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Pediatric Care and Support for Children Living with HIV in Saskatchewan

Prepared for the Saskatchewan Prevention Institute

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Executive Summary

The current review, conducted by the Saskatchewan Prevention Institute, aimed to summarise the issues and challenges commonly faced by children living with HIV in Saskatchewan, along with their care and support needs. Antiretroviral therapy (ART) and other advancements in care have resulted in HIV being reclassified from a fatal disease to a chronic medical condition. While children living with HIV currently face a less symptomatic disease course, they continue to face numerous challenges that can impact their overall health and quality of life. These challenges include those directly related to HIV and its treatment, and those associated with the social conditions often experienced by those living with HIV. For children to receive appropriate treatment and care, it is important for health and allied healthcare professionals to understand the unique needs of these children.

Although there is not a lot of available research on the impact of HIV infection on children's developing immune systems, it is known that children living with HIV are more prone to certain kinds of illnesses, infections, and cancers. Although ART reduces the risk of many of these illnesses and infections, some remain frequent (e.g., bacterial pneumonia). In addition to the direct damage HIV has on the immune system, pediatric HIV infection can damage several organ systems simultaneously, including the renal, cardiac, and central nervous systems. Likely related to this damage, research has shown that HIV can affect children cognitively, developmentally, emotionally, psychologically, and educationally. Children with greater degrees of HIV-related immune deficiency have been shown to have more severe deficits than those without HIV. Therefore, in order to enhance well being and quality of life for children with HIV infection, attention needs to be given to monitoring all aspects of development (physical, cognitive, behavioural, social, and emotional).

The medical treatment of pediatric HIV can also be challenging for children and their families. Challenges related to the medical treatment of pediatric HIV infection include: maintaining adherence to life-long therapy; selecting successive ART regimens considering the limited availability of pediatric formulations and the lack of safety data for children; overcoming extensive drug resistance in multi-drug-experienced children; and managing the side effects of treatment. Side effects can range from nausea, diarrhea, and headaches to memory loss, abnormal fat redistribution, cardiac, and/or renal problems. Children may be particularly vulnerable to side effects of ART as their bodies are still developing, and they are likely to be exposed to ART for long periods of time.

Adherence to ART is another complex area of pediatric HIV care. The effectiveness of ART is dependent on adherence; poor adherence can lead to virologic failure and the development of drug resistance. Adherence is a complex health behaviour that is influenced by the medication prescribed, patient and family factors, and the characteristics of the healthcare provider(s) and healthcare system. Barriers to treatment adherence can arise in association with any of these factors (e.g., medication taste and side effects, age of the patient, familial resources, and accessibility of treatment). Other factors that impact adherence include poverty, parental HIV disease, unstable housing, stigmatization, and limited social

support. Once potential barriers to adherence have been identified, supports can be put in place to improve adherence levels.

As demonstrated by the list of potential barriers to treatment adherence, factors other than the direct effects of HIV can greatly impact the health and quality of life of children living with HIV. Unfortunately, children living with HIV often face problems related to the social determinants of health, including poverty, poor nutrition, social instability, a high incidence of familial substance use, deaths of family members, and issues related to stigma and discrimination. Each of these factors can play a confounding role in pediatric treatment outcomes, either by mitigating or increasing the adverse impacts of HIV. Therefore, one of the challenges of understanding HIV in children is determining which of the biological, psychological, neuropsychiatric, and social factors is most relevant at any given moment.

Finally, other relevant issues for pediatric HIV include: disclosure of the child's HIV status to the child and to others, available support for the child and his/her family, nutritional considerations, and daycare/ school issues. As HIV has become a chronic disease, disclosure has become one of the most important aspects of raising a child living with HIV. Disclosure is seen as more difficult than in other chronic childhood diseases for a number of reasons: infectious disease transmissibility, the potential for stigma and isolation from peers, vertical transmission with potential maternal guilt, and more than one family member living with the virus. Disclosure is particularly difficult for biological parents who may be the source of the child's infection as it may heighten feelings of guilt. Although there is no single, easy guide to deciding when and to whom HIV infection should be disclosed, disclosure is a vital part of comprehensive care for children living with HIV. Research suggests that disclosure should be viewed as an ongoing, dynamic process. As such, disclosure should involve multiple conversations that are tied to the child's cognitive development, clinical status, and social circumstances and should facilitate a gradual deepening of understanding of the impact of HIV infection.

Current research suggests that appropriate treatment of pediatric HIV and associated issues requires a multidisciplinary team approach that includes physicians, nurses, nutritionists, pharmacists, dentists, psychologists, social workers, child life specialists, and outreach workers. It is important for these health and allied health care professionals to understand the unique needs of children living with HIV. These needs can only be fully met if responsibility is shared amongst a multidisciplinary team, where pediatric HIV specialists provide HIV therapy and care of opportunistic infections, and other physicians and allied health care professionals provide primary care and supportive services. Research also suggests that an ideal treatment model for children living with HIV would be the integration of medical, psychosocial, and social services by both primary clinicians and community-based outreach staff. While all healthcare professionals cannot and should not be expected to be knowledgeable about every aspect of care and treatment for pediatric HIV, their assistance can greatly improve the care received by children living with HIV.

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

1. Introduction

With the advent of combination antiretroviral therapy (ART)[1] and other advancements in the care of individuals living with human immunodeficiency virus (HIV), HIV has been reclassified from an acute, fatal disease to a chronic medical condition (Das et al., 2010; Davies, Bachanas, & McDaniel, 2002; Dobrova-Krol et al., 2010; Garvie et al., 2009; Hazra, Sibery, & Mofenson, 2010; Paul et al., 2009; Rao et al., 2007). These advances have also led to improved prevention of mother-to-child transmission (MTCT) of HIV and, consequently, fewer children being born with HIV (Canadian AIDS Treatment Information Exchange [CATIE], 2007; Muralidhar & Nair, 2010). For children who are born with HIV, ART has resulted in decreased mortality and morbidity, meaning that individuals born with HIV live to much older ages and experience a less symptomatic disease course (Butler et al., 2009; Das et al., 2010; Mellins et al., 2002). As a result, research has shifted from focusing solely on prolonging survival to considerations of quality of life, sustained overall health, and clinical monitoring of health markers (Garvie et al., 2009; Paul et al., 2009).

