FACTORS ASSOCIATED WITH SELF-REPORTED DEPRESSIVE SYMPTOMS AMONG PEOPLE LIVING WITH HIV/AIDS IN SASKATOON, SASKATCHEWAN

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By

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ABSTRACT

In the past years, the co-existence of depressive disorders/symptoms with HIV infection has been well documented in the literature. However, factors that are associated with increased depressive disorders/symptoms among individuals living with HIV remain largely understudied. Therefore, this study aims to examine sociodemographic, behavioral and clinical risk factors that are associated with self-reported depressive symptoms in people living with HIV/AIDS (PLWHA) in Saskatoon.

We used a cross sectional study of 351 PLWHA who were accessing care at the positive living program (PLP) unit of the Royal University Hospital (RUH) in Saskatoon from 2010 to 2015. Descriptive statistics were carried out to explore our data. Univariate analysis was performed using Pearson's chi-square test and univariate/multivariable logistic regression models were used to examine the association between self-reported depressive symptoms and the variables being investigated. All variables were analyzed using SPSS version 21 and the significant level was $P < 0.05$ throughout the analysis.

Our study examined the medical chart records of 351 patients. 113 patients (32.2%) self-reported depressive symptoms at baseline, 18 (5.1%) denied depressive symptoms and 219 (62.6%) were missing depression information. From the 113 (32.2%) patients who self-reported depressive symptoms, 81 (71.7%) were above the age of 35 years, 68 (60.2%) male, 49 (43.4%) were from indigenous ancestry and 40 (35.4%) reported injection drug use (IDU). Their clinical/laboratory test reports indicated that 24 (21.2%) patients had low $CD4^+$ cell counts (< 200 cells/µl), 49 (43.4%) medium $CD4^+$ cell counts (200 – 500 cells/µl), 27 (23.9%) high CD

cell counts (>500 cells/μl), and 10 (8.8%) had non-detectable viral load. Our analysis showed that people from indigenous ancestry, employed, formal support, men who have sex with men (MSM)/homosexual men and prior history of incarceration were independently associated with self-reported depressive symptoms. However, MSM (P <0.04) and employed PLWHA (P <0.02) were associated with self-reported baseline depressive symptoms at the level of the multivariate logistic model. Based on the study findings, future social programs should pay closer attention to MSM/homosexual men and employed PLWHA to manage early signs and symptoms of depression among these vulnerable populations in Saskatoon.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AGSPC	Advisory Group on Suicide Prevention in Canada
ALT	Alanine Aminotransferase
AST	Aspartate Aminotransferase
AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
ART	Anti-Retroviral Therapy
CATIE	Canadian AIDS Treatment Information Exchange
CCHS	Canadian Community Health Survey
CDC	Centre for Disease Control
CD4	Cluster of Differentiation 4
DMDD	Disruptive Mood Dysregulation Disorder
DNA	Deoxyribonucleic Acid
GGT	Gamma Glutamyl-Transferase
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
IAPT	Improving Access to Psychological Therapies
ICES-PHO	Institute for Clinical Evaluation Sciences Public Health Ontario
IDUs	Injection Drug Users
MDD	Major Depressive Disorder
MSM	Men who have Sex with Men
NICE	National Institute for Health and Clinical Excellence
NIMH	National Institute of Mental Health
PDD	Persistent Depressive Disorder

PHAC	Public Health Agency of Canada
PLP	Positive Living Program
PLWHA	People Living with HIV/AIDS
PMDD	Premenstrual Dysphoric Disorder
RUH	Royal University Hospital
SHR	Saskatoon Health Region
USA	United State of America
VIF	Variance Inflator Factor
WHO	World Health Organization

CHAPTER 1: NATURE AND PURPOSE OF THE STUDY

INTRODUCTION

Despite global efforts to reduce the spread of human immunodeficiency virus (HIV), the infection continues to spread rapidly among the general population (World Health Organization, 2005). Although, rapid availability of treatment regimens have considerably reduced HIV burden, however, factors such as lack of coverage and access to prevention services as well as inadequate scientific evaluation programs have reduced desired outcomes (Bertozzi *et al*., 2006).

People living with HIV/AIDS (PLWHA) are known to have high needs that may necessitate consistent support to cope with their disease status (Gerbi *et al*., 2012). Some of the potential feelings they face include shock of positive serology, fear of disease advancement, fear of being neglected by friends and relatives, worries about disease transmission and stress of keeping up with routine treatment (Gerbi *et al*., 2012). Aside psychological and physiology stressors that come with HIV infection, the disease is also highly stigmatized (Valdiserri, 2002; Link and Phelan, 2006; Wailoo, 2006). The accumulation of these stressors may result in potential mental disorders among infected individuals (Gerbi *et al*., 2012).

Depression and HIV/AIDS are two chronic conditions that have posed challenges to public health practitioners and unfortunately, both illnesses are highly comorbid (Bing *et al*., 2001; Ciesla and Roberts, 2001; Simoni *et al*., 2011). Stressful daily living, adverse life events, side effects of medications and the neurological effects of HIV infection could trigger depressive symptoms among individuals living with HIV/AIDS and may rapidly advance HIV infection to AIDS (Leserman *et al*., 1997). Studies in Western countries estimated the prevalence of depressive disorders/symptoms to be twice as common in PLWHA when compared with HIV free population

(Ciesla and Roberts, 2001). The comorbidity of both illnesses can reduce patient adherence to HIV treatment (Himelhoch *et al*., 2009; Sin and DiMatteo, 2013), lower their quality of life and increase morbidity and mortality rate amongst the sufferers (Andrinopoulos *et al*., 2011; Reis *et al*., 2011).

Many studies have explored the association between depressive disorders/symptoms and HIV infection. However, the results from several studies are equivocal. For instance, some researchers found factors such as age (Liu *et al*., 2014), ethnicity (Pellowski *et al*., 2013, gender (Stewart *et al*., 2011) and injection drug uses (Hammond *et al*., 2016) to be positively associated with depressive disorders/symptoms among PLWHA, while others found no association between those factors and depressive disorders/symptoms (Mohammed *et al*., 2015; Rai and Verma, 2015).

Based on the equivocal findings from prior research and coupled with the fact that no study has examined factors associated with depressive disorders/symptoms among PLWHA in Saskatoon, it was imperative to carry out a study that examined the factors that are associated with self-reported depressive symptoms in individuals with HIV/AIDS. This thesis explored factors associated with self-reported depressive symptoms among PLWHA at the positive living program (PLP) unit of the Royal University Hospital (RUH) in Saskatoon from 2010 to 2015. The findings from this study will add to the body of evidence by providing valuable information and recommendations to policymakers, clinicians and end users on the management of depressive disorders/symptoms among individuals living with HIV/AIDS.

RESEARCH QUESTIONS

To achieve the purpose of our study, the following questions were investigated and answered.

- What is the prevalence of self-reported depressive symptoms among PLWHA in Positive Living Program (PLP)?

- Is there an association between socio-demographic factors and self-reported depressive symptoms among PLWHA in PLP?
- Is there an association between behavioral variables and self-reported depressive symptoms among PLWHA in PLP?
- Is there an association between clinical variables and self-reported depressive symptoms among PLWHA in PLP?

MEASUREMENT OF STUDY VARIABLES

The analysis in this study was achieved by systematically extracting data from patients' medical records at the PLP of the RUH in Saskatoon. The outcome variable was self-reported depressive symptoms by the patients at their initial visit to PLP and recorded by the attending nurse. Other variables of interest such as socio-demographic, behavioral and clinical variables were obtained from the patients' initial assessment forms, HIV case report forms and laboratory test reports in their medical charts.

NATURE OF THE STUDY

This is a cross sectional study of PLWHA at the PLP unit of the RUH. The outcome variable is self-reported depressive symptoms, and the independent variables are age, gender, ethnicity, marital status, social support, employment status, men who have sex with men (MSM), injection drug users (IDUs), substance use, viral load, $CD4^+$ cells counts and liver enzymes function tests. For statistical purposes, the independent variables were categorized into socio-demographic variables (age, gender, ethnicity, marital status, social support, employment status), behavioral variables (MSM, IDU, incarceration, substance use and alcohol use) and clinical variables (viral load, $CD4^+$ and liver enzymes).

We analyzed these variables independently and jointly to test the association between our independent variables on the outcome variable. Descriptive statistics were conducted to summarize the data. Univariate and multiple regression models were used to examine the association between the predictor variables and the outcome variable. All significant variables at $P<0.05$ in our univariate analysis were further considered for multivariable analysis. The significance level for multivariable analysis was set at $P<0.05$. Confounding and biologically plausible interactions were also examined. All analyses were conducted using SPSS version 23.

CHAPTER 2: LITERATURE REVIEW

This section provides a brief introduction to HIV/AIDS infection and the magnitude of the problem, including the global, national and provincial epidemiology of HIV/AIDS. The section also gives a detailed description of depression and its comorbid effects on individuals living with HIV/AIDS infection. Factors identified in previous studies to be associated with depressive disorders/symptoms in people living with HIV/AIDS (PLWHA) are also presented. The conceptual framework that explained those factors predisposing PLWHA to depressive disorders/symptoms is discussed. The term diagnosed HIV infection meant the incidence of HIV infection as reported by many studies.

OVERVIEW/ TRANSMISSION OF HIV

Human immunodeficiency virus (HIV) is a group of retroviruses that cause acquired immunodeficiency syndrome (AIDS), a condition in which most of the body immune system are being destroyed making way for opportunistic infections to advance (Joint United Nations Programmes for HIV/AIDS, 2000). HIV infection is transmitted through sexual contacts, parenteral and perinatal transmission (Shaw and Hunter, 2012).

HIV infection is commonly referred to as a sexually transmitted disease because it is contracted mostly through various sexual contacts with the bodily fluid of infected individuals (Galvin and Cohen, 2004; Klimas *et al*., 2008). Integrated approaches to risky behaviors and condom use are effective in decreasing the risk of HIV transmission through sexual contacts (Coates *et al*., 2008). Parenteral transmission includes unsafe blood transfusion, exposure to blood through exchange of contaminated needles/syringes and inadequate sterilization of instruments used in healthcare facilities (Baggaley *et al*., 2006). Preventive measures such as needle exchange programs, treatment of opioid dependence and other behavioral interventions targeted towards injection drug

users (IDUs) are effective in reducing the spread of HIV through parenteral routes (Vlahov *et al.*, 2010). Perinatal disease transmission occur in utero, during conception or shortly after delivery (Ishrat *et al*., 2010; Siegfried *et al*., 2011). Chorioamnionitis, premature rupture of membranes and breastfeeding can increase perinatal transmission (Bhoopat *et al*., 2005; Ocheke *et al*., 2016).

GLOBAL BURDEN OF HIV/AIDS

A report from the WHO in 2008 showed that approximately 33.4 million people were living with HIV/AIDS worldwide (World Health Organization and UNAIDS, 2009). In 2016, 36.7 million people were reported to be living with HIV. In the same year, 1.8 million people were newly diagnosed and approximately 1 million people died due to HIV/AIDS complications (Joint United Nations Programme on HIV/AIDS, 2017). The epidemic of HIV/AIDS infection has severely affected most African countries particularly the sub-Saharan region. According to 2017 WHO report, about 25.7 million people were living with HIV/AIDS in sub-Saharan Africa, accounting for approximately 68% of global HIV burden in 2018 (World Health Organization, 2019).

Asia and the Pacific regions recorded the second largest number of HIV infections worldwide. According to the Joint United Nations Programme for HIV/AIDS (UNAIDS) report in 2017, about 5.1 million people had HIV infection and in 2016, approximately 270,000 new cases of HIV were reported in Asia and Pacific regions (Joint United Nations Programme on HIV/AIDS, 2017). In the European region, about 159,000 people were newly diagnosed with HIV in 2017 (World Health Organization Regional Office in Europe, 2018a). The World Health Organization reported that almost 160,000 people were newly infected in Europe with the majority of cases (about 80%) occurring in the eastern parts of the continent (World Health Organization Regional Office in Europe, 2018b).

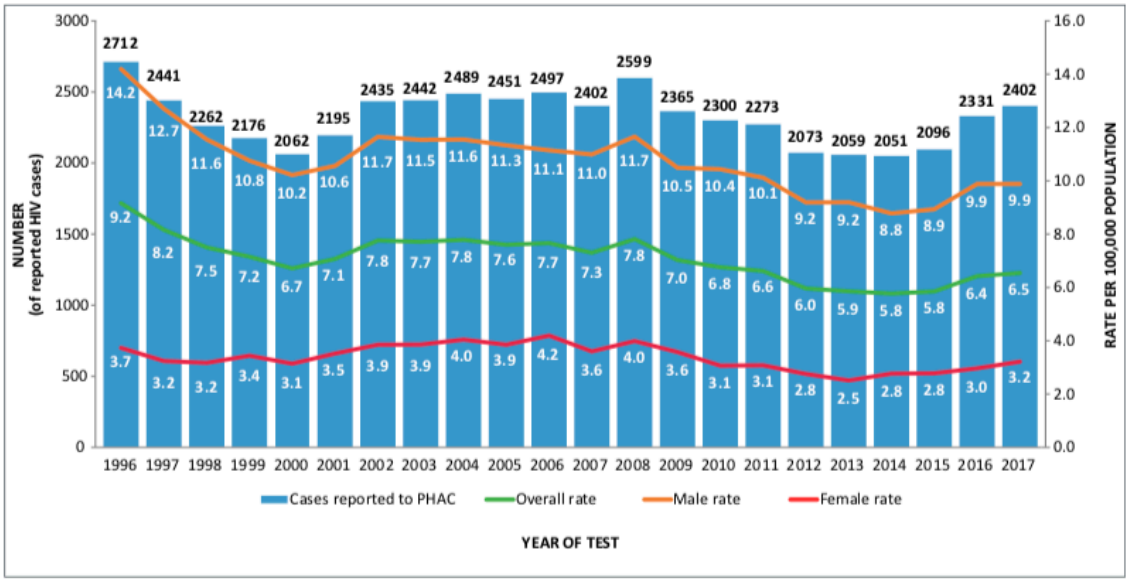
HIV IN NORTH AMERICA

In 2016, North America and Western and Central Europe reported that 2.1 million adults and children were living with HIV. In the same year, about 73,000 people were newly diagnosed with HIV and 18,000 people died due to AIDS-related complications (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2017). In the United States, approximately 1.1 million people (13 years and older) were reported to have HIV infection (Centers for Disease Control and Prevention, 2018). Populations most affected by the burden of HIV infection are men who have sex with men (MSM), African American/black men, Hispanic men and transgender women (Centers for Disease Control and Prevention, 2018). Rigorous HIV/sex education, condom use, awareness campaigns, efforts to reduce HIV infection via vertical transmission and harm reductions have been effective in reducing HIV transmission in the United States (Centers for Disease Control and Prevention, 2015).

HIV IN CANADA

In 2016, 63,110 people were living with HIV infection in Canada (Public Health Agency of Canada, 2015, 2016). In 2017, 2,402 new cases of HIV infection were reported nationally, this shows an increase of 3% and 17.1% in the numbers of newly reported HIV infection in 2016 and 2014 respectively (Public Health Agency of Canada, 2017). Also, the national diagnosis rate showed an increase from 5.8 per 100,000 population in 2014 to 6.5 per 100,000 population in 2017 (Public Health Agency of Canada, 2017). Kindly refer to figure 2-1 for further details.

