

The Impact of Substance Use on Mother-to-Child Transmission of HIV Literature Review

Prepared for the Saskatchewan Prevention Institute

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Executive Summary

The current review, conducted by the Saskatchewan Prevention Institute, aimed to assess the impact of substance use on mother-to-child transmission (MTCT) of HIV. Such a review was deemed necessary due to Saskatchewan's unique HIV profile. Specifically, new cases of HIV in Saskatchewan are: (a) the highest in Canada; (b) most often associated with injection drug use (IDU); and (c) increasing rapidly in women of childbearing age (ages 15 to 39; average age of new adult female cases in 2010 was 31.3 years). Because the number of new cases of HIV in Saskatchewan is increasing in women in their reproductive years, and because the majority of new cases of HIV are due to IDU, it is highly likely that at least some pregnant women are living with HIV/AIDS and substance use issues. Therefore, in order to effectively reduce the risk of MTCT of HIV, an understanding of the impact of substance use on HIV infection, transmission, and MTCT is required.

Current research has established that substance use is associated with an increased likelihood of HIV infection and transmission, both directly through high risk substance use behaviours (e.g., sharing needles and other injection paraphernalia, sharing other substance use equipment) and indirectly through high risk sexual behaviours that are more common among people who use substances (e.g., inconsistent condom use, multiple sexual partners, exchanging sex for drugs or money). In individuals already infected with HIV, substance use has been associated with HIV disease progression. Current explanations for this relationship include: (a) direct negative effects on immune functioning and viral suppression; (b) issues with adherence to treatment regimens; and (c) increased probability of detrimental drug interactions.

Maternal health is extremely important for both reducing the likelihood of HIV disease progression and reducing the risk of MTCT of HIV. The impact of substance use on immune functioning, viral load, and HIV treatment adherence are some of the explanations provided for the association between substance use and MTCT of HIV. In addition, substance use has been associated with many other factors that can negatively impact maternal health, including: poor nutrition, poor sleep habits, lack of medical and prenatal care, stress, depression, physical abuse, sexual violence, sexually transmitted infections, and lack of support. Many of these outcomes associated with substance use compound the risks associated with HIV infection, greatly increasing the risk of MTCT of HIV.

Specifically, maternal substance use is associated with preterm labour and delivery, increased HIV viral replication and maternal viral load, increased risk of placental damage, and increased risk of fetal damage. Each of these consequences is also related to an increased risk of MTCT. While increased viral replication and high maternal viral load increase the likelihood of MTCT through their negative impact on maternal health, the remaining consequences (i.e., preterm labour and delivery, placental damage, and fetal damage) increase the likelihood of MTCT through their negative impact on fetal health. For instance, if the placenta is damaged through maternal substance use, this can directly affect the developing fetal immune system, resulting in heightened susceptibility to HIV infection in utero or during labour and delivery if exposed.

Research has shown that an infant's best interests are served by the optimal treatment of the pregnant woman. As such, when pregnant women living with HIV use substances, their medical care must address the management of their substance use, the pregnancy itself, and their HIV disease simultaneously. Many women who use substances report a heightened desire to make healthier choices during pregnancy, and these healthier choices can have a positive impact on maternal health and pregnancy outcomes, including reducing the risk of MTCT of HIV.

Substance use treatment has been identified as an effective way to stop or reduce substance use and related risk behaviours, resulting in a potential reduction in MTCT risk. For example, substance use treatment has been associated with improved HIV treatment adherence, increased contact with applicable services (e.g., prenatal care), and stabilization of substance use and lifestyle. Although abstinence throughout the course of the pregnancy may appear ideal, overemphasis on achieving abstinence can be counterproductive, resulting in relapse and discouraging mothers from continuing and/or seeking help. Because withdrawal during pregnancy can be dangerous unless done under close medical supervision, researchers suggest that stabilization of substance use can be more important than abstinence.

Researchers have stated that substance use treatment should be considered primary HIV prevention, due to the fact that substance use treatment often leads to a reduction in HIV risk behaviours. Primary prevention of HIV infection in women of childbearing age is obviously the most effective way to prevent MTCT of HIV. For those already infected with HIV, however, substance use treatment is still linked to risk reduction behaviours, leading to increased maternal health, better pregnancy outcomes, and reduced risk of MTCT of HIV. Therefore, in order to insure the best possible pregnancy outcomes for women living with HIV, and in order to reduce the risk of MTCT, access to appropriate substance use treatment programs is needed.

*For more detailed information, including references, please refer to the main body of the report.

1. Introduction

Since 2003, Saskatchewan has seen significant increases in the number of new cases of human immunodeficiency virus (HIV). Saskatchewan has the highest rates of new cases of HIV in Canada at twice the national average (20.8 versus 9.3/100,000) (Public Health Agency of Canada; PHAC, 2009). The HIV risk profile of Saskatchewan also differs from the rest of Canada in that the main risk factor reported for new cases of HIV is injection drug use (IDU) (78% versus 19% in 2008) (PHAC, 2010). In fact, the number of new cases of HIV with IDU reported as the primary risk factor has more than doubled in the last ten years in Saskatchewan, increasing from 30% to 74% between 2001 and 2010 (Saskatchewan Ministry of Health, 2011).¹

While decreasing trends in the proportion of positive HIV tests attributed to IDU among Canadian men has been noted, an increasing trend among women has been observed since 2003 (PHAC, 2010). The overall number of new HIV cases in women has also risen, particularly in younger women (Saskatchewan Ministry of Health, 2011). In Saskatchewan, the number of new cases of HIV is increasing rapidly in women of childbearing age (i.e., women between the ages of 15 and 39 years; average age of new adult females cases in 2010 was 31.3 years). Women of childbearing age also represent the largest group of women accessing alcohol and drug services in Saskatchewan (Saskatchewan Ministry of Health, 2009b). These facts highlight the importance of understanding the role of substance use in HIV risk behaviours and HIV transmission. As women of childbearing age represent one of the groups with the largest increases in HIV infection rates in Saskatchewan, it is also important to understand the impact of substance use on pregnancy in women infected with HIV and on mother-to-child transmission of HIV.

1.1 Current Literature Review

Recognizing the importance of understanding substance use in the context of HIV/AIDS and pregnancy, the Saskatchewan Prevention Institute conducted a review of the literature in this area. In order to highlight the importance of substance use on HIV infection, the following review first summarizes information about the influence of substance use on high risk behaviours that can, in turn, lead to HIV infection. Included is information about the effect of substance use on adherence to HIV treatment regimens and HIV disease progression. Finally, the review will focus on the available literature regarding the impact of substance use on the health of pregnant women living with HIV/AIDS, including the impact on mother-to-child transmission of HIV. The information from this review will be shared by the Saskatchewan Prevention Institute in an effort to increase understanding about HIV transmission and prevention, particularly around mother-to-child transmission of HIV.

1.2 Terminology

The phrases and terminology used in the current literature review follow those that are set out

¹ HIV risk exposure is self-reported. Only the primary self-reported risk factor is reported in the statistics provided by the Saskatchewan Ministry of Health. Therefore, although people may identify more than one risk factor, only a single exposure category is reported based on a nationally recognized hierarchy of risk.

by the Canadian AIDS Society (2010). First, as already specified above, the acronym “IDU” will be used for intravenous drug use. When speaking about people who use intravenous drugs, the acronym “IDUs” will be used. Second, unless specifically talking about IDU or the use of a specific drug, the term “substances” will be used. This term includes illegal drugs, alcohol, solvents, and pharmaceutical drugs that may or may not have been obtained legally. This term also does not imply a specific mode of intake, and therefore encompasses injection, ingestion, and/or inhalation. Third, the term “use,” as opposed to “abuse,” is used in order to avoid moralistic judgements about the intake of substances. Finally, the phrase “people who use” is used as opposed to “user” or “abuser” in order to separate the person from what he/she does.

2. Substance Use and HIV Infection Risk

2.1 Introduction to Substance Use

Substance use can occur along a spectrum ranging from beneficial use to non-problematic use to problematic and/or dependent use (BC Ministry of Health Services & BC Ministry of Children and Family Development, 2010). For most people, substance use does not lead to dependence. However, even in the case of non-dependent substance use, much harm can result. The intoxicating effects of substance use can impair judgements and affect the ability to weigh risks and benefits when making decisions about potentially risky behaviours (Canadian AIDS Society, 2005; Kendall, 2011). This means that even a single episode of substance use can result in high risk behaviour(s) taking place.

The likelihood of experiencing harms is increased for people with dependent substance use, also referred to as addiction(s). The Canadian Society of Addiction Medicine (CSAM, 2011)² defines addiction as:

a primary, chronic disease of brain reward, motivation, memory and related circuitry. Dysfunction in these circuits leads to characteristic biological, psychological, social and spiritual manifestations. This is reflected in an individual pathologically pursuing reward and/or relief by substance use and other behaviours. Addiction is characterized by inability to consistently abstain, impairment in behavioural control, craving, diminished recognition of significant problems with one's behaviours and interpersonal relationships, and a dysfunctional emotional response. Like other chronic diseases, addiction often involves cycles of relapse and remission. Without treatment or engagement in recovery activities, addiction is progressive and can result in disability or premature death.

This definition and description highlights the fact that addiction is a brain disease, in that dependent substance use changes the neurochemical and molecular structure of the brain. This changes how the brain works (NIDA, 2007). Because psychoactive substances produce their

² In 2011, the CSAM passed a motion to temporarily adopt the 2011 American Society of Addiction Medicine's definition of addiction. The definition presented here is this adopted definition.

effects by acting on the “survival” receptors in the brain (i.e., those linked to food and sex), ongoing substance use can trick the brain into believing that substance use is an essential survival activity (Kendall, 2011).