Although ART is a necessary component of care and treatment for children living with HIV, their needs are by no means restricted to these treatments (Ayres et al., 2006). Previous reviews of the literature have shown that, in addition to direct effects of HIV on their immune systems and health, pediatric HIV infection can affect children cognitively, developmentally, emotionally, psychologically, behaviourally, and educationally (Garvie et al., 2009; Paul et al., 2009; Wachsler-Felder & Golden, 2002). Children living with HIV also often face other problems, such as poverty, social instability, a high incidence of familial substance use, deaths of family members, and issues related to medication adherence and disclosure of HIV status (Nozyce et al., 2006). The Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children (2011) suggests that appropriate treatment of these issues requires a multidisciplinary team approach that includes physicians, nurses, nutritionists, pharmacists, dentists, psychologists, social workers, child life specialists, and outreach workers. It is important for these health and allied health care professionals to understand the unique needs of children living with HIV. These professionals also need to understand the role that they can play in the treatment and care of children living with HIV, along with that provided by pediatric infectious disease specialists (Franklin et al., 2005).

1.1 Current Literature Review

Recognizing the importance of understanding the treatment and care needs of children living with HIV, the Saskatchewan Prevention Institute conducted a review of the literature in this area. The focus of the current review is on children living with HIV, between the ages of 6 and 18 years, who acquired the virus through MTCT. For information related to infants and younger children (aged 0 to 5) living with HIV, please refer to a previously completed report by the Saskatchewan Prevention Institute titled “Human Immunodeficiency Virus (HIV) and Pediatric

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[1] Highly active antiretroviral therapy (HAART) and ART are essentially equivalent in developed countries where combination regimens (i.e., three or more medications from at least two classes of drugs) are the approved standard of care. In order to reduce potential confusion, the term ART will be used in the current document.

Treatment and Care in Saskatchewan" (2012). Issues particular to adolescents (e.g., sexual and reproductive health, and transitioning to adult care) will be covered in a separate review.

It is important to note that the purpose of this review is not to provide specific medical or HIV treatment advice. Such advice should only be taken from a pediatric infectious disease specialist or another professional equally knowledgeable about pediatric HIV. Instead, the purpose of this review is to provide information for health and allied health professionals about common issues facing children living with HIV. The information from this review will be shared by the Saskatchewan Prevention Institute in an effort to increase understanding about the care and support needs of children living with HIV in Saskatchewan. The unique needs of these children can only be fully met if the responsibility is shared among a multidisciplinary team, where pediatric HIV specialists provide HIV therapy and care of opportunistic infections, and other physicians and allied health care professionals provide primary care and supportive services (British Columbia Centre for Excellence in HIV/AIDS, 2009).

2. Introduction to HIV

HIV is an acronym for human immunodeficiency virus. This name highlights the fact that HIV can only be transmitted from one human to another human, and that it is a virus that causes a deficiency in the immune system (Positive Women's Network, 2001). HIV is spread when: a body fluid with a high concentration of HIV (blood, semen and pre-cum, vaginal fluid, anal fluid, breast milk) enters the body through an activity (e.g., intercourse, sharing needles, breastfeeding, during labour and delivery) that provides direct access to the bloodstream (e.g., through breaks in the skin or by passing through a mucous membrane) (Positive Women's Network, 2001; Sheth & Thorndycraft, 2009). Common risky activities include unprotected vaginal and anal sex, sharing needles and other substance use equipment, and tattooing and piercing with used needles and equipment. HIV-positive mothers can transmit HIV to their babies through pregnancy, childbirth, and breastfeeding.

Once the virus enters the body, HIV infects the CD4+ T cells. CD4+ T cells the key components of the human cellular immune system (UNAIDS, 2008). When HIV enters these cells, it impairs or destroys them, resulting in a deterioration of the immune system (Society of Obstetricians and Gynaecologists of Canada [SOGC], 2004). HIV is a progressive disease that continually causes changes and damage to an individual's immune system. This makes it difficult for the body to fight off infections and diseases and increases the likelihood of contracting life-threatening infections (UNAIDS, 2008). While currently available drugs (ART) do not cure the HIV infection, they do prevent the development of acquired immunodeficiency syndrome (AIDS). ART prevents the replication of HIV; if this growth stops, then the body's immune cells (most notably the CD4+ cells) are able to live longer and provide the body protection from infection. As these drugs cannot eliminate the virus from the body, people living with HIV must take ART for the rest of their lives (UNAIDS, 2009).

2.1 Pediatric HIV

According to AVERT (AVERTing HIV and AIDS, 2011), 3.4 million children were living with HIV/AIDS around the world in 2010, with an estimated 390,000 new infections in children in the same year. While the vast majority of children living with HIV/AIDS are born in sub-Saharan Africa, there are children living with HIV/AIDS in Canada and in Saskatchewan. Around the world, the most common mode of HIV transmission to children is MTCT (Bracher et al., 2007; Cooper et al., 2007; Davies et al., 2002; Eley & Nuttall, 2007; Goldstein & Morewitz, 2011; Leelanukrom & Pancharoen, 2007; Muralidhar & Nair, 2010; Rao et al., 2007). Other routes of transmission during childhood and adolescence include exposure in a medical setting (through the use of unsterilized needles or contaminated blood products[2]), risky sexual behaviour (either voluntary or coerced, including sexual abuse and rape), and/or high risk substance use (Allison et al., 2009; Brophy et al., 2009). While other modes of transmission do exist, MTCT accounts for over 90% of HIV infections in children around the world (Allison et al., 2009; AVERT, 2011).

MTCT of HIV can occur in utero (through the placenta), intrapartum (during labour and delivery), or postpartum (through breastfeeding) (AIDS InfoNet, 2011; Allison et al., 2009; Blanchette et al., 2002; Brophy et al., 2009; Leelanukrom & Pancharoen, 2007; Miller et al., 2008). According to the Public Health Agency of Canada (PHAC, 2010), an estimated 25% of women living with HIV will transmit the infection to their baby during pregnancy and delivery in the absence of any intervention. If a mother living with HIV breastfeeds her baby and is not receiving treatment, the risk of transmission increases to an estimated 35%. Because of increases in knowledge about MTCT, women receiving proper care have less than a 2% chance of having a baby infected with HIV (Walmsley, 2003). At this time, breastfeeding is still considered a route of HIV transmission, regardless of maternal and infant ART use. Therefore, in North America, it is recommended that all mothers living with HIV exclusively formula feed their children. The use of ART, elective caesarean sections, and formula feeding have been found to produce MTCT rates that are less than 1% (Boucher, 2001; Coovadia, 2004; Thorne & Newell, 2003).