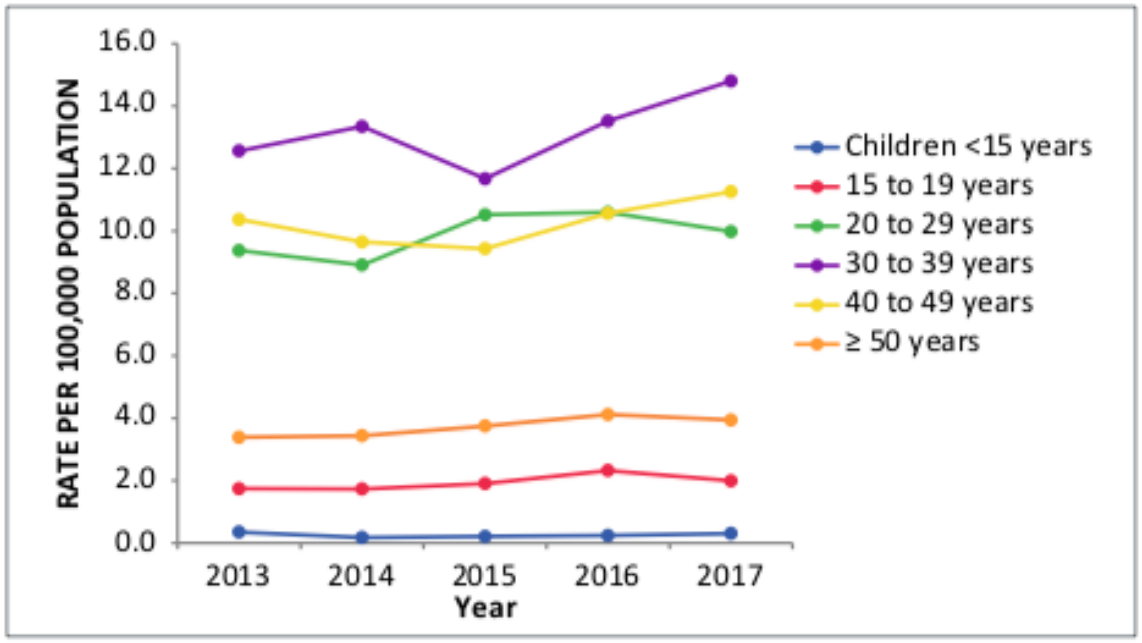
Figure 2.1: Number of reported cases, including national, male and female diagnostic rates, by year of test— Canada, 1996–2017



Source: HIV in Canada – Surveillance Report, 2017 (Public Health Agency of Canada, 2017: p326).

Nationally, the distribution of diagnosed HIV infection by age between 2013 to 2017 showed that 30 – 39 age group reported the highest rate of HIV infection (14.8 per 100,000 population). Children less than 15 years had the least average rate within the 5 years period (Public Health Agency of Canada, 2017). Refer to figure 2.2 for further details.

Figure 2.2: HIV Diagnosis rate, by age group and year of test—Canada, 2013–2017



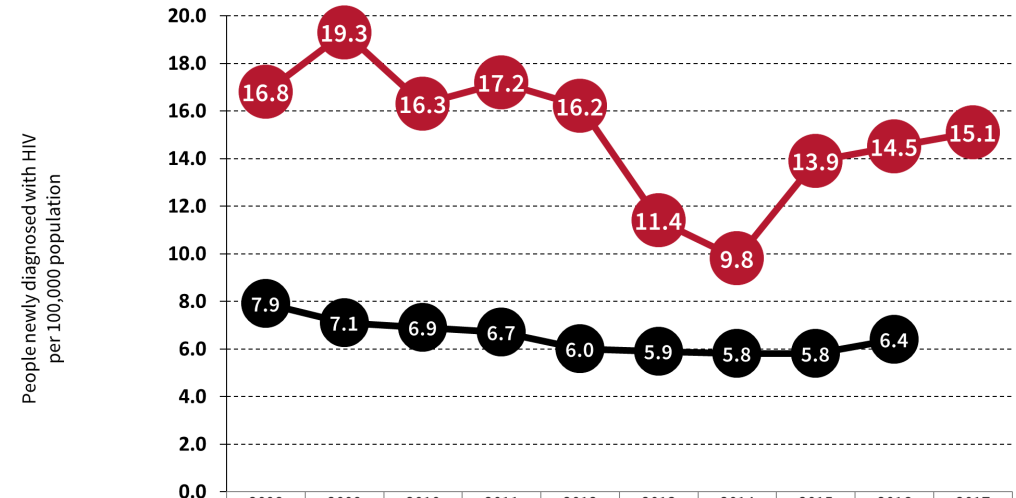
Source: HIV in Canada – Surveillance Report, 2017 (Public Health Agency of Canada, 2017: p327).

By exposure category, high risk individuals are often over represented among the newly diagnosed cases across Canada (Moraros *et al.,* 2011; Bird *et al*., 2016). From PHAC 2016 surveillance report, 2,165 were newly diagnosed with HIV, of which 52.5% (1,136) were observed among MSM and bisexual men, 11.3% (244) among IDUs, and 33% (744) from various heterosexual contacts (Public Health Agency of Canada, 2016). Similarly, in 2017, 2,402 newly diagnosed HIV were reported (>15 years), approximately 46.5% (1,115) were reported among gay, bisexual, and other men who have sex with men and 16.3% (392) among IDUs (Public Health Agency of Canada, 2017). Also, indigenous people and immigrants from endemic nations are over-represented in the epidemic of newly diagnosed HIV infection in Canada. For example, from the 2,165 new cases in 2016, 11.3% (245) were observed among indigenous people and 13.6% (294) among immigrants from endemic countries (Public Health Agency of Canada, 2016).

HIV IN SASKATCHEWAN

Diagnosed HIV infection rates have considerably declined within the last few decades due to rigorous efforts in the management and treatment of HIV/AIDS across Canada (Rogers *et al*., 2015). However, Saskatchewan still battles with the increase in the reported incidence rate of HIV infections (Rogers *et al*., 2015; Vogel, 2015). For example, Saskatchewan showed an increase in the reported incidence rate of HIV infection from 3.3 per 100,000 in 2002 to 20.8 per 100,000 in 2008 (Public Health Agency of Canada, 2014), reaching its peak of 193 per 100,000 in 2009 (Saskatchewan Ministry of Health, 2017). In 2016, the reported incidence rate of HIV infection in Saskatchewan was 14.5 per 100,000, a rate that is approximately 2.3 times higher than the national average of 6.4 per 100,000 (Saskatchewan Ministry of Health, 2016). Refer to figure 2.3 for additional information.

Figure 2.3: HIV diagnosis rates, Saskatchewan versus Canada from 2008 to 2017.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SK	16.8	19.3	16.3	17.2	16.2	11.4	9.8	13.9	14.5	15.1
Canada*	7.9	7.1	6.9	6.7	6.0	5.9	5.8	5.8	6.4	N/A
Comparison SK vs Canada	2.1	2.7	2.4	2.6	2.7	1.9	1.7	2.4	2.3	N/A

Source: HIV Prevention and Control Report 2017 (Saskatchewan Ministry of Health, 2017: p10).

HIV IN SASKATOON

Data specific for Saskatoon is not generally available, therefore, data from SHR will be used unless stated otherwise. In 2004, the Saskatoon Health Region (SHR) reported 16 new cases of HIV but 39 in 2005, 53 in 2006, 57 in 2007, 77 in 2008 and 94 in 2009 (Lemstra et al, 2011). In 2012, SHR reported an annual incidence rate of 17.0 per 100, 000 individuals, a rate which almost triple that of the national average of 5.9 per 100, 000 in 2012 (Saskatoon Health Region, 2015).

The increasing number of diagnosed HIV infections observed in Saskatoon has been associated with the high rate of risky behaviors such as IDUs and unsafe sexual practices (Bird *et al*., 2016). With the increase in the number of IDUs among indigenous people in Saskatoon, the number of unsafe needles sharing among the population also contributed to the burden of HIV in the city (Saskatchewan Ministry of Health, 2014). In addition, majority of the indigenous people in Saskatoon live in areas with higher rates of unemployment, lower education, low income cut-off and higher rates of inadequate housing, all of which could increase their vulnerability to HIV infection (Saskatchewan Ministry of Health, 2014).

MENTAL HEALTH/DISORDER

The World Health Organization (WHO) defines mental health as "a state of well-being in which an individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community" (World Health Organization, 2014). Mental illnesses encompass a range of disorders that can negatively affect our mood, thoughts and actions (Center for Disease Control and Prevention, 2018b). Currently, more than 300 million people are suffering from depression

(World Health Organization, 2017). According to the model of Risk Analytica in Toronto, Canada, it was observed that over 6.7 million people (9 years and older) suffered from mental illness in 2011, and one in five Canadians is likely to develop a mental disorder (Smetanin *et al*., 2011).

MENTAL HEALTH OF PLWHA

Often, being diagnosed with HIV infection results in an initial shock of positive serology test, panic over disease advancement, fear of being neglected by family and friends and worries about disease transmission (Gerbi *et al*., 2012). Besides advancing opportunistic infections that PLWHA often face, these emotional burdens could also result in potential mental disorders such as depression in HIV infected individuals (Gerbi *et al*., 2012). Depressive disorders are more common in PLWHA when compared to the general population (Baingana *et al*., 2005 ; Nosrat *et al*., 2017).

OVERVIEW OF DEPRESSIVE DISORDERS

"Depression is a multifactorial disorder with clinically heterogeneous features involving disturbances of mood and cognitive function" (Gong and He, 2015). According to Diagnostic and Statistical Manual of Mental Disorders V (DSM-V), depressive disorders are classified based on the severity, time and causes of the depressive disorder(s) into major depressive disorder (MDD), persistent depressive disorder (PDD), premenstrual dysphoric disorder, disruptive mood dysregulation disorder, substance induced mood disorders and mood disorders due to medical conditions (American Psychiatric Association, 2013).

Major depressive disorder (MDD) is a mental illness with symptoms including loss of interest in daily activities, insomnia or excessive sleep, weight loss or gain not attributable to dieting or excessive food intake, psychomotor impairments, loss of concentration and suicidal thoughts

lasting for a minimum period of two weeks subsequently impacting sufferers ability to function (Belmaker and Agam, 2008).

Persistent depressive disorder (PDD), previously known as dysthymia lasts for a minimum period of two years in adults and one in children (American Psychiatric Association, 2013). The onset of PDD is gradual and it produces more harmful effects such as functional impairment and suicidal thought and ideation over time (Melrose, 2017).

Premenstrual dysphoric disorder (PMDD) occurs before monthly menstruation in menstruating women and disappears shortly after menstruation (American Psychiatric Association, 2013). "Mood and behavioural symptoms such as irritability, tension, depressed mood, and mood swing are the most distressing, however, breast tenderness and bloating can also be an issue with PMDD." (Yonkers *et al*., 2008).

Disruptive mood dysregulation disorder (DMDD) consists of irritable behavior or excessive temper outbursts (in the form of verbal or behavioral) in children below 10 years. Children with DMDD consistently display noticeable irrational behaviors thrice or more a week for over a year (American Psychiatric Association, 2013; Dougherty *et al*., 2014).

PROGNOSIS OF DEPRESSIVE DISORDERS

Generally, the onset of depressive disorders occurs in the mid-twenties but may begin in adolescence through adulthood. Some cases of depressive disorders may appear in infants and young children (Mueller and Leon, 1996; Fava and Kendler, 2000). The onset of depressive disorders (prodrome) varies considerably among individuals. Some people may present with symptoms such as anxiety, panic attack etc. that are due to stressful life events, while others may develop symptoms that are independent of the negative surrounding events (Anderson *et al*., 2010).

GLOBAL BURDEN OF DEPRESSIVE DISORDERS

The global estimate of depressive disorders is still unclear because depressive disorders remain largely under-diagnosed among the general population (Patten, 2015). Although depressive disorders are a worldwide health challenge, the prevalence of depressive disorders is difficult to estimate due to poor mental assessment strategies across nations (Murray and Lopez, 1996; Rosmond, 2004). However, recent evidence according to World Health Organization showed that over 322 million individuals suffered from depression in 2015 (World Health Organization, 2017a).

The WHO postulated that depressive disorders would account for the world's second most common cause of global disease burden by 2020 and the most common cause of disability by 2030 (World Health Organization, 2001). Knoll and MacLennan examined the prevalence of depression in Canada using the data from Canadian Community Health Survey- Mental Health (CCHS-MH) focus content cycle 2012, and observed a lifetime prevalence rate of 11.2%. They also found that women are 1.8 times more likely than men to suffer from major depression in their lifetime (Knoll and MacLennan, 2017).

SIGNS / SYMPTOMS OF DEPRESSIVE DISORDERS

Depressive disorders generally present with loss of interest in life/daily activities, low self-esteem, insomnia, fatigue, loss of concentration, psychomotor retardation, sluggish movement, suicidal thoughts and health-related functional and cognitive impairments (Olatunji *et al*., 2006; Ownby *et al*., 2010; Ndu *et al*., 2011; National Institute of Mental Health, 2016). The severity of depressive symptoms depends on the stage of the disorders and the nature of the accompanying illnesses where applicable (National Institute of Mental Health, 2016).

CAUSES OF DEPRESSIVE DISORDERS

The etiology of depressive disorders is multifactorial, with biological, social and psychological variables all found to be contributory (Ramasubbu *et al*., 2012; Chibanda *et al*., *2014*; Nanni *et al*., 2015). Biological causes are thought to be due to differences in genetic makeup and/or chemical imbalances in the body. A possible explanation of a biological cause of depressive disorder is the imbalance in monoamine neurotransmitters such as serotonin and noradrenaline (Fu *et al*., 2001; Healy, 2001; France *et al*., 2007). Serotonin is the neurotransmitter that is responsible for regulating mood, sleep, aggression, sexual behavior et cetera in the body, and a decrease in the level of serotonin could result in depressive disorders (Nemade *et al*., 2017).

Another popular theory is the catecholamine hypothesis, which suggests that a decline in nor-epinephrine (excitatory hormone) can lead to depressive mood (Lambert *et al*., 2000; Nemade *et al*., 2017). A major deficiency of the catecholamine hypothesis is that there are no known gold standards to measure the amount of neurotransmitter in the brain (Nemade *et al*., 2017). Social contributors include pre-disposing adverse life events such as job loss, geographical isolation, bereavement, broken relationships/marriages, redundancy, sustained physical injury, childhood traumatic experiences, health-related illnesses and poor social support network (Rashmi, 2017). Psychological contributors include psychodynamics, cognitive and behavioral factors. Unhealthy self-perceptions can also lead to depressive disorders over time (Wright *et al*., 2012).

EFFECTS OF DEPRESSIVE DISORDERS

Depressive disorders when not given prompt medical attention may become chronic, severe or recurrent and could impair an individual's daily responsibilities and obligations (World Federation for Mental Health, 2018). More severely, depressive disorders can result in suicidal ideation (Catalan *et al*., 2011), disability and increase mortality (Rayner *et al*., 2008). From an economical

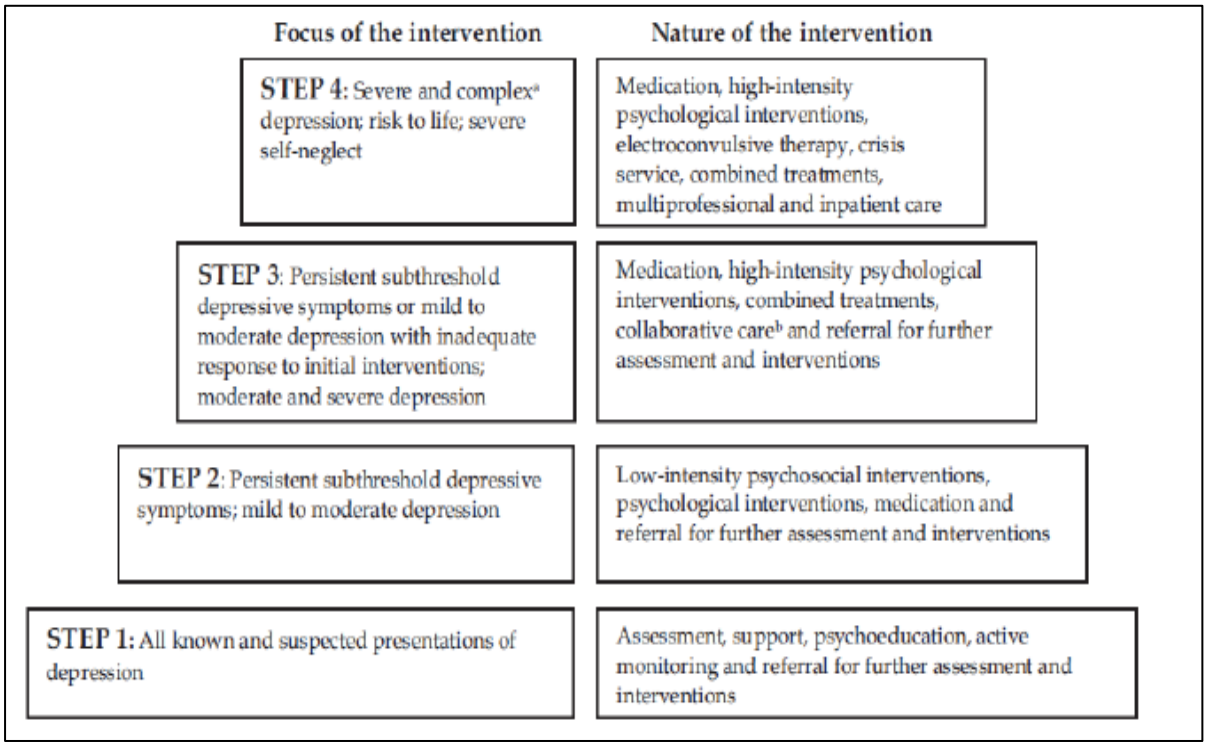
viewpoint, the cost of treating mental related illnesses is 4.2 times higher than the cost of treating a population without mental illness (World Health Organization, 2014).

