to emerging adult population. Most questions were around sexuality and therefore questions needed to be sensitive to their culture and developmental stage. At interpersonal level, questions regarding social and sexual networks including social support and how mobile phones can be utilized in HIV prevention, because cell phones are reported highest usage among the emerging adults in SSA.

The MSEM is based on the premise that while individual-level risks are necessary for the spread of disease, it is not the only aspect at play, upstream social and structural levels of risk (network, community, policy, level/stage of epidemic) represent risk factors outside of the control of any individual person (Wellings et al., 2006).This model therefore recognizes the important role social and structural factors can have in HIV transmission dynamics in emerging adults, which has been demonstrated by some research in African settings (Fay et al., 2011).

Figure 4 The diagram showing how the two theoretical frameworks overlap in guiding research in HIV prevention among the emerging adult population



CHAPTER 4: METHODOLOGY

Chapter Summary

In this chapter, the methodology used in this qualitative study is explained. A descriptive qualitative design guided the study. The descriptive qualitative research method is aimed at describing individual experiences in a certain phenomenon. This methodology has been widely applied in health research to explore a variety of topics, it is considered a useful and valuable research method for understanding health care from the patient or service user perspective (Biggerstaff & Thompson, 2008; Brocki & Wearden, 2006).

The individual, interpersonal and community layers of risk for HIV infection outlined in the Modified Social Ecological Model (MSEM) and the Theory of Emerging adulthood guided the development of the semi-structured interviews and focus group discussions. The MSEM was crucial in visualizing multi-level domains of HIV infection risks and guided the development of data collection tools and informed the recommended prevention strategies unique to emerging adult population. The theory of emerging adulthood guided in the development of age appropriate questions specific to emerging adult population. Most questions were around sexuality and therefore questions must be sensitive to their culture and developmental stage. Semi-structured interviews and focus group discussions were used to examine the experiences of emerging adults in the use of mobile phone in HIV testing and prevention in rural Kenya.

This chapter is organized into the following subheadings: study design, recruitment and data collection plan, sample, instruments and measures, data management and analyses using narrative methodology in combination with thematic analysis, limitations, and strengths of the study. Finally, the means used to assure trustworthiness of the findings and protection of

participants is discussed. The organization of the methods section is informed by 32 item COREQ checklist.

Study Design

The use of mobile phones for meeting HIV prevention and testing information needs by emerging adult male population in rural Kenya was approached using descriptive qualitative design. Semi-structured interviews and Focus Group Discussions were used to examine the experiences of emerging adults in use of mobile phone in HIV testing and prevention in rural Kenya setting.

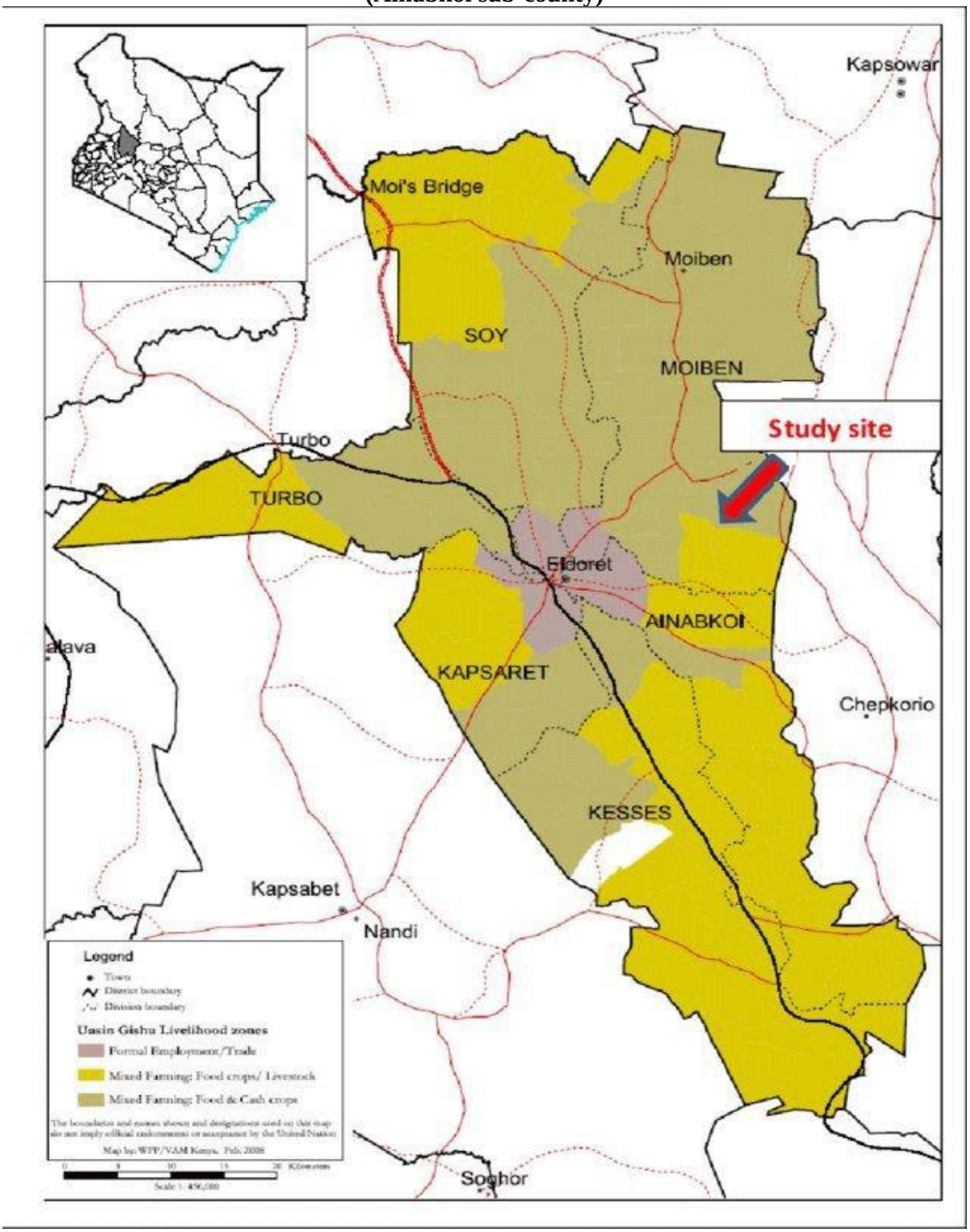
Setting

The study was conducted in largely rural Ainabkoi Sub-county of Uasin Gishu County in Kenya, East Africa. Kenya lies astride the equator on the eastern coast of Africa. It is a medium-sized country by continental standards, covering an area of about 586,600km square. Kenya is bordered by Somalia and the Indian Ocean to the east, Ethiopia to the north, Sudan to the northwest, Uganda to the west and Tanzania to the south. The coastline, about 550km long, faces the Indian Ocean.

Uasin Gishu County is one of the 47 Counties of Kenya. It is located in the former Rift Valley Province. Its headquarters and largest town is Eldoret. The town of Eldoret is the county's largest population center as well as its administrative and commercial center. The county has an estimated population of 894,179 with urban population contributing about 31% of the entire population. The population density is 267 persons per sq. km. The county borders Trans-Nzoia County to the north, Elgeyo-Marakwet and Baringo counties to the east, Kericho county to the

south, Nandi county to the south, south-west and Kakamega county to the west (Uasin Gishu County Government, 2021).

Figure 5 The map of Kenya showing Uasin Gishu County highlighting the study site (Ainabkoi sub-county)



In 2019, the Uasin Gishu County has a population of 1,092,803, comprising of 549,000 males (50%) and 543,803 females (50%). Children below 15 years constitute 39% of the population, while youth aged 15-24 years constitute 23% of the population (KNACC, 2018). Approximately half of the population in Uasin Gishu live below the Kenyan poverty line of 1.90 United States dollars (US$) per day, (Braitstein et al., 2019). The HIV prevalence in Uasin Gishu is 4.7% consistent with national average prevalence. By the end of 2015 a total of 26,771 people were living with HIV in the county, with 15% being young people aged 15-24 years (KNACC, 2018).

The KDHS 2014 revealed that 10% of women and 16% of men in Uasin Gishu County had never tested for HIV (KDHS, 2014). The County needs more innovative strategies including mHealth to improve on HIV testing and counseling. The comprehensive knowledge about AIDS According to KDHS 2014, comprehensive knowledge about HIV is a composite measure defined as knowing that consistent use of condoms during sexual intercourse and having just one uninfected faithful partner can reduce the chance of contracting HIV, knowing that a healthy-looking person can have HIV, knowing that HIV cannot be transmitted by mosquito bites, and knowing that HIV cannot be contracted by sharing food with a person who has AIDS. The survey revealed that 67% of women and 68% of men had a comprehensive knowledge of HIV and AIDS (KDHS, 2014; KNACC, 2018).

Recruitment and Data Collection Procedure

Prior to the start of the study, approvals were obtained from the University of Wisconsin-Milwaukee Institutional Review Board (IRB), the Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC) and the Kenya National Commission for Science, Technology and Innovation (NACOSTI). Once the investigator

received required permits and ethical approvals from appropriate institutions, male participants Aged between 18-24 years were recruited within Ainabkoi sub-country of larger Uasin Gishu Country. Participants signed the consent forms prior to their participation in both individual interviews and Focus Group Discussions.

Details on Recruitment

Purposive sampling was utilized in the initial phase of the recruitment process. This sampling method assures that the participants provides insightful information that enhances the understanding of their experience about use of mobile phones in HIV prevention, which is the main objective of the study (Ritchie & Lewis, 2014) Purposive sampling criterion-based sampling is important to ensure participants were not recruited from one section of subcounty and leaving out the other parts. Purposive sampling and snowball sampling guided the recruitment of participants. Purposive sampling is a deliberative approach wherein participants are targeted for the rich information they are likely to yield about study phenomena; and Snowball is a non-probability sampling where already identified subjects help identify other potential subjects from among their friends until the desired number is reached (Ritchie et al., 2013).

Recruitment of Participants for Individual Interviews

The initial contact was made with through the local community leaders. They recommended additional key informants who should be contacted for interviews, based on their experience of working with the young people in their area of jurisdiction. Over a 6-week period, the researcher went through the local community leaders (ward administrators, area Chief and village elders) in the Ainabkoi sub-country office. The purpose of the study was explained to the

community leaders and seek their cooperation, then the local community leaders were requested to help in identifying potential participants within their jurisdiction.

The young men identified by the local community leaders were requested to identify their friends who might be interested to participate in the study through the snowball sampling to guide the recruitment of more participants. This process was repeated with all new interviewees to continue to identify participants sharing relevant perspectives for the study. Flyers were used to help identify potential participants. The flyers were posted at the public notice boards where the youth frequently visit; mainly at the sub county administrative offices, local churches, pubs and entertainment joints, with information for those interested in the study to contact PI for further information on participation. The Participants were explained about informed consent and freedom to participate in the study and assured that their participation in the study is voluntary and were free to change their mind and withdraw from the study at any stage.

Recruitment of Participants for Focus Group Discussions

The Focus Group Discussion participants were different group of young men from the participants in the individual interviews. As with individual interviews the initial contact was made through the local community leaders. They recommended additional key informants on who should be contacted for interviews, based on experience of working with the young people in their area of jurisdiction. The researcher paid attention to avoid recruitment of the same participants who participated in the individual interviews.

Like individual interviews, the snowballing sampling method was used to identify the potential participants from the rural areas of Ainabkoi sub-county where a participant recruited helped identify their friends/colleagues using an existing network. Like participant interviews, flyers were also be used to help identify potential participants. The flyer were posted at the

public notice boards where the youth frequent; mainly at the sub county administrative offices, local churches, pubs and entertainment joints, with information for those interested in the study to contact PI for further information on participation.

Inclusion and Exclusion Criteria

Males between the ages of 18-24 years, the ownership and regular use of a cellphone, English and/or Swahili Speaking from Ainabkoi sub-country of Uasin Gishu County were included in the study. Swahili is Kenya national language and spoken widely and anyone unable to speak in English was given an opportunity to be interviewed in Swahili. Females between the ages of 18-24 years, emerging male adults between 18-24 years who are unable to speak in English or Swahili and emerging male adults without cellphone were excluded in the study.

Sample

The study sample size was 60 male participants aged between 18-24 years. A total of 30 participants engaged in the individual interviews and another 30 participated in the FGDs. Triangulating individual interviews and FGDs assured validity of the data by combination of one method of data collection. The use of purposive sampling, use of community leaders and the researcher's network within the local community ensured participants from rural setting of the community were identified and recruited for individual interviews or FGDs.

Data Collection

The key informants' interviews, FGDs as well as in-depth individual interviews were used. FGDs is a common method when people's experiences, opinions, beliefs, values, and desires are studied. The questionnaires were in English and Swahili. Swahili is Kenya national language and spoken widely among all age groups and anyone unable to communicate in English

was given an opportunity to be interviewed in Swahili. FGDs and in-depth interview is the most used method in qualitative research designs (Biggerstaff & Thompson, 2008; Mackey, 2005; Pereira, 2012; Rashid-Doubell et al., 2016; Tindall, 2009).

FGDs, key informants and In-depth individual interviews are powerful qualitative data collection methods because it "gives us the opportunity to step into the mind of another person, to see and experience the world as they do themselves" (Ritchie et al., 2013). It only sets broad parameters for the discussions, leaving participants free to tell their own stories. A loosely structured, discursive conversation during FGDs and semi structured in-depth interviews is a good way to access participants' conscious experiences and allow their realities to emerge (Chen, 2018). The sample individual interview guide and FGDs is attached in the appendix section.

Key Informants Interview

The key informant interviews represent one of the most frequently used techniques in assessment studies. They are conducted, one-to-one with individuals who hold key information by virtue of their position or life experience, using semi-structured questionnaire. In-depth individual interviews (Ritchie et al., 2013).This method was utilized to get data about higher-level factors (policy and state of HIV epidemic) in Uasin Gishu County and Kenya in general. The HIV awareness and prevention programs targeting the young people in the Uasin Gishu county were sought from the Uasin Gishu County HIV and AIDS coordinator.

Individual Interviews

Individual in-depth semi-structured interviews was conducted face-to-face by the investigator in a private space/room within the sub-county offices. The interview began with a verbal explanation of the voluntary nature of the interview, the freedom to withdraw at any point

and an explanation of how confidentiality was going to be maintained throughout the research process was clarified to the participants. The interviewer opened the discussion general questions and went ahead to discuss the participant's HIV risk factors and the current use of mobile devices, more specifically their experiences of using mobile devices in accessing HIV testing and prevention information. The duration of each interview was about one hour. The individual interviews and FGDs were audio recorded and the participants were not identified by their names on the tape to maintain confidentiality.

First the interview began with a "warm-up" question-something that the respondent was able to answer easily and at some length. It did not have to pertain directly to what is being investigated but this was initial rapport-building to put the participant at ease and made the rest of the interview flow more smoothly. The difficult or potentially embarrassing questions were asked toward the end of the interview when rapport has been adequately established. Then the last question provides some closure for the interview, and left the respondent feeling empowered, listened to, or otherwise glad that they talked to me.

Focus Group Discussions (FGDs)

There was three (3) follow-up FGDs and was composed of different set of participants from the individual interviews willing to participate. A Focus Group Discussion was important because it generated richness of data not always possible with individual interviews in addition to being a more efficient way of resolving any seemingly conflicting information and validating information obtained from individual interviews by using multiple data collection methods (Harrell & Bradley, 2009). Participants were encouraged to speak freely and their perspective on the topic of discussion. Confidentiality was assured and participants were identified by serial numbers and not names during the FGDs. The discussions were tape recorded for reference

during analysis and report writing. The ground rules include one person speaking at a time was laid down to ensure each person's contribution was captured by the tape. Each FGDs session took about 60 minutes.

Data Management and Analysis

Data management involves the "systematic, coherent process of data collection, storage and retrieval" (Ryan & Deci, 2000). All data was kept in a secure location and all written and digital information was kept in the strictest confidence and were inaccessible to anyone but members of the research team. Identifying information was removed from transcribed data and audio-recordings. Transcripts was entered into MAXQDA software program for qualitative data analysis and will be kept only on the researcher's personal computer and with password protection to avoid unauthorized access.

In this study following the transcription of the interviews, the researcher read and reread the transcripts several times, making personal notes and reflections. Then the transcribed notes along with field notes were subjected to line-by-line analysis by author, paying close attention to experiential claims, concerns and understandings of the participants regarding use of mobile phones for accessing HIV testing and prevention information by the emerging adults in rural setting in Kenya. The key words, phrases and/or descriptions from the participants were documented, as the authors reflexively engaged with the data. Convergence and divergence of data was noted, in the process of developing the preliminary emergent themes. Triangulating individual interviews and FGDs was done to assure trustworthiness of the data by combination of one method of data collection. Triangulation addresses the issue of internal validity by using more than one method of data collection to answer a research question (Barbour, 2001).

The emerging themes were further interrogated and refined with reference to participants' original words while also including the author's collective interpretations. MAXQDA software was used to facilitate coding and analysis of qualitative data. MAXQDA is a well-built, easy to use data analysis software program with both qualitative (text, audio, and video) and quantitative data analysis capability (Sozialforschung, 2011; Verbi, 1989).

Addressing the Scientific Rigor in the Study

The study is a community-based qualitative study assessing factors associated with the use of mobile phones for meeting HIV prevention and testing information by emerging adult population in rural Kenya. The study is handy in examining personal experience of mobile phone use by the emerging adults in accessing HIV prevention and testing information. Rigor is addressed in an integrative way using an approach that balances methodological and experiential (what is observed or what participants experience in use of mobile phones in accessing HIV prevention and testing information) concerns. The procedures and techniques is applied that generate meaningful results not for the purpose of meeting dissertation requirement but that will advance nursing sciences (Pereira, 2012).

Focus group discussions and semi-structured in-depth interviews were used as the major dissertation study methods. FGDs brings in rich data by the participants discussing HIV risk factors and what they do on their daily lives in using mobile technology in accessing HIV prevention and testing information. The facilitators and barriers of using mobile technology in rural areas were also discussed in the FGDs. The in-depth interviews were applied to get the inputs from participants as follow-up to the individual interview to get their opinions of mHealth (current status, barriers, and facilitators of using mobile technology particularly in HIV prevention).