These changes in the brain can then lead to the harmful and high risk behaviours seen in people who are addicted to substances (NIDA, 2007). Specifically, substance use is known to alter judgment ability, lower inhibitions, and lead people to engage in impulsive and unsafe behaviours (NIDA, 2011). As such, substance use is associated with a vast array of negative health, social, and economic consequences (Saskatchewan Ministry of Health, 2009a). Negative consequences related to substance use can include interpersonal conflicts, violence, unplanned and unwanted sexual encounters, sexually transmitted infections (STIs), and HIV infection.

2.1.1 Substance Use in Saskatchewan

In comparison to other provinces, Saskatchewan has slightly higher rates of hazardous alcohol use, as well as higher rates of illicit substance use related harms (Saskatchewan Ministry of Health, 2009a). During 2008-2009, women represented 36% of all admissions to alcohol and drug services in Saskatchewan (Saskatchewan Ministry of Health, 2009b). During this time period, the largest group of women accessing these services were between the ages of 20 and 29. Five percent of women were pregnant at the time of access to services. Sixteen percent of women who accessed alcohol and drug services in this timeframe reported IDU in the past 12 months.

Cocaine has been identified as the most frequently injected substance by those accessing addictions services in Saskatchewan, followed by morphine and Ritalin (PHAC, 2006; Saskatchewan Ministry of Health, 2010). This is important because cocaine injections occur more frequently than other substances (e.g., heroin) due to cocaine’s shorter lasting effects (Prithwish et al., 2007). The increased number of injections thereby increases the risk of HIV infection and transmission (AVERT, 2011a).

2.2 Introduction to HIV

HIV is a virus that causes a deficiency in the immune system (Positive Women’s Network Society, 2001), by infecting the CD4 positive T cells. T cells are the key components of the human cellular immune system (Joint United Nations Programme on HIV/AIDS; UNAIDS, 2008). HIV attacks and destroys the body’s immune system, which is the body’s natural defence system against diseases and infections (Society of Obstetricians and Gynaecologists of Canada; SOGC, 2004). Specifically, HIV destroys the immune system’s CD4 cells. Therefore, HIV makes it difficult for the body to fight off infections, making it more likely that life-threatening infections will occur. For example, HIV infection increases susceptibility to many malignancies, including tumours, Kaposi’s sarcoma, and various forms of lymphoma (Canadian AIDS Treatment Information Exchange; CATIE, 2009a).

HIV can only be transmitted when there is a direct exchange of specific bodily fluids between two humans. The five fluids capable of transmitting HIV are: 1. blood; 2. semen and pre-cum; 3. vaginal fluid; 4. anal fluid; and 5. breast milk (Positive Women's Network Society, 2001). Common risky activities include unprotected vaginal and anal sex, sharing needles and other substance use equipment, and tattooing and piercing with used needles and equipment. HIV-positive mothers can transmit HIV to their babies through pregnancy, childbirth, and breastfeeding. Of the different ways HIV can be transmitted, the most efficient way is to inject HIV directly into the bloodstream with a contaminated needle (e.g., through IDU, tattooing, or piercing) (CATIE, 2011b; UNDCP/UNAIDS, 2011).

2.2.1 HIV in Saskatchewan

According to self-reports, IDU continues to define the overall risk-profile of HIV in Saskatchewan (74% of cases in 2010) (Saskatchewan Ministry of Health, 2011).³ The second most commonly reported risk category was heterosexual sex (15% of cases). Overall, in Saskatchewan, there has been a steady increase in the annual number of HIV diagnoses over the last ten years. Since 2006, Saskatchewan rates have consistently been higher than the national rates, particularly with regard to the number of female cases in the younger age groups.

According to the Saskatchewan Ministry of Health (Population Health Branch, 2009), there has been a steady upward trend in the numbers of Saskatchewan youth testing positive for HIV since 2001. This report also showed that the group with the largest increases in HIV infection rates were women of childbearing age. Given this statistic, it is fortunate that the occurrence of HIV transmission from mother to child is relatively rare in Saskatchewan, with ten cases of perinatal transmission being reported since 1997 (Saskatchewan Ministry of Health, 2011).

2.3 Links between Substance Use and HIV Infection

Substance use has been a known contributor to the transmission of HIV since the beginning of the epidemic in Canada (PHAC, 2007). Although IDU is a predominant focus of much of the research in this area, substance use by any route can put a person at risk for HIV infection. HIV transmission can occur by sharing needles and other injection paraphernalia and/or sharing other substance use equipment (e.g., straws, pipes) (Kendall, 2011; NIDA, 2011; Wang & Ho, 2011). Because substance use affects decision-making, it can increase the likelihood of sexual risk factors for HIV infection (e.g., inconsistent condom use, commercial sex work) (NIDA, 2011; Wang & Ho, 2011).

Research has shown that substance use is also associated with other high risk behaviours for HIV

³ It is again important to note that people may have reported more than one risk exposure category for HIV. Because IDU is the most efficient method of HIV infection and transmission, and because only the primary risk factor is reported in Saskatchewan statistics, anyone who reported IDU would have this listed as their risk factor.

infection, like unsafe tattooing and piercing (Raspa & Cusack, 1990). Roberts and Ryan (2002) found an association between substance use, tattooing, and unprotected intercourse. These findings were still significant after controlling for sociodemographic factors and peer substance use. The risk of HIV infection through tattooing and piercing is greatly reduced when universal precautions are followed (e.g., use of new needles, gloves, new ink, properly sterilized equipment, etc.) (CATIE, 2011b). Because these precautions are often not followed when tattoos and piercings are done outside of professional businesses (e.g., in homes or in prisons), the risk for HIV infection can be increased in these settings (AIDS Action Council, 2001). HIV infection risk can also be increased through substance use which can thin the blood and increase the amount of bleeding that occurs, thereby increasing the risk of blood exposure (CATIE, 2011b).

Substance use and addiction can negatively affect a person's overall health, thereby altering their susceptibility to HIV infection if exposed (NIDA, 2011). Substances such as opioids, cocaine, methamphetamine, and alcohol have been found to compromise immunity, making people who use these substances more susceptible to HIV infection if exposed (Wang & Ho, 2011). Previous research has also shown that personal social networks are an important influence in determining the extent to which people who use substances engage in the HIV risk behaviours highlighted here (i.e., risky substance use and sexual behaviours) (Neaigus et al., 1996).

2.3.1 Social Determinants of Health

A person's overall health is determined by complex interactions between social and economic factors, the physical environment, and individual behaviours (PHAC, 2011). These factors are referred to as social determinants of health and include: income and social status, gender, culture, housing, food insecurity, education, employment, social and physical environments, personal health practices and coping skills, and health services (Mikkonen & Raphael, 2010; PHAC, 2011). The social determinants of health demonstrate that the conditions in which people live and work directly affect their quality of health.

Specifically, each of these social determinants of health has been shown to have strong effects upon the health of Canadians, including substance use and the risk of HIV infection. For example, Mikkonen and Raphael (2010) state that adverse social and material living conditions (e.g., low income, poor quality housing, food insecurity) lead to high levels of physiological and psychological stress. These high levels of stress can lead to people adopting unhealthy coping behaviours like substance use. Substance use and attempts to improve living conditions can also lead to high risk sexual practices (e.g., sex work). Numerous research projects, summarised by Martin Spigelman Research Associates (2002), have identified an association among poverty, disadvantage, social exclusion, substance use, and other factors that place people at higher risk of HIV infection.

2.4 Substance Use Risk Behaviours

Substances can be consumed many different ways. For the purposes of HIV transmission, the

methods of consumption focused on include snorting, smoking, and injecting. There is a potential of HIV transmission through the sharing of straws (for snorting) or pipes (for smoking) due to the likelihood of blood being present from cuts and sores on the nasal membranes and lips (Canadian AIDS Society, 2005). HIV does not survive well outside of the body; therefore, the likelihood of HIV transmission is lessened by the amount of time that the pipe or straw is exposed to the air before being used by another person (Canadian AIDS Society, 2005).

Because HIV is transmitted so efficiently through IDU as compared to other methods of substance use (Arasteh & Des Jarlais, 2009; Centers for Disease Control and Prevention, 2004; United Nations International Drug Control Programme; UNDCP/UNAIDS, 2011), it is the primary focus of much of the research in this area. Needle sharing, the transfer of a previously used syringe between two or more IDUs, has been identified as the primary causal link between IDU and HIV infection (Koester, Booth, & Zhang, 1996). When people inject drugs, whether the blood is visible or not, it is present in a used needle or syringe in sufficient quantities for HIV transmission to occur (Kendall, 2011). Other behaviours associated with IDU also facilitate infection, including the sharing of water for mixing drugs and rinsing syringes, the common use of mixing containers (cookers and spoons), the shared use of cottons for filtering the drug solution, and the shared use of the drug solution (Booth, Kwiatkowski, & Chitwood, 2000; CATIE, 2010; Koester et al., 1996; Strathdee et al., 2001).

HIV risk has also been linked to the following personal network characteristics of IDUs: the size of one's injecting network (where larger networks are associated with greater risk of HIV), the frequency of contact with other IDUs, and being part of a group that injects together (Booth et al., 2000; Crisp et al., 1994; Prithwish et al., 2007). IDUs with a sex partner who participates in IDU are more likely to report high risk injection practices compared to those without a sex partner who participates in IDU (Koester et al., 1996). Perhaps explaining this finding, Mulleady and Scherr (1989) found that IDUs who share injecting equipment with their partners, relatives, and/or close friends often do not consider that they are taking a risk.