TREATMENT OF DEPRESSIVE DISORDERS

Depression is a treatable illness (Pratt and Brody, 2008). The treatment options for depressive disorders or symptoms depend on the stage of the illness. The treatment of depressive disorders can be categorized into acute, continuation and prophylactic treatment options. Treatment therapies are targeted towards the treatment of ongoing depressive disorders. Examples include psychotherapies and antidepressant drugs (Anderson *et al*., 2010; Gautam *et al*., 2017).

Optimum adherence to antidepressant drugs and psychotherapies has been proven to be effective in the treatment of debilitating effects of depressive disorders (Gautam *et al*., 2017). A popular adopted model for treatment of depression is the stepped care model. The stepped care model aims to improve mental healthcare access between the patients and the service providers (National Collaborating Centre for Mental Health, 2004). The model suggests a framework progressing from the least effective intervention to the most effective treatment. Refer to figure 2.4 for further information.

Figure 2.4: Stepped Care Model



Source: Investigating the use of NICE guidelines and IAPT services in the treatment of depression (Gyani et al., 2012: p151).

DEPRESSIVE DISORDERS AND HIV

Depressive disorders and HIV infection are highly comorbid (Bing *et al*., 2001; Choi *et al*., 2016). For example, the comorbidity of depressive disorders with HIV infection was evident in a meta-analysis of ten studies carried out by Ciesla and Robert in 2001. It was observed that being diagnosed with HIV infection was associated with elevated odds of depressive disorders (Ciesla and Roberts, 2001).

Global reports on the actual prevalence of mental disorders in PLWHA are diverse due to wide variation in the data used to generate the estimates. However, the prevalence of depression among PLWHA varied from 22% (Campos *et al*., 2010) to 71% (Savetsky *et al*., 2001). The burden of depressive disorders among PLWHA across the globe varies widely across nations. For instance,

the prevalence of self-reported depression in United States was observed to be thrice as common in PLWHA compared to the general population (Do *et al*., 2014). The co-existence of depressive disorders with HIV infection could be as high as 63% in Cameroun (L'akoa *et al*., 2013). Also, a survey from the University of Nigeria teaching hospital, Nsukka observed that one in five individuals with HIV/AIDS met the criteria for depressive disorders based on the hospital anxiety and depression scale (Ndu *et al*., 2011).

The effects of comorbid depressive disorders with HIV infection are far-reaching. The comorbidity of depressive disorders/symptoms with HIV infection may influence the decline in CD4+ cell counts, elevate blood viral level (Rivera-Rivera *et al*., 2016) and reduce treatment adherence in PLWHA (Gonzalez *et al*., 1999).

FACTORS ASSOCIATED WITH DEPRESSIVE DISORDERS IN PLWHA

Social-demographic Variables: Age

Depressive disorders are more common in children and young adults (Cesar and Chavoushi, 2013). The social, medical, psychological, and neurological effect of HIV infection on the developing brain could account for the high prevalence of mental health disorders among adolescents (Kemigisha *et al*., 2019). However, depression at older ages comes with more severe health risks (Girling *et al*., 1995; Fiske *et al*., 2009).

The number of older PLWHA with depressive disorders is increasing. Treatment adherence has increased the life expectancy of older PLWHA who might have been diagnosed with depressive disorders/symptoms earlier in life (Mills *et al*., 2011; Cahill and Valadez, 2013; Liu *et al*., 2014). Liu *et al*. (2014) in Nanning, China examined the psychological impacts
of HIV infection on older (50 years and above) and younger (18 to 49 years) PLWHA, the authors observed the prevalence of depressive symptom to be 74.2% in older patients and 48.7% in

younger patients (Liu *et al*., 2014). Similarly, a study in Uganda observed that PLWHA above the age of 50 are 1.93 times more likely to self-report depressive symptoms when compared to participants between the ages of 18 to 30 (Kaharuza *et al*., 2006).

Positive serology comes with severe health challenges especially with advancement in age. Older individuals with HIV/AIDS often experience a significant decline in their immune function and impairment in their physical abilities which may limit their ability to access treatment (Nichols *et al*., 2002; Liu *et al*., 2014). Participants from the study of Liu and colleagues highlighted that the stress of keeping up with routine medical care, financial constraints, and minimal social support are responsible for increased depressive symptoms (Liu *et al*., 2014).

Contrarily, Anagnostopoulos *et al*. (2015) in Switzerland examined the frequency and the risk factors associated with clinically diagnosed depressive disorders in a Swiss HIV cohort and observed that aging had a protective effect on depressive disorders among MSM, heterosexual men and men who inject recreational drugs (Anagnostopoulos *et al*., 2015). Also, a cross-sectional survey of Rai and Verma. (2015) found no significant association between age and self-reported depression among PLWHA in Uttar Pradesh, India.

Gender

With few exceptions, the onset, severity and prevalence of depressive disorders are higher in females than in males. The depressive disorders in females typically begin in mid-puberty and continue through adulthood (Piccinelli and Wilkinson, 2000). While trying to explore the likely causes of elevated odds of depression in females, Schreiber in her book "women's experiences with depression" says depression is a social disease that affects females due to gender-specific stressful life experiences. Schreiber listed infertility, miscarriages, perinatal period, adverse effects of pills, hormone replacement therapy and domestic violence, as the potential factors

responsible for elevated odds of depressive symptoms in female participants in Vancouver (Schreiber, 2001). In her study, the participants through interviews further highlighted oppression, marginalization and domestic violence as the cause(s) of their depression disorders/symptoms (Schreiber, 2001).

Also, how males and females react to somatic symptoms (tiredness, unusual rhythm in sleep and eating pattern) could increase their vulnerability to depressive disorders (Silverstein, 1999). Studies have reported that females are more likely than males to complain of anxiety and somatic symptoms (Silverstein, 1999; Silverstein *et al*., 1995). After adjusting for all forms of anxiety and other somatic symptoms, Silverstein *et al*., (1999) observed no gender differences in the rate of depression among their participants (Silverstein, 1999).

In PLWHA, Aljassem *et al*. (2016) observed elevated odds of depressive symptoms among females than in males Ontario residents (Aljassem *et al*., 2016). Also, the multivariate analysis by Bhatia *et al.* (2011) in Houston, Texas found a stronger association between depressive symptoms among females than in males who were newly diagnosed with HIV infection (Bhatia *et al*., 2011). Furthermore, Morrison *et al*. (2002) in Florida determined

that seropositive women are four times more likely to report depressive disorders than seronegative women (Morrison *et al*., 2002).

In contrast, Mohammed *et al*. (2015) in Ethiopia found that males PLWHA are 1.6 times more likely to be depressed than females PLWHA (Mohammed *et al*., 2015). However, the authors pointed out that the study was carried out among participants from a specific population, and that the methodology was prone to recall bias, all of which may affect the generalizability of their results (Mohammed *et al*., 2015). Rai and Verma. (2015) found no significant association between

gender and self-reported depression among PLWHA in Uttah Pradesh, India (Rai and Verma, 2015).

Various studies have observed a stronger association between chronicity of depressive disorders, and rapidity of HIV progression in males than in females (Leserman, 2008) but higher mortality in females than in males (Ickovics *et al*., 2001; Antelman *et al*., 2007; Aljassem *et al*., 2016). A nine-year follow up study on HIV homosexual men in San Francisco observed that HIV infection advances to AIDS 1.5 years sooner in males with depressive disorders compared to males without depressive disorders (Leserman, 2008).

Ethnicity

The rates of major depression differ globally and across various cultures (Kessler and Bromet, 2013). Cross-cultural beliefs according to ethnomedical sciences have observed differences in people's perception and acceptance of depressive disorders among various ethnic groups (Rashmi *et al*., 2007). Ethnicity can also influence the biological makeup of people making them more vulnerable to depression (Rashmi *et al*., 2007). Kirmayer *et al*. (2000) examined the mental health of Aboriginal people in Canada and observed that indigenous communities have experienced cultural changes and being marginalized in societies and at workplace. They emphasized that the disengagement in the culture of indigenous people has resulted in high rate of depressive symptoms, drug uses, excessive alcohol consumption and suicidal ideation amongst them (Kirmayer *et al*., 2000).

Studies across nations on different population groups found out that ethnicity is positively associated with depressive disorders/symptoms in individuals infected with HIV/AIDS (Nelson, 2002; Williams and Mohammed, 2009; Loutfy *et al*., 2012; Pellowski *et al*., 2013; Cano *et al*., 2016; Williamson *et al*., 2017). Racial identity can also act independently or interactively with

other social factors to limit the diagnosis and expression of depressive disorders/symptoms (Nelson, 2002; Williams and Mohammed, 2009; Pellowski *et al*., 2013). Cain *et al*. (2013) interviewed some indigenous people across Canada and authenticated colonization, stigmatization and risky behaviors as the underpinning factors for higher rates of depressive disorders amongst them (Cain *et al*., 2013).

In 2013, Wong et al. (2013) examined the causes of mental health disorders among non-status immigrants with HIV infection in Toronto, and they discovered that racism, discrimination, sexism, social isolation and immigration problems were significantly associated with depressive disorders (Wong *et al.,* 2013). Similarly, Chen *et al*. (2014) observed increased depressive symptoms among non-status immigrants (Asian and Pacific Islanders) living with HIV infection in San Francisco and New York City. In the same study, the majority of the respondents attested that the difficulties experienced in adapting to an entirely new environment negatively affected their mental health (Chen *et al*., 2014).

Employment

Employment is important in maintaining income and standard of living most especially in people with long-lasting illnesses (Greenwald *et al*., 1989). Studies conducted in Western countries consistently reported high unemployment rates among PLWHA, ranging from 45 to 65% (Ezzy *et al*., 1998; Kupek *et al*., 1999; Vitry-Henry *et al*., 1999; Dray-Spira *et al*., 2003). The association between employment status and depressive disorders in PLWHA has been well-researched, and the association was linked to the incapacitating effect of HIV infection on affected individuals (Goldman and Bao, 2004).

For instance, a study examined the association between changes in employment status and its effect on depression among 7,368 Korean adults observed that changing from a permanent employment to casual jobs elevated the risk of reporting depressive symptoms by 1.45 (95% CI: 1.23-1.70), and by 1.78 (95% CI: 1.30-2.43) among participants that changed from full time employment to being unemployed (Yoo *et al*., 2016). In addition, Bhatia *et al.* (2011) in Houston, Texas determined that being unemployed elevated the risk of self-reported depressive symptoms by 1.54 in PLWHA (Bhatia *et al*., 2011). Conversely, Karina *et al*. (2017) in São Paulo, Brazil found the risk of depressive symptoms to double among participants currently employed and above the age of 40 compared to unemployed PLWHA (Karina *et al*., 2017).

The effects of unemployment on PLWHA have been documented in several studies. Anagnostopoulos *et al*. (2015) observed that being unemployed was a risk factor for reporting depressive disorders among Swiss PLWHA (Anagnostopoulos *et al*., 2015). Maruthappu *et al*. (2017) found unemployment to increase HIV mortality among Organization of Economic Co-operation and Development (OECD) member states (Maruthappu *et al*., 2017), while Voss *et al*. (2004) observed elevated suicidal related mortality among Swedish PLWHA with depressive disorders (Voss *et al*., 2004). Therefore, it is expedient to see employment beyond making a living and view its long-term effect on self-image, social integration and psychological wellness (Nordenmark, 1999).

Marital Status

Some studies have suggested that married individuals have fewer psychological illnesses and may be physiological healthier than never married, separated, divorced or widowed (Ross *et al*., 1990; Waite, 1995). The health benefit of marriage is due to its role in social support and social

integration (House *et al*., 1988). However, it has also been well-recognized that marital problems can be a threat to personal health and wellbeing in marriage (Robles *et al*., 2014).

Conflicting findings exist in the literature regarding the association between depressive disorders and marital status of various individuals. For instance, Rong *et al*. (2017) in Wuhan, Hubei, China observed that being married or living with a partner increased the odds of reporting depressive symptoms by 2.40 among PLWHA(Rong *et al*., 2017). Meanwhile, Egbe *et al*. (2017) determined that single PLWHA were 2.81 more likely to report depressive disorders compared to married PLWHA in Nigeria (Egbe *et al*., 2017). Although factors responsible for varying rates of depressive symptoms among married and never married individuals living with HIV infection from above studies were not reported, differences may be due to the methodological approaches and the method of recruitment of their study participants.

Social Support

Social support refers to supportive functions performed for individual(s) by significant others, such as family members, friends, and coworkers (Thoits, 1995). Social support can be emotional, informational or instrumental (Bekele *et al*., 2013). Social support forms a significant component of the biopsychosocial etiological model of depressive disorders (Wright *et al*., 2012). Various studies have shown that providing consistent social support to individuals living with HIV/AIDS infection can help to reduce the burden of depressive disorders/symptoms amongst them (Vyavaharkar *et al*., 2010; Liu *et al*., 2013; Liu *et al*., 2014; Kingori *et al*., 2015; Matsumoto *et al*., 2017; Thai *et al*., 2017).

Bekele *et al*. (2013) in Ontario, Canada examined both the direct and indirect effects of perceived social support on the physical and mental wellbeing of a cohort of about 602 Ontario residents living with HIV/AIDS observing that perceived social support had significant effects on the

physical and mental wellbeing on the participants (Bekele *et al*., 2013). The authors also found that PLWHA with perceived social support were less likely to report depressive symptoms when compared to those participants without social support (Bekele *et al*., 2013). Consistent social supports in individuals living with HIV/AIDS could significantly reduce depressive disorders (McDowell and Serovich, 2007; Mavandadi *et al*., 2009), increase patient's adherence to ART therapy (Vyavaharkar *et al*., 2007) and boost their CD4+ cell counts (Persson *et al*., 2002).

Discrimination and Stigmatization

People with certain health conditions are often being discriminated and prejudiced (Valdiserri, 2002; Link and Phelan, 2006; Wailoo, 2006). A study In the United State observed that HIV infection was perceived as an illness that results from the person's responsibility and action because the modes of transmission are mostly behavioral that are voluntary and avoidable (Herek and Capitanio, 1998), leading to negative perception of PLWHA as people lacking moral values (Foreman, 1999; Varga, 1999). Chandra *et al*. (2005) in India examined the factors associated with depressive disorders among PLWHA and most participants accentuated stigmatization over all other potential factors underpinning their depressive disorders (Chandra *et al*., 2005).

Similarly, a report from the Joint United Nations Programme on HIV/AIDS gathered national data from countries with available literature observed that 50% of people had discriminatory behaviors towards individuals with HIV/AIDS. Approximately one in eight PLWHA was denied healthcare access due to rejection and stigmatization in healthcare facilities (Joint United Nations Programme on HIV/AIDS, 2015). The outcomes of stigma and discrimination are widespread in PLWHA (Katz *et al*., 2013; Stangl *et al*., 2013). Stigma and stigmatization have eroded many PLWHA of their rights, means of livelihood, marriages and access to HIV treatment (Katz *et al*., 2013; Stangl *et al*., 2013).

BEHAVIORAL RISK FACTORS

Substance Use: Alcohol Use

The prevalence of alcohol use disorder is higher in PLWHA than in general population (Cook *et al*., 2001;Petry, 1999; Samet *et al*., 2004). According to American Addiction Centers. (2018), people indulge in excessive alcohol consumption when faced with unfavorable life conditions as a means of coping with depressive symptoms. Unfortunately, the effect of alcohol consumption as a coping strategy is ephemeral (American Addiction Centers, 2018). Excessive alcohol consumption often lead to alcohol dependence that may impact daily activities and work obligations (American Addiction Centers, 2018). Moreover, frequent alcohol intake can reduce the level of serotonin neurotransmitter in the brain.