For the study results to add new knowledge to nursing and public health practice, attention was focused on the readability, credibility, dependability, confirmability, transferability, and thus, trustworthiness of the findings. The findings from the dissertation study also contributes to the actionability of qualitative research by enhancing the generalizability of study findings (Pereira, 2012; Sandelowski & Leeman, 2012). Establishing trustworthiness of the data through credibility, transferability, dependability, and confirmability enables the investigator to present findings that are not only believable but also meaningful. Spending over 6 weeks in the field gathering and analyzing data promoted the rigor of the study as this allowed a deeper understanding of the field as well as the phenomenon under investigation (Kako et al., 2013; Mkandawire-Valhmu, Kako, Kibicho, & Stevens, 2013; Pereira, 2012; Sandelowski & Leeman, 2012)

The data analysis and report writing involved describing the research context and the assumption to enhance transferability, as this makes it more likely that other scholars reading the findings might find it useful and applicable to their own contexts. The decisions made regarding the study design, data collection, and analysis was tracked through an audit trail to provide a rationale for the methodological and interpretative judgements of the researcher, this ensured dependability of the findings. To establish confirmability, the results of the analysis was reviewed by all the authors as well as the major professor who are the experts on HIV testing and prevention in emerging adults in resource constrain settings. This helped to establish confirmability of the data by providing the opportunity insightful constructive criticism of the identified themes to be challenged before dissemination (Pereira, 2012; Sandelowski & Leeman, 2012).

The study findings are presented in a way that allows policy makers and healthcare workers to judge the findings transferability and adequacy regarding their unique caregiving and policy making situations particularly in nursing and healthcare informatics. The detailed and appropriate descriptions in the findings and discussions to include excerpts from the field notes showing how the themes were developed from the data helps readers make informed decisions about the applicability of the findings to specific contexts.

Ethical Issues and How it was Addressed

Considering the nature of qualitative studies, the interaction between researchers and participants was ethically challenging for the researcher, as he was personally involved in the different stages of the study. These included anonymity, confidentiality, informed consent and the potential impact on the participants (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014; Weinhardt et al., 2014). Anonymity was difficult to achieve in the study because the investigator was interacting with the participants in Focus Group Discussions and in-depth interviews, however confidentiality was maintained in all steps in the research process. The topic is about HIV and some participant's HIV status might have been known during the discussion and this information was not disclosed or linked in the discussion to any participant's HIV status.

The researcher endeavored to minimize the possibility of intrusion into the autonomy of the study participants by all means. When highly sensitive issues were concerned, it was clarified to the participants that they may decide not to continue with interview and FGDs at any stage of the interviews without any fear of intimidation or coercion. It was clarified in writing on which persons can have access to the initial data and how the data might be used as part of transparency to the research participants in the research process.

Informed consent has been recognized as an integral part of ethics in research carried out in different fields. For qualitative researchers, it is of the utmost importance to specify in advance which data will be collected and how they are to be used (Sanjari et al., 2014). The principle of informed consent stresses the researcher's responsibility to completely inform participants of different aspects of the research in comprehensible language. Clarifications need to include the following issues: the nature of the study, the participants' potential role, the identity of the researcher and the financing body, the objective of the research, and how the results will be published and used and the informed consent will be ongoing negotiation of the terms of agreement as the study progresses (Klykken, 2021). The potential benefits to the community and/or society will be clarified which will include informing policy in HIV testing and prevention and improvement of health policy as far as mobile technology in concerned.

Benefits and Risks

There are were no direct benefits to the participant other than to further research and knowledge generation in the field of study. There were no costs for participating apart from providing with airtime/talk timecard of Ksh 500 per participant. The risks in participation was considered minimal. It was clarified that in the Individual interview and Focus Group Discussions there might be some questions that will make some participant uncomfortable, and it was highlighted by the researcher that they were free not to answer those questions. With FGDs there is always the risk that someone in the group will share personal responses with others who were not in the group. To minimize this risk, participants were informed in the Focus Groups do not share anything they do not want others to know.

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CHAPTER V: RESULTS (MANUSCRIPT 2 & 3)

Chapter 5 is a compilation of the findings from the study in two manuscripts. Manuscripts 2 and 3 primarily focus on the results from in-depth interviews and Focus Group Discussions with emerging male adults in rural Kenya about their experiences using mobile phones in HIV prevention. The 2nd manuscript will be *Addressing the unique needs of emerging male adults in HIV prevention in in rural Kenya, and* the 3rd one will be *Facilitators and Barriers to using mobile phones in HIV prevention for emerging adults in rural settings in Kenya*.

Manuscript 2 Title: Addressing the Unique Needs of Emerging Male Adults in HIV Prevention in Rural Setting in Kenya

The second manuscript reports the HIV prevention and testing needs for emerging male adults in rural settings in SSA with a focus in rural western Kenya. It is formatted based on the author's guidelines for the *SSM - Population Health*, a companion journal to Social Science & Medicine as the target journal for publication. The manuscript starts with the introduction and summarizes pertinent literature on unique prevention and testing needs in emerging males in SSA. The modified social-ecological model (MSEM) will be used to visualizing multilevel domains of HIV acquisition risks and identify barriers and opportunities in HIV prevention unique to emerging male adults in rural communities. The results are then analyzed based on the identified themes, then implications to nursing research, practice, and policy are discussed.

Table 3 Manuscript # 2 and the Target Journal

Manuscript	Title	Target Journal
The results	Addressing the unique needs of emerging male adults in HIV prevention in rural setting in Kenya	The *SSM - Population Health*, a companion journal to Social Science & Medicine as the target journal for publication

TITLE:

Addressing the Unique Needs of Emerging Male Adults in HIV Prevention in Rural Setting in Kenya.

Abstract

Emerging male adults continue to be disproportionately affected by HIV compared to other age groups in SSA. Recent demographic data indicate that AIDS related illness is currently the leading cause of death among young people in Sub-Saharan Africa (SSA). This period of life is critical when it comes to sexuality because it is marked by the formation of identity and the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infection. Understanding HIV prevention and testing needs in emerging male adults in rural settings is essential to developing prevention efforts.

Therefore, this descriptive qualitative study was conducted to understand the HIV prevention and testing needs for emerging male adults in rural Kenyan setting. 30 in-depth interviews and 3 FGDs were conducted with emerging adults in rural Ainabkoi sub-county in Uasin Gishu county in Kenya. Findings indicate that emerging adults in rural settings experience unique challenges in HIV testing and prevention influenced by socio-cultural, economic, political, and legal factors elevating their risk to HIV infection compared to other age groups.

The young men in the rural setting are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. The study underscore that HIV is still the greatest threat among emerging adults in SSA and will require innovative approach to develop and implement youth and young adults', especially males, sensitive interventions across multiple sectors that influence HIV prevention knowledge, service use, and treatment options for youths.

Keywords: HIV: Emerging male adults, Sub-Saharan Africa, rural settings, Adolescents and Young Adults (AYAs)

1.0. Introduction

Globally, HIV and AIDS is the leading cause of death among young people and the leading cause death among young people (aged 15-24) in Africa (Avent, 2018; UNAIDS, 2020b; WHO, 2020). Despite the progress made in the past 10 years, with a 46% decline in new HIV infections among young people, the world, death among young people (aged 10-24) in Africa particularly Sub-Saharan Africa (SSA) is still behind on achieving the targets set for young people (UNAIDS, 2021). The HIV and AIDS is currently the leading cause of death among young people in sub-Saharan Africa, with up to 79% of new HIV infections occurring in young people aged 15-24 years (NACC, 2021; UNAIDS, 2021; WHO, 2021) This is a serious public health issue which need urgent cost-effective interventions by local and international players to save the emerging adults from the HIV pandemic.

The Kenya Ministry of Health data shows that, nationally, approximately 29% of all new HIV infections are among adolescents and young people who still bear the greatest impact of the HIV epidemic due to limited access to information, services, stigma and discrimination (NACC, 2019, 2021) .As per 2020 statistics, the HIV prevalence in Uasin Gishu is currently at 5.6% above the national average of 4.3% and prevalence has been on the upward trend in since 2013 which was at 4.3% (KDHS, 2014; NACC, 2021). In Uasin Gishu, the young people aged 15 to 24 make up more than half of the new HIV infections, with the biggest driver of HIV infections being the drug abuse and transactional sex, especially in informal settlements (NACC, 2021).

There is limited research on HIV prevention and testing needs of adolescents and emerging male adults and the few available target the young people living in urban towns and cities (Brown et al., 2013; Pettifor et al., 2013; UNICEF., 2011). The HIV infection in emerging adult male population is underreported because they have lower rate of HIV testing compared to

female counterparts and therefore more HIV testing and prevention awareness need to be conducted on this population. Encouraging men to get tested and treated is a major challenge, but one that is poorly recognized. (Galdas, Cheater, & Marshall, 2005; Mills, Beyrer, Birungi, & Dybul, 2012)

To end HIV, interventions involving men especially emerging male adults critical. Interventions have been focused on women, except for male circumcision. The epidemiological evidence is accumulating, and indicates that males in sub-Saharan Africa are not accessing HIV services as often as their female counterparts, and as a result, men have worse outcomes of care, including mortality (UNAIDS, 2018: Mills, Beyrer, Birungi, & Dybul, 2012). Funding and research organizations need to recognize the social and health impacts associated with not engaging men in primary and secondary HIV prevention campaigns (Mills, Beyrer, Birungi, & Dybul, 2012).

Several studies have reported that men in sub-Saharan Africa are less likely to be self-aware of their HIV status compared to their female counterparts (Hamilton et al., 2021; Mills et al., 2012; Musheke et al., 2013; UNAIDS, 2016). For example, a survey conducted in 2016-17 in Tanzania showed that only 45% of men living with HIV (MLWH) were aware of their positive HIV status (Hamilton et al., 2021). Programmatic efforts should account for this disparity and recognize that it may be necessary to seek out men for HIV prevention, testing, care in order to eradicate HIV and achieve HIV free generation (Mills et al., 2012; UNAIDS, 2019c).

1.2. Theoretical Framework

The theoretical and conceptual framework for the study was first guidance by Modified Social Ecological Model (MSEM) to help visualize multilevel domains of HIV infection risks and guide the development of prevention strategies in emerging adults. Secondly the concepts

from theory of development of emerging adults from the late teens through the twenties proposed by Arnett (2000) were utilized.

2.0. Materials and Methods

The descriptive qualitative design guided the study. This methodology has been widely applied in health research to explore a variety of topics and it is considered as a useful and valuable research method for understanding health care from the patient or service user perspective (Biggerstaff & Thompson, 2008; Brocki & Wearden, 2006).

2.1. Study Design

Descriptive qualitative research design was used for this study to understand HIV prevention and testing needs for emerging male adults in rural setting in Kenya.

2.2. The Sample and Setting

The study sample was 60 male participants aged between 18-24 years. A total of 30 participants participated in the individual interviews and another 30 were engaged in the Focus Group Discussions (FGDs). The recruitment and interviewing of participants took place over 6 weeks in July-August 2021. Purposive sampling enhanced with snowball sampling was utilized in the initial phase of the recruitment process. These sampling methods assured that the participants will provide insightful information that enhances the understanding of their experience about HIV prevention risk factors and needs unique to this age group as supported by previous similar studies (Ritchie et al., 2013).

The study was conducted in largely rural Ainabkoi Sub- County of Uasin Gishu County in Kenya, East Africa. Uasin Gishu County is one of the 47 Counties of Kenya and is in located in the former Rift Valley Province. The town of Eldoret is the county's largest population center

as well as its administrative and commercial center. The county has an estimated population of 894,179 with rural population contributing about 69% of the entire population.

2.3. Recruitment

The study sample was 60 male participants aged between 18-24 years. A total of 30 participants participated in the individual interviews and another 30 were engaged in the Focus Group Discussions (FGDs). The recruitment and interviewing of participants took place over 6 weeks spanning July to August 2021. In the process of recruiting the participants for individual and FGDs, the initial contact was made through local community leaders at Ainabkoi sub-country administrative offices. The focal persons then recommended participants to be contacted for interviews, based on experience of working with the young people in their area of jurisdiction. The purpose of the study was explained to the community leaders and seek their cooperation and help in identifying potential participants

2.4. Inclusion and Exclusion Criteria

Inclusion: Males between the ages of 18-24 years, the ownership and regular use of a cellphone, English and/or Swahili Speaking from Ainabkoi sub-country of Uasin Gishu County. Swahili is Kenya's national language and spoken widely and anyone unable to speak in English was given the opportunity to be interviewed in Swahili

Exclusion: Females between the ages of 18-24 years, emerging male adults between 18-24 years who are unable to speak in English or Swahili. Emerging male adults without cellphone were excluded in the interviews.

2.5. Data Collection

Data was collected from individual, focus groups and key informants.

2.5.1. Key Informants Interview

This method was utilized to get data about higher-level factors (policy and state of HIV epidemic) in Uasin Gishu County and Kenya in general. The Ainabkoi Sub-country HIV and AIDS coordinator was interviewed about HIV and AIDS prevalence, policies and prevention programs targeting the young people in the county and sub-counties.

2.5.2. Individual Interviews

Individual interviews were conducted face-to-face by the investigator in a private space/room in different localities in Ainabkoi Sub- County. The interviewer opened the discussion with general questions and went ahead to discuss the participant's HIV risks factors and needs in HIV testing and prevention unique to this age group. The duration of each interview was about 60 minutes. Interviews was audio recorded and the participants were not identified by their numbers but serial numbers on the tape to maintain confidentiality.

2.5.3. Focus Group Discussions (FGDs)

There were three follow-up FGDs and participants were composed of different individuals from the in-depth interviews. Conducting the three follow-up FGDs was for triangulating and raising the trustworthiness and internal validity by combination of one method of data collection. During the FGDs the participants were encouraged to speak freely and give their perspective about HIV risks factors and needs in HIV testing and prevention unique to their age group. Confidentiality was maintained and participants were strictly identified by serial numbers and not their names during the FGDs. The discussion was tape recorded for reference during analysis and report writing. Each FGDs session took about 60 minutes.

2.6. Data Management and Analysis

All written and digital information are kept in the strictest confidence and are inaccessible to anyone but members of the research team. Identifying information were removed from transcribed data and audio-recordings. Transcripts were entered into MAXQDA software program for coding and qualitative data analysis in a password protected computer to avoid unauthorized access. Following the transcription of the interviews, the researcher read and reread the transcripts several times and making personal notes and reflections.

Then the transcribed notes along with field notes were subjected to line-by-line analysis by author paying close attention to experiential claims, concerns and understandings of the participants regarding HIV risk and needs in testing and prevention information by the emerging adults in rural setting in Kenya. The key words, phrases and descriptions from the participants were collated in the process of identifying the codes in an iterative process and shared with the major professor for validation. The convergence and divergence of data were noted in the process of developing the preliminary emergent themes. These themes were further interrogated and refined with a second review by the major professor.

2.7. *Ethical Consideration*

This study was reviewed and approved by the University of Wisconsin- Milwaukee's Institutional Review Board (IRB) and Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC). Emerging adult men who met the criteria and consented to participating in the study were interviewed by the researcher. Prior to commencing the interview process, participants were informed of their right to terminate the interview at any time or drop out of the study. The researcher also reviewed the study informational sheet with the participant prior to beginning the interview to ensured

understanding and informed consent. Participants received a $5 talk time voucher as appreciation for participating in the study.

3.0. Results

3.1. Socio-Demographic Characteristics of the Participants

As summarized in table 4, all the of participants were between 18-24 years with majority of them 9 (30.0%) being at the age of 24. Majority of them 25 (83.3%) were single while 4 (13.3%) where single and one participant was separated/divorced. Majority of the participants 23 (76.7%) were not having any children, and the remaining 23.3% were having 1 or children as shown in the demographic table. Most of the participants were not employed and rely on casual labor or family support to meet their daily basic needs. The average income per month for majority 22(73.3%) of the participants is less than Kenya shillings 5000 (approximately $50) and they reported that this income in not adequate to meet their basic needs and sometimes rely on family and well-wishers for additional support.

Most of the participants (96.7%) had at least secondary school education with and they were generally proficient with written and spoken English. Half of the participants were actively in school/college pursuing studies while the remaining half were not in school/college. More than half 17 (56.7%) of the participants were living with their parents or relatives, followed by 9 (30.0%) who were renting a house/apartment, the remaining 4 (13.4%) were either living with spouse/sexual partner or in student hostel. About HIV status, 11 (36.7%) of the participants reported that they have never tested for HIV, 17 (56.7%) reported that they were negative and 2 (6.7%) were not willing to disclose their status, no participants reported to be HIV positive.

Table 4 The Demographic Data for the Participants Interviewed (n=30)

Variable	Categories of Variables	Count (X)	Percentage
Age (18-24)	18 Years	5	16.7
	19 Years	3	10.0
	20 Years	3	10.0
	21 Years	6	20.0
	22 Years	1	3.3
	23 Years	3	10.0
	24 Years	9	30.0
Marital Status	Single	25	83.3%
	Married	4	13.3%
	Separated/Divorced	1	3.3%
Number of Children	0	23	76.7%
	1	6	20.0%
	2	1	3.3%
Employment Status	Self-Employed	4	13.3%
	Not employed	12	40.0%
	Student	14	46.7%
Main Source of Income	Regular employment	0	0.0%
	Casual jobs	12	40.0%
	Support from family/friends	14	46.7%
	Self Employed	4	13.3%
Average Income/Month	< Ksh 5000	22	73.3%
	Ksh 5,001-10,000	7	23.3%
	Ksh 10,001-15,000	1	3.3%
Financial Situation	Barely adequate	13	43.3%
	Inadequate	17	56.7%
Level of Education	Primary	1	3.3%
	Secondary	21	70.0%
	Post Primary certificate Training	5	16.7%
	Associate Degree/Diploma	1	3.3%
	Bachelors	2	6.7%
Currently in College	Yes	15	50.0%
	No	15	50.0%
Current Living Situation	Rental a house/apartment	9	30.0%
	Family House	17	56.7%
	Spouse/Sexual partner	2	6.7%
	Student Hostel	2	6.7%
HIV Status	Negative	17	56.7%
	Positive	0	0.0%
	Not ready to Disclose	2	6.7%
	Never tested	11	36.7%

We used the MSEM framework to give a comprehensive description of the unique risk factors that are driving the HIV and AIDS epidemic among the emerging male adults in rural Kenya. The MSEM is a health promotion model, which focuses attention to both the individual and the social environmental factors as targets for health promotion and disease prevention and outlines the complex interaction of individual and social contexts and actors comprising of Intra-personal/Individual, Interpersonal, Institutional and public policy level factors necessary for HIV acquisition and spread.

