saskatchewan
preventioninstitute
our goal is healthy children

Human Immunodeficiency Virus (HIV) and Pediatric Treatment and Care in Saskatchewan

Prepared for the Saskatchewan Prevention Institute

August 2011

Human Immunodeficiency Virus (HIV) and Pediatric Treatment and Care in Saskatchewan

A report prepared for the Saskatchewan Prevention Institute
August 2011

Table of Contents

1. Introduction

Human Immunodeficiency Virus (HIV) is a virus that causes a deficiency in the **immune system** by infecting a key component of this system, the **CD4+ T-lymphocytes** which are a type of **white blood cell** (Joint United Nations Programme on HIV/AIDS, 2008; Positive Women's Network Society, 2001). When HIV enters these cells, it impairs or destroys them, resulting in a deterioration of the immune system to the extent that it is no longer able to fight off infections and diseases. An individual who has been diagnosed with HIV is said to have **AIDS (Acquired Immunodeficiency Syndrome)** when they have a CD4+ T-lymphocyte count of less than 200 (the lower limit of a healthy range is 500), and have contracted one or more **opportunistic infections**. Opportunistic infections refer to infections to which individuals with healthy immune systems are not susceptible but those with lowered immune systems are (Joint United Nations Programme on HIV/AIDS, 2008). AIDS is considered a syndrome, or group of signs, symptoms, illnesses and infections, that are related to the damage done to the immune system due to infection with HIV (Joint United Nations Programme on HIV/AIDS, 2008).

HIV is transmitted through the direct exchange of specific bodily fluids (blood, semen and precum, vaginal fluid, anal fluid and/or breast milk) between two humans (Positive Women's Network Society, 2001). Transmission can occur behaviourally or perinatally (Gaughan et al., 2004). **Behavioural transmission** can occur through unprotected vaginal or anal sexual intercourse, sharing needles and other drug equipment, or tattooing with used needles (Positive Women's Network Society, 2001). **Perinatal transmission** or **mother-to-child transmission (MTCT)**[1] occurs when a mother living with HIV passes HIV to her baby through pregnancy (i.e., in utero), during labour and childbirth, or through breastfeeding. Most infants and children living with HIV have been infected perinatally (Hansell & Hughes, 1999); however, there is a small population infected by other means. Some examples include sexual abuse, accidental needle stick injuries, accidental transmission from parent to child (e.g., through provision of first aid or through pre-mastication of food) (Center for Disease Control and Prevention (CDC), 2011), and blood transfusions (Miller, Grant, Almeida, Sharma, & Lipshultz, 2008). In Canada, donor blood and plasma have been screened for HIV since 1985 (Krever, 1997), therefore contaminated blood transfusions would primarily affect immigrants to Canada whose countries do not have accurate and widespread screening for HIV in donor blood.

In this report, the focus is on the needs of children who have contracted HIV from MTCT rather than behavioural transmission. Care and treatment needs are likely to be similar between individuals infected through MTCT and behaviourally infected individuals; however, behaviours, **adherence** rates and outcomes may be different due to lifestyle, upbringing and age of infection (Gaughan, et al., 2004). This literature review seeks to address the need for this information by providing an overview of the diagnosis, treatment, care, and support needs of infants through early childhood (birth to age 6). Although the research on HIV is not Saskatchewan-specific, the information provided in this report is focused specifically on the Saskatchewan population, and the recommendations for treatment and care are based on the guidelines used in Saskatchewan health regions. The audience for this report is wide, including health professionals, caregivers, and other adults who may come into contact with children infected with HIV.

[1] This type of transmission is also referred to as vertical transmission (World Health Organization, 2001). For the purposes of the current document, the term MTCT will be used.

2. HIV in Saskatchewan

Although rates of HIV infection have been decreasing across Canada, the opposite trend is occurring in Saskatchewan. The incidence of HIV infection has been increasing in Saskatchewan, with 197 new infections in 2009 compared to 40 in 2003 (Saskatchewan Ministry of Health, 2010). Research has shown that proper and timely **prevention of mother-to-child transmission (PMTCT)** and increased screening for HIV during the **prenatal period** has helped to decrease the rates of MTCT to less than 2% in non-breastfed babies. However, if treatment is not accessed, the transmission risk increases to 15-30% (Cooper et al., 2002).

The increasing use of effective treatments is reflected in the declining rates of MTCT in Canada. From 2000 to 2008, MTCT rates decreased in Canada from 9.3% to 1.7%. In Saskatchewan however, between 2005 and 2009, the MTCT rate was 7.4% (Skinner, 2011). Some reasons for this may be that many women in Saskatchewan do not have access to **antiretroviral treatments (ART)** and those with access may be unable to adhere to the treatment regimen. As well, one of the highest growing populations living with HIV in Saskatchewan since 2000 is women of child-bearing age (15-29 years), often surpassing new cases of males living with HIV (Saskatchewan Ministry of Health, 2010; Skinner, 2011). Many of these women are highly vulnerable and facing difficult life circumstances that may decrease access to testing and treatment. Consequently, many women in Saskatchewan may be unaware of their HIV-positive status, and this may lead to increased MTCT rates. From 2005 to 2008, there were 28 cases of MTCT reported in Canada; 6 of these were in Saskatchewan (Public Health Agency of Canada, 2009). As such, there is an urgent need in Saskatchewan to address the following issues: HIV screening for women, MTCT of HIV, screening of exposed infants, treatment of exposed infants, and care and support of infants/children diagnosed with HIV.

One area that needs to be paid special attention is the treatment, care, and support needed by children living with HIV throughout their lifespan. With increasing advances in the treatment of HIV, the life expectancy of this population is much higher and many children who have been infected through MTCT are surviving into adolescence and adulthood (American Academy of Pediatrics, American Academy of Family Physicians, American College of Physicians, & American Society of Internal Medicine, 2002).

The pathogenesis (development) of HIV infection and the principles governing the use of ART are similar in all individuals living with HIV; however, there are also many infant- and child-specific differences that necessitate research, education and understanding, such as:

- understanding of perinatal exposure to HIV, MTCT and prevention of MTCT;
- differing needs for diagnosis in infants and young children, such as **virological testing** for children younger than 18 months;
- in utero exposure to antiretroviral drugs and how this exposure affects later treatment options;
- age-specific differences in CD4+ T-lymphocyte counts and consequently, differences in immunological staging for young children;

- changes in drug metabolism and tolerance with age as the organ systems continue to develop;
- differences in clinical and virological manifestations of secondary conditions (e.g., opportunistic infections and effects of ART use) between infants, children and adults;
- special considerations associated with adherence to ART for infants and children, as they rely on a caregiver for their medication and care (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

3. Identification of Infants and Children Living with HIV

3.1 Need for Early Identification

Diagnosis, treatment and care of HIV-positive infants and children must begin with identification of those who are at risk for HIV infection. All at-risk infants and children should be tested, with parental consent. However, diagnosis of these infants and children can be difficult because of the availability and accessibility of PMTCT services and/or testing programs.

Early identification of women living with HIV and thus infants exposed to HIV is crucial for promoting prevention and desirable treatment outcomes for women and infants infected with HIV. Prenatal identification of women living with HIV enables:

- women living with HIV to receive appropriate ART, prevent opportunistic infections, and receive proper prenatal care;
- proper ART during pregnancy, labour and to the newborn to reduce the risk of MTCT of HIV;
- counselling of women living with HIV about the best treatment options for themselves and their children to reduce MTCT;
- counselling of women living with HIV about the risks of HIV transmission through breastfeeding;
- counselling of women living with HIV to help them adjust to their positive status, and to refer them to support services available in the area;
- initiation of prophylaxis against certain opportunistic infections in infants exposed to HIV with unknown or confirmed HIV status beginning at age 4 to 6 weeks;
- improved treatment outcomes through the early initiation of ART in infants living with HIV;
- counselling about the need to protect others from HIV transmission (e.g., safe sex practices) (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

Early identification is also important for infants exposed to HIV, as certain prophylactic (preventative) options are time sensitive (e.g., zidovudine must be administered to the infant within 12 hours of birth to be effective in reducing transmission). This is true of both PMTCT strategies for the mother (e.g., ART during pregnancy), as well as for the infant after birth (e.g., zidovudine).

3.2 Identification of Women living with HIV and Infants and Children Exposed to or Living with HIV

The easiest way to identify high-risk infants is through prenatal testing of pregnant women. Testing should be done early in the pregnancy, if possible at the first prenatal visit. If the mother

is HIV-negative but involved in high risk activities (see below), testing should be repeated. Pregnant women should be tested in each trimester and tested twice in the third trimester (including a rapid test during labour) if they meet any of the following criteria:

- receives healthcare in an area with elevated incidence of HIV or AIDS among women 15-45 years of age;
- receives healthcare at a facility that identifies at least 1 pregnant woman living with HIV per 1,000 women screened;
- injection drug users or partners of injection drug users;
- exchanges sex for money or drugs;
- is a sex partner of person living with HIV;
- had a new, or more than 1, sex partner during this pregnancy;
- a diagnosis of a new sexually transmitted infection during pregnancy;
- has signs or symptoms of acute HIV infection (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

If a mother is living with HIV, appropriate PMTCT strategies should be taken (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

If a woman is in labour and has not been tested, or if she is deemed to be high risk for HIV, a rapid test kit should be used to ascertain her HIV status. Rapid tests will provide results regarding the woman's HIV status within minutes to a few hours. A positive HIV test result should be followed by a confirmatory test. The initiation of ART for PMTCT is recommended while awaiting confirmatory testing after a positive rapid HIV test (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

If a woman is at high risk of HIV infection and does not receive testing prior to or during labour, she should be offered rapid testing immediately after birth, and her newborn should be tested using rapid HIV **antibody** testing, with the consent of the mother [2] (with confirmatory tests to confirm a positive result). The test on the newborn is not diagnostic of infection, but merely indicates HIV exposure. Further testing of an infant exposed to HIV will be necessary to confirm an HIV-positive or negative diagnosis. If the baby is found to be HIV-exposed, PMTCT treatment should be initiated immediately. Preventative measures, such as administration of zidovudine (AZT), can still be effective even after the baby is born, and therefore should be administered if the mother living with HIV. If the rapid test on the newborn is negative, the antiretroviral prophylaxis (e.g., AZT) can be discontinued (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

[2] In Saskatchewan, there are instances in which an infant or child can be tested without parental consent. For instance, if a medical professional considers the HIV testing and/or treatment to be essential, a protection order can be sought from the court. This issue will be discussed further in section 5.2 Parental Involvement in Diagnosis.

There are also various other potential scenarios that indicate testing of the infant or child should occur, including:

- if the mother's HIV status is not known until much after the birth, even if the child has no symptoms (i.e., when the child is older);
- if any other family member is found to have HIV, even if the child has no symptoms;
- if the infant has been exposed to breast milk of a mother subsequently diagnosed to be HIV-positive, even if the infant had previously tested negative to HIV;
- if the mother's HIV status is unknown or is not possible to ascertain (e.g., biological mother is not present or has passed away), and the child is presenting with symptoms of an opportunistic infection (DeGennaro & Zeitz, 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

It may also be important for children who have immigrated to Saskatchewan from countries in which HIV is endemic to be tested for HIV. Saskatchewan's immigrant population is increasing (Sask Trends Monitor, 2007). From 2000 to 2009, there were 26 cases of HIV in Saskatchewan that began in an HIV endemic country (Saskatchewan Ministry of Health, 2010). Although the age of those living with HIV was not reported in this document, it highlights the potential importance of HIV testing for this population.

In infants or children, identification usually occurs because of knowledge regarding the mother's HIV status, or because of testing due to high-risk activities of the mother. However, children may also present with indicator conditions of HIV (for more information, see section 6.5: Opportunistic Infections). In many cases of MTCT, these conditions will occur in infancy if appropriate therapy is not initiated. These children are called **'early progressors'**, as their HIV progresses to AIDS and death early in life (before 12 months of age). However, some children are **'late progressors'**, meaning that the onset of their progression to AIDS takes place later in life, around the age of six (The European Collaborative Study, 2001). These children may have no symptoms of HIV until this time. In these cases, if the mother is not identified as HIV-positive, and the child is not identified at birth, it can be difficult to identify their HIV status until they come in for medical help with an opportunistic infection (The European Collaborative Study, 2001).

Early identification and diagnosis of infants living with HIV can improve treatment outcomes as CD4+ counts are able to remain high and **viral loads** low. Delaying testing until infants develop symptoms or get older to test using standard methods is not ideal because children will already be experiencing the effects of a decreased immune system, and ART may be less effective in slowing the progression of the disease. Therefore, identification of at-risk children should begin prenatally, if possible. If prenatal identification has been missed, then at-risk children should be identified and tested as soon as possible, even if they show no signs of illness.

3.3 Barriers to Early Identification

Identification of infants and children at-risk for HIV infection can be difficult, but testing for all at-risk children is recommended. Ideally, at-risk children would be identified before birth (e.g., the high-risk mother would be tested for HIV before or during pregnancy), but there are many barriers to early identification.

Firstly, many women do not or cannot access PMTCT services and/or HIV testing programs. As well, mothers may not be able to access standard prenatal and postnatal services, which may preclude early identification of HIV and may contribute to a lack of education surrounding proper prenatal care, healthy pregnancy, and PMTCT. Common barriers to the proper use of and access to HIV healthcare services include:

- lack of social support;
- difficulty accessing ART and other treatment;
- lack of child care during appointments;
- mistrust of health professionals;
- difficulty accessing information about HIV and pregnancy;
- low patient self-efficacy;
- isolation from services (e.g., geographical);
- alcohol and substance use;
- worry about disclosure of HIV status to others;
- fear of stigma and discrimination;
- difficulty accessing testing (e.g., transportation);
- difficulty accessing the health care system;
- difficulty attending multiple health care appointments (Bunting & Seaton, 1999; Leenerts, 1998; Mill et al., 2007; Wood & Tobias, 2005).

Secondly, although disclosure of one's HIV status to health professionals is strongly encouraged, it is not mandatory. Additionally, some women may be unaware of their HIV status. As a result, health care professionals may become aware of the HIV status only at the time of labour if/when the woman is tested. This can result in certain preventative and treatment options not being possible (Kellerman & Essajee, 2010).

4. Prevention of Mother-to-Child Transmission of HIV

4.1 Prenatal Prevention

If a woman's HIV status is discovered before pregnancy, steps can be taken to reduce the risk of transmission to the baby. These steps are dependent on whether the mother needs ART for her own health, or if her HIV is stable and ART is being used solely for PMTCT. Research on the use of ART medications in pediatric populations has been limited. Some of these medications may have adverse effects on infants, prenatally and postnatally; however, these effects are still being researched. Some of the potential effects of ARTs include prematurity, neural tube defects, low

birth weight, pre-eclampsia and gestational diabetes mellitus (Thorne & Newell, 2005, 2007). Because of the potential for HIV transmission prevention in infants using ART, and the risk of rapid HIV progression in infants not using ART, the current known benefits of HIV treatment and prevention efforts outweigh the potential adverse effects. It is important for physicians and other healthcare providers to remain informed about current research and best practices for PMTCT and pediatric HIV treatment.

For women who are already on ART for their own health needs and are planning to become pregnant, ART should be continued during pregnancy, labour, and delivery. This therapy regimen would ideally have minimal **teratogenic effects** on the developing fetus, and should avoid efavirenz in the first trimester, which has been associated with adverse effects (Panel on Treatment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission, 2010). Further information is needed regarding the risks of toxicity of exposure to ART drugs for the infant.

For women living with HIV who do not need ART for their own health, ART prophylaxis for PMTCT is recommended. This preventative treatment should involve a three drug combination regimen (also known as **Highly Active Antiretroviral Therapy (HAART)**). This treatment should be started from as early as 14 weeks or as soon as possible during pregnancy, labour and delivery or after birth (within 12 hours of birth) for maximum effectiveness. For more information on specific treatments available and recommended for PMTCT and ART, contact the appropriate Saskatchewan health region, or see the available guidelines used in Saskatchewan from the Panel on Treatment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission (2010), *Recommendations for use of antiretroviral drugs in pregnant HIV-1-infected women for maternal health and interventions to reduce perinatal HIV transmission in the United States*.

HIV-1 infection is established in most infants infected through MTCT by 1 to 2 weeks of age. As such, the initiation of postnatal prophylaxis after 2 days of age is less likely to be effective in PMTCT (King, 2004) and treatment of HIV should be considered.

Further research is needed on the best regimens for both maternal and infant health. AZT given prenatally, at delivery and postnatally has reduced MTCT by 67%, with transmission reduced to less than 2% with more effective perinatal and postnatal combination ART (Wade et al., 2004). However, AZT is also associated with **anemia** (Mofenson & Munderi, 2002), and some studies suggest that combination ART during pregnancy increases the risk of preterm birth and other adverse pregnancy outcomes, although there is some conflicting evidence (King, 2004).

4.2 Postnatal Prevention

When a mother's HIV status is determined at the time of labour and delivery, and consequently the woman has not received any ART throughout her pregnancy, there are still several options

for the prevention of transmission of HIV (King, 2004). However, only certain options are indicated by the guidelines used in Saskatchewan health regions. Because each health region may have slightly different protocols concerning the care and treatment of women living with HIV and their children, it is necessary to check with the appropriate health region before administering any care or treatment. That being said, Saskatchewan follows the guidelines put forth by the Panel on Antiretroviral Therapy and Medical Management of HIV from United States National Institute of Health in 2011, the *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV-1 Infection*. These guidelines are based on the available literature and the recommendations are made based on the strength of the findings of academic research. The information and resulting guidelines were used to create the guidelines used by the Saskatoon and Regina-Qu'Appelle health regions as well as the Saskatchewan-specific information for this section.

When the woman is known to be living with HIV, she should be given intravenous AZT at the onset of active labour, the rupture of membranes, or prior to a C-section. A vaginal delivery is preferred unless otherwise indicated (obstetrically or by HIV indicators such as high viral load). As well, invasive monitoring and trauma to the infant should be avoided (e.g., internal fetal scalp electrodes, fetal scalp sampling, intrauterine pressure catheters, or assisted delivery with vacuum/forceps).

For infants born to women living with HIV, there are also treatment indications for the infant to promote prevention of HIV transmission. These treatments are dependent in part on the gestational age of the infant at birth (e.g., born at > 35 weeks gestation, preterm infants of 30-34 weeks gestation, and preterm infants of <30 weeks gestation). In all cases, oral AZT should be given if possible (4 mg/kg/dose every 12 hours if >35 weeks gestation and 2 mg/kg/dose every 12 hours if infant <35 weeks gestation); however, intravenous medication (1.5 mg/kg/dose) may be given if the infant cannot tolerate oral medications. As well, if the mother has received AZT during labour, the infant should begin treatment within 6 to 12 hours of birth. If she has not received AZT during labour, AZT treatment should begin immediately.

AZT medications should be given for a total of six weeks, regardless of gestational age. For infants born at greater than 35 weeks gestation, or full term infants, AZT should be administered orally twice daily for six weeks. For preterm infants of 30-34 weeks gestation, AZT should be administered every 12 hours for the first 2 weeks, then every 8 hours for the last four weeks. For preterm infants <30 weeks gestation, AZT should be given every 12 hours for the first 4 weeks, and then every 8 hours for the last 2 weeks. Intravenous medications should be given only until the infant can tolerate oral feeding, with doses administered every six hours after the initial dose.

In Saskatchewan, AZT is recommended as the only ART until the infant is 6 weeks of age. However, nevirapine is indicated if the mother did not receive any ART during her pregnancy or in labour, or she received ART during this time but has a high viral load (>1000 copies/mL) prior

to delivery. Nevirapine should only be administered at the request of an infectious disease specialist.

5. HIV Diagnosis of Infants & Children

5.1 Complications of Infant Diagnosis

A diagnosis of HIV is complicated in young children. Most infants who are born to mothers living with HIV will test positive for HIV at birth using standard testing. Many of these are false positives though, which occur because standard (antibody) testing for HIV detects the presence of **IgG antibodies,** and infants born to HIV-positive mothers receive these antibodies from their mother through placental transfer (Center for Disease Control and Prevention (CDC), 1994). Only 15-30% of those that test positive are actually infected with HIV (Leelanukrom & Pancharoen, 2007). As such, the means of diagnosis for infants differs from that of older children and adults.

