



Protecting the Liberated: An Investigation of the Bases of Hiv/aids Transmission and the Development of Effective Prevention Interventions for Black, South African Women

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INTRODUCTION

“We have the solution to protect you”: The Great Deception

As a first-year medical student at the University of Cape Town, I participated on a health prevention and promotion medical expedition to rural Eastern Cape, South Africa. We were divided into six teams, one for each of the clinics in the two-hundred-kilometer radius serviced by a single hospital. Zithulele Mission Hospital is “a 147-bed district hospital providing primary health care services for a catchment area of 130 000 people” (Zithulele, 2018). Each of the clinics was entirely run by nursing staff and community workers, and patients needing a doctor were referred to the Zithulele Hospital. Our purpose was to provide health screenings and medical evaluations; assisting and supplementing the work of the clinic nurses, who were overtaxed and under-resourced. We were trained and set up to provide testing for hypertension and diabetes, HIV counseling and testing, perform pap smears, and the implantation, under local anesthetic, of the long-term, reversible, hormonal contraceptive, *Implanon*. News of our presence and services travelled widely and quickly throughout the various communities in the area, and on each day large crowds of, predominantly female, patients sought out our services. Many of the women walked long distances and waited in line for extended periods of time, because of the value they placed on their health. The socio-economic barriers to accessing health care in the area were evident from the very first day. Whilst performing a pap smear on an HIV positive mother, I found a large cervical lesion, which I had been taught could be a precursor to cervical

cancer, and directed her to go to the hospital for further testing, as soon as possible. As I was writing the note for the hospital and doctor, the woman told me that she would be unable to go to the hospital until the beginning of the following month because she did not have the R15 (\$1) necessary for taxi fare. Despite her understanding of the necessity and desire to access further care, there were these barriers that obstructed her. There were many more similar reminders of inequality in the access and quality of healthcare in South Africa – however one incidence stood out to me and has stuck with me ever since.

On my first day I was placed on HIV testing and counseling duty. I felt prepared; I had all my necessary tools to perform the tests, and my counseling speech was ready, as were the packets of condoms I planned to hand out with each rendition of my counseling spiel. I was nervous, but excited to be a small part of the efforts to combat an epidemic I had grown up afraid would kill me and my loved ones.

My first two patient encounters went smoothly – both were HIV negative, and they took the packets of condoms I handed them without disagreement. My third patient was different and that encounter is the catalyst for this project.

I began as I had begun before – with my pre-test counseling, followed by the HIV testing process. Her test came back negative so we proceeded to the final counseling portion. As I reached to hand her the pack of condoms, I explained to her that this was best way for her to protect herself. She told me that she could not take them. She told me that she was married, but her husband was constantly engaging in extra-marital affairs with multiple women. Although she understood

the dangers, her husband did not like to wear condoms, so she could not take them. She could not go against her husband's wishes or question his authority by requesting he wear a condom, which forced her to leave her health at risk. Despite employing both prevention tools I had been given – HIV education through counseling and barrier protection in the form of condoms – I had a patient who these couldn't work for. Here was someone vulnerable to contracting HIV; and we purported to have the solution which she could use to protect herself – but it could not work for her. If our *solution* did not work for her and women like her, I began to acknowledge that, maybe, we didn't have solution. We had implemented a prevention intervention that did not fit her socio-cultural reality – and we had nothing else to offer her. We had let her down – and everyday we didn't address the need for unique prevention strategies, created *for* the women of South Africa, we would continue to fail her and women like her.

Since the late 1990s and the early 2000s, South Africa has made huge strides in the prevention of transmission and treatment of HIV/AIDS. South Africa spends around \$1 billion dollars on HIV prevention and treatment – leading to South Africa having the largest antiretroviral program in the world. According to the *National Strategic Plan*, prepared by the South African government, HIV mortality has dropped from almost seven hundred thousand in 2006, to just over one hundred and fifty thousand in 2016 and the annual new HIV infections has decreased to just over two hundred and seventy thousand in 2016. However, South Africa continues to carry the highest burden of the virus, with an estimated 7.1 million citizens (just over 12% of the population) infected with the virus (*South African Department of*

Health, X). Additionally, alongside TB, HIV/AIDS continues to be the leading cause of death in the country. There are many populations that are at a heightened risk for HIV infection compared to the general population. Some of the populations highlighted in both a report co-written in 1993 by the South African Medical Research Council and the University of Witwatersrand Center for Health Policy, as well as in the *National Strategic Plan*, released in 2016 by the South African Department of Health, are sex workers, men who have sex with men, drug users, inmates, migrant workers, LGBTI populations and girls and young women (*South African Department of Health, XV*). Whilst strategies for HIV prevention and protection for all South Africans should be analyzed, investigated, researched and implemented (particularly for the vulnerable populations mentioned above), in this paper, I will focus on the specific vulnerable population of black, South African girls and young women. Not only do young black women (aged 20-34) have the highest prevalence rate (at just over 30%), the *National Strategic Plan* (7) states that 37% of new infections every year are young women aged 15-24. There are clear signs of the burden of this epidemic on this population, and in this paper, I aim to analyze the gap between the underlying causes of vulnerability and the prevention strategies being used to address this, how this gap perpetuates the susceptibility of this population, and finally, investigate a possible path forward. The “young, black, South African girls and women” referred to in this paper include women from ages 15-34.

The first chapter will be an analysis of what the socio-cultural, economic and political paradigms that heighten the vulnerability of these young women, and

then investigate the gaps in efficacy of the current prevention interventions for these women.

The second chapter takes a step back and, using the writings of Franz Fanon and Steve Biko as a lens, explores the development of the South African landscape that has caused the HIV epidemic to take the shape that it has taken. It will then use these lenses to analyze how to move towards the development of effective prevention interventions.

The third chapter draws this together in a discussion of South Africa's neglect of the development of locally created and locally targeted biomedical prevention interventions. Bringing together everything discussed above, the chapter provides a proposal for the development of a tenofovir based, biomedical prevention intervention, designed specifically for young, black, South African women.

CHAPTER I

The “Who?”, “Why?”, and “How?”: Understanding Vulnerabilities and Developing Interventions

In 1993, ten years after the first case of the Human Immunodeficiency Virus was confirmed in South Africa, it was beginning to become clear that South Africa was at the start of its HIV/AIDS epidemic. According to a report created by South Africa’s University of the Witwatersrand’s Center for Health Policy and the Medical Research Council (of South Africa), an estimated 2.4% of the South African population were infected with HIV and it was estimated that this figure would exponentially increase to around 25% over the course of the following decade – following a similar trajectory to the spread of the epidemic in other Southern African countries. *Understanding the possible: Policies for the prevention of HIV in South Africa* was the report written by the Center for Health Policy in the University of the Witwatersrand and the South African Medical Research Council, aimed at outlining necessary steps, strategies and policies that needed to be implemented in the fight towards the prevention of the transmission of HIV. These strategies were all contextualized and aimed specifically at targeting the spread of HIV in the *South African context*. The report highlights the primary drivers behind the epidemic, the most vulnerable populations as well as target populations and strategies that should be implemented and focused on. At that early stage in the epidemic, the report made it clear that women, particularly young black women from disadvantaged and low economic backgrounds, were an incredibly vulnerable population when it came to the infection and transmission of HIV. Whilst there are

physiological and biological factors that increase women's susceptibility to HIV infection the focus of this chapter will be on unpacking the economic, social, cultural and political factors that perpetuate the vulnerability of young, black South African women because "in South Africa [...] AIDS is fundamentally a disease of social disadvantage" (Schneider et al, 4), and as a result, "considerable attention is being focused on the low status of women as a key social factor in the spread of HIV" (Schneider et al, 5).

Although the vulnerability of girls and young women and the need for targeted prevention programming were identified at the very beginning of the epidemic, and despite South Africa's large investment into HIV prevention and treatment, young, black women continue to be infected at a rate far higher than any other demographic. This chapter will analyze the specific factors, found in the South African context, that underpin the vulnerability of black girls and young women to the HIV epidemic. Additionally, it will examine HIV prevention strategies and programming that have been utilized in South Africa since the late 1990s, focusing on how these relate to young, black women and the specific factors of susceptibility they face.

Factors influencing young, black women's vulnerability to HIV transmission

"...Women face a series of obstacles in attempting to protect themselves from HIV. Multiple partnerships in men are seen as acceptable; their social, economic and cultural dependency on men makes it difficult for women to force men into safer sex practices; and women do not have access to the technology to protect themselves from HIV."

Understanding the possible: Policies for the prevention of HIV in South Africa (Schneider et al, 1993)

The World Health Organization's *Social Ecology Model* is often used as the basis for modeling the characteristics of South Africa's HIV/AIDS epidemic (Department of Health, Republic of South Africa, 2016). This adapted model analyses the spread of HIV and HIV risk factors on five different levels: "Individual, Peers, Family, Relational and Community/Societal" (Psaros et al, 2017; Department of Health, Republic of South Africa, 2016). In this section, I will use a similar strategy in analyzing the "how" and "why" of HIV infection and transmission for young, black South African women, through looking at, young women's perception of the risks of HIV (*Individual and Peers*), gender roles and familial structures (*Family and Community/Societal*), gender inequality and gender based violence (*Relational and Community/Societal*), and disproportionate age gaps, intergenerational and economic sexual relations (*Relational*).

Young women's Perception of the Risks of HIV

"...if you use a condom then the girls say, "Everybody has got it, so what's the use of using the condom?", so the guys end up not using the condoms."

Nixon et al, 2011

The high prevalence of HIV and the accelerating rate of infection, especially in low-income, informal areas, has spurred the acceptance of the inevitability of acquiring the virus (Leclerc-Madlala, 2010). The inevitability and acceptance of HIV as a part of life, is viewed, within certain populations, not only as something

you can acquire, but also as a weapon you can control and purposefully spread. Susan Leclerc-Madlala gives us an example of townships in the province of KwaZulu-Natal, where, in response to socio-political and economic tensions and violence, and elevated crime rates, young people are weaponizing the spread of HIV with the resolve to infect others (Leclerc-Madlala, 2010). It follows that, given this context of rampant, and in certain cases purposefully deceitful, spread of this epidemic, there will be young people who consider HIV prevention futile.

Conversely, when analyzing the perceptions towards the *danger* of having HIV (as opposed to the risk of infection), it can be seen how the provision of effective, consistent and user-specific solutions and care can address communal surrender and bolster buy-in and engagement:

“I think they do not fear it because people continue to live with it. You find people claiming that HIV is like having the flu. You see, now people with HIV are much better than us. They are taken care of in a lot of places; they are the most important people and the pills are now available. It is not easy for you to just die like that anymore. I would not have a problem if I get infected.”

Psaros et al, 2017

The success of South Africa’s HIV treatment campaigns has created a nationwide acceptance that, whilst HIV infection is likely life-long, it is no longer the death sentence it used to be (Nordling, 2016). A by-product of this is that it has relieved some of the engagement with prevention programming that was initially stimulated by fear. This coupled with youthful notions of invincibility, increase the

likelihood of engagement in risk-enhancing sexual behavior and abandonment of protective strategies (Tenkorang, 2016).