The emerging male adult's HIV access and prevention opportunities were described under the major theme: *Addressing the unique needs of emerging male adults in HIV prevention in rural setting,* and under this major theme, initial codes were collated, resulting in the four sub themes consistent with MSEM model framework. The major theme and subthemes captured the idea that young men in the rural setting are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. The young men participating in the FGDs and individual interviews reported several factors which heighten their risk for HIV infection in the rural settings. The table 5 below highlights the theme and subthemes based on the MSEM framework.

Table 5 The Major Theme and Subthemes based on the MSEM Framework

Major Themes	**Sub-themes in each category based on MSEM framework**
Addressing the unique needs of emerging male adults in HIV prevention in rural setting	1. Individual HIV acquisition risk factors. ✓ Negative attitude towards condom use ✓ Alcoholism and other substance abuse 2. Interpersonal and Social HIV acquisition risk factors. ✓ Peer influence ✓ Multiple sexual partners ✓ Cultural practices ✓ Lack of family and social support. 3. Healthcare system related HIV acquisition risk factors ✓ Long distance to healthcare facilities ✓ Unwelcoming attitudes of healthcare workers offering HIV preventive services

	4. Policy related issues which increase the risk of HIV acquisition and transmission. ✓ Widespread unemployment among the youth ✓ Payment of HIV testing services in some health facilities ✓ Lack of HIV prevention course in the colleges and universities

3.1. Intra-personal/Individual HIV acquisition risk factors.

The participants interviewed highlighted negative attitude towards condom use, alcoholism and other substance abuse as the major individual factors increased the risk for HIV transmission among the emerging adults in the rural areas. Most of the young men have less belief in condom effectiveness for HIV prevention and the perception is even worsened under the influence of alcohol and drug abuse because most men interviewed reported that condom use declined when under the influence of alcohol or other substance use.

Some of the negative attitudes and perceptions reported by the participants towards condom use includes, condoms reduce pleasure, can't find condoms that fit, thinks it is an interruption when you two are just ready to have sex after fore play, insisting on condom use is a sign of unfaithfulness, and your partner appearing clean and showing no signs of sickness. Some of the participants also reported that their girlfriends do not want them to wear condom because they feel the rubber can easily slip and get lost in their uterus. For many men interviewed, safety from HIV does not play a central role in their decision-making about condoms as one says. One participant during the individual interview stated:

> *These condoms are not doing any good brother, I used once and I completely never enjoyed that sex, the activity which we are supposed to enjoy with my girlfriend was tasteless. I don't think I will use it again especially now I know my girlfriend very well and she also trust me. I am not sure if she is 100% if she is seeing other men, but we still don't use condom anymore because of that reason I just told you. My girlfriend is also cool with that.*

Another participant in the interview said:

I don't like using a condom because that process of putting on interrupts when you two are just ready to have sex after fore play, and going back to the same level of excitement takes time and you know time is a factor especially when you agreed for a quick one.

Another participant during FGDs said:

> *When I use a condom, my girlfriend will feel I am cheating or her so to avoid suspicious I rather not use it.*

Another participant during the FGDs said:

> *My girlfriend recently told me that when we use the rubber (condom), it can easily slip and get lost in her uterus and we all got scared when we think of using it during the act (sexual intercourse).*

Alcoholism and other substance abuse are another individual factor which predisposes young men to HIV infection. They gave many reasons why young people are engaging in drug abuse, main one being frustrations arising from very unemployment rate currently in Kenya. All the participants interviewed were not having any formal employment and they expressed their frustration that they are becoming hopeless and sometimes give up in looking for employment opportunities because they can't find any job leave alone job relevant to their education and qualifications. Those who drinks alcohol out of frustrations gave the least indication they would use condoms because they are drunk and careless at that time. One participant in the interview stated:

> *I was not drinking before I graduated in college, I am now drinking but cheap alcohol like "Busaa" and "Changaa". The reason why I resorted to drinking because I can't secure any job even with by degree in procurement and supply chain management. The only work I can secure of casual worker at building and construction sites. But I wonder why I went to the university just to be a casual laborer. I even have a huge loan from higher education loan board, and I am hopeless on how I will repay that back. Yes, and I am sexually active, and I don't even remember to use a condom when I am drunk sometimes with my main girlfriend and sometimes with just a casual girl.*

3.2. Interpersonal and social HIV acquisition risk factors

The participants mentioned the following interpersonal factors which increase the risk to HIV infection among the emerging adults in rural areas; peer influence and having multiple sexual partners. Cultural practices, lack of family and social support including not going to churches was also mentioned as other social factors which increases risk to HIV infection among the young people in the rural communities. Some of the youth acknowledged that going to church and frequent teachings from the church that engaging in pre-marital sex is taught as sin has really helped them stay away from risky sexual practices. One participant in the interview said:

> *I associate with African Inland Church, and in our church, we usually have youth camps where a speaker in invited to speak about sexuality and sometimes even about HIV. These sessions emphasize about living a pure life and seek guidance from the lord to help overcome extramarital sexual temptations until after marriage is church. Personally, these teachings have been helpful*

Another participant during the FGDs explained the following about cultural practices common in their village.

> *In every December during long holidays young men are initiated to adulthood through circumcision and secluded teachings in the nearby forest. Most of these young men immediately when they came out from seclusion, they are under pressure to engage in sexual intercourse with their girlfriends to proof that they are no longer children anymore. This way some get infected with HIV and other sexually transmitted infections.*

Having multiple sexual partners was reported by the participants to be common and they blamed it on peer influence. Many young people engage in sexual activity with multiple sexual partners simply because their peers are doing it and if you are not part of the game then you are not a real young man. Most of the participants acknowledged that even with short-duration multiple sexual partners they rarely use a condom which even increased the risk for acquisition of HIV. Many young people interviewed in these villages reported that they are usually under intense pressure from peers to become sexually active or accrue sexual partners. cultural influences also played because in this local community the emerging adults interviewed reported

that having multiple sexual partners and unprotected sex are perceived as normal behavior for men. For example, one participant in the individual interview said:

> *I have many friends of my age who have multiple sexual partners and we usually discuss about this every time we meet. If you do not have many girlfriends, you are inadequate man among your peers, and you can be easily isolated. Furthermore, these things are considered normal for any sexually active young man in this village.*

Our in-depth interview showed that the sexual norms that prevailed in the families, communities and peer groups of the young men shaped their sexual behaviors and attitudes. One participant in the FGDs said that:

> *In this village, I was raised in, the majority of the men had multiple sexual partners…so having as many partners as possible was normalized, some men were in polygamous relationships So having multiple sexual partners or even several wives is acceptable for me in this community.*

3.3. Healthcare system related HIV acquisition risk factors.

Under the healthcare system related HIV risk factors, the participants interviewed highlighted the following as; long distance to healthcare facilities and unwelcoming attitudes of healthcare workers offering HIV preventive services. Participants frequently mentioned lack of access to health care due to distance and unwelcoming comments from healthcare workers as a factor that contributed to differences in rural community HIV infection risk in that it prevented them from visiting the health centers and obtaining necessary health information that could be used to protect themselves from acquiring HIV and other STIs. For example, one participant during the FGDs stated:

> *It's harder for us young people. I feel like our age groups in the urban areas have more access to doctors and information that they need because they live closer to the health facilities. In this village you must have to walk over 10 kilometers to the nearest health center and sometimes when you go there you find it locked and no one to attend to you.*

One of the participants during the individual interview said that the negative attitude and bad language among some healthcare providers discourages young men from visiting the health facilities for HIV testing or even HIV prevention information.

> *One afternoon, I visited the local health facility after the days casual work in construction for HIV testing, the healthcare, I was not welcomed, and I was the last priority to be seen. Later the healthcare provider said I am smelly of alcohol and she will not attend to me until next time I visit them being more organized and tidier. I have never gone back because I don't want to be humiliated again.*

The visiting hours to health facilities were mentioned not to be convenient to the young men schedule. Most of them reported that they engage in casual labor like construction and farming which takes the whole day and usually the visiting hours in all these health facilities and over when are they are free to visit for HIV preventive information. For example, one participant in the individual interviews lamented:

> *Brother, I have a major problem with our nearby dispensary vising hours, 8AM-4PM will not work for hustlers like me and of course many other young men because these are the hours, we are busy working, the hospitals to be considerate to us and set aside time outside normal working hours so that we can visit the facility for HIV testing and prevention information.*

3.4. Policy and laws that increase the risk for HIV acquisition and transmission.

The participants reported some of the laws and policies which increases the risk to HIV acquisition include widespread unemployment among the youth, payment of HIV testing services and lack of HIV prevention course in the colleges and universities. All the young men interviewed were not having any formal employment and they raised their concerns and wanted the government to address the issues before it gets out of hand. They reported that in the past the government were having job creation policies for the youth for example in road construction or employment through national youth service. The young men interviewed said that

unemployment has led to frustrations and alcoholism which in most cases lead to irresponsible sexual behavior. One participant during the interview said.

> *I graduated with Surveying course from a local Technical College in 2019. I am constantly looking for employment, but I can't find employment, it is getting harder everyday even to secure casual work. The government need to help create jobs for the youth. For example, in the past administration there was "Kazi kwa Vijana" program and I remember many youths secured jobs in road and construction. I am not choosy I am ready for any kind of a job to put food on the table.*

Another participant during FGDs session reported about payment for HIV self-testing kits as a discouraging issue for them to get tested.

> *The HIV self-testing is popular among the young men. I like testing myself using the HIV self-test kit, but they sell it at Ksh 500, when you go to chemist, they sell it, yet the government says it is provided free of charge*

One participant in the interview expressed the view that the college education needs to be reviewed to include a general course about HIV and preventive measures. He reported that he just graduated from a local university recently, but he did not cover ant HIV related content in his entire university education.

> *I have a degree in education and in the entire university curriculum we were never taught HIV and AIDS content. The policy makers in higher education need to review the university education curriculum to include content in HIV and prevention.*

4.0. Discussion

The young men in the rural setting are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. The young men reported individual, interpersonal, health system and policy level factors which heighten their risk for acquisition and speed of HIV infection in the rural communities in Kenya. The negative attitude towards condom use was common among the participants interviewed and posed as a major individual level risk factor for HIV acquisition and transmission. Several studies posits that correct and consistent use of a condom is needed for efficacious prevention in high prevalence settings particularly in SSA (Bogart et al., 2011; Chirinda & Peltzer, 2014; Dokubo et al., 2014). This is consisted with findings from studies conducted in SSA which reported that even though AYA's have good knowledge about condom use, they seldom use it correctly and consistently and still engaged in risky sexual behavior (Bogart et al., 2011; Hattori, 2014; Yosef & Nigussie, 2020).

The HIV/AIDS misconceptions among the rural emerging males may be barriers to HIV prevention, thus it is important to create awareness and overcome misconceptions about HIV and AIDS in rural communities and changing young men's HIV/AIDS misconceptions may promote men's positive attitudes and beliefs in condom use and protect themselves from HIV (Farrar, 2013; Nubed & Akoachere, 2016; Sano et al., 2016). It is also important to develop a culturally appropriate HIV-prevention messages that address such beliefs and perception among the young people in order to have sustainable HIV prevention interventions.

Participants also raised that they frequently engage in alcoholism and other substance abuse. This elevates their risk to acquisition of HIV because they are unlikely to use a condom when they were under influence of alcohol or other substance of abuse. These findings are

consistent with other studies conducted in SSA rural setting that showed that alcohol was perceived as a social lubricant by most AYA's, which often led to risky sexual behaviors (Khumalo et al., 2020; Lancaster et al., 2018). The association between alcohol and substance abuse and HIV acquisition and transmission has been well documented as directly affect cognitive ability and judgement, which can lead to high-risk sexual behaviors, including unprotected, multiple sexual partners, and coercive sex (Krishen Samuel, 2019; Lancaster et al., 2018; Woolf-King et al., 2013).

Peer pressure and having multiple sexual partners represents an important behavioral risk factor for HIV and other STI's acquisition among young adults, especially if they fail to use condoms correctly and consistently (Alexander et al., 2015; Widman et al., 2016). The desire to impress friends or conform to perceived peer norms may be an important driver of risky sexual intercourse or having multiple sexual partners especially among emerging males in sub-Saharan Africa. This is consistent with qualitative data from three SSA countries, namely Tanzania, South Africa and Ghana suggesting that peer pressure to engage in sexual activity may be substantial for young men compared to young women (Bingenheimer et al., 2015).

The participants reported some cultural practices like rite of passage to adulthood through circumcision and secluded teachings increases the pressure to engage in sexual intercourse with their girlfriends to proof that they have transitioned to adulthood. It is well documented that sexual behaviors and cultural norms are interconnected, it is through culture that people learn how to behave and understand the world around them (Juma et al., 2014; Thiabaud et al., 2020). In many cultural contexts, young men are taught from a very young age how to behave based on dominant notions of what it means to be a man in that context. As such, in some cultural context sexual risk-taking such as having multiple sexual partners and unprotected sex are perceived as

normal behavior for men (Khumalo et al., 2020; Thiabaud et al., 2020). Some young men embrace such normalized sexual behaviors which often has negative implications in terms of HIV acquisition.

Some of the youth acknowledged that going to church and frequent teachings in the church that engaging in pre-marital sex is sin helped them stay away from risky sexual practices. The church is well positioned to make important contributions to HIV prevention in SSA because they are more trusted by the indigenous population and are well placed to disseminate HIV and AIDS education messages (Mpofu et al., 2014). Other studies have explored religiosity, and sexual HIV risks and suggested that abstinence is more common among people who attend religious services more regularly and is primarily explained through attitudes about acceptable sexual behavior which may include associating pre and extramarital sex to sin (Shaw & El-Bassel, 2014). The church also provides some social support to people living with HIV and AIDS or even those engaged in alcoholism and drug abuse.

The community and healthcare system related risk factors stated by the participants included long distance to healthcare facilities and unwelcoming attitudes of healthcare workers offering HIV preventive services. Although Kenya has decentralized HIV including services, distance and user fees at some facilities are still a barrier to service utilization by the youth, especially with the current unemployment and other economic challenges (NACC, 2021). Young people seeking access to free HIV services has to travel long distances, congestion in health facilities, lack of privacy and long waiting time need to be addressed to ensure accessibility of these services to emerging males who are at the highest risk to acquisition of HIV infection.

Long waiting times at health facilities and the negative attitudes of healthcare providers highlighted above generally reflect the human resource constraints typical of rural settings in

SSA (Parkhurst, 2013; Sanga et al., 2019). Long waiting times have been mentioned as a key driver in the loss of interest in seeking HIV services considering many emerging men have other competing activities such as looking for work and social. Introduction of evening and weekend hours outside the traditional schedule working hours is likely to improve uptake of these services among the young people (Gourlay et al., 2013; Mbokazi et al., 2020; Sanga et al., 2019).

Our finding of a negative attitude among healthcare workers towards PLHIV is consistent with other studies and is associated with non-visits to HIV care and treatment centers. Considering the sparsity of health services in rural areas of most of sub-Saharan Africa there is need to train health personnel in the importance of empathy towards patients, as well as engaging patients as partners in the HIV care process (Gourlay et al., 2013; Tilahun et al., 2012). Such negative attitudes will be barriers to service utilization by adolescents and young people and hampers the efforts to prevent HIV transmission and other STI's (Kimera et al., 2020; Tilahun et al., 2012). We therefore call for a targeted effort toward alleviating negative attitudes toward youth and young people-friendly HIV and reproductive health service.

The participants reported some of the laws and policies which increases the risk to HIV acquisition include widespread unemployment among the youth, payment of HIV testing services and lack of HIV prevention course in the colleges and universities to equip students with knowledge and skills about HIV prevention. Limited economic opportunities and unemployment have been associated with risky sexual practices, such as exchanging sex for money, drugs, housing, food and safety and ultimately, these practices can place individuals at risk for HIV (APA, 2010; Igulot & Magadi, 2018; Khuzwayo & Taylor, 2018; Ogunmola et al., 2014). Furthermore, research on unemployment and HIV/AIDS suggests that a person's socioeconomic

standing may affect his or her likelihood of contracting HIV (Igulot & Magadi, 2018; Rogan et al., 2010).

HIV self-test is popular among the young men interviewed. They reported that it is convenient and easy to use however they were disappointed that it is being sold in most outlets especially local pharmacies. The HIV self-test kits high acceptability among men has been reported in other studies in SSA. The majority of men showed a willingness to use HIV self-testing (HIVST) in studies conducted in Malawi, Tanzania, South Africa, and Kenya (Choko et al., 2011; Conserve et al., 2018; Knight et al., 2017; Ngure et al., 2017). The HIVST is highly popular among young men possibly because they engage themselves with HIV testing services without visiting health facilities. In addition to that, the HIVST model further empowers young people and sexually active individuals to be independent and have the option to choose the location and timing of the test and to control the disclosure of their results (Hlongwa et al., 2020).

There was a concern among the participants that they do not cover HIV and AIDS content at the college level. The knowledge they have is from primary and secondary school teaching. In an effort to help students address HIV and AIDS at personal and professional levels, universities must be involved in a proactive and sustainable manner in mitigation of the pandemic through the integration of HIV/AIDS in the teaching curriculum (UNESCO, 2009). This will ensure development of HIV/AIDS educated and HIV/AIDS competent graduates who will be adequately qualified to carry AIDS concerns into their subsequent lives, to address AIDS issues in their professions and to bring AIDS into the open within their societies.

Limitations

There are some limitations to this study. Methodologically, this is a qualitative study using a mixed method study might have yielded more interesting experiences in this age group of participants. This study took 6 weeks and data collection for a longer period and a longitudinal approach might yield more nuanced experiences from the participants.