With universal prenatal screening for HIV offering women an opportunity to access transmission prevention and treatment services, MTCT of HIV has been almost eliminated in many parts of the developed world (Mawn, 2012). Along with prenatal testing, these prevention measures include reducing maternal viral load through ART, reducing exposure of the fetus to maternal fluids during delivery, neonatal antiretroviral prophylaxis, and the avoidance of breastfeeding (Leelanukrom & Pancharoen, 2007). Prevention of MTCT is critical in preventing pediatric HIV infection. Where such prevention programs fail, interventions to improve the health and well-being of children living with HIV are vital (Kimani-Murage et al., 2010).

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[2] Since universal screening of donated blood was initiated in 1985, this mode of transmission has been virtually eradicated (Wachsler-Felder & Golden, 2002).

Children who acquire HIV through MTCT (also known as perinatally acquired HIV or PaHIV) are usually followed and treated from birth, resulting in a significant reduction in HIV-related morbidity and mortality (Bracher et al., 2007; Little, Bland, & Newell, 2008). These reductions are attributed primarily to the use of combination ART since the mid-1990s (Hazra, Siberry, & Mofenson, 2010). ART, along with other advancements in knowledge and treatment, have resulted in children living longer, healthier lives with HIV (Mialky, Vagnoni, & Rutstein., 2001). In many developed countries, a child living with HIV now faces a chronic disease rather than a progressive, fatal one (Hazra et al., 2010; Rao et al., 2007). Despite these successes, challenges remain for children who are living with PaHIV (Contugno et al., 2012; Mawn, 2012). Although ART allows individuals to live longer lives, there is no cure for HIV. The effects of the virus remain, requiring lifelong support and specialized care from a variety of health and allied health care providers (Franklin et al., 2005; Mawn, 2012; Miller, 2003; Wachsler-Felder & Golden, 2002).

Challenges related to the medical treatment of pediatric HIV infection include: maintaining adherence to life-long therapy; selecting successive ART regimens considering the limited availability of pediatric formulations and the lack of pharmacokinetic data (the absorption, distribution, metabolism, and excretion of the drug in the body) and safety data for children; overcoming extensive drug resistance in multi-drug-experienced children; and managing the side effects of treatment (Bracher et al., 2007; Hazra et al., 2010; Mawn, 2012). These side effects can range from nausea, diarrhea, and headaches to memory loss, abnormal fat redistribution, cardiac, and/or renal problems (Hazra et al., 2010). HIV is also associated with the potential for multiple cognitive, behavioural, and psychological issues (Noyce et al., 2006). Adding to these challenges, HIV remains more prevalent among children with multiple life stressors, including poverty, familial substance use, parental HIV disease, and the persistence of societal stigma and discrimination (Naar-King et al., 2006; Noyce et al., 2006; Steele, Nelson, & Cole, 2007).

2.1.1 Pediatric HIV in Canada

The pediatric HIV patient population in Canada currently consists of a relatively stable group of children living with HIV who are progressing through their teenage years and entering young adulthood. However, a small number of newly infected infants continue to be born annually (Hazra et al., 2010; PHAC, 2011a). This demographic shift is driven by two major advances during the past 15 years: 1. effective prophylaxis and treatment in pregnant women living with HIV, which have led to extremely low rates of transmission of HIV to their babies; and 2. administration of ART to those babies and children who are infected, with subsequent dramatic declines in mortality (Hazra et al., 2010).

As the number of people living with HIV in Canada has increased, so too has the number of infants perinatally exposed to HIV. However, the number of these infants who are subsequently confirmed to be infected has declined dramatically in recent years. Between 1984 and 2010, 3317 infants were identified as being perinatally exposed to HIV (PHAC, 2011a). In the same time period, 531 infants whose mothers received no perinatal ART prophylaxis were confirmed infected with HIV. Of those whose mothers received any perinatal ART prophylaxis, 35 infants were confirmed infected. Further highlighting the effectiveness of perinatal ART prophylaxis, the number of infected infants born in Canada dropped to 4 out of the 235 reported to be perinatally exposed in 2010 (PHAC, 2011a). Highlighting the effectiveness of ART for reducing HIV-related mortality in children, of the 66 infants confirmed to be infected between 2003 and 2008 in Canada, none died of AIDS-related causes (PHAC, 2011a).[3]

These facts are evidence that Canadian children living with HIV can enjoy relatively healthy lives if they receive appropriate treatment and care on a regular basis and take their medications as prescribed. Unfortunately, HIV has its greatest impact on Canadian populations already vulnerable to a range of health, social, and economic inequities (Saskatchewan Ministry of Health, 2010a). When families are dealing with issues such as poverty, inadequate housing, lack of education or job training, child abuse, and family violence, following HIV treatment and care regimens may be extremely difficult. These issues can impact the care received by the child and, as a result, his or her health.

2.1.2 Pediatric HIV in Saskatchewan

Saskatchewan has seen a substantial increase in the number of new cases of HIV since 2003. In 2010, Saskatchewan had the highest rates of new cases of HIV in Canada at twice the national average (19.1 vs 8.2/100 000) (PHAC, 2011a). According to the Saskatchewan Ministry of Health (2010a), there were 8 cases of HIV infection identified in children 0 to 4 years, and 3 cases identified in children aged 5 to 14 years between 2004 and 2009. It is important to note, particularly for the older age groups, that this data does not specify the mode of transmission. PHAC reports that between 1984 and 2010, 125 infants in Saskatchewan were perinatally exposed to HIV, with 14 becoming infected (PHAC, 2011a). Of these children, 1 died of AIDS and another 1 died of other causes.

Currently in Saskatchewan, women of childbearing age (ages 15 to 39 years; average age of new adult female cases in 2010 was 31.3 years) are one of the groups with the largest increases in HIV infection rates (Saskatchewan Ministry of Health, 2011). Therefore, it can be expected that there will also be a rise in perinatally exposed infants. With appropriate treatment and care, including the use of ART, the risk of MTCT of HIV is very low. For those children that are born with HIV, appropriate treatment and care is needed in order to ensure the highest quality of life possible (Paul et al., 2009).

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[3] In contrast, 101 of the 500 infants confirmed to be infected between 1984 and 2002 died of AIDS-related causes (PHAC, 2011).