According to Arvin Bhana and Inge Peterson, this is compounded by compromised cognitive and emotional instincts in youth who are yet to reach biopsychosocial maturity (p. 59). Universally, youth are more likely to engage in impulsive and “high-risk sexual behavior” (p. 59) and this phenomenon is amplified by South African socio-cultural and economic realities. South Africa’s high poverty rates (which will be discussed in more detail in the second chapter) are cited as a primary source of many factors that increase “high-risk sexual behavior” (Bhana & Peterson, 58). One particular consequence is the effect it has on family structures – particularly parent-to-child interactions. The stress that poverty introduces into familial and parental structures correlates with parents having limited time and energy to spend with their children; additionally, it is associated with “harsher treatment” and less “warmth, structure and support” (p. 59). The absence of physical presence and emotional connection inhibits the ability of parents to play an active role in guiding, protecting and communicating with their children regarding sexual matters, which decreases their likelihood of being protected from risky sexual practices and situations (p. 59).

With a decrease in parental influence, the role of peers in teaching and modeling behavior is even more influential than is typical. The actions and opinions of peers can play a key role in the sexual behaviors of this youth population (Bhana & Peterson, 60). Awareness, or perceptions, of peers engaging in particular sexual activities or avoiding condoms will spread the same high-risk behavior throughout

peer groups. This is especially true in males – particularly in relation to multiple sexual partners and condom use (Bhana & Peterson, 60). Peer influence is a key component in the development of individual sexual knowledge, expression, values, perceptions, and behavior.

A final layer to be considered in how young women as individuals perceive HIV risks is the effect of discouraging female sexuality through the reinforcement of depictions women as passive role players; whose sexuality is only necessary in ensuring the release of male masculine sexual virility; and linking exposure, infection and the dangers of HIV, and other sexually transmitted illnesses, directly to female sexuality (MacEntee, 2016). This dual *suppress-and-vilify* mechanism reinforces the negative depiction of female sexuality. Through the repetition of this message on numerous platforms – within homes and communities, in the media, in Life Orientation lessons (a subject that every high school student in South Africa must take throughout the course of their schooling), in churches and even in HIV public media campaigns – the positive sexual expression, culture and health of women is continuously being repressed (MacEntee, 2016). There are many psychological and social consequences of stigmatizing female sexual relationships, but one particularly important consequence is the effect it has in limiting the agency and proactiveness a woman will take in the control of her own sexual identity, desire, experiences and health. This pressures girls and young women to hand over sexual control to their male sexual partners and rely on these partners for the validation of their “esteem, beauty and desirability” (Jewkes, 31). This shift in

control and power links directly to the next two sections regarding *gender roles* and *gender inequality*.

Gender roles and Familial Structures

“Patriarchal social arrangements ultimately serve to coalesce power and privilege into the hands of men while simultaneously curtailing the autonomy of women.”

Leclerc-Madlala et al (p. 17)

South Africa’s *Rainbow Nation* is composed of diverse races and ethnicities with distinct cultural and religious beliefs, practices and traditions. According to Suzanne Leclerc-Madlala, Leickness Simbayi and Allanise Cloete, there are, however, similarities in the history, and its modern implications, of how many indigenous South African ethnicities handle marriage and the construction of the “family”. A history of a “common acceptance of polygyny, patrilocality and patriliney with bride wealth” continues to impact the relationship between men and women within the family structure (p. 15). Through modernization, colonialism, and socio-economic changes, the implications and robustness of these rules have changed over time, however “patrilineal descent, polygyny, bride-wealth exchange and patrilocality” continue to influence modern “social order” (p. 15).

The patriarchal construction of the home means that wives, like their children, are under the financial, behavioral and cultural jurisdiction of their husbands. This includes the control of the frequency and characteristics of a wife’s sexual encounters (Leclerc-Madlala et al, p. 15). The societal, biological, familial and cultural reinforcement of male superiority in the home, suppresses a woman’s

ability to make requests, decisions or have any control over sexual behavior, and especially sexual health (Jewkes, p. 35). This means that even when women acknowledge potential health dangers, or wish to protect themselves, the social, cultural and physical repercussions of outward displays of disrespect to their husband are too high.

This context leaves many women's sexual health at the mercy of cultural and male priorities. A major concern is how this relates to the use of condoms – particularly within marriages. There is intense cultural reproductive pressure, and the use of condoms is associated with the inhibition of producing descendants (Leclerc-Madlala et al, 16). Reproductive success can also be viewed as a sign of male virility among black African men (p. 16). Some of these men view condoms as “tools used by men to prevent disease and children” and, thus, using them, would be an admission of infection or an affront to their masculinity (Leclerc-Madlala et al, 16).

There is no significant causal link between a decline in condom use within a *monogamous* marriage setting and HIV transmission – however the proclivity for men, in certain contexts, to validate their masculinity and virility through concurrently engaging with multiple sexual partners is what increases risk and danger (Leclerc-Madlala et al, 16). Whilst polygamy only occurs in very few cultural settings, the idea and acceptance of the male *right*, because of the needs associated with their “biological virility”, to have multiple concurrent sexual partners continues to be socially ingrained (p. 17). These extra-marital sexual

relationships place these married women at an increased risk of HIV infection without the power and control to protect themselves.

Gender Inequality and Gender Based Violence

The patriarchal gender dynamics discussed above are not isolated to the family setting. The belief in the biological and cultural “natural superiority of men” (Leclerc-Madlala et al, 17) amplifies the uneven power dynamics in sexual and romantic relationships.

The disproportionate distribution of sexual and relationship power has a two-fold consequence. Firstly, the normalization and celebration of masculinity and sexual virility through female conquests has been shown to “increase men’s HIV risk behaviors” such as having multiple concurrent sexual partners, coercive or abusive sexual acts and engaging in unprotected sex (Mathews et al, 148). Additionally, the suppression of women’s needs and rights, especially within sexual and romantic relationships, has been linked to the low rates of women seeking out, requesting or adopting HIV prevention methods (Mathews et al, 148). The male control of female sexuality also forces women into sexual behavior, that may be uncomfortable, painful or dangerous, to increase male sexual pleasure. Examples of this include “dry sex and vaginal douching” (Leclerc-Madlala et al, 19). Dry sex and vaginal douching involves the use of chemicals, creams, roughly-textured materials and cleansers inside and outside the vaginal canal, to clean, dry and tighten the vagina to increase the pleasure of the male partner (p. 19). These materials cause

“extensive local irritation and inflammation of the vaginal walls” which leads to pain and discomfort as well as increasing the woman’s biological risk for infection (p. 19). Engaging in injurious sexual behavior, for the pleasure of the male partner, can be done for the maintenance of affection, show of respect or through violence and coercion (p. 19).

The notions of control, power and superiority, discussed above, are also a component in the increasing rate of gender-based violence and rape (Jewkes, 34). Historically and culturally ingrained gender dynamics have been magnified by poverty, crime and “gang culture” that have grown since the beginning of apartheid, leading to a rise in sexual violence against women in South Africa (p. 34). According to the South African Police Services, there are around fifty-thousand cases of rape reported every day. In the year between September 2014 and September 2015, the South African Police service stated that “53 617 sexual offences [were] reported” (RapeCrisis, 2015). This figure means that around 150 cases of rape took place every day throughout that year in South Africa. Given that there are a great number of rape and sexual assault cases that go unreported it is likely that the true figure is far higher than this, with the *South African Demographic and Health Survey* estimating that 15.2% of women “who had been forced to have sex” had reported it to the police (RapeCrisis, 2015; Wilkinson, 2016). More than half of women who disclose rape have been sexually assaulted more than once (RapeCrisis, 2015). Many women who do not consider any of their sexual experiences to have been “sexual assault”, report feeling coerced or unable to decline sexual requests – with “two-thirds of sexually active teenagers in Cape

Town” reporting sexual coercion (Jewkes, 35). The seriousness of South Africa’s sexual assault problem is also indicated by rates of perpetrator disclosure (in research settings). A study conducted in the rural Eastern Cape province found that 21% of males admitted to having raped a woman – many reporting that the rapes had occurred with multiple other perpetrators (Jewkes, 34). Another study conducted in the Gauteng province found that 37.4% of men admitted to having raped a woman (Wilkinson, 2016).

Increases in female risk for HIV infection are not only limited to sexual violence – but are also correlated to physical, verbal, emotional and financial abuse and control (Jewkes, 35). Multiple studies have found that between 40-50% of South African women have experienced physical violence (Jewkes, 35) and around 80% of South African women experienced physical, verbal, emotional or financial abuse during the 2016 year (Senthilingam, 2017).

Gender-based violence is a huge problem in South Africa, partially because of the social normalization of gender hierarchies, male control and power over women and “female discipline”. A study conducted by Julia Kim and Mmatshilo Motsei, in KwaZulu-Natal, found men describing physical violence towards women in justifiable terms revolving around “discipline and punishment” and that it was the duty of the man to correct any faults observed in a woman – with violence if necessary (Kim and Motsei, 2002). Additionally, the same study found that, whilst women did not find physical abuse justifiable or appropriate, even in the context of discipline, it was something they felt was inevitable and looked upon with general social approval (Kim and Motsei, 2002). This social normalization of

gender-based violence, through the cultural approval of male superiority, has also leaked into how the South African society responds to sexual assault and rape survivors.

An example that illustrates the normalization of gender-based violence and sexual assault in South Africa was the response following Jacob Zuma's rape allegations and subsequent trial in 2005. During his term as the deputy president of South Africa, Jacob Zuma was accused of raping the 31-year old, HIV positive, daughter of his friend – Fezekile Ntsukela Kuzwayo. Zuma admitted to engaging in *unprotected* sex with Kuzwayo, but claimed it was *consensual* and that he had reduced his risk of acquiring HIV from her by “taking a shower afterwards” (Evans and Wolmarans, 2006). Throughout the trial, despite her identity being kept confidential by the court (by having the media refer to her as “Khwezi”), Kuzwayo was the victim of numerous threats and acts of violence – from having her home set on fire to large crowds of female Zuma supporters burning photos of her whilst screaming “Burn this bitch” in Zulu (York, 2017; Skeen, 2007). Following the trial, Kuzwayo was forced into exile in Tanzania and then the United Kingdom because of the threats she faced (York, 2017). Whilst Zuma was suspended from being deputy president for the duration of the rape trial, he continued to enjoy wide-spread political and cultural support (Skeen, 2007). Three years following the incident and trial, Jacob Zuma became the president of the Republic of South Africa (York, 2017). Although Zuma had largely lost the support of the South African people by the time he stepped down in early 2018, at the time of the rape and his initial presidential appointment he had an incredibly powerful support base (Skeen, 2007).

His Zulu cultural capital and personal history with poverty gave him an accessibility and connection to the majority of black South Africans made him the antithesis to the then-president, Thabo Mbeki, who's intellectual elitism alienated many struggling, black, South Africans (Xie). This socio-cultural and political clout played a fundamental role in the early societal dismissal and vilification of Kuzwayo and her allegations (Skeen, 2007). Although he was eventually acquitted of the rape charges, the court of public opinion convicted a possible victim of sexual assault in favor of supporting the culturally and politically powerful African male long before the courts had made a judgment (York, 2017). This case is a high-profile and complex illustration of how the normalization of gender-based violence is closely linked to African masculinity and power. It also shows the ways in which this can hinder the support survivors receive if they come forward, and even more importantly, whether they come forward at all.