Another limitation is that this study was conducted in rural Uasin Gishu in Western Kenya and will not include emerging male adults in urban areas therefore their views might not be captured. Nevertheless, while this study will not investigate the unique needs of emerging male adults in HIV prevention in urban setting, the findings from this study could still be transferable to urban populace. It is also justifiable to target the rural population because literature review reveals that there is limited research on HIV prevention and testing needs of adolescents and emerging male adults in rural settings in SSA and the few available target the young people living in urban towns and cities

Implications to Nursing Practice, Research, and Policy

This study has a great potential to inform the nursing practice, research, and policy about multilevel risk factors for HIV acquisition unique to emerging adult population in rural settings in SSA. The participants reported lack of important HIV transmission and prevention knowledge indicating a gap in prevention among young people in the rural areas in Kenya and generally in SSA. Therefore, more research needs to be conducted to include emerging adults' knowledge and behavioral change strategies for HIV in rural areas. There are multiple risk factors for HIV transmission in rural setting, notably alcohol and drug abuse, and this can be another area of research to identify ways of addressing these upstream factors in HIV prevention.

This study found out that stigma and discrimination associated with HIV is still rampant in the rural communities and nurses and healthcare workers must be in the frontline to change the narrative. The nurse scientists may lead stigma-reduction efforts by investigating and conducting more studies on stigma and implementing stigma-reducing interventions at health facility or community level. Overall, the findings from this study can be utilized by HIV and AIDS policy makers and researchers to inform HIV and AIDS prevention work unique to emerging male adults in rural setting in SSA.

Conclusion

In conclusion our findings showed the young men in the rural setting are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. Understanding these factors will inform the development of tailored prevention interventions and programs. Finally, this study underscore that HIV is still the greatest threat among emerging adults in SSA and will require innovative approach to develop and implement youth and young adults' sensitive interventions across multiple sectors, including educational, social, policy, and health care systems that influence prevention knowledge, service use, and treatment options for youths.

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Manuscript 3 Title: Facilitators and Barriers to Using Mobile Phones in HIV Prevention for Emerging Adults in Rural Setting in Kenya: A Qualitative Study

The 3rd manuscript reports the facilitators and barriers in the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings It is formatted based on the author's guidelines for *Online Journal of Nursing Informatics*, the target journal for publications. The manuscript starts with introduction and gives a summary of pertinent literature on mobile health technology and their application in HIV prevention with focus to emerging adult population in SSA setting. The results from 30 in-depth interviews and 3 Focus Group Discussions are then analyzed based on the content themes, then implications to nursing and public health research, practice and policy are discussed.

Table 6 Manuscript # 3 and the Target Journal

Manuscript	Title	Target Journal
The results	Facilitators and Barriers to Using mobile phones in HIV prevention for emerging adults in rural setting in Kenya: A Qualitative Study	Online Journal of Nursing Informatics

TITLE:

Facilitators and Barriers to Using Mobile Phones in HIV Prevention for Emerging Adults in Rural Setting in Kenya: A Qualitative Study

Abstract

Background and Aim: Mobile health (mHealth) technologies have the potential to be a useful mode of delivering HIV prevention information, particularly for young people who is currently the leading cause of death among young people in Sub-Saharan Africa (SSA).The adolescents and young adults (AYA's are the greatest users of Internet and mobile devices globally with high usage reported even in SSA countries. Therefore, this qualitative study was conducted in 2021 to understand the facilitators, and barriers to the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings in SSA.

Method: Thirty in-depth interviews and three Focus Group Discussions (FGDs) were conducted with emerging adults in rural Kenyan setting. The FGDs and Individual Interviews were audio recorded, transcribed verbatim and coded using the software MAXQDA.

Results: Findings showed that most of the emerging adults in rural settings own a smartphone and they were receptive and acknowledge several benefits and facilitators of use of mHealth technology for creating awareness about HIV prevention and testing, but they also described some barriers.

Conclusion: Use of mobile phones in HIV prevention in rural communities comes with huge benefits as a cost-effective intervention. Also, barriers including poor internet infrastructure, trustworthiness of information obtained, and privacy concerns were highlighted which need to be addressed as we work to reach and sustain an AIDS-free generation.

Keywords: Emerging adults, HIV and AIDS prevention, mHealth, Sub-Saharan Africa (SSA), Adolescents and Young Adults (AYA's), Benefits, Facilitators, Barriers.

Introduction

There is paucity in research about facilitators and barriers to the use the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings in Sub-Saharan Africa and few available target the young people living in urban towns and cities (Brown et al., 2013; Njoroge et al., 2017; Pettifor et al., 2013). Globally, HIV and AIDS is the leading cause of death among young people and the leading cause death among young people (aged 15-24) in Africa (Avent, 2018; UNAIDS, 2020b; WHO, 2020). The Kenya, approximately 29% of all new HIV infections are among adolescents and young people who still bear the greatest impact of the HIV epidemic due to limited access to information, services, stigma, and discrimination (NACC, 2019, 2021). In Uasin Gishu county, where this study was conducted, the HIV prevalence is currently at 5.6% above the national average of 4.3% and prevalence has been on the upward trend in since 2013 from 4.3% (KDHS, 2014; NACC, 2021).

Emerging male adults in rural areas often difficult to engage in care due to challenges of accessibility and false perception that HIV has always been worse in women (Mills, Beyrer, Birungi, & Dybul, 2012). The HIV infection in emerging adult male population is underreported because they have lower rate of HIV testing compared to female counterparts and therefore more HIV testing and prevention awareness need to be conducted on this population. Encouraging men to get tested and treated is a major challenge, but one that is poorly recognized. (Galdas, Cheater, & Marshall, 2005; Mills, Beyrer, Birungi, & Dybul, 2012). Programmatic efforts should account for this disparity and recognize that it may be necessary to seek out men for HIV prevention, testing, care in order to eradicate HIV and achieve HIV free generation (Mills et al., 2012; UNAIDS, 2019c).

To end HIV, interventions involving men especially emerging male adults critical. Interventions have been focused on women, except for male circumcision. The epidemiological evidence is accumulating, and indicates that males in sub-Saharan Africa are not accessing HIV services as often as their female counterparts, and as a result, men have worse outcomes of care, including mortality (UNAIDS, 2018: Mills, Beyrer, Birungi, & Dybul, 2012). Funding and research organizations need to recognize the social and health impacts associated with not engaging men in primary and secondary HIV prevention campaigns (Mills, Beyrer, Birungi, & Dybul, 2012).

Mobile phones are increasingly becoming important in HIV prevention because of its convenience and effectiveness to send tailored messages particularly to the young people who are the greatest users (Holloway et al., 2017). Owing to the wider access and acceptance of mobile phones have a great potential for HIV prevention in resource limited settings and understanding facilitators and barriers in use of cellphones in HIV prevention is crucial in developing toiled interventions. Thus, the purpose of this qualitative study is to develop in-depth understanding of the barriers and facilitators of using mobile phone applications/technology for accessing HIV prevention and testing information by emerging male adults in rural Kenya.

Theoretical Framework

The theoretical and conceptual framework for the study was first guidance by Modified Social Ecological Model (MSEM) to help visualize multilevel domains of HIV infection risks and guide the development of prevention strategies in emerging adults. Secondly the concepts from theory of development of emerging adults from the late teens through the twenties proposed by Arnett (2000) were utilized.

Materials and Methods

The descriptive qualitative design guided the study. This methodology has been widely applied in health research to explore a variety of topics and it is considered as a useful and valuable research method for understanding health care from the patient or service user perspective (Biggerstaff & Thompson, 2008; Brocki & Wearden, 2006). The individual interviews and FGDs were used to collect data and delve deeper into the viewpoints of the participants about facilitators and barriers to using mobile phones in HIV prevention for emerging adults in rural settings in Kenya.

Study Design

Descriptive qualitative research design was used for this study to understand HIV prevention and testing needs for emerging male adults in rural setting in western Kenya

Sample and Setting

The study sample was 60 male participants aged between 18-24 years. A total of 30 participants participated in the individual interviews and another 30 were engaged in the Focus Group Discussions (FGDs). The recruitment and interviewing of participants took place over 6 weeks in July-August 2021. Purposive sampling enhanced with snowball sampling was utilized in the initial phase of the recruitment process. These sampling methods assured that the participants will provide insightful information that enhances the understanding of their experience about HIV prevention risk factors and needs unique to this age group as supported by previous similar studies (Ritchie et al., 2013).

The study was conducted in largely rural Ainabkoi Sub- County of Uasin Gishu County in Kenya, East Africa. Uasin Gishu County is one of the 47 Counties of Kenya and is in located in the former Rift Valley Province. The town of Eldoret is the county's largest population center

as well as its administrative and commercial center. The county has an estimated population of 894,179 with rural population contributing about 69% of the entire population.

Instruments

i. Key Informant Interview

This method was utilized to get data about higher-level factors (policy and state of HIV epidemic) in generally in Kenya and specifically in Uasin Gishu County. The Ainabkoi Sub-country HIV and AIDS coordinator was interviewed about HIV and AIDS prevalence, policies and prevention programs targeting the young people in the county and sub-counties.

ii. Individual Interviews

Individual interviews were conducted face-to-face by the investigator in a private space/room in different localities in Ainabkoi sub-county. As part of individual interviews, the participants responded to survey and demographic questions. The survey and demographic questions were used better understand the participants background characteristics including age, race, ethnicity, income, work situation, marital status, among others. Then open-ended questions followed with the interviewer opening the discussion with general questions and went ahead to discuss the participant's HIV risks factors and barriers to using mobile phones to facilitate HIV testing and prevention unique. The duration of each interview was about 60 minutes. Interviews was audio recorded and the participants were not identified by their numbers but serial numbers on the tape to maintain confidentiality.

iii. Focus Group Discussions

There were 3 follow-up FGDs conducted and participants were drawn from different individuals from the ones who participated in the in-depth interviews. The FGDs was divided into three groups, with each group comprised of 10 participants. During the FGDs the

participants were encouraged to speak freely and give their viewpoint about HIV facilitators and barriers to using mobile phones for HIV prevention. Confidentiality was maintained and participants were strictly identified by serial numbers and not their names during the FGDs. The discussion was audio recorded for reference during analysis and report writing. Each FGDs session took about 60 minutes

Inclusion and Exclusion Criteria

Inclusion: Males between the ages of 18-24 years, the ownership and regular use of a cellphone, English and/or Swahili Speaking from Ainabkoi sub-country of Uasin Gishu County. Swahili is Kenya's national language and spoken widely and anyone unable to speak in English was given the opportunity to be interviewed in Swahili

Exclusion: Females between the ages of 18-24 years, emerging male adults between 18-24 years who are unable to speak in English or Swahili. Emerging male adults without cellphone were excluded in the interviews.

Data Collection

Prior to the start of data collection, human subjects' approval was obtained from the University of Wisconsin-Milwaukee Institutional Review Board (IRB) and Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC). Data was collected from multiple sources namely, individual, focus groups and key informants. To protect the privacy of the respondents, they were strictly identified by serial numbers and not their names during the individual interviews and FGDs.

Data Management and Analysis

All written and digital information are kept in the strictest confidence and are inaccessible to anyone but members of the research team. Identifying information were removed from transcribed data and audio-recordings. The characteristics of the study respondents were analyzed using descriptive statistics and presented in tabular form. Qualitative data was transcripts were entered into MAXQDA software program for coding and qualitative data analysis in a password protected computer to avoid unauthorized access. Following the transcription of the interviews, the researcher read and reread the transcripts several times and making personal notes and reflections.

The transcribed notes along with field notes were subjected to line-by-line analysis by author paying close attention their viewpoint about facilitators and barriers of mobile phones in HIV prevention in rural settings in Kenya. The key words, phrases and descriptions from the participants were collated in the process of identifying the codes in an iterative process and shared with the major professor for validation. The convergence and divergence of data were noted in the process of developing the preliminary emergent themes. These themes were further interrogated and refined with a second review by the major professor.

Several methods were used to ensure to address rigor in the study. Data was collected from multiple approaches for triangulation and for raising trustworthiness of the findings and resolving any conflicting information The research context and the research assumption were described to enhance transferability, and the dependability of the findings was achieved through a detailed audit trail by the principal investigator. To establish confirmability, the results of the analysis were reviewed by all the authors as well as the major professor who are the experts in

the field of qualitative studies and HIV research for insightful constructive criticism of the data analysis and report writing before dissemination.

Ethical Consideration

This study was reviewed and approved by the University of Wisconsin- Milwaukee's Institutional Review Board (IRB) and Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC). Emerging adult men who met the criteria and consented to participating in the study were interviewed by the researcher. Prior to commencing the interview process, participants were informed of their right to terminate the interview at any time or drop out of the study. The researcher also reviewed the study informational sheet with the participant prior to beginning the interview to ensured understanding and informed consent. Participants received a $5 talk time voucher as appreciation for participating in the study.

Results

Socio-Demographic Characteristics of the Participants

As presented in table 7, most of the participants were not employed and rely on casual labor or family support to meet their daily basic needs. The average income per month for majority 22(73.3%) of the participants is less than Ksh 5000 (approximately $50) and they reported that this income in not adequate to meet their basic needs and sometimes rely on family and well-wishers for additional support. Most of the participants (96.7%) had at least secondary school education with and they were generally proficient inwritten and spoken English. About HIV status, 11 (36.7%) of the participants reported that they have never tested for HIV, 17 (56.7%) reported that they were negative and 2 (6.7%) were not willing to disclose their status, no participants reported to be HIV positive.

As presented in table 8, all the participants were owning a smartphone and the apps and technologies they commonly used are Facebook, WhatsApp, text messaging and emails. Only 6 (20.0%) were having a health App in the phone. The health-related apps some participants reported to have access were exercise and fitness reported by 5 (16.7%) and medications adherences/reminders reported by 1 (3.3%) participant. No one have even used an App for HIV education, prevention, and testing awareness but they all expressed their interest and willingness to use if guided on where to get them. However, all the participants were quick to point out that they were not ready spend money on purchasing apps considering that they are already faced with thought economic hardship. Another important use of cellphones reported by all the participants interviewed is send and receive money popularly known as Mpesa services in Kenya.

Table 7 The Demographic Data from the Participants Interviewed (n=30)

Variable	Categories of Variables	Count (X)	Percentage
Age (18-24)	18 Years	5	16.7
	19 Years	3	10.0
	20 Years	3	10.0
	21 Years	6	20.0
	22 Years	1	3.3
	23 Years	3	10.0
	24 Years	9	30.0
Marital Status	Single	25	83.3%
	Married	4	13.3%
	Separated/Divorced	1	3.3%
Number of Children	0	23	76.7%
	1	6	20.0%
	2	1	3.3%
Employment Status	Self-Employed	4	13.3%
	Not employed	12	40.0%
	Student	14	46.7%
Main Source of Income	Regular employment	0	0.0%
	Casual jobs	12	40.0%
	Support from family/friends	14	46.7%
	Self Employed	4	13.3%
Average Income/Month	< Ksh 5000	22	73.3%
	Ksh 5,001-10,000	7	23.3%
	Ksh 10,001-15,000	1	3.3%
Financial Situation	Barely adequate	13	43.3%
	Inadequate	17	56.7%
Level of Education	Primary	1	3.3%
	Secondary	21	70.0%
	Post Primary certificate Training	5	16.7%
	Associate Degree/Diploma	1	3.3%
	Bachelors	2	6.7%
Currently in College	Yes	15	50.0%
	No	15	50.0%
Current Living Situation	Rental a house/apartment	9	30.0%
	Family House	17	56.7%
	Spouse/Sexual partner	2	6.7%
	Student Hostel	2	6.7%
HIV Status	Negative	17	56.7%
	Positive	0	0.0%
	Not ready to Disclose	2	6.7%
	Never tested	11	36.7%

Table 8 The Mobile Phones related Data from the Participants Interviewed (n=30)

Variable	Categories of Variables	Count (X)	Percentage
Type of Cellphone	Basic Phone Smartphone	0 30	0.0% 100.0%
Most frequently used technologies and apps	Facebook Texting Twitter WhatsApp	12 8 2 8	40.0% 26.7% 6.6% 26.7%
Frequency of use of social network Apps	Daily Weekly	25 5	83.3% 16.7%
Whom to communicate with frequently	Friends parents/relatives Spouse/Lover	14 4 12	46.7% 13.3% 40.0%
Using cellphone to connect with others	Talking Texting Emailing Use of Apps	4 18 1 7	13.3% 60.0% 3.3% 23.3%
Other important uses of your cellphones	Mpesa (Money transfer)	30	100%
Amount of cellphone credit/Airtime per day	< Ksh 100 ($1) >Ksh 100 ($1)	30 0	100.0% 0.0%
How do you get/access internet?	Buy internet bundles from cellphone providers	24	80.0%
	Share internet with someone through hotspot	2	6.7%
	Public Wi-Fi	4	13.3%
How often do you find Information online?	Always Rarely/Sometimes Never	13 16 1	43.3% 53.3% 3.3%
Do you have a Health App in your Phone?	No Yes	24 6	80.0% 20.0%
If yes which Health App?	Exercise and Fitness	5	16.7%
	Medications adherences (tracking or reminders)	1	3.3%
How did you discover these apps?	Recommendation from Healthcare Provider	2	6.7%
	Recommendations from a friend/family/peer	2	6.7%
	Self-search/Discovery	2	6.7%
Which cellphone technology most appropriate for HIV education, prevention, and testing awareness?	Text Messaging Mobile web Mobile App	15 2 13	50.0% 6.7% 43.3%
Are you willing to purchase an HIV or health App in your Phone?	Yes No	0 30	0.0% 30%

Benefits of Mobile Phones in HIV and other Disease Prevention

The participants reported several benefits of using mobile phones accessing HIV and other health information in both the FGDs and individual interviews, these includes; decreasing the isolation of the young men in the rural community; making it possible for healthcare workers to provide real-time accurate health information in rural and marginalized areas where minimal or no health services exist. This will lead to increases awareness about HIV testing and prevention, makes care individualized, confidential and helps overcome stigma issues. For example, one participant during individual interview said

> *Having a mobile phone will help me subscribe to free messages and this way I can get information in my village about HIV or other diseases. This way we are not isolated from other young men living in urban areas where clinics are closer to them.*

A participant in FGDs said

> *I am grateful I have a mobile phone because I can easily call my friend who is a clinical officer and he can provide me with information about HIV or even COVID without having to travel to the clinic. We also have WhatsApp group which we share social and any relevant information interesting including reminding ourselves about condom use in sexual encounters.*

The other benefits of mobile phones in HIV prevention mentioned by young men interviewed were mobile phones improves quality, efficiency and cost-effectiveness of HIV and other diseases prevention in the community and it helps to reduce the frequency of unnecessary healthcare facilities visits. It is also an alternative for shy people who get nervous when visiting health facilities for HIV information or testing. The participants also reported that SMS and voice call will create HIV and AIDS awareness to many people within a short time frame. A participant in the individual interview said:

> *To me there are many health benefits of owning a mobile phone, which includes cutting down on unnecessary visits to dispensaries and using that time to look for employment. Sincerely I always feel nervous going to clinic for HIV information, some people might think I am already infected so getting information through my phone is the best option for me.*

Facilitators of Cellphones in HIV and other Disease Prevention

The major factors facilitating the use of mobile phones in accessing HIV and AIDS information reported by emerging male adults in rural Kenya include assurance of confidentiality, secrecy, easy retrieval of information, free, quick, and easy correspondence. The other facilitators reported by the participants includes positive attitudes and a willingness to use mobile phones to access HIV information by the young people. The mobile phone ownership as well as the type of mobile phone owned was another facilitator reported with the reason being having a smartphone will give you technology advantage of social network and accessing online HIV related information as opposed to others who only have a basic cellphone without smartphone features. One of the participants during the FGDs said:

> *I love my smartphone, I like the options which come with it including internet access, downloading of apps, receiving, and sending video and pictures through WhatsApp on or even sharing in Facebook. This gives me advantage of accessing health information including HIV data which other people without smartphone can't access easily.*

Another participant in the individual interview said:

> *These smartphones are making our lives easier brother, the world is a global village because of smartphones. My smartphones help me to connect with other young men in the country or even worldwide through mobile applications for example Instagram, Facebook, or WhatsApp. Through this people can share information on HIV prevention, comfort each other or even have financial support (through Mpesa) to each other at the time of need.*

Most of the participants in the individual interviews and FGDs wanted the apps to be free of charge so the he can be encouraged to use more often, for example a participant in the FGDs said:

I will be encouraged to use a health app which is free of charge and I am not willing to spend money to purchase an app. In my smartphone I have health and fitness app which I usually use to track my steps and I do not pay for it. The problem it comes with adds which is quite annoying, but I can tolerate that because it is free app.