Access to appropriate facilities for the testing of infants poses a complication for infant diagnosis of HIV. Because infants under 18 months of age cannot be tested using standard tests (testing for the presence of antibodies), they require virological assays (Leelanukrom & Pancharoen, 2007). Saskatchewan uses the **Polymerase Chain Reaction (PCR)** test for infants, which detects the genetic material of HIV rather than the antibodies to the virus (Avert, 2011a).[3] Some centers may not offer testing because they do not have the necessary equipment, and/or the cost of this testing may be limiting (Kellerman & Essajee, 2010). However, because of the possibility of rapid progression of HIV to AIDS in infants and young children infected through MTCT (Penazzato, Donà, Wool, Rampon, & Giaquinto, 2010), steps must be taken to diagnose children as early as possible to allow for the timely initiation of treatment and support as needed.

There is a 30% to 45% chance that a baby can be infected with HIV through breast milk (in the absence of other PMTCT strategies), depending on the length of the breastfeeding period (McKeegan, Rutstein, & Lowenthal, 2011; Muralidhar & Nair, 2010). Breastfeeding can also complicate testing results. Because HIV can be transmitted through breast milk, infants who test negative initially can become infected later if they are exposed to breast milk. This necessitates additional testing for infants exposed to breast milk, which can be further complicated due to barriers of primary testing (e.g., transportation and service availability). As well, if counselling about the risks of breastfeeding does not take place, parents may not realize the potential for postnatal infection via breast milk, and therefore, may not seek follow up. This seriously decreases the effectiveness of therapy, as early initiation of ART is essential for reducing infant mortality and slowing the progression of HIV to AIDS (Violari et al., 2008).

[3] For more information on Saskatchewan-specific testing, treatment and care, contact the Positive Living Program in Saskatoon (306-655-1783).

Because of the risks of transmission, all women living with HIV are advised not to breastfeed; they should be counselled on the risk of breastfeeding, encouraged to formula feed, and given information about formula feeding. Several provinces in Canada provide formula for mothers living with HIV; however, Saskatchewan does not currently follow this practice.

As well, women who are at high risk of contracting HIV infection and choose to breastfeed should be tested frequently. Testing and appropriate follow-up measures may help to prevent transmission to the infant through breast milk (Dunn, Newell, Ades, & Peckham, 1992). If the woman tests positive for HIV, the infant should be tested as well, and breastfeeding should be discontinued.

5.2 Parental Involvement in Diagnosis

All HIV testing in Canada currently requires consent. This consent must be obtained before any diagnostic tests are initiated. When HIV testing involves an infant or child, consent is sought from the parents of the infant or child. The need for consent may therefore act as a barrier to diagnosis and subsequent treatment. One obstacle to obtaining consent may be the understanding of the parent or caregiver of the need for several tests to be given in infancy to confirm the diagnosis of HIV. Another obstacle may be parents' hesitation to learn about their child's HIV status because of the implications that it may have for their own health (Leelanukrom & Pancharoen, 2007). The child should be included in the consent process once he/she is developmentally ready. Even young children have a right to information about their health status, although this may be explained to them based on their developmental age and maturity level (World Health Organization & UNICEF, 2010).

In cases where parental consent is withheld, Child and Family Services of Saskatchewan can become involved. Section 11(a)(iv) of *The Child and Family Services Act* states that a child is in need of protection when "medical, surgical, or other recognized remedial care or treatment that is considered essential by a duly qualified medical practitioner has not been or is not likely to be provided to the child." While this policy is not specific to HIV testing and treatment, it can be used in these cases. Child and Family Services would first discuss the situation with the parent(s) in an effort to obtain consent for testing. If parental consent is still withheld, Child and Family Services can then attempt to obtain a protection order from the court. Such an order would require confirmation from a medical professional that the diagnosis and treatment are needed, and that there would be negative consequences for the child if treatment is withheld. If a protection order is granted, the child enters the care of the Ministry of Social Services, who would then consent to testing and treatment on behalf of the child.

At the initial assessment of the infant, a maternal health history should be obtained to determine the mother's HIV status, as well as potential exposure to maternal co-infections such as **tuberculosis (TB), syphilis, toxoplasmosis, hepatitis B** or **C, cytomegalovirus**, or **herpes simplex virus** (King, 2004). If the child has been exposed to any of these diseases from other

family members, it is also important to disclose this information as it may affect treatment decisions.

If the mother's HIV status is unknown, it is important to test the mother as soon as possible (before birth) or the infant immediately after birth so that preventative measures can be taken (see *Section 4: Treatment* for more information). Testing for HIV infection should be done as soon as possible after birth (within 24 hours) using an HIV Screening or by using rapid testing kits (INSTI HIV-1 Rapid Antibody Test in Saskatchewan). An HIV Screening Test uses the first step of the standard laboratory HIV-1 antibody testing, whereas rapid testing kits test a single specimen for HIV-1 antibodies. Rapid testing should be confirmed by standard HIV-1 testing. If either test is positive, then a confirmatory test is required for a definitive diagnosis (King, 2004). A positive test indicates that the mother is HIV-positive, although further testing will be needed to determine the infant's HIV status.

5.3 Infant Testing

If a mother is living with HIV or has a suspected HIV-positive status, there are several different types of virological assays that can be performed to determine HIV status in infants less than 18 months of age. As previously mentioned, a negative test cannot provide a conclusive diagnosis until the child is greater than 18 months of age since the presence of maternal antibodies may persist until then. However, a positive test can identify children who are HIV-infected, indicating the need for early treatment and thus improving treatment outcomes (World Health Organization, 2010). Virological assays, rather than standard antibody assays, are necessary for accurate diagnosis in infants because the persistence of maternal antibodies in young children (less than 18 months of age) will lead to a potentially false positive.

All infants exposed to HIV should have HIV virological testing at the ages of 14-21 days, 1-2 months and 4-6 months, or as soon as possible afterward. All at-risk children (i.e., those infants born to mothers living with HIV who did not receive prenatal care or prenatal ART or who had high HIV viral loads close to delivery) should also be tested for exposure to HIV using **serological testing** (standard testing) to look for the presence of maternal antibodies (World Health Organization, 2010).

The standard virological test is the HIV DNA (**deoxyribonucleic acid)** polymerase chain reaction (PCR), which can accurately identify 30-50% of infected infants at birth and almost 100% by 3 to 6 months of age (Leelanukrom & Pancharoen, 2007). This test detects HIV-1 DNA within the **peripheral blood mononuclear cells**. Another testing method is the HIV-1 RNA assay, which detects viral RNA **(ribonucleic acid)** in plasma by using a variety of methodologies (King, 2004). Other tests that are not often used include HIV peripheral blood **lymphocyte** culture and **HIV p24 antigen**, which tests for the p24 **antigen** (the major internal core protein of the virus (King, 2004; Leelanukrom & Pancharoen, 2007). For all of the above tests, the sample from the infant must be a **neonatal** sample, not a **cord blood** sample to ensure that maternal antibodies are not a cause for a false positive.

After the infant is older than 18 months, maternal antibodies should not be present in the infant's blood. Therefore, the child can be tested using standard methods that test for the presence of HIV IgG antibodies (Leelanukrom & Pancharoen, 2007).

5.4 Making a Conclusive Diagnosis of HIV Status

According to the American Academy of Pediatrics and the Canadian Paediatric Society, a conclusive exclusion of HIV infection can be made in non-breastfed infants and young children if all virological testing results (obtained at birth, at 4-7 weeks, and at 8-16 weeks) are negative. Despite this, serological testing (standard testing) should be done at 12 months of age to ensure that all of the maternal antibodies which were passed to the infant during pregnancy have disappeared. If the child is still antibody positive at 12 months, the testing should be repeated at 18 months of age. Loss of the HIV-1 antibody in a child with previously negative virological assays (e.g., HIV-1 DNA PCR) confirms that the child is HIV-1 uninfected (King, 2004).

If infants or young children test positively to virological assays (with at least one confirmatory test) or if HIV-1 antibodies are still present at 18 months of age, they are said to have HIV (Leelanukrom & Pancharoen, 2007).

As well, a presumptive diagnosis of HIV can be made in infants and children who are less than 18 months of age if they test positively to a serological test (have maternal antibodies for HIV infection) and have specific symptoms that are suggestive of HIV (see section 3: Identification of HIV-positive Infants and Children) (World Health Organization, 2010).

6. Treatment

6.1 Need for Treatment

The progression of HIV to AIDS in untreated infants generally follows one of two patterns (MaWhinney, Pagano, & Thomas, 1993; The European Collaborative Study, 2001):

- early, with progression to AIDS and/or death before 12 months of age (approximately 20% of infants infected through MTCT); or
- late, with progression to AIDS and/or death by age 6 (approximately 40% of infants infected through MTCT).

With the use of HAART, the progression of HIV to AIDS can be delayed. Because of the high risk for infants to progress rapidly to AIDS (i.e., over half of untreated children living with HIV will die before their second birthday; Anaky et al., 2010), there is a need for early diagnosis and treatment of HIV. This rapid progression may be due to the developing immune system in infants and young children, as viral levels decrease much more slowly in infants than adults, and the infant's immune system does not yet have the capacity to fight the HIV virus (Hazra, Siberry, & Mofenson, 2010). However, even though the level of viral replication in infants infected

through MTCT is high, early initiation of treatment can result in sustained viral suppression and lead to a healthier immune response (Penazzato, et al., 2010).

Currently, there is no cure for HIV. However, advances in treatment have allowed for HIV to be treated as a chronic infection using ART. The goals of ART in treating infants, children, adolescents and adults living with HIV include:

- reducing HIV-related **mortality** (death rate due to HIV) and **morbidity** (the rate of HIV in a certain population);
- restoring and/or preserving immune function;
- suppressing viral replication;
- minimizing drug-related toxicity;
- maintaining normal physical growth and neurocognitive development; and
- improving the quality of life of those infected and affected by HIV (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

ART is initiated at or around the time of diagnosis and is maintained throughout the lifespan to slow the progression of HIV to AIDS and prevent the child's death (Vreeman et al., 2010). There are four classes of drugs used in ART in children, each of which fight the HIV virus in a different way (Leelanukrom & Pancharoen, 2007). Therefore, combinations of these classes of drugs can make the treatment more effective. **Combination therapy** involves using two or more antiretroviral drugs at the same time, whereas HAART involves using three or more different antiretroviral drugs to manage the progression of HIV in the infant or child (Avert, 2011b).

HAART is extremely effective in slowing the progression of HIV to AIDS. Before HAART, the mean age of death for infants and children infected through MTCT was 9 years (Hazra et al., 2010). Although individuals living with HIV do continue to have shortened life spans due to a number of factors related to their disease and the use of ART, life spans exceeding 60 years are currently the norm.

The four classes of antiretroviral drugs used in children are shown in Table 1: Antiretroviral Drug Classes for Children.

Table 1: Antiretroviral Drug Classes for Children (Avert, 2011a)

DRUG FAMILY	HOW THE DRUG FIGHTS HIV IN THE BODY
Nucleoside analog/nucleotide reverse transcriptase inhibitors (NRTIs; NtRTIs)	• Interferes with the action of an HIV protein called reverse transcriptase, which the virus needs to make new copies of itself.
Non-nucleoside reverse transcriptase inhibitors (NNRTIs)	• Stops HIV from replicating within cells by inhibiting the reverse transcriptase protein of HIV, which the virus needs to make new copies of itself.
Protease inhibitors (PIs)	• Inhibits the activity of protease, which is a protein involved in the HIV replication process.
Fusion inhibitors	• Prevents HIV from binding to or entering human immune cells.

As of 2010, 17 drugs have been approved for the treatment of pediatric HIV and 15 have pediatric formulations. However, the safety of their use in infants and young children is currently unknown (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011). There are many potential complications with pediatric ART, even with infant and child formulations being approved and available.

Firstly, infants who were exposed to ART prenatally and were still infected by the virus may have developed a resistance to certain drugs; this may remove whole families of drugs from their treatment options (Penazzato, et al., 2010). Secondly, many ART drugs are approved for pediatric use based on efficacy data from adult studies. Adult dosing requirements do not translate easily to pediatric dosing, especially in young infants. This is especially important because child development can significantly affect drug absorption and metabolism. Children may, therefore, metabolise drugs differently than adults, resulting in inefficacy of treatment (Penazzato, et al., 2010). Thirdly, although they are approved for pediatric treatment, some of these drugs may not have appropriate formulations for young children (e.g., liquid formulation or small crushable pills), and thus may be difficult to administer. Finally, even when child-friendly formulations are available (e.g., liquid forms), some of their special characteristics may discourage use by certain populations. These include higher costs, poor palatability, use of chemicals to keep the drug in solution that could be harmful to children, special storage requirements (e.g., needing refrigeration) and only being available in large volumes (Committee on Pediatric AIDS, 2007). In addition to the aforementioned complications, as infants and children are living longer due to advances in treatment, planning is needed to ensure proper drug sequencing throughout the life span, both to avoid toxicity and to promote tolerability (Penazzato, et al., 2010).

Because of the limited data available on ART in infants and young children, there are still many unknowns regarding the best regimen to use for the treatment of HIV in this population. Protease-Inhibitor based regimens (PIs) are very effective at suppressing HIV viral replication

and do not mutate easily, which makes it harder for the HIV virus to become resistant to these drugs. However, PIs have the potential for multiple drug interactions and side effects, which may be difficult to overcome with lifelong use (Penazzato, et al., 2010). Non-nucleoside reverse transcriptase inhibitor based regimens have also been shown to be effective in older children, but data is limited in younger children. In recognition of the inadequacy of treatment options for children, particularly younger children, those working in the field have called for more resources to be put into research and development for improved, affordable and appropriate pediatric treatment options (Lallemant, Chang, Cohen, & Pecoul, 2011).

6.2 Classification of HIV in Children

Before treatment can begin, infants or children must be assessed for the progression of HIV in their bodies. Certain treatment options are only recommended once the child has reached a certain age, clinical stage (e.g., has a certain opportunistic infection), or has a certain CD4+ T-lymphocyte count or HIV viral load.

The pathogenesis of HIV is similar in both adults and children; however, there are certain key differences to consider, including the speed of progression of HIV to AIDS and HIV treatment (see Section 1: Introduction for key similarities and differences) (AIDS Education and Training Centers, 2010). The progression of pediatric HIV involves more serious and more frequent effects from the impact of the disease on the individual's body. At each stage of the disease, the complications increase as the virus exerts its effects more strongly on the developing immune system.

The determination of HIV stages in children is different than for adults because of the differences in CD4+ T-lymphocyte levels in young children as opposed to older children, adolescents and adults. However, the symptoms and conditions at each stage are similar between children and adults, although clinical manifestations of these conditions may differ (AIDS Education and Training Centers, 2010).

There are two ways of classifying HIV disease: by clinical stage or by immunological markers. The first uses symptoms to identify the progression of the disease, whereas the second uses CD4+ T-lymphocyte counts and percentages. The WHO classification of HIV-associated clinical disease should be assessed once the infant or child's HIV infection has been confirmed. There are four clinical stages, increasing with the severity of the disease. The first clinical stage indicates that the child is asymptomatic. The second indicates that the child exhibits mild symptoms. The third indicates advanced symptoms and the fourth, severe symptoms. Examples of conditions that indicate each stage can be found in *Section 6.2.1: Clinical Stages of HIV Disease in Infants & Children* as well as in *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV-1 Infection* (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

6.2.1 Clinical Stages of HIV Disease in Infants and Children

At the first stage of HIV, where the patient is asymptomatic (stage N), there may only be a persistent generalized **lymphadenopathy** (enlarged lymph nodes). However, at clinical stage 2 (stage A), there are a variety of possible conditions associated with HIV including persistent **hepatosplenomegaly**, papular **pruritic eruptions**, extensive **wart virus infection**, extensive **molluscum contagiosum**, recurrent **oral ulcerations**, unexplained persistent **parotid enlargement**, **linear gingival erythema**, **herpes zoster**, recurrent or **upper respiratory tract infections** and/or **fungal nail infections** (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011; World Health Organization, 2010).

At the third stage (stage B), the conditions are more serious: unexplained moderate malnutrition that does not adequately respond to therapy, unexplained persistent **diarrhea** (>14 days), unexplained persistent **fever** (>37.5°C, intermittent or constant, for >1 month), persistent **oral candidiasis, oral hairy leukoplakia**, **acute necrotizing ulcerative gingivitis/periodontitis**, **lymph node TB**, **pulmonary TB**, severe recurrent bacterial pneumonitis, chronic HIV-associated lung disease including **bronchiectasis**, and/or unexplained anemia, **neutropenia** or chronic **thrombocytopenia** (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011; World Health Organization, 2010).

In the fourth stage of HIV (stage C), the conditions are more specific to HIV and tend not to occur in those without a severe immunodeficiency. These conditions include: unexplained **severe wasting**, stunting or severe malnutrition that does not respond to treatment, **pneumocystis pneumonia**, recurrent severe bacterial infections, chronic herpes simplex infection, **extra-pulmonary TB, Kaposi's sarcoma**, esophageal **candidiasis**, central nervous system toxoplasmosis, **HIV-related encephalopathy**, cytomegalovirus infection, **extrapulmonary cryptococcosis** (including **meningitis**), disseminated endemic **mycosis**, chronic **cryptosporidiosis** (with diarrhea), chronic **isosporiasis**, disseminated **non-tuberculous mycobacterial infection**, cerebral or B-cell **non-Hodgkin lymphoma**, progressive **multi-focal leukoencephalopathy**, and/or HIV-associated **cardiomyopathy** or **nephropathy** (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011; World Health Organization, 2010).

6.2.2 Immunological Stages of HIV Disease in Infants & Children

CD4+ T-lymphocyte levels in infants are higher than those of adults, even in healthy, non-HIV infected populations. The high levels in infants slowly decline to adult values by the age of 5 or 6 (World Health Organization, 2010). Measurements of CD4+ T-lymphocytes should be taken over time and reviewed together, while also taking age into account (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011). Absolute CD4+ T-lymphocyte counts measure how many functional CD4+ T-lymphocytes are circulating in the blood – the lower the count, the weaker the

immune system. The percentage of CD4+ T-lymphocytes measures the amount of CD4+ T-lymphocytes in the blood relative to the total number of lymphocytes in the blood. A lower percentage of CD4+ is a sign of a weaker immune system (Yu, Easterbrook, & Marshall, 1997). Absolute counts in infants and children are not as reliable as percentages because they are less constant over time. In infants and young children, CD4+ percentages should be used as a measurement (Yu, et al., 1997). The younger the child, the less predictive these measurements are of mortality, so even children with high levels of CD4+ T-lymphocytes (e.g., >1500 cells/mm^3 or %CD4+ >25) are at risk of death from HIV (World Health Organization, 2010).

Treatment may be deferred if the child is deemed well enough based on clinical stage and percent and absolute count of CD4+ T-lymphocytes. Although ART is effective in reducing viral load and improving CD4+ T-lymphocyte levels, there are many difficulties that come with the initiation of treatment which may be especially challenging in younger populations (e.g., side effects, adherence, caregiving).

6.3 Treatment Recommendations

6.3.1 Infant Treatment Recommendations

The guidelines for Saskatchewan, based on the National Institute of Health (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011), recommend initiating ART for all HIV-infected infants (up to 12 months of age), irrespective of CD4+ count or clinical stage. When viral testing results are not available, infants with a presumptive HIV diagnosis (as shown by clinical signs of HIV) should start ART as soon as possible and confirmatory diagnosis should be obtained.