Serotonin is known as a mood stabilizer and excessive alcohol consumption can reduce the level of this neurotransmitter in the brain leading to a depressed or lowered mood (American Addiction Centers, 2018). Sullivan *et al*. (2008) examined the impact of alcohol use on depressive symptoms in HIV infected patients with current or past alcohol problems using data from HIV-Longitudinal Interrelationship of Viruses and Ethanol (HIV-LIVE) and observed that current alcohol dependence was significantly associated with increased depression score on Center of Epidemiology Studies Depression (CES-D) scale (Sullivan *et al*., 2008).

Cocaine Use

Depressive disorders are frequently observed among frequent cocaine user with HIV infection. Hammond *et al*., (2016) in Baltimore, Maryland observed the prevalence of cocaine use to be 81.4% among African American PLWHA who were depressed to 69.3% who were not depressed. Also, the authors observed a two-fold increased odds of depression among cocaine users compared to non-cocaine users (Hammond *et al*., 2016).

Injection and Other Non-Injection Drug Users

Injection drug users are more likely to get infected with HIV, and to report major depression (Brook *et al*., 2002). Physical, psychological and social dysfunctions resulting from injection drug addictions may negatively affect the mental health of injection drug users over time (Li *et al*., 2014). Several studies have observed the risk of depressive symptoms to be higher in people who use injection or non-injection drugs (Bing *et al*., 2001; Anagnostopoulos *et al*., 2015). Carrico *et al*. (2007) in United States observed that PLWHA using stimulants had 5 times higher viral loads than non-stimulant users (Carrico *et al*., 2007).

Incarceration

HIV infected individuals are overrepresented in prisons. Substance abuse and mental related illnesses are also frequently reported among inmates in various nations (Bing *et al*., 2001; Hammett *et al*., 2002). Lack of freedom and the need to comply to an entirely distinct rules and regulations may pose a significant threat to the mental health of inmates. Also, where applicable, the pre-existing adverse life events before being incarcerated may result to depressive cognition among inmates in the United States (Boterrell, 1984). Shrestha *et al*. (2017) in Eastern Nepal observed that the rates of reporting depressive symptoms is 1.97 times more common among inmates with prior history of incarceration compared to those inmates without prior incarceration history (Shrestha *et al*., 2017).

Men who have Sex with Men (MSM)/Homosexual men

Studies have shown that homosexual males are at higher risk of depressive symptoms than heterosexual men (Ahaneku *et al*., 2016; Choi *et al*., 2016). For instance, a study in Netherlands observed that MSM are 3 times more likely to report depressive symptoms than heterosexual men (Choi *et al*., 2016). In the United States, homosexual men are also more likely to report depressive

symptoms: 22.8% to 33% in MSM than it is for heterosexual men (Perdue *et al*., 2003; Reisner *et al*., 2009; Fendrich *et al*., 2013; Hammond *et al*., 2016). In developing countries, few studies have examined the association between HIV infection and depressive disorders/symptoms in homosexual men. In Tanzania, the rate of depressive disorders/symptoms is 46.3% among HIV infected homosexual men (Ahaneku *et al*., 2016). Sociocultural and civil stigma that confront homosexual men in Tanzania is responsible for the higher rate of depressive disorders/symptoms observed among the group (Ahaneku *et al*., 2016).

CLINICAL RISK FACTORS

Studies that examined the association between clinical parameters and the risk of depressive disorders/symptoms on PLWHA are limited. However, this section will explore the association between CD4+ cell counts, viral load and the risk of depressive disorders/ symptoms among individuals with HIV from reported studies.

CD4 Cell Counts

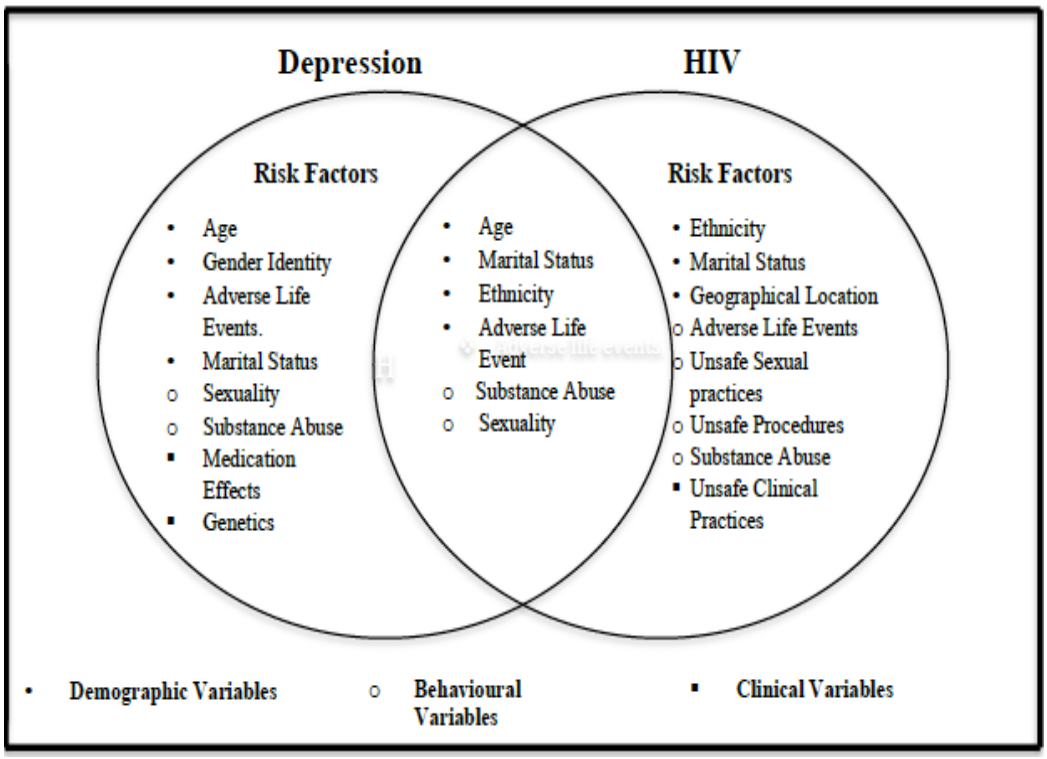
From a clinical perspective, studies have suggested that the chronicity of depressive disorders correlates with rapid decline in CD4+ cell counts (Hughes *et al*., 2004; Boarts *et al*., 2006), and an increased viral load (Ndu *et al*., 2011). This implies that failure to treat depressive disorders may accelerate HIV disease progression and reduce life expectancy of PLWHA over time (Ickovics *et al*., 2001; Ndu *et al*., 2011). Ickovics *et al*. (2001) in Baltimore, USA observed that a depressive disorder lasting for more than seven years was associated with significant reduction in CD4+ cell counts in female PLWHA (Ickovics *et al*., 2001)

Viral Load

Several authors have attested that the severity of depressive disorders correlates with elevated viral load (Carrico *et al*., 2007; Cook *et al*., 2002; Ickovics *et al*., 2001; Ndu *et al*., 2011). Carrico *et al*.

(2007) in USA observed a 50% increase in mean viral loads of patients as their depressive disorders/symptoms become more several (Carrico *et al*., 2007). This study also tested other clinical variables for their association with self- reported depressive symptoms in PLWHA. These variables include liver enzymes aspartate aminotransferase (AST), gamma-glutamyl-transferase (GGT), bilirubin and alanine aminotransferase (ALT).

Figure 2.5: Factors Associated with HIV and Depressive Disorders/Symptoms



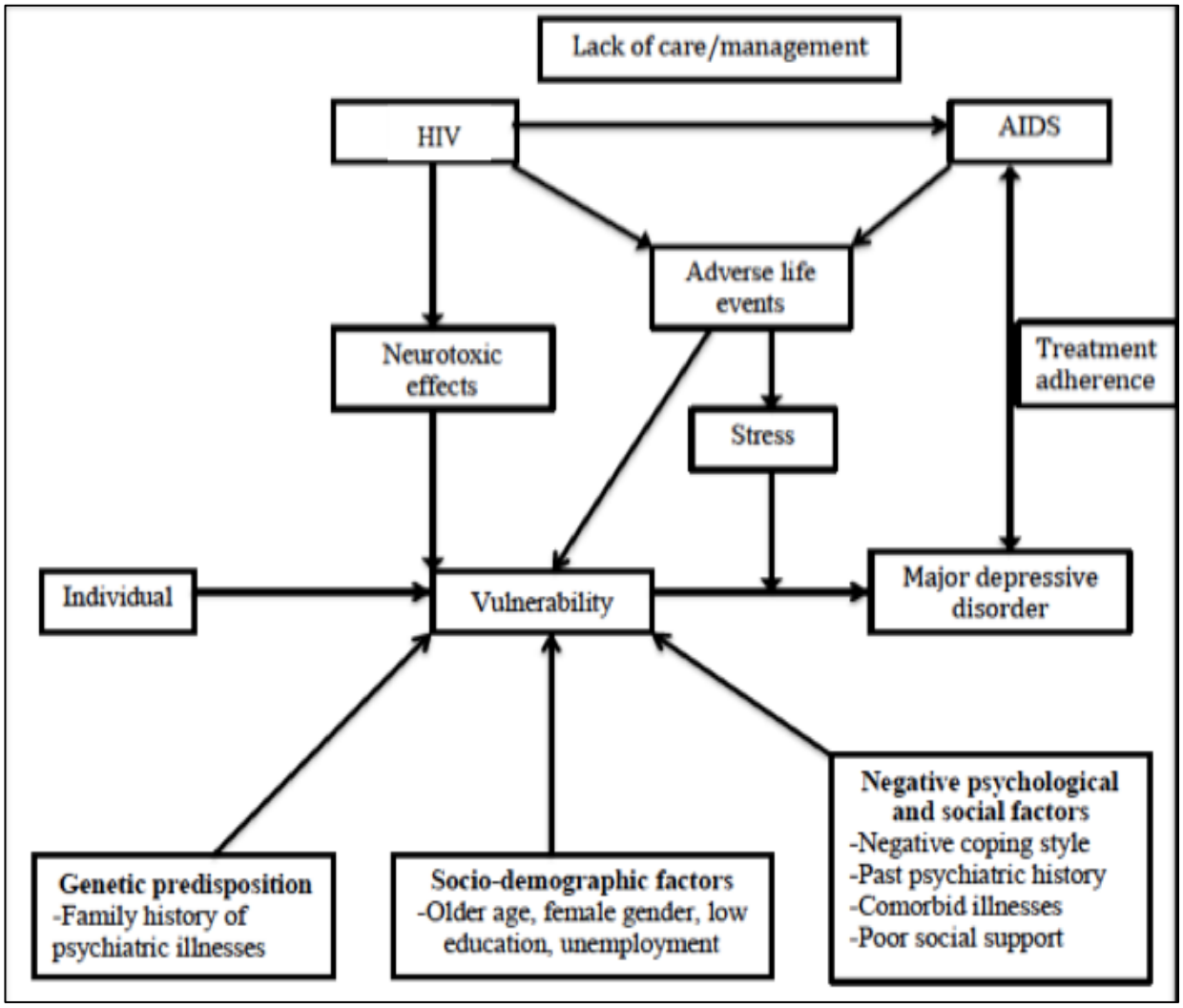
CONCEPTUAL FRAMEWORK

The framework for our study was adopted and modified from the study of Kinyanda *et al.'s* (2011) in Uganda that examined the prevalence and the risk factors for major depressive disorders among individuals living with HIV/AIDS in semi-urban Entebbe district of Uganda (Kinyanda *et al*., 2011). Kinyanda *et al.'s* (2011) conceptual framework was based on the Diathesis-Stress Model – this model gives the detailed description on how the genetic components and biological factors act

collaboratively with environmental stress to result in an illness (Goforth *et al*., 2011; Kinyanda *et al*., 2011).

More precisely, the model suggested that stressful life events could trigger individual's vulnerabilities to some specific psychological disorders. Diathesis-Stress Model expatiated that if the at-risk individuals have low resilience or vulnerability for a particular disorder, an extremely high level of stress would be needed to initiate the symptoms of such disorder and vice versa (Goforth *et al*., 2011). Our study framework identified biopsychosocial factors predisposing individuals to major depression. Also, the neurotoxic effects of HIV infection reinforced by the stress of managing HIV infection can increase individual's vulnerability to major depression. See figure 2.6 for further detail.

Figure 2.6: Study Framework



Adapted and modified from "Prevalence and risk factors of major depressive disorder in HIV/AIDS as seen in semi-urban Entebbe district, Uganda" (Kinyanda et al., 2011: p3)

CHAPTER 3: METHODOLOGY

This chapter focuses on the theoretical perspectives, research design and rationale used in this study. The latter part gives the detailed descriptions of the study variables, population, location and the statistical procedures employed in the study.

STUDY DESIGN

Our study is a cross-sectional study from medical charts of PLWHA that accessed care at Positive Living Program (PLP) at the Royal University Hospital (RUH) in Saskatoon, Saskatchewan, Canada.

STUDY LOCATION

The study data collection was conducted at the PLP of the RUH. PLP was established to provide care and support for seropositive patients residing in Central and Northern Saskatchewan. The mission is to provide comprehensive, multi-disciplinary, patient-centered health care and social support to individuals living with HIV/AIDS and Hepatitis C Virus (HCV) patients at no cost through their program offices at RUH and Westside community clinic (Saskatchewan Health Authority, 2017). Other services that patients received during their visit to the unit include counselling, immunization, clinical assessment and treatment evaluation strategy (Saskatchewan Health Authority, 2017).

STUDY POPULATION

This study included seropositive adult persons age 18 and older receiving care and monitoring at the Saskatoon Health Region Positive Living Program from 2010 to 2015.

OPERATIONAL AND ETHICAL APPROVALS

Ethical approval was obtained from the University of Saskatchewan Behavioral Research and Ethics Board (Bio 14-290). This was to ensure compliance with university regulations and to establish proper research administration oversight. During data extraction, we ensured that only needed variables were extracted from the medical charts while maintaining confidentiality. All data was coded with password encryption. All stored data will be discarded through electronic file deletion after five years.

DATA COLLECTION

The PLP data was collected from September 1 to November 31, 2016. Data was collected prospectively from patients' medical charts from 2010 to 2015. The data was directly entered in a password encrypted excel sheet. The variables that were gathered include socio-demographic variables (sex, ethnicity, age, housing status, transportation status, marital status, employment status, and available support network), behavioral risk factors (MSM, substance use and history of incarceration) and clinical parameters (CD4 cell counts, viral load test and liver enzymes).

Two available standardized medical forms were available for data collection. These were the Saskatoon Health Region HIV Case Reporting Form and HIV Initial Assessment Form. Both forms contain patient's socio-demographic and behavioral factors, which were all check-marked by the attending nurse during a brief interview with each patient at their first visit to the site. Please refer to Appendix G for the copy of this form. Clinical variables were obtained from laboratory test reports in the patient medical chart. Kindly refer to Appendix H for the copy of the form.

DESCRIPTION OF VARIABLES

Outcome Variable (Baseline)

Depressive Symptoms – The attending nurse during the patient's first visit to PLP assessed the self-reported response. Patients were asked if they were depressed or not. The dichotomous variable (self-reported depressive symptoms) was coded as "yes or no."

Independent Variables (Baseline)

Socio-demographic factors

Age – This was obtained from HIV case reporting form. We categorized age into 10-year intervals.

Gender – Information on gender was obtained from HIV case report form. Gender was classified as male, female and other (transgender).

Ethnicity – This was obtained from HIV initial assessment form. The categories include White, Black (e.g. African, Haitian, Jamaican, Somali, etc.), First Nations, Métis, Inuit, Asian (e.g. Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Filipino etc.), South Asian (e.g. East Indian, Pakistani, Sri Lankan, Punjabi, Bangladeshi, etc.), Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Moroccan, etc.), Latin-American (e.g. Mexican, Central/South American, etc.), or other ethnicities. In our analysis, ethnicity was categorized distinctly into three groups namely: Caucasian (patients self-identified as white of Canadian descent), Indigenous (self-identified descend as either North American Indian, Métis and Inuit), and Others (patients from Africa, Asian, South Asian, West Asian, Latin America etc).