The perceived ease of use of the smartphone was also reported as a facilitator to accessing HIV and other health information by young people in rural areas. The familiarity with the technologies and perceptions that these advanced technologies would offer convenience, of accessing HIV and AIDS information. One participant in the individual interview said:

I have TECNO android smartphone and I love it more than the Apple smartphones. Recently, my brother in the US bought me an apple phone and it was too complicated to use and I had to sell and then bought this one (TECNO android). I love android it is user friendly and even stronger in network coverage. I am sure I can receive and forward HIV related information with android compared to apple phone.

Anonymity of their identity was also an issue which will encourage young people to use their cellphones to access HIV information. Many participants were for the idea that they do not want to be identified as the person seeking HIV and AIDS information including testing. One participant in one of the FGDs said:

I don't want to use my phone where the nurse will know my number and even my name. If there is a way I can message or call the clinic for HIV information and testing without showing my name and number, then I will be comfortable using it.

It was also reported in the FGDs as well as individual interviews that the language used in some of the websites and apps is complex with medical jargon and not easily understood by a lay/non-medical person as one participant in the individual interview said:

Some websites and apps use big words medical terms." Making it boring and difficult to use especially with me who never proceeded with education beyond secondary school.

Most of the young men in the individual interviews and the FGDs suggested that they would like to see an app which not only cover HIV but also other common diseases like COVID-

19, cancer, diabetes, and hypertension important for their health and well-being, not necessarily one app targeted exclusively at HIV prevention and testing information. For example, one participant in the FGDs said.

> *I would love to have an app which not only cover HIV content but also other diseases like hypertension, cancer, diabetes, and COVID-19. This way you can easily get information in more than one disease instead of having multiple apps for each diseases/condition.*

Barriers of Mobile Phones in HIV and other Disease Prevention

The participants in the FGDs and individual interviews reported that they encountered multiple barriers when using the mobile health applications and internet in accessing HIV & AIDS and other health related information. We identified the following barriers to mobile health application use: cost of internet, unreliable internet connectivity, decreased technological literacy, poor telecommunication/network coverage, lack of electricity/power outage, trustworthiness of information obtained, and privacy concerns. One of the participants in the individual interview said:

> *One major barrier is the cost of internet access; it is expensive to have unlimited internet which makes access to HIV or other information online difficult sometimes*.

Another participant in the FGDs raised the barrier of lack of reliable electricity and the frequency of charging of smartphone as an obstacle in effective use of mobile phones for HIV information and awareness. This is what he said.

> *The electricity is not reliable in our village and the smartphones need frequent charging and it becomes a problem when you do not have reliable source of electricity.*

Other barriers reported include lack of continuous mobile phone or phone number retention due to financial instability, substance use, and theft. Some apps and internet sites might

give misleading information making it difficult to rely on them for HIV and AIDS information. For example, a participant in the individual interview confides:

> *I have never retained a single phone and a number for over one year because of two things, theft and misplacement when I am drunk and two I sell my phone whenever I am completely broke to get the cash to buy food or even alcohol or a cigarette to smoke and kill my stress.*

The complexity and having no option to verify the online materials related to HIV prevention was cited by some participants during the FGDs and individual interviews. Another participant in the FGDs said:

> *Some of the online information I access online might be fake and I do not have the means to verify them.*

Discussion

This study explored the benefits, facilitators and barriers associated with use of mobile phones by emerging male adult in rural Kenya in HIV prevention. All the young men interviewed were having a smartphone and motivated to access HIV information by SMS, through apps or internet search, meaning that this tool can be utilized not only in urban area but also in the rural setting for HIV information and awareness. The benefits of using mobile phones in HIV prevention includes providing real-time accurate health information in rural and marginalized areas leading to increases awareness about HIV testing and prevention.

A recent survey revealed that mHealth is popular among the youth in Africa and Asia, they are more likely to use mobile technology than their colleagues working in areas with more sophisticated infrastructures and easy internet access. Of those surveyed 99% believed the impact of mobile technology to be positive and 'revolutionary' in accessing healthcare information in resource limited areas (Aranda-Jan et al., 2014; Free et al., 2013; Jones et al.,

2014). To support use of innovative technology improve wellbeing of marginalized communities, in 2005 the World Health Organization (WHO) proposed the use of mobile health and other communication technologies to improve the quality of health care delivery particularly at the primary healthcare (PHC) level, as well as build health worker capacity in resource-poor countries (WHO, 2018).

The mobile phone is accessible in even the most remote areas of the world where oftentimes access to clean water, medical personnel or health facilities do not exist. Cellphones in its simplicity has already dramatically changed how societies and communities interact on a personal and professional level and the promise it offers health care is no less remarkable (Leach-Lemens, 2009; WHO, 2013). Another study in Kenya documented benefits of mobile phones in HIV prevention and testing in rural areas with over 80% uptake of HIV testing among those eligible clients in rural communities (Leach-Lemens, 2009).

As listed the facilitating the use of mobile phones in accessing HIV and AIDS information includes assurance confidentiality, secrecy, easy retrieval of information, quick and easy correspondence. Other studies conducted in Kenya and Tanzania is in support that many people is rural settings would prefer using mobile phones to access health related information because it assures privacy and address stigma related issues which is still prevalent in rural areas (Feroz et al., 2021; Lester et al., 2010; Ronen et al., 2018). Another popular facilitator mentioned by participants for use of mobile phones for accessing HIV and AIDS information is the inbuild security features in smartphones, several studies have reported that smartphones have inbuild security features including data encryption, device password lock, remote data wipe, remote device locator, and antimalware apps therefore providing a strong protection to users' privacy

and their sensitive data such as health records (Montag et al., 2015; Poushter, 2016; Zhou et al., 2019).

The perceive ease and familiarity with advanced technologies (e.g., social media and messaging apps) varied among participants and influenced their use of using mobile technologies. Some participants expressed greater perceived ease to use. The WhatsApp messaging apps was very popular among the young men interviewed and they reported using social media tools like Facebook or Instagram as back up measures to stay connected within their family and friends, especially if mobile phones are lost, stolen, or sold. This finding is supported by other studies in SSA where young people utilize apps like Facebook and WhatsApp tools for health information because of greater perceived ease of use (Boulos et al., 2011; Simoni et al., 2011; van der Kop et al., 2018; You et al., 2020).

Anonymity was also an issue which will encourage young people to use their cellphones to access HIV information. Many participants were for the idea that they do not want to be identified as the person seeking HIV and AIDS information including testing due to stigma and discrimination common in rural communities. Other studies have reported the similar challenge and future research should explore whether social media or other accounts (e.g., Facebook, twitter, telegram WhatsApp) independent of a phone number would be an acceptable way to increase use of mobile phones for HIV and other disease prevention in rural setting particularly in SSA (Aranda-Jan et al., 2014; Boulos et al., 2011; You et al., 2020).

Since emerging adults frequently use smartphones with internet access, this is a holds a great promise in the development of health interventions using mobile technology. Nonetheless, while young adults are interested in using applications and features on their phone, the language and interface needs to be tailored for their use (Pengpid et al., 2013; Punchoojit &

Hongwarittorrn, 2017). Our study findings indicated that mHealth technology targeted for young people must be designed specifically to meet their HIV information needs and avoid use of medical jargon which makes the information difficult to be understood and subsequently leads to loss of interest in using the mobile app ore even internet search of the information.

While the results of our study indicated that most of the health information needs are often met when they access online materials using their smartphones, it is important to educate young people who are heavy users of mobile technology and the Internet on how to verify their sources of information. This is supported by another article that stated that emerging adults and adolescents need to be educated about credible sources of health information so that they can be informed consumers of health information (Boulos et al., 2011; Poushter, 2016; Schnall et al., 2015). However further research on how emerging adults verify their sources of health information need to be explored further.

Mobile phones especially the smartphones can be influential if the flow of information is continuous. A participant suggested that the mobile phones experts should instead create a platform that allows for communication between individuals and the subject experts or healthcare provider in an interactive manner through apps or text messaging as supported by other research conducted in SSA (Lester et al., 2010; Smillie et al., 2014; van der Kop et al., 2018). The ability of users to communicate directly with HIV health care providers may present challenges in terms of cost and scalability of health apps. However, this could be highly effective at engaging users and directing them to appropriate HIV prevention and treatment services particularly in rural settings.

The power of social media like Facebook, Twitter, Instagram, and WhatsApp can be explored and utilized to spread HIV prevention messages and build social support networks

among young people. Some studies have used existing social media platforms, like Facebook, to deliver HIV-prevention interventions for youth (Bull, 2010; Holloway et al., 2017). In a pilot randomized controlled trial in Los Angeles, network ties among users increased over a 12-week period, which was associated with greater requests for HIV home testing kits and lower self-reported HIV risk behaviors(Wray et al., 2018). These findings support the integration of social media functionality in smartphones to increase engagement in HIV prevention and treatment among the emerging adults particularly in SSA(Bervell & Al-Samarraie, 2019; Taggart et al., 2015). However, stigma and discrimination might be a potential risk in use of social networks in creating HIV awareness, testing and care due to inadequacies in privacy settings.

mHealth utilization among the young people is not without challenges, particularly in the developing world. However understanding is needed about these challenges which includes data privacy, cost, technological literacy, internet and phone access in order address the barriers impeding the uptake of mHealth for improving young people HIV and other reproductive health information access and services in rural settings of SSA (Jones et al., 2014; Kruse et al., 2019; Zhou et al., 2019). The mHealth technology can help overcome most of the barriers including provider prejudice, stigmatization, discrimination, fear of refusal, lack of privacy and confidentiality, an embarrassment in seeking HIV services among the youth in rural areas. As supported by several studies, mHealth technology is an innovative approach to reach out to youth population and to engage them to provide acceptable, safe, cost-effective HIV prevention services (Aranda-Jan et al., 2014; Feroz et al., 2021; Mangone et al., 2016; WHO, 2018).

Limitations

Some limitations should be considered when evaluating the results of this study. Methodologically, this is a qualitative study using individual interviews and focus group

discussion and a mixed method study might have yielded more interesting experiences in this age group of participants. Data collection in the field took 6 weeks and data collection for a longer period and a longitudinal approach might yield more nuanced experiences from the participants. Most young people where in school/colleges at that time. This school season may have potentially affected the overall diversity of participants and reduced the overall numbers of emerging male adults who engaged in the interviews. Moreover, although the findings apply to young men in rural Eldoret, Kenya they might not be generically generalizable across rural settings in SSA. Generalizability is, however, rarely the intention of qualitative data collection.

In this study, most of the study participants had good health status even though we did not use health status as one of the selection criteria during screening. We understand that the findings could be significantly different if those with serious health problems and a strong desire to take advantage of the convenience offered by mHealth apps had been part of the population.

Implication for Nursing Practice

The mHealth will not only benefit inpatient care but also delivery of health education to the rural communities especially in geographic distant locations and provides access to information to marginalized and geographically isolated client. The findings from this study recommends innovative ways in which nurses intervene, access health information, and communicate with patients in hard to reach settings, thus enhancing prevention, diagnosis, and treatment of illness and health promotion in venerable populations.

The telehealth and teleconsultation have been noted to benefit the patient care in underserved areas and facilitate management of not only for HIV but also other chronic diseases complications like diabetic and hypotensive complications in rural settings where accessing a healthcare provider is usually difficult. The mobile devices and telehealth platforms help nurses

to answer patient questions about health concerns and treatment and cut down on traveling for patients and in the long run lead effectiveness community health interventions.

Conclusion

Emerging male adults were receptive and acknowledge several benefits of use of mHealth technology for creating awareness about HIV prevention and testing, but they also described many barriers. Future work must strongly consider health privacy and ensure that the young people who are at greatest risk of HIV infection are not systematically excluded from programming and research requiring mHealth technology. While there is extraordinary potential for healthcare interventions leveraging technology among emerging male adult population in rural settings in SSA, substantial barriers remain and the views, opinions, and participation of emerging male adults must be primary throughout the design and implementation.

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CHAPTER VI: SYNTHESIS AND DISCUSSION

Overview

This chapter analyzes the findings reported in the two manuscripts and discusses their implications for research, policy, and practice. Consistent with a socioecological model and the theory of emerging adulthood emphasis will be placed on socioecological context and unique issues affecting the emerging male adults in rural setting in Kenya in the and recommendation with the aim of driving HIV prevention needs and social change. This study was a descriptive qualitative study of emerging male adults' use of mobile technology in HIV prevention in emerging adults in rural setting in Kenya as reported in the findings section.

Due to ongoing high HIV prevalence among the young people in SSA, and limited HIV prevention efforts focus on young men , this study sought to answer the following specific questions: 1) What are the HIV prevention and testing needs of emerging male adults in rural Kenya? 2) What are the factors that facilitate the use of mobile phones in HIV prevention and testing awareness among emerging male adults? and 3) What are the barriers in the use of mobile phones in HIV prevention and testing awareness among emerging male adults? These research questions are adequately answered as demonstrated in manuscript 2 and 3 that there are unique risk factors predisposing emerging male adults to HIV acquisition risk and how mobile phones can be explored as a cost-effective intervention for HIV prevention for this group. In this final chapter, I will begin with an overview of the important contributions from each chapter, share some of my own views about the process of conducting this qualitative research, and outline the ways we can further utilize the work presented here to support nursing research, practice, and health care policy.

As described in Chapter 1, HIV and AIDS is currently the leading cause of death among young people aged 15-24 years in SSA (Odaga, 2012; UNAIDS, 2020b). This is a serious public health issue which need urgent interventions locally, regionally, and internationally to save the emerging adults from the HIV pandemic. On the other hand the youth particularly the emerging adults are the greatest users of cellphones globally (GlobalComms, 2015; Pettifor et al., 2013), and owing to the wider access and acceptance of mobile phones among the youth in SSA , this technology has an untapped cost-effective potential for HIV prevention (Aker & Mbiti, 2010; Brown et al., 2013; Wesolowski, Eagle, Noor, Snow, & Buckee, 2012). This chapter also reports the positive health-related outcomes of mobile health technologies and many authors posits that the success especially in low resource settings is based on the accessibility, acceptance and low-cost of the technology (Aranda-Jan et al., 2014; Barsky et al., 2019; Betjeman et al., 2013).

Chapter 2, is a manuscript that is published at the *International Journal of Health Promotion and Education,* a systematic review of the literature to understand the current practices and gaps in HIV prevention for emerging adult population in SSA and reviews the current state of mHealth in in SSA and how this innovative approach can be tapped in HIV awareness and prevention among the emerging adults. The review of literature in this chapter included the following themes; (1) Risk factors for HIV transmission in emerging adults in SSA, (2) Social and structural drivers for acquisition and transmission of HIV, (3) Combination HIV prevention with focus on emerging adult population from SSA, (4) Using new tools and technology in HIV prevention.

Chapter 3 provides a review of the conceptual, theoretical, and philosophical foundations underpinning the dissertation study. The theoretical and conceptual framework for the study was guided firstly by Modified Social Ecological Model (MSEM) to help visualize multi-level

domains of HIV infection risks (Baral et al., 2013), and directs the development targeted interventions including using mobile phones as a vehicle for awareness and prevention messages to emerging adults (Arnett, 2000). The MSEM builds on existing frameworks by examining multi-level risk contexts for HIV infection and situating individual HIV infection risks within wider network, community, and public policy contexts as well as epidemic stage (Baral et al., 2013). The concepts from theory of development of emerging adults outlines emerging adulthood as a period from the late teens through the twenties, with a focus on ages 18-25 marked by the formation of identity, the establishment of more mature and consistent intimate relationships which might increase vulnerability to sexually transmitted infections including HIV infections to this age group (Arnett, 2000, 2014).

In Chapter 4, the methodology the descriptive qualitative design is explained and how it was applied in the study. The descriptive qualitative research method is aimed at describing individual experiences in a certain phenomenon. This methodology has been widely applied in health research to explore a variety of topics, it is considered as a useful and valuable research method for understanding health care from the patient or service user perspective (Biggerstaff & Thompson, 2008; Brocki & Wearden, 2006). Semi-structured interviews and focus group discussions were used to examine the experiences of emerging adults in the use of mobile phone in HIV testing and prevention in rural Kenya. This chapter is organized into the following subheadings: Study design, Recruitment and Data Collection plan, sample, Instruments and Measures, Data Management and Analyses, Limitation of Proposed Research, Strengths of proposed research. Finally, means used to assure trustworthiness and protection of participants will be discussed.