There are many factors (as noted above) that need to be considered when making decisions about ART in all populations living with HIV. These include:

- severity of HIV disease and the risk of disease progression, as determined by the classification of HIV clinical stages;
- availability of appropriate drug formulations and dosing information for the age group;
- potency, treatment complexity (e.g., dosing frequency and food requirements), and potential adverse effects;
- effect of initial regimen choice on later ART options;
- presence of other conditions or infections;
- potential drug interactions;
- ability of the caregiver and child to adhere to the prescribed regimen (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

In both infants and children, a combination of at least 3 antiretroviral drugs from at least 2 drug classes (PIs, NRTIs, NNRTIs, or fusion inhibitors) is recommended for initial

therapy. Monotherapy and two-drug therapy is not recommended. Combination therapy slows disease progression and improves survival, and optimally would result in greater and more sustained virologic and immunologic responses, and would delay the development of drug-resistant forms of the virus (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011). There are several combinations that are generally used, although their benefits over one another are not yet determined completely (Hazra, et al., 2010). For a more complete description of the recommended treatment regimens as well as those treatments that are not used for infants and children, see Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children (2011).

6.3.2 Child Treatment Recommendations

Currently, in children aged 1 to 5 years, recommended treatment depends on both clinical staging and immunologic status. Guidelines for treatment of this population can be found in Table 2: Treatment Guidelines for Children with HIV Aged 1 to 5. For children over 5 years of age, the treatment guidelines are slightly different; these can be found in Table 3: Treatment Guidelines for Children with HIV over Age 5.

Table 2: Treatment Guidelines for Children with HIV Aged 1 to 5

TREATMENT RECOMMENDATION	CLINICAL STAGING AND IMMUNOLOGICAL STATUS
Recommended	Clinical stage 3 or 4 (significant HIV-related symptoms or AIDS).
Recommended	%CD4+ is less than 25%, regardless of clinical stage or HIV RNA level.
Considered	Clinical stage 1 or 2 (asymptomatic or mild symptoms) and both a %CD4+ greater than 25% and HIV RNA levels greater than 100 000 copies/mL.
Deferred	Clinical stage 1 or 2 (asymptomatic or mild symptoms) and a %CD4+ greater than 25% and HIV RNA less than 100 000 copies/mL.

Table 3: Treatment Guidelines for Children with HIV over Age 5

TREATMENT RECOMMENDATION	CLINICAL STAGING AND IMMUNOLOGICAL STATUS
Recommended	Clinical stage 3 or 4 (significant HIV-related symptoms or AIDS).
Recommended	Absolute CD4+ T-lymphocyte count is less than 500 cells/mm^3.
Considered	Clinical stage 1 or 2 (asymptomatic or mild symptoms) and both an absolute + T-lymphocyte count greater than 500 cells/mm^3 and HIV RNA levels greater than 100 000 copies/mL.
Deferred	Clinical stage 1 or 2 (asymptomatic or mild symptoms) and both an absolute CD4+ T-lymphocyte count greater than 350 cells/mm^3 and HIV RNA levels less than 100 000 copies/mL.

6.4 Effects of Treatment

ART is intended to restore or preserve immune functioning of individuals living with HIV while suppressing viral replication. In this process, there are many potential side effects due to the use of certain drugs, or combinations of drugs. Therefore, a balance must be set between the need for treatment in infants and young children and the potential long-lasting side effects of the treatment options. Because HAART is a fairly recent form of HIV treatment, its long-term effects in children infected through MTCT are largely unknown.

Assessment of drug toxicities is complicated by the effects of progressing HIV infection; the two can often be confused and careful research is necessary to determine the true cause of adverse outcomes. Side effects of antiretroviral agents are described in Table 4; for information on associated ARTs, clinical manifestations, frequency, risk factors, prevention and management, see *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV-1 Infection (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011)*.

Table 4: Side Effects of ART

EFFECT TYPE	DISORDER	DEFINITION
Mitochondrial Dysfunction	**Lactic Acidosis**	Occurs when lactic acid builds up in the blood stream faster than it can be removed. Lactic acid is produced when oxygen levels in the body drop (PubMed Health, 2010q).
	Hepatic Toxicity	A general term for liver damage, including inflammation of the liver (hepatitis), death of liver cells (hepatic necrosis), and overabundance of fat in the liver (hepatic steatosis) (AIDS Info, 2005a).
	Pancreatitis	Inflammation of the pancreas (PubMed Health, 2010s).
	Peripheral Neuropathy	A general term for damage to the peripheral nerves, which carry information to and from the brain, and from the spinal cord to the rest of the body (PubMed Health, 2011c).
	Hyperbilirubinemia	Excess bilirubin in the blood caused by improper liver functioning. Bilirubin is produced when red blood cells are broken down, and is normally removed from the blood by the liver. Excess bilirubin causes jaundice (Mayo Clinic, 2011a).
Metabolic Abnormalities	**Lipodystrophy**	A disturbance in the way the body produces, uses, and stores fat; also known as fat redistribution (AIDS Info, 2005c).
	Central Lipohypertrophy	Excessive fat growth, especially around the midsection (AIDS Info, 2005c).
	Facial/Peripheral Lipoatrophy	Fat wasting or fat loss from particular areas of the body, including the arms, legs, face and

EFFECT TYPE	DISORDER	DEFINITION
		buttocks (AIDS Info, 2005c).
Metabolic Abnormalities *(Continued)*	**Dyslipidemia**	Excess amount of fatty substances (e.g., cholesterol and triglycerides) in the blood (PubMed Health, 2010m).
	Osteopenia	Bones become less dense than normal, and may lead to osteoporosis (University of Michigan Health System Clinical Care Guidelines Committee, 2009).
	Osteoporosis	A condition where the bones become less dense and more fragile, and are therefore at more risk of fracture from a smaller amount of trauma (University of Michigan Health System Clinical Care Guidelines Committee, 2009).
	Osteonecrosis	A loss of blood supply to the bones, leading to bone death (National Institute of Athritis and Muscoloskeletal and Skin Diseases, 2009).
	Insulin Resistance	The body's lack of response to insulin, which helps blood sugar (glucose) to enter cells. This causes more and more insulin to be produced, without allowing blood sugar levels to fall thereby leading to higher blood sugar levels and affecting kidney function and blood fat levels (PubMed Health, 2010r).
	Hyperglycemia	High levels of glucose in the blood. Glucose responds to the production of insulin, and is necessary for cells to make energy and function properly (AIDS Info, 2005b).
	Diabetes Mellitus (DM)	A chronic condition caused by the body's inability to sufficiently produce and/or properly use insulin, which is needed by cells to process glucose and create energy (Public Health Agency of Canada, 2003).
Hematologic Effects	**Anemia**	A condition where the number of healthy red blood cells decrease, which thereby decreases oxygen flow to the rest of the body (Medline Plus, 2011b).
	Neutropenia	A condition where there is an abnormally low number of neutrophils in the blood. Neutrophils (a type of white blood cell) help defend the body against bacterial and fungal infections, therefore with a lowered number of neutrophils, risk of infection is increased (Greenberg, 2009).

EFFECT TYPE	DISORDER	DEFINITION
Allergic Reactions	**Skin Rash**	Changes in the color or texture of the skin because of inflammation or allergies (Medline Plus, 2009a).
	Systemic Hypersensitivity Reaction	An excessive immune reaction to an allergen (e.g., pollen, dust, animal hair, food, etc.) that spreads throughout the body (Medline Plus, 2010a).
	Stevens-Johnson Syndrome (SJS) or Erythema Multiforme Major (EM)	A rare disorder where the skin and mucous membranes react severely to a medication or infection, involving a painful skin rash that eventually causes the top layer of skin to die and shed (Mayo Clinic, 2011b).

6.5 Opportunistic Infections, Co-existing Conditions and Treatment

Opportunistic infections are those that take advantage of the infant or child's weakened immune system; they do not generally occur in those with healthy immune systems. As such, opportunistic infections can be an indicator of HIV infection among children whose HIV status is unknown. Like HIV, opportunistic infections can be passed through MTCT. Therefore, women living with HIV who are co-infected with certain opportunistic infections may be more likely than women without HIV to transmit opportunistic infections to their infants. Because many opportunistic infections are spread through close contact, if an HIV-positive mother or other family member is co-infected with an opportunistic infection, she/he will be more likely to transmit the infection horizontally to the infant or child as well. This increases the infant/child's risk of contracting the opportunistic infection.

The transmission, progression, and effects of opportunistic infections can differ between infants and children living with HIV and adults living with HIV. Many opportunistic infections in adults are reactivations of the condition, whereas in infants or children, it is often the primary infection that takes place when the child's immune system is already compromised.

Diagnosis of opportunistic infections in infants and children may indicate the presence of HIV. Therefore, children with opportunistic infections should be tested for HIV if their status is unknown. Diagnosis of opportunistic infections can be difficult because of the child's inability to describe his/her symptoms, the persistence of maternal antibodies until the infant is older than 18 months of age, certain diagnostic tests not being suitable for young children, and a differing presentation than that of adults.

Opportunistic infections become more serious as HIV progresses towards AIDS. Therefore, young children may experience any of the opportunistic infections listed in the table below if their HIV has progressed to the further stages. HAART, when adhered to correctly, is the most important factor in controlling and preventing opportunistic infections among children living

with HIV. However, if an opportunistic infection does occur, treatment for that condition is necessary. For a summary chart of several common opportunistic infections and their descriptions, see Table 5: Common Opportunistic Infections in Infants and Children Living with HIV.

Table 5: Common Opportunistic Infections in Infants and Children Living with HIV (Mofenson et al., 2009)

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Cancers			
Kaposi's Sarcoma (KS) (Mehta, 2010): a cancerous tumour of the connective tissue; often associated with HIV; in HIV/AIDS patients, the cancer can develop quickly and may also involve the skin, lungs, gastrointestinal tract, and other organs (PubMed Health, 2010o)	• An AIDS-defining illness • Occurs in less than 1% of children living with HIV in the USA • Occurs almost exclusively in immune compromised individuals	• Presents with lesions on the skin or oral mucosa (e.g., tip of nose, in the mouth, arms) • May spread to the lymphatic system, the lungs and the digestive tract	• HAART can help to stop progression of KS • Chemotherapy or other treatments may be required • No effective cure for KS; therefore treatment should focus on the symptoms
Bacterial Infections			
Pneumonia: a respiratory condition in which there is an infection of the lung caused by a bacteria (Pubmed Health, 2011d)	• One of the most common opportunistic infections in children living with HIV • Children living with HIV have a higher risk than other children for infection due to Streptococcus pneumonia, a bacteria that causes pneumonia and other conditions • Children living with HIV with pneumonia are more likely to be bacteremic, which carries a higher risk of death	• Often presumptively diagnosed in children • Symptoms may be similar to those of children without HIV: elevated white blood cell count, fever, difficulty breathing, cough, need for extra oxygen • May be recurrent in children living with HIV	• Treatment is the same for HIV-positive and HIV-negative children • Vaccinations can help to prevent occurrence if due to certain bacteria

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Syphilis (congenital): an infectious disease caused by the spirochete *Treponema pallidum* that is transmitted from mother to child during pregnancy or labour (PubMed Health, 2010w)	• Can be transmitted from mother to child at any stage of pregnancy or delivery • Can be transmitted despite prophylactic treatment (depending on maternal stage of syphilis, gestational age at treatment, short interval from treatment to delivery) • Untreated early syphilis can lead to spontan-eous abortion, stillbirth, preterm delivery and perinatal death	• Symptoms may appear early (before 2 years of age) or later (after 2 years of age) • At birth, may have symptoms: hepato-splenomegaly, jaundice, mucocutaneous disorders, lymphadenopathy, anemia, thrombocytopenia or pneumonia	• Prevention and detection of congenital syphilis depends on the identification of syphilis in pregnant women; therefore, screening is necessary during prenatal visits • Penicillin is the treatment of choice for syphilis, congenital or acquired, regardless of HIV status
Mycobacterial Infections			
Tuberculosis (TB): a contagious bacterial infection that involves the lungs and can spread to other parts of the body (PubMed Health, 2010u)	• Rate of infection in children living with HIV is unknown • Increased risk for TB among children living with HIV • Congenital TB is rare, but has been reported among children born to women living with HIV and TB • Children with TB are almost always infected by a family member or friend • Drug resistance is a possible problem	• All children living with HIV are more likely to develop active TB once infected • Clinical features are similar to those of HIV-negative children, but are usually more severe • Children living with HIV and TB are more likely to be symptomatic and have atypical features, and may have rapidly progressive disease	• Infants and children living with HIV should be tested for TB • Those testing negative should have preventative therapy • Those testing positive should start treatment immediately, based on the advice of a specialist because of the possibility of interactions between ART and TB-related medications

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Mycobacterium Avium Complex (MAC) Disease: an opportunistic infection caused by a species of *Mycobacterium*; can cause localized disease and other complications in individuals living with HIV (HRSA HIV/AIDS Bureau, 2011)	• Less common in the pediatric population due to HAART • Risk of disseminated infection in pediatric HIV increases with age and declining CD4+ T-lymphocyte count • May occur at higher CD4+ T-lymphocyte counts among younger children living with HIV (especially under 2 years of age) than among older children or adults	• Early symptoms can be minimal • Symptoms of disseminated MAC: persistent or recurrent fever, abdominal pain and/or diarrhea, weight loss or failure to gain weight, sweats, fatigue	• Prevention of disseminated MAC among children living with HIV is most effective using HAART
Fungal Infections			
Candida Infections (e.g., thrush, candidiasis, dermatitis): manifestations of a fungal disease of the mouth, tongue and oral tract (AIDS Education and Training Centers, 2011)	• Oral thrush and diaper dermatitis occur among 50-85% of children living with HIV • Can become localised (e.g., oropharyngeal candidiasis (OPC), esophageal disease, diaper dermatitis) • OPC has been one of the most frequent opportunistic infections in children living with HIV during the HAART era (28% of children)	• Children who develop OPC despite HAART may have atypical symptoms • Risk factors for OPC include low CD4+ T-lymphocyte count, high viral load and neutropenia	• Candida infections are difficult to prevent, because of the prevalence of the fungus in the environment • Effective treatment for children living with HIV who develop candida infections is available, and depend on the condition and its presentation

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Viral Infections			
Cytomegalovirus (CMV): a herpes-type virus that can cause disease in different parts of the body such as the esophagus, stomach or intestines, eye or lung, with symptoms similar to those of mononucleosis (Pubmed Health, 2009f)	• Can be acquired during infancy, early childhood or adolescence • Transmission can occur through MTCT or horizontally, often through exposure to infected breast milk or saliva • Most common congenitally transmitted infection • MTCT of CMV may be higher among infants born to women dually infected with CMV and HIV • HIV infected children are at higher risk for CMV in early childhood than others, especially during first 12 months	• Congenital CMV can present with symptoms at birth or can present with manifestations later (e.g., sensory-neural hearing loss, neurologic defects) • Co-infection with CMV may lead to faster progression of HIV • Effects of CMV include: CMV retinitis, end-organ CMV disease, gastrointestinal effects, central nervous system effects	• CMV infection can be difficult to diagnose in children living with HIV, especially young children (under 18 months) • Children should be tested for CMV • Treatment for asymptomatic CMV is not standard • HAART is the most effective treatment option for CMV, by preventing severe **immune-suppression**
Hepatitis B Virus (HBV): a swelling or inflammation of the liver due to HBV; often refers to a viral infection in the liver (PubMed Health, 2010j)	• Can be transmitted from parent to child, through MTCT, or sexual contact • HBV is common; most children who acquire HBV have minimal problems • Because of their weakened immune system, children living with HIV co-infected with HBV are at higher risk of complications, but the prevalence is unknown	• Most children with chronic HBV infection are asymptomatic • Some symptoms (e.g., cirrhosis) may occur, but usually develop over many years, therefore not occurring in childhood	• Testing should occur if the mother has HBV infection • All infants born to HBV-infected women (including women co-infected with HIV) should receive the hepatitis B vaccine and immune globulin • More research is needed to determine and confirm best-practice treatments for infants and children co-infected with HIV and HBV

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Hepatitis C Virus (HCV): a viral disease, caused by the hepatitis C virus, that leads to swelling (inflammation) of the liver (PubMed Health, 2010k)	• Occurs among 0.2% of children, and may be higher in infants and children living with HIV • MTCT is the predominant mode of acquisition in children • Maternal HIV co-infection with HCV increases the risk for MTCT transmission (6%-23%)	• Most children with HCV are asymptomatic • Some symptoms (e.g., cirrhosis) may occur, but usually develop over many years, therefore not occurring in childhood • Limited information on how HIV/HCV co-infection affects disease progression or symptoms	• Testing should occur in any child whose mother has HCV, or who is living with HIV • Limited information is available on the treatment of children with HCV, with or without a co-infection with HIV
Herpesvirus 6 (HHV-6) & 7 (HHV-7): human herpesviruses that cause roseola infantum, and possibly other conditions (Braun, Dominguez, & Pellett, 1997; European Bioinformatics Institute (EBI), 2011)	• Can be transmitted from mother to child in utero, but also through saliva • HHV-6 infects same target cells as HIV; this may decrease rates of co-infection • If co-infection does occur, it may increase risk for HIV disease progression	• Many cases are asymptomatic, or may have transient fever, irritability and allergic reactions or rash • Severe infection in severe immune-compromised children is associated with CNS disorders and convulsions	• Can be difficult to diagnose because of frequent, asympto-matic reactivation • No special indications for children co-infected with HHV-6 or HHV-7 and HIV
Herpes Simplex Virus (HSV): a viral infection caused by the herpes simplex virus (HSV) that causes ulcers (small blisters) and mainly affects the mouth or genital area (Medline Plus, 2011a)	• Transmitted through infected oral or genital secretions • Can be transmitted from mother-to-child in utero • HSV infection may increase the risk for MTCT of HIV • Recurrent or persistent HSV infection is the AIDS-indicator condition in ~6% of children with AIDS	• Children living with HIV have more frequent and severe episodes of HSV reactivation • Can present as: encephalitis, rash, localized CNS disease, disseminated multiorgan disease, HSV genitalis	• Prevention of MTCT is important • HAART can decrease the risk of, but not prevent, transmission • Treatment options are available

CONDITION	PREVALENCE AND AGE	PRESENTATION	PREVENTION AND TREATMENT
Varicella-Zoster Virus (VZV): a herpes virus that causes **varicella** (chicken pox) and herpes zoster (shingles), and is associated with fever and a pruritic rash (Arvin, 1996)	• Incidence has decreased with the use of the varicella vaccine • Children living with HIV have higher risk of morbidity and mortality • Varicella can be transmitted through skin leasions, air, and from MTCT • Herpes zoster is transmitted through skin lesions and MTCT • Children living with HIV are at a higher risk for infection than the general population	• Children living with HIV may present with fever and pruritic lesions on the body, as well as retinitis • Disease may last longer than normal in children living with HIV and may have more complications	• Can be diagnosed by the presence of lesions • Children living with HIV without immunity to VZV should avoid contact with infected persons • Family members of children living with HIV should receive vaccine to avoid horizontal transmission • Infants/children living with HIV should be vaccinated, depending on several clinical features (e.g., CD4+ T-lymphocyte levels)

6.5.1 Tuberculosis & HIV

Tuberculosis (TB) is a contagious bacterial infection, due to Mycobacterium tuberculosis, that generally involves the lungs (**pulmonary tuberculosis**), but can spread to other areas (extra-pulmonary tuberculosis). TB is spread through contact with contaminated air droplets from a cough or sneeze of an infected person. The risk of acquiring TB depends on the extent of exposure to these droplets and the susceptibility of the individual, meaning that those with decreased immune status because of HIV or AIDS will be at a higher risk for contracting TB (Muralidhar & Nair, 2010). In general, TB infections in children living with HIV are more invasive, more likely to disseminate and have worse outcomes than in children who are HIV-negative (Jaspan, Huang, Cotton, Whitelaw, & Myer, 2008).

TB disease in those living with HIV can develop immediately after exposure, or can occur as a reactivation (e.g., the person recovered from TB earlier in life, and then it was reactivated). Children living with HIV who had TB before and recovered are at a higher risk of re-infection (Muralidhar & Nair, 2010). Childhood TB consists of 10-20% of all TB cases and is most common in the age group of 1-4 years. As well, young children are highly susceptible to extra-pulmonary TB, which accounts for 25% of TB in persons living with HIV. The most common forms of extra-pulmonary TB in children are: disseminated TB (where TB spreads to other parts of the body through the blood or lymph systems),

tuberculosis meningitis (especially in children less than 3 years old), lymphadenopathy (enlarged lymph nodes), effusions (excess fluid) and spinal TB (Muralidhar & Nair, 2010).