I-Track is Canada's national surveillance system focused on IDU. Reports based on this surveillance found that over 20% of respondents reported borrowing or lending used equipment in the previous six months (PHAC, 2010). Respondents were most likely to borrow used equipment from their regular sex partners and close friends. A 2005 survey of IDUs living in Montreal found that factors such as large injecting networks, frequent mutual injections, and younger age were strong predictors of equipment borrowing and/or lending (Prithwish et al., 2009). Despite the fact that younger IDUs have been socialized to IDU after the risk of HIV infection has been well-established, Miller et al. (2003) found that new IDUs were just as likely to report sharing syringes as longer-term IDUs.

The substance that is chosen for injecting influences the frequency of injections and type of interactions between injecting partners (Prithwish et al., 2007). Based on I-Track surveillance data, cocaine is the most commonly injected drug in Canada (52%), followed by morphine (13%),

heroin (7%), and dilaudid (7%) (PHAC, 2010). People who use cocaine tend to inject more frequently due to its short-acting effects (Prithwish et al., 2007). Due to the increased number of injections and the accompanying increased risk, injecting cocaine has been identified as an independent contributing factor for HIV infection (Booth et al., 2000). High risk behaviours that are well documented among people who inject cocaine include the use of shooting galleries (i.e., places where substances can be obtained, prepared, and taken by injection, often with the equipment provided on the premises), frequent needle sharing, and having a high number of needle-sharing partners (Booth et al., 2000; Prithwish et al., 2007).

Please refer to Wang and Ho's (2011) review for more detailed information about the effects of specific substances on HIV infection/replication and their implication in HIV progression. The effects of alcohol and crack cocaine (i.e., cocaine that is smoked rather than injected) will be covered in greater detail later in the current review.

2.5 Sexual Risk Behaviours

Although a lot of the literature on substance use and HIV/AIDS is focused on high risk injection behaviours, researchers have begun to recognize the impact of sexual risk behaviours in HIV transmission among people who use substances (Go et al., 2006; NIDA, 2006; Strathdee & Sherman, 2003). Specifically, substance use affects judgment and can increase the likelihood of risky sexual behaviours, which put people at risk for getting HIV or transmitting it to someone else (Edlin et al., 1994; Go et al., 2006; Kendall, 2011; Leigh & Stall, 1993; NIDA, 2006; Saskatchewan Ministry of Health, 2009c). After reviewing the literature in this area, Leigh and Stall concluded that there is a clear positive relationship between substance use and high risk sexual practices. For example, substance use has been consistently associated with multiple sex partners, inconsistent condom use, and exchanging sex for drugs or money (Baum et al., 2009; PHAC, 2010).

Risky sexual behaviours have also been associated with IDU, which can result in an even greater risk of HIV infection and/or transmission (PHAC, 2006; Strathdee et al., 2001). IDU has been associated with high rates of unprotected sex, exchanging sex for drugs and money, and multiple sex partners (Booth et al., 2000; Booth, Watters, & Chitwood, 1993; Go et al., 2006; Krupitsky et al., 2005; Pinkham & Malinowska-Sempruch, 2008). Although many partners of IDUs do not use substances themselves, they are nevertheless at risk of HIV infection if they engage in unprotected sex with a partner who participates in IDU (NIDA, 2006; UNDCP/UNAIDS, 2011). It is for this reason that Booth et al. (2000) suggest that IDUs play a critical role in the transmission of HIV to people who do not use substances.

IDU and sexual networks do tend to overlap, leading to increased vulnerability to HIV for those involved in either or both of these networks (Miller et al., 2002; Pinkham & Malinowska-Sempruch, 2008; Tyndall et al., 2002). This overlap is particularly true for certain populations of people (e.g., sex trade workers, patrons of sex trade workers). IDUs who report having a sex partner who participates in IDU have also reported significantly higher amounts of unprotected

sex (Booth et al., 2000). In fact, rates of HIV infection were double for women having sex with IDUs than women not reporting IDUs as sexual partners (Strathdee et al., 2001). Although IDU in itself is a risk factor for HIV infection and transmission if unsafe injecting practices are used, Strathdee et al. found that sexual risks still played a significant role in HIV infection even after accounting for injection related risks. For women, high risk sexual behaviours were found to be more significant than IDU related activities in terms of HIV infection.

2.6 Alcohol Use

Alcohol use has been identified as an independent risk factor for engaging in unsafe sexual behaviours, such as sex with multiple partners and unprotected intercourse (Canadian AIDS Society, 2005; Krupitsky et al., 2005). The effects of alcohol use on risk behaviours are important to understand as alcohol is reported to be the most commonly used and misused substance in Saskatchewan (Saskatchewan Ministry of Health, 2009a). Reasons underlying the association between alcohol use and high risk behaviours for HIV include decreased inhibitions, increased impulsivity, decreased perception of risk, belief that alcohol enhances sexual arousal, and the deliberate use of alcohol to excuse high risk behaviour (Krupitsky et al., 2005; Saxon & Calsyn, 1992).

Supporting this association, the prevalence of HIV infection has been found to be increased among alcohol-dependent individuals who are in treatment centres (Avin et al., 1994; Meyerhoff, 2001; National Institute on Alcohol Abuse and Alcoholism, 2002). Combined alcohol and drug use often leads to even more frequent occurrences of risky sex and substance use behaviours (Krupitsky et al., 2005; National Institute on Alcohol Abuse and Alcoholism, 2002; Rees et al., 2001). High levels of alcohol use are particularly common among IDUs. Researchers have found consistent connections between alcohol use and high risk behaviours among IDUs, including needle sharing, multiple sexual partners, unprotected intercourse, and sex with high risk sex partners (Arasteh, Des Jarlais, & Perlis, 2008; National Institute on Alcohol Abuse and Alcoholism, 2002; Saxon & Calsyn, 1992).

The National Institute on Alcohol Abuse and Alcoholism (2002) states that research clearly shows that the use of alcohol and other substances is a factor in the spread of HIV and can complicate the long-term health outcomes of people living with HIV. Research also suggests that alcohol use lowers immune system functioning (Wang & Ho, 2011), thereby increasing the susceptibility of human cells to HIV infection (Meyerhoff, 2001). This means that the risk of infection is increased if a person who uses alcohol is exposed to HIV. Among people already infected with HIV, alcohol use at any level has been associated with increased sexual risk behaviours (Stein et al., 2005) and continued injection related risk behaviours (Arasteh & Des Jarlais, 2009). Therefore, alcohol use can increase the risk of transmission of HIV to uninfected sexual and injection partners.

2.7 Crack Cocaine Use

Crack cocaine is a condensed, more potent form of cocaine which is smoked (CATIE, 2009b;

Edlin et al., 1994). The use of crack cocaine has also been identified as an independent risk factor for HIV infection (Booth et al., 1993; Wang & Ho, 2011). Although the prevalence of HIV among people who smoke crack cocaine is lower than among IDUs, research suggests that infection rates are on the rise in this group (AVERT, 2011a). Some people who smoke crack suffer from burns, blisters, and cuts on their lips and inside their mouths. Blood from these wounds can contaminate the smoking equipment and be passed along to the next smoker if equipment is shared. If two smokers both have open sores, then there is a risk of HIV transmission (AVERT, 2011a; Canadian AIDS Society, 2005; Faruque et al., 1996). Oral sex may also be risky for people who smoke crack and have open oral sores (AVERT, 2011a; Faruque et al., 1996).

Although HIV transmission is possible through the sharing of smoking equipment, the use of crack cocaine is most often associated with HIV infection due to increased sexual risk behaviours (Booth et al., 1993; Edlin et al., 1994; Wang & Ho, 2011). Crack cocaine produces a rapid short-acting euphoria followed by reduced inhibitions and decision-making abilities. This can lead to risky sexual behaviours such as multiple sex partners, unprotected sex, and exchanging sex for money or drugs (Booth et al., 1993). People who smoke crack have also been more likely to report sex with IDUs, exchanging sex for drugs and/or money, using substances before or during sex, and unprotected sexual intercourse (Booth et al., 1993).

2.8 Youth and HIV Risk

The younger population of people who use substances have been found to be particularly vulnerable to HIV infection, due to their self-reported high levels of substance use and sexual risk behaviours (PHAC, 2010). Middle and late adolescence is generally a time when young people engage in risk-taking and sensation-seeking behaviours (HIV Neurobehavioral Research Center Group, 2003). Substance use can increase the chances of unsafe behaviours by altering judgement and decision-making (NIDA, 2011). Research has found that the adolescent brain may be particularly susceptible to the effects of substance use, both making it more likely that risk behaviours will take place and resulting in vulnerabilities to substance use in later life (Kendall, 2011).

Substance use in youth has been associated with earlier age of onset of sexual activity, more sexual partners, less consistent condom use, more STIs, and greater frequency of HIV testing compared to non-using peers (Tapert et al., 2001). These authors suggest that youth who use substances are more likely to engage in risky sexual behaviours during adolescence and to continue these behaviours to the extent that substance use persists. Despite having knowledge about HIV/AIDS, new IDUs often do not engage in risk reduction behaviours (Neaigus et al., 1996). In fact, some studies have reported that younger IDUs are more likely to engage in higher levels of risk behaviours than longer-term injectors and less likely to use HIV prevention programs like needle exchanges (Kleinman et al., 1990).