3. Medical Treatment of Pediatric HIV

Without effective treatment, HIV rapidly progresses (Eley & Nutall, 2007). In the absence of treatment, most infants and children younger than 5 years old with PaHIV experience rapid progression to severe symptomatic disease and death. This is particularly true in resource-limited settings (Committee on Pediatric AIDS, 2007). In Canada, the majority of children living with HIV are diagnosed when they have no or few symptoms (Brophy et al., 2009). Early diagnosis of HIV is important for the initiation of ART prior to severe immune deficiency (CATIE, 2009). Specifically, early treatment benefits viral suppression, disease progression, growth and neurological development, and reduces long-term neurological complications (Paul et al., 2009; Penazzato et al., 2010). Those who are severely immune-compromised at the start of therapy experience higher morbidity and mortality (Brophy et al., 2009; Haldar & Reddy, 2009).

For children living with HIV who are not identified soon after birth, diagnosis of infection may not occur until they present with symptoms (e.g., widespread lymphadenopathy, recurrent bacterial infections, bilateral persistent parotid gland enlargement, or opportunistic infections) (Kennedy, 2003). Other clinical signs suggestive of HIV include generalized lymph node enlargement, oral thrush, generalised rash, recurrent abscesses, recurrent herpes simplex infections, Kaposi's sarcoma, shingles, and molluscum contagiosum (Muralidhar & Nair, 2010). Children older than 18 months of age can be diagnosed through serological testing (Leelanukrom & Pancharoen, 2007). For those who are confirmed to be living with HIV, their immune status (severity of HIV-related immunodeficiency) can be assessed by measuring the absolute number (per mm) or percentage of CD4+ cells (Muralidhar & Nair, 2010). It is important to note that children normally have a much higher CD4+ cell count than adults. This is also true of viral load (i.e., the amount of HIV in the blood). Children's CD4+ cell counts and viral load levels usually approach adult levels when they enter adolescence (CATIE, 2009). Age must therefore be taken into account as a variable when considering absolute CD4+ counts or CD4+ percentages (Muralidhar & Nair, 2010).

In addition, children living with PaHIV present with their own set of treatment issues, separate from those seen in adult populations (Muralidhar & Nair, 2010). Complex areas of pediatric HIV care include: what to prescribe; how to ensure adherence; when and how to tell a child his/her diagnosis; and the differing needs of children of different ages (Kennedy, 2003). The Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children (2011) states that monitoring growth and development, short and long-term drug toxicities, neurodevelopment, symptom management, and nutrition are all essential in the care of children living with HIV as these factors can significantly influence quality of life. Laufer and Scott (2000) suggest that children living with HIV should be seen at least every three months. At every visit, a complete physical examination should be done, with attention paid to each of these factors. When necessary, referrals to specialty services can be made.

3.1 Introduction to ART

Current recommendations for treating HIV in children include combination ART, the most effective intervention for improving the outcome of pediatric HIV infection (Eley & Nuttall, 2007;

Gulick, 2010; Muralidhar & Nair, 2010). Children living with HIV have been treated with combination ART since 1996 (Eley & Nutall, 2007). ART includes starting treatment early and achieving maximal suppression of viral replication using a combination of at least three different medications from at least two different classes (Cotugno et al., 2012; Committee on Pediatric AIDS, 2007; Forsyth, 2003; Miller et al., 2008; Resino et al., 2006; Roberts et al., 2004; van Dyke et al., 2011).

When used optimally, ART can reduce pediatric HIV viral loads to undetectable levels through its ability to interfere with the way that HIV makes copies of itself and the way it spreads from cell to cell (Lin et al., 2011; Naar-King et al., 2006; Pontali, 2005; UNAIDS, 2009). As ART suppresses HIV virus production and increases CD4+ cell counts, its use is associated with improved immune function, delayed clinical progression, a reduction in opportunistic infections and other complications of HIV infection, and improved growth and neurocognitive function (Brown et al., 2000; Gulick, 2010; Hammami et al., 2004; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Pontali, 2005; Roberts et al., 2004; Shah, 2007; van Dyke et al., 2011).

ART has also been shown to reduce mortality in children living with HIV (Cooper et al., 2007; Eley et al., 2006; Miller et al., 2008; Paul et al., 2009; Resino et al., 2006; Viani et al., 2004). The Committee on Pediatric AIDS (2007) reports that ART has been shown to decrease mortality in children by fivefold or more, resulting in survival rates into adulthood of over 90 percent. Related to this finding is the fact that ART is associated with immune rebuilding and recovery (Cotugno et al., 2012; Miller et al., 2008; Resino et al., 2006; Roberts et al., 2004), leading to enhanced health status overall (Eley et al., 2006; Miller et al., 2008; van Dyke et al., 2011; Viani et al., 2004). This immune recovery typically occurs faster in children than in adolescents and adults (Cotugno et al., 2012). Unfortunately, the success of ART remains far from universal or permanent. Issues such as adherence to treatment can have a large impact on treatment success (Cotugno et al., 2012). This will be discussed later in this review.

3.2 ART Guidelines

The Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children (2011) outlines the goals of ART for children living with HIV as including: reducing HIV-related mortality and morbidity; restoring and/or preserving immune function as reflected by CD4+ cell measures; suppressing viral replication as much as possible for as long as possible; preventing viral drug-resistant mutations; minimizing drug-related toxicity; maintaining normal physical growth and neurocognitive development; and improving quality of life. The guidelines around the use of ART are designed to ensure that these goals are met through the appropriate treatment and care of children living with HIV.

Since the first evaluation of combination ART in children in the mid-1990s, many more ART drugs have been developed and several new classes of drugs have become available. Pediatric use of these drugs has been hampered, however, by the lack of pediatric formulations and pharmacokinetic data (information about the long term impact and metabolism of these drugs) (Hazra et al., 2010). As of early 2009, 25 ART drugs have been approved by the U.S. Food and Drug Administration (FDA).[4] Seventeen of these drugs have been approved for use in pediatric populations, and 15 are available as a pediatric formulation (e.g., liquid) (AIDS InfoNet, 2011; Hazra et al., 2010). It can be difficult to determine the best dose for children, as adult dosing does not directly translate to pediatric dosing (Hazra et al., 2010). Instead, pediatric doses can be based on weight, body surface area, or a child's individual development (AIDS InfoNet, 2011). Lack of data on adequate dosing for different age groups can lead to inadequate drug concentrations and decreased effectiveness of treatment in children (Hazra et al., 2010).