Finally, Chapter 5 provided a description of the findings and discussions formatted in two manuscripts. The 2nd manuscript will be *Addressing the unique needs of emerging male adults in HIV prevention in rural setting in Kenya*. It is formatted based on the author's guidelines for the *SSM - Population Health*, a companion journal to Social Science & Medicine as the target journal for publication. The manuscript starts with the introduction and summarizes pertinent literature on unique prevention and testing needs in emerging males in SSA. The modified social-ecological model (MSEM) is utilized to visualizing multilevel domains of HIV infection risks and identify barriers and opportunities in prevention unique to emerging adults in rural communities

The emerging male adult's HIV access and prevention opportunities were described under the major theme "addressing the unique needs of emerging male adults in HIV prevention in rural setting", and under this major theme, initial codes were collated, resulting in the four sub themes consistent with MSEM model which are: 1) Individual HIV acquisition risk factors which are negative attitude towards condom use, alcoholism and other substance abuse. 2) Interpersonal and Social HIV acquisition risk factors which includes peer influence, multiple sexual partners, cultural practices, lack of family and social support. 3) Healthcare system related HIV acquisition risk factors which are long distance to healthcare facilities, unwelcoming attitudes of healthcare workers offering HIV preventive services. 4) Policy related issues increase the risk for HIV acquisition and transmission which includes widespread unemployment among the youth, Payment of HIV testing services in some health facilities, and lack of HIV prevention course in the colleges and universities framework. The results are then analyzed based on the identified themes, then implications to nursing and public health research, practice, and policy are discussed.

The 3rd manuscript is entitled the *Benefits, Facilitators and Barriers to the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings. This manuscript* reports the benefits, facilitators and barriers in to the use of mobile phones in HIV and other disease prevention by emerging adults in rural settings It is formatted based on the author's guidelines for *Journal of Health Informatics in Developing Countries*, the target journal for publications. The manuscript starts with introduction and gives a summary of pertinent literature on mobile health technology and their application in HIV prevention with focus to emerging adult population in SSA setting. The results from the 30 in-depth interviews and 3 Focus Group Discussions are then analyzed and discussed based on the content themes.

The salient factors facilitating the use of mobile phones in accessing HIV and AIDS information by emerging male adults in rural Kenya includes assurance of confidentiality, secrecy, easy retrieval of information, free, quick, and easy correspondence. On the other hand, several barriers associated with using the mobile phones and internet in accessing HIV & AIDS related information which includes the cost of internet, unreliable internet connectivity, decreased technological literacy, poor telecommunication/network coverage, lack of electricity/power outage, trustworthiness of information obtained, and privacy concerns. Finally, the implications to nursing and public health research, practice and policy are discussed.

Reflection and Discussion

The main aim of the dissertation study was to understand the needs, barriers, and facilitators of using mobile phone applications/technology for accessing HIV prevention and testing information by emerging male adults in rural Kenya setting thus, increases awareness of the in use of mobile technology in HIV prevention. Based on a modified socioecological model and theory of emerging adulthood, our analysis reveals that many young men in resource constraint rural areas, such as rural Kenya, have numerous needs and are faced with myriad of barriers to access and utilization of HIV and AIDS health services. The young men reported several factors which heighten their risk to HIV acquisition in the rural setting. These factors include, negative attitude towards condom use, Alcoholism, peer influence, multiple sexual partners, cultural practices, long distance to healthcare facilities and unwelcoming attitudes of healthcare workers offering HIV preventive services.

Why the emerging adult males

This study is a result of our work with young adults in HIV prevention and care in East Africa. This study found out that many particularly young men are equally affected with HIV as female counterparts, however very few HIV prevention programs in rural settings in East Africa offered targeted preventive interventions to this group. In East Africa and generally Sub-Saharan Africa, the focus of the epidemic has historically been on women and children because of biological factors, their reduced sexual autonomy, and men's sexual power and privilege over them (Higgins et al., 2010; Mills et al., 2012; Mkandawire-Valhmu et al., 2013). This has led HIV/AIDS public health prevention and treatment campaigns to focus on women and children and leaving out men, especially young men from prevention and treatment programs in Sub-Saharan setting (Mills et al., 2012; UNAIDS, 2019c).

The HIV response in Sub-Saharan Africa has been far less successful for the prevention and treatment of men and there is less Antiretroviral treatment (ART) coverage for men compared to women in Africa (Mantell et al., 2019), also evidence shows that men typically have higher mortality (Adeyeye et al., 2018). Additionally, men also tend to present at clinic with advanced disease and are more likely to be lost to follow-up (Mills et al., 2012). Engaging men, especially young men, in HIV Prevention and Treatment including using mHealth in HIV prevention and seeking their opinions on facilitators and barriers to use of mHealth in HIV prevention is crucial and this formed the impetus to development of this study. Therefore, funding and research organizations need to recognize the social and health impacts associated with not engaging men in primary and secondary HIV prevention campaigns and rethink more male focused intervention to address HIV prevention from a holistic approach (Mills et al., 2012; UNAIDS, 2019c).

Factors Contributing to Increase in HIV Infection Rate Among the Emerging Adults

As there might be many factors contributing to increase in HIV infection rate among the young people, some factors reported by participants in this study includes: the inadequate knowledge about the virus and engage in risky sexual behaviors that increase their chances of infection this is also supported by other studies conducted in similar settings in Africa (Kharsany & Karim, 2016; Kibel et al., 2019; Ssewanyana et al., 2017). In Kenya for example, the latest findings indicate that all new HIV infections reported in Kenya in 2019 occurred among Adolescents and Young Adults (AYA's) aged between 15-24 years (Mureithi F, 2019).

This is largely because young people tend to have little knowledge about the virus and engages in risky sexual behaviors that increase their chances of acquiring HIV (Kharsany & Karim, 2016; Kibel et al., 2019; Ssewanyana et al., 2017).The poor utilization barriers in young

people were reported in this study to included lack of youth friendly tailored services, unwelcoming attitude from healthcare providers, long wait-time for appointments, inconvenience of clinic visiting hours and including weekend and evening hours might help address this challenge.

Use of Social Media in HIV/AIDS Awareness

The findings indicated that social media is widely used by the emerging adults even in rural settings. The power of social media like Facebook, Twitter, Instagram, and WhatsApp can be explored and utilized to spread HIV prevention messages and build social support networks among young people. Some studies have used existing social media platforms, like Facebook, to deliver HIV-prevention interventions for youth in resource limited settings (Bull, 2010; Holloway et al., 2017).

These findings support the integration of social media functionality in smartphones to increase engagement in HIV prevention and treatment among the emerging adults particularly in SSA (Bervell & Al-Samarraie, 2019; Taggart et al., 2015). However, stigma and discrimination might be a potential risk in use of social networks in creating HIV awareness, testing and care due to privacy challenges associated with social media.

Smartphone Ownership in Rural Setting

Findings suggested that majority of the emerging adults in rural settings own a smartphone and this can be tapped as a cost-effective smartphone-based technology intervention in creating awareness in HIV prevention and testing among the young people. As reported in the manuscript discussion, the mobile health interventions are critical for reversing the HIV epidemic particularly in emerging adults in rural settings who carry the highest burden for HIV infection and at the same time constitute the highest rate of users of mobile and smartphones in

SSA (Holloway et al., 2017; Mangone et al., 2016; M. Njoroge et al., 2017). The mHealth intervention may be useful for bringing multifaceted HIV prevention strategies that are cost-effective compared to other interventions particularly in resource limited settings (Betjeman et al., 2013; Noar, 2011).

What follows are the implications of this study for nursing research, clinical practice, and health care policy. In addition to the policy and practice recommendations outlined in each manuscript, this section proposes broader changes based on the research findings.

Implications for Nursing Research

The research centered about experiences of rural emerging male populations in western Kenya, and how they are faced with myriad of risk factors and challenges in accessing and utilizing HIV information and prevention services. The factors associated with the use of mobile health to bringing a multifaced cost-effective HIV prevention in resource limited settings is also discussed. The positive potential for m-health is huge and more rigorous research and evaluation is including clinical trials and qualitative research is needed because the evidence for the value of m-health remains scarce, especially in SSA (Aranda-Jan et al., 2014; Bardosh et al., 2017). In fact, development of mHealth technologies is currently progressing at a much faster pace than the science to evaluate their validity and efficacy, introducing the risk that that ineffective or even potentially harmful applications will be implemented (Doswell et al., 2013).

As reported in chapter 5, manuscript 2, the participants reported lack of important HIV transmission and prevention knowledge indicating a gap in prevention among young people in the rural areas in Kenya and generally in SSA. Therefore, more research needs to be conducted to include emerging adults' knowledge and behavioral change strategies for HIV in rural areas. There are multiple risk factors for HIV transmission in rural setting, notably alcohol and drug

abuse were common, and this can be another area of research to identify ways of addressing this as an upstream factor in HIV prevention

In Chapter 5, manuscript 3, the participants were interested in mobile app not only for HIV but also other diseases prevention like cancer, diabetes, hypertension or ever use in alcohol intake or cigarette use addition programs. This is another of research area which need to be explored further in disease prevention informatics to possibly come with an app which can be used to share prevention information for multiple diseases instead of a single disease prevention app. This will also be cost-effective because the target population will not necessarily have to have multiple apps to access health information in their smartphones. Other areas for mHealth research are use of mobile phones in Covid-19 treatment and prevention. Participants also inquired if there is an app which can help them answer questions about Covid-19 because in the villages they get a lot of conflicting information about Covid-19 treatment and prevention.

Up to date, there is very limited research evidence, within the theoretical framework of emerging adulthood, regarding HIV prevention in SSA. Based on my research experience in interview questions development and conducting of interviews in the field, the theory of emerging adulthood is crucial in guiding the development of age sensitive questions specific to emerging adult population. Most questions were around sexuality and therefore theory of emerging adulthood ensured that the researcher was sensitive to their culture and developmental stage. It will be beneficial for the nursing and public health researchers to consider this theory especially in sexual and reproductive health research targeting young people in rural setting.

My decision to use qualitative research is influenced by my desire to approach HIV prevention among emerging male adults from their local context and elicit their own views on what their health needs are regarding HIV prevention. One undertakes qualitative research in a

natural setting where the researcher is an instrument of data collection who gathers words or pictures, analyzes them inductively, focuses on the meanings for participants and expresses analytic results in richly descriptive and persuasive language (Kako et al., 2013). Qualitative research has and will continue to demonstrate utility in the field of HIV/AIDS research, where many of the social phenomena being studied are personal, intensely private, and sometimes illicit, or not well studied (Power, 2002). Many current studies on mHealth and HIV prevention has been primarily quantitative and positivist in nature; little of the existing work on mHealth explores their qualitative dimensions from user perspective (Chen, 2018; Pereira, 2012; Rashid-Doubell et al., 2016), however provided an alternate method of investigating technology and society particularly in regard to accessing HIV prevention and testing information and services which can be explored further by health informatics researchers.

With increasing economic and technological advancements in SSA, this study provides a catalyst for development of sustainable mobile health research and solutions in improving HIV and other disease prevention through mobile phones. The HIV prevention research gaps for young and emerging adults in the assessment and utilization of technology particularly cell phones interventions in the rural areas persist (Pettifor et al., 2013), and this is an area which call for further studies on how mobile phones can be utilized in HIV prevention among the young people who are the greatest users of mobile technology in SSA. The HIV infection in emerging adult male population is underreported because they have lower involvement in prevention and rate of HIV testing compared to female counterparts. Therefore, more HIV research targeting testing and prevention awareness need to be conducted on this population because encouraging men to get tested and treated is a major challenge, but one that is poorly recognized and addressed by existing literature.

Implications for Nursing Practice

This study found out that stigma and discrimination associated with HIV is still rampant in the rural communities and nurses and healthcare workers must be in the frontline to change the narrative. Stigma is driven by a social and psychological process and its manifestation includes negative, hostile, and derogatory language, as well as disrespect when attending to HIV and AIDS clients in the health facilities (Nyblade et al., 2018; Pinto-Foltz & Logsdon, 2009). On an individual level, nurses can advocate for clients. Since nurses provide most of the care in resource limited areas and are usually the first entry point for patients accessing care, by advocating for patients/clients they can ensure all healthcare workers are free from stigmatizing attitudes (Pinto-Foltz & Logsdon, 2009). This includes careful attention to use of language, discriminating behaviors, and advocating for clients who might not receive the full scope of treatment because of stigma and discrimination. Registered community health nurses may lead stigma-reduction efforts by investigating and conducting more studies on stigma and implementing stigma-reducing interventions at health facility or community level (Kimera et al., 2020; Mburu et al., 2013; Nyblade et al., 2018).

The telehealth and teleconsultation has also been noted to benefit the patient care in rural areas and also helpful to the healthcare workers because it facilitated greater equity and efficiency in healthcare delivery, specifically facilitating equitable access to care in underserved areas, improving referral mechanisms, reducing healthcare delivery cost and time, and increasing access to data for decision-making (Fry et al., 2020). In a study in rural settings in Kenya, teleconsultation and text messaging is reported to facilitate management of not only HIV but also other chronic diseases complications like diabetic and hypotensive complications in rural settings where accessing a healthcare provider is usually difficult (Kurji et al., 2013; Nanji et al., 2020).

The mobile devices and telehealth platforms help nurses to answer patient questions about health concerns and treatment, ease their hospital stay, communicate quickly with doctors, and facilitate clinical procedures and tests (Wicklund, 2018).

The mHealth are not only for patient care but also for delivery of nursing education to nursing students, providing a means of communication between healthcare professionals located close and at greater geographic distances, and provides access to information and personal monitoring for geographically isolated clients (Doswell et al., 2013). The capabilities and functions of the smartphone may be adapted for use in nursing education in both the classroom and clinical areas as well. The mHealth technologies are changing the ways in which nurses intervene, access health information, and communicate with patients and other care providers, thus enhancing prevention, diagnosis, and treatment of illness and health promotion (Aranda-Jan et al., 2014; Betjeman et al., 2013; Doswell et al., 2013).

Implications for Health Policy

The study to identifying factors associated with effective use of mobile phones in creating HIV prevention awareness by emerging adult males in rural Kenya has a potential to inform the public health policy on effective use of mobile phones in HIV prevention and further research and theory development not only to this age group but also to other marginalized groups faced with similar problems. Based on my experience in conducting this study, there is no policy or guidelines for Health research and interventions in Kenya and the rest of SSA countries therefore, every country in SSA need to develop guidelines to support research to develop and test the flood of health apps to assist clients in the management of their health.

The public health policy includes laws and policies which form the general framework for shaping the risk of marginalized populations including emerging adults in rural communities

and it involves the local, national, regional and global laws and policies (Baral et al., 2013; Mechael et al., 2010) . The presence of restrictive policies in the allocation of national resources for adolescent and young adults for example high fees for health services or lack of policies that mitigate youth unemployment was commonly reported by participants interviewed as heightening their risk for acquisition of HIV. Or the other hand the as part of HIV prevention policy among the sexually active in Kenya, the government aims at providing condoms to all those sexually active (KDHS, 2021). This has not however been a reality in terms of consistent condom access by sexually active young people in rural settings as reported by the findings of this study.

Generally, the government policies influence the allocation of resources to education, health care and HIV prevention services and therefore play a substantial role in shaping structural contexts of HIV risk to all age groups. (Baral et al., 2013; Houle et al., 2018; K. Njoroge et al., 2010; WHO, 2020). The healthcare professionals in the policy making and influence arenas will play a big role in shaping healthcare resource allocation and in this light to this, the nurses should join government policy making discussions, informatics committees in their workplace, and become leaders in innovation by becoming nurse scientists and healthcare informatics experts to advance the important agenda of mHealth in diseases prevention agenda.

Conclusion

This dissertation study has provided important contributions to the field of mobile health and HIV prevention for emerging male adults in rural settings. The mobile phones have a great potential to offer increased access to HIV prevention resource and healthcare in general for emerging male adults. It is crucially important to work in partnership with young people, who are often at the forefront of emerging practices and who know better than anyone else what these

might mean for them. The potential for m-health to transform formal healthcare provision, especially in geographically remote areas in Sub-Saharan Africa is huge. We therefore need to think urgently about how young people might be facilitated to use mobile phones effectively and safely in relation HIV and other diseases prevention. This study has a great potential to inform the public health policy and healthcare informatics on cost-effective use of mobile phones in HIV prevention not only to this age group but also to other age groups faced with similar challenges as we work to reach and sustain an AIDS-free generation.

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APPENDIX A: UWM Institutional Review Board Approval Letter

UNIVERSITY of WISCONSIN
UWMILWAUKEE

Department of University Safety & Assurances

Melody Harries
IRB Administrator
Institutional Review Board
Engelmann 270
P. O. Box 413
Milwaukee, WI 53201-0413
414-662-3544

uwm.edu/irb
harries@uwm.edu

Continuing Review - Notice of IRB Expedited Approval

Date: April 14, 2021

To: Peninnah Kako
Dept: Nursing

CC: Augustine Kiplagat

IRB #: 20.248
Title: Use Of Mobile Phones For HIV Prevention and Testing Information Needs By Emerging Adult Male Population In Rural Kenya. A Qualitative Study

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has received continuing approval as minimal risk Expedited under Category 6 & 7 as governed by 45 CFR 46.110.

This protocol has been approved on **April 14, 2021** for one year. IRB approval will expire on **April 13, 2022**. If you plan to continue any research-related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, a Continuation for IRB Approval must be filed by the submission deadline. If the study is closed or completed before the IRB expiration date, please notify the IRB by completing and submitting the Continuing Review form found in IRBManager.

This study may be selected for a post-approval review by the IRB. The review will include an in-person meeting with members of the IRB to verify that study activities are consistent with the approved protocol and to review signed consent forms and other study-related records.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. You are responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records, and promptly reporting to the IRB any adverse events which require reporting. You are also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

It is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation, and best wishes for a successful project!

Respectfully,
Melody Harries
Melody Harries
IRB Administrator

APPENDIX B: Approval from MTRH/Moi University Research and Ethics Committee

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2020/78
Approval Number: 0003673
Augustine B. Kiplagat,
University of Wisconsin-Milwaukee,
College of Nursing,
P.O. Box 413,
MILWAUKEE,WI.53201.