Disproportionate Age Gaps, Age Disparate and Economic Sexual Relations

According to the *South African National HIV Prevalence, Incidence and Behaviour Survey*, in 2012 the HIV incidence rate for males in the 15-24 year cohort was 0.55, whereas it was 2.54 for females of the same age cohort. One of the primary inferences that can be made from the fact that young women are almost five times more likely to be infected by HIV than their male peers, is that they are being infected by older men. In fact, the partners of young girls and women in this age group are, on average, 5 years older than they are (Mathews et al, 147). These intergenerational sexual relationships bring with them an additional layer of power

imbalance for young women originating out of the gender *and* age hierarchies that are pervasive in most South African communities. Whilst in most societies age comes with an increase in power, this ethos is particularly emphasized in a country like South Africa. Respect for elders is something that is explicitly culturally and socially ingrained in South Africa, particularly in black South African ethnic groups (Leclerc-Madlala, 19; Abdool-Karim et al, 256).

Intergenerational relationships often include elements of physical violence or psychological, emotional or economic coercion (Leclerc-Madlala, 16; Evans et al, 2016). One such manifestation are relationships that are characterized by older men financing the material lives of younger women. These men are commonly known as “sugar daddies”, but in South Africa they are termed “blessers”. These “blessers” are older men, who often have partners their own age, are engaging in sexual relations with multiple partners; increasing the risk of HIV transmission and infection. This phenomenon establishes itself differently in South Africa, as it does not only exist in the realm of those seeking out luxury, and it is often used as a mechanism of economic survival. South Africa has a national unemployment rate of a “worrying 27.7%”, but it is particularly significant and jarring that the *youth unemployment rate* (youth being defined as younger than twenty-five) is 67.4% (Peyper, 2017). It is in this context that older men exchange financial protection and stability for the control of a young woman’s body and sexuality. This control will define who a woman has sex or other relations with, the “when”, “how” and “how often” of sexual encounters and whether she will use protection against STIs, HIV and pregnancy. Any deviation or resistance can lead to physical violence, the

loss of luxury and material comforts or a return to poverty (Khazan, 2018). The *Center for the AIDS Program of Research in South Africa* has found that the *blessers* phenomena is often passively encouraged within families, particularly in poverty-stricken areas, as the “blessers’” financial support will often be shared and used to help within the family (Khazan, 2018).

Adolescent girls and young women engaging in sexual relationships with experienced, older men not only means that they are far more likely to engage in risky sexual acts, such as unprotected sex, sex with multiple partners and anal sex; it is also more likely that the power dynamics discussed above will make it far more difficult “for women to negotiate safer sex and condom use with older partners” (Evans et al, 2016). The disproportionate age, gender and economic power hierarchies that characterize age disparate and economic sexual relationships, largely strip young women of their agency and control over their sexual experiences, relationships and health. This culture is providing the perfect platform for the spread of HIV from older men to younger women, without giving them any tools with which to protect themselves.

The absence of agency and control, regarding both socio-economic conditions, and sexual and romantic relationships is a commonality in many of the vulnerability factors discussed here. Socio-cultural and economic circumstances make it difficult for black, young women to control and protect their own sexual health, leaving them at an increased risk for HIV infection. These women need a prevention measure that can be constant and consistent, physically accessible, and

most importantly, one that can be privately used and controlled. Currently, no prevention method confronts these issues directly.

HIV Prevention in South Africa and its effect on young, black female vulnerability

Since the 1990s, the South African government and research institutions have sought to implement solutions and interventions that specifically target vulnerable populations and areas, with the hope that this would ensure the effectiveness of their strategies. When we compare the 1993 report prepared by the South African Medical Research Council and the University of Witwatersrand's Centre for Health Policy (*Understanding the possible: Policies for the prevention of HIV in South Africa*) with the 2016 *Health Sector HIV Prevention* report prepared by the South African Department of Health, we see a common model followed: first, a highlighting of target and vulnerable populations in the spread of HIV, and then developing HIV strategies to target those. One would expect this to be a comprehensive model that should lead to effective results, however, the success of this model would be dependent on not only highlighting target groups and vulnerable populations, but also on assessing the core reasons that make them vulnerable and developing strategies that are comprehensive *and* specifically targeted to those underlying issues.

There are issues with both the policies and strategies suggested in the 1990s as well as the ongoing and new policies and strategies being implemented currently,

that hinder the effectiveness of these solutions on the issues pertinent to young, black South African women.

In the 1993 report, the *South African Medical Research Council* and the *University of Witwatersrand's Centre for Health Policy*, base their proposed prevention programming almost entirely on the programming that exists in other countries. Whilst taking into consideration and applying the prevention strategies successfully used in other countries is a necessary step, it is far from sufficient. A detailed analysis of the intricacies and nuances of what is driving the epidemic in South Africa as well as an analysis of how and why the virus has affected the South African population in ways that are different from other parts of the world is done in the first half of the report (p. 3-7), however, this analysis is almost completely ignored in the second half (p. 7-13) of the report that is focused on the prevention programming to be implemented in South Africa. The discussion of prevention activities occurs using universal generalities and is devoid of an explanation of why and how each activity will affect the South African population, and its specific underlying issues. This report distinguishes the target and vulnerable populations for the purpose of knowing which populations to focus programming roll-out on, and not necessarily which populations to focus on during development and formation of these prevention programmes. The report notes that –

“AIDS prevention programmes in other countries generally include some or all of the following technical elements:

1. Screening of blood and blood products
2. HIV/AIDS education programmes
3. Condom distribution
4. STD control

5. Voluntary HIV testing and counseling
 6. Needle exchange programmes (for intravenous drug users)”
- Schneider et al, (p. 7).

The “priority target [...] interventions for South Africa on a national level” proposed in the 1993 report are: “AIDS education, condom promotion and distribution, STD control and voluntary testing and counseling” (p. 9). It is, therefore, clear that the original proposed HIV prevention strategies were taken directly from programming conducted in other countries, leaving the risk that they may not answer the HIV-related issues that were specific to the South African population.

Over the past two decades it has become clear that whilst the prevention methods above have worked to a certain extent, within certain populations more than others, the vulnerability of certain populations highlighted in the 1990s has continued. We can see the manifestation of the response to this consequence in the South African Department of Health’s 2016 *HIV Prevention Strategy* report. The report begins similarly to the 1993 report, by highlighting specific vulnerable and target populations and areas, many of whom are the same that were highlighted in the 1990s (p. 4). However, this report extends on this through the creation of population specific strategies *in addition* to the necessary general strategies for the entire country (p. 10). In this report, the prevention strategies are constructed as “combination prevention packages” aimed at “reduction of HIV transmission and risky behaviours, strengthened treatment cascade, reduction of HIV morbidity and mortality, [and] reduction of stigma and discrimination” (p. 10). The “prevention interventions” are organized by two different measures – firstly by population and

secondly by intervention type: biomedical, socio-behavioral and structural (p. 10-31). Below are the “combination prevention packages” for the adult general population (p. 10), for young people (p. 15) and for young women and girls (p. 18):

Adult general population

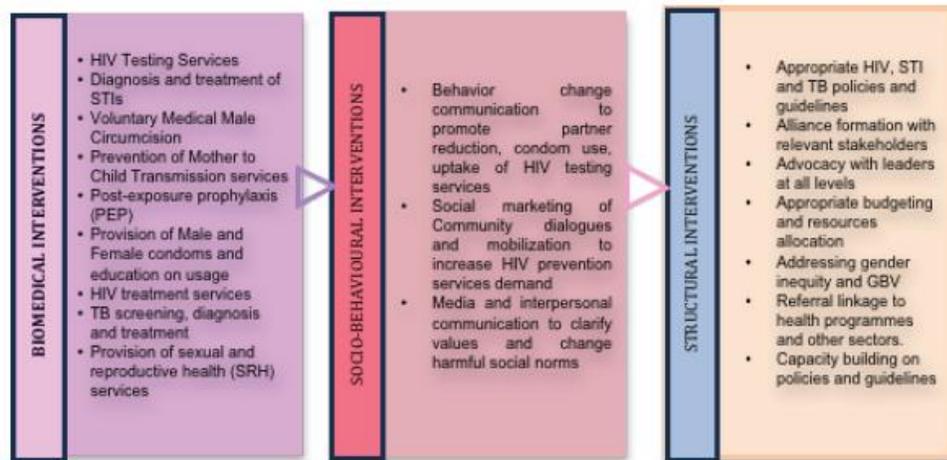


Image source: Department of Health Republic of South Africa. *Health Sector HIV Prevention.* 2016. p. 10

Young people

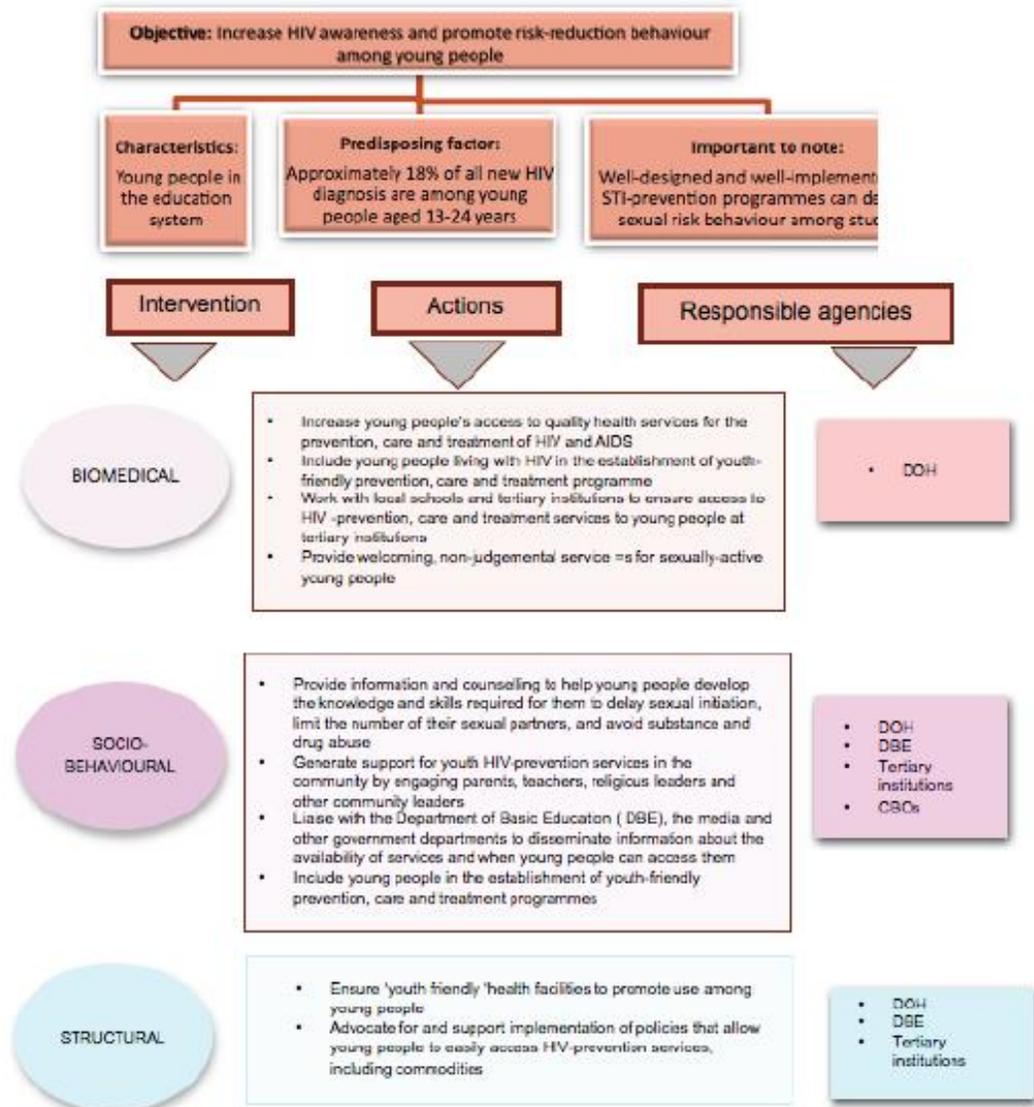


Image source: Department of Health Republic of South Africa. *Health Sector HIV Prevention*.