Guidelines on the use of ART in children change rapidly. Therefore, health care professionals are advised to talk to specialists in this area and keep updated from relevant websites (Kennedy, 2003; Leelanukrom & Pancharoen, 2007). Although the details of treatment are beyond the scope of this review, updated guidelines on treatment can be found online at http://www.aidsinfo.nih.gov/Guidelines. These guidelines were last updated in 2010 and are updated regularly to provide the most current information. Canada does not currently have national treatment guidelines, which is a reflection of Canada's provincially administered healthcare system. In practice, Canada tends to follow these US guidelines.

After initiating ART or starting a new ART treatment regimen, it is recommended that children be evaluated within 1-2 weeks to screen for clinical side effects and to ensure patient/caregiver adherence to the regimen (AIDS Info, 2011). More frequent evaluations may be needed following any change in therapy. These evaluations can take place in person or over the phone. At least every 3-4 months, it is suggested that children are seen by their health care provider to assess both the effectiveness and the potential toxicity of the chosen ART regimen (AIDS Info, 2011).

3.3 Efficacy of ART

The effectiveness of ART treatment in children is monitored by clinical improvement, gain in body weight, decrease in the occurrence and severity of HIV-related diseases, increase in total lymphocyte count, and improvement in the biological markers of HIV (e.g., CD4+ T-lymphocyte counts and plasma HIV RNA levels) (Muralidhar & Nair, 2010). Research has shown that undetectable viral loads can be sustained in children over a ten year period, along with a marked decrease in morbidity and mortality due to HIV/AIDS (Bracher et al., 2007).

Many factors can interfere with the effectiveness of ART and its ability to suppress viral replication. These include incorrect dosing resulting in low potency of one or more of the ART drugs, viral resistance, and/or inadequate adherence to therapy (Pontali, 2005; Roberts et al.,

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[4] Although Canada typically follows the FDA's recommendations for ART drug approvals, each province has its own approval process. More information about the accessibility of each medication by province can be found at http://www.hivclinic.ca/main/drugs_reimbuse_files/Provincial%20Coverage%20of%20HIV%20medications.pdf.

2004; Shah, 2007). The major factor determining the success of ART appears to be adherence; ideally patients need to take each dose of the prescribed medications at the correct time. Poor adherence increases the risk of treatment failure and viral resistance (Paranthaman et al., 2009; Shah, 2007). Treatment failure is defined as a suboptimal response or a lack of a sustained response to therapy using virologic, immunologic, and clinical criteria (British Columbia Centre for Excellence in HIV/AIDS, 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

Clinical factors include progressive neurodevelopmental deterioration, growth failure, and severe or recurrent infections. Virologic factors include an incomplete viral response to therapy (i.e., poor response after 8 – 12 weeks of therapy or viral load not suppressed to undetectable levels after 6 months of therapy) and viral rebound (i.e., repeated detection of viral load after being undetectable or increase in viral load after initial response to therapy). Immunologic factors associated with treatment failure include incomplete immunologic response to therapy and immunologic decline (British Columbia Centre for Excellence in HIV/AIDS, 2009). Each of these types of treatment failure factors can occur alone or in combination.

While not all instances of treatment failure require an immediate change in ART, a careful assessment is needed to evaluate the cause of treatment failure and determine an appropriate management strategy (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Clinical failure represents the most urgent and concerning type of treatment failure and should prompt an immediate evaluation (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Although many children can remain on stable ART for several years, at some point a reassessment of the regimen will become necessary.

3.4 ART and Drug Resistance

Reassessment of an ART regimen may also become necessary due to HIV drug resistance. The development of drug resistance compromises ART's ability to control the progression of HIV and to prolong survival of children living with HIV (Clavel & Hance, 2004). Resistance is the consequence of mutations that emerge in the viral proteins targeted by ART agents. ART drug-resistant viruses can develop in both multi-drug experienced children and children who received initial regimens containing one or two drugs that incompletely suppressed viral replication (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Additionally, primary resistance may be seen in infants and children who received a drug resistant strain of HIV through MTCT. Drug resistant strains of HIV can also develop due to the administration of maternal or infant ART used for the prevention of MTCT (AVERT, 2012; Hazra et al., 2010; WHO, 2010).

Development of drug resistance in children is usually related to poor adherence, use of suboptimal regimens, or to problems with drug absorption, metabolism, or elimination (WHO, 2010). HIV is a retrovirus characterized by rapid replication, a high mutation rate, viral recombination, and the need for lifelong treatment (Clavel & Hance, 2004; WHO, 2010). Because of these characteristics, some degree of drug resistance is anticipated to occur among persons on treatment even if appropriate ART regimens are provided and optimal adherence to therapy is supported (WHO, 2010). In patients who receive combination ART as their first-line therapy (as opposed to a one or two drug regimen), the emergence of viral resistance is more difficult but is still possible (Clavel & Hance, 2004). When drug resistance does occur, several classes of drugs are often affected, along with cross-resistance between drugs within a class. This further complicates efforts to control viral replication following the identification of drug resistance (Clavel & Hance, 2004).

In an effort to reduce the likelihood of drug resistance developing, current ART regimens usually comprise a combination of at least three antiretroviral drugs from at least two drug classes (Clavel & Hance, 2004; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2009). There are three different classes of drugs: nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors, and protease inhibitors. The first two classes of drugs block the reverse transcriptase that the HIV virus needs in order to make new copies of its genetic material. The last class of drugs blocks protease that HIV needs to multiply in the body (UNAIDS, 2009). The use of drugs from different classes is important for controlling the development of resistance (Clavel & Hance, 2004). The first combination of drugs taken by a patient is called the first line regimen. Although this first line regimen can be effective for many years, a second line regimen is needed if the first one begins to fail. If the second line therapy also eventually fails, a third line or salvage cocktail of medicines is usually recommended (UNAIDS, 2009).

It is worth emphasizing that in the context of ART, resistance is most often the consequence – not the cause – of initial treatment failure (Clavel & Hance, 2004). Once resistance begins to develop however, a vicious circle of increasing treatment failure and increasing levels of resistance can lead to situations in which it becomes very difficult to control viral replication with currently available drugs (Clavel & Hance, 2004). Therefore, prevention of resistance is a priority that requires ongoing patient education regarding the risks of resistance and the use of improved drug regimens that ensure optimal tolerance, adherence, and potency.