2.9 Women and HIV Risk

During the 1990s, the HIV/AIDS epidemic shifted to include a growing proportion of women (Ahdieh, 2001). Since 2003, increasing numbers of positive HIV tests attributed to IDU among women has been noted (NIDA, 2006; PHAC, 2010). According to national surveillance data, just over 30% of positive HIV tests attributed to IDU have been among women (PHAC, 2007; Wiebe & Reimer, 2000). Along with substance use risks, sexual risk behaviours are significant for HIV infection, particularly among women.

Based on their sex alone, women are twice as likely as men to become infected with HIV through unprotected intercourse due to a number of factors (AVERT, 2011d; Pinkham & Malinowska-Sempruch, 2008). For example, the vagina and cervix have a much larger surface area compared to the areas of the penis where HIV transmission can happen (CATIE, 2009c). Because it acts as a barrier to protect a potential fetus, the cervix is home to a large number of immune cells. Many of these immune cells are CD4 cells. These cells are the ones that HIV is most able to infect. Another reason for women's increased risk is that if ejaculation occurs, women are exposed to considerable amounts of seminal fluid. Female hormone levels also impact HIV transmission in that low levels of estrogen lead to a thinning of the vaginal wall, making it easier for HIV to pass through (CATIE, 2009c).

Women who use substances also have unique factors that may put them at heightened risk of HIV infection as compared to men (PHAC, 2010). Women who use substances tend to engage in high numbers of both sexual and substance use related risk behaviours. Miller et al. (2002) found that HIV positivity is concentrated among those women engaging in both risk categories. In terms of high risk substance use behaviours, women are more likely than men to report being injected by others (El-Bassel, Terlikbaeva, & Pinkham, 2010; Miller et al., 2002; Platt et al., 2005; Thorne, Semenenko, & Malyuta, 2011), borrowing and lending substance use equipment (particularly with their sexual partners), and injecting last when sharing equipment (New York State Department of Health AIDS Institute, 2009; PHAC, 2010; Pinkham & Malinowska-Sempruch, 2008).

In terms of sexual risk behaviours, women who use substances are more likely to report multiple partners and sex work (Platt et al., 2005; Terplan et al., 2010; Thorne et al., 2011) and are more likely to report that the majority of their sex partners are other IDUs (Booth et al., 1993; Ramsey et al., 2007; Strathdee et al., 2001). As discussed previously, in their sample of women engaged in IDU, Strathdee et al. found that sexual risk behaviours were more commonly associated with HIV infection than IDU related risk behaviours.

The disparity of HIV infection risk between women and men is both biological (due to the sex related differences in anatomy discussed above) and social, leading to a differential burden of HIV for female IDUs (Terplan et al., 2010). Studies of HIV prevalence among women who use substances suggest that a variety of social and psychological factors are predictive of HIV infection, including: substance use duration, substance type, having a partner who uses

substances, having numerous lifetime partners, homelessness, experiencing emotional abuse, history of sexual abuse, and engaging in sex work (Chaudhury et al., 2011; Miller et al., 2002).

2.9.1 Sex Work

Women who engage in sex work are not universally at high risk of becoming infected with HIV. Instead, individual sex workers may be more vulnerable to HIV infection due to a number of social, economic, and personal factors (Canadian HIV/AIDS Legal Network, 2005). These factors influence the extent to which women are able to make free and informed decisions about their lives. The Canadian HIV/AIDS Legal Network states that HIV vulnerability can arise from inadequate information about HIV infection and/or the absence of personal characteristics and skills required to reduce the risk of infection.

Although women who engage in sex work have a relatively high number of sexual partners, their HIV risk will not be increased if they use condoms consistently and correctly. However the reality is that many women are unable to negotiate safer sex, even if they try to do so (AVERT, 2011b). Despite knowledge of and efforts to reduce risk, women have described being forced to engage in unprotected sex by both paying and intimate partners (Witte, Batsukh, & Chang, 2010). Witte et al. also found that women were less likely to use condoms with their intimate partners, as cultural norms of intimacy and trust suggest that one does not have to be protected from one's intimate partner.

The inability to negotiate safer sex is particularly true for sex workers dealing with paying clients. Clients may refuse to pay for sex if they have to use a condom, or they may offer to pay more money for unprotected sex (AVERT, 2011b; Witte et al., 2010). Because many sex workers live in poverty (Canadian HIV/AIDS Legal Network, 2005), the offer of more money can be difficult to refuse. Clients and other sexual partners may use intimidation or violence to enforce unprotected sex (AVERT, 2011b; Rhodes et al., 2012; Witte et al., 2010). Rhodes et al. found that attempts to negotiate condom use were associated with higher levels of rape and client-perpetrated violence among sex workers. This lack of control over their working conditions places women who engage in sex work at a particularly high risk for HIV infection (Edlin et al., 1994).

Sex work and substance use behaviours are often linked in women, leading to an even greater risk of HIV infection (AVERT, 2011c; Miller et al., 2002; Neaigus et al., 1996). Some women become involved in sex work as a means of financing their substance use, while others are involved in sex work first (AVERT, 2011b; Kennedy, 2003). Women in this latter category may turn to substance use as a way to cope with the burdens of their work and/or because other sex workers have introduced them to it. Women who are supporting their own (and sometimes their partner's) substance using habits will often engage in higher risk forms of sex work than women who do not use substances (Pinkham & Malinowska-Sempruch, 2008).

Many women who engage in sex work have experienced high rates of poverty, partner violence, physical abuse, and sexual abuse (Canadian HIV/AIDS Legal Network, 2005; Miller et al., 2002; Witte, Batsukh, & Chang, 2010). Women's economic circumstances often require them to submit to unsafe sex for survival (Pinkham & Malinowska-Sempruch, 2008; Witte et al., 2010). Women may also provide sex in exchange for housing, sustenance, and protection (Pinkham & Malinowska-Sempruch, 2008). Epele (2002) states daily survival is chosen over the comparatively abstract risk of HIV infection.

2.9.2 Sexual Violence

Like sex work, the relationship between sexual violence⁴ and substance abuse appears to be bi-directional (Najavits, Weiss, & Shaw, 1997; Pinkham & Malinowska-Sempruch, 2008). First, experiencing sexual violence can increase the likelihood of substance using behaviours. Specifically, women who have experienced sexual violence, as a child or as an adult, may use substances as a coping mechanism (Canadian Aboriginal AIDS Network, 2009; Ryan White HIV/AIDS Program, 2008). Indeed, much research has shown that women who use substances have very high rates of identified early trauma, including physical and sexual violence (Chavoshi et al., 2009; Kendall, 2011; PHAC, 2004; Schiff et al., 2002). Poole and Dell (2005) found that women who have experienced sexual violence are more likely to use substances, and to use them earlier, more often, and in greater quantities.

Second, substance use is linked to sexual violence in that substance use can increase the likelihood of experiencing sexual violence (Najavits et al., 1997). Some substances (e.g., ketamine, GHB) can decrease awareness and the ability to move and speak, or they may even result in a loss of consciousness (CATIE, 2009b). This can greatly increase the possibility of physical and/or sexual violence, which is why these drugs are commonly known as "date rape" drugs (CATIE, 2009b). Women who use substances often inhabit high risk environments for violence, including those associated with the criminal world (Schiff et al., 2002; Velez et al., 2006).

In terms of HIV infection, sexual violence can lead to HIV infection directly, particularly because violent sex can increase the risk of transmission (Andersson, Cockcroft, & Shea, 2008; AVERT, 2011d; CATIE, 2009b; WHO, 2002). Sexual violence has also been found to increase HIV risk indirectly, as women who have experienced sexual assault, violence, and abuse have been found to engage in more high risk sexual behaviours (Andersson et al., 2008; Chavoshi et al., 2009; Kalichman & Simbayi, 2004). The identified high risk behaviours include sex work, multiple sex partners, inconsistent condom use, and increased difficulty refusing unwanted sex (Canadian Aboriginal AIDS Network, 2009;

⁴ The World Health Organization (WHO; 2002) uses the term "sexual violence" to describe any sexual act or attempts to obtain a sexual act using coercion, by any person regardless of their relationship to the victim, in any setting. As such, sexual violence includes rape, attempted rape, sexual intimidation, and other forms of assault involving a sex organ.

Chavoshi et al., 2009; Ryan White HIV/AIDS Program, 2008). Because of the impact of sexual violence on HIV infection and transmission, the National Conference on Women and HIV/AIDS (2000) recommended that more resources need to be made available for women who have experienced sexual violence. Similarly, it is important for clinical and social service providers to be aware of and sensitive to the possibility and prevalence of sexual violence in HIV positive women's lives (Kalichman & Simbayi, 2004; Zierler, Witbeck, & Mayer, 1996).

3. Substance Use and HIV Disease Progression

As previously discussed, current research has established that substance use is associated with an increased likelihood of HIV infection and transmission, both directly through high risk substance use behaviours and indirectly through high risk sexual behaviours that are more common among people who use substances. Research has also shown that substance use can negatively impact HIV viral load and viral suppression (Carrico et al., 2007; Cofranecesco et al., 2008), as well as facilitate viral replication (Wang & Ho, 2011). In other words, substance use has been associated with HIV disease progression.

Carrico (2011) states that it is difficult to determine whether the relationship between substance use and HIV disease progression is due to the effects of specific substances, specific routes of substance use (e.g., smoking versus injecting), or a general pattern among active users of any substances. Although the relationship between substance use and HIV disease progression is not yet fully understood, the current explanations for the relationship include: direct effects on immune functioning and viral load, issues with adherence to anti-HIV medications, and increased probability of detrimental drug interactions.