2016. p. 15

Young women and girls

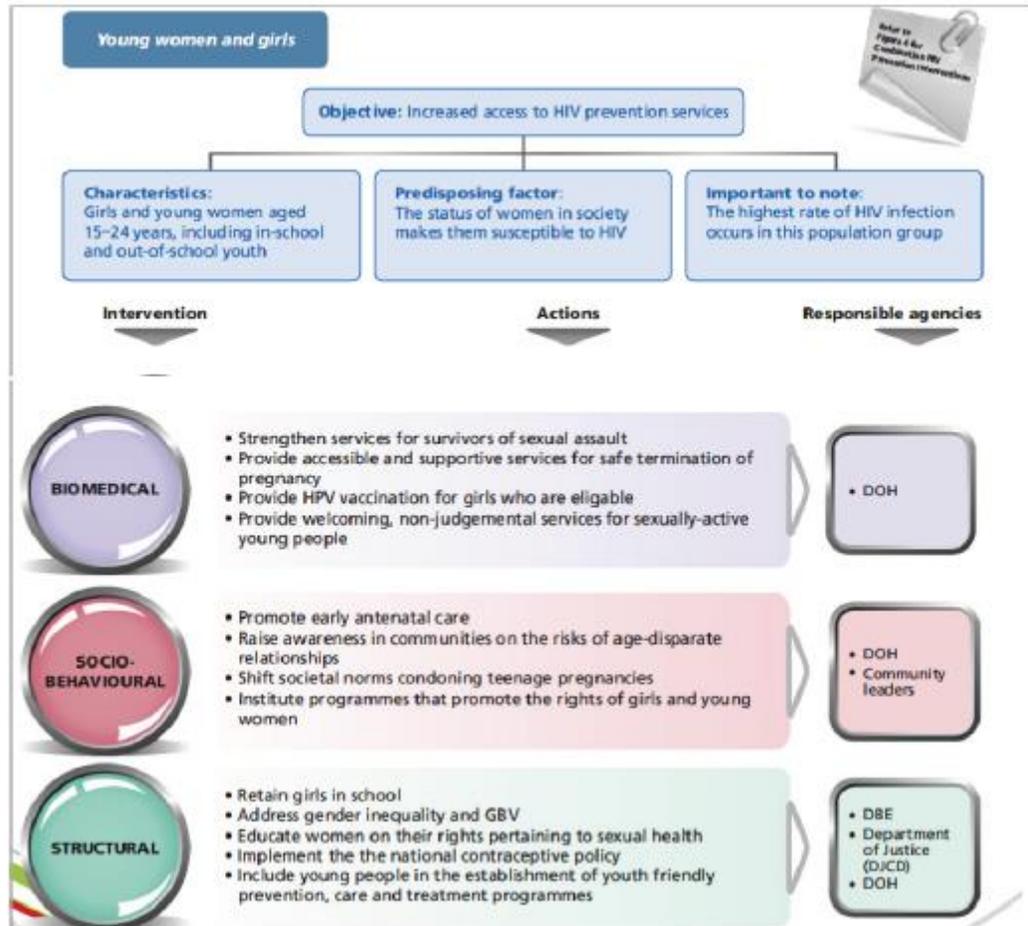


Image source: Department of Health Republic of South Africa. *Health Sector HIV Prevention*. 2016. p. 18

Compared to the 1993 report, not only does this report provide prevention interventions targeted towards specific populations, it also provides a strategically multi-faceted schema (biomedical, socio-behavioural and structural) to target a multi-faceted and complex health issue. This setup is very useful, as each of the facets they highlight are necessary in providing robust and effective prevention programming. This thesis focuses, specifically, on biomedical interventions – particularly using biomedical knowledge, research and technology to address the

behavioral, economic, political and socio-cultural factors discussed above, that characterize the vulnerability of young, black women.

In the South African government's *Health Sector HIV Prevention* report, the ambiguous way biomedical interventions are defined and characterized undermines the role, purpose and effectiveness of the "biomedical" facet in the "combination prevention package" approach. Firstly, there is no delineation between medical/biotechnical interventions and socio-behavioral or structural interventions that *occur* in medical settings. Both of these avenues are important, but they are distinct in the role they play and the factors they address. Conflating them increases the risk of overlooking one or the other. An example is, for the "young people" and "young women and girls" populations, provision of "welcoming, non-judgmental services for sexually-active young people" (p. 15 & 18), "working with local schools and tertiary institutions to ensure access to HIV-prevention, care and treatments services to young people at tertiary institutions" (p. 15) and "[increasing] young people's access to quality health services for the prevention, care and treatment of HIV and AIDS" (p. 15) are listed as "biomedical interventions". A distinction needs to be made between the *actual* biomedical prevention services being provided and the structures and strategies regarding *how* they will be provided. Secondly, through the broad labeling of all biomedical interventions as "services" there is no specificity or description provided, for example, "quality health services for the prevention, care and treatment of HIV and AIDS" (p. 15). This ambiguity in the definition and substance of biomedical interventions is important as it relates directly to South Africa's failure to

prioritize, particularly through funding, novel, targeted and context-effective biomedical and biotechnological interventions. This concern and its importance will be explained and further explored in the third chapter.

Of the biomedical/biotechnological interventions listed above that directly target the prevention of HIV infection in sexually active, young women, male and female condoms (barrier methods) remain the primary prevention instrument employed in the South African context. According to Mags Beksinska, Jennifer Smit and Joanne Mantell, education, research and distribution of male and female condoms is one of the “key priority areas in [HIV] prevention [in] the National HIV and AIDS and Strategic Plan for South Africa” (2012) – with male condoms considered a primary method, to be made “always available in all public sector facilities” and female condoms considered a method that should made “available in selected facilities” (2012). Rates of condom use in South Africa are complex because, although more than 52% of young people, aged fifteen to twenty-four, report using during their last sexual encounter, only 33% report that they consistently used condoms (Beksinska et al, 2012). Additionally, there is a large discrepancy across education and socio-economic ranges (Beksinska et al, 2012). Another study (Chimbindi et al, 2010), found similar results regarding general youth condom use, but also found that condom use among women was generally lower than among men of the same age group, and the rate of condom use went down as the age of the female’s partner increased (Chimbindi et al, 2010). Through the disproportionate emphasis on male condoms, control over condom use inevitably skews towards men (Chimbindi et al, 2010). Additionally, the socio-

cultural power, control and gender dynamics discussed earlier go a long way in explaining the statistics above as well as the limitations of any barrier method of protection (male or female). Other biomedical interventions include medical male circumcision and HPV vaccinations. Both measures are important in HIV prevention, however, neither addresses the core issues young women have in sexual and romantic relationships and encounters that make them so vulnerable to HIV infection.

South Africa has made great progress in how HIV prevention is considered, organized, designed and implemented. Furthermore, the research and detection of specific cultural and behavioral risks has allowed for the implementation of educational, structural and socio-cultural programming aimed at mitigating those risks and altering sexual behavior. However, it is in seeing this progress that it becomes apparent that there is an absence of the pursuit of better, targeted and context-effective biomedical interventions and solutions, through research and development. Performing HIV-related biotechnological research will increase the country's ability to target the unique manner this epidemic has spread and affected South Africa. However, to accomplish this, there needs to be a comprehensive understanding of the South African conditions that have affected the spread of this virus. Using Franz Fanon's work regarding decolonization as a lens, chapter two will attempt to elucidate the South African conditions that created the optimal context for the spread of this virus and affect the development of potential solutions.

CHAPTER II

Decolonizing a Democracy

Decades after the official end of British colonial rule and twenty-four years after the end of the oppressive apartheid regime, the indigenous black majority continues to face major structural, social and economic inequalities in several facets of life in South Africa. As of 2015, 55.5% of the country was living below the “Upper Bound Poverty Line” of R992 (approximately \$84) per month (Statistics SA, 2017). Whilst this figure overall decreased since the end of apartheid, it has risen by 2.3% from 53.2% in 2011. Of those living below the upper bound poverty line, 84.83% of them were black South Africans, 6.14% were coloured South Africans, and 0.1478% were white South Africans. 64.2% of all black South Africans live below the upper bound poverty line, compared to 41.3% of all coloured South Africans and just 1% of white South Africans (Statistics SA, 2017). The British and Dutch colonial regimes and apartheid regime relied heavily on the seizure of land and displacement of indigenous South Africans to advance the effects and purpose of their oppressive policies – and, at the end of apartheid, the white minority (approximately 8% of the country) owned upwards of 70% of the country's land (Institute of Poverty, Land and Agrarian Studies, 2013). Twenty-four years into the democratic South Africa, the unequal distribution of land continues to be a glaring reminder of centuries of oppression. According to the *Institute of Poverty, Land and Agrarian Studies* as of 2012, the white South African minority owned 67% of the country's land, whilst 15% of the land was black owned

and 10% of the land was state owned (2013). Whilst many steps have been taken to undo the consequences of the Bantu education system, in particular, and apartheid in general, on the current state of basic education and tertiary education, educational inequality across racial lines continue to plague South Africa. Of the twelve years of basic schooling in South Africa, black students spent on average 8.3 years in school, whilst white students spent on average 11.4 years in school (Mokati, 2017). There are many factors that underpin the huge dropout rates for black students, but the most frequently cited cause identified by children who dropped out of school before the age of eighteen was a lack of finances and an inability to afford schooling (BusinessTech, 2015). Despite this, as of 2013, black South Africans comprise 70% of the higher education and tertiary student population, compared to white students, who make up 17.5% of the student population (South African Center for Higher Education, 2016). However, it is important to note that this is still not in line with population demographics and, more importantly, it is necessary that we analyze the nuances of “higher and tertiary” education and its demographics. Although black South African students make up 70% of the total higher education student population, when we look at the highest ranked South African universities, in terms of instructional quality and research output, we see a different story. Looking specifically at the top three ranked universities, the University of Pretoria, the University of Cape Town and Stellenbosch University (Govinder et al, 2013) we find that black students make up 56.1%, 19.2% and 13.9%, respectively, of these three universities. Conversely, white students make up, 39.2%, 38.6% and 67.6%, respectively of these

universities. Additionally, at South Africa's top ten universities all had majority white staff, instructors, and faculty – with a median of 66% white staff, instructors, and faculty (Pillay & Hoffman, 2009). There are many other sectors of life, such as health, transportation, area type, unemployment, that intersect with the sectors above and continue to show the consequences of years of oppression, but even by just looking at poverty, land distribution and education, we see how the needle towards equality is struggling to move in South Africa.