24th September, 2020

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
24 SEP 2020
APPROVED
P. O. Box 4606 - 30100 ELDORET

Dear Mr. Kiplagat,

USE OF MOBILE PHONES FOR HIV PREVENTION AND TESTING INFORMATION NEEDS BY EMERGING ADULT MALE POPULATION IN RURAL KENYA: A QUALITATIVE STUDY

This is to inform you that ***MU/MTRH-IREC*** has reviewed and approved your above research proposal. Your application approval number is ***FAN: 0003673.*** The approval period is ***24th September, 2020 – 23rd September, 2021.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MU/MTRH-IREC***.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***MU/MTRH-IREC*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***MU/MTRH-IREC*** within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to ***MU/MTRH-IREC.***

Prior to commencing your study; you will be required to obtain a research license from the National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and other relevant clearances. Further, a written approval from the CEO-MTRH is mandatory for studies to be undertaken within the jurisdiction of Moi Teaching & Referral Hospital (MTRH), which includes 22 Counties in the Western half of Kenya.

Sincerely,

DR. S. NYABERA
DEPUTY-CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc	CEO	-	MTRH	Dean	-	SOP	Dean	-	SOM
	Principal	-	CHS	Dean	-	SON	Dean	-	SOD

An ISO 9001:2015 Certified Hospital

MOI TEACHING AND REFERRAL HOSPITAL

Telephone :(+254)053-2033471/2/3/4
Mobile: 722-201277/0722-209795/0734-600461/0734-683361
Fax: 053-2061749
Email: ceo@mtrh.go.ke/directorsofficemtrh@gmail.com

Nandi Road
P.O. Box 3 – 30100
ELDORET, KENYA

Ref: ELD/MTRH/R&P/10/2/V.2/2010

29th September, 2020

Augustine B. Kiplagat,
University of Wisconsin-Milwaukee,
College of Nursing,
P.O. Box 413,
MILWAUKEE,WI.53201.

APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Use of Mobile Phones for HIV Prevention and Testing Information Needs by Emerging Adult Male Population in Rural Kenya: A Qualitative Study".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

MOI TEACHING AND REFERRAL HOSPITAL
CEO
APPROVED
29 SEP 2020
SIGN
P.O. Box 3-30100, ELDORET

29/09/2020

DR. WILSON K. ARUASA, *MBS*
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

cc - Senior Director, (CS)
- Director of Nursing Services (DNS)
- HOD, HRISM

APPENDIX C: NACOSTI Approval Letter

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **871986**

Date of Issue: **15/October/2020**

RESEARCH LICENSE

This is to Certify that Mr.. Augustine Boswony Kiplagat of University of Wisconsinâ€“Milwaukee, has been licensed to conduct research in Uasin-Gishu on the topic: Use Of Mobile Phones For HIV Prevention and Testing Information Needs By Emerging Adult Male Population In Rural Kenya. A Qualitative Study for the period ending : 15/October/2021.

License No: **NACOSTI/P/20/7072**

871986

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

APPENDIX D: Demographic Survey Questions

Participant code……

1. **What is your age? _____**

2. **What is your marital status?**

Single ○ Married ○ Separated ○ Divorced ○ Widowed ○

3. **Number of children (if any)?** ……..

4. **What is your professional or Employment Status?**

Employed fulltime □ Employed part-time □ Self-employed□ Not employed□ Student□

Other (Specify)……

5. **Main Source of income in the past 6 months**

Employment (full-time) ○ Casual/Parttime employment ○ Upkeep/support from family, charity organizations or well-wisher's ○ Self-employed ○ Other ○ Specify……..

6. **Your average income per month**

Less than KSH 5,000 per month (less than KSH 60,000 per annum) ○

KSH 5,001-10,000 per month (KSH 60,001- 120,000 per annum) ○

KSH 10,001-15,000 per month (KSH 120,001- 180,000 per annum) ○

KSH 15,001- 20,000 per month (KSH 180,001- 240,000 per annum) ○

KSH 20,001- 25,000 per month (KSH 240,001- 300,000 per annum) ○

KSH 25,001- 30,000 per month (KSH 300,001- 360,000 per annum) ○

More than KSH 30,000 per month (>KSH 360,000) ○

Refused to disclose income ○

7. **What is your financial situation?**

I have enough Money to live comfortably ○ I can barely get by on the money I have ○
It is inadequate to meet my basic needs ○

8. **What is the highest degree or level of education completed? If currently enrolled, highest degree received?**

Primary ○ Secondary/High School ○ Trade/technical/vocational

Training ○ Associate degree/Diploma ○ Bachelor's degree ○ Master's degree ○

9. Are you currently a student? ____ If yes, which course are you pursuing and at what level?

……..

10. **What is your current living situation?**

Own house ○ Rental house or apartment ○ Family member's house ○

Friend's house or apartment ○ Living in spouse or lover or sexual partner's house, or apartment○

Student Hostel ○ Other ○ Specify……

11. Which kind of cellphone do you have/own?

Basic Cell Phone ○ Smartphone ○

12. How often/frequent do you use your phone on daily basis?

How frequent do you use the following feature in your mobile phone?	**Often**	**Sometimes**	**Rarely**	**Never**
Downloading and using applications including Health apps: May include social network applications, healthcare applications, music applications, games, applications to help organize better, Calendar, etc. Please specify the App	O	O	O	O
-Facebook	O	O	O	O
-Instagram	O	O	O	O
-Twitter	O	O	O	O
-WhatsApp	O	O	O	O
-Telegram	O	O	O	O
Text messaging	O	O	O	O
Making Phone calls	O	O	O	O
Mobile web (internet access)	O	O	O	O
Money transfers (Mpesa/AirtelMoney)	O	O	O	O
Emails	O	O	O	O
Other-	O	O	O	O
Other-	O	O	O	O
Other-	O	O	O	O
Other-	O	O	O	O
Other-	O	O	O	O
Other-	O	O	O	O

13. How would you rate the ease of using the following cell phone technologies in your phone? *Check all that apply. Check never used if you have never used any of the mobile technology listed*

How would you rate the ease of use of the following feature in your mobile phone?	**Easy**	**Difficult**	**Never used**
Downloading and using applications including Health apps: May include social network applications, healthcare applications, music applications, games, applications to help organize better, Calendar, etc... Please specify the App	O	O	O
-Facebook	O	O	O
-Instagram	O	O	O
-Twitter	O	O	O
-WhatsApp	O	O	O
-Telegram	O	O	O
Text messaging	O	O	O
Making Phone calls	O	O	O
Mobile web (internet access)	O	O	O
Money transfers (Mpesa/AirtelMoney)	O	O	O
Emails	O	O	O
Other-	O	O	O
Other-	O	O	O
Other-	O	O	O

14. Whom do you communicate with frequently with your mobile phone: (check all that apply)?

Friends O Parents/relatives O Spouse or lover O Casual sexual partner O
Roommate O Family of origin O others O, specify ……..

15. How do you use your mobile phone to connect with people? (Check all that apply)

Talking○ Texting○ Email○ Apps○ Websites○ Other○**, s**pecify…….

16. What is the average amount of money (in Kenya Shilling) do you spend on airtime credit per day for your daily Phone use?

Less than KSH 100 ○
KSH 100-499 ○
KSH 500-999 ○
KSH 1000-1,999 ○
More than KSH 3000 ○

17. How do you get internet in your cell phone (Check all that applies)?

Internet bundles from cellphone service providers ○ Share Someone's Internet ○
Find Public Wi-Fi (e.g., at a library) ○ Other○**,** Specify…….

18. Which other communication devices do you use (check all that apply)?

Laptop ○ Desktop computer ○ Tablet ○ Public computer (e.g., at a library) ○

Other○, Specify……..

19. Which Social networking app do you usually use (check all that applies)?

Facebook ○ Twitter ○ Instagram ○ WhatsApp ○ Snapchat ○ Other○,Specify.…….

20. What is the frequency of social networking app use to connect with people?

Daily ○ Weekly ○ Monthly ○ more than a month ○

21. How often do you find information online?

Always ○ Sometimes ○ Never ○

22. Do you have a health-related app in your phone?

Yes ○

No O

i. If yes which one? Check all that apply

HIV/AIDS/STD prevention. Care and treatment O
Exercises, fitness, pedometer etc. O
Medications management (tracking, reminders etc.) O
Diet, food, calorie counter, weight management etc. O
Wellness (Sleep, mood, quit smoking, quit alcoholism etc.) O
Other, Specify…… O

ii. How did you `discover`/learn about these App/Apps.

Healthcare provider recommended O
Peer/Friend/Family recommended O
Self-search/discovered by self O
Recommended in school/College O
Other, Specify…… O

23. Which cell phone technologies do you think would be the most appropriate means for HIV *education, prevention and testing for young adults? Check that apply*

Text messaging O
Phone calls O
Mobile web O
Use of mobile app O
Other (specify)……. O

24. Have you tested for HIV? Yes O No O

If yes, what is your HIV status? HIV positive O HIV negative O Not ready to disclose O

APPENDIX E: In-depth Interview Questions

Participant code……

1. Which activities do you normally engage/do on a daily basis to meet your personal and family needs?

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……
……

2. Tell me what you know about HIV & AIDS and when you first heard about it?
   [Probe, if participant says it is sexually transmitted] What kind of sex and what do you think you can do to keep from getting HIV during sex?

   ……
   ……
   ……
   ……
   ……
   ……
   ……

3. Where do you normally get information about HIV and AIDS?

   ……
   ……
   ……
   ……
   ……
   ……

4. What do you think, prevents young males from accessing HIV and AIDS information and services from Hospital/Health care facility? *Prompt if necessary: Shyness, fear, Distance, Unknown locations, stigma and discrimination, Costs etc.*

……
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……
……

5. If you have ever tested for HIV, please briefly describe how the process was like? *Prompt if required: the provider was friendly, privacy, psychological support, connection to required resources, the length of the counselling and testing,*

……
……
……
……
……

6. How is it like, being a youthful male in this community? *Prompt if required: family responsibilities, community expectations, unemployment, supporting aging parents, exploration, change of sexual partners and predisposition to HIV infection.*

……
……
……
……
……

7. Please tell me about your thoughts as factors or reasons that predisposes you or other young men to HIV infection in your community

   Prompt if required: exploration, Frequency of sexual partners, lack of male circumcision, poverty, unemployment, drug abuse, alcoholism, negative attitude towards condom use,

prevalence of HIV infection, inadequate knowledge about HIV prevention, alcoholism, leisure travels and holidays, staying away from your partner due to transfers or seeking new employment opportunities, mobile phones lead to easy access to sexual partners, stress, Lack of Parental Monitoring.

NB: categorize participant responses as per MSEM: i.e. individual/intra-personal, interpersonal, Institutional/Community, Socio-cultural/Policy factors

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8. You mentioned the above factors which predisposes young people to HIV infection, what are your thoughts on how to overcome these challenges and help you or other young men to stay HIV negative?

   Prompt if required: widespread health education by utilizing mobile phones (positive use of cell phones), availability of HIV testing sites, youth friendly HIV services, availability of HIV preventive services e.g. condoms, VCT and PITC accessibility,

   ……

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9. Apart from HIV infection please tell me about what another challenges young people in your age group deal within this community?

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10. How can the community and its surrounding contribute or mitigate the risk for HIV transmission in young people?

    i. Contribution of the local community in increase risk and transmission of HIV in young people

    Prompt if required: customs or traditions, sexual networks, drug use networks, peer group influence, high HIV infection rates

    ……
    ……
    ……

    ii. Contribution of the local community in reducing the risk and transmission of HIV in young people

    Prompt if required: religious networks, peer educators, low HIV infection rates, family and friends social support, community resources.

    ……
    ……
    ……
    ……

11. What is your opinion/suggestions on the use of HIV prevention mobile health applications to better your knowledge and others and used as a tool to create more awareness on HIV prevention?

Prompt if required: These are a form of mobile applications specially tailored for HIV prevention or care for example testing and linkage to Care app, treatment adherence, and HIV education resources.

……
……

12. According to your experience or opinion, are there any barriers to you using a mobile health application?

Prompt if required: Barriers such as time, privacy issues, reluctance to change management habits, whether it is too complex to use, etc.

……
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……

13. Do you think young people will be interested in a cellphone program that allows them to have a personal consultation with a doctor or a nurse concerning HIV?

    i. Very interested (briefly explain)

    ……
    ……
    ……
    ……
    ……
    ……

    ii. Not interested (please briefly explain)

    ……
    ……
    ……
    ……
    ……
    ……
    ……

14. What do you think makes mobile phones convenient in HIV testing and prevention?

Prompt if required: time saving, information easily accessible, user friendliness of the application etc.

……
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……

15. What is your opinion on the use of social media to share HIV and AIDS related experiences with others?

Prompt if required: Such examples of experiences which may aid others in living with or preventing HIV.

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16. When using your mobile phone to search HIV information, do you usually get answers to your questions? If not, what are the barriers or challenges?

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……

17. Are you aware of any laws or guidelines in this community that helps reduce or increased the spread of HIV, please give examples, and explain how they prevent or increase HIV prevention?

    i. Examples of the laws that can help prevent HIV prevention in Kenya
    Prompt if required: provision of free HIV services, availability of peer educators, games, and sporting activities

    ……
    ……
    ……
    ……
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    ……

    ii. Examples of the punitive/restrictive laws that can might lead to increase in HIV transmission.
    Prompt if required: payment for HIV services, lack of policies that mitigate unemployment, outlawing of same sex relationships

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    ……
    ……

18. Is there anything else about this topic that you would want to talk about?

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……..

APPENDIX F: Focus Group Discussion Guide

Introduction:

We want to thank you for taking time to came for this group discussion. Today we would like to have a discussion with you as a group about the mobile phones uses in meeting HIV prevention and testing information needs. The session will take about 60 minutes

I want to request you to speak freely and share from your heart. What will be discussed here will be confidential and whatever we speak here not to be shared elsewhere. And if there is something that you want to remain secret, do not mention it here because I do not have the power to prevent it from being repeated by anyone of you outside this discussion. We will not use individual names during the Focus group discussion. You were all given numbers with which to identify yourselves. If it is your turn to speak first identify yourself with the number before you proceed with your contribution. I will tape record our conversation so that it can be easy during analysis and report writing. You should also speak one at a time to ensure each person's contribution is captured by the tape.

Open-ended Discussion Questions

1. What do you do on daily basis to meet individual and family needs?

2. What do you do on daily basis to protect yourself from HIV?

3. What are your experiences or general ideas/suggestions of using mobile phones to access Health or HIV related information? That is

    i. What are the benefits of using mobile phones to access Health or HIV related information?

    ii. What are the barriers/Challenges associated with mobile phones use in Health or HIV related information by emerging adults?

    iii. What are the common barriers in HIV testing and how do you overcome them?

Thank you for your participation in this discussion

APPENDIX G: Health Department Focal Person Interview Guide

Introduction:

Thank you for finding time to be available for this interview.
I would like to get information from you about HIV policies and prevention at the country level with focus to the youth and young adults in UasinGishu County. The session will take about 60 minutes I will tape record our conversation so that it can be easily retrieve during analysis and report writing.

Open-ended discussion questions:

1. What is your role in the health department in this county?

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   ……
   ……
   ……

2. What is the current HIV prevalence in Uasin Gishu county?

   ……
   ……
   ……

3. What is your major role in HIV prevention with special emphasis in the youth and young adults?

   ……
   ……
   ……
   ……

4. Do you have HIV and AIDS prevention policy, and if so, please briefly tell us what are its contents?

   ……
   ……

5. Do you have special programmes targeting HIV prevention in youth and young adults, please briefly explain?

   ……
   ……
   ……

6. Anything else would you like to share with us regarding HIV prevention programmes in this county.

   ……
   ……
   ……

Thank you for your participation in this discussion

APPENDIX H: Recruitment Flyer

Recruitment Flyer posted on the Public Notice Boards in Ainabkoi Sub-County.