3.1 Immune Functioning and Viral Load

Substance use and HIV infection both affect the brain. Research has shown that HIV causes greater injury to cells in the brain and to cognitive functioning among people who use substances than those living with HIV that do not use substances (HIV Neurobehavioral Research Center Group, 2003; NIDA, 2011). Animal studies have shown that substance use is associated with an increased amount of HIV in brain cells (NIDA, 2011). In other words, substance use can worsen the progression of HIV and its consequences, especially in the brain (Meyerhoff, 2001; NIDA, 2006; 2011).

Research has also shown that the use of certain substances is more likely to result in worse HIV clinical and immunologic outcomes than other substances (New York State Department of Health AIDS Institute, 2009; Thorne et al., 2011). For example, alcohol use has been directly associated with induction of immune deficiencies, including decreased viral suppression, increased viral load, and lowered CD4 cell counts (Chander, Lau, & Moore, 2006; Krupitsky et al., 2005; Samet et al., 2007; Wang & Ho, 2011), which are markers of HIV disease progression (National Institute on Alcohol Abuse and Alcoholism, 2002). Alcohol consumption is also

associated with nutritional deficiencies, due to a high percentage of caloric intake from alcohol, decreased absorption of nutrients, and interference with the metabolism of nutrients (Watzl & Watson, 1992). Therefore, it is plausible that nutritional deficiency is another mechanism by which alcohol leads to more rapid HIV progression (Hahn & Samet, 2010).⁵

IDU and the use of crack cocaine have also been associated with higher HIV viral load levels (Baum et al., 2009; Cook et al., 2008), lower number of CD4 cells, development of AIDS-defining conditions, and mortality due to AIDS-related causes, even among those reporting adherence to anti-HIV medications (Cook et al., 2008).

3.2 Adherence to Anti-HIV Medications

Although the effects of substance use on HIV disease progression have been identified independent of adherence to anti-HIV medications (Carrico et al., 2008; Cofranecesco et al., 2007), issues with adherence can greatly impact the progression of HIV disease. When the HIV/AIDS epidemic first began in the early 1980s, the virus was considered to be a death sentence. Although there is still no cure for HIV, there are treatments that can achieve sustained suppression of HIV replication and reduced morbidity and mortality rates in patients with advanced HIV infection (Purohit et al., 2011; Wood et al., 2008).

Anti-HIV medications, known as anti-retroviral therapy (ART) or highly active anti-retroviral therapy (HAART), can stop the virus from replicating in the body which, in turn, stops the virus from rapidly damaging the immune system (UNAIDS, 2009). Combination HAART, which is the use of three or more anti-HIV medications, allows CD4 cells to live longer and protect the body from infections (Meyerhoff, 2001). Because this therapy does not eliminate HIV from the body, people with HIV need to take these medications for the rest of their lives.

HIV is able to quickly adapt to medications, which makes the use of combination HAART very important. For the same reason, treatment adherence is also important. In order to be effective, at least a 95% adherence rate to the HAART regimen is required in order to prevent drug resistance (Meyerhoff, 2001; Purohit et al., 2011). Because HIV is characterized by high levels of virus production and mutation, the virus can become resistant to medication with lower levels of adherence (Clavel & Hance, 2004; Deeks, 2006). When HIV becomes resistant to one medication, it may also become resistant to other medications in the same class, even if the individual has never taken those medications (CATIE, 2009a; Clavel & Hance, 2004). As there are only a certain number of drug combinations available, acquiring resistance to a drug class can greatly reduce an individual's treatment options. Keeping the right levels of medications in the body at all times makes it more difficult for the virus to become resistant to the medication (UNAIDS, 2009).

⁵ For a more in-depth review of the literature on the effects of alcohol use on HIV disease progression, please refer to Szabo (1999).

Although high levels of adherence to HAART are essential for viral suppression and longer survival in people living with HIV (Meyerhoff, 2011), this can be a challenge for many people. Its use is not always straightforward and must be tailored to the individual's needs and circumstances (Ahdieh, 2001). Adherence can be particularly problematic for people who use substances. Their potentially chaotic lifestyles may interfere with their ability to follow prescribed regimens (NIDA, 2006). Numerous studies have shown that substance use is associated with reduced adherence to HAART, thereby facilitating HIV disease progression (Arnsten et al., 2002; Baum et al., 2009; Carrico, 2011; Chander et al., 2006; Hinkin et al., 2007; Lucas et al., 2002; Meyerhoff, 2001; New York State Department of Health AIDS Institute, 2009; Palepu et al., 2006; Petry, 1999).

Research has also shown that the effects of substance use on more rapid HIV disease progression may be explained in part by impaired access to HAART and late presentation for HIV medical care (Carrico, 2011; Chander et al., 2006; Meyerhoff, 2001; National Institute on Alcohol Abuse and Alcoholism, 2002; Palepu et al., 2006; Petry, 1999). Motivation and personal circumstances can impact both accessing HAART and adhering to HAART (Kennedy, 2003; Strathdee et al., 1998). For example, IDU (Strathdee et al., 1998) and binge drinking (Cook et al., 2001; Hicks et al., 2007) have been identified as predictors of unwillingness to start HAART and non-adherence to HAART among those who started treatment. HAART non-adherence among people who use substances has important implications for disease progression, in that medication resistant strains of HIV can develop, which can limit treatment options and potentially hasten disease progression (Carrico, 2011).

3.3 Drug Interactions

In addition to dealing with medication resistant strains of HIV, drug interactions have become an increasingly complex challenge for clinicians treating patients with HIV infection. Interactions between anti-HIV medications and substance use can impact health and the effectiveness of HIV treatment (CATIE, 2011a). According to CATIE, drug interactions can have several effects. First, one drug can slow down the breakdown of another drug in the body. This can increase the level of the drug in the body, which might improve its efficacy but could also lead to more intense side effects or toxicity. Second, a drug interaction can also have the opposite effect. Specifically, one drug can speed up the breakdown of another. In that case, the second drug's effectiveness may be diminished. If the second drug is an anti-HIV medication, this can lead to viral resistance. If the second drug is methadone, this interaction can lead to withdrawal symptoms.

Finally, interactions can also affect the likelihood of side effects. If two drugs tend to cause the same type of side effect, using them together may increase the chances that a serious side effect will occur. For example, some drugs may: increase the side effects of medications, possibly leading to toxicity; decrease the therapeutic effect of medications, possibly leading to treatment failure; decrease the effect of medications, leading to drug resistance, which can limit future options for treatment; modify the action of medications, possibly leading to unexpected

complications; and/or enhance the therapeutic effect of medications, possibly leading to over medication (CATIE, 2011a).

Therefore, when considering HIV treatment for people who use substances, it is extremely important to be aware of possible drug interactions. To this end, researchers are beginning to evaluate the potential interactions between HAART and substance use. Although this research is relatively rare (New York State Department of Health AIDS Institute, 2008), some drug interactions have been identified. For example, opioids can increase zidovudine levels; methadone can decrease the absorption of stavudine and didanosine; and the combination of ecstasy and ritonavir can be fatal (Kennedy, 2003). According to the New York State Department of Health (2009), barbituates should not be co-administered with ART medications, and GHB and methamphetamine may result in life-threatening toxicity when taken with ART medications.⁶

Much of the research in this area has focused on the potential interactions between medications used to treat substance use (e.g., methadone replacement therapy) and HAART. Clinicians need to be alert to the possibility of such interactions, as they can result in decreased effectiveness of either or both treatments, medication toxicity, or both (NIDA, 2006). For example, when methadone is administered with certain ART medications that are components of HAART, the concentration of methadone in the blood is significantly decreased, potentially compromising its effectiveness and leading to withdrawal (McCance-Katz, 2005; New York State Department of Health AIDS Institute, 2008).

Even the use of oral contraceptives can interact with HAART medications, making them less effective methods of contraception (New York State Department of Health AIDS Institute, 2010). Therefore, women taking certain kinds of HAART medications (e.g., efavirenz, nevirapine, ritonavir) should be advised to use alternate or additional forms of birth control.

4. Substance Use and Other Infections

While much of the substance use and infection literature focuses on the impact on HIV infection and transmission, substance use can also result in other infections. Specifically, the likelihood of becoming infected with the hepatitis C virus (HCV) and/or sexually transmitted infections (STIs) is greatly increased when people use substances. Acquiring either of these infections can greatly impact HIV infection risk, disease progression, and HIV transmission.

4.1 Co-infection with HCV

In addition to HIV infection, high risk substance use and sexual behaviours can increase the risk of HCV infection. HCV infection is the leading cause of liver disease (Kendall, 2011). If left

⁶ For more in-depth information about HIV drug interactions, including interactions with substance use, please see www.hiv-druginteractions.org. The Toronto General Hospital Immunodeficiency Clinic also provides several drug interaction tables, including ones for methadone, narcotics, and recreation drugs. Please see http://www.hivclinic.ca/main/drugs_interact.html for more information.

untreated, HCV becomes chronic in 50 - 85% of individuals, which can then lead to serious illness or death (Seeff, 1997). Saskatchewan has the second highest incidence of HCV cases in Canada, at double the national average (70 versus 35/10,000) (Saskatchewan Ministry of Health, 2010). The number of newly diagnosed cases of HCV is also high, with 600 to 700 new cases reported annually (Saskatchewan Ministry of Health, 2010). Co-infection of HCV and HIV is also very common. This co-infection is of particular concern, as HIV can hasten the progression of HCV disease, and co-infection can complicate or reduce the treatment options for both diseases (Canadian AIDS Society, 2005).