3.5 Potential Side Effects of ART

Despite the successes of ART, these medications can be associated with significant adverse side effects (Forsyth, 2003). Reductions in HIV-related mortality has resulted on focus now being placed on issues related to chronic, long-term HIV infection and its treatment (Hazra et al., 2010). Treatment-related toxicity (adverse reactions) may be acute, occurring soon after a drug has been administered; sub acute, occurring within 1-2 days of administration; or late, occurring after prolonged drug administration (AVERT, 2012). According to the Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children (2011), side effects of ART agents should prompt a re-evaluation of the ART regimen.

In general, mild and moderate toxicities do not require a discontinuation of therapy or drug substitution. Moderate or severe toxicities may require the substitution of a drug, but do not require the discontinuation of all ART (WHO, 2010). Severe life-threatening toxicity requires the discontinuation of all ART and the initiation of appropriate supportive therapy until the child is stabilized and the toxicity is resolved. With the substitution of another drug, ART can be resumed after the symptoms resolve (AVERT, 2012; British Columbia Centre for Excellence in HIV/AIDS, 2009). Even mild adverse effects may have a negative impact on medication adherence and should be discussed before the initiation of therapy, at regular health care visits, and at the onset of any side effects (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; WHO, 2010). More minor side effects (e.g., nausea, headaches, and abdominal discomfort) may recede over time or respond to changes in diet or method and timing of medication administration (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

Differentiating between complications of HIV disease and ART toxicity is sometimes difficult (Leelanukrom & Pancharoen, 2007). Alternative explanations for an observed toxicity can include a concurrent infection (e.g., common childhood illnesses) or a reaction to medications other than ART (WHO, 2010). Certain side effects (e.g., lipodystrophy) can be hard to assess in children because of growth changes and puberty (Miller et al., 2008). Such changes can be subtle and less severe than those seen in adults and are often associated with puberty in healthy populations (Miller et al., 2008). Therefore, care should be taken to exclude other possible causes of illness.

While many side effects are not considered serious and can improve over time (UNAIDS, 2009), other side effects are serious. Possible adverse reactions of ART include:

1. Mitochondrial dysfunction (e.g., lactic acidosis, hepatic toxicity, pancreatitis, and peripheral neuropathy);
2. Lipodystrophy and metabolic abnormalities (e.g., fat maldistribution and body changes, hyperlipidemia, hyperglycemia and insulin resistance, and bone disorders such as osteopenia, osteokporosis, and osteronecrosis);
3. Hematologic adverse events from drug-induced bone marrow suppression (e.g., anemia, neutropenia, and thrombocytopenia); and
4. Allergic reactions (skin rashes and hypersensitivity responses) (British Columbia Centre for Excellence in HIV/AIDS, 2009; Leelanukrom & Pancharoen, 2007; Roberts et al., 2004).

Treatment-related metabolic complications are frequently observed during ART in children (UNAIDS, 2009). Altered body composition, lipid abnormalities, and abnormal glucose metabolism are all factors leading to an increased risk of cardiovascular disease. These factors are due to both medications and HIV effects (Miller et al., 2008). Lipodystrophy syndrome is characterized as body fat abnormality (i.e., wasting and disappearance of fat from the face and limbs but an increase in fat in the abdominal region and over the lower part of the rear of the neck) and/or metabolic disturbances (Alam et al., 2012; Forsyth, 2003; Hazra et al., 2010; Miller et al., 2008). The prevalence of these body composition changes in children living with HIV has been cited to range from 10% to as high as 43% (Hazra et al., 2010). Alam et al. (2012) found that risk of fat abnormality is associated with puberty and with the use of specific drugs, including stavudine and ritonavir. In addition to the increased cardiovascular risk associated with lipodystrophy, there can also be adverse psychological consequences. These can include reduced adherence to treatment, low self-esteem, and depression. There can also be challenges in emotional and sexual development (Miller et al., 2008). These issues are heightened in adolescents who may be more sensitive to changes in physical appearance (Forsyth, 2003; Miller et al., 2008; Pontali, 2005).

Children's bodies are still developing, and they will be exposed to ART for prolonged periods of time, making them particularly vulnerable to side effects of ART (AVERT, 2012). Therefore, it is important to understand the side effects of treatment and the impact of these side effects on children undergoing treatment. Children living with HIV will receive ART for increasingly long durations, be exposed to drugs at critical points in physiological development, and will likely accumulate exposures to multiple regimens (Alam et al., 2012). Side effects are a commonly highlighted treatment issue, one that is often directly related to treatment adherence and quality of life perceptions (Sacajiu, Raveis, &Selwyn, 2009). Therefore, although it can be difficult in the context of lifelong treatment, it is important to find a suitable balance between the effectiveness of ART and the side effects of treatment (Penazzato et al., 2010). More detailed information about specific adverse reactions and their management is available at www.aidsinfo.nih.gov.

3.6 Importance of Family-Centred Care and Treatment

As most HIV infections in children occur through MTCT, pediatric HIV has implications for the entire family, including the potential loss of parents and siblings to the same disease (Hansell et al., 1999; Steele et al., 2007). Therefore, many researchers advocate for a family-centred approach to treatment for children living with HIV (Brown, Lourie, & Pao, 2000; Cohen, 1994; DeGennaro & Zeitz, 2009). Cohen (1994) suggests that pediatric HIV treatment should include three areas: 1. individual characteristics, 2. disease characteristics, and 3. family processes. Researchers have found that comprehensive family-centred care requires prompt maternal and pediatric HIV diagnosis, antiretroviral prophylaxis, opportunistic infection prophylaxis, long-term ART for the entire family, nutritional supplementation, and optimal infant feeding support (DeGennaro & Zeitz, 2009). Ideally this would be provided in one centre that would also have access to psychosocial support and community-based support programs.

The Oak Tree Clinic in the Children's and Women's Health Centre of BC in Vancouver, British Columbia is an example of family-centred care for HIV. This centre provides HIV care and treatment to children, pregnant women, and women and their partners (British Columbia Centre for Excellence in HIV/AIDS, 2009). Treatment includes a medical team of pediatric infectious disease specialists, internal medicine and gynecology, nurses, pharmacists, dieticians, social workers, outreach workers, and mental health physicians.