It can be difficult to diagnose TB in children living with HIV as the clinical features are not very specific and can be difficult to identify. Children living with HIV may test smear negative for pulmonary TB because cavitation does not often occur (Muralidhar & Nair, 2010). Therefore, a medical history of the parents (to determine if the parents are living with HIV) can be helpful for diagnosis, as the healthcare provider will then know to look for TB (most children with normal immune systems will not contract TB, or will have common clinical signs of TB if it is contracted). For a diagnosis of TB to be made in children living with HIV, three of the following are required:

- clinical signs of TB: contact with an adult who has TB, failure to thrive or weight loss, and a cough for more than 3 weeks;
- physical signs of TB: **gibbus**, non-painful enlarged cervical lymphadenopathy with **fistula** formulation;
- physical signs of extra-pulmonary TB: **pleural effusion**, distended abdomen with **ascites**, sub-acute meningitis;
- positive tuberculin skin test (TST): less than 5mm in children with HIV or are severely malnourished (high risk) or greater than 10mm in other children; and/or
- chest X-ray suggestive of TB (Muralidhar & Nair, 2010).

Children diagnosed with TB should be tested for HIV if this has not already been done. Treatment of TB in the context of HIV involves ART for the treatment of HIV if indicated, and then antibiotics for TB (Muralidhar & Nair, 2010).

6.5.2 Pneumocystis Pneumonia & HIV

Even with advances in treatment (e.g., HAART, PMTCT), pneumocystis pneumonia remains a common opportunistic infection for infants and children living with HIV and is also a common AIDS-indicator disease in this population. The highest incidence of pneumocystis pneumonia among infants and children living with HIV is within the first year of life, peaking at age 3-6 months (Mofenson, et al., 2009). Pneumocystis pneumonia is likely spread by airborne human-to-human transmission, although this is not confirmed.

Pneumocystis pneumonia occurs almost exclusively in immune-compromised populations. The most important factor in susceptibility of infants and children living with HIV is the status of the immune system of the host. Severe immune-compromise in individuals is shown by a marked decrease in CD4+ T-lymphocyte count and percentage (Mofenson, et al., 2009).

The prevention of pneumocystis pneumonia involves chemoprophylaxis and is recommended for all children living with HIV aged 6 and older who have CD4+ T-lymphocyte counts of <200 cells/mm^3 or %CD4+ T-lymphocyte <15%, for children 1-5 years with CD4+ T-lymphocyte counts of <500 cells/mm^3 or %CD4+ T-lymphocyte <15%, and for all infants living with HIV younger than a year (starting at 4-6 weeks of age) regardless of CD4+ T-lymphocyte counts or percentages (Mofenson, et al., 2009).

6.5.3 Other Opportunistic and Co-existing Infections

There are many other infections and conditions that commonly occur with HIV, and may be due to the effects of HIV on the child, or secondary factors such as the treatment of HIV (e.g., ART using PIs is associated with dyslipidemia; Miller et al., 2008). The treatment of these conditions is often made complex by the need for ART in children living with HIV, as certain drug interactions are to be avoided and effects on the body may be worsened by the use of certain drug combinations. Consequently, treatment options for certain conditions may be limited. For a full list of the opportunistic infections occurring in infants and children living with HIV as well as guidelines for treatment, see Mofenson et al. (2009).

Cardiac effects of HIV can be seen even in young children and are associated with poor prognosis (Tudor, Anca, Luminos, & Mardarescu, 2010). More serious cardiac conditions (e.g., dilated cardiomyopathy) can be found in all clinical stages of HIV but they are more likely to be seen in those in later stages and in those living with AIDS. The most frequent cardiac finding in children living with HIV is left ventricle dysfunction, however clinical signs of cardiac dysfunction may be 'silent' or have no indications. Side effects of ART medications may also contribute to adverse cardiac effects in those living with HIV, as the changes in metabolism can lead to **dyslipidemia**. Dyslipidemia, in turn, can increase the risk of myocardial infarctions, especially for those with lifelong treatment. This means that the effects may not be seen in early childhood, but HIV and ART in infants and young children can cause cardiac difficulties in the future (Miller, et al., 2008). It is important to take preventative measures to keep the children as healthy as possible through diet and exercise to avoid these outcomes (Tudor, et al., 2010).

Mucocutaneous disorders are also common in children living with HIV. With increased immunosuppression, mucocutaneous outbreaks become more frequent, are often atypical (as compared to those in non-HIV populations), difficult to diagnose and resistant to treatment (Panya, Mgonda, & Massawe, 2009). Infections are usually the cause of mucocutaneous disorders. The use of ART can diminish the prevalence of some mucocutaneous disorders, although it may take considerable time to see the effects (Panya, et al., 2009).

7. Caregiving

7.1 Healthcare Professionals

In regards to the care of infants and children living with HIV, healthcare professionals have many factors to consider when ensuring the appropriate management of the disease as well as the prevention of transmission to others. Healthcare professionals are also responsible for providing support and information for family members and primary caregivers of the infant or child living with HIV. The relationship between healthcare professionals, the individual with HIV, and the family is often long-term.

7.1.1 Primary Care

Healthcare professionals should be able to recognize women at-risk for HIV infection, and subsequently the risk level of their children. Once an individual is identified as living with HIV, treatment should be initiated as appropriate (see Section 4: Treatment). After the birth of the child, treatment should be recommended and prescribed as appropriate, and a conclusive diagnosis of HIV status for the child should be made. If the healthcare professional is not an expert in HIV, a referral should be made to an infectious disease specialist, or another health professional who has experience dealing with pediatric HIV so that the woman and her child can receive the best care possible (King, 2004). Further, because an HIV diagnosis in the child indicates a maternal, if not also a paternal, HIV infection, testing is strongly recommended for both parents if a child receives an HIV diagnosis (King, 2004).

As with all patients, confidentiality should be maintained regarding the child's and mother's HIV status. This is especially important because of the stigma surrounding HIV and beliefs regarding the transmission methods and lifestyle indications of HIV (e.g., drug use and/or unsafe sexual behaviour).

All infants and children exposed to and living with HIV should receive routine vaccinations, unless otherwise indicated. As well, preventative measures should be taken against opportunistic infections that are specific to those infected with HIV (e.g., PJP chemoprophylaxis). For more information, see the *Guidelines for the Prevention and Treatment of Opportunistic Infections among HIV-exposed and HIV-infected children* (Mofenson, et al., 2009) and the *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection* (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

Breastfeeding is a method of MTCT of HIV, and is therefore not recommended. If the child is exposed to breast milk at any time, it is necessary to retest for the presence of HIV in the child. Avoiding breastfeeding can prevent postnatal transmission of HIV. Women should be counselled about the risks of breastfeeding and strongly encouraged to formula-feed their infant (Violari, et al., 2008).

Infants who are exposed to or living with HIV should receive postnatal ART to further lower the risk of transmission (see section 4: Treatment). Healthcare professionals should ensure that parents or guardians are told about the need for immediate

treatment in infants (less than 12 months) because of the possibility of rapid progression of the disease. Treatment considerations should also include the liquid formulations available, as infants and young children often cannot take pills consistently or at all. Potential side effects should be disclosed to parents and treated as necessary.

It is important for parents or guardians to be informed at all stages of the diagnosis, treatment and care processes. This is especially necessary if the mother herself has also received a new diagnosis of HIV. Treatment options, care needs, dietary recommendations and restrictions, as well as expectations for the future should be discussed. Support networks and community resources should be identified and accessed for the parents or guardians (DeGennaro & Zeitz, 2009).

It is also important for the healthcare professional to use universal precautions and to explain universal precautions to the primary caregiver in order to prevent the accidental transmission of the virus to other family members or people the child may come into contact with (e.g., friends, babysitters and classmates). Based on the recommendations from the CDC for the prevention of transmission of HIV, universal precautions apply to blood and to other body fluids containing visible blood, to semen and vaginal fluids, as well as to tissues and to **cerebrospinal fluid** (CSF), **synovial fluid**, **pleural fluid**, **peritoneal fluid**, **pericardial fluid**, and **amniotic fluid** (CDC, 2001). Universal precautions do not apply to feces, nasal secretions, saliva, **sputum**, sweat, tears, urine, and vomit unless they contain visible blood. Breast milk can transmit HIV; however, HIV is unlikely to be transmitted via exposure to breast milk to other family members, caregivers, healthcare workers, or other individuals. Gloves should be worn where the risk of exposure to breast milk may be high to avoid transmission of HIV from milk to handler (e.g., breast milk banking) (CDC, 2001).

7.2 Primary Caregivers

Primary caregivers of children living with HIV have a very important and demanding responsibility. Infants and children rely solely on their parents or caregivers for their basic needs, and in the case of pediatric HIV infection, also for medication, treatment and support. However, parents dealing with pediatric HIV may also be dealing with their own HIV-positive status and illness, which may further complicate the care that they can provide for their child.

7.2.1 HIV-Positive and HIV-Negative Caregivers

An HIV-positive status in a child often indicates an HIV infection in one or both of the parents. Parents living with HIV may face additional challenges in the care of their child and in self-care and because of this, their experience with parenting can be quite different than that of caregivers not living with HIV (Hansell & Hughes, 1999). For these parents, HIV/AIDS impacts both their personal health and their caregiving abilities. They must deal with having an ill child, while experiencing an unpredictable and progressive illness themselves (Hansell & Hughes, 1999).

Parents living with HIV may have financial restrictions, limited opportunities for formal employment, may be ill or faced with physical symptoms of HIV, may have limited social support or access to specialized programs, and/or may face isolation because of perceived or experienced stigma and discrimination from others (DeGennaro & Zeitz, 2009). They may also live with a high level of stress, shame, worry and fear for the future of both themselves and their child (Winstead et al., 2002). Parents living with HIV may also be struggling with lifestyle choices that may limit their ability to provide adequate care for the child (e.g., substance use, sex work). These factors may all act as barriers to the level of care given to the child.

Parents not living with HIV may also face many stressors when caring for children who do live with HIV, including worry and fear for the future of the child, and stigma towards themselves and the child. This stigma can lead to isolation from others (Kimani-Murage, Manderson, Norris, & Kahn, 2010).

All caregivers of children living with HIV face the additional difficulties of adherence to medication (many HAART regimens involve daily or twice-daily pills), as well as disclosure to the child regarding their HIV status. These issues will be discussed below (Section 7.6: Adherence and Section 7.7: Disclosure).

7.3 Available Supports for Caregivers

Caregivers of children living with HIV, regardless of their own HIV status, need access to and knowledge of social support and services within their area. Social support can lessen a caregiver's stress and enhance coping with the difficulties of pediatric HIV (Hansell & Hughes, 1999). Social support and support from family members can also increase adherence rates, which are vital for effective viral suppression (reduction of HIV RNA viral loads) (Sacajiu, Raveis, & Selwyn, 2009). Caregivers should be given information on:

- HIV/AIDS and progression of the disease;
- treatment (e.g., what it does, how it works);
- side effects of treatment;
- treatment options;
- other care information (e.g., nutrition, adherence strategies);
- support services available in their area;
- counselling services available in their area;
- disclosure; and
- universal precautions.

Social support can be a protective factor for many areas of HIV, including adherence, stress, stigma, and discrimination. Therefore, it is important to counsel caregivers about the importance and benefits of disclosure to trusted family members and/or friends so that they can

help with care, adherence to medications, and can support the primary caregiver. Disclosure of the child's HIV status may raise questions about the parent's HIV status; this may deter some parents from disclosure. Caregivers not living with HIV have been shown to have increased levels of social support (as compared to caregivers living with HIV); however, social support may be even more important for caregivers living with HIV (Hansell & Hughes, 1999).

Because HIV predominantly affects certain minority populations, there may be additional barriers to accessing support services such as stigma regarding the implicated lifestyle of an individual living with HIV and/or the infectious nature of HIV (Hansell & Hughes, 1999).

For a complete list of the HIV/AIDS related services in Saskatchewan, see Section 9: HIV/AIDS-related Services in Saskatchewan.

7.4 Older Caregivers

As mentioned, cases of pediatric HIV often indicate an HIV diagnosis in one or both of the parents. Depending on the time of diagnosis, treatment strategies, adherence, and progression of the disease in the parent, this may also mean that the child is living with someone other than a parent because the parent(s) has/have passed away. Often, the child is placed in the care of a grandparent (Boyer & Poindexter, 2005).

Caring for a child living with HIV can be especially difficult for older adults because of the amount of healthcare that the child needs. Getting to and from appointments, filling prescriptions, and the various costs of such needs can be difficult for older populations, especially if they are on a fixed income. These individuals may also suffer from stigma, discrimination, or isolation because of a lack of disclosure of the parent's HIV status. This may lead to a subsequent loss of social support (Boyer & Poindexter, 2005).

Elderly caregivers may also face various stresses related to later-life parenting. They may lack the energy necessary to keep up with and properly care for a young child, and may also deny themselves care in order to take care of the child. This may increase health risks for the caregiver (Boyer & Poindexter, 2005).

Childcare may be further complicated by the grandparent's lack of legal guardianship or adoptive parent status. Many parents living with HIV do not make future custodial plans for their children (Boyer & Poindexter, 2005). This may add further stress to the grandparent because of worry of one of the biological parents returning to claim the child. Older adults may also be unwilling to become adoptive parents for fear that additional income will cause them to lose financial supports that they have been receiving.

As this area has received little research, more information is necessary to know what the needs of this population are, and how to effectively help and support them in caring for children living with HIV.

7.5 Nutrition

In general, caregivers are responsible for the nutrition and food that their child receives. In the case of HIV, it is especially important to provide the right types of food for the child for reasons such as the following:

- maintaining body weight and strength;
- replacing lost vitamins and minerals;
- improving the function of the immune system and the body's ability to fight infection;
- extending the period from infection to the development of AIDS;
- improving response to treatment;
- reducing time and money spent on health care; and
- keeping children living with HIV active and productive (Food and Agriculture Organization of the United Nations (FAO) & World Health Organization, 2002).

Infants and children living with HIV often have poor growth, poor weight gain, weight loss, **wasting syndrome** and/or height stunting (Arpadi, 2000). Since HAART became available, growth outcomes have improved to the extent that in the United States, obesity rates in behaviourally-infected youth living with HIV are as high as those in non-infected youth (Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2008). The prevalence of being overweight or obese among children with HIV acquired through MTCT is not known (Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2008).

It is important to ensure that the child is receiving appropriate nutrition for his or her age, and to take preventative steps against adverse health outcomes. This requires a careful nutritional assessment and targeted intervention for the child. Appropriate growth rates for age and gender are a sign of good health in children; if these rates are not reached, a nutritional assessment can help to identify the factors involved. Growth should be monitored every three months and then compared to national growth curves to check for a deficiency (Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2008).

The diet of a child living with HIV should meet the requirements set out in Canada's Food Guide (a copy can be obtained from http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/food-guide-aliment/view_eatwell_vue_bienmang-eng.pdf). For an asymptomatic child living with HIV, a nutrient-rich diet with adequate fibre should be given in order to maintain healthy weight for his or her age, gender and height (Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2008).

If the child's HIV is progressing, nutrition is of special importance. HIV infection damages the immune system and leads to other infections and conditions, including fever and diarrhea. These conditions can lower food intake because they can reduce the appetite and interfere with the body's ability to absorb food. This results in malnourishment, weight loss and weakness in the child, which can further hinder his or her ability to fight off infections and increase recovery

time (Food and Agriculture Organization of the United Nations (FAO) & World Health Organization, 2002).

Micronutrients, such as vitamins and minerals, are very important to the development and activity of the immune system. It is important, therefore, to incorporate foods with these micronutrients into the child's diet through such foods as legumes, milk and animal products, fruits and vegetables, fats and oils, and sugars (Food and Agriculture Organization of the United Nations (FAO) & World Health Organization, 2002; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2008).

Certain complications of HIV/AIDS can be avoided or aided by the selection of certain foods, as shown in Table 6: Nutrition and HIV-related Conditions, based on the manual for *Living well with HIV/AIDS* (Food and Agriculture Organization of the United Nations (FAO) & World Health Organization, 2002).

Table 6: Nutrition and HIV-Related Conditions

CONDITION	HOW IT AFFECTS THE CHILD	NUTRITIONAL RECOMMENDATIONS
Diarrhea	• Leads to loss of water and minerals from the body • Can cause dehydration, poor absorption of food, significant weight loss and malnutrition • Can be very serious in young children if left untreated	• Drink lots of fluids (more than 8 cups per day) • Eat foods that are high in nutrients and water (e.g., fruits and vegetables, porridge, soup) • Eat refined food (soluble fibres) such as white rice, bread, noodles, and potatoes • Make sure that food is soft, peeled, and/or cooked • Avoid fats, acidic foods, coffee, tea and alcohol, spicy foods, and vegetables that are harder to digest (e.g., beans, broccoli, cabbage)
Lack of Appetite	• Can lead to weight loss • Can lead to malnutrition	• Try different foods and spices to find a desirable, varied diet with many flavours • Eat smaller meals more often • Drink fluids throughout the day, but not right before or during meals • Exercising lightly can stimulate the appetite
Nausea & Vomiting	• Loss of water and dehydration	• Drink plenty of fluids after meals • If child is too sick to eat, small and frequent drinks of water, fruit juice and vegetable soups may help • Eat dry and salty foods such as toast, crackers and cereal

CONDITION	HOW IT AFFECTS THE CHILD	NUTRITIONAL RECOMMENDATIONS
Sore Mouth or Painful to Eat	• Difficulty eating • Reduction in food intake, leading to weight loss	• Eat soft, mashed, smooth or moist foods, or add liquids to food to soften them • Drink cold drinks, soups, vegetables, and fruit juices • Use a straw for drinking fluids • Avoid very spicy and/or salty foods, and acidic foods • Do not eat foods that are too hot or cold • Avoid foods that need a lot of chewing, are sticky or hard to swallow
Other Digestive Problems (e.g., constipation, bloating)	• Destruction of the naturally occurring bacteria in the intestine needed to digest food, caused by antibiotics or other medications	• Chew food to make it easier to digest • Fermented foods can be easier to digest and help the digestion of other foods • For constipation, eat insoluble fibre-containing foods (e.g., raw vegetables, dried fruit, whole-grain cereals) • To prevent bloating, avoid foods that create gas in the stomach (e.g., beans, onion, broccoli, cauliflower, fizzy drinks) and limit/exclude sugar and sugary foods from the diet
Changes in Food Taste	• As a result of medications, foods may have different taste or texture from usual	• Experiment with different foods, and aim for a varied diet • Some spices seem to lose their taste when medicines are taken (e.g., mint, garlic, ginger), so try preparing food with sugar, vinegar or lemon instead
Skin Problems	• Can lead to skin rashes, sores, dry patches or poor healing of wounds • May be related to malnutrition or vitamin deficiencies	• Eat foods with vitamin A (yellow, orange and green vegetables and liver) • Eat foods with vitamin B6 (cereals, kernels, whole grains, seeds and nuts, as well as figs and green leafy vegetables)
Colds, coughs & influenza	• Can cause a runny nose, sore throat, cough and fever	• Drink plenty of fluids and get plenty of rest • Breathe in hot vapours with eucalyptus, mint or thyme leaves added

7.6 Adherence

Once infants or children beginART, it is recommended that they stay on this treatment regimen for the rest of their lives, although the medications and dosages may change. This means that infants and children may be taking several pills, once or twice a day, for many years. Because

young children are completely dependent upon their caregivers to meet their basic needs, parents or caregivers are also responsible for ensuring that medications are given as prescribed.