Marital Status – This was assessed from the medical chart, which included single/never married, married and separated/divorced/widowed. This study categorized marital status into single/never married, married and separated/divorced/widowed.

Employment Status – This was obtained from the HIV initial assessment form. Patients were asked if they were employed or unemployed at their first visit to the site.

Available Transportation and Housing – The information on housing and transportation were obtained from HIV initial assessment form. Patients were asked to disclose any issues relating to housing or transportation that might affect their subsequent visits to PLP.

Social Support – This is also available in HIV initial assessment form. The available social support for patients was categorized as formal (government support) or informal (family, friends or both).

Behavioral Factors (Baseline)

Men who have sex with men (MSM) – This HIV risk was self-reported and recorded by the attending healthcare practitioner. MSM was categorized into yes and no.

Injection Drug Use (IDU) – This was obtained from the patient initial assessment form. It was self-identified by patients. This is categorized into yes/no options.

History of Incarceration – This was available from the patient initial assessment form. Prior history of incarceration was self-reported by each patient at their initial visit to PLP. This response was classified as yes/no.

Smoking – This was obtained in the HIV case report form. This was self-identified and recorded by the attending nurse. Smoking status was categorized as yes or no.

Alcohol Consumption – This was assessed from the patient initial assessment form. It was self-identified and checkmarked by attending nurse. Alcohol intake was categorized as yes or no.

Cocaine Use – This was also obtained from the patient initial assessment form. Cocaine use was self- identified by patients and classified as yes/no.

Marijuana Use – This HIV risk was self-reported and checkmarked by the attending nurse and classified accordingly into yes/no.

Clinical Parameters (First available clinical/laboratory test)

Viral Loads – This was obtained from the first available clinical/laboratory test report from the patient medical chart. The viral load of each patient was tested periodically to check the effectiveness of the ART treatment options.

CD4 Cell Counts – The periodical laboratory test report in the patient medical chart was being assessed to obtain the CD4 cell counts of each patient. In our analysis, we categorized CD4 cell counts into three according to Center for Disease Control (CDC) classification into low (< 200 cells/µl), medium (200-500 cells/µl) and normal (> 500 cells/µl) (Vajpayee *et al*., 2005).

AST – This was obtained from laboratory test report in the patient medical chart. For ease of analysis, we grouped AST into normal (<45 U/L), mild (46-135 U/L) and high (>136 U/L) (Liver Doctor, 2018).

ALT – This was obtained from laboratory test report in the patient medical chart. For ease of analysis, we grouped AST into normal (< 45 U/L), mild (46-135 U/L) and high (>136 U/L) (Liver Doctor, 2018).

INCLUSION CRITERIA

All HIV positive individuals accessing care at the PLP in Saskatoon from 2010 to 2015 were eligible to be included in the study. However, cases were limited to individuals above 18 years.

VARIABLE SELECTION

Outcome Variable

The outcome variable of interest in this study was self-reported depression. Baseline self-reported depression was coded and extracted as "yes/no" from the patient medical chart.

Independent Variables

Variables that were known to be associated with self-reported depression in individuals living with HIV/AIDS as identified earlier in the literature were categorized into socio-demographic, behavioral, and clinical variables. Some of the independent variables had large amount of missing data and were problematic in the analysis. The independent variables of interest considered for analysis are summarized in Table 3.1.

Table 3.1: Baseline Independent Variables

Categories	**Variables**	**Description**	**Type**
Demographic (Baseline)	Gender	Male, Female and Others	Categorical
	Age	Birth Date	Categorical
	Ethnicity	Caucasian, Indigenous, Black and Others	Categorical
	Marital Status	Single/Never Married, Married and Separated/Divorced/Widowed	Categorical
	Employment Status	Yes or No.	Categorical
	Available	Yes or No.	Categorical
	Transportation	Yes or No.	Categorical
	Available Housing	Yes or No.	Categorical
		Formal or Informal	Categorical

	Available Social Support		
Behavioral (Baseline)	MSM IDU Incarceration Smoking Status Alcohol Consumption Cocaine Use Marijuana Use	Yes, No Yes, No Yes, No Yes, No Yes, No Yes, No Yes, No	Categorical Categorical Categorical Categorical Categorical Categorical Categorical
Clinical (First test)	Viral Load CD4 Cell Counts AST ALT	 Low <200 Medium 200-500 Normal >500 Normal <45 Mild 46-135 High >136 Normal <45 Mild 46-135 High >136	Continuous Categorical Categorical Categorical

STATISTICAL PROCEDURE

A purposeful variable selection approach for logistic proposed by Hosmer and Lemeshow was followed by exploring the univariate analysis of all independent variables at $P < 0.05$ (Bursac *et*

al., 2008). Table 4–3 shows the univariate analysis for all independent variables considered for potential inclusion in the final model. To align with the principle of parsimony and to avoid inflation of standard errors, multicollinearity analysis using test of tolerance and variance inflation factors of the independent variables was conducted as a parameter reduction strategy. See Appendix 1 to 3 for multicollinearity analyses. After multiple iterations of fitting the multivariable model to assess the relationship between the independent variables and our outcome of interest, a backward model-building approach was applied to arrive at the final predictive model. Multivariable analysis was conducted at $P < 0.05$. Confounding and biologically plausible interactions of other non-significant independent variables were explored. However, none of the non-significant independent variable was found to be confounding or modifying the existing association in the multivariable model.

STATISTICAL ANALYSIS

Descriptive statistics were used to summarize the data by reporting on the mean and standard deviation. To assess baseline characteristics, t-test was used for continuous variables and dichotomous variables were assessed using chi-square or Fishers exact test. For the univariate analysis, several logistic regression models were used to assess the association between the independent variables and self-reported depressive symptoms. Due to the high level of missing data, a backward stepwise selection approach was used for our multivariate analysis. Corresponding p-values and 95% confidence intervals for the regression coefficients were also estimated. All statistical analysis was conducted using SPSS version 23.

CHAPTER 4: RESULTS

STUDY POPULATION BASELINE CHARACTERISTICS

Sociodemographic Variables

A total of 351 PLWHA were included in this study. Of them, 220 (62.9%) males, 129 (36.8%) females and 1 (0.3%) self-identified as a transgender. 113 (32.3%) self-reported depressive symptoms at baseline, 18 (5.1%) denied depressive symptoms and 219 (62.6%) were missing data for depressive symptoms. The study mean age was 45.2 years (SD = 11.8) and most of the patients 280, (79.7%) were between 30 - 59 age range. 169 (48.3%) patients were from indigenous ancestry, 100 (28.6%) Caucasian, 17 (4.8%) Black, 17 (4.8%) other ethnic groups and 48 (13.7%) were missing ethnicity data. Of the total 351 patients, 146 (41.6%) identified their marital status, 81 (23.1%) single, 45(12.8%) married and 20 (5.7%) were separated, divorced or widowed.

Behavioral Variables

181 (51.6%) patients reported their sexual identities, 63 (18%) self-identified as MSM/homosexual men and 106 (30.3%) denied MSM practices. 153 (43.7%) patients reported recent history of IDU and 110 (31.4%) denied IDU. 60 (17.1%) patients reported prior incarceration history and 39 (11.1%) denied prior incarceration history. The smoking status of 235 (67%) patients was gathered, 190 (54.3%) reported cigarette smoking and 45 (12.9%) self-identified as non-smoker. 148 (42.3%) patients reported alcohol consumption and 61 (17.4%) denied alcohol intake.

Clinical Variables

From the 351 patients in our study, 305 (87.1%) patients had their CD4 cell counts measured at initial diagnosis. From the available data, 73 (20.9%) had a low CD4 cell counts (<200 cells/µl), 150 (42.9%) medium CD4 cell counts (200-499 cells/µl) and 82 (23.4%) had high CD4 cell counts

(>500 cells/µl). The mean CD4 cell counts was 374 cells/µl. See Table 4–1 and 4–2 for the study's baseline characteristics.

Table 4.1: Baseline Patient's Characteristics (N=351)

Variables	N	%
Age		
Mean (±Std)	45.2 (11.77)	
18-29	30	8.6
30-39	92	26.2
40-49	98	27.9
50-59	90	25.6
>60	37	10.5
Missing	4	1.1
Ethnicity		
Caucasian	100	28.6
Indigenous (First Nation, Inuit and Metis)	169	48.3
Black	17	4.8
Others	17	4.8
Missing	48	13.7
Gender		
Male	220	62.9
Female	129	36.8
Transgender	1	0.3
Missing	1	0.3
Marital Status		
Married	45	12.8
Single	81	23.1
Separated/Widow/Divorce	20	5.75

Variables	N	%
Missing	205	58.4
Employment Status		
Yes	95	27.1
No	42	12.0
Missing	213	60.9
Available Housing		
Yes	81	23.1
No	7	2.0
Missing	262	74.9
Available Transportation		
Yes	38	10.9
No	13	3.7
Missing	299	85.4
Formal Social Support		
Yes	129	36.9
No	5	1.4
Missing	217	61.7
Informal Social Support		
Yes	100	28.5
No	16	4.6
Missing	235	67.0
Any Social Support (Formal + Informal)		
Yes	176	50.1
No	11	3.1
Missing	164	46.7

Variables	N	%
History of Incarceration		
Yes	60	17.1
No	39	11.1
Missing	251	71.7
MSM		
Yes	63	28.6
No	106	48.2
Missing	51	23.2
IDU		
Yes	153	43.7
No	110	31.4
Missing	87	24.9
Smoking Status		
Yes	190	54.3
No	45	12.9
Missing Values	115	32.9
Alcohol Consumption		
Yes	148	42.3
No	61	17.4
Missing	141	40.3
Cocaine Use		
Yes	80	22.9
No	94	26.9
Missing	176	50.3
CD4 Cell Counts		
Mean (±Std)	374.4 (238.5)	
Low <200	73	20.9

Variables	N	%
Medium 200-500	150	42.9
Normal >500	82	23.4
Missing	45	12.9
ALT		
Mean (±Std)	64.1 (93.3)	
Normal <45	144	41.1
Mild 46-135	51	14.6
High >136	26	7.4
Missing	129	36.9
ALP		
Mean (±Std)	92.5 (56.0)	
Normal 30-120	177	50.6
Mild 121-360	35	10.0
High >360	1	0.3
Missing	137	39.1
GGT		
Mean (±Std)	67.8 (70.9)	
Normal <45	62	17.7
Mild 46-135	23	6.6
High >136	13	3.7
Missing	143	72.0
Bilirubin		
Mean (±Std)	9.9 (7.7)	
Normal <20	198	56.6
Mild 21-60	8	2.3
High >60	1	0.3
Missing Values	143	40.9

Table 4.2: Independent Baseline Variables and Self-Reported Depressive Symptoms Status (n, %)

Covariates	Depressed (%)	Not Depressed (%)	P-Value
Age			
18-29	12 (92.3)	1 (7.7)	0.45
30-39	34 (91.9)	3 (8.1)	
40-49	30 (85.7)	5 (14.3)	
50-59	26 (83.9)	5 (16.1)	
>60	11 (73.3)	4 (26.7)	
Gender			
Male	68 (87.2)	10 (12.8)	0.79
Female	45 (84.9)	8 (25.1)	
Marital Status			
Married	11 (61.1)	7 (38.9)	0.08
Single	25 (83.3)	5 (16.7)	
Separated/Widow	7 (100)	0 (0.0)	
Ethnicity			
Caucasian	45 (93.7)	3 (6.3)	0.09
Indigenous (First Nation, Inuit and Metis)	49 (79.0)	13 (21.0)	
Black	3 (75.0)	1 (25.0)	
Other	4 (100)	0 (0.0)	
Employment Status			
Yes	29 (85.3)	5 (14.7)	**0.02**
No	12 (57.1)	9 (42.9)	

Covariates	Depressed (%)	Not Depressed (%)	P-Value
Available Housing			
Yes	22 (66.7)	11 (33.3)	**0.01**
No	0 (0.0)	4 (100)	
Available Transportation	9 (47.4)	10 (52.6)	0.41
Yes	1 (25.0)	3 (75.0)	
No			
Formal Social Support	39 (79.6)	10 (20.4)	**0.01**
Yes	1 (25.0)	3 (75.0)	
No			
Informal Social Support	24 (77.4)	7 (32.6)	0.57
Yes	5 (62.5)	3 (37.5)	
No			
Any Social Support (Formal +Informal)			
Yes	53 (81.5)	12 (18.5)	0.13
No	4 (57.1)	3 (42.9)	
Incarceration			
Yes	17 (85.0)	3 (15.0)	**0.01**
No	11 (47.8)	12 (52.2)	
MSM			
Yes	22 (95.7)	1 (4.3)	**0.01**
No	22 (61.1)	14 (38.9)	
IDU			
Yes	40 (76.9)	12 (23.1)	0.18

Covariates	Depressed (%)	Not Depressed (%)	P-Value
No	41 (87.2)	6 (12.8)	
Marijuana			
Yes	20 (86.9)	3 (13.1)	0.46
No	27 (79.4)	7 (20.6)	
Smoking			
Yes	56 (84.8)	10 (15.2)	0.61
No	17 (89.5)	2 (10.5)	
Alcohol Consumption			
Yes	50 (90.9)	5 (9.1)	0.06
No	18 (75.0)	6 (25.0)	
Cocaine Use			
Yes	25 (86.2)	4 (13.8)	0.94
No	30 (85.7)	5 (14.3)	
CD4 Cell Counts			
Low <200	23 (82.1)	5 (17.9)	0.47
Medium 200-500	50 (91.0)	5 (9.0)	
Normal >500	27 (84.4)	5 (15.6)	
GGT			
Normal <45	19 (90.5)	2 (9.5)	0.73
Mild 46-135	5 (83.3)	1 (16.7)	
High >136	3 (100)	0 (0.0)	
AST			
Normal <45	56 (88.9)	7 (11.1)	0.22
Mild 46-135	10 (76.9)	3 (23.1)	

Covariates	Depressed (%)	Not Depressed (%)	P-Value
High >136	4 (66.7)	2 (33.3)	
ALT			
Normal <45	55 (90.2)	6 (9.8)	0.13
Mild 46-135	12 (80.0)	3 (20.0)	
High >136	6 (66.7)	3 (33.3)	

Table 4.3: Univariate Logistic Regression Analysis

Covariates	Odds Ratio	95% CI	P-Value
Age			
18-29	4.41	0.42, 45.25	0.22
30-39	4.12	0.80, 21.33	0.08
40-49	2.13	0.50, 9.64	0.30
50-59	1.89	0.43, 8.41	0.40
>60	-	-	-
Gender			
Female	-	-	-
Male	1.21	0.44, 3.30	0.71
Ethnicity			
Caucasian	-	-	-
Indigenous (First Nation, Inuit and Metis)	0.25	0.06, 0.94	**0.04**
Others	0.47	0.04, 5.14	0.54
Marital Status			
Married	-	-	-
Others (Single, Separated, Widow)	0.29	0.08, 1.08	**0.07**

Covariates	Odds Ratio	95% CI	P-Value
Employment Status			
No	-	-	**-**
Yes	4.40	1.21, 15.70	**0.03**
Formal Social Support	-	-	**-**
No	11.7	1.10, 124.80	**0.04**
Yes			
Informal Social Support	-	-	-
No	1.97	0.37, 10.40	0.42
Yes			
Any Social Support (Formal+ Informal)			
No	-	-	-
Yes	3.31	0.65, 16.80	0.15
Available Transportation			
No	-	-	-
Yes	2.70	0.03, 30.85	0.42
MSM			
No	-	-	-
Yes	14.00	1.69, 115.83	**0.01**
Incarceration			
No	-	-	-
Yes	6.18	1.41, 27.02	**0.02**
Smoking Status			
No	-	-	-
Yes	0.67	0.13, 3.30	0.61

Covariates	Odds Ratio	95% CI	P-Value
Marijuana Use			
No	-	-	-
Yes	1.73	0.40, 7.52	0.47
Cocaine Use			
No	-	-	-
Yes	1.04	0.25, 4.30	0.96
Alcohol Consumption			
No	-	-	-
Yes	0.30	0.08, 1.11	0.07
Viral Load	1.00	1.00, 1,00	0.13
CD4 Cell Counts			
Low <200	-	-	-
Medium 200-500	2.17	0.57, 8.26	0.25
Normal >500	1.17	0.30, 4.57	0.82
AST			
High >136	-	-	-
Normal <45	4.00	0.62, 26.00	0.15
Mild 46 -135	1.67	0.20, 14.10	0.64
ALT			
High >136	-	-	-
Normal <45	4.60	0.90, 23.21	0.11
Mild 46 -135	2.00	0.31, 13.06	0.50

UNIVARIATE ANALYSIS RESULTS

Our study examined the association between sociodemographic, behavioral and clinical factors earlier identified by previous studies to be associated with depressive disorders/symptoms in PLWHA. This study examined the relationship between each independent variable on self-reported baseline depressive symptoms using the univariate analysis approach.