This chapter seeks to investigate the “social disadvantage” conditions that are believed to be the foundation of South Africa's HIV epidemic. Firstly, using Franz Fanon's decolonization theories as the lens of analysis, this chapter will investigate how systems and infrastructure that are remnants of the colonial and apartheid regimes continue to exist and the impact they have on the status and development of a post-oppression, democratic South Africa – with specific focus on the HIV epidemic. Secondly, this chapter aims to investigate avenues to bring South Africa beyond resignation to ineffective and disenfranchising systems and infrastructure.

Deconstructing the Systems and Infrastructure that Remain

An argument can be made (and is often made) that twenty-four years is not enough time to significantly counter three centuries of oppression. In 2013, the then president of South Africa, Jacob Zuma stated, "while wanting to see change happening fast in every corner of the country, we are under no illusion that South

Africa will automatically and comprehensively change in only twenty years. That is impossible. The legacy of apartheid runs too deep and too far back for the democratic administration to reverse it in so short a period" (Steward, 2013). Whilst the history of oppression and its consequences created and reinforce the gross inequalities observed in South Africa, we need to critique and hold the post-oppression, democratic government and leadership accountable for the decisions and policies they have undertaken and employed that reinforce structures of disenfranchisement. Instead of the implementation of policies that would redistribute economic and social power, the African National Congress-led, post-apartheid, democratic government "[adopted] a neoliberal capitalist path, with small reforms here or there, while posturing as if social democracy was on the horizon" (Bond, 2004). Citing the ensuring of peace in the democratic transition and aims to keep South Africa economically viable in the rapidly globalizing world, the new "liberation" government, not only allowed the white minority to keep control of economic power, they also "set in motion neoliberal policies that exacerbated class, race and gender inequality" (Bond, 2004).

Whilst the colonial and apartheid dogma, policies and laws no longer underpin South African society, for many South Africans – particularly poor, black South Africans – similar socio-economic effects continue to exist and become reinforced. The reflections offered in Franz Fanon's 1961 book, *The Wretched of the Earth*, highlight how it requires more than just the removal of the colonial figures and perpetrators of oppressive regimes, to ensure true, encompassing and

sustainable decolonization in a country prepared for equality encouraging socio-economic development. Fanon offers the following:

The colonized intellectual has thrown himself headlong into Western culture. Like adopted children who only stop investigating their new family environment once their psyche has formed a minimum core of reassurance, the colonized intellectual will endeavor to make European culture his own (p. 156) ... In its narcissistic monologue colonialist bourgeoisie, by way of its academics, had implanted in the minds of the colonized that the essential values -meaning Western values remain eternal despite all errors attributable to man. The colonized intellectual accepted the cogency of these ideas and there in the back of his mind stood a sentinel on duty guarding the Greco-Roman pedestal (p. 11) ... We have seen that the nationalist parties base their methods and doctrines on the Western parties and therefore in the majority of cases do not direct their propaganda at the rural masses (p. 66).

Fanon argues that in post-colonial states, the commonalities that bound the colonized and the oppressed in their struggle for liberation against oppressive and colonial regimes, is not, in and of itself, sufficient to create a unified society poised for the attainment of justice and equality (p. 139-143). Once the common “physical enemy” is deposed, the stratifications among those that were colonized and oppressed comes into focus and paves the way for the establishment of a new self-directed, neocolonial-esque regime. Fanon divides the previously colonized into three broad categories: the colonized intellectuals, the urban workers and the majority “rural masses” (p. 29). The colonized intellectuals are those who most closely interacted with the structures of colonialism – and whilst they understood the tyrannical, dehumanizing and unjust nature of the regime, much of their

structural “intellectual” development and their deepening revulsion to colonial hypocrisy and injustice, occurred through exposure to the structures and tools of the colonial regime. It is through this proximity that, although the need for liberation from colonial control is widely recognized and fought for, there is an unwitting neglect of the remnants of the infrastructure the colonial society and the hierarchies upon which it was built. Beyond policy, social intervention and dogma, through “objective”/scientific academia and economic power differentials, “colonialists” built systems that defined the parameters of opportunity, success and development, that the decolonized state has been incredible difficulty getting rid of (p. 10-12). Through not deconstructing this infrastructure and rebuilding, the new “colonized intellectual” elite run the high risk of replicating a system designed with implicit hierarchies, where there is simply “a transfer of [the] power previously held by the elite” (p. 104) to the “elite” of the previously colonized, leading them to neglect and reinforce the plight of the “rural masses” (p. 63-66). Fanon offers a scathing rebuke of the neglect of deconstructing the artifacts of colonially built infrastructure, claiming that through attempting nation building within this infrastructure, the newly decolonized elite are transforming themselves into a “caricature of [colonial] Europe” (p. 119).

There are two main conclusions proposed in Fanon’s analysis, that I seek to apply to South Africa, specifically as they relate to the HIV epidemic, with relation to our history of colonial and apartheid oppression. First, I consider the difficulty of acknowledge and implement the needed deconstruction of the “Western values” that have become synonymous with being the objective default (Fanon, 13-16) and

the ways in which this perpetuates injustice. Secondly, I explore the futility of trying to build a just society within a system that was designed specifically for the disenfranchisement of the majority of the nation.

At the precipice of the democratic revolution, with ethnic and racial violence and tensions incredibly high, South African leaders focused on the establishment of peace at the mutual exclusion of radically seeking out mechanisms for the implementation of justice and equality (Lane, 1994). Few object that given the volatile state of the nation at the time, prioritizing peace at the beginning of an attempt to rebuild the nation was a necessity. However, inculcating a governmental culture that shied away from and was reluctant to implement the essential transformation in preference for slow and incremental steps towards black South African upliftment, presented its own limitations. Of this, Fanon predicts the violent revolt of the struggling majority upon the recognition of the absence of change, equality and justice. This is evident in the tensions that continue to rise in South Africa – from racially volatile threats on social media to violent, tragic, protests like in Marikana (Pollitt, 2017) – incremental steps at the expense of radical and observable transformation are not only insufficient in producing change, they do not adequately quell the violence they were instituted to prevent. The policies and systems that constitute these “incremental steps” are emblematic of the continued adoption of the remaining colonial infrastructure that Fanon discusses. There are many examples that highlight this, but a particularly illustrative example is the journey towards land reform and redistribution in South Africa.

As mentioned above, a major vehicle in colonial and apartheid oppression was the appropriation and seizing of land from South African natives, leading to the grossly disproportionate figures regarding land ownership discussed above. Since 1994, the South African government has promised both overall redistribution of land as well as the reclaim and return of stolen land – however, twenty-four years later barely a dent has been made in the redistribution of land (see above) and land claims can take over three decades to resolve (Roelf, 2018; Ramutsindela et al, 2016). Up until now South Africa has employed the “Willing Buyer-Willing Seller” redistribution policy, which gives the power to deny redistribution efforts or sell land at “exorbitant prices” to the (majority white) land owners (de Vos, 2013). This policy was not only endorsed by the World Bank, but also celebrated by the Western world and white land owners, as this “market-led approach” allowed for the easy and uncomplicated maintenance of “capital-intensive farming” at the expense of actively seeking the reform, equality and socio-economic upliftment of the black majority (Lahiff, 2007). This policy is a clear relic of colonial infrastructure and colonial modes of thinking as it exists with the assumption that the inherited economic status quo is objectively necessary and, once again, neglects the rural, poor black South African majority. Whilst this is an powerful example that supports South Africa’s place in Fanon’s predictions for a post-colonial (and in this case, post-apartheid) society – what is more significant in South Africa’s land reform story are the most recent developments and the global response.

The announcement and subsequent parliamentary vote to pursue “Land Expropriation without Compensation” has received global attention and critique,

and shows the unique factors that oppose the removal of colonial infrastructure in South Africa. This policy is an aim to, in the words of South Africa's president Cyril Ramaphosa, "speed up the transfer of land to black people, whilst ensuring the preservation of food production and security" (Roelf, 2018). This step towards reform and equality, a gross departure from "Willing Buyer-Willing Seller," is an attempt, on the South African government's part, at undoing infrastructures that disenfranchise the majority of black South Africans and a step towards the radical "demolition of colonial institutions" that Fanon claims is a necessary condition for the true and total freedom of the previously oppressed (Yansané, 35). The immediate and primary response of most of the global media, markets and institutions was to raise concerns about whether South Africa would become the "next Zimbabwe" and make immediate assumptions about the potential for an economic and food supply crisis (Kirsten & Sihlobo, 2018; Philander and Felix, 2018). There is no doubt that this undertaking comes with many risks and obstacles and that charting the path forward must be done skillfully and ethically, however, the global response is a reiteration of the "very Western, [...], very disparaging, idea that the [African] masses are incapable of governing themselves" (Fanon, 130) – which is incredibly dangerous and undermines the necessary attempts to undo disenfranchising infrastructure for the betterment of the South African majority.

The response of several white South Africans (specifically white South African farmers) illustrates a second, specifically South African, hindrance to the deconstruction of colonial infrastructure, that extends Fanon's idea that colonial mentality continues through indoctrination of the previously colonized elite.

Amongst some white South Africans there has been an immediate response of feelings of victimization by what they feel is indicative of the oppression of white South Africans. There were unsubstantiated claims and fears of a “white genocide” through the murder of white South African farmers (Gedye, 2018) – and despite a lack of verifiable statistics, with some analysts reporting the farm murder rate could be as low as 0.4 per 100 000 people (Wilkinson, 2017), compared to almost 300 per 100 000 people for black men in urban townships (Allison, 2018), these fears have culminated in Australia’s home affairs minister publicly announcing considering expedited visas for white South African farmers “on humanitarian grounds” (Goldman, 2018). This unsubstantiated assumption of oppression is an exaggerated example of a uniquely South African impediment towards true decolonization, freedom and equality.

Attempting to rebuild a just and equal nation in a post-colonial and post-apartheid South Africa is complicated by the protection of infrastructure and systems, that disenfranchise the majority of South Africa, by a minority who, not only benefitted from racial privilege during the oppressive colonial and apartheid regimes, but continue to benefit from the presence of the remaining infrastructure. Balancing the need for the unification of the society in the process of democratic rebuilding, with the need to deconstruct and replace infrastructure, that a minority may seek to protect, but that the majority *need* to be gone, is a unique tension in South Africa that requires deliberate and skillful navigation.

This contextualization of Fanon’s theories in South Africa provides a platform and lens through which we can analyze the nuances of the spread of

HIV/AIDS and the populations most vulnerable to it. When returning to the HIV incidence and prevalence statistics we first encountered in the introduction, we can see the “left-behind masses” Fanon warns us about, in his chapter “Grandeur and Weakness of Spontaneity” in *The Wretched of the Earth*, carrying the brunt of the burden when it comes to the HIV/AIDS epidemic in South Africa. The slow process of *incremental progress*, and the disenfranchising infrastructure it allows the continuation of, has created both the socio-economic determinants that have propelled the spread of the virus throughout disadvantaged South Africa, but also acts as a potential hindrance in the development of effective solutions. In order to help illustrate this reality, I will analyze the interface between colonial infrastructure – and how the democratic government upholds this – the consequential socio-economic disenfranchisement and the resulting vulnerability to the HIV epidemic in one of the hardest hit sectors of the South African population: *Urban Informal* areas and the townships that they are closely associated to.