In order to achieve maximal effectiveness, adherence to an ART regimen must be extremely high. Significant viral load differences have been reported between those who were 90-95% adherent and those who were 95-100% adherent (Beals, Wight, Aneshensel, Murphy, & Miller-Martinez, 2006). Adherence refers to the extent to which a person's behaviour (e.g., taking medication, following a diet, changing lifestyle) corresponds with agreed recommendations from a health care provider (Hammami et al., 2004; Pontali, 2005). Even moderate non-adherence to ART can have negative consequences, such as the risk of a further compromised immune system as shown by a higher viral load and/or lower CD4+ T-lymphocyte counts, and the risk of developing drug-resistant strains of HIV which can lead to the exclusion of a certain drug or family of drugs from possible treatment regimens (R. Steele et al., 2001).

High levels of adherence can be challenging. There are many factors that affect adherence. These include factors related to the caregiver, the treatment and treatment options available for children with HIV, the health care system, and the patients themselves.

7.6.1 Caregivers and Adherence

Caregivers play a very important role in adherence, as the child relies completely on them for their medication needs, which include doctor's visits to prescribe the medication, picking the medication up, administering the medication at the appropriate times and refilling prescriptions when necessary. Children may not know what medications they are taking or why they are taking them. They may not even know that the medications are related to HIV, or that they have HIV. This necessitates the caregiver to be adherent for the child (Pontali, 2005).

Pontali (2005) notes that caregivers may be facing difficulties of their own that make adherence for the child difficult. Caregivers may be living with HIV themselves, or have a family member who is living with HIV. This may mean they are coping with the difficulties related to their own illness (e.g., complex medication regimens, doctor's visits, psychosocial issues) or may be caring for more than one person with HIV. Caregivers may also be engaging in dangerous lifestyles and/or high-risk behaviours that may preclude their ability to provide the necessary adherence levels and support for the child. Dealing with a serious illness has many side effects and caregivers may experience anxiety, depression, fear, or guilt regarding HIV.

Caregivers may also be wary of administering medication in situations where the child's HIV status may be discovered (Pontali, 2005). This may become especially apparent as the child gets older and spends more time away from their primary caregivers (e.g., at daycare, school, or sleepovers), making it more difficult to provide medication at the appropriate times.

The caregivers' attitudes towards ART can also play a large role in adherence. If caregivers do not believe that the child's HIV will be affected by ART, they will be less likely to administer the medications regularly. As well, they may want to limit ART because of the adverse effects it has on the child, believing that the medications are harming more than helping (Wrubel et al., 2005).

7.6.2 Treatment and Adherence

The treatment options available for infants and small children can also affect their adherence to medication. Fewer options are available for these populations than for adults because of the limited testing that has been done on the safety and effectiveness of certain ART medications for infants and children. Although there are still a variety of medications available for infants and children, the options become fewer for second-line treatments which are used in the case of treatment failure, drug resistance or high levels of toxicity. In order to improve adherence in infants and children, ART drugs should: have appropriate formulations (e.g., liquid forms, small or easily crushable tablets), have child-specific dosing information, require only once or twice daily administrations, have low food to drug or drug to drug interactions, be easily combinable with other ART drugs, and be tolerable (Pontali, 2005).

The amount of medication needed, the strict timing of doses and/or the frequency of medication administration can also complicate adherence. ART can also have many side effects which may also reduce adherence (see section 6.4: Effects of Treatment for more information).

7.6.3 Healthcare Systems and Adherence

The health care system can also affect adherence. Although smaller centres and clinics may be more accessible, these facilities may also have less expertise and experience regarding HIV than larger hospitals or health care centres. As well, access to other health-related needs and support services (e.g., pharmacies, counselling) may be limited for many women and families. This may affect their adherence because of a lack of access to medications, lack of knowledge regarding the need for a high level of adherence, and/or lack of support for the caregiver, child and family (Malee et al., 2011; Pontali, 2005).

7.6.4 Children and Adherence

The child living with HIV can also affect adherence to ART. The child may not want to take the medications (refusal), or may be unable to take medication (e.g., pills). The child may also not understand his or her illness, and therefore may not comprehend the need for medication. It is unclear how disclosure to the child about his or her HIV status affects the child's adherence, as studies have had conflicting results (Pontali, 2005).

7.6.5 Strategies for Adherence

There are several strategies to facilitate adherence. Several of these are related to knowledge about the need for adherence and how medication affects HIV. These involve the provision of information (e.g., written and visual materials), demonstrations on the use of syringes, medication cups and pill boxes, and the provision of adherence tools such as a daily schedule that notes the time and dosage of medication. Other strategies are related to reminders for taking medication, such as notes, timers, diaries, calendars and pill sorters. To encourage children to take the medication, training young children to swallow pills and/or mixing pills with food to disguise the taste can help to improve adherence as well (Pontali, 2005).

7.7 Disclosure

Disclosure to children about what HIV is, their HIV-positive status, and how it was transmitted to them can be very difficult for parents or caregivers, especially if one or both of the parents are living with HIV themselves (Mellins et al., 2002). Disclosure should be treated as a process, not a one-time event, especially as children understand their health differently as they age (Mellins, et al., 2002). For the purpose of this report, disclosure in terms of children from birth to age 6 will be discussed, although full disclosure and understanding may not occur until the child is much older.

7.7.1 Need for Disclosure

Disclosure is important for children as it can promote trust between caregiver and child, and between the child and health professionals. As well, it can help to engage the child in his or her own medical care, and can thus promote adherence to medication regimens. It can also enhance long term physical and mental health (Mellins, et al., 2002), as well as short-term mental health in terms of improved self-esteem, decreased problematic behaviour, and less psychological distress (Domek, 2010). The benefits of disclosure are not limited to the child only, but can also have positive effects on the mental health of caregivers by decreasing stress, psychological distress and depression (Domek, 2010). Disclosure to the child, especially as he or she reaches puberty, is especially important in preventing the spread of HIV through accidental or behavioural transmission (Domek, 2010).

Disclosure often does not happen until after age 5, but children may begin to wonder why they are sick at times, or why they have to take medications daily, especially if they otherwise feel well. Rates of disclosure increase significantly with the age of the child (Mellins, et al., 2002). Thus, non-disclosure may be a result of the parents' or caregivers' own concerns, rather than a lack of interest and desire for understanding from the child (Mellins, et al., 2002). Disclosure may also be related to health status.

Children who are more symptomatic or more immune-compromised are more likely than children who are largely asymptomatic to have learned about their HIV status. Caregivers may also feel that children in this situation deserve to know about what their illness is. As their HIV progresses, and doctor's visits become more frequent, children themselves may be more likely to figure out that they are ill, and potentially what their illness is (Mellins, et al., 2002).

7.7.2 Barriers to Disclosure

There are many barriers that preclude a caregiver's or parent's disclosure to their child about the child's HIV-positive status. These may be dependent on the parent's or caregiver's HIV status, as non-biological or uninfected caregivers may be less concerned about the barriers surrounding disclosure (e.g., stigma) and therefore may be more likely to disclose the child's status than parents not living with HIV (Mellins, et al., 2002). Barriers to disclosure include the following:

- a belief that the child will be overwhelmed by the information;
- a belief that the child lacks the maturity to understand the information and diagnosis;
- a belief that the child is too young;
- a desire to not upset the child;
- that the child is not asking questions, however the child may not ask questions because they are afraid, or hope their illness is due to something else, or because of cultural restraint;
- a fear of the child's subsequent and unintended disclosure of their status (and potentially the parent's status as well) to others;
- a fear of stigma and ostracism should the child tell others about his or her diagnosis;
- a feeling of guilt about the source of the child's HIV transmission, or worry about questions regarding the parent's lifestyles, blame, judgement, and/or damage to the parent-child relationship;
- an uncertainty by caregiver or parent on how to initiate the disclosure process;
- a difficulty, emotionally and/or psychologically, for the caregiver in providing disclosure; and
- a lack of information to explain the diagnosis or answer the child's questions (Domek, 2010; Mellins, et al.; Vaz et al., 2008).

Despite the apparent obstacles, disclosure is very important. Health professionals should encourage parents or caregivers to begin the disclosure process with their child and information on HIV should be made available to the parent to aid them in answering any of the child's questions. Although healthcare professionals may believe that disclosure should occur, they should respect the caregiver's preferences regarding disclosure of the child's HIV diagnosis (Mellins, et al., 2002). Healthcare professionals and other support services should help the parent or caregiver with disclosure by giving

information on how to deal with HIV in a child-friendly and age-specific way, what to tell and what not to tell regarding HIV, how to deal with the parent's own emotions and fears about HIV and their child's diagnosis, and by balancing the advantages and disadvantages of disclosure based on the personal context (Nöstlinger et al., 2004). As this is a newer area of study, more research is necessary to determine exact child- and age-specific approaches to disclosure, and the process of disclosure that is best for families in this situation.

8. Neurological, Psychiatric and Social Factors

8.1 Neurological Disorders

In both children and adults, HIV can have an effect on neurological development and functioning. This is especially devastating in children, as their brains are developing quickly, and damage can be permanent. One of the most prevalent conditions affecting neurological development in children with HIV is HIV-related encephalopathy.

HIV-related encephalopathy has two different presentations in children. The first involves an early onset, with a rapid progression of symptoms and effects. Three-quarters of children with encephalopathy are diagnosed before they are 3 years of age, and the estimated survival after diagnosis is less than 2 years. Clinical presentations of early onset HIV-related encephalopathy include a halt in head growth, loss of developmental milestones or failure to achieve new milestones, and progressive development of central nervous system symptoms (e.g., weakness and/or flaccidity leading to spastic paraparesis or quadriparesis). The progression of the disease is generally quite rapid, between 1 to 2 months (Forsyth, 2003; Wachsler-Felder & Golden, 2002).

The second presentation of HIV-related encephalopathy has a later onset with a slower progression of symptoms. This group does not lose milestones, but rather developmental deficits become more evident as they age and new skills are acquired more slowly. They may also exhibit lowered academic performance, problems with attention and possibly conduct disorders. Motor, cognitive and language deficits are also potential symptoms (Forsyth, 2003; Wachsler-Felder & Golden, 2002).

The presence of HIV-related encephalopathy and other neurological effects of HIV can lead to difficulties in school and at home. The damage to the brain can also lead to other conditions and psychiatric disorders (Forsyth, 2003; Wachsler-Felder & Golden, 2002). Special considerations for learning, teaching and development need to be developed through further research.

8.2 Psychiatric Disorders

Infants and children living with HIV have been shown to have significant neurological, developmental, cognitive, and language deficits. These may all affect the child's behaviour in the home and in the outer environment (e.g., at daycare, school). Children living with HIV often

have difficulties at school which affect their academic performance, development, and ability to function independently.

There are many factors associated with HIV/AIDS that can contribute to the development of a psychiatric disorder, as shown in Table 7: Factors Contributing to Psychiatric Disorders in Children Living with HIV; these factors can also influence each other (Rao, Sagar, Kabra, & Lodha, 2007).

Table 7: Factors Contributing to Psychiatric Disorders in Children Living with HIV

TYPE OF FACTOR	FACTOR AND EFFECT
Biological factors	• The effect of HIV on the central nervous system, which can cause brain damage and/or changes • Physical difficulties because of the effects of HIV on the body, leading to body image disturbances • Neuropsychiatric effects from medication used to treat HIV
Familial factors	• Parent-child relationship • Family environment, which can contribute to psychiatric disorders in many ways (e.g., poverty, drug use, poor support systems) • Family conflict and stress because of the illness
Psychological factors	• Isolation from peers due to stigma, discrimination, and/or repeated, long-term hospitalizations, which can have an adverse effect on the child's social, cognitive, and communicative development • Knowledge of HIV status through disclosure of HIV infection, which can lead to adjustment problems • Fear of death and suffering, which can be a source of anxiety and stress for the child • Loss of a parent or sibling due to AIDS, which can lead to anxiety and depression • Parental illness, which can limit care for the child and can lead to anxiety, behavioural and/or depressive disorders

The prevalence of psychiatric disorders in children with HIV is largely unknown. It is difficult to diagnose psychiatric disorders in children because of confusion between non-pathological states (e.g., grief, mourning) and psychiatric illness such as depression and anxiety, and the possibility that symptoms appearing to indicate psychiatric disorders may actually be attributable to conditions resulting from HIV infection or medications used to treat HIV (Rao, et al., 2007).

Despite the difficulties in diagnosis and the limited studies that have focused on psychiatric disorders in children of this age group, research has indicated that rates of psychiatric disorders are higher in children living with HIV than in non-infected individuals. The most common disorders for children are depression, anxiety disorders (e.g., separation anxiety disorder),

disruptive and conduct disorders, and hyperactivity disorders (Bachanas et al., 2001; Rao, et al., 2007).

HIV can have effects on neurodevelopment, therefore some developmental and learning difficulties can be attributed to the disease itself; however, the home environment of the child can also contribute to such difficulties. The prevalence of psychiatric disorders is higher in lower socio-economic classes, where a high proportion of pediatric HIV cases occur. In these cases, it can be difficult to determine whether the psychiatric disorder is due to the HIV infection itself, or whether it is due to the family environment. The extent that each of these factors exerts on the development of the child is unknown, and further research must be done. As treatment for HIV becomes more effective, increasing numbers of children living with HIV will be attending daycare and school, and staff must know how to effectively respond to these children.

8.3 Home Environment

Family and the home environment can play a large role in the development of psychiatric disorders. The prevalence of substance use in families affected by HIV has resulted in HIV and AIDS disproportionately affecting children in poor and/or minority populations, who often have higher incidence of substance use (Forsyth, 2003; Mellins et al., 2009; Remien & Mellins, 2007). Parents often have limited education, are unemployed, live in unstable housing, and may themselves be dealing with HIV or AIDS (Forsyth, 2003; Remien & Mellins, 2007).

It is likely that the stresses of living in a disadvantaged environment can be a strong predictor for the development of a psychiatric disorder in children living with HIV. In several studies, no differences were found in the rates of psychiatric disorders between HIV-positive and HIV-negative children in low socioeconomic neighbourhoods (R. Steele, Nelson, & Cole, 2007). Home environments with abuse (physical, psychological and/or sexual) have also been linked to neurobiological effects in children, which can affect the development of psychiatric disorders in both HIV-positive and -negative children (R. Steele, et al., 2007).

As well, living with a parent who has a terminal illness can also influence psychiatric disorders in children living with HIV. If the parent has HIV, he or she may become sicker as the HIV progresses to AIDS. Children may see their parent(s) becoming more ill and maybe even die. This is a devastating event for any child, but can be especially traumatizing when the child has the same illness (Domek, 2009). Parental death is one of the strongest predictors of child mental health problems (Mellins, et al., 2009). Children orphaned by AIDS often face instability in their environment and are often shuffled between the homes of family members, foster homes, and/or adoptive homes. Sibling separation may further exacerbate any stress, anxiety and fear that the child might face (Bachanas, et al., 2001; Domek, 2009).

The social isolation and discrimination that children living with HIV face can possibly lead to psychiatric disorders, especially when they reach school age and desire to fit in with their peers.

They may not understand this stigma, and therefore may become depressed, or have behavioural difficulties (Domek, 2009; Rao, et al., 2007).

Both social and familial factors can have a great influence on children living with HIV. Even without an HIV diagnosis, children in disadvantaged living conditions are at higher risk of developing psychiatric disorders (R. Steele, et al., 2007). Further research is necessary to determine the link between psychiatric disorders, HIV and family environment. It is important to determine how family and home environments can be strengthened to help support children and families affected by HIV, and to learn how to reduce the rate of psychiatric disorders in these populations.

8.4 School/Daycare

With the use of more effective treatments (i.e., HAART), the progression of HIV has been delayed into older ages. This has given children living with HIV the chance to go to daycare and school. Aside from their need for daily medication, children living with HIV may not be distinguishable from their playmates; however, they may have underlying issues due to their disease. This necessitates families, teachers, schools and other caregivers being prepared for students living with HIV being in the classroom.

Children living with HIV face health and educational challenges. As previously discussed, HIV can affect neuro-development, which can lead to difficulties at school, learning disabilities, or the requirement for special services. HIV has also been associated with psychological disorders (see Section 8.2: Psychological Disorders), which may further complicate school life for the child.

As his or her disease progresses, the child may need more medical care, doctor's appointments, and/or hospital stays. As a result, there may be an increase of school absences. Absenteeism can lead to lowered academic performance, questions from classmates and/or teachers, and further difficulty in school (Cohen et al., 1997; Franks, Miller, Wolff, & Landry, 2004; Mialky, Vagnoni, & Rutstein, 2001).

As children living with HIV often have a parent and possibly another family member who is also living with HIV, they may also experience the serious illness or loss of this family member. This can lead to further difficulties and absences from school or daycare as the child is grieving and dealing with the loss of a loved one (Franks, et al., 2004).

Parents can choose whether to disclose their child's HIV status to the school. Parents or caregivers may worry about the stigma or discrimination that the child may face as a result of disclosure. Parents may be concerned about confidentiality within the school. As such, many parents or caregivers decide not to disclose their child's HIV-positive status to their school or daycare (Mialky, et al., 2001). Keeping the child's HIV-positive status a secret becomes increasingly difficult as the disease progresses. For example, more medications may be needed and they may need to be taken at school or more absences from school due to hospital visits

(Cohen, et al., 1997). Support from healthcare providers may increase the family's ability to disclose the child's HIV status to others, including relevant daycare and school staff (Cohen, et al., 1997).

Daycare staff and teachers must be prepared for the possibility of students living with HIV being placed into their care. Franks, Miller, Wolff, and Landry (2004) note that although these staff members are not expected to be medical personnel, they need to understand the basic information surrounding HIV and how HIV can affect them and the children in their care. They must also be able to provide support for the child living with HIV and to prevent the horizontal transmission of HIV through accidental exposures (e.g., biting).

The daycare worker, teacher or other school workers need access to and knowledge of the following information:

- universal precautions for the prevention of transmission of HIV;
- how HIV is and is not transmitted;
- the physical and emotional effects of HIV and its treatment on children living with HIV;
- the learning difficulties that may be experienced by children living with HIV, and the need for personalized and specialized education;
- awareness of their own and others' attitudes towards HIV;
- awareness of the possible behavioural and physical changes that may occur in the child's life due to their HIV status, and that their behaviour may be influenced by their HIV status (e.g., fear of death, living with illness and medical treatment, and/or loss of a loved one) (Franks, et al., 2004).

9. Conclusion

Pediatric HIV is an important issue to address in Saskatchewan given the relatively high number of cases of pediatric infection in Saskatchewan compared to the rest of Canada. Infants and children with HIV require special treatment and care, yet there is limited information on best practices and appropriate drug formulations for this population.

Prevention or a reduction of the risk of perinatal HIV transmission is possible in Saskatchewan. Appropriate and timely prenatal screening of at-risk pregnant women and treatment of HIV-positive pregnant women is necessary for the most effective prevention options. Although less effective than prenatal and perinatal strategies, postnatal testing can also help to reduce the risk of HIV transmission.

If a child does acquire HIV from his or her mother, it is important to begin treatment (as described by the guidelines) to slow the progression of HIV. Infants under the age of one year are at an increased risk of a rapid progression to AIDS, and as such, it is important for them to begin ART as

soon as possible. For older children, it is important for them to be assessed for their HIV clinical and immunological stages, and then to begin treatment as necessary.

There are many opportunistic infections associated with pediatric HIV. Prevention of these involves vaccinations for young children, limiting contact with infected individuals and adherence to HAART. If opportunistic infections do occur, it is important to treat them as effectively as possible.

Caring for an infant or child with HIV can be difficult because of the need for adherence to medication, the eventual disclosure of their HIV status, and the possibility of intermittent illnesses and hospital stays. This can be exacerbated by a parent's own HIV status, or potentially, the stresses of a grandparent or other family member raising the child. There are many other potential stressors that are apparent in families affected by HIV such as loss of a parent, sibling separation, lifestyle factors (e.g., drug use), and poverty. In caring for the child and their family, appropriate support services need to be made available so that further damage to the family can be prevented, and the family unit can be strengthened.

Stigma and discrimination play a large role in the perception of HIV and the life of HIV-positive children and other individuals. Promotion of HIV prevention and information about HIV can help to reduce stigma in our society, and can help to support individuals with HIV in schools, workplaces, and other environments.