The primary risk factor for HCV transmission is IDU. In Canada, more than half of current HCV cases, and three out of four new cases, are related to IDU (Zou, Forrester, & Giulivi, 2003). Other transmission pathways include other methods of substance use (e.g., snorting, smoking), sexual transmission, unsafe tattooing and piercing, accidental injuries, and mother-to-child transmission (Canadian Centre on Substance Abuse; CCSA, 2005). Unlike HIV, sexual transmission of HCV is rare (Kendall, 2011). The infection risk of HCV through smoking crack, however, is increased compared to HIV. Smoking crack can lead to burns and inflammation in the mouth, which significantly increases the risk of viral transmission via sharing pipes and oral sex (Faruque et al., 1996).

Among IDU, HCV is transmitted through the sharing of needles and other equipment used for injection, which come into contact with and carry infected blood particles. Infective HCV may remain present in the blood particles found in a used needle or syringe for several days or even weeks (Canadian AIDS Society, 2005), making the transmission of HCV through injection equipment sharing very likely.⁷ Unfortunately, known HCV status has not been shown to impact needle sharing behaviours, including among new IDUs (Miller et al., 2003). As such, new IDUs are at high risk for acquiring HCV infection shortly after initiating injecting, and this risk climbs steadily according to the duration of IDU (CCSA, 2005; Miller et al., 2003). NIDA funded studies have found that within three years of beginning injecting, a majority of IDUs contract HCV (NIDA, 2006).

Both HIV and HCV are transmitted by parenteral routes (i.e., routes other than through the digestive tract), and co-infection with these viruses is common among IDUs (Haydon et al., 1998; Prithwish et al., 2007), including among IDUs in Saskatchewan. The Saskatchewan Ministry of Health (2010) reports that 70% of those diagnosed with HIV are co-infected with HCV. How HCV and HIV infection interact is not yet completely understood. It is known, however, that the course of HCV infection is accelerated in dually infected individuals, with higher rates of HCV-associated medical consequences and higher rates of progressive liver disease and death compared to those infected with HCV alone (Hershow et al., 2005; Martino et al., 2001; NIDA, 2005; 2006). This is particularly true in people who use substances who are co-infected with HIV

⁷ It is for this same reason that HCV transmission is very likely through the use of shared, infected tattooing and piercing equipment.

and HCV (Martino et al., 2001). For example, alcohol use has been identified as a co-factor associated with liver cirrhosis and HCV related mortality. In terms of the impact of HCV on HIV disease however, HCV has not been found to influence immunological decline or the clinical progression of HIV disease to AIDS (Haydon et al., 1998; Hershov et al., 2005).

Because of the improvement in survival in people living with HIV/AIDS, HCV co-infection has now become more of a concern. It is known that treatment for co-infected patients is more complex than for those singly infected with either virus. Studies indicate that people can be successfully treated for HCV when they are co-infected with HIV. However, they are more likely to have side effects, discontinue treatment, and have lower rates of virus suppression than people who are not co-infected with HIV (Canadian AIDS Society, 2005; Martino et al., 2005). The standard treatment for HCV is interferon therapy, but research has shown higher levels of toxicity when this treatment is administered along with HAART (Canadian AIDS Society, 2005). This HCV treatment can also lower CD4 cells, be harmful to the immune system, and/or change the amount of anti-HIV drugs in the blood, potentially resulting in resistance to these drugs. Due to these concerns, liver specialists and HIV doctors often prefer to treat HCV first, when a patient's CD4 cell count is well above 500 (Canadian AIDS Society, 2005).

Like HIV, HCV can be transmitted from mother to child. The Canadian AIDS Society (2005) reports that average maternal transmission rates are around 5%. Being co-infected with HIV and HCV increases the risk of mother-to-child transmission of HCV (Airoldi & Berghella, 2006; Hershov et al., 1997) but has no detectable effect on this type of transmission of HIV (Bulterys et al., 1997; Van Dyke, 2011). Unlike preventing mother-to-child transmission of HIV, no safe and effective method of preventing HCV transmission currently exists (Airoldi & Berghella, 2006). The likelihood of HCV transmission is increased with viral load, which is higher during active IDU (Thorne et al., 2011; Yen, Keefe, & Ahmed, 2003).

4.2 Co-infection with STIs

Besides increasing their risk of HIV and HCV infection, individuals who engage in high risk behaviours associated with substance use (e.g., unprotected sex) also put themselves at risk for contracting a number of STIs (e.g., syphilis, chlamydia, trichomoniasis, gonorrhoea, genital herpes) (NIDA, 2011). Research has established that STIs can facilitate HIV infection and transmission in several ways (Cohen, 1998; Go et al., 2006; Wasserheit, 1992; Witte et al., 2010). First, all STIs cause inflammation of the mucous membranes. When inflammation occurs, a large number of immune cells come to the area to fight the infection (CATIE, 2009c). Many of these immune cells are CD4 cells, which are involved in HIV transmission. When these cells are fighting off an infection, they become activated. Activated CD4 cells are more easily infected by HIV. Second, some STIs cause open lesions or sores, which impair mucosal and skin barriers against HIV infection (CATIE, 2009c; Kendall, 2011; Kennedy, 2003). The impact of STIs on HIV is also attributed to the induced immuno-suppression caused by STIs (Kennedy, 2003), which can result in increased HIV viral loads and infectiousness, particularly during acute episodes of STIs (Kendall, 2011).

Comparatively high levels of HIV have been found in people who also have STIs, particularly genital ulcer diseases like genital herpes or syphilis (Edlin et al., 1994). Strathdee et al. (2001) found that the incidence of HIV was more than double in women who had reported having an STI in the last six months. As previously mentioned, co-infection with HIV and STIs can greatly increase the likelihood of HIV transmission. Research has also found this type of co-infection is associated with an increased risk of mother-to-child transmission of HIV (European Collaborative Study, 1996). It is for all of these reasons that STIs must be identified and treated promptly in order to reduce the risks of HIV infection and HIV transmission (Kennedy, 2003).

5. Substance Use, Pregnancy, and HIV

The HIV/AIDS epidemic is increasingly affecting young women in their reproductive years (Ahdieh, 2001), making it inevitable that at least some of them will become pregnant while infected with HIV (Bessinger et al., 1998). Because ART is improving the manageability of HIV disease, there is an increased likelihood that women living with HIV will choose to become pregnant (Ahdieh, 2001; Bessinger et al., 1998). Women living with HIV/AIDS may also become pregnant through high risk sexual practices, which are more likely to occur when under the influence of substances (Tapert et al., 2001; Thorne et al., 2011).

Because many pregnancies are unplanned, and because regular substance use can cause amenorrhea, women who use substances may not know they are pregnant for several months. As a consequence, they may not attempt to enter substance use treatment programs, safely reduce substance use, or improve nutrition and sleep habits until relatively late in their pregnancies (Keegan et al., 2010; Pinkham & Malinowska-Sempruch, 2008). Therefore, substance use during pregnancy is also related to maternal health and pregnancy outcomes.

Obtaining accurate data about the prevalence of substance use during pregnancy is difficult due to the stigma, shame, and illegality of this activity (PHAC, 2009b). Saskatchewan statistics show that 5% of the women who accessed alcohol and drug services between 2008 and 2009 were pregnant (Saskatchewan Ministry of Health, 2009b). Many women who use substances are not accessing treatment, indicating that the number of pregnant women using substances is much higher. The issue of pregnancy and substance use is important to address because of the associated effects on both the mother and the unborn child, especially regarding infections that are common among women who use substances (Gyarmathy et al., 2009).

5.1 Pregnancy and HIV Risk

Both substance use and sexual HIV risk behaviours are common among pregnant women who use substances (Ramsey, Engler, & Stein, 2007). In the absence of intervention, these behaviours may continue throughout pregnancy, placing the women and their unborn children at risk of contracting HIV. The high levels of STIs found in some samples of pregnant women, especially those who use substances, indicate that sex related HIV risk behaviours are occurring during

pregnancy (Ramsey et al., 2007). In addition to serving as a potential indicator for HIV risk, STIs can increase the risk of maternal infection if exposed to HIV and can increase the potential for mother-to-child transmission (Cohen, 1998). According to CATIE (2009c), pregnant women may be at more risk for HIV infection if exposed because of increased hormones and changes to the immune system that occur during pregnancy (i.e., to protect the fetus).

For pregnant women, women contemplating pregnancy, or women having unprotected sex, knowing their HIV status can help them to prevent the spread of HIV to their fetus or newborn child. Therefore, regular HIV testing of women of childbearing age is extremely important. Frequent testing is particularly important for people who are engaged in high risk activities like substance use, as their HIV infection status may change rapidly (CATIE, 2009a).

For more detailed information about HIV/AIDS in the context of pregnancy, please refer to a previously completed literature review by the Saskatchewan Prevention Institute titled "Mother to Child Transmission of HIV: Prevention, Treatment, and Education."

5.2 Substance Use, Maternal Health, and Prenatal Care

Maternal use of substances can weaken the immune system, impact nutrition, and increase the risk of infections and viruses, thereby significantly impacting maternal health (Mehta, Moore, & Graham, 1997). Many women who use substances report a heightened desire to make healthier choices during pregnancy however, and these healthier choices can have a positive impact on maternal health and pregnancy outcomes (Terplan et al., 2010). The maternal motivation inspired by pregnancy can create an excellent opportunity for healthcare providers to offer care that can protect and enhance the health of women and their future child(ren) (Pinkham & Malinowska-Sempruch, 2008).