SOCIODEMOGRAPHIC VARIABLES AND SELF-REPORTED DEPRESSIVE SYMPTOMS

I examined eight sociodemographic variables including: age, gender, ethnicity, marital status, employment status, formal and informal social support and available transportation.

According to our univariate analysis, age was not significantly associated with self-reported depressive symptoms. However, we observed that the odds of reporting depressive symptoms decrease with increasing age.

Gender did not significantly predict depressive symptoms among PLWHA in our study (P = 0.71). However, we observed that male PLWHA are 1.21 more likely to self-report depressive symptoms than female PLWHA OR 1.21 (95% CI: 0.44 – 3.30).

Our results on ethnicity found indigenous ancestry to be negatively associated with self-reported depressive symptoms among our participants. Indigenous people are 75% less likely to self-report depressive symptoms when compared with Caucasians OR 0.25 (95% CI: 0.06 – 0.94).

The association between marital status and self-reported depressive symptoms was marginally significant (P = 0.07). We found single, separated or divorced status to be protective against depressive symptoms among our participants.

Being employed was an independent predictor of self-reported depressive symptoms (P = 0.03). Employed PLWHA are 4.4 times more likely to self-report depressive symptoms than it is for unemployed participants OR 4.40 (95% CI: 1.21 – 15.70).

Formal social support independently predicts depressive symptoms (P = 0.04). PLWHA with consistent support from the government are 11.7 time more likely to self-report depressive symptoms when compared to participants without government assistance OR 11.70 (95% CI: 1.10 – 124.80). Informal social support was not associated with self-reported depressive symptoms in our study (P = 0.42).

Available transportation and informal social support were not statistically significant. This might be because the data had too many missing values.

BEHAVIORAL VARIABLES AND SELF-REPORTED DEPRESSIVE SYMPTOMS

Seven behavioral variables were examined including: men sex men (MSM), injection drug use (IDU), incarceration, smoking, marijuana use, cocaine use and alcohol consumption.

MSM/homosexual practice was an independent predictor of self-reported depressive symptoms among our participants (P = 0.01). Homosexual men are 14 times more likely to self-report depressive symptoms when compared to heterosexual men

OR= 14.0 (95% CI: 1.69 – 115.83).

Prior incarceration history independently predicted self-reported depressive symptoms in our study (P = 0.02). PLWHA with prior incarceration history are 6.18 times more likely to report depressive symptoms than PLWHA without incarceration history OR= 6.18 (95% CI: 1.41 – 27.02).

Alcohol consumption was found to be protective against depressive symptoms. Although the variable is marginally significant (P = 0.07), PLWHA that reported alcohol intake are 70% less

likely to self-report depressive symptoms when compared to those that denied alcohol consumption.

Smoking, injection and non-injection drug, marijuana and cocaine use did not independently predict the odds of self-reporting depressive symptoms.

CLINICAL VARIABLES AND SELF-REPORTED DEPRESSIVE SYMPTOMS

We independently tested four clinical variables including: viral load, CD4 cell counts**,** AST and ALT liver enzymes.

Blood viral load was not a significant predictor of depressive symptoms in our study (P = 0.13). The CD4 cell count was not associated with self-reporting depressive symptoms in our study. Although CD4 cell counts was not statistically significant, we observed the odds of self-reporting depressive symptoms to decrease as the blood CD4+ increases in our study.

We did not find significant association between liver enzymes (AST&ALT) and self-reported depressive symptoms. Our results suggested that the odds of self-reporting depressive symptoms decrease as the liver enzymes blood counts increase.

Table 4.4: Multivariate Logistic Regression Analysis

Covariates	Odds Ratio	95% CI	P-Value
MSM			
No			
Yes	17.1	1.12 - 44.50	**0.04**
Employment			
No			
Yes	7.04	1.48 - 198.50	**0.02**

MULTIVARIATE ANALYSIS RESULTS

Five variables from the univariate analysis independently predicted the odds of self-reporting depressive symptoms in our study. These were ethnicity, employment status, formal social support, MSM and incarceration. However, only MSM and employment status were significant at the level of multivariate analysis.

Homosexual men are 17.1 times more likely to self-report depressive symptoms compared to heterosexual men after controlling for employment status OR 17.1 (95% CI: 1.12 – 44.50).

Employed PLWHA are 7.04 times more likely to self-report depressive symptoms than unemployed individuals living with HIV/AIDS after controlling for homosexuality OR 7.04 (95% CI: 1.48 – 198.50).

Interaction between homosexuality and employment status was not significant.

CHAPTER 5: DISCUSSION AND CONCLUSION

In this study, we focused on the factors that are associated with self-reported depressive symptoms among three hundred and fifty-one seropositive patients that were accessing care at the PLP of the RUH in Saskatoon. We aimed to estimate the prevalence of depressive symptoms, and to identify those factors that would be associated with the odds of self-reporting depressive symptoms among our study participants. In this chapter, we summarize our findings, compare our results with previous studies and highlighted the study implications and some limitations in our study.

PREVALENCE OF DEPRESSIVE SYMPTOMS

Approximately one third (32.3%), 113 of 351 participants self-reported depressive symptoms and 18 (5.1%) denied depressive symptoms. From the 113 patients that self-reported depressive symptoms, majority 90 (76.6%) were between 30 to 50 years of age, 68 (60%) male, 45 (40%) females, 49 (48.5%) self-identified as First Nation, Métis or Inuit, 45 (44.5%) Caucasian, 3 (2.97 %) Black, and 4 (3.96%) were from other ethnicities.

L'akoa *et al*. (2013) reported 63% rate of depressive symptoms among PLWHA in Yaoundé, Cameroon (L'akoa *et al*., 2013), Wang *et al*. (2018) observed 50.8% prevalence rate of depressive symptoms among Chinese individuals living with HIV/AIDS (Wang *et al*., 2018), and Choi *et al*. (2016) established a 28% prevalence of depressive symptoms among 3,816 PLWHA in Ontario, Canada (Choi *et al*., 2016). The observed prevalence of depressive symptoms in our study (32.3%) is significantly lower than the studies of L'akoa *et al*. (2013) and Wang *et al*. (2018). However, our observed prevalence lies within 0% to 47.8% global rate of depressive disorders (Ciesla and Roberts, 2001) and comparable with the results of Choi *et al*. (2016) in Ontario, Canada.

Our study did not explore specific factors that contributed to the high prevalence of depressive symptoms among our participants-variances might have resulted from the study design.

SOCIO-DEMOGRAPHIC FACTORS AND DEPRESSIVE SYMPTOMS

Socio-demographic variables (ethnicity, employment status and formal support) were significantly associated with self-reported depressive symptoms when examined independently. Indigenous PLWHA were 75% less likely to self-report depressive symptoms than Caucasians OR 0.25 (95% CI: 0.06 – 0.94). Also, employed PLWHA were 4.4 times more likely to self-report depressive symptoms than unemployed PLWHA OR 4.40 (95% CI: 1.21 – 15.70).

Age – Liu *et al*. (2014) in Nanning, China, observed that older participants were more likely than younger participants to report depressive symptoms. The authors determined that older participants often experience problem keeping up with medical care and sometimes reduced social supports (Liu *et al*., 2014). Anagnostopoulos *et al*. (2015) in Switzerland found that younger participants were more likely to self-report depressive symptoms compared to older participants (Anagnostopoulos *et al*., 2015). Choi *et al*. (2016) in Ontario also established that younger participants were more likely to report both incidence and prevalence depressive symptoms when compared to older participants (Choi *et al*., 2016). Our results on age were contrary to the findings of Liu *et al*. (2014), Anagnostopoulos *et al*. (2015) and Choi *et al*. (2016), as we found no significant association between age and self-reported depressive symptoms. Our results did agree with the results of Rai and Verma. (2015) that found no significant association between age and depression among 104 PLWHA in India (Rai and Verma, 2015).

Gender – Earlier study by Bhatia *et al*. (2011) in Houston, Texas established that female individuals living with HIV/AIDS were 5.71 more likely than male PLWHA to report major depression (P = 0.004) (Bhatia *et al*., 2011). Also, Choi *et al*. (2016) in Ontario, Canada observed

higher odds of depressive symptoms among female participants than it was for male participants OR 1.20 (95% CI: 1.02 – 1.40)(Choi *et al*., 2016). On the contrary, Mohammad *et al*. (2015) observed that male PLWHA were 1.6 times more likely than female PLWHA to self-report depression (Mohammed *et al*., 2015). Our results contradicted the studies of Bhatia and Munjal. (2014), Choi *et al*. (2016) and Mohammad *et al*. (2015), as we did not find a significant association between gender and self-reported depressive symptoms. However, our result was consistent with the findings of Rai and Verma. (2015) that did not find an association between gender and depression (Rai and Verma, 2015).

Ethnicity – Earlier studies have observed higher rates of depressive disorders/symptoms among indigenous people and immigrants to a new environment (Cain *et al*., 2013; Wong *et al.,* 2013; Chen *et al*., 2014). Perceived stigmatization, racism, social isolation and other psychosocial stressors confronting immigrants were highlighted to be responsible for the increased prevalence of depressive disorders/symptoms amongst them (Wong *et al.*, 2013; Chen *et al*., 2014). Choi *et al*. (2016) in Ontario, Canada found no significant association between ethnocultural minorities and the incident of reporting depressive symptoms (Choi *et al*., 2016). Contrary to the results of Choi *et al*. (2016), our univariate analysis found patients that self-identified as First Nations, Inuit and Métis were 75% less likely than Caucasians to self-report depressive symptoms OR 0.25 (95% CI: 0.06 – 0.94).

Indigenous ancestry was not a significant predictor in our multivariable model. Our results on ethnicity was based on 118 (33.6%) reported data. Most of the data was missing, resulting in unevenness in our variable (ethnicity) both across and within the group. Also, previous studies have observed that people with consistent social support (formal or informal) are less likely to report depressive disorders/symptoms when compared with people with minimal social support

(Vyavaharkar *et al*., 2010; Liu *et al*., 2013; Liu *et al*., 2014; Kingori *et al*., 2015; Matsumoto *et al*., 2017; Thai *et al*., 2017). From our study, a majority (54.4%) of indigenous people had social support (formal or informal) as opposed to 33% of Caucasians that reportedly denied being on social support; this also could have been the reason why we found indigenous ancestry to be protective against self-reported depressive symptoms.

Marital Status – Marital discord could increase the burden of depressive disorders/symptoms among married people (Robles *et al*., 2014). Rong *et al*. (2017) in Wuhan, China observed that married people/staying with a partner increases the odds of reporting depression by 2.40 when compared to single or never married PLWHA (Rong *et al*., 2017). Meanwhile, Egbe *et al*. (2017) in Abuja, Nigeria determined that single people were 2.8 times more likely than married PLWHA to report a depressive episode (Egbe *et al*., 2017). Our study contradicted the studies of Rong *et al*. (2017) and Egbe *et al*. (2017), but consistent with the results of Rai and Verma. (2015) as we did not find a significant association between marital status and self-reported depressive symptoms.

Employment – Being unemployed is an independent predictor of depressive disorders/symptoms in PLWHA (Bing *et al*., 2001; Su *et al*., 2013; Anagnostopoulos *et al*., 2015). Bhatia *et al*. (2011) observed that unemployed PLWHA are 1.54 times more likely than unemployed PLWHA to report depressive episodes (Bhatia *et al*., 2011). Nordenmark. (1999) observed the role of employment on self-perception, psychological wellness and social integration (Nordenmark, 1999). Contrarily, Maslach *et al*. (2001) determined that work related stress (burnout) such as role conflict, lack of autonomy and time pressure can increase the risk of depression among the employed population (Maslach *et al*., 2001). According to Maslach *et al*. (2001), "burnout encompasses a work-related syndrome, which is defined by three dimensions: an overwhelming exhaustion, feelings of

cynicism and detachment from the job, and a sense of ineffectiveness and lack of accomplishment at work". (Maslach *et al*., 2001).

The results from our multivariate analysis showed that employed PLWHA are 7.04 more likely to self-report depressive symptoms than unemployed PLWHA OR 7.04 (95% CI: 1.48 – 198.50). Apart from high missing values (60.9%) that can bias our result, work related stress reinforced by the stress of coping with HIV infection could account for the high rate of depressive symptoms among employed PLWHA in our study.

Social Support (Formal/Informal) – Earlier studies argued that consistent social support can help to reduce the burden of depressive disorders/symptoms in individuals living with HIV/AIDS (Vyavaharkar *et al*., 2010; Liu *et al*., 2013; Liu *et al*., 2014; Kingori *et al*., 2015; Thai *et al*., 2017; Matsumoto *et al*., 2017). Bekele *et al*. (2013) found that PLWHA with social support were less likely to feel depressed compared to those without social support (Bekele *et al*., 2013). Our result showed that formal support independently predicted the odds of reporting depressive symptoms OR 11.7 (95% CI: 1.10 – 124.80). Formal support was found not to be significant at the level of multivariable analysis. Although we did not know why our result on formal support contradicts the results from previous studies, we, however, attributed the conflicting findings to high numbers of missing data.

BEHAVIORAL RISK FACTORS AND DEPRESSIVE SYMPTOMS

Apart from MSM and incarceration, our study did not find any association between other behavioral factors being examined and self-reported depressive symptoms.

Among the entire population, homosexual men are being discriminated against due to their sexual identity (Ahaneku *et al*., 2016). Also, their sexual orientation may limit the expression of depressive disorders/symptoms amongst them (Ash and Mackereth, 2013). Feuillet *et al*. (2017)

in France determined that homosexual men are 5.1 times more likely than heterosexual men to report major depression (Feuillet *et al*., 2017). Scott *et al*. (2016) in Canada observed that homosexual men are 2.09 more likely than heterosexual men to report depressive symptoms (Scott *et al*., 2016). From our study, we determined that homosexual men (MSM) were 17.1 times more odds to self-report depressive symptoms than heterosexual men OR 17.1 (95% CI: 1.12 - 44.50).

Also, we observed that prior history of incarceration was independently associated with the odds of reporting depressive symptoms OR 6.18 (95% CI: 1.41 - 27.02). Due to high numbers of missing values (71.7%), we did not consider this variable for our multivariate analysis.

CLINICAL RISK FACTORS AND DEPRESSIVE SYMPTOMS

This study did not find any significant association between clinical factors and depression in PLWHA. Our result on CD4 cell counts agrees with the study by Rai and Verma. (2015) India where the association between CD4 cell counts and depression among participants was not significant (Rai and Verma, 2015).

STUDY LIMITATIONS

Several limitations of this study should be noted. Firstly, as this is a cross-sectional study, causal relationships cannot be inferred based on the results. The self-reported nature of our outcome variable (depressive symptoms) was prone to information bias. Secondly, based on the method of recruiting the patients to the PLP care center, our results would be prone to selection bias which can affect the generalizability of our findings. Finally, many of our variables are missing and unobtainable in our study, this can reduce the statistical power and increase our estimates bias.

STUDY STRENGTHS

Despite the study limitations highlighted above, the study also had several strengths. First, our study is the first of its kind to examine the influence of socio-demographic, behavioural and clinical variables on the relationship between HIV and depression among PLWHA in Saskatoon. This study is important because prior studies have excluded, ignored or controlled for the impact of clinical variables such as CD4+ cell counts, viral load and liver function test from their explanatory models for the relationship between HIV and depression among PLWHA and does not mirror reality.

The evidence showed by this study for employed and MSM patients is critical for future research. This study also contributes significantly to the evidence based on the relationship between depression and HIV among PLWHA due to the paucity of information in this research area, especially in Saskatchewan.