3.7 Importance of the Treatment Team

Appropriate pediatric HIV care requires participation by more than a pediatric infectious disease specialist. Other important care professionals include a social worker who can discuss emotional and family concerns; a dietitian who can discuss diet and nutrition needs; a developmental specialist who can discuss child development and learning issues; a physiotherapist to assess overall motor development; a psychiatrist who can assess self-esteem, readiness for disclosure, and any mental health concerns; and a family doctor or pediatrician for regular care (Brophy et al., 2009; Brown et al., 2000; Davies et al., 2002). According to Brown et al. (2000), an ideal treatment model for children living with HIV would be the integration of medical, psychosocial, and social services by both primary clinicians and community-based outreach staff.

3.8 Importance of Vaccinations

Vaccines are an extremely effective primary prevention tool, aimed at preventing infectious diseases (Cotugno et al., 2012; Mofenson et al., 2009). Due to their weakened immune systems, children living with HIV are very vulnerable to opportunistic infections and other diseases. Therefore, these children need to be provided with preventative treatment and vaccinations to prevent such illnesses (AVERT, 2012; Mofenson et al., 2009). Although most vaccines recommended for routine use can be administered safely to children living with HIV, the use of “live” vaccines is not recommended (AVERT, 2012). As the ability to respond to vaccinations depends on the functioning of the immune system at the time of vaccination, it is recommended that the child’s HIV be stable, and their CD4+ cell count be high enough, prior to performing any vaccination (CATIE, 2009; Cotugno et al., 2012). In Saskatchewan, the immunization schedule is set by Saskatchewan Public Health and can be found at http://www.health.gov.sk.ca/immunization-schedule.

4. Treatment Adherence

It has been proven that ART is effective in suppressing HIV replication, decreasing morbidity and mortality associated with HIV, and improving quality of life in children infected with HIV (Paranthaman et al., 2009; Shah, 2007). However, the effectiveness of ART is dependent on patients’ adherence to the medication schedule (Hazra et al., 2010). Adherence to medication, also known as compliance, is “the extent to which a person’s behaviour in taking medication, following dietary specifications and/or executing lifestyle changes corresponds to the agreed recommendations from a healthcare provider” (p. 56). In the case of pediatric HIV, both the caregiver’s and the child’s behaviours are important, and agreement on treatment recommendations is required from both the child and caregiver (Shah, 2007).

Medical adherence is fundamental to the success of ART (Martin et al., 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Adherence is a major factor in determining the degree of viral suppression achieved in response to ART (Forsyth, 2003; Martin et al., 2009). Poor adherence may lead to virologic failure and the development of drug resistance to one or more drugs in a given regimen and possible cross resistance to other drugs in the same class (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Naar-King et al., 2006; Williams et al., 2006). Therefore, poor adherence has implications for limiting future effective drug regimens for patients who develop drug-resistant viral strains. Non-adherence leading to drug resistance results in the use of more expensive and often more toxic second or third line drugs, which has negative impacts at both individual and population levels (Paranthaman et al., 2009).

In patients with HIV infection, it is essential to achieve more than 95% adherence to ART in order to suppress viral replication and disease progression and to avoid the emergence of drug resistance (Beals et al., 2006; Hammami et al., 2004; Hazra et al., 2010; Lin et al., 2011; Martin et al., 2009; Naar-King et al., 2006; Pontali, 2005; Roberts et al., 2004; Wrubel et al., 2005). Studies have shown that less than 95% adherence is associated with a virologic failure rate of more than 50% (Shah, 2007), and a substantially increased risk of disease progression and death (Hazra et al., 2010). Achieving such high rates of adherence is often very challenging because ART regimens include multiple drugs that may have complex dosing schedules. ART regimens may also cause food interactions and adverse reactions (Forsyth, 2003; Hammami et al., 2004; Shah, 2007; Williams et al., 2006). There are many steps in ensuring adherence: remembering that it is time to take the medications, opening the bottles and retrieving the medications, swallowing the medication, noticing when refills are needed, and calling to arrange and pick up the refills (Beals et al., 2006; Marhefka et al., 2008). Adherence can be negatively affected at any of these steps.

More recent advances in ART have allowed for a reduction in the number of pills an individual needs to take (pill burden) and less frequent dosing, meaning that adherence may be less challenging than in the past for many individuals (Martin et al., 2009). Evidence suggests, however, that adherence remains a problem, particularly in children and adolescents. Multiple studies have reported that fewer than 50% of children and/or caretakers report full adherence to prescribed HIV regimens (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

4.1 Assessing Adherence

Adherence is commonly quantified as the percentage of doses taken as prescribed (i.e., number of correct doses taken at the correct time) (Martin et al., 2009; Williams et al., 2006). However, variables such as the number of doses per day, the number of pills per dose, the number of medications, and specific requirements of the regimen (e.g., meal indications, medication storage conditions) all play a part in adherence and the ease with which adherence can be achieved (Martin et al., 2009). Therefore, adherence to treatment should be assessed on a regular basis. Use of multiple methods to assess adherence is typically recommended (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

Viral load response to a new regimen is often the most accurate indication of adherence, but it may be a less valuable measure in children with long treatment histories and those with a multidrug-resistant virus (Panel on Antiretroviral Therapy and Medical Management of HIV-

Infected Children, 2011). Other assessment methods include: self-reports by children and caregivers, descriptions of medication regimens, reports of barriers to administration of medications, pharmacy refill checks, and pill counts (Martin et al., 2009). Targeted questions about stress, pill burden, and daily routine are also recommended (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Electronic monitoring devices, such as Medication Event Monitoring System (MEMS) caps, which are equipped with a computer chip that records each opening of a medication bottle, have been shown to be useful in some settings (Martin et al., 2009). Home visits can play an important role in assessing adherence as well.

If a pediatric patient is not responding to therapy and problems related to the medication regimen are ruled out, then nonadherence by the caregiver must be investigated (Roberts et al., 2004). In some cases, suspected nonadherence can only be confirmed when persistently elevated viral load levels decrease with directly observed therapy (i.e., during hospitalizations or in other supervised settings) (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Roberts et al., 2004).

4.2 Barriers to Treatment Adherence

Adherence is a complex health behaviour that is influenced by the regimen prescribed, patient and family factors, and the characteristics of the healthcare provider (Chantry et al., 2010; Naar-King et al., 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Penazzato et al., 2010; Pontali, 2005; Shah, 2007; Williams et al., 2006). Adherence is not a static concept and once achieved it must be maintained over time. Understanding barriers to treatment adherence is important because decreased adherence to ART is associated with diminished treatment efficacy, increased viral load, the development of antiretroviral drug resistance, and reduction in HIV treatment options (Malee et al., 2011; Marhefka et al., 2006; Paranthaman et al., 2009).