Despite this reported willingness to reduce substance use behaviours, many women may find it difficult or almost impossible to stop their substance use during pregnancy. Women who use substances often report using more than one substance. Therefore, it can be difficult to separate the effects of individual substances on maternal health and pregnancy outcomes (Keegan et al., 2010). Overall, it is known that substance use (particularly cocaine use) can suppress maternal appetite, contributing to poor maternal and fetal nutrition (Keegan et al., 2010). Maternal substance use has also been associated with lack of adequate obstetric care, stress, depression, physical abuse, sexual violence, and lack of support, all of which can greatly affect maternal health and pregnancy outcomes (Keegan et al., 2010, Winklbaur et al., 2008).

Along with the direct effects of substance use on maternal health, the living environment that may accompany substance use is especially problematic in pregnancy. It may lead to poor self-care, including poor nutrition and loss of sleep (Terplan et al., 2010). Women who continue to use substances during pregnancy also tend to shun available institutional supports like prenatal care (Terplan et al., 2010). This is even true for women also living with HIV (Fischer, 2000). Perceived or experienced stigma and the fear of losing custody of their children serve as

pervasive barriers to prenatal care and HIV treatment among women who use substances (Poole & Dell, 2005). These barriers can make it difficult for women to disclose they need help, meaning that they are less likely to get the help and care they require for optimal maternal and fetal health.⁸

5.3 Substance Use and Pregnancy Outcomes

Because many women who use substances may not know they are pregnant for several months, they may not engage in risk reduction strategies until relatively late in their pregnancies (Pinkham & Malinowska-Sempruch, 2008). By this time, most potential injury to the fetus has been done. As previously discussed, women who use substances are highly likely to use more than one substance, making it difficult to separate the effects of individual substances on pregnancy outcomes (Keegan et al., 2010).⁹ That being said, substance use has been associated with numerous pregnancy outcomes, including increased risk of preterm labour and delivery, intrauterine growth retardation, low birth weight, increased exposure to HIV and HCV (Fischer, 2000; New York State Department of Health AIDS Institute, 2007; PHAC, 2009b; Thorne et al., 2011), and placental abruption (New York State Department of Health AIDS Institute, 2007).

Because of the correlations between substance use and other potentially harmful health behaviours (e.g., lack of prenatal care, poor nutrition, stress, STIs), the direct effect of substance use on pregnancy outcomes is not entirely clear (Hepburn, 2004; PHAC, 2009b). Researchers have found that secondary factors like malnutrition, lack of sleep, and lack of medical and prenatal care often have more profound effects on pregnancy outcomes than substance use (Pinkham & Malinowska-Sempruch, 2008; Terplan et al., 2010). These findings suggest that the effects of substance use on pregnancy are multifactorial in nature and, together with other associated factors, may lead to an increased risk for poor pregnancy outcomes (Hepburn, 2004). Some of the pregnancy outcomes associated with substance use may also compound the risks associated with HIV infection (e.g., preterm labour and delivery, intrauterine growth restriction, placental abruption), increasing the risk of mother-to-child transmission of HIV (Kennedy, 2003).

Misunderstandings about the impact of substance use on pregnancy outcomes may also inadvertently increase the risk of negative pregnancy outcomes. Pregnancy is often a powerful motivator for women to reduce their substance use (Pinkham & Malinowska-Sempruch, 2008). As such, pregnant women who use substances may try to cease all substance use abruptly and without medical support. Abrupt and unmonitored withdrawal from the substances may then cause injury to the fetus (Pinkham & Malinowska-Sempruch, 2008), including spontaneous abortion and/or premature labour and delivery (New York State Department of Health AIDS

⁸ Many of these barriers are related to social determinants of health. For more detailed information about how these determinants of health impact MTCT of HIV, please refer to previously completed literature review by the Saskatchewan Prevention Institute titled "Mother to Child Transmission of HIV: Prevention, Treatment, and Education."

⁹ For detailed information about the effects of individual substances on pregnancy, please refer to the New York State Department of Health AIDS Institute's (2007) summary entitled "What are These Drugs?."

Institute, 2007). Due to these risks of withdrawal, along with the risks of relapse, methadone maintenance is often preferred to detoxification (New York State Department of Health AIDS Institute, 2009). The New York State Department of Health AIDS Institute (2009) states that methadone maintenance treatment is an effective therapy for opioid dependency during pregnancy, and does not adversely affect fetal or postnatal development.

6. Substance Use and Mother-to-Child Transmission of HIV

The research highlighted in the previous sections shows that substance use does occur during pregnancy and is associated with poorer HIV disease outcomes and greater likelihood of HIV transmission. This is also true of the impact of substance use on mother-to-child transmission (MTCT) of HIV. Pregnant women living with HIV have approximately a 25% chance of transmitting HIV to their fetus and/or newborn in the absence of preventative measures and HIV treatment (Boucher, 2001; Margolese, 2009; SOGC, 2004; Walmsley, 2003). Of the ten cases of MTCT identified in Saskatchewan between 2001 and 2010, all ten of the women did not receive HIV treatment during pregnancy or delivery (Saskatchewan Ministry of Health, 2011). Because of increases in knowledge about MTCT, women receiving proper care (e.g., the use of HAART, elective caesarean sections, formula feeding) have been found to have MTCT rates that are less than 1% to 2% (Boucher, 2001; Coovadia, 2004; Thorne & Newell, 2003; Walmsley, 2003).

In the post-HAART era, the principal determinants of the MTCT risk are maternal viral load and use of ART during pregnancy (Van Dyke, 2011). Maternal factors like advanced stage of disease and decreased CD4 cell count have also been linked to increased chances of MTCT (Boyer et al., 1994; Katz, 2003; Krist & Crawford-Faucher, 2002). Previously discussed research has shown that substance use has the potential to negatively affect these factors in non-pregnant populations. Because substance use also has the potential to increase MTCT (Bulterys et al., 1997; Landesman et al., 1996; Mehta et al., 1997), it is important to elucidate the role of substance use in MTCT.

6.1 Factors that Increase MTCT Risk

Because HIV infection is so strongly associated with substance use among women, infants born to women living with HIV are often exposed to the consequences of both conditions (Rodriguez et al., 1996). As already discussed, maternal substance use is associated with preterm labour and delivery, increased HIV viral replication and maternal viral load, increased risk of placental damage (Rodriguez et al., 1996), and increased risk of fetal damage (Purohit et al., 2011).¹⁰ Each of these consequences is also related to an increased risk of MTCT. Stigma and discrimination have been identified as significant barriers to MTCT risk reduction.

6.1.1 Preterm Birth

¹⁰ Please refer to Purohit et al. (2011) for a more in-depth and scientific discussion of the potential mechanisms by which substance use may increase MTCT of HIV. A diagrammed summary of the influence of substance use on MTCT, as presented by these authors, can be found in Appendix A.

Research has shown that preterm birth (i.e., delivery at less than 33 weeks) is a risk factor for MTCT of HIV (Townsend et al., 2008; Warszawski et al., 2008). While the role of substance use was not examined in these studies, several other studies have shown that substance use can induce preterm birth in pregnant women (Rodriguez et al., 1996; Van Dyke, 2011). Specifically, both prenatal cocaine exposure (Bada et al., 2005) and methamphetamine exposure (Winslow, Voorhees, & Pehl, 2007) have been associated with increased risk of preterm births. Bulterys et al. (1997) found that combined cocaine and heroin IDU accounted for the majority of the association between preterm birth and MTCT of HIV in their study.

Importantly, for pregnant women living with HIV, recent research also suggests that the use of HAART during pregnancy may increase the risk of preterm birth (Haeri et al., 2009). Purohit et al. (2011) suggest that the increased risk of preterm birth associated with HAART may actually be due to the fact that preterm birth reduces the duration of HAART, reducing its efficacy, and thereby leading to an increase in MTCT of HIV.

6.1.2 Maternal Viral Load and Adherence to HAART

Although maternal viral load can be affected by factors other than HAART adherence, adherence directly affects viral load. Purohit et al. (2011) suggest that substance use may increase viral load partially through promoting non-adherence to HAART, which then impairs the efficacy of HAART. Numerous researchers have also identified a link between substance use and significantly less adherence to HAART (Carrico, 2011; Hicks et al., 2007; Van Dyke, 2011).

Non-adherence to HAART can also be caused by its side effects, which can include nausea, vomiting, headaches, and skin rashes (Mellins et al., 2008). Most of these side effects improve over time or can be managed through a change in diet or the use of additional medications (CATIE, 2009a). Although these side effects can usually be managed, they can sometimes cause low adherence to HIV treatment (Mehta et al., 1997). This may be especially true in pregnant women who may already be experiencing some of these effects from pregnancy (e.g., nausea and vomiting). For pregnant women living with HIV, non-adherence to HAART can result in damage to their own health and increased potential for MTCT of HIV (Mellins et al., 2008).

Substance use has also been associated with increased viral loads in men and non-pregnant women, despite HAART therapy. Therefore, it is likely that similar outcomes can occur during pregnancy, leading to an increased risk of MTCT (Purohit et al., 2011). Studies have indeed shown that higher maternal viral load is a significant risk factor for MTCT of HIV (Tornatore et al., 2010; Townsend et al., 2008; Warszawski et al., 2008). In addition to the effects of non-adherence to HAART, viral load may be increased in women who use substances due to a higher likelihood of viral replication (Bulterys et al., 1997; Mellins et al., 2008; Purohit et al., 2011; Rodriguez et al., 1996; Wang & Ho, 2011). The enhancing

effects of substance use on HIV replication may also diminish the effectiveness of HAART (Arnesten et al., 2002; Chander et al., 2006). Therefore, it is extremely important that researchers continue to examine the impacts of substance use on MTCT and on the efficacy of treatment regimens currently used for pregnant women.