10. Support Services

HIV/AIDS Service Organizations in Saskatchewan:

Prince Albert

601 North Outreach
101 - 15th Street East
Prince Albert, SK S6V 1G1
Phone: 306-922-4279

Regina

AIDS Programs South Saskatchewan (APSS)
2911 – 5th Avenue
Regina, SK S4T 0L4
Phone: 306-924-8420

All Nations Hope AIDS Network (ANHAN)
2735 – 5th Avenue
Regina, SK S4T 0L2
Phone: 306-924-8424

Saskatoon

AIDS Saskatoon
1143 Avenue F North
Saskatoon, SK S7L 1X1
Phone: 306-242-5005

Persons Living With AIDS (PLWA) Network
127C Avenue D North
Saskatoon, SK S7M 1M5
Phone: 306-373-7766

STC Health Centre (formerly known as SHARP)
1514 - 20th Street West
Saskatoon, SK S7M 0Z6
Phone: 306-956-0340

Yorkton

601 East Outreach
130-345 Broadway Street West
Yorkton, SK S3N 0N8
Phone: 306-783-1722

Infectious Disease Specialists in Saskatchewan:

Regina

General Infectious Disease Specialists

Dr. Valda Chijide
Phone: 306-766-3915

Dr. Kumudhini Karunakaran
Phone: 306-766-3915

Saskatoon

General Infectious Disease Specialists

Dr. Oscar Larios
Phone: 306-655-7494

Dr. Karen McClean
Phone: 306-655-1777

Dr. Kurt Williams
Phone: 306-655-1777

Dr. Stephen Sanche
Phone: 306-655-6658

Dr. Stu Skinner
Phone: 306-655-1785

Pediatric Infectious Disease Specialists

Dr. Athena McConnell
Phone: 306-966-7927

Dr. Ben Tan
Phone: 306-966-7927

Positive Living Program
Royal University Hospital
103 Hospital Drive
Saskatoon, SK S7N 0W8
Phone: 306-655-1783

Family Support and Outreach Services:

Regina

Rainbow Youth Centre
Kids First Program
977 McTavish Street
Regina, SK
Phone: 306-757-9759

Healthiest Babies Possible Program
Four Directions Health Centre
3510-5th Avenue
Regina, SK
Phone: 306-766-7540

Indian Metis Christian Fellowship
3131 Dewdney Avenue
Regina, SK
Phone: 306-359-1096

Carmichael Outreach
1925 Osler Street
Regina, SK
Phone: 306-757-2235

Catholic Family Services
974 Albert Street
Regina, SK
Phone: 306-525-0521

Family Services Regina
2020 Halifax Street
Regina, SK
Phone: 306-757-6675

Circle Project
1115 Pasqua Street Prenatal &
Early Childhood Development
Regina, SK
Phone: 306-569-5988

Saskatchewan Community Resources – Family & Youth Services
1920 Broad Street
Regina, SK S4P 3V6
Phone: 306-787-3648
Fax: 306-787-0925
Website: www.dcre.gov.sk.ca/

Aboriginal Head Start Program (AHS)
Canada Prenatal Nutrition Program (CPNP)
Community Action Program for Children (CAPC)
Public Health Agency of Canada
1920 Broad Street
Regina, SK S4P 3V2
Phone: 306-780-6944
Fax: 306-780-6207
Website: www.hc-sc.gc.ca

Aboriginal Family Service Centre
1102 Angus Street
Regina, SK
Phone: 306-525-4161

Child & Youth Services
1680 Albert Street
Regina, SK
Phone: 306-766-6700

KidsFirst Program
Programs
1st Floor, 2220 College Avenue
Regina, SK S4P 3V7
Phone: 306-787-8301

Regina Native Youth & Community Services Inc.
5111 – 3rd Avenue
Regina, SK S4T 0G1
Phone: 306-949-9600

Prince Albert

Baby S.A.F.E. (Substance Abuse Free Environment) Program
c/o Family Futures
1895 Central Avenue B West
Prince Albert, SK S6V 4W8
Phone: 306-763-0760
Fax: 306-763-8165

Catholic Family Services of Prince Albert Inc.
#300, 1008 – 1st Ave West
Prince Albert, SK S6V 4Y4
Phone: 306-922-3202

Saskatoon

Métis Addictions Council of Saskatchewan Incorporated (MACSI) - Head Office
100 - 219 Robin Crescent
Saskatoon, SK S7L 6M8
Phone: 306-651-3021
Fax: 306-651-2639
Toll-free: 1-800-236-5204 (in SK)

Family Support Centre
315 Avenue M South
Saskatoon, SK S7K 2H6
Phone: 306-933-7751
Fax: 306-933-5665
Website: www.dcre.gov.sk.ca/

Family Service Saskatoon Inc.
102, 506 – 25 Street East
Saskatoon, SK S7K 4A7
Phone: 306-244-0127
Website: http://www.familyservice.sk.ca/

Saskatoon Tribal Council Health & Family Services Inc.
200 - 335 Packham Avenue
Saskatoon, SK S7N 4S1
Phone: 306-956-6100

FASD Support Network of Saskatchewan
510 Cynthia Street
Saskatoon, SK S7L 7K7
Toll-free: 1-866-673-3276
Phone: 306-975-0884
Fax: 306-242-8007
Website: www.skfasnetwork.ca

Catholic Family Services (CFS)
202 – 506 – 25th Street East
Saskatoon, SK S7K 4A7
Phone: 306-244-7773
Website: http://www.cfssaskatoon.sk.ca/

La Ronge

New Beginnings Program
Box 6000
La Ronge, SK S0J 1L0
Phone: 306-425-4840
Fax: 306-425-8514

La Ronge Native Women's Council Inc.
P.O Box 888
La Ronge, SK S0J 1L0
Phone: 306-425-3900

Melfort

North East Crisis Outreach & Support Services Inc.
P.O. Box 2066
Melfort, SK S0E 1A0
Phone: 306-752-9464

Humboldt

Partners for Rural Family Support
636 9th Street
P.O. Box 2741
Humboldt, SK S0K 2A0
Phone: 306-682-4135
Toll-free 1-866- 682-4135

Moose Jaw

Saskatchewan Community Resources - Community Living Division
205-110 Ominica Street West
Moose Jaw, SK S6H 6V2
Phone: 306-894-3565
Website: www.dcre.gov.sk.ca/

The Moose Jaw Women's Transition Association
P.O. Box 1866
Moose Jaw, SK S6H 7N6
Phone: 306-693-6511

North Battleford

Métis Addictions Council of Saskatchewan (MACSI)
Box 1752
North Battleford, SK S9A 3W2
Phone: 306-445-3319
Fax: 306-445-9830

Catholic Family Services of the Battlefords
Box 373
North Battleford, SK S9A 2Y3
Phone: 306-445-6960
Website: http://www.cfspa.org/

Yorkton

Yorkton Women in Need
P.O. Box 1828
Yorkton, SK S3N 3R3
Phone: 306-787-7233

Yorkton Tribal Council Child and Family Services
21 Bradbrooke Drive North
Yorkton, SK S3N 3R1
Phone: 306-782-8838
Toll Free: 888-895-1243

Other Areas of the Province

TFHQ Safe Shelter Inc
Qu'Appelle Haven of Hope
Box 457
Fort Qu'Appelle, SK S0G 1S0
Phone: 306-332-6881

Métis Addictions Council of Saskatchewan Incorporated (MACSI) – Archerwill
Box 158
Archerwill, SK S0E 0B0
Phone: 306-323-4232
Fax: 306-323-4520

West Central Crisis and Family Support Centre
Box 2235
Kindersley, SK S0L 1S0
Phone: 306-463-6655

Hudson Bay & Family Support Centre
P.O. Box 405
Hudson Bay, SK S0E 0Y0
Phone: 306-865-3064

North West Friendship Centre
P.O. Box 1780
Meadow Lake, SK S0M 1V0
Phone: 306-236-3766

Further Information (Provincial & National):

Saskatchewan Health
Community Care Branch
3475 Albert Street
Regina, SK S4S 6X6
Tel: (306) 787-1501
Fax: (306) 787-7095
Website: www.health.gov.sk.ca

Best Start: Ontario's Maternal, Newborn & Early Child Development Resource Centre
180 Dundas St. W, Suite 190
Toronto, ON M5G 1Z8
Phone: (toll-free) 1-800-397-9567
Website: www.beststart.org

College of Physicians & Surgeons of Saskatchewan
211 Fourth Avenue South
Saskatoon, SK S7K 1N1
Tel: (306) 244-7355
Fax: (306) 244-0090

Motherisk – The Hospital for Sick Children, University of Toronto
Alcohol and Substance Use in Pregnancy
Phone: (toll-free) 1-877-327-4636
Website: www.motherisk.org

Northern Inter-Tribal Health Authority
2300-10th Ave W
Cottage 11
Prince Albert, SK S 6V 5S4
Tel: (306) 953-0670

Saskatchewan Prevention Institute
1319 Colony Street
Saskatoon, SK S7N 2Z1
Phone: 306-655-2512
Fax: 306-655-2511
Website: www.skprevention.ca

First Nations and Inuit Health Branch
Website:
www.hc-sc.gc.ca/fnih-spni/index_e.html

Public Health Agency of Canada
National FASD Initiative
Website: www.publichealth.gc.ca/fasd

11. Glossary

Acquired immune deficiency syndrome (AIDS): severe HIV-related immunosuppression indicated by a CD4+ count of less than 200 and one or more opportunist infections (Pubmed Health, 2010a).

Acute necrotizing ulcerative gingivitis/periodontitis: a painful bacterial infection that involves swelling (inflammation) and ulcers in the gums, and can lead to inflammation and infection of the ligaments and bones that support the teeth (periodontitis); also known as trench mouth (Pubmed Health, 2010y).

Adherence: refers to the extent to which a person's behaviour (e.g., taking medication, following a diet, changing lifestyle) corresponds with agreed recommendations from a healthcare provider (Hammami, et al., 2004).

Amniotic fluid: a clear, slightly yellowish fluid that surrounds the fetus during pregnancy and is contained in the amniotic sac (Pubmed Health, 2009a).

Anemia: a condition where the number of healthy red blood cells decrease, which thereby decreases oxygen flow to the rest of the body (Medline Plus, 2011b).

Antibody: proteins produced by the body's immune system when it detects any harmful substances (antigens), or what it believes to be harmful substances (PubMed Health, 2010b).

Antigen: a substance that causes the immune system to produce antibodies; can be a foreign substance from the environment (e.g., bacteria, virus, chemicals), or may also be formed within the body (e.g., bacterial toxins or tissue cells) (Pubmed Health, 2009b).

Antiretroviral Therapy (ART): treatment for individuals with HIV using anti-HIV drugs, generally consisting of a combination of at least three drugs that suppress HIV replication. Drug combinations are used to reduce the risk of the virus developing resistance (World Health Organization, 2011).

Ascites: excess fluid in the space between the tissues lining the abdomen and abdominal organs (peritoneal cavity) (Pubmed Health, 2010c).

Behavioural transmission: when HIV transmission occurs through unprotected vaginal or anal sexual contact, sharing needles and other drug equipment, or tattooing using needles (Positive Women's Network Society, 2001).

Bronchiectasis: destruction and widening of large airways (Pubmed Health, 2010d).

Candidiasis: a fungal disease of the mouth, tongue and oral tract; found only in immune-suppressed individuals or those with HIV. It is also an AIDS-defining condition, occurring in individuals with low CD4+ counts (<200 cells/µL) (AIDS Education and Training Centers, 2011).

Cardiomyopathy: a weakening of the heart muscle or a change in the heart muscle structure (e.g., inadequate heart pumping) (Pubmed Health, 2010e).

CD4+ T-lymphocytes: a type of **white blood cell**; part of the immune system (Joint United Nations Programme on HIV/AIDS, 2008).

Central lipohypertrophy: excessive fat growth, especially around the midsection (AIDS Info, 2005c).

Cerebrospinal fluid: the fluid that surrounds the brain and spinal cord, acting as a cushion to protect them from injury (Pubmed Health, 2009d).

Combination therapy: taking two or more antiretroviral drugs at a time (Avert, 2011b).

Cord blood: the blood that remains in the umbilical cord and placenta following delivery of the baby. Cord blood contains all of the normal elements of blood (red blood cells, white blood cells, platelets and plasma), as well as stem cells (National Cord Blood Program, 2010).

Cryptosporidiosis: an infection that occurs when the small intestine is infected with the parasite *Cryptosporidium* that causes diarrhea, which can lead to severe malnutrition and loss of muscle and body mass in those with HIV/AIDS (PubMed Health, 2010g).

Cytomegalovirus disease: a herpes-type virus that can cause disease in different parts of the body such as the esophagus, stomach or intestines, eye or lung, with symptoms similar to those of mononucleosis (Pubmed Health, 2009f).

Deoxyribonucleic Acid (DNA): the genetic material in humans, and is passed from parent to child (National Human Genome Research Institute, 2011).

Diabetes Mellitus (DM): a chronic condition caused by the body's inability to sufficiently produce and/or properly use insulin, which is needed by cells to process glucose and create energy (Public Health Agency of Canada, 2003).

Diarrhea: a condition where the individual has loose, watery stools more than three times in one day (Mayo Clinic, 2010).

Dyslipidemia: Excess amount of fatty substances (e.g., cholesterol and triglycerides) in the blood (PubMed Health, 2010m).

Dyspnea: difficulty breathing, or uncomfortable breathing, or a feeling of not getting enough air (PubMed Health, 2009c).

Early progressors: individuals who exhibit a pattern of HIV progression where the HIV progresses to AIDS and death early in life (before 12 months of age) (The European Collaborative Study, 2001).

Extra-pulmonary cryptococcosis: an infection caused by the *Cryptococcus neoformans* fungus that enters the lungs and has spread throughout the body (disseminate) (PubMed Health, 2010f).

Extra-pulmonary tuberculosis: see tuberculosis, disseminated.

Facial/peripheral lipoatrophy: fat wasting or fat loss from particular areas of the body, including the arms, legs, face and buttocks (AIDS Info, 2005c).

Fever: a temporary increase in the body's temperature in response to some disease or illness (Medline Plus, 2010b).

Fistula: an abnormal connection between an organ, vessel, or intestine and other structure as a result of injury, surgery, infection or inflammation (Pubmed Health, 2009g).

Fungal disease, disseminated and severe: see mycosis, disseminated and endemic.

Fungal nail infection: an infection of the nails by a fungus (Pubmed Health, 2010i).

Fusion inhibitors: a type of antiretroviral therapy that prevents HIV from binding to or entering human immune cells (Avert, 2011b).

Gibbus: also known as kyphosis; a curving of the spine that causes a bowing or rounding of the back which leads to a hunchback or slouching posture (Pubmed Health, 2010p).

Hematologic effects: conditions that affect the blood and its functioning (American Society of Hematology, 2011).

Hepatic toxicity: A general term for liver damage, including inflammation of the liver (hepatitis), death of liver cells (hepatic necrosis), and overabundance of fat in the liver (hepatic steatosis) (AIDS Info, 2005a).

Hepatitis B: a swelling or inflammation of the liver due to the Hepatitis B Virus (HBV) (PubMed Health, 2010j).

Hepatitis C: a viral disease, caused by the hepatitis C virus, that leads to swelling (inflammation) of the liver (PubMed Health, 2010k).

Hepatosplenomegaly: enlargement of the liver and spleen beyond their normal sizes (PubMed Health, 2010l).

Herpes simplex: a viral infection caused by the herpes simplex virus (HSV) that causes ulcers (small blisters) and mainly affects the mouth or genital area (Medline Plus, 2011a).

Herpes zoster: a painful, blistering skin rash due to the varicella-zoster virus; also called shingles (PubMed Health, 2010v).

Herpesvirus 6: a human herpes virus that causes roseola infantum (Braun, et al., 1997).

Herpesvirus 7: a human herpes virus that is very common and is closely related to herpesvirus 6; its effect on humans is yet unconfirmed (European Bioinformatics Institute (EBI), 2011).

Highly Active Antiretroviral Therapy (HAART): taking a combination of three or more antiretroviral drugs at a time (Avert, 2011b).

HIV p24 antigen: the major internal core protein of the HIV virus (King, 2004).

HIV-related encephalopathy: characterized by a progressive impairment in cognitive function that is accompanied by behavioural changes and motor abnormalities; also known as AIDS-related dementia complex, AIDS-related dementia (National Institute of Neurological Disorders and Stroke, 2006).

Human Immunodeficiency Virus (HIV): a virus that attacks the immune system, leading to Auto Immune Deficiency Syndrome (AIDS) (Positive Women's Network Society, 2001).

Hyperbilirubinemia: excess bilirubin in the blood caused by improper liver functioning. Bilirubin is produced when red blood cells are broken down, and is normally removed from the blood by the liver. Excess bilirubin causes jaundice (Mayo Clinic, 2011a).

Hyperglycemia: high levels of glucose in the blood. Glucose responds to the production of insulin, and is necessary for cells to make energy and function properly (AIDS Info, 2005b).

IgG antibodies: immunoglobin G antibody; the most abundant type of antibody that is found in all of the body fluids and protects against bacterial and viral infections (KidsHealth, 2011a).

Immune system: made up of cells, proteins, tissues and organs to defend people against germs and microorganisms that may hurt the body; the body's defense system (KidsHealth, 2011c).

Immunosuppression: when the body's immune response is reduced or absent (PubMed Health, 2010n).

Insulin resistance: the body's lack of response to insulin, which helps blood sugar (glucose) to enter cells. This causes more and more insulin to be produced, without allowing for blood sugar levels to fall, thereby leading to higher blood sugar levels and affecting kidney function and blood fat levels (PubMed Health, 2010r).

Isosporiasis: a disease caused by the protozoa *Isospora belli*, and affects the lining of the small intestine, causing severe diarrhea and malabsorption of nutrients (AIDS Meds, 2009).

Kaposi's sarcoma: a cancerous tumour of the connective tissue; often associated with HIV; in HIV/AIDS patients, the cancer can develop quickly and may also involve the skin, lungs, gastrointestinal tract, and other organs (PubMed Health, 2010o).

Lactic acidosis: occurs when lactic acid builds up in the bloodstream faster than it can be removed. Lactic acid is produced when oxygen levels in the body drop (PubMed Health, 2010q).

Late progressors: individuals who exhibit a pattern of HIV progression where the onset of the progression of HIV to AIDS takes place later in life, around the age of six, and the children may have no symptoms of HIV until this time (The European Collaborative Study, 2001).

Linear gingival erythema: affects the soft tissue of the periodontium, appearing as a red line 2-3 mm in width around the teeth (HIV Clinical Resource, 2001).

Lipodystrophy: a disturbance in the way the body produces, uses, and stores fat; also known as fat redistribution (AIDS Info, 2005c).

Lymph node tuberculosis: see tuberculosis, disseminated.

Lymphadenopathy: enlargement of the lymph nodes (AETC National Resource Center, 2011).

Lymphocyte: white blood cell; these make up part of the immune system and help to fight off infections or harmful substances in the body (MedLine Plus, 2009c).

Lymphoma: a cancer of the lymphatic system, which is part of the immune system (Medline Plus, 2011c).

Meningitis: inflammation of the thin tissue that surrounds the brain and spinal cord (the meninges) (Medline Plus, 2011d).

Mitochondrial dysfunction: problems with the functioning of the structures within cells that convert the energy from food into a form that can be used by the cell (Genetics Home Reference, 2011a).

Molluscum contagiosum: a viral skin infection that causes raised, pearl-like papules or nodules on the skin (Medline Plus, 2011e).

Morbidity: the rate of incidence of a disease in a certain population (Merriam-Webster, 2011a).

Mortality: death rate (Merriam-Webster, 2011b).

Mother-to-Child Transmission (MTCT): the transmission of HIV from an HIV-infected mother to her child during pregnancy, labour or delivery, or breastfeeding; also known as vertical transmission (World Health Organization, 2001).

Mucocutaneous disorders: conditions that affect the skin or mucous membranes of the body (Genetics Home Reference, 2011b).

Multi-focal leukoencephalopathy: a rare disorder that damages the material that covers and protects nerves in the white matter of the brain (myelin); caused by the reactivation of a common virus in the central nervous system of immune-compromised individuals (National Institute of Neurological Disorders and Stroke, 2010).