CONCLUSIONS

Aside from the varying rates of the prevalence of depressive disorders/symptoms reported in PLWHA in developed and developing countries, the relationship between depressive symptoms and PLWHA have not been extensively researched. Differences in measuring instruments, study timeframe, location and study population make it impractical to have a unified rate of depressive disorders/symptoms in PLWHA. Also, there have been several equivocal results or opinions from prior studies on the impact of examined risk factors on the association between depressive disorders/symptoms and PLWHA. Particularly neglected in prior research is the impact of clinical factors, which was thoroughly examined in this thesis but was not associated with depressive symptoms in individuals living with HIV.

Based on this study, we observed that indigenous ancestry, employed, formal social support, men who have sex with men (MSM)/homosexual men and those with history of incarceration were independently associated with self-reported baseline depressive symptoms in unadjusted models. However, MSM and employed PLWHA were significantly associated with self-reported baseline depressive symptoms in PLWHA at the level of the multivariate logistic model. Therefore, future social programs targeting homosexual men and employed PLWHA should be developed to manage early signs and symptoms of depression among these vulnerable populations in Saskatoon.

For future research, we suggest the use of a standardized means of diagnosing depression among PLWHA. A unified approach to the diagnosis of depression will reduce the potential for information and misclassification bias in the data. Researchers and healthcare providers should employ multiple ways to ensure completeness of participant data to improve the precision of the study estimate. Adequate staff training, telephone reminders and patient-tracking tools can be used to improve the documentation in resource-limited settings, especially on clinical risk factors in patient charts. Overall, the use of electronic medical records is a viable option to increase the study rigor and validity as opposed to paper charts.

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APPENDICES

APPENDIX A

Correlation matrix between socio-demographic independent variables

Coefficient P-Value Frequency	Age	Sex	Ethnicity	Marital Status	Employment Status	Formal Social Support	Avail Housing	Avail Transport
Age	1	-.265	-.227	.140	.156	.075	-.001	. 180
		0.000	0.000	0.097	.069	.395	.989	.211
	347	347	300	141	137	132	85	50
Sex	-.265	1	.291	.084	-.118	-.089	.057	-.242
	0.000		.000	.325	.168	.307	.600	.087
	347	350	303	141	137	134	87	51
Ethnicity	-.227	.291	1	.182	-.093	-.130	-.037	-.255
	0.000	.000		.041	.319	.162	.759	.084
	300	303	303	.126	118	117	72	47
Marital Status	.140	.084	182	1	.101	.154	.156	.038
	0.097	.325	.041		.400	.217	.313	.836
	141	141	.126	141	72	54	44	32
Employment Status	.156	-.118	-.093	.101	1	.170	.445	.295
	.069	.168	.313	.400		.170	.001	.101
	137	137	44	72	137	67	55	32
Formal Social Support	.075	-.089	-.130	.154	.170	1	.287	.106
	.395	.307	.162	.217	.170		.053	.539
	132	134	117	66	67	134	46	36

Coefficient P-Value Frequency	Age	Sex	Ethnicity	Marital Status	Employment Status	Formal Social Support	Avail Housing	Avail Transport
Available Housing	-.001 .989 85	.057 .600 87	-.037 .759 72	.156 .313 44	.445 .001 55	.287 .053 46	1 87	.568 .000 39
Available Transport	.180 .211 50	-.242 .087 51	-.255 .084 47	.038 .836 32	.295 .101 32	.106 .539 36	.568 .000 39	1 51

APPENDIX B

Correlation matrix between behavioral independent variables

Coefficient P-Value Frequency	MSM	IDU	Incarceration	Smoking	Marijuana Use	Cocaine Use	Alcohol Consumption
MSM	1	-.503	-.289	-.295	.070	-.220	.023
		.000	.024	.001	.546	.043	.811
	169	134	62	115	77	85	111
IDU	-.503	1	.407	.323	.417	.596	.024
	.000		.000	.000	.000	.000	.763
	.134	263	82	190	118	143	165
Incarceration	-.289	.407	1	.451	.169	.391	.226
	.024	.000		.000	.263	.002	.068
	61	82	99	74	46	60	66
Smoking	-.295	.323	.451	1	.338	.369	.268
	.001	.000	.000		.000	.002	.000
	115	190	74	235	137	153	190
Marijuana Use	.070	.417	.169	.338	1	.467	.162
	.546	.000	.263	.000		.000	.060
	77	118	46	137	148	120	135
Cocaine Use	-.220	.596	.391	.369	.467	1	.162
	.043	.000	.002	.000	.000		.051
	85	143	60	153	120	174	146

.

Coefficient P-Value Frequency	MSM	IDU	Incarceration	Smoking	Marijuana Use	Cocaine Use	Alcohol Consumption
Alcohol	.023	024	.226	.268	.162	.162	1
Consumption	.811	.763	.068	.000	.060	.051	
	111	165	66	190	135	146	209

APPENDIX C

Correlation matrix between clinical variables of interest

Coefficient P-Value Frequency	CD4	GGT	ALT	AST	ALP	BIL	VL
CD4	1	.022	.028	-.080	-.081	.102	-.108
		.838	.690	.254	.255	.156	.073
	305	92	208	204	200	194	278
GGT	.022	1	.455	.457	.360	.039	.178
	.838		.000	.000	.000	.713	.099
	92	98	95	96	93	90	87
ALT	.028	.455	1	.780	.308	.011	-.011
	.690	.000		.000	.000	.876	.870
	208	95	221	.212	208	201	206
AST	-.080	.457	.780	1	.318	.019	.140
	.254	.000	.000		.000	.792	.045
	204	96	212	218	206	198	204
ALP	-.081	.360	.308	.318	1	.044	.181
	.255	.000	.000	.000		.536	.010
	200	93	208	206	213	199	201
BIL	.102	.039	.011	.019	.044	1	-.043
	.156	.713	.876	.792	.536		.547
	194	90	201	198	199	207	196
VL	-.108	.178	-.011	.140	.181	-.043	1
	.073	.099	.870	.045	.010	.547	
	278	87	206	204	201	196	319

APPENDIX D

Socio-demographic Variables VIF

Variables	Tolerance	Variance Inflated Factor
Age	.283	3.535
Sex	0.040	**25.241**
Ethnicity	0.045	**22.336**
Marital Status	0.201	4.977
Employment Status	0.289	3.462
Formal Social Support	0.228	4.387
Available Housing	0.660	1.515
Available Transport	0.393	2.544

APPENDIX E

Behavioural Risk Factors VIF

Variables	Tolerance	Variance Inflation Factor
MSM	0.36	2.79
IDU	0.47	2.12
Incarceration	0.74	1.35
Smoking	0.53	1.90
Marijuana Use	0.79	1.36
Alcohol Consumption	0.65	1.54
Cocaine Use	0.62	1.62

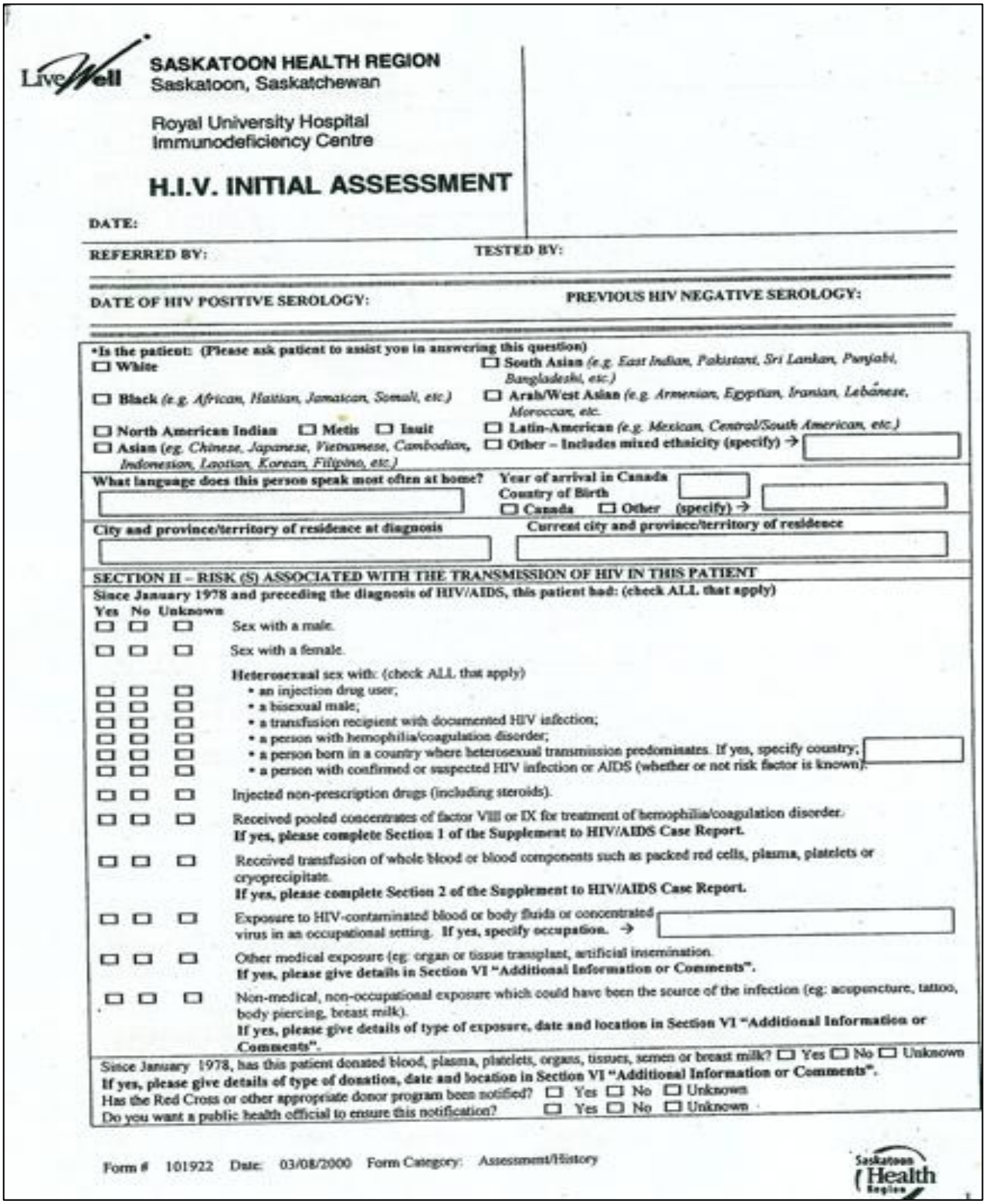
APPENDIX F

Clinical Risk Factors VIF

Variables	Tolerance	Variance Inflation Factor
Viral Load	0.87	1.15
CD4+	0.80	1.25
AST	0.42	2.40
ALT	0.38	2.64
GGT	0.64	1.57
ALP	0.84	1.19
Bilirubin	0.63	1.60

APPENDIX G

Positive Living Program Initial Assessment Form



LiveWell

SASKATOON HEALTH REGION
Saskatoon, Saskatchewan

Royal University Hospital
Immunodeficiency Centre

H.I.V. INITIAL ASSESSMENT

DATE:

REFERRED BY: **TESTED BY:**

DATE OF HIV POSITIVE SEROLOGY: **PREVIOUS HIV NEGATIVE SEROLOGY:**

***Is the patient: (Please ask patient to assist you in answering this question)**

☐ **White**
☐ **Black** *(e.g. African, Haitian, Jamaican, Somali, etc.)*
☐ **North American Indian** ☐ **Metis** ☐ **Inuit**
☐ **Asian** *(eg. Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Laotian, Korean, Filipino, etc.)*
☐ **South Asian** *(e.g. East Indian, Pakistani, Sri Lankan, Punjabi, Bangladeshi, etc.)*
☐ **Arab/West Asian** *(e.g. Armenian, Egyptian, Iranian, Lebanese, Moroccan, etc.*
☐ **Latin-American** *(e.g. Mexican, Central/South American, etc.)*
☐ **Other – Includes mixed ethnicity (specify) →**

What language does this person speak most often at home?

Year of arrival in Canada
Country of Birth
☐ **Canada** ☐ **Other** **(specify) →**

City and province/territory of residence at diagnosis

Current city and province/territory of residence

SECTION II – RISK (S) ASSOCIATED WITH THE TRANSMISSION OF HIV IN THIS PATIENT

Since January 1978 and preceding the diagnosis of HIV/AIDS, this patient had: (check ALL that apply)

Yes	No	Unknown	
☐	☐	☐	Sex with a male.
☐	☐	☐	Sex with a female.
			Heterosexual sex with: (check ALL that apply)
☐	☐	☐	• an injection drug user;
☐	☐	☐	• a bisexual male;
☐	☐	☐	• a transfusion recipient with documented HIV infection;
☐	☐	☐	• a person with hemophilia/coagulation disorder;
☐	☐	☐	• a person born in a country where heterosexual transmission predominates. If yes, specify country;
☐	☐	☐	• a person with confirmed or suspected HIV infection or AIDS (whether or not risk factor is known).
☐	☐	☐	Injected non-prescription drugs (including steroids).
☐	☐	☐	Received pooled concentrates of factor VIII or IX for treatment of hemophilia/coagulation disorder. **If yes, please complete Section 1 of the Supplement to HIV/AIDS Case Report.**
☐	☐	☐	Received transfusion of whole blood or blood components such as packed red cells, plasma, platelets or cryoprecipitate. **If yes, please complete Section 2 of the Supplement to HIV/AIDS Case Report.**
☐	☐	☐	Exposure to HIV-contaminated blood or body fluids or concentrated virus in an occupational setting. **If yes, specify occupation. →**
☐	☐	☐	Other medical exposure (eg: organ or tissue transplant, artificial insemination. **If yes, please give details in Section VI "Additional Information or Comments".**
☐	☐	☐	Non-medical, non-occupational exposure which could have been the source of the infection (eg: acupuncture, tattoo, body piercing, breast milk). **If yes, please give details of type of exposure, date and location in Section VI "Additional Information or Comments".**

Since January 1978, has this patient donated blood, plasma, platelets, organs, tissues, semen or breast milk? ☐ Yes ☐ No ☐ Unknown
If yes, please give details of type of donation, date and location in Section VI "Additional Information or Comments".
Has the Red Cross or other appropriate donor program been notified? ☐ Yes ☐ No ☐ Unknown
Do you want a public health official to ensure this notification? ☐ Yes ☐ No ☐ Unknown

Form # 101922 Date: 03/08/2000 Form Category: Assessment/History

Saskatoon Health Region

NAME: _____

Was a Conversion Illness Experienced?

Location of Infection:

Was Partner Notification Completed upon Diagnosis? Current Partners Notified? Explain.