6.1.3 Placental Injury

Research has suggested that another possible mechanism for the effects of substance use on MTCT risk is through damage caused to the placenta (Purohit et al., 2011), particularly by the use of cocaine (Bauer et al., 2002; Wang & Ho, 2011). Specifically, Bauer et al. found that cocaine exposure during pregnancy is associated with higher incidence of placental abruption. Purohit et al.'s review of the literature found that cocaine use during pregnancy is also associated with placental inflammation, which may promote HIV replication and HIV transmission through the injured placenta. Alcohol use has also been associated with placental dysfunction, decreased placental size, impaired blood flow and nutrient transport, and increase rates of placental abruption (Burd et al., 2007).

Substances taken by a pregnant woman reach the fetus primarily by crossing the placenta, the same route taken by oxygen and nutrients (Wang & Ho, 2011). If the integrity of the placenta is damaged, this can directly affect the developing fetal immune system, resulting in heightened susceptibility to HIV infection during labour and delivery (Bulterys et al., 1997). Recent research has also suggested that substance use may even increase the permeability of the placenta, thereby increasing the risk of intrauterine transmission of HIV (Wang & Ho, 2011).

6.1.4 Fetal Damage

Related to the impact of substance use on the placenta, researchers have indicated that fetal exposure to maternal substance use may create a fetal environment that enhances susceptibility of fetal cells to infection if exposed to HIV, either in utero or intrapartum (Bulterys et al., 1997; Rodriguez et al., 1996). Maternal substance use may exacerbate fetal immunity defects and decrease immune functioning, facilitating HIV infection of fetal immune cells and promoting MTCT (Li et al., 2003; Wang and Ho, 2011).

6.1.5 Stigma and Discrimination

Stigma against HIV is reported to be the main reason for reluctance to be tested, to disclose HIV status, and to participate in ART (Obermeyer & Osborn, 2007). These authors suggest that fear of potential judgements and internalized stigma may be especially experienced by women who use substances. The stigma associated with substance use is felt even more intensely by pregnant women living with HIV/AIDS (New York State Department of Health AIDS Institute, 2009).

The stigma associated with a pregnant woman who uses substances can force pregnant women into riskier practices such as injecting alone, concealing their pregnancy, and

engaging in the most marginal, high risk forms of sex work (Pinkham & Malinowska-Sempruch, 2008; Terplan et al., 2010). Fear of discrimination and/or being “caught” by the police heightens women’s evasion techniques, including rushed injections, short-cuts in needle hygiene, injecting in hidden (and potentially more dangerous) locations, and sharing substance use equipment (Rhodes et al., 2012). Many women who use substances may conceal their substance use behaviour from healthcare workers, resulting in little likelihood of substance use treatment and care (El-Bassel et al., 2010).

Other women may avoid prenatal care and HIV treatment because of stigmatization, fear of losing custody of their child(ren), or fear of prosecution. Women may be fearful, suspicious, and distrustful of the healthcare system and treatment programs, thereby keeping them from seeking much needed services (New York State Department of Health AIDS Institute, 2009) and from learning about the prevention of MTCT of HIV (El-Bassel et al., 2010).

6.2 Factors that Reduce Transmission Risk

For the purposes of the current review, one of the most important ways to reduce MTCT of HIV is for women to increase behaviours that support a healthy immune system, including decreasing substance use (Positive Women’s Network Society, 2001). Receiving both HIV treatment and substance use treatment is a vital step toward reducing MTCT risk.

6.2.1 HIV Treatment

In countries with widespread access to ART, MTCT of HIV during pregnancy, delivery, and during the postpartum period has been significantly reduced. Even with easy access, however, adherence to ART can be difficult, particularly if women are also dealing with substance use issues. In Saskatchewan, female IDUs are at a high risk for HIV infection. Aggleton, Jenkins, and Malcolm (2005) suggest that “the twin stigmas of drug dependence and injecting, often in association with sex work, can make female IDUs one of the hardest to reach populations” (p. 26). Successful interventions that have been used to reduce the risk of HIV infection and/or transmission in this population include needle exchange programs, various forms of outreach, voluntary counselling and testing, peer-led education, treatment programs, and methadone therapy. Aggleton et al. suggest that IDUs need information on how to prevent transmission of HIV, the means to prevent this transmission (e.g., sterile needles, condoms), a supportive peer environment, and access to health and social services.

In women who are already infected with HIV, outreach programs can be especially effective at establishing links with the necessary services (e.g., drug treatment, HIV counselling and treatment, medical care, social services) (Aggleton et al., 2005; Spielberg et al., 2003). The Center for Disease Control (1988) states that outreach programs are particularly effective in reaching IDUs who have never been in contact with mainstream services and in reducing their HIV risk behaviours. When pregnant women living with HIV

use substances, their medical care must address the management of substance use, the pregnancy itself, and their HIV disease (as well as potential co-infections with HCV) simultaneously (Kennedy, 2003). As this requires specialized medical care, it is extremely important for pregnant women to find a knowledgeable doctor they trust and see him or her regularly (Margoese, 2009).

Kennedy (2003) states that the underlying goal of care and treatment is to help a mother reach optimal physical and psychological health, and to deliver an uninfected baby. Bunting and Seaton (1999) found that many pregnant women with HIV are intensely motivated by concerns about their present and future children's welfare. These authors suggest that healthcare providers and educators should consider this factor when designing education and treatment programs.

6.2.2 Substance Use Treatment

There is increasing recognition that an infant's best interests are served by optimal treatment of the pregnant woman (Ahdieh, 2001; Kennedy, 2003). In substance-using pregnant women living with HIV, optimal treatment must include substance use treatment. Even in non-pregnant women, substance use treatment has been identified as an effective way to stop or reduce substance use and related risk behaviours, resulting in a decreased risk of HIV transmission (NIDA, 2011; NIDA, 2006). Because substance use behaviours are related to an elevated risk of MTCT of HIV, it is likely that reducing these behaviours through substance use treatment will also lead to a reduction in MTCT risk.

Research has shown that while active substance use is associated with decreased adherence to HAART, substance use treatment is associated with improved adherence levels (i.e., adherence levels similar to those who had never used substances) (Hicks et al., 2007). Strathdee et al. (1998) found that people enrolled in substance use treatment programs were more likely to receive ART than those not in treatment. These findings highlight the importance of substance use treatment for preventing MTCT of HIV, since participation in and adherence to ART is one of the main factors for decreasing MTCT risk.

Methadone remains the standard opioid substitution therapy, with proven medical and social benefits due to the stabilization of substance use and lifestyle, as well as increased contact with applicable services (Hepburn, 2004). Women taking methadone also demonstrate better compliance with prenatal care, resulting in improved newborn health outcomes (Keegan et al., 2010) and improved adherence to HIV care (Wood et al., 2008). Overall, the benefits of methadone serve to reduce the risk of MTCT in women who use opioids. Although abstinence throughout the course of the pregnancy may appear ideal, over-emphasis on achieving abstinence can be counterproductive, resulting in relapse and discouraging mothers from continuing and/or seeking help (Winklbaur et al., 2008). Because opioid withdrawal during pregnancy can be dangerous unless done under close

medical supervision, researchers suggest that stabilization of substance use is more important than abstinence (Hepburn, 2004; Keegan et al., 2010).

Researchers have stated that substance use treatment should be considered primary HIV prevention, due to the fact that substance use treatment often leads to a reduction in HIV risk behaviours (Chaudry et al., 2011; National Institute on Alcohol Abuse and Alcoholism, 2002). Primary prevention of HIV infection in women of childbearing age is obviously the most effective way to prevent MTCT of HIV (Vogler, 2006). For those already infected with HIV, however, substance use treatment is still linked to risk reduction behaviours. This indicates that substance use treatment should also be considered an HIV transmission prevention strategy. As highlighted above, substance use treatment can indeed serve to reduce the risk of MTCT of HIV.

For pregnant women who use substances, a lack of access to appropriate substance use treatment programs is a central barrier to reducing the risk of MTCT of HIV (Wood & Tobias, 2005). Medical substance abuse treatment programs are necessary, and sorely lacking, for pregnant women who are HIV positive and using substances. For women who have other children to care for, attending treatment programs can be impossible if the programs do not allow the women to have their children with them. Lack of childcare while in treatment has been identified as a significant barrier to participating in substance use treatment programs (Wood & Tobias, 2005). In order to insure the best possible pregnancy outcomes for women living with HIV, and in order to reduce the risk of MTCT, access to appropriate substance use treatment programs is needed.

7. Conclusions

HIV infection and transmission are the outcome of multiple contributing factors interacting together (Rhodes et al., 2012). The present review has shown that substance use impairs judgement and decision-making. This leaves people more prone to engage in HIV risk behaviours, including high risk substance use and sexual behaviours. Substance use also adversely affects health, and may therefore increase the risk of HIV infection if exposed and exacerbate disease progression in those already infected with HIV. Due to its effects on pregnant women (e.g., increasing maternal viral load, causing injury to the placenta, and inducing preterm birth), substance use also has the potential to increase mother-to-child transmission of HIV, even in the presence of HAART. The impact of substance use treatment on HIV infection and transmission risk behaviours provides evidence for the idea of substance use treatment as HIV infection and transmission prevention. Therefore, in order to reduce the likelihood of HIV transmission from mother to child, it is important to explore the availability of substance use treatment programs for pregnant women living with HIV/AIDS.

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Appendix A. Diagram of the influence of substance use on mother-to-child transmission of HIV.

The following figure was obtained from Dr. Vishnudutt Purohit (see Purohit et al., 2011), with copyright clearance from Elsevier.