Mycobacterium avium complex disease (MAC): an opportunistic infection caused by a species of *Mycobacterium*; can cause localized disease and other complications in HIV-infected individuals (HRSA HIV/AIDS Bureau, 2011).

Mycosis, disseminated: a fungal infection that has spread throughout the body (Walsh & Dixon, 1996).

Neonatal: the period from birth to four weeks of age (Saskatchewan Prevention Institute, 2011).

Nephropathy: kidney disease or damage (PubMed Health, 2011a).

Neutropenia: a condition where there is an abnormally low number of neutrophils (a type of white blood cell) in the blood. Neutrophils help defend the body against bacterial and fungal infections, therefore with a lowered number of neutrophils, risk of infection is increased (Greenberg, 2009).

Non-Hodgkin's lymphoma: cancer of the lymphoid tissue, including the lymph nodes, spleen and other organs of the immune system. This cancer often starts in the B-lymphocytes or B-cells, which are a type of white blood cell that helps to prevent infections (Pubmed Health, 2011b).

Non-nucleoside reverse transcriptase inhibitors (NNRTIs): a type of antiretroviral therapy that stops HIV from replicating within cells by inhibiting the reverse transcriptase protein of HIV, which the virus needs to make new copies of itself (Avert, 2011b).

Non-tuberculous mycobacterial infection: infection caused by mycobacteria other than *Mycobacterium tuberculosis* (e.g., lung disease, lymphadenitis) (Harrison's Practice, 2010).

Nucleoside Analog/Nucleotide Reverse Transcriptase Inhibitors (NRTIs; NtRTIs): a type of antiretroviral therapy that interferes with the action of an HIV protein called reverse transcriptase, which the virus needs to make new copies of itself (Avert, 2011b).

Opportunistic Infection (OI): infections or conditions that take advantage of the weakness in the immune system caused by HIV (Women's Health, 2011).

Oral candidiasis: a yeast infection of the mucus membrane lining of the mouth and tongue; also known as thrush (Medline Plus, 2009d).

Oral hairy leukoplakia: an oral infection caused by the Epstein-Barr virus where white patches can develop in the mouth (AIDS Meds, 2003).

Oral ulcerations: crater-like lesions in the mucous membrane of the mouth (PubMed Health, 2010z).

Osteonecrosis: a loss of blood supply to the bones, leading to bone death (National Institute of Athritis and Muscoloskeletal and Skin Diseases, 2009).

Osteopenia: bones become less dense than normal, and may lead to osteoporosis (University of Michigan Health System Clinical Care Guidelines Committee, 2009).

Osteoporosis: a condition where the bones become less dense and more fragile, and are therefore at more risk of fracture from a smaller amount of trauma (University of Michigan Health System Clinical Care Guidelines Committee, 2009).

Pancreatitis: inflammation of the pancreas (PubMed Health, 2010s).

Parotid enlargement: enlargement of the large salivary glands (American Cancer Society, 2011).

Pericardial fluid: the fluid in the sac surrounding the heart (Medline Plus, 2010c).

Perinatal transmission: see mother-to-child transmission.

Peripheral blood mononuclear cells: a blood cell that has a round nucleus, and includes many types of blood cells including leukocytes, lymphocytes, and monocytes (Mesothelioma Asbestos Help Center, 2011).

Peripheral neuropathy: a general term for damage to the peripheral nerves, which carry information to and from the brain, and from the spinal cord to the rest of the body (PubMed Health, 2011c).

Peritoneal fluid: the fluid from the peritoneal cavity, which is the space between the wall of the abdomen and the organs inside (PubMed Health, 2009h).

Pleural effusion: a build-up of fluid between the layers of tissue that line the lungs and chest cavity (PubMed Health, 2010t).

Pleural fluid: fluid from the space around the lungs (Pubmed Health, 2009i).

Pneumocystis: a fungal infection of the lungs; a type of pneumonia (PubMed Health, 2009j).

Pneumocystis jirovecii Pneumonia (PJP): a respiratory condition in which there is an infection of the lung caused by a bacteria, Pneumocystis jirovecii (Pubmed Health, 2011d).

Polymerase Chain Reaction (PCR): a diagnostic test that detects the genetic material of HIV rather than the antibodies to the virus (Avert, 2011a).

Prenatal period: 22 weeks gestation (154 days) to 7 days after birth (Saskatchewan Prevention Institute, 2011).

Prevention of mother-to-child transmission (PMTCT): the strategies (e.g., ART therapy) used to prevent an HIV-positive mother from transmitting the virus to her child during pregnancy, labour & delivery, and the lactation period (World Health Organization, 2001).

Progressive encephalopathy: a condition caused by HIV infection of the brain that causes swelling, and subsequently damage to the brain's tissues over time (KidsHealth, 2011b).

Protease inhibitors (PIs): a type of antiretroviral therapy that inhibit protease, which is a protein involved in the HIV replication process (Avert, 2011b).

Pruritic eruption: an itchy rash or skin eruption (e.g., papules) (Taylor, Zirwas, & Sood, 2011).

Pulmonary tuberculosis: see tuberculosis, pulmonary.

Ribonucleic Acid (RNA): transmits genetic information from DNA to proteins produced by the cell; is also important in protein synthesis and other cell activities (Genetics Home Reference, 2011c).

Serological testing: methods of testing for the presence of antibodies against a micro-organism or virus such as HIV; these tests are not accurate in children under 18 months of age because of the persistence of maternal antibodies (Medline Plus, 2009b).

Severe wasting: the involuntary loss of more than 10% of body weight, plus more than 30 days of diarrhea, weakness and/or fever; linked to disease progression and death (AIDS InfoNet, 2011).

Skin rash: changes in the color or texture of the skin because of inflammation, allergies, or other causes. (Medline Plus, 2009a).

Sputum: a secretion from the lungs and bronchi (PubMed Health, 2009k).

Stevens-Johnson Syndrome (SJS) or Erythema Multiforme major (EM): a rare disorder where the skin and mucous membranes react severely to a medication or infection, involving a painful skin rash that eventually causes the top layer of skin to die and shed (Mayo Clinic, 2011b).

Synovial fluid: produced in the spaces between certain joints to help reduce friction and facilitate movement of the joint (eArthritisHealth, 2011).

Syphilis: a sexually transmitted infectious disease caused by the spirochete *Treponema pallidum;* can also be transmitted from mother to child during pregnancy or labour (PubMed Health, 2010w).

Systemic hypersensitivity reaction: an excessive immune reaction to an allergen (e.g., pollen, dust, animal hair, food, etc.) that spreads throughout the body (Medline Plus, 2010a).

Teratogenic effects: any agent that disrupts normal fetal development, such as some medications, alcohol, radiation, and some chemicals (Saskatchewan Prevention Institute, 2011).

Thrombocytopenia: any disorder in which there is an abnormally low amount of platelets, which are the parts of the blood which help with clotting (PubMed Health, 2010x).

Thrush, persistant: see oral candidiasis.

Toxoplasmosis: an infection due to the parasite *Toxoplasma gondii*, and can affect the brain, lungs, heart, eyes or liver (PubMed Health, 2009l).

Tuberculosis, disseminated: infection due to a bacteria (Mycobacterium tuberculosis) that has spread from the lungs to other parts of the body through the blood or lymph system; also known as extra-pulmonary tuberculosis (PubMed Health, 2010h).

Tuberculosis, extra-pulmonary: see tuberculosis, disseminated.

Tuberculosis, lymph node: see tuberculosis, disseminated.

Tuberculosis, pulmonary: a contagious infection due to a bacteria (Mycobacterium tuberculosis) that involves the lungs, that can spread to other parts of the body (PubMed Health, 2010u).

Upper respiratory tract infections: a non-specific term used to describe acute infections involving the nose, paranasal sinuses, pharynx, larynx, trachea and bronchi (e.g., the common cold) (Mossad, 2011).

Varicella: also known as chickenpox, varicella is caused by a virus and results in a break out of fluid-filled blisters that burst and form crusts, and are usually accompanied by a fever, headache, stomach-ache, or loss of appetite (Pubmed Health, 2009e).

Varicella-zoster virus: a herpesvirus that causes varicella (chicken pox) and herpes zoster (shingles), and is associated with fever and a pruritic rash (Arvin, 1996).

Vertical transmission: see mother-to-child transmission.

Viral load: a measure of the amount of virus in the blood; the lower the amount of virus in the blood, the lower the viral load. People with higher HIV viral loads are at greater risk for other infections and a quicker progression to AIDS than those with lower HIV viral loads (Aidsmap, 2011).

Virological testing: methods of testing for the presence of HIV virus, rather than antibody testing (include DNA and RNA sampling) (Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children, 2011).

Wart virus infection, extensive: small, usually painless growths on the skin caused by a viral infection (human papillomavirus or HPV), that has spread throughout the body, or to one area of the body (Pubmed Health, 2009m).

Wasting syndrome: the involuntary loss of more than 10% of body weight, plus more than 30 days of either diarrhea, or weakness and fever. Wasting syndrome is associated with AIDS progression and death (AIDS InfoNet, 2011).

White blood cells: also called leukocytes; the cells in blood that help to fight infections and make up the immune system (MedLine Plus, 2011f).

References

AETC National Resource Center. (2011). Lymphadenopathy. *Guide for HIV/AIDS Clinical Care* Retrieved August 11, 2011, from http://www.aidsetc.org/aidsetc?page=cg-508_lymphadenopathy

AIDS Education and Training Centers (Producer). (2010, July 6, 2011). Guidelines for the use of antiretroviral agents in pediatric HIV infection. *Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children*.

AIDS Education and Training Centers. (2011). Guide for HIV/AIDS Clinical Care *Candidiasis, oral and esophageal*: AETC.

AIDS Info. (2005a). Hepatotoxicity. (pp. 1-2): U.S. Department of Health and Human Services.

AIDS Info. (2005b). Hyperglycemia (pp. 1): U.S. Department of Health and Human Services.

AIDS Info. (2005c). Lipodystrophy (pp. 1-2): U.S. Department of Health and Human Services.

AIDS InfoNet. (2011). Wasting Syndrome. Retrieved August 11, 2011, from http://www.aidsinfonet.org/fact_sheets/view/519

AIDS Meds. (2003). Oral hairy leukoplakia. Retrieved August 11, 2011, from http://www.aidsmeds.com/articles/OHL_6819.shtml

AIDS Meds. (2009). Isosporiasis Retrieved August 15, 2011, from http://www.aidsmeds.com/articles/Isosporiasis_6874.shtml

Aidsmap. (2011). Viral load. Retrieved August 11, 2011, from http://www.aidsmap.com/Viral-load/page/1044622/

American Academy of Pediatrics, American Academy of Family Physicians, American College of Physicians, & American Society of Internal Medicine. (2002). A consensus statement of health care transitions for young adults with special health care needs. *Pediatrics, 110*(6), 1304-1306.

American Cancer Society. (2011). Salivary gland cancer. Retrieved August 11, 2011, from http://www.cancer.org/Cancer/SalivaryGlandCancer/DetailedGuide/salivary-gland-cancer-what-is-salivary-gland-cancer

American Society of Hematology. (2011). Blood basics. Retrieved August 11, 2011, from http://www.hematology.org/Patients/Blood-Basics/5222.aspx

Arpadi, S. M. (2000). Growth Failure in Children With HIV Infection. *Journal of Acquired Immune Deficiency Syndromes, 25*, S37-S42.

Arvin, A. M. (1996). Varicella-zoster virus. *Clinical Microbiology Reviews, 9*(2), 361-381.

Avert. (2011a). The different types of HIV test. *HIV testing.* Retrieved July 20, 2011, from http://www.avert.org/testing.htm

Avert. (2011b). Introduction to HIV and AIDS Treatment. Retrieved July 12, 2011, from http://www.avert.org/treatment.htm

Bachanas, P. J., Kullgren, K. A., Schwartz, K. S., Lanier, B., McDaniel, J. S., Smith, J., & Nesheim, S. (2001). Predictors of psychological pdjustment in school-age children infected With HIV. *Journal of Pediatric Psychology, 26*(6), 343-352. doi: 10.1093/jpepsy/26.6.343

Beals, K. P., Wight, R. G., Aneshensel, C. S., Murphy, D. A., & Miller-Martinez, D. (2006). The role of family caregivers in HIV medication adherence. *AIDS Care, 18*(6), 589-596. doi: 10.1080/09540120500275627

Boyer, N. C., & Poindexter, C. C. (2005). Barriers to permanency planning for older HIV-affected caregivers. *Journal of Gerontological Social Work, 44*(3/4), 59-74. doi: 10.1300/J083y44n03_05

Braun, D. K., Dominguez, G., & Pellett, P. E. (1997). Human herpesvirus 6. *Clinical Microbiology Review, 10*(3), 521-567.

Bunting, S. M., & Seaton, R. (1999). Health care participation of perinatal women with HIV: What helps and what gets in the way? *Health Care for Women International, 20*, 563-578.

Center for Disease Control and Prevention (CDC). (1994). 1994 revised classification system for Human Immunodeficiency Virus infection in children less than 13 years of age. Official authorized addenda: human immunodeficiency virus infection codes and official guidelines for coding and reporting ICD-9-CM. *Morbidity and Mortality Weekly Report, 43*(No. RR-12), 1-20.

Center for Disease Control and Prevention (CDC). (2011). Premastication of food by caregivers of HIV-exposed children - nine U.S. Sites, 2009-2010. *Morbidity and Mortality Weekly Report, 60*(9), 273-275.

Cohen, J., Reddington, C., Jacobs, D., Meade, R., Picard, D., Singleton, K., . . . Prevention. (1997). School-related Issues Among HIV-Infected Children. *Pediatrics, 100*(1), e8. doi: 10.1542/peds.100.1.e8

Committee on Pediatric AIDS. (2007). Increasing antiretroviral drug access for children with HIV infection. *Pediatrics, 119*, 838-845.

Cooper, E. R., Charurat, M., Mofenson, L., Hanson, I. C., Pitt, J., Diaz, C., . . . Women and Infants' Transmission Study Group. (2002). Combination antiretroviral strategies for the treatment of pregnant HIV-1-infected women and prevention of perinatal HIV-1 transmission. *Journal of Acquired Immune Deficiency Syndrome, 29*(5), 484-494.

DeGennaro, V., & Zeitz, P. (2009). Embracing a family-centred response to the HIV/AIDS epidemic for the elimination of pediatric AIDS. *Global Public Health, 4*(4), 386-401. doi: 10.1080/17441690802638725

Domek, G. J. (2009). Facing adolescence and adulthood: The importance of mental health care in the global pediatric AIDS epidemic. *Journal of Developmental & Behavioral Pediatrics, 30*(2), 147-150 110.1097/DBP.1090b1013e318196b318190cc.

Domek, G. J. (2010). Debunking common barriers to pediatric HIV disclosure. *Journal of Tropical Pediatrics, 56*(6), 440-442.

Dunn, D. T., Newell, M. L., Ades, A. E., & Peckham, C. S. (1992). Risk of human immunodeficiency virus type 1 transmission through breastfeeding. *Lancet, 340*(8819), 585-588.

eArthritisHealth. (2011). Synovial fluid definition. Retrieved August 11, 2011, from http://www.earthritishealth.com/glossary/synovial-fluid

European Bioinformatics Institute (EBI). (2011). Virus genomes - Human herpesvirus Retrieved August 15, 2011, from http://www.ebi.ac.uk/2can/genomes/viruses/Human_herpesvirus.html

Food and Agriculture Organization of the United Nations (FAO), & World Health Organization. (2002). Living well with HIV/AIDS: a manual on nutritional care and support for people

living with HIV/AIDS. Rome, Italy: World Health Organization, Food and Agriculture Organization of the United Nations (FAO).
Forsyth, B. W. (2003). Psychological aspects of HIV infection in children. *Child and Adolescent Psychiatry Clinics in North America, 12*(3), 423-437.
Franks, B. A., Miller, M. D., Wolff, E. J., & Landry, K. (2004). HIV/AIDS and the teachers of young children. *Early Child Development & Care, 174*(3), 229-241. doi: 10.1080/0300443032000153552
Gaughan, D. M., Hughes, M. D., Oleske, J. M., Malee, K., Gore, C. A., & Nachman, S. (2004). Psychiatric hospitalizations among children and youths with human immunodeficiency virus infection. [Article]. *Pediatrics, 113*(6), e544-e551.
Genetics Home Reference. (2011a). Mitochondrial DNA. Retrieved August 11, 2011, from http://ghr.nlm.nih.gov/chromosome/MT
Genetics Home Reference. (2011b). Mucocutaneous. Retrieved August 12, 2011, from http://ghr.nlm.nih.gov/glossary=mucocutaneous
Genetics Home Reference. (2011c). RNA. Retrieved July 12, 2011, from http://ghr.nlm.nih.gov/glossary=rna
Greenberg, S. (2009). Neutropenia. Retrieved July 6, 2011, from http://www.utoronto.ca/kids/Neutropenia.htm
Hammami, N., Nöstlinger, C., Hoerée, T., Lefèvre, P., Jonckheer, T., & Kolsteren, P. (2004). Integrating adherence to highly active antiretroviral therapy into children's daily lives: A qualitative study. *Pediatrics, 114*(5), 591-e597. doi: 10.1542/peds.2004-0085
Hansell, P. S., & Hughes, C. B. (1999). Boosting social support in caregivers of children with HIV/AIDS. [Article]. *AIDS Patient Care & STDs, 13*(5), 297-302.
Harrison's Practice. (2010). Nontuberculous mycobacterial infections. Retrieved August 12, 2011, from http://www.harrisonspractice.com/practice/ub/view/Harrisons%20Practice/141065/0/Mycobacteria
Hazra, R., Siberry, G. K., & Mofenson, L. M. (2010). Growing up with HIV: Children, adolescents, and young adults with perinatally acquired HIV infection. *Annual Review of Medicine, 61*(1), 169-185. doi: doi:10.1146/annurev.med.050108.151127
HIV Clinical Resource. (2001). Linear gingival erythema (LGE). *Clinical manifestations and management of HIV-related periodontal disease.* Retrieved August 11, 2011, from http://www.hivguidelines.org/clinical-guidelines/hiv-and-oral-health/clinical-manifestations-and-management-of-hiv-related-periodontal-disease/
HRSA HIV/AIDS Bureau. (2011). Mycobacterium avium complex. *Guide for HIV/AIDS Clinical Care.* Retrieved August 15, 2011, from http://www.aidsetc.org/aidsetc?page=cg-622_mac
Jaspan, H. B., Huang, L. C., Cotton, M. F., Whitelaw, A., & Myer, L. (2008). Bacterial disease and antimicrobial susceptibility patterns in HIV-infected, hospitalized children: A retrospective cohort study. *PLoS ONE, 3*(9), 1-6. doi: 10.1371/journal.pone.0003260
Joint United Nations Programme on HIV/AIDS. (2008). Fast facts about HIV: Joint United Nations Programme on HIV/AIDS.
Kellerman, S., & Essajee, S. (2010). HIV testing for children in resource-limited settings: What are we waiting for? *PLoS Medicine, 7*(7), 1-5. doi: 10.1371/journal.pmed.1000285