The development of “Informal Settlements” and townships in South Africa was a design of the apartheid government’s segregationist mission. Through forced removals and laws like the *Group Areas Act* of 1950, the apartheid government forced black and coloured South Africans in “urban areas” into settlements known as townships placed just outside the outskirts of cities (Findley & Ogbu, 2011). These settlements existed outside the *Bantustan* – territories set aside for black self-governance as they served to house the “black population [used] as [the] temporary labor” needed within white cities (Findley & Ogbu, 2011). Townships during the apartheid era were characterized by the lower standard in resources – like

healthcare, sanitation, education and general facilities – that was indicative of the apartheid government’s general treatment of South Africans. Particularly, they were characterized by homogenous, small “matchbox houses” and were located far outside the cities – it could take people up to three hours to reach their jobs in the city (Findley & Ogbu, 2011). Since the end of apartheid, the problem of townships has grown. Large migration to urban areas, of black Africans seeking jobs and opportunities, has caused an exponential increase in the population living in the limited space and resources of informal suburban townships. The boom in population caused the introduction and exponential increase of illegal and informal “shacks”, built with corrugated zinc (Bosworth, 2016; Worcester Polytechnic Institute, 2015). There are often entire families who live in these single room occupancies, without electricity, running water or sanitation facilities. Other basic resources like healthcare and education are also characterized by poor quality and a lack of resources (Hyatt, 2016). It is in these communities, on the outskirts of cities, that most black South Africans in urban areas live. In the past two decades the poverty, lack of basic resources, crime and neglect that is synonymous with South African townships is a sad illustration of the failings of the democratic government to undo the infrastructure of oppression. It cannot be denied that this reality is a vestige of the oppressive apartheid government, but the democratic government has reinforced these vestiges through both neglect and active policies and actions.

Looking specifically at two programs the government has undertaken to address the issue of informal, peri-urban settlements, we are reminded of Fanon’s

assertions that real socio-political and economic freedom can only be attained through the demolition of “colonial institutions” (Yansané, 35) – we are reminded of the futility of trying to achieve upliftment, equality and development from within the same infrastructure that was designed for one’s own disenfranchisement.

In attempting to address the lack of sanitation in townships, particularly in areas densely populated by shacks, municipal governments intervened with the introduction of shared outhouse toilets and taps. These toilets are primarily “container, chemical or portable flush toilets” (Ampofo-Anti, 2017). Unlike “full flush toilets”, these toilets are not connected to the municipal sewerage system and require regular maintenance and waste removal (Ampofo-Anti, 2017). When communities protested the indignity of these toilets, the sanitation concerns they created, and the safety issues they raised for those (especially women) using them at night, the government responded by increasing the ratio of toilets from “1 toilet for 9.6 households to 1 for 4.3 households” (TimesLive, 2016). Furthermore, when looking to tackle the township housing issues, the national government implemented their *Reconstruction and Development Programme*. This involves the cheap building of “subsidized housing on cheap, readily available land on the outskirts of major cities” (Bosworth, 2016). Both of these primary strategic attempts of the democratic government focused on trying to improve these apartheid-created informal settlements, rather than aiming to *eliminate* them to give way to a new structure of housing. These attempts of “upgrading” these apartheid-created structures has been futile, not only because it has failed to address the issues of these settlements, purposefully created by the apartheid government, they have, in certain

cases, exacerbated them. Scaling up the same system of outdoor toilets, employed during apartheid; and building cheap housing on the outskirts of cities for poor black people, as was general practice during apartheid, does not reform or confront problematic systems, it reinforces them.

It is in this context of poverty, crime, lack of sanitation and access to health and education resources – neglected and reinforced by the remaining disenfranchising infrastructure – that the HIV epidemic was destined to flourish. As discussed in the first chapter, “in South Africa, AIDS is fundamentally a disease of social disadvantage” (University of Witwatersrand’s Center for Health Policy & South African Medical Research Council, 2013) – informal urban settlements, perfectly embody social disadvantage that is historically created, and modernly reinforced. According to Bhana and Peterson, “poor socio-economic conditions and [a] lack of opportunities as well as poor school environments can enhance [the] high-risk sexual behavior” that is linked to increase HIV prevalence and incidence rates (p. 60). It thus follows, that as of 2012, by far the highest prevalence of HIV (by “locality type”) was in these “urban informal” settlements/townships (Shisana et al, 2012) – with a prevalence rate of 19.9% (7.7% above the national average prevalence rate), with the next highest prevalence rate being rural, informal settlements which had a prevalence rate of 13.4%. Using decolonization as our lens of analysis, we have been able to track how attempting to build and develop *within* the remnants of colonial and apartheid societal infrastructure, is both futile and reinforces systematic and structural disenfranchisement – and how (with relation to

the first chapter) this socio-structural disenfranchisement and disadvantage can be directly linked to the spread of HIV in South Africa.

Fanon's commentary regarding the colonial assertion of the objectivity of the "West's" intellectual, economic and social knowledge and "values", in order to ensure that "Western values remain eternal despite all errors attributable" to the colonizer (p, 11), reminds us that although the unjust, cruel and persecuting nature of colonial and apartheid oppressors, and their regime, is largely uncontested, we must be aware of our indoctrination and propulsion into actualizing "Western values" and knowledge into objective truth., Using this knowledge and these values as the default "essentials" we build our societal actions and programmes off of, undermines our ability to factor in the nuances of our socio-cultural realities, that "Western" knowledge struggles to acknowledge or understand. When we relate this directly to the HIV epidemic for black South African women, we see that the "Western" knowledge that is responsible for the prevention programming discussed in chapter one, does not need to acknowledge or seek to correct the unique issues that underpin the vulnerability of black, South African girls and young women. Thus, assuming objective, eternal and essentiality of this knowledge and its discoveries, places the health community in a position where they are not able to effectively protect these girls and young women from the HIV epidemic. This signals the need for a profound shift emphasizing knowledge creation, research and invention – by South Africans, specifically for the South African context. I will elaborate on this, with relation to HIV prevention research in chapter three.

Mapping the Journey Forward

For the people the party is not the authority but the organization whereby they, today the people, exert their authority and will... In an underdeveloped country the party must be organized such a way that it is not content merely to stay in touch with the masses. The party must be the direct expression of the masses... It is the vigorous spokesperson and incorruptible defender of the masses.

Frantz Fanon, *The Wretched of the Earth*, p.127, 128, and 130

A major theme of “The Trials and Tribulations of National Consciousness” in Fanon’s *The Wretched of the Earth*, is the idea that in a post-colonial (or post-oppression in the case of South Africa) country, the organizations of leadership are required to be the voice and vehicle of the needs and will of *the people*. There are many layers of lessons that we can take out of his analysis. Firstly, Fanon elucidates the need for the “masses” be the *focus* and *subjects* in the restructuring of society and in the construction and implementation of development strategies and actions taken by the leadership. It is not enough to make them either passive beneficiaries to indirect strategies. This is an important lesson that we can apply to the formulation of target and effective prevention strategies for the girls and young women who embody Fanon’s “masses” left increasingly vulnerable to HIV infection and transmission. Unlike the prevention strategies discussed in chapter one, a unique strategy, in which these women are the *subject* and user being catered for, needs to be constructed and implemented. Secondly, the idea that government and leaders should not be “the authority, but rather the organizations whereby [...] people exert their authority and will” (p. 127) is crucial in highlighting the need to

ensure black girls and young women have agency, choices and a voice in every step of the process, from inception, through development, and especially during implementation. The importance of self-direction in creating community buy-in – and the importance of giving them all the tools and information needed to consistently have agency and control over well-informed decisions – cannot be ignored. In chapter four, I will elaborate on this in a discussion of the implementation lessons that can be learnt from the problems experienced during the roll-out of the contraceptive *Implanon* in the third chapter.

I have spent much of this chapter outlining the necessity of breaking away from colonial infrastructure, but it is important to distinguish the *raw material- esque* knowledge and technology from the socio-political, hierarchical structures they historically stemmed from, or were a response to. Ali Mazrui calls this “domestication” (Mazrui, 93) in his discussion of the steps “decolonizing” societies need to take in their journey of modernization; explaining this as the idea of taking imported knowledge, values or goods, and critically and carefully deconstructing and reconstructing them to make them relevant and pertinent to the local context. This is the same way that I want to propose HIV prevention in South Africa can be approached: using existing or developing cutting edge knowledge, technology or methodology to invent novel, targeted strategies to address this South African socio-cultural issue. It is essential that South Africans are careful and considerate as they decide which pieces of the larger global knowledge and infrastructures to use and be cautious in this balance to not perpetuate mistakes, like those of former president Thabo Mbeki, in his denialism of the link between HIV and AIDS and

his restriction of antiretroviral drug treatment programme in South Africa that is estimated to have caused the “unnecessary deaths of 330 000 people and the infection of 35 000 new born babies” (Boseley, 2008), in the name of a “decolonization mission”.

Finally, as discussed earlier, in South Africa, there is a difficult balance between critique and deconstruction of oppressive infrastructure, whilst attempting to build a united society that does not villainize those that benefitted or continue to benefit from this unjust infrastructure. An interesting way to confront this tension, is through looking at it through Steve Biko’s ideas of *Black Consciousness*. *Black Consciousness* is a unique liberation movement as it, first and foremost, involved the liberation of “the minds of black people” through the emphatic creation of the black person’s belief in the “positive, creative and gifted” black identity to counter black submission to the governmental message of black inferiority (Hadfield, 2017). The movement was underpinned by the idea of the self-liberation of “black” (this included coloureds and Indians as well) people. Biko argued that through their proximity to privilege, *white liberals* opposing apartheid could never fully understand and *own* the experience of subjugation, and thus could not, and should not be the main drivers, architects or characters in the fight for liberation and change (Kamola, 2014). Applying this idea, whilst it is useful and important to have national, private and global assistance in targeting HIV Prevention, the main subjects, architects and strategists that drive the programmatic change, must be from within those primarily affected. According to the World Health Organization, one in five people living with HIV *in the world* are South Africans, and 87% of

South Africans living with HIV are black – meaning that 17.4% of people living with HIV in the world are black South Africans. Nobody understands the impact of this virus on young, black South Africans – particularly young black South African women as intimately; few can comprehend and investigate the socio-cultural, economic and traditional realities that have propelled this epidemic better; and finally, nobody cares as much as we do. Steve Biko’s *Black Consciousness* extends on Fanon’s idea of agency and subject focus, through a reminder that it is necessary, but not sufficient, to have those within vulnerable populations as the target focus in the development of novel and effective preventive measure, it is also necessary that these vulnerable populations take responsibility for driving this agenda in order to achieve effective change.

CHAPTER III

Locally developed, locally targeted: Creating Effective Biomedical Interventions

“Therefore, national liberation takes place when, and only when, national productive forces are completely free of all kinds of foreign domination. The liberation of productive forces and consequently the ability to determine the mode of production most appropriate to the evolution of the liberated people necessarily opens up new prospects for the cultural development of the society in question by returning to that society all its capacity to create progress”

Cabral, Return to the Source: Selected Speeches of Amilcar Cabral, p. 43.

Cabral communicates so eloquently the need for a nation’s recapturing of control and creativity, and purposeful self-direction in the production process. This is important because of the socio-cultural and political expertise the citizens can inject into the production process, and because this liberation empowers and institutes trust in the nation’s production and innovation capabilities and creativity. An emphasis on this “liberation of productive forces” needs to be placed on locally produced and directed knowledge and research.