My name is Augustine Kiplagat. I am conducting a study on the use of mobile phones for HIV prevention and testing information by emerging male adults in Ainabkoi Sub-County, Uasin Gishu County, Kenya. I am looking for young men ages 18-25 years living in the rural areas of the Sub-county (Ainabkoi). If you are interested to participate please contact me for further information on the Phone Number: +1804 655 8288/+254720972989

Thank you

Contact Information:

- Cell Phone: +1 804 655 8288/ +254720972989

- Email: kiplagat@uwm.edu or augustinekip@yahoo.com

Sincerely,

Augustine Boswony Kiplagat

APPENDIX I: Evidence Table for Manuscript #1

Title: The HIV Transmission Risk Factors and Opportunities for use of mHealth in HIV Prevention Among Emerging Adult Population in the Sub-Saharan Africa Context: A Review of The Literature

SN	Author Year Country	Title of the article	Design	Measures/tools	Analyses Used	Findings	Strengths/Limitation
1	Author: Kibel et al. Year: 2019 Country: Kenya	Acceptability of a Pilot Intervention of Voluntary Medical Male Circumcision and HIV Education for Street-Connected Youth in Western Kenya	Qualitative	FGDs and In-depth interviews	Thematic analysis of interview data	This implementation of VMMC was found to be acceptable to Street-Connected Youth (SCY) participants and could be scaled up in other SSA countries.	**Strengths:** - First study to explore implementation and acceptability of a VMMC and educational program for SCY in SSA, and one of the only implementation studies on HIV-prevention interventions in this population **Limitations** - Unable to obtain data on this intervention's long-term impact on HIV incidence or behavioral outcomes. -Data quality may have been limited by participants' reluctance to

							disclose sensitive information
2	Author: Dokubo et al,. Year: 2014 Country: Mozambique	Awareness of HIV Status, Prevention Knowledge and Condom Use among People Living with HIV in Mozambique	Quantitative (cross-sectional Design)	A questionnaire was completed for selected households	All analyses were performed in SAS version 9.3 (SAS Institute Inc., Cary, NC, USA) using survey procedures	Of persons with positive HIV test results (N=1182), 61% (95% confidence interval [CI] 57–65%) were unaware of their serostatus. Men had twice the odds of being unaware of their serostatus compared with women	**Strengths:** - These findings support calls for expanded HIV testing, especially among groups less likely to be aware of their HIV status and key populations at higher risk for infection in SSA setting. **Limitations** - Cross-sectional household-based Survey and it might not have captured in-depth information in HIV risks and transmission in different age groups
3	Author: Kangmennaang et al,. Year: 2016 Country: Multiple (6) counties in SSA	Circumcision Status and Time to Sexual Debut Among Youth in Sub-Saharan Africa: Evidence from Six Demographic and Health Surveys	Quantitative (Demographic and Health Survey)	Questionnaires from Demographic and Health Survey	Survival analysis (log logistic) models were used to examine the risk of experiencing first sex among never married men by	Findings revealed that efforts to prevent new HIV infection through circumcision could benefit from a proper understanding of how diverse	**Strengths** -The Survey covered 6 SSA countries therefore it can be generalized and applied in SSA **Limitation** - Self-reported nature of circumcision status may have introduced some bias

					circumcision status while controlling for relevant covariates	set of factors interact in specific contexts to shape youth's decisions to initiate early sex.	in the results
4	Author: Sanyu & Wamoyi Year: 2019 Country: Multiple SSA countries	Contextual drivers of HIV risk among young African women	Meta-analysis	Not mentioned	Literature synthesis	In this paper, the authors characterize the intervention context and examine how it can be strategically utilized to maximize HIV prevention interventions among young women in SSA	**Strengths:** - This commentary has examined how contextual drivers might contribute to stalling epidemics, and how they might be deployed to maximize HIV prevention in SSA. **Limitations** -The design and tools are not outlined
5	**Author:** Harrison et al,. **Year:** 2010 **Country:** South Africa	HIV prevention for South African youth: which interventions work? A systematic review of current evidence	Meta-analysis	Not mentioned	Systematic, analytical review of HIV prevention interventions targeting youth in	Eight youth HIV prevention interventions were included; all were similar in HIV	**Strengths:** - Eight large scale youth HIV prevention interventions can be generalized in other SSA countries

					South Africa since 2000	prevention content and objectives, but varied in thematic focus, hypothesized causal pathways	**Limitations** --The design and tools were not outlined
6	**Author:** Bogart et al,. **Year:** 2011 **Country:** South Africa	HIV/AIDS misconceptions may be associated with condom use among black South Africans: an exploratory analysis	Quantitative Cross-sectional study	Questionnaires	descriptive analyses by gender and Logistic Regression to examine the association between the four beliefs and the respondents' recent condom-use behavior with a main partner	-The participants at high risk of HIV who endorsed a belief linking HIV to witchcraft had less positive attitudes about condom use. -participants who thought that vitamins, fruits, and vegetables could cure AIDS also had lower condom-use intentions.	**Strengths:** -The study added new Knowledge about distinct types of HIV/AIDS misconceptions which will help in the design of culturally appropriate HIV-prevention messages that address such beliefs **Limitations:** - The respondents were all clients at a youth clinic where they had tested for an STI, and thus might not be representative of the general population
7	**Author:** Savanna R. **Year:** 2009	Injection drug use, unsafe medical injections, and HIV	Meta-analysis	No mentioned	A systematic review	injection drug use (IDU) is increasingly common	**Strengths:** -The review was large scale covered most of SSA

	Country: Multiple Africa Countries	in Africa				among young adults in sub-Saharan Africa and is associated with high risk sex and is a growing risk factor for acquiring HIV in the region	countries. **Limitation:** -The methodology of the study not described.
8	**Author:** Kreniske et al,. **Year:** 2019 **Country:** Uganda	Narrating the Transition to Adulthood for Youth in Uganda: Leaving School, Mobility, Risky Occupations, and HIV	Qualitative	In-depth Interviews	analysis of narrative life histories	This article shows the complex connection between leaving school, mobility, and occupation with implications for HIV risk.	**Strengths:** -The design allowed controlled comparison of narratives from youth who shared similar sociodemographic characteristics but differed in terms of their HIV status **Limitation:** -Not mentioned
9	**Author:** Pettifor et al,. **Year:** 2013 **Country:** Review of studies from multiple countries	Preventing HIV Among Young People: Research Priorities for the Future	Meta-analysis	Not mentioned	A systematic review	The majority of current research has focused on individual behavior change, while promising biomedical and structural	**Strengths:** -The review lead to summary of the current state of research on HIV prevention in adolescents by providing examples of successful interventions and best practices and highlighting current

						interventions have been largely understudied in adolescents. Combination prevention interventions may be particularly valuable to this group	research gaps. **Limitation:** - Not mentioned
10	**Author:** Aluzimbi et al,. **Year:** 2012 **Country:** Uganda	Risk factors for unplanned sex among university students in Kampala, Uganda: a qualitative study	Qualitative study	in-depth individual interviews	analysis of narrative life histories and categorized into content themes	The students reported unplanned unprotected sex as commons due to peer pressure or for economic gain (pocket money). Addressing factors associated with unplanned sex may contribute to prevention and control of HIV/STI and unplanned pregnancies	**Strengths:** -The study adds to an understanding of unplanned sex in highly educated emerging adults and may help inform programmes to mitigate HIV/STI risk in this population. **Limitation:** - Further, our results cannot be generalized to Ugandan youth as our sample represents a highly educated demographic group.

						among emerging adults in sub-Saharan Africa.	
11	**Author:** Mhalu,Leyna, German, & Mmbaga. **Year:** 2013 **Country:** Tanzania	Risky behaviors among young people living with HIV attending care and treatment clinics in Dar Es Salaam, Tanzania: implications for prevention with a positive approach.	Cross-sectional Quantitative study	face-to-face interviews using questionnaire	Data was summarized using frequencies tables and logistic regression models were built to identify independent predictors of risky sexual behaviors.	Unprotected sex and multiple sexual partnerships were prevalent among young people. Less knowledge on STI and lack of HIV disclosure increased the vulnerability and risk for HIV transmission among young people.	**Strengths** -This study describes the magnitude and determinants of risky sexual behaviors among young people living with HIV **Limitations** -the study is based on self-report, which could be subject to bias especially sexual behaviour-related information
12	**Author:** Houle et al,. **Year:** 2018 **Country:** South Africa	Sexual behavior and HIV risk across the life course in rural South Africa: trends and comparisons	population-based quantitative survey	Questionnaire	The prevalence of reported behaviors by were compared age group, gender, and HIV status	Younger adults continue to be at risk of HIV, with potential partners being more likely to have been diagnosed with an STI and more likely to	**Strengths** - Findings show continued high risk of HIV among young adults. Sexual debut now occurs earlier, creating a longer period for exposure to HIV **Limitations** - The self-reports may be

						have HIV, partner change is high, and condom use is low. Middle aged and older adults engage in sexual behavior that makes them vulnerable at older ages, including extramarital sex, low condom use, and cross-generational sex with people in age groups with the highest rates of HIV	subject to recall, reporting, and social desirability bias, along with selection effects that also vary by respondent gender and age
13	**Author:** Closson et al,. **Year:** 2018 **Country:** Multiple	Sexual Self-Efficacy and Gender: A Review of Condom Use and Sexual Negotiation Among Young Men and Women in Sub-Saharan Africa	Meta-analysis	Not mentioned	Literature Synthesis	On average, young men had higher condom use self-efficacy (CUSE) than young women, while young women had higher sexual	**Strengths** - recommended future research and HIV-prevention interventions that must be gender targeted **Limitations**

						refusal self-efficacy (SRSE) than young men	-None mentioned
14	**Author:** Yamanis et al,. **Year:** 2010 **Country:** Tanzania	Social venues that protect against and promote HIV risk for young men in Dar es Salaam, Tanzania	Qualitative	In-depth interviews	Analysis from in-depth interviews and Emergent themes categorized and analyzed	It was found that participants engage in HIV risk behaviors, such as meeting new sexual partners and having sex in or around the camp at night. Some members promoted concurrent sexual partnerships with their friends and resisted camp leaders' efforts to change their sexual risk behavior.	**Strengths** - Although the findings may not be generalizable, such research may be used to complement findings from social epidemiology **Limitations** - The self-reports may be subject to recall, reporting, and social desirability bias
15	**Author:** Guy et al,. **Year:** 2018	Sources of social support and sexual behavior advice for young adults in	Quantitative	Interviewer administered	Descriptive statistics and logistic regression to analyze	Relatives provided most informational, financial, and	**Strengths** - Given the strong patterns of how social support varied by

	Country: South Africa	rural South Africa		Questionnaires/ Interviews	support and advice provision patterns	physical support, friends and partners more social support and sexual advice. Respondents reported discussing sexual matters with 60% of contacts. Sources of support changed with age, from friends and parents, towards siblings and partners	respondent age and gender, the study presents several testable hypotheses for future larger studies **Limitations** - limited power to see significant associations in the data for interactions and stratified analyses
16	**Author:** Sharma, Ying, Tarr, & Barnabas **Year:** 2015 **Country:** Multiple countries	Systematic review and meta-analysis of community and facility-based HIV testing to address linkage to care gaps in sub-Saharan Africa	Systematic review and meta-analysis	Not mentioned	Literature synthesis	Across modalities, community HIV Testing and Counselling (HTC) successfully reached target groups (men, young adults,	**Strengths** - This analysis strongly recommends linkage and populations reached by HTC modalities to inform policymakers who are charged with addressing gaps in testing

						and first-time testers) with higher coverage than facility HTC. High uptake of community HTC reflects population acceptability of testing outside of health-care facilities.	**Limitations** - The heterogeneity across studies in different countries might affected generalization of the systematic review.
17	**Author:** Imrie & Tanser **Year:** 2011 **Country:** multiple countries	Targeting strategies and behavior change to combat the HIV epidemic in southern Africa	Systematic review	Not mentio ned	Literature Synthesis	Behavior change remains a cornerstone of effective HIV prevention, whether interventions aim to reduce primary HIV acquisition or in the context of 'prevention for positives', the likelihood of onward transmission.	**Strengths** - The review gives a better understanding and more accurate targeting of sub-populations, communities in behavior change for HIV prevention. **Limitations** - None mentioned.
18	**Author:** Rogan et al,.	The effects of gender and	Quantitativ e Survey	Intervi ews	Descriptive statistics and logistic	The findings suggest that	**Strengths** -The article discusses

	Year: 2010 **Country:** South Africa	socioeconomic status on youth sexual-risk norms: evidence from a poor urban community in South Africa	Design		regression	gender interacts significantly with peer norms to predict sexual behavior. Peer norms and the experience of intimate partner violence were significantly associated with sexual risk behavior among girls participating in the study.	both the wider implications of gender and socioeconomic status on youth sexual-risk norms and the implications for school-based and peer-facilitated HIV interventions. **Limitations** - The self-reports may be subject to recall, reporting, and social desirability bias
19	**Author:** Ochako, Ulwodi,Njagi, Kimetu & Onyango. **Year:** 2011 **Country:** Kenya	Trends and determinants of Comprehensive HIV and AIDS knowledge among urban young women in Kenya	Quantitative (From Kenya Demographic & Health Surveys)	Interviews/Questionnaires from Kenya Demographic & Health Surveys	bivariate and multivariate logistic regression was used for analysis	As evident from the results, comprehensive HIV and AIDS knowledge has increased over the 15-year period among urban young women from 9% in 1993 to 54% in 2008/09 The	**Strengths:** - The study call for more interventions to ensure young women receive HIV education because majority still lack comprehensive knowledge about HIV. **Limitation:** -Sampling did not consider the slum settlements although HIV and AIDS affect them.

						predictors for having comprehensive knowledge were found to be Education, having tested for HIV and knowing someone with HIV	
20	**Author:** Odaga, A **Year:** 2012 **Country:** Multiple SSA countries	Youth and HIV/AIDS in Africa: a call for effective policies and programs	systematic review	Not mentioned	Literature Synthesis	This review found out that African youth are increasingly sexually active, with declining rates of sexual debut, and high rates of risky sexual practices and transactional sex. Coupled with low rates of comprehensive knowledge of HIV in young persons aged 15-24 years, and low	**Strengths:** - While these lessons, many of which are widely recommended, would appear to hold the key to the prevention and curtailment of HIV/AIDS in young persons, there has been limited use and scale up of specific youth-focused sexuality and reproductive health programming in the region. **Limitation:** -Not mentioned

						condom use that are characteristics of the region, it is evident that multiple factors converge to increase the risk of HIV acquisition for the African youth.	

Abbreviations

AIDS- Acquired Immunodeficiency Syndrome

AYA- Adolescent and Young Adult

COVID-19- Coronavirus Disease of 2019

eHealth-electronic Health

FGDs-Focus Group Discussions

HIV- Human Immunodeficiency Virus

HSV- Herpes Simplex Virus

ICTs- Information and Communication Technologies

mHealth-mobile Health

NASCOP-Kenya National AIDS and STI Control Program

PrEP- pre exposure prophylaxis

PRISMA- Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SMS-Short Message System

MSM-Men having Sex with men

SSA-Sub-Saharan Africa

STI-Sexually Transmitted Infections

UNAIDS- United Nations Programme on HIV/AIDS

UNICEF- United Nations Children's Fund, formerly (1946–1953) United Nations International Children's Emergency Fund

CURRICULUM VITAE

Augustine B. Kiplagat PHD(c), MPH, PCCN, RN

Education	
PhD in Nursing (Expected date of graduation, May 2022) *University of Wisconsin-Milwaukee* *Milwaukee, Wisconsin*	2022
Master of Public Health *St. Augustine University of Tanzania* *Mwanza, Tanzania*	2011
Bachelor of Science in Nursing *Moi University* *Eldoret, Kenya*	2004

Certifications/ Licenses	
License# 0001265435 *Virginia Board of Nursing*	Exp 2023
Certification: Registration # 2000105259 *Progressive Care Certified Nurse (PCCN)*	Exp 2024
ACLS *American Heart Association*	Exp 2023
BLS *American Heart Association*	Exp 2023

Academic Experience	**Year**
Medical Surgical Nursing Lecturer/Instructor at CUHAS Tanzania	4 years
Community Health Nursing Lecturer/Instructor at CUHAS Tanzania	4 years
NUR 2103P (Competencies for Nursing Practice I) Lecturer/Instructor at BSMCON	<1 year
NUR 3316 (Population and Global Health) Lecturer/Instructor at BSMCON	<1 year

Professional Experience	Year
ASSOCIATE CLINICAL PROFESSOR *Bon Secours Memorial College of Nursing, Richmond, VA* Participates in the assessment, planning, implementation, analysis, and evaluation of the curriculum. Responsibilities include teaching, service, practice, and scholarship.	September 2021-Present
UNIT CHARGE NURSE AND PROGRESSIVE CARE CERTIFIED NURSE (PCCN), *Bon Secours Memorial Regional Medical Center, Mechanicsville, VA* Working at Progressive Care Unit (PCU) at to provide leadership, aggressive, specialized care to acutely sick adult patients who need critical and progressive care.	2018-2021
REGISTERED NURSE AT LONG TERM ACUTE CARE UNIT *Vibra Hospital of Richmond, Richmond, Virginia* Worked at Vibra Hospital of Richmond as a Registered Nurse. It is a Long-Term Acute Care Hospital which provides aggressive, specialized care to adult patients who need critical care with extended hospital stays.	2016-2018
TRAINING COORDINATOR/EDUCATOR *Zonal Health Training Centre/Bugando Teaching Hospital, Mwanza, Tanzania* Train, Mentor, and support healthcare workers on current evidence-based practices about high burden diseases in the region notably Malaria, HIV, TB, and Childhood illnesses. Conduct research on priority health challenges in the region and to disseminate the findings to all relevant stakeholders.	2008-2016
ADJUNCT FACULTY *Bugando University School of Nursing, Tanzania* Worked as part-time Faculty member at Bugando University School of Nursing in assessment, planning, implementation, analysis, and evaluation of the Nursing curriculum. Participated in teaching/instruction of nursing students pursuing Associate (Diploma) and undergraduate (BSN) degrees. I facilitated modules in Health Research, Leadership, Medical-Surgical & Community Health Courses for nursing students at the school.	2008-2016
CLINICAL REGISTERED NURSE & TUTOR. *Tumutumu Hospital, Kenya* Worked as Medical-Surgical general nurse & part-time nurse tutor at P.C.E.A Tumutumu hospital, Nyeri, Kenya. My main duties were nursing care of patients suffering from various medical & surgical conditions. Also worked as part time nurse tutor at the Tumutumu hospital school of nursing.	2005-2008

Areas of Specialty

Critical Care Nursing, Medical-Surgical, Population & Global Health, Gerontology, Healthcare Research, Informatics/Health Technology

Areas of Interest

Critical Care Nursing, Medical-Surgical, Population & Global Health, Gerontology, Healthcare Research, Informatics/Health Technology, Global Health Research, Grant writing and Project management

Honors and Awards	Year
Ruth K. Palmer Research Award *University of Wisconsin-Milwaukee*	2017
Graduate Student Travel Award *University of Wisconsin-Milwaukee*	2018

Presentations

May 2018: Kiplagat, A. (2018). Factors associated with the use of mobile phones in HIV prevention among the emerging African American male population in Richmond, Virginia. Pilot study findings presented at 14th International Congress of Qualitative Inquiry, University of Illinois at Urbana-Champaign, USA

March 2017: Kiplagat A & Kako, P.M. (2017). The use of mHealth as a cost-effective intervention for HIV prevention and care in emerging adult population in sub-Saharan Africa, Presented at the 2017 Ruth K. Palmer Research Symposium, Loyola University, Chicago, USA

Publications

Kiplagat, B.A., Kako, P. M., Mkandawire-Valhmu L, Chelagat D, Seok Hyun Gwon, H. S, Luo J & Dixon, V.M (2021). The HIV transmission risk factors and opportunities for use of mHealth in HIV prevention among emerging adult population in the Sub-Saharan Africa context: a review of the literature, *International Journal of Health Promotion and Education,* DOI: 10.1080/14635240.2021.1995464

February 2021: Kako, P. M., Ngui, E., Kako, T., Ndakuya-Fitzgerald, F., Mkandawire-Valhmu, L., **Kiplagat A,** Dressel, A. E & Egede, L. E. (2021). Sustaining peer support groups: Insights from women living with HIV in rural Kenya. *Public Health Nursing*. DOI: 10.1111/phn.12879

March 2014: Kiplagat, A., Musto, R., Mwizamholya, D., & Morona, D. (2014). Factors influencing the implementation of integrated management of childhood illness (IMCI) by healthcare workers at public health centers & dispensaries in Mwanza, Tanzania. *BMC public*

health, *14*(1), 1-10. DOI: 10.1186/1471-2458-14-277

March 2012: Kiplagat, A., Effective Human Resources for Health (HRH) in Tanzania as part of Health System Strengthening. Found at: http://www.cmi.no/publications/file/4614-huge-potential-for-improved-health-service-quality.pdf