MEDICAL / FAMILY HISTORY:

STD'S:
G.C. [Y] [N] Hepatitis [B] [C] [NO] Warts [Y] [N] Syphilis [Y] [N] Chlamydia [Y] [N] HSV II [Y] [N]

OPPORTUNISITIC INFECTIONS:
Candida [Y] [N] _____ PCP [Y] [N] _____
OHL [Y] [N] _____ MAC [Y] [N] _____
TB [Y] [N] _____ Other _____

FEMALES:
PID [Y] [N] _____ Vaginitis [Y] [N] _____
Menstrual History

Last Pap Smear _____ Result _____ Contraception _____

MEDICATION HISTORY:

ANTIRETROVIRALS	OTHER Rx	COMPLIMENTARY THERAPIES

PREVIOUS IMMUNIZATIONS:

Pneumovax [Y] [N] Date: Hepatitis B [Y] [N] Date:
Influenza [Y] [N] Date: dT [Y] [N] Date:
Hib [Y] [N] Date: Other [Y] [N] Date:
Mantoux [Y] [N] Date: Result:

Social Hx
- Financial / Employment
- Family
- Supports - Formal / Informal
- Relationships / Sexual Health
- Substance Use
- Transportation Issues
- Food Security
- Housing
- Disclosure

SASKATOON DISTRICT HEALTH
SASKATOON, SASKATCHEWAN
ROYAL UNIVERSITY HOSPITAL
CENTRAL SASKATCHEWAN
IMMUNODEFICIENCY CLINIC

H.I.V. INITIAL ASSESSMENT

Yes	No	SYMPTOM CHECKLIST	DESCRIBE	Yes	No	SYMPTOM CHECKLIST	DESCRIBE
[ ]	[ ]	Fever/Night Sweats		[ ]	[ ]	Dysphagia	
[ ]	[ ]	Fatigue		[ ]	[ ]	Odynophagia	
[ ]	[ ]	Nausea		[ ]	[ ]	Headache	
[ ]	[ ]	Vomiting		[ ]	[ ]	Peripheral Neuropathy	
[ ]	[ ]	Diarrhea		[ ]	[ ]	Oral Lesions	
[ ]	[ ]	Weight Loss		[ ]	[ ]	Genital	
[ ]	[ ]	Cough		[ ]	[ ]	Vision	
[ ]	[ ]	SOB		[ ]	[ ]	Skin Lesions	
[ ]	[ ]	Other		[ ]	[ ]	Other	

CURRENT CONCERNS:

PHYSICAL EXAM: (WNL [✓]) WT_____ HT_____ BP_____ PULSE_____ RR_____ TEMP_____

GENERAL	
LYMPHADENOPATHY	[ ]
ENT	[ ]
EYES / FUNDI	[ ]
DENTAL	[ ]
SKIN	[ ]
PULMONARY	[ ]
CARDIOVASCULAR	[ ]
ABDOMEN	[ ]
GENITO-URINARY	[ ]
RECTAL	[ ]
NEUROLOGICAL	[ ]
M. SKELETAL	[ ]

Form # 101922 Date: 03/08/2000 Form Category: Assessment/History

3

EMOTIONAL \ MENTAL ASSESSMENT:

PROBLEMS:

PLANS:

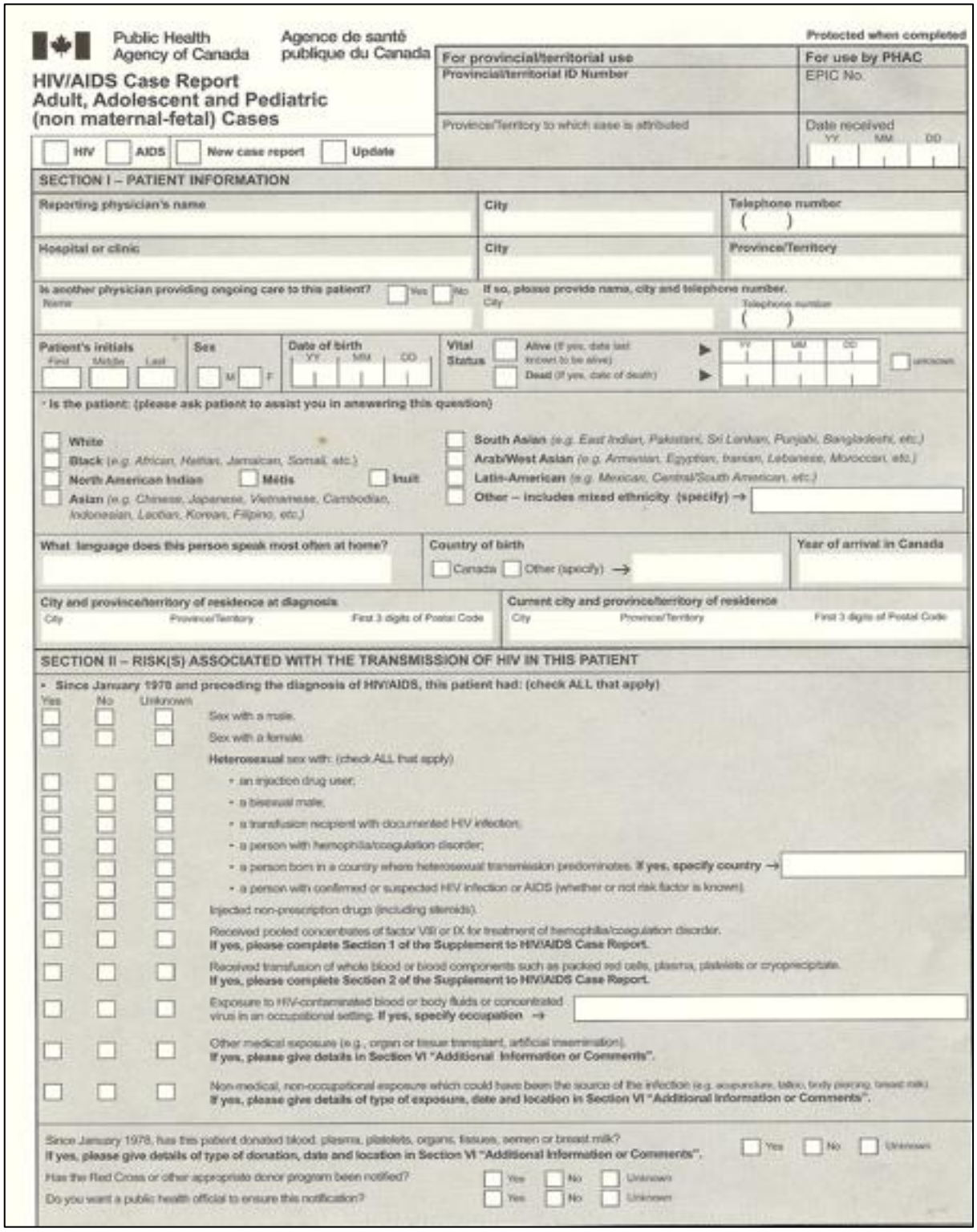
COUNSELLING:

FOLLOW-UP:

Interviewer's Signature RN _____ **Physician's Signature** _____

APPENDIX H

HIV Case Report Form



Public Health Agency of Canada / Agence de santé publique du Canada

Protected when completed

HIV/AIDS Case Report
Adult, Adolescent and Pediatric
(non maternal-fetal) Cases

For provincial/territorial use | For use by PHAC

Provincial/territorial ID Number | EPIC No.

Province/Territory to which case is attributed | Date received (YY MM DD)

☐ HIV ☐ AIDS ☐ New case report ☐ Update

SECTION I – PATIENT INFORMATION

Reporting physician's name | City | Telephone number ( )

Hospital or clinic | City | Province/Territory

Is another physician providing ongoing care to this patient? ☐ Yes ☐ No — If so, please provide name, city and telephone number.
Name | City | Telephone number ( )

Patient's initials (First, Middle, Last) | Sex ☐ M ☐ F | Date of birth (YY MM DD) | Vital Status ☐ Alive (If yes, date last known to be alive) ▶ (YY MM DD) ☐ unknown ☐ Dead (If yes, date of death) ▶ (YY MM DD)

- Is the patient: (please ask patient to assist you in answering this question)

☐ White
☐ Black (e.g. African, Haitian, Jamaican, Somali, etc.)
☐ North American Indian ☐ Métis ☐ Inuit
☐ Asian (e.g. Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Laotian, Korean, Filipino, etc.)
☐ South Asian (e.g. East Indian, Pakistani, Sri Lankan, Punjabi, Bangladeshi, etc.)
☐ Arab/West Asian (e.g. Armenian, Egyptian, Iranian, Lebanese, Moroccan, etc.)
☐ Latin-American (e.g. Mexican, Central/South American, etc.)
☐ Other – includes mixed ethnicity (specify) →

What language does this person speak most often at home? | Country of birth ☐ Canada ☐ Other (specify) → | Year of arrival in Canada

City and province/territory of residence at diagnosis: City | Province/Territory | First 3 digits of Postal Code

Current city and province/territory of residence: City | Province/Territory | First 3 digits of Postal Code

SECTION II – RISK(S) ASSOCIATED WITH THE TRANSMISSION OF HIV IN THIS PATIENT

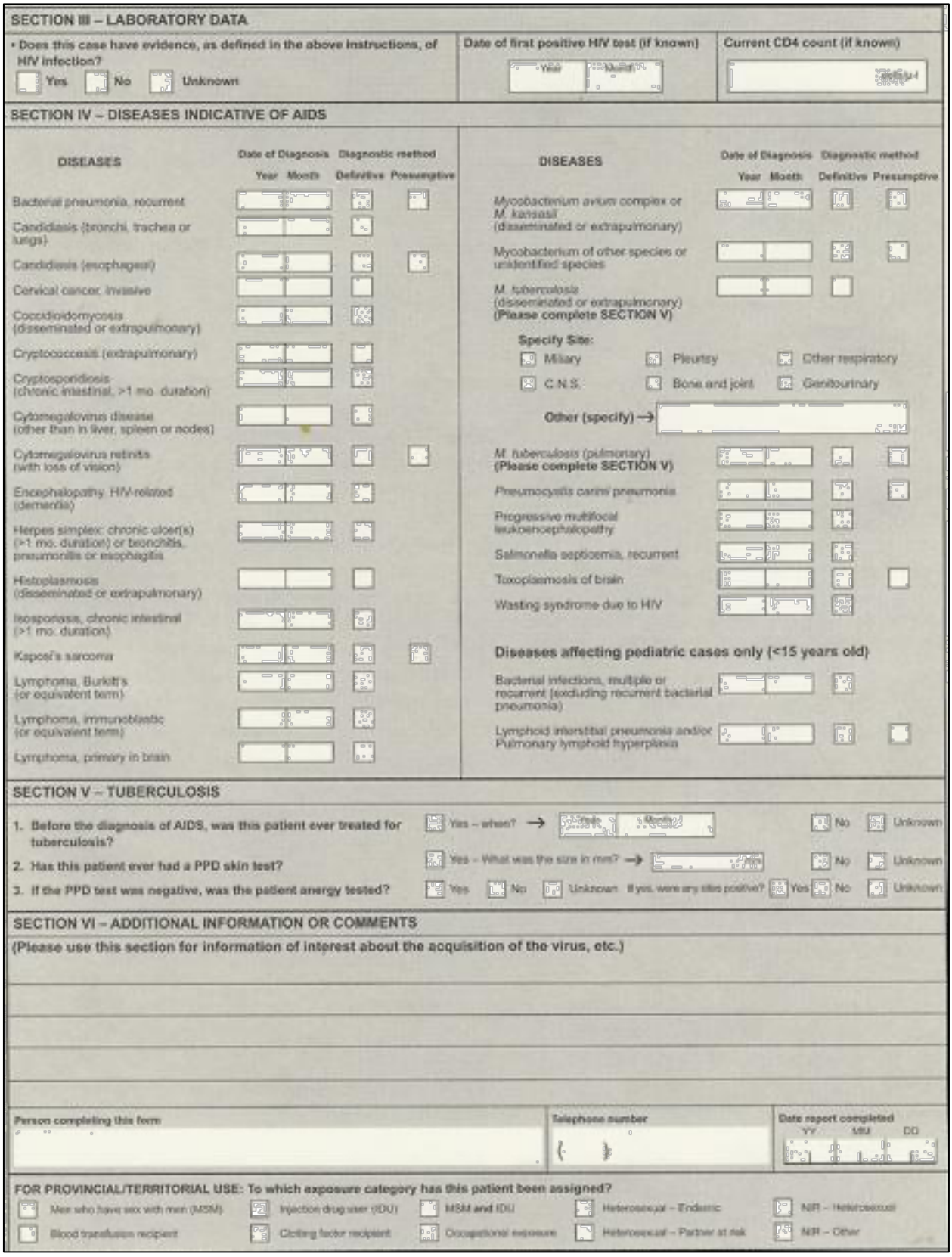
- Since January 1978 and preceding the diagnosis of HIV/AIDS, this patient had: (check ALL that apply)

Yes	No	Unknown	
☐	☐	☐	Sex with a male.
☐	☐	☐	Sex with a female.
			Heterosexual sex with: (check ALL that apply)
☐	☐	☐	• an injection drug user;
☐	☐	☐	• a bisexual male;
☐	☐	☐	• a transfusion recipient with documented HIV infection;
☐	☐	☐	• a person with hemophilia/coagulation disorder;
☐	☐	☐	• a person born in a country where heterosexual transmission predominates. **If yes, specify country →**
☐	☐	☐	• a person with confirmed or suspected HIV infection or AIDS (whether or not risk factor is known).
☐	☐	☐	Injected non-prescription drugs (including steroids).
☐	☐	☐	Received pooled concentrates of factor VIII or IX for treatment of hemophilia/coagulation disorder. **If yes, please complete Section 1 of the Supplement to HIV/AIDS Case Report.**
☐	☐	☐	Received transfusion of whole blood or blood components such as packed red cells, plasma, platelets or cryoprecipitate. **If yes, please complete Section 2 of the Supplement to HIV/AIDS Case Report.**
☐	☐	☐	Exposure to HIV-contaminated blood or body fluids or concentrated virus in an occupational setting. **If yes, specify occupation →**
☐	☐	☐	Other medical exposure (e.g., organ or tissue transplant, artificial insemination). **If yes, please give details in Section VI "Additional Information or Comments".**
☐	☐	☐	Non-medical, non-occupational exposure which could have been the source of the infection (e.g. acupuncture, tattoo, body piercing, breast milk). **If yes, please give details of type of exposure, date and location in Section VI "Additional Information or Comments".**

Since January 1978, has this patient donated blood, plasma, platelets, organs, tissues, semen or breast milk? ☐ Yes ☐ No ☐ Unknown
If yes, please give details of type of donation, date and location in Section VI "Additional Information or Comments".

Has the Red Cross or other appropriate donor program been notified? ☐ Yes ☐ No ☐ Unknown

Do you want a public health official to ensure this notification? ☐ Yes ☐ No ☐ Unknown



SECTION III – LABORATORY DATA

• Does this case have evidence, as defined in the above instructions, of HIV infection?
Yes No Unknown

Date of first positive HIV test (if known) Year Month

Current CD4 count (if known)

SECTION IV – DISEASES INDICATIVE OF AIDS

DISEASES	Date of Diagnosis Year	Month	Diagnostic method Definitive	Presumptive
Bacterial pneumonia, recurrent				
Candidiasis (bronchi, trachea or lungs)				
Candidiasis (esophageal)				
Cervical cancer, invasive				
Coccidioidomycosis (disseminated or extrapulmonary)				
Cryptococcosis (extrapulmonary)				
Cryptosporidiosis (chronic intestinal, >1 mo. duration)				
Cytomegalovirus disease (other than in liver, spleen or nodes)				
Cytomegalovirus retinitis (with loss of vision)				
Encephalopathy, HIV-related (dementia)				
Herpes simplex: chronic ulcer(s) (>1 mo. duration) or bronchitis, pneumonitis or esophagitis				
Histoplasmosis (disseminated or extrapulmonary)				
Isosporiasis, chronic intestinal (>1 mo. duration)				
Kaposi's sarcoma				
Lymphoma, Burkitt's (or equivalent term)				
Lymphoma, immunoblastic (or equivalent term)				
Lymphoma, primary in brain				

DISEASES	Date of Diagnosis Year	Month	Diagnostic method Definitive	Presumptive
Mycobacterium avium complex or *M. kansasii* (disseminated or extrapulmonary)				
Mycobacterium of other species or unidentified species				
M. tuberculosis (disseminated or extrapulmonary) **(Please complete SECTION V)**				

Specify Site:
Miliary Pleurisy Other respiratory
C.N.S. Bone and joint Genitourinary

Other (specify) →

M. tuberculosis (pulmonary) **(Please complete SECTION V)**			
Pneumocystis carinii pneumonia			
Progressive multifocal leukoencephalopathy			
Salmonella septicemia, recurrent			
Toxoplasmosis of brain			
Wasting syndrome due to HIV			

Diseases affecting pediatric cases only (<15 years old)

Bacterial infections, multiple or recurrent (excluding recurrent bacterial pneumonia)		
Lymphoid interstitial pneumonia and/or Pulmonary lymphoid hyperplasia		

SECTION V – TUBERCULOSIS

1. **Before the diagnosis of AIDS, was this patient ever treated for tuberculosis?** Yes – when? → Month Year No Unknown
2. **Has this patient ever had a PPD skin test?** Yes – What was the size in mm? → No Unknown
3. **If the PPD test was negative, was the patient anergy tested?** Yes No Unknown If yes, were any sites positive? Yes No Unknown

SECTION VI – ADDITIONAL INFORMATION OR COMMENTS

(Please use this section for information of interest about the acquisition of the virus, etc.)

Person completing this form

Telephone number ( )

Date report completed YY MM DD

FOR PROVINCIAL/TERRITORIAL USE: To which exposure category has this patient been assigned?

Men who have sex with men (MSM) Injection drug user (IDU) MSM and IDU Heterosexual – Endemic NIR – Heterosexual
Blood transfusion recipient Clotting factor recipient Occupational exposure Heterosexual – Partner at risk NIR – Other