This chapter focuses on the local production of biomedical HIV prevention methods. This chapter will analyze how the South African government’s funding of HIV/AIDS programming supports the notion proposed in chapter one that the development of, locally produced and locally directed, biomedical HIV prevention interventions is being neglected. Additionally, it will propose and discuss a novel locally directed biomedical intervention based on tenofovir diphosphate.

Prioritizing HIV/AIDS Biomedical Prevention Intervention Funding

Looking specifically at the 2013-2014 fiscal year, of the South African government's total year expenditure, 14% is spent on public healthcare services, programming and research (WHO, 2014). The South African government made up 48.4% of the South African health sectors total expenditure over the course of the year. The rest of the funding for the South African health sector was a combination of donor aid (1.8%) and private funding (51.6%). Of the health sector's total expenditure during this year, 23% of funding went to HIV/AIDS expenditure (WHO, 2014). The South African government financed 77% of the HIV/AIDS expenditure, which totaled 1.5% of the government's total spending over the course of the 2013-2014 fiscal year (WHO, 2014). South Africa dedicates one of the highest percentages of its GDP to its health sector, and specifically to HIV/AIDS spending (UNICEF, 2017) and that is a trend that has remained consistent over the last few year's. Of the total R38 billion to R50 billion health budget, R16 billion to R23 billion was (or is planned to be) spent on "HIV and AIDS, Tuberculosis and Maternal and Child Health" (UNICEF, 2017) between 2017 and 2020. This is 42-46% of the total health budget, which is the second highest government health expenditure; marginally following what has been budgeted for "Hospitals, Tertiary Health Services and Human Resource Development". In this same time period, the health sector made up 13.4-14.1% of the South African government's total yearly expenditure (UNICEF, 2017). These figures are significant, as they show an acknowledgement and dedication to generally combatting the HIV/AIDS epidemic. However, further analysis of the direction and focus of HIV/AIDS spending,

particularly HIV prevention spending, demonstrates the South African government's overlooking of the need for biomedical prevention intervention research.

In the 2013-2014 fiscal year, 40% of South Africa's HIV/AIDS and TB expenditure, went to "care and treatment" (Guthrie et al, 2016). Given the already existing burden of those infected with HIV in the country, it is logical that provision of treatment and care for those already infected will be a primary focus of HIV/AIDS and TB budgeting. Treatment of those already infected with HIV, not only reduces mortality and improves quality of life for those living with the virus and disease, but through controlling and reducing the viral load in those already infected, using Antiretroviral Treatment, the risk of transmission drops significantly (Hosseinipour et al, 2002).

In the 2013-2014 fiscal year, 27% of South Africa's HIV/AIDS and TB expenditure went to HIV prevention strategies, programming and research. 44.4% of the budget allocated to HIV prevention (and 12% of the total HIV/AIDS and TB budget) was spent on "Social Programme Enablers and Communication" and the remainder of the HIV prevention budget (55.6% of the prevention budget, and 15% of the overall HIV/AIDS and TB budget) was divided between all other prevention strategies, namely: comprehensive condom programming, HIV counseling and testing, "key populations", medical male circumcision, Prevention of Mother to Child Transmission (PMTCT) and finally, "other biomedical prevention" (Guthrie et al, 2016).

We see that investment into researching and developing biomedical prevention interventions has been neglected by the South African government. In addition to minimal budgeting for this research in South Africa's HIV prevention expenditure, 85% of what has been budgeted towards biomedical interventions comes from international aid – particularly from the United States of America's government's *President's Emergency Plan for AIDS Relief* (PEPFAR) (Guthrie et al, 2016). The South African government's neglect of locally developed and locally directed biomedical research, undermines South Africa's ability to provide direct and effective interventions to vulnerable populations like girls and young women.

Locally Developed, Locally Directed Biomedical Interventions

There is a need for local emphasis on developing novel, target-specific biomedical interventions. This section aims to discuss the use of tenofovir diphosphate in current and emerging HIV prevention treatments and research, and then propose modifications and adaptations that can develop a novel biomedical intervention specifically for black, young South African girls and women.

Tenofovir Disoproxil Fumarate/Tenofovir/Tenofovir Diphosphate

Tenofovir diphosphate is nucleotide reverse transcriptase inhibitor (NRTI). It is a nucleotide analog with an absent 3' hydroxyl group, thus, blocking the next nucleotide from forming the phosphodiester necessary for continued transcription. This mechanism of prevention of viral replication allows tenofovir diphosphate to be used in both antiretroviral treatment and in HIV prevention (Baheti et al, 2011).

Tenofovir (and tenofovir diphosphate) are ionic and polar, reducing its bioavailability when ingested orally. As a result, tenofovir is introduced into the body in the form of its prodrug: tenofovir disoproxil fumarate in order to mask the ionic regions, enabling gut penetration (Anderson et al, 2011). In the liver, tenofovir disoproxil fumarate is transformed into tenofovir, which is the primary form of the drug that circulates in the plasma (Anderson et al, 2011; Duwal et al, 2012). Once tenofovir enters its target cells, it undergoes phosphorylation twice, forming tenofovir diphosphate – which is an analog of the nucleotide “deoxyadenosine triphosphate” (Anderson et al, 2011; Duwal et al, 2012). When tenofovir diphosphate is incorporated into the growing viral-DNA chain by HIV reverse transcriptase, instead of deoxyadenosine triphosphate, it blocks the continuation of DNA polymerization, thus averting the formation of the pro-viral DNA necessary for HIV replication (Nelson et al, 2015). Tenofovir is a primary drug used in approved HIV prevention treatments and in ongoing prevention research.

Specific Tenofovir based HIV Prevention Treatment

Truvada is currently the only drug or medication that has been approved by the United States’ Food and Drug Administration and the South African Medical Control Council (Nelson et al, 2015; Medical Control Council, 2015) to be used for the purposes of preventing HIV infection and transmission. Truvada is a combination of tenofovir disoproxil fumarate and emtricitabine. Similarly to tenofovir, emtricitabine is phosphorylated to form an analog of deoxycytidine 5’-triphosphate, which it outcompetes during transcription, halting the further growth of the viral DNA chain (National Center for Biotechnology Information, 2018).

Truvada is usually prescribed as one tablet, once daily, ingested orally. In each tablet there is 300mg of tenofovir disoproxil fumarate, of which 245mg are tenofovir, and 200mg of emtricitabine (Gilead & FDA, 2005). The intracellular half-lives of tenofovir diphosphate and emtricitabine are 150 hours and 39 hours, respectively. This extended half-life allows room for minor adherence lapses, however, it takes four half-lives for the drug to reach “steady-state” and inconsistent use plays a major role in the effectiveness of the drug (Anderson et al, 2011). Patient adherence is one of the primary causes in cases where Truvada fails to prevent HIV transmission. When multiple clinical trials reported low rates of Truvada efficacy (ranging from 39-75%), the data was analyzed by cohorts of adherence. In groups showing high drug adherence rates, Truvada was found to be 91% effective in preventing HIV transmission and a drug regimen consisting of only tenofovir disoproxil was found to be 88% effective in preventing HIV transmission (Nelson et al, 2015). Inconsistent drug use and low adherence are especially concerning as both tenofovir and emtricitabine are first-line antiretroviral treatments, thus, in addition to unreliable prevention of HIV transmission, inconsistent Truvada use could result in tenofovir and emtricitabine drug resistance.

Adherence to treatment is an ongoing problem in South Africa’s health sector. Financial, socio-cultural and individual factors have all been cited as affecting patient adherence. High rates of poverty make seeking out and procuring health related items a far lower priority than securing more fundamental needs, like food and shelter. Additionally, many patients report not having sufficient funds for transportation to clinics and hospitals (Azia et al, 2016). Other barriers include

social perceptions and stigma. Medication in the form of *prophylaxis* is not yet common throughout South Africa. As a result, taking medication and treatment is associated with illness and disease. Consequently, adherence is limited by fears of being perceived as sick and the stigma that comes with that (Azia et al, 2016). One final factor reported is inadequate “health literacy”. In the overburdened public health care system, clinicians and caregivers cannot prioritize detailed treatment and drug counseling. A limited understanding of the dangers of inconsistent treatment use and dissatisfaction or fear at drug side effects, decrease patient adherence.

Tenofovir and emtricitabine HIV prevention drugs, particularly Truvada, are advancements that have the potential to ease the burden of HIV transmission on vulnerable populations. Looking specifically at young, black girls and women in South Africa, Truvada fits many of the constraints a targeted and effective biomedical intervention would need to possess that are discussed above. A medication like Truvada would afford these women the agency, control and privacy that is missing from current biomedical interventions being employed in South Africa. However, the need for daily ingestion and the existing adherence concerns may undermine the effectiveness of this drug. The need for long-acting or intermittent PrEP drug delivery systems is becoming increasingly acknowledge. A lot of research is being directed towards drug loaded vaginal gels/creams and intravaginal rings (Nelson et al, 2015). However, both of these methods lose some of the advantages offered by an oral dose. The need to apply vaginal gels and creams before and after a sexual encounter and the observable physical presence of

intravaginal rings in the vagina (Nelson et al, 2015) may eliminate the privacy advantage, thus placing the woman's ability to control the employment and operation of this intervention at risk. An extended release tablet would decrease adherence risks, whilst maintaining the advantages provided by daily, oral, PrEP. The rest of this chapter will investigate the use of osmotically controlled drug delivery to develop a tenofovir-based tablet that replaces the daily regimen needed for Truvada, with a weekly regimen.

An Osmotically-Driven, Extended Release, Tenofovir Disoproxil Fumarate Tablet

The development of this extended release tablet will adapt the known prophylactic pharmacokinetics of the absorption and elimination of tenofovir, with osmotically modulated drug release. The intracellular steady-state tenofovir diphosphate concentration is $80 \text{ fmol}/10^6 \text{ cells}$. With daily, 300mg doses of tenofovir disoproxil fumarate, this steady-state concentration is reached following approximately 25 consistent and daily dosages (Anderson et al, 2011). To map out the delivery of tenofovir via an osmotically controlled release, a method to calculate the release rate, absorption rate, cellular metabolism and elimination rate must be developed.

The variables, parameters and terms that will be used in calculating and illustrating this mechanism are as follows:

A_s – is the surface area of the tablet. In order for the tablet to be large enough to hold approximately 2 grams of drug and polymer it will be the following dimensions (Capsuline, 2018): total height – 26.5mm; tablet width/spherical width

– 10mm; non-spherical height – 16.5mm. This means the tablet surface is $8.32522 \times 10^{-4} \text{m}^2$.

h – is the thickness of the semi-permeable membrane. Varying this thickness will change the water flow rate across the membrane, thus changing the release rate.

L_m – is the mechanical permeability of the semi-permeable membrane.

σ – is the reflection coefficient. Assuming the membrane is perfectly semi-permeable, the reflection coefficient is 1 (Sahoo et al, 2015).

Π – is the osmotic pressure.

$\frac{dm}{dt}$ – is the drug delivery rate.

$C_0(t)$ – is the concentration of the tenofovir disoproxil fumarate inside the tablet at a given time t .

BA_{bio} – is the bioavailability of tenofovir diphosphate. The fasting bioavailability of tenofovir disoproxil fumarate is 0.25 (Moss, 2017).

k_a – is the rate constant governing the absorption and conversion of tenofovir disoproxil to tenofovir. In Duwal et al's model depicting the pharmacokinetics of the prophylactic efficacy of tenofovir, is calculated as $\frac{1}{3600} \text{s}^{-1}$ (2012).