KidsHealth. (2011a). Blood test: Immunoglobulins (IgA, IgG, IgM). Retrieved August 11, 2011, from http://kidshealth.org/parent/system/medical/test_immunoglobulins.html
KidsHealth. (2011b). HIV and AIDS. Retrieved August 11, 2011, from http://kidshealth.org/parent/infections/std/hiv.html
KidsHealth. (2011c). Immune System. *A Body Basics Article.* Retrieved August 11, 2011, from http://kidshealth.org/parent/general/body_basics/immune.html
Kimani-Murage, E. W., Manderson, L., Norris, S. A., & Kahn, K. (2010). 'You opened our eyes': care-giving after learning a child's positive HIV status in rural South Africa. *Health & Social Care in the Community, 18*(3), 264-271. doi: 10.1111/j.1365-2524.2009.00891.x
King, S. M. (2004). Evaluation and treatment of the human immunodeficiency virus-1-exposed infant. *Pediatrics, 114*(2), 497-505.
Krever, H. (1997). Commission of inquiry on the blood system in Canada (pp. 1197): Commission of Inquiry on the Blood System in Canada.
Lallemant, M., Chang, S., Cohen, R., & Pecoul, B. (2011). Pediatric HIV — A Neglected Disease? *New England Journal of Medicine, 365*(7), 581-583. doi: doi:10.1056/NEJMp1107275
Leelanukrom, R., & Pancharoen, C. (2007). Anesthesia in HIV-infected children. *Pediatric Anesthesia, 17*(6), 509-519. doi: 10.1111/j.1460-9592.2006.02150.x
Leenerts, M. H. (1998). Barriers to self-care in a cohort of low-income white women living with HIV/AIDS. *Journal of the Association of Nurses in AIDS Care, 9*, 22-36.
Malee, K., Williams, P., Montepiedra, G., McCabe, M., Nichols, S., Sirois, P. A., . . . Kammerer, B. (2011). Medication adherence in children and adolescents with HIV infection: Associations with behavioral impairment. [Article]. *AIDS Patient Care & STDs, 25*(3), 191-200. doi: 10.1089/apc.2010.0181
MaWhinney, S., Pagano, M., & Thomas, P. (1993). Age at AIDS diagnosis for children with perinatally acquired HIV. *JAIDS Journal of Acquired Immune Deficiency Syndromes, 6*(10), 1139-1144.
Mayo Clinic. (2010). Diarrhea. Retrieved August 10, 2011, from http://www.mayoclinic.com/health/diarrhea/DS00292
Mayo Clinic. (2011a). Infant Jaundice. Retrieved July 6, 2011, from http://www.mayoclinic.com/health/infant-jaundice/DS00107/DSECTION=causes
Mayo Clinic. (2011b). Stevens-Johnson Syndrome. Retrieved July 6, 2011, from http://www.mayoclinic.com/health/stevens-johnson-syndrome/DS00940
McKeegan, K., Rutstein, R., & Lowenthal, E. (2011). Postnatal infant HIV prophylaxis: A survey of U.S. practice. [Article]. *AIDS Patient Care & STDs, 25*(1), 1-4. doi: 10.1089/apc.2010.0255
Medline Plus. (2009a). Rashes. *Health topics.* Retrieved July 6, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003220.htm
Medline Plus. (2009b). Serology. Retrieved August 12, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003511.htm
MedLine Plus. (2009c). T-cell count. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003516.htm
Medline Plus. (2009d). Thrush. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/000626.htm
Medline Plus. (2010a). Allergies. *Health topics.* Retrieved July 6, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/000812.htm

Medline Plus. (2010b). Fever. Retrieved August 10, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003090.htm
Medline Plus. (2010c). Pericardial fluid culture. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003720.htm
Medline Plus. (2011a). AIDS. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/000594.htm
Medline Plus. (2011b). Anemia. *Health topics.* Retrieved July 6, 2011, from http://www.nlm.nih.gov/medlineplus/anemia.html
Medline Plus. (2011c). Lymphoma. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/lymphoma.html
Medline Plus. (2011d). Meningitis. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/meningitis.html
Medline Plus. (2011e). Molloscum contagiosum. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/000826.htm
MedLine Plus. (2011f). WBC count. Retrieved August 11, 2011, from http://www.nlm.nih.gov/medlineplus/ency/article/003643.htm
Mehta, P. (2010). HIV-associated malignancies. *HIV Curriculum for the Health Professional*. Houston, TX.
Mellins, C. A., Brackis-Cott, E., Dolezal, C., Richards, A., Nicholas, S. W., & Abrams, E. J. (2002). Patterns of HIV status disclosure to perinatally HIV-infected children and subsequent mental health outcomes. *Clinical Child Psychology and Psychiatry, 7*(1), 101-114. doi: 10.1177/1359104502007001008
Mellins, C. A., Brackis-Cott, E., Leu, C.-S., Elkington, K. S., Dolezal, C., Wiznia, A., . . . McKay, M. (2009). Rates and types of psychiatric disorders in perinatally human immunodeficiency virus-infected youth and seroreverters. *Journal of Child Psychology & Psychiatry, 50*(9), 1131-1138. doi: 10.1111/j.1469-7610.2009.02069.x
Merriam-Webster. (Ed.) (2011a) Merriam-Webster. Encyclopaedia Britannica.
Merriam-Webster. (Ed.) (2011b) Merriam-Webster. Encyclopaedia Britannica.
Mesothelioma Asbestos Help Center. (2011). Definition of peripheral blood mononuclear cells. Retrieved August 12, 2011, from http://www.mesotheliomaasbestoshelpcenter.com/dictionary/peripheral-blood-mononuclear-cell-pbmc.html
Mialky, E., Vagnoni, J., & Rutstein, R. (2001). School-age children with perinatally acquired HIV infection: Medical and psychosocial issues in a Philadelphia cohort. *AIDS Patient Care & STDs, 15*(11), 575-579. doi: 10.1089/108729101753287667
Mill, J., Austin, W., Chaw-Kant, J., Dumont-Smith, C., Edwards, N., Houston, S., . . . Reintjes, F. (2007). The influence of stigma on access to health services by persons with HIV illness. Final report.
Miller, T. L., Grant, Y. T., Almeida, D. N., Sharma, T., & Lipshultz, S. E. (2008). Cardiometabolic disease in human immunodeficiency virus-infected children. *Journal of the Cardiometabolic Syndrome, 3*(2), 98-105. doi: 10.1111/j.1559-4572.2008.07651.x
Mofenson, L. M., Brady, M. T., Danner, S. P., Dominguez, K. L., Hazra, R., Handelsman, E., . . . Van Dyke, R. (2009). Guidelines for the prevention and treatment of opportunistic

infections among HIV-exposed and HIV-infected children. [Article]. *MMWR Recommendations & Reports, 58*(RR-11), 1-166.
Mofenson, L. M., & Munderi, P. (2002). Safety of antiretroviral prophylaxis of perinatal transmission for HIV-infected pregnant women and their infants. *JAIDS Journal of Acquired Immune Deficiency Syndromes, 30*(2), 200-215.
Mossad, S. B. (2011). Upper respiratory tract infections. Retrieved August 11, 2011, from http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/infectious-disease/upper-respiratory-tract-infection/
Muralidhar, S., & Nair, D. (2010). HIV – Tuberculosis in children – Combating the deadly duo! *Journal of Pediatric Infectious Diseases, 5*(1), 9-20. doi: 10.3233/jpi-2010-0224
National Cord Blood Program. (2010). What is cord blood? *Cord blood Q & A.* Retrieved July 12, 2011, from http://www.nationalcordbloodprogram.org/qa/
National Human Genome Research Institute. (2011). Deoxyribonucleic acid (DNA). Retrieved July 12, 2011, from http://www.genome.gov/25520880#al-1
National Institute of Athritis and Muscoloskeletal and Skin Diseases. (2009). What is osteonecrosis? *Osteonecrosis.* Retrieved July 6, 2011, from http://www.niams.nih.gov/Health_Info/Osteonecrosis/osteonecrosis_ff.asp
National Institute of Neurological Disorders and Stroke. (2006). Neurological complications of AIDS fact sheet. Retrieved August 11, 2011, from http://www.ninds.nih.gov/disorders/aids/detail_aids.htm
National Institute of Neurological Disorders and Stroke. (2010). NINDS progressive multifocal leukoencephalopathy information page Retrieved August 12, 2011, from http://www.ninds.nih.gov/disorders/pml/pml.htm
Nöstlinger, C., Jonckheer, T., de Belder, E., Van Wijngaerden, E., Wylock, C., Pelgrom, J., & Colebunders, R. (2004). Families affected by HIV: parents' and children's characteristics and disclosure to the children. *AIDS Care, 16*(5), 641-648. doi: 10.1080/09540120410001716432
Panel on Antiretroviral Therapy and Medical Management of HIV-infected Children (Producer). (2011, August 15, 2011). Guidelines for the use of antiretroviral agents in pediatric HIV infection. Retrieved from http://aidsinfo.nih.gov/contentfiles/PediatricGuidelines.pdf
Panel on Treatment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission. (2010). Recommendations for use of antiretroviral drugs in pregnant HIV-1-infected women for maternal health and interventions to reduce perinatal HIV transmission in the United States.: National Institute of Health.
Panya, M. F., Mgonda, Y. M., & Massawe, A. W. (2009). The pattern of mucocutaneous disorders in HIV -- infected childrenattending care and treatment centres in Dar es Salaam, Tanzania. *BMC Public Health, 9*, 234-238. doi: 10.1186/1471-2458-9-234
Penazzato, M., Donà, D., Wool, P.-S., Rampon, O., & Giaquinto, C. (2010). Update on antiretroviral therapy in paediatrics. *Antiviral Research, 85*(1), 266-275. doi: 10.1016/j.antiviral.2009.10.017
Pontali, E. (2005). Facilitating adherence to highly active antiretroviral therapy in children with HIV infection: What are the issues and what can be done? *Pediatric Drugs, 7*(3), 137-149.

Positive Women's Network Society. (2001). Pocket guide for women living with HIV. Vancouver, BC: Canadian HIV/AIDS Clearinghouse.
Public Health Agency of Canada. (2003). Diabetes in Canada. (2 ed.): Public Health Agency of Canada.
Public Health Agency of Canada. (2009). HIV and AIDS in Canada. Surveillance report to December 31, 2008. Ottawa, ON.
Pubmed Health. (2009a). Amniotic fluid. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002884/
Pubmed Health. (2009b). Antigen. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002888/
PubMed Health. (2009c). Breathing difficulty. Shortness of breath, Breathlessness, Difficulty breathing, Dyspnea. *PubMed Health Diseases and Conditions.* Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0003566/
Pubmed Health. (2009d). Cerebral spinal fluid (CSF) collection: Spinal tap, Ventricular puncture, Lumbar puncture, Cisternal puncture, Cerebrospinal fluid culture. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0003902/
Pubmed Health. (2009e). Chickenpox. Varicella, Chicken pox. *PubMed Health Diseases and Conditions.* Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002559/
Pubmed Health. (2009f). CMV- immunocompromised host. Cytomegalovirus - immunocompromised host. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001684/
Pubmed Health. (2009g). Fistula. *PubMed Health Diseases and Conditions.* Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0003018/
PubMed Health. (2009h). Peritoneal fluid culture. Retrieved August 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0004188/
Pubmed Health. (2009i). Pleural fluid culture. Retrieved August 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0004187/
PubMed Health. (2009j). Pneumocystis jiroveci pneumonia. Retrieved August 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001692/
PubMed Health. (2009k). Routine sputum culture. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0004185/
PubMed Health. (2009l). Toxoplasmosis. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001661/
Pubmed Health. (2009m). Warts. Retrieved August 10, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001888/
Pubmed Health. (2010a). AIDS. Acquired immuned deficiency syndrome. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001620/
PubMed Health. (2010b). Antibody. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002887/
Pubmed Health. (2010c). Ascites. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001331/

Pubmed Health. (2010d). Bronchiectasis. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001199/
Pubmed Health. (2010e). Cardiomyopathy. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002095/
PubMed Health. (2010f). Cryptococcosis. Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002304/
PubMed Health. (2010g). Cryptosporidium enteritis. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001642/
PubMed Health. (2010h). Disseminated tuberculosis. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001648/
Pubmed Health. (2010i). Fungal nail infection. *PubMed Health Diseases and Conditions.* Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002306/
PubMed Health. (2010j). Hepatitis B. Retrieved August 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001324/
PubMed Health. (2010k). Hepatitis C. Retrieved August 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001329/
PubMed Health. (2010l). Hepatitis. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002139/
PubMed Health. (2010m). High blood cholesterol and triglycerides. Lipid disorders; Hyperlipoproteinemia; Hyperlipidemia; Dyslipidemia; Hypercholesterolemia. *PubMed Health Diseases and Conditions.* Retrieved July 6, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001440/
PubMed Health. (2010n). Immunodeficiency disorders. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001821/
PubMed Health. (2010o). Kaposi's sarcoma. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001682/
Pubmed Health. (2010p). Kyphosis. *PubMed Health Diseases and Conditions.* Retrieved July 15, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002220/
PubMed Health. (2010q). Lactic Acidosis. *PubMed Health Diseases and Conditions.* Retrieved July 6, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001428/
PubMed Health. (2010r). Metabolic Syndrome. Insulin resistance syndrome; Syndrome X. *PubMed Health Diseases and Conditions.* Retrieved July 6, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0004546/
PubMed Health. (2010s). Pancreatitis. *PubMed Health Diseases and Conditions.* Retrieved July 6, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002129/
PubMed Health. (2010t). Pleural effusion. Retrieved August 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001150/
PubMed Health. (2010u). Pulmonary tuberculosis. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001141/
PubMed Health. (2010v). Shingles. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001861/#A000858_reflist

PubMed Health. (2010w). Syphilis - primary. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001864/

PubMed Health. (2010x). Thrombocytopenia. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001612/

Pubmed Health. (2010y). Trench Mouth, Vincent's stomatitis, Acute necrotizing ulcerative gingivitis. *PubMed Health Diseases and Conditions.* Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002039/

PubMed Health. (2010z). Ulcers. Retrieved August 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0003712/

PubMed Health. (2011a). Diabetic nephropathy. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001524/

Pubmed Health. (2011b). Non-Hodgkin's lymphoma. Retrieved July 12, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001607/

PubMed Health. (2011c). Peripheral neuropathy. Retrieved July 6, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001619/

Pubmed Health. (2011d). Pneumonia. Retrieved August 11, 2011, from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001200/

Rao, R., Sagar, R., Kabra, S. K., & Lodha, R. (2007). Psychiatric morbidity in HIV-infected children. *AIDS Care, 19*(6), 828-833. doi: 10.1080/09540120601133659

Remien, R. H., & Mellins, C. A. (2007). Long-term psychosocial challenges for people living with HIV: let's not forget the individual in our global response to the pandemic. *AIDS, 21*, S55-S63 10.1097/1001.aids.0000298104.0000202356.b0000298103.

Sacajiu, G., Raveis, V. H., & Selwyn, P. (2009). Patients and family care givers' experiences around highly active antiretroviral therapy (HAART). *AIDS Care, 21*(12), 1528-1536. doi: 10.1080/09540120902923113

Saskatchewan Ministry of Health. (2010). HIV and AIDS in Saskatchewan. Regina, SK: Population Health Branch, Saskatchewan Ministry of Health.

Skinner, S. (2011). *HIV - A brief review.* Paper presented at the HIV Discussions, Meadow Lake, <

Steele, R., Anderson, B., Rindel, B., Dreyer, M. L., Perrin, K., Christensen, R., . . . Flynn, P. M. (2001). Adherence to antiretroviral therapy among HIV-positive children: examination of the role of caregiver health beliefs. [Article]. *AIDS Care, 13*(5), 617-629. doi: 10.1080/09540120120063241

Steele, R., Nelson, T. D., & Cole, B. P. (2007). Psychosocial functioning of children with AIDS and HIV infection: Review of the literature from a socioecological framework. *Journal of Developmental & Behavioral Pediatrics, 28*(1), 58-69 doi: 10.1097/DBP.0b013e31803084c6

Taylor, J. S., Zirwas, M. J., & Sood, A. (2011). Pruritis. Retrieved August 11, 2011, from http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/dermatology/pruritus-itch/

The European Collaborative Study. (2001). Fluctuations in symptoms in human immunodeficiency virus-infected children: The first 10 years of life. *Pediatrics, 108*(1), 116-122. doi: 10.1542/peds.108.1.116

Thorne, C., & Newell, M.-L. (2005). The safety of antiretroviral drugs in pregnancy. *Expert Opinion on Drug Safety, 4*(2), 323-335. doi: doi:10.1517/14740338.4.2.323

Thorne, C., & Newell, M.-L. (2007). Safety of Agents Used to Prevent Mother-to-Child Transmission of HIV: Is There Any Cause for Concern? *Drug Safety, 30*(3), 203-213.

Tudor, A. M., Anca, I., Luminos, M., & Mardarescu, M. (2010). Dilated cardiomyopathy in an HIV-infected adolescent on HAART: Case report. . *14*, 302-305.

University of Michigan Health System Clinical Care Guidelines Committee. (2009). Osteoporosis in women. Ann Arbor, MI: University of Michigan.

Vaz, L., Corneli, A., Dulyx, J., Rennie, S., Omba, S., Kitetele, F., & Behets, F. (2008). The process of HIV status disclosure to HIV-positive youth in Kinshasa, Democratic Republic of the Congo. *AIDS Care, 20*(7), 842-852. doi: 10.1080/09540120701742276

Violari, A., Cotton, M. F., Gibb, D. M., Babiker, A. G., Steyn, J., Madhi, S. A., . . . McIntyre, J. A. (2008). Early antiretroviral therapy and mortality among HIV-infected infants. *New England Journal of Medicine, 359*(21), 2233-2244. doi: doi:10.1056/NEJMoa0800971

Vreeman, R. C., Nyandiko, W. M., Ayaya, S. O., Walumbe, E. G., Marrero, D. G., & Inui, T. S. (2010). The perceived impact of disclosure of pediatric HIV status on pediatric antiretroviral therapy adherence, child well-being, and social relationships in a resource-limited setting. *AIDS Patient Care & STDs, 24*(10), 639-649. doi: 10.1089/apc.2010.0079

Wachsler-Felder, J. L., & Golden, C. J. (2002). Neuropsychological consequences of HIV in children: A review of current literature. *Clinical Psychology Review, 22*(3), 441-462. doi: 10.1016/s0272-7358(01)00108-8

Wade, N. A., Zielinski, M. A., Butsashvili, M., McNutt, L.-A., Warren, B. L., Glaros, R., . . . Birkhead, G. S. (2004). Decline in perinatal HIV transmission in New York State (1997-2000). *JAIDS Journal of Acquired Immune Deficiency Syndromes, 36*(5), 1075-1082.

Walsh, T. J., & Dixon, D. M. (1996). *Medical microbiology.* Galveston, TX: University of Texas Medical Branch.

Winstead, B. A., Derlega, V. J., Barbee, A. P., Sachdev, M., Antle, B., & Greene, K. (2002). Close relationships as sources of strength or obstacles for mothers coping with HIV *Journal of Loss & Trauma, 7*(3), 157-184. doi: 10.1080/10811440290057602

Women's Health. (2011). Opportunistic infections and other conditions Retrieved August 11, 2011, from http://womenshealth.gov/hiv-aids/opportunistic-infections-and-other-conditions/

Wood, S. A., & Tobias, C. (2005). Barriers to care and unmet needs for HIV-positive women caring for children. *Journal of HIV/AIDS and Social Services, 3*, 47-65.

Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children. (2008). Nutrional care in pediatric HIV/AIDS *Guidelines for the use of antiretroviral Agents in Pediatric HIV infection* (pp. 11-18).

World Health Organization. (2001). Prevention of mother-to-child transmission of HIV: Selection and use of nevirapine (pp. 25). Geneva, Switzerland: World Health Organization.

World Health Organization. (2010). *Antiretroviral therapy of HIV infection in infants and children: Towards universal access. Recommendations for a public health approach - 2010 revision*. Geneva, Switzerland: World Health Organization.

World Health Organization. (2011). Antiretroviral therapy. Retrieved July 12, 2011, from http://www.who.int/topics/antiretroviral_therapy/en/

World Health Organization, & UNICEF. (2010). *Policy requirements for HIV testing and counselling of infants and young children in health facilities*. Geneva, Switzerland World Health Organizaiton.

Wrubel, J., Tedlie Moskowitz, J., Anne Richards, T., Prakke, H., Acree, M., & Folkman, S. (2005). Pediatric adherence: Perspectives of mothers of children with HIV. *Social Science & Medicine, 61*(11), 2423-2433. doi: 10.1016/j.socscimed.2005.04.034

Yu, L. M., Easterbrook, P. J., & Marshall, T. (1997). Relationship between CD4 count and CD4% in HIV-infected people. *International Journal of Epidemiology, 26*(6), 1367-1372. doi: 10.1093/ije/26.6.1367