$C_{\text{plasma}}(t)$ – is the concentration of tenofovir in the plasma at a time t .

k_e – is the rate constant governing the elimination of tenofovir directly from the plasma. In Duwal et al's model depicting the pharmacokinetics of the prophylactic efficacy of tenofovir, is calculated as $3 * 10^4 \text{s}$ (2012).

V_p – is the volumetric conversion parameter as tenofovir is phosphorylated twice intracellularly to form tenofovir diphosphate. In Duwal et al’s model depicting the pharmacokinetics of the prophylactic efficacy of tenofovir, is calculated as $2.5 * 10^{-3} \frac{g*s}{dm^3}$ (2012).

k_p – is the rate constant that governs the diphosphorylation of tenofovir into tenofovir diphosphate in the cell. In Duwal et al’s model depicting the pharmacokinetics of the prophylactic efficacy of tenofovir, is calculated as $3.413 * 10^{-8} g * dm^3$ (2012).

$C_{cell}(t)$ – is the concentration of tenofovir diphosphate in the cell at a given time t.

k_{out} – is the rate constant that governs the elimination of tenofovir diphosphate from the cell. In Duwal et al’s model depicting the pharmacokinetics of the prophylactic efficacy of tenofovir, is calculated as $5.184 * 10^{-3} \frac{g*s}{dm^3}$ (2012).

Molecular Weight (Tenofovir Disoproxil Fumarate) = 287.213 g/mol

Solubility (Tenofovir Disoproxil Fumarate) = $13.4 \frac{mg}{ml} = 13.4 \frac{g}{dm^3}$ (NIAID, 2013)

V_{tablet} – is the volume of our tablet. Using the dimensions discussed above,

$$V_{tablet} = 1.819505745 \times 10^{-3} dm^3$$

The tablet consists of a “drug layer” – which holds both the prodrug tenofovir disoproxil fumarate and an osmotic agent. An osmotic agent is an ionic

substance that assists in the creation of a concentration gradient, which drives the osmotic uptake of water into the tablet (Gupta et al, 2010). Below this will be an expanding polymer that will expand as water enters. The expansion of this polymer will aid in driving the tenofovir disoproxil, through the orifice, from the tablet (Keraliya et al, 2012). The tablet will be covered by a semi-permeable membrane with a single orifice at the center of the membrane covering the drug layer. The semi-permeable membrane will allow water to flow across, but not any drug solute. The concentration gradient across the membrane will drive water into the tablet, the resulting pressure, will force the drug solution through the orifice (Gupta et al, 2010). The drug release rate from the osmotically controlled tablet is dependent on the water flow rate across the membrane and the concentration of the drug in the tablet at a given time. The volume flow of water is modeled by the equation below. The presence of the orifice makes any changes hydrostatic pressure negligible, and the osmotic pressure in the gastrointestinal tract can be ignored as it is far smaller than the osmotic pressure within our tablet (Sahoo et al, 2015; Liu et al, 2014; Keraliya et al, 2012; Ende, 717-719). This results in an equation dependent on tablet surface area, membrane thickness, permeability and reflection coefficient, and the osmotic pressure within the cell:

$$\frac{dV}{dt} = \frac{A_s}{h} * L_m * \sigma * \Pi \text{ (Sahoo et al, 2015; Ende, 717-719)} \quad (1)$$

The differential equation modeling the amount of tenofovir disoproxil present for absorption is the osmotic drug release rate combined with a term that accounts for the absorption of tenofovir into the plasma. The absorption term is modulated by BA_{bio} , which is the bioavailability of tenofovir disoproxil fumarate.

This bioavailability tells us the percentage of tenofovir the body will be able to absorb and transform and use:

$$\frac{dm}{dt} = \frac{dV}{dt} * C_0(t) - BA_{bio} * k_a C_{plasma}(t)$$

Incorporating equation (1):

$$\frac{dm}{dt} = \frac{A_s}{h} * L_m * \sigma * \Pi * C_0(t) - BA_{bio} * k_a C_{plasma}(t) \quad (2)$$

The concentration of tenofovir in the plasma is a combination of the process of absorbing tenofovir into the blood circulation, the process of tenofovir conversion into tenofovir diphosphate as it is absorbed into the cell, and finally, the metabolism and elimination of tenofovir directly from the plasma:

$$\frac{dC_{plasma}(t)}{dt} = BA_{bio} * k_a M(t) - C_{plasma}(t) * k_e - \frac{V_p * C_{cell}(t)}{k_p + C_{cell}(t)} \quad (Duwal \text{ et al, 2012})$$

(3)

The concentration of tenofovir diphosphate in target cells involves the absorption and phosphorylation of tenofovir and the process of metabolizing and eliminating tenofovir diphosphate from the cells:

$$\frac{dC_{cell}(t)}{dt} = \frac{V_p * C_{plasma}(t)}{k_p + C_{plasma}(t)} - C_{cell}(t) * k_{out} \quad (Duwal \text{ et al, 2012}) \quad (4)$$

These four equations form the general backbone for modeling the release, absorption and elimination of an osmotically controlled tenofovir release system. We can further develop this by applying the following constraints and boundary conditions that are specific to our tablet:

In order to maintain plasma and cell concentrations over the course of the week that are adequate and comparable to those produced by a daily drug regimen, a delivery rate constraint can be set that corresponds with the daily regimen:

$$\frac{dm}{dt} = \frac{300mg}{24hrs} = 3.4722222222 \times 10^{-6} \text{ g/s} \quad (1)$$

Additionally, we can set initial and boundary conditions for the concentrations found in each tablet. The molecular weight and solubility of tenofovir disoproxil fumarate help in the calculation of the initial tablet concentration:

$$C_0(t = 0) = 4.018479621 \text{ mol/dm}^3 \quad (2)$$

$$C_0(t \rightarrow \infty) = 0 \quad (3)$$

In developing the above equations and parameters, the following assumptions have to be made:

1. The outlet orifice is large enough to allow us to consider the hydrostatic pressure gradient as negligible (Sahoo et al, 199)
2. The osmotic pressure inside the device is much larger than the osmotic pressure of the external environment, therefore we can consider the external osmotic pressure as negligible (Sahoo et al, 199).
3. All the drug present in the plasma is either eliminated directly from the plasma or is absorbed into the cells

Finally, using the variables and parameters above, the following set of ordinary differential equations can be used to investigate the osmotically controlled release of tenofovir disoproxil fumarate administered intra-orally, weekly:

$$\frac{dm}{dt} = \frac{8.325 \cdot 10^4}{h} * L_m * \Pi * C_0(t) - 6.94 * 10^{-6} * C_{plasma}(t)$$

$$\frac{dC_{plasma}(t)}{dt} = 6.94 * 10^{-6} M(t) - 3 * 10^4 * C_{plasma}(t) - \frac{2.5 \cdot 10^{-3} * C_{cell}(t)}{3.413 \cdot 10^{-8} + C_{cell}(t)}$$

$$\frac{dC_{cell}(t)}{dt} = \frac{2.5 \cdot 10^{-3} * C_{plasma}(t)}{3.413 \cdot 10^{-8} + C_{plasma}(t)} - 5.184 * 10^{-3} C_{cell}(t)$$

With the following constraints and initial/boundary conditions:

$$\frac{dm}{dt} = \frac{300mg}{24hrs} = 3.472222222 \cdot 10^{-6} g/s$$

$$C_0(t = 0) = 4.018479621 mol/dm^3$$

$$C_0(t \rightarrow \infty) = 0$$

The variables not set (h , L_m and Π) are dependent on the choice of semi-permeable membrane, “push-pull” polymer and osmotic agent. These choices can be manipulated to find the optimum conditions. Although this set of equations and constraints have been developed from manipulating and combining different, verified models, the next step would have to involve testing in order to substantiate and verify validity.

Combining scientific research, discoveries and development with purposeful socio-cultural understanding is a gap that needs to be filled in South Africa’s HIV prevention programming. Successful and effective prevention of HIV

transmission in young South African girls and women, exists at the interface of purposeful research and development, and the liberation of our local production of knowledge and innovation (Cabral, 43).

CODA

Dal Segno al Coda: The Importance of Implementation

In music, *Dal Segno al Coda* refers a player to the section of music before they can conclude. Similarly, this thesis regarding the prevention strategies for young, black, South African women, would be incomplete without emphasizing the significance of treatment implementation. The development of effective interventions only takes the process to a certain point and effective implementation into target communities is the final piece.

Returning to the story that started this whole journey – during our health promotion trip to Zithulele in rural Eastern Cape, we spent a lot of our time inserting Implanon NXT into girls and women. Implanon is small, rod-like object, that contains a long-acting (up to three years), reversible, hormonal contraceptive and is implanted, sub-dermally on the upper arm (RxList, 2017). Prior to providing this service, we were briefly trained in the steps of insertion: measure and label the area, inject the local anesthetic, angle the device at a 45° angle and insert just below the dermis. However, beyond being told to mention a few side effects and when it would need to be removed, we were not trained in how to appropriately counsel our patients both in helping them decide *which* contraceptive method was best for them and in discussing thoroughly discussing the medication – its effects, side effects, contraindications, risks, constraints, etc. Concerns regarding provider training and adequate patient counseling was not limited to us – and an inconsistent and inadequate implementation plan has undermined the effectiveness of an exceptional biotechnological advancement.

Excitement and anticipation for Implanon spread rapidly as many felt that the long-acting contraception was superior to the daily pill or monthly injection (Pillay et al, 2017). However, concerns and early removals began soon afterwards. The first issue was the lack of a well-structured and informative counseling plan that could consistently be enacted by healthcare providers. One of the primary factors cited in the shifting perceptions regarding Implanon is that patients did not receive sufficient information from their providers. Whilst 99% of users knew that the implant lasted three years, only 20-29% of users had the contraceptive effectiveness and timeline of the drug explained to them (Pillay et al, 2017). Additionally, side effects and risks were often found to be inadequately discussed. 90% of those who removed Implanon, cited concerns regarding unexpected side-effects as their reason for discontinuation (Pillay et al, 2017). This lack of consistent and adequate drug counseling allowed for the spread of rumors, misinformation and fear escalation within communities of users, damaging perceptions regarding the contraceptive treatment (Pillay et al, 2017). A second issue is the inadequate training of providers. Many nurses stated that they had only received two days of training or unofficial trainings from fellow nurses in preparation for the delivery of Implanon. They mention feeling unprepared, not only with regards to the physical process of inserting or removing the device, but especially regarding how to counsel patients (Adeagbo, 2017). This has resulted in inadequate patient preparation and in some cases, not suggesting or delivering Implanon, unless it is directly requested by the patient (Adeagbo, 2017). These two issues and the effect they have had on

Implanon uptake among South African women, highlight the importance of the careful consideration of intervention implementation.

Moreover, the Implanon case study brings attention to the necessity of direct input and collaboration among all the role-players involved in the development, implementation and use of any intervention measure. In order to develop effective, context specific interventions, collaboration between researchers, developers, target communities, target demographic populations, and healthcare providers, among many other role players is a requirement. The ongoing development of HIV prevention must bring together these role-players, just as it must combine ethnographic and technological understandings, ideas and discoveries. But, at the center of it all, the subject of the ongoing *HIV Prevention* sentence cannot be the advancement of interventions, procuring of funding, implementation planning, or anything else – the center that all of these must orbit around *has* to be the vulnerable populations we have left exposed for far too long.

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