4.2.1 Medication Related Adherence Factors

Research examining barriers to adherence report that medication-related factors tend to be among the most common reasons provided for non-adherence (Forsyth, 2003; Paranthaman et al., 2009). Relevant medication-related factors that can affect adherence include: formulation (liquid, tablet, capsule), taste and palatability, size of tablets/capsules, storage requirements, complexity of regimen (e.g., number of different drugs, dietary requirements, dosage, pill burden), drug-drug interactions, toxicity and adverse effects, and cost (Eley & Nuttal, 2007; Forsyth, 2003; Hammami et al., 2004; Malee et al., 2011; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Paranthaman et al., 2009; Pontali, 2005; Shah, 2007). Some of these factors may be particularly difficult for children to overcome.

One of the key barriers to adherence for children is the palatability of the medications. At times, this is so unpleasant that the liquid formulations of some drugs may be practically unusable (Committee on Pediatric AIDS, 2007; Wrubel et al., 2005). Drug palatability is a specific concern in children because of their inability to consume tablet and capsule forms orally. In a Canadian study of 119 children, one third of the children failed adhere to their treatment because of poor drug taste (Lin et al., 2011). Further, physicians in this study stated that liquid ritonavir required a treatment change because of its poor taste more than 50% of the time. However, this knowledge rarely prevented them from prescribing these drugs as first-line therapy to children. While adverse drug reaction profiles, administration schedule, potential drug interactions, cost, or efficacy of drugs typically play an important role in ART selection for children, palatability does not (Lin et al., 2011).This is despite the fact that improved taste of ART drugs in children leads to better adherence, resulting in better treatment outcomes and reduced family stress (Bracher et al., 2007; Lin et al., 2011). Treatment changes because of poor palatability are clinically important because they indicate periods of poor adherence prior to treatment change, a situation that may result in sub-therapeutic drug exposure leading to viral resistance (Lin et al., 2011).

Along with palatability, there are other problems with liquid formulations. For example, they can be difficult to dose adequately, need to be refrigerated, and are often given in large volumes (Committee on Pediatric AIDS, 2007; Hazra et al., 2010; Little et al., 2008).Because of the lack of appropriate pediatric formulations for certain drugs, caregivers may break or crush tablets meant for an adult patient in an attempt to produce child-sized doses (Committee on Pediatric AIDS, 2007). With tablets that are asymmetric or not scored, this may lead to administration of erratic and inappropriate doses due to the difficulty of breaking tablets into exact doses (AVERT, 2011; Paranthaman et al., 2009). Therefore, the non-availability of pediatric fixed-dose combinations and incomplete information on dosing of young children for some agents are additional barriers to treatment and adherence (Eley & Nuttal, 2007).

As previously discussed, certain side effects (e.g., metabolic complications, lipodystrophy) can also significantly affect adherence (Bracher et al., 2007; Shah, 2007). Other side effects associated with medication non-adherence include nausea, vomiting, stomach cramps, diarrhea, rash, sleeplessness, and sedative effects (Wrubel et al., 2005). Vomiting is particularly problematic because it makes taking the medication even more aversive to children. Vomiting after taking medication also poses a problem because it can be difficult to judge whether to re-administer the medication (Wrubel et al., 2005). These side effects, along with dosage requirements, can interfere with daily activities and quality of life for children living with HIV. A lack of compatibility of ART with daily activities is very often observed and is considered one of the most limiting factors in relation to adherence to ART in pediatric patients (Pontali, 2005).

Most of the adherence related factors discussed in this section gain even more relevance with the use of complex (four or more) combination regimens, which are typically used after multiple treatment failures. In these cases, clinicians are forced to use drugs that are less well tolerated and regimens that contain a larger number of pills (Pontali, 2005). Perinatally infected youth are often in need of such salvage therapy because of extensive drug resistance and treatment experience (Hazra et al., 2010). These salvage ART regimens typically involve a heavy pill burden, multiple doses per day, and complex dosing instructions (Hazra et al., 2010). These complicated regimes pose greater challenges to adherence, and can therefore lead to further resistance and the need for even more complex regimens.

4.2.2 Pediatric Patient Adherence Factors

Child related issues such as age, clinical stage, change in health status, and knowledge of HIV status can also negatively affect adherence (Malee et al., 2011; Pontali, 2005; Shah, 2007). Willingness to take medications and refusal of treatment are other significant factors (Malee et al., 2011; Paranthaman et al., 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Pontali, 2005; Shah, 2007). Children may actively resist taking medications, spit them out, or hide them (Marhefka et al., 2008; Simoni et al., 2007). Whereas adults generally know why they are taking their medications, control their own medication usage, and have some sense of the importance of adherence, many children living with HIV have not been explicitly told their diagnosis or why adherence to their medications is important (Pontali, 2005; Vreeman et al., 2010). This can increase levels of treatment refusal.

Research has also shown that adherence rates are associated with child age, health beliefs, and psychosocial functioning (Steele et al., 2007). Age becomes particularly relevant to adherence in infancy and adolescence because of the specific developmental and psychological issues present in these age groups (Malee et al., 2011; Pontali, 2005). Administration of complex regimens at a time when children do not want to be different from their peers (adolescence) can act as a significant barrier for adherence (Bracher et al., 2007; Shah, 2007). The expectation that older children and adolescents should assume responsibility for taking their medication – in the setting of peer pressure to conform, chaotic social schedules, and issues related to stigma and body image – is often unrealistic (Hazra et al., 2010). However, many caregivers expect children to take their medications more independently as they age, sometimes without supervision and reminding, possibly before children are ready for this responsibility (Marhefka et al., 2006). This can lead to increased levels of nonadherence.

Related to the impact of psychosocial functioning on pediatric adherence to ART, children with emotional and behavioural problems, including depression and conduct disorders, have been found to have higher rates of nonadherence (Malee et al., 2011; Williams et al., 2006). Behavioural problems may interfere with children's motivation and ability to comply with directions and may affect caregivers' ability to foster positive adherent behaviours in their children (Malee et al., 2011; Williams et al., 2006).

4.2.3 Family Related Adherence Factors

Treatment adherence in children living with HIV is made more difficult by the fact that adherence involves an interaction between the parent/family and the child, in which many children depend almost entirely on a caregiver to administer the medications and to access the clinical care system (Hazra et al., 2010; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Pontali, 2005; Simoni et al., 2007; Vreeman et al., 2010; WHO, 2010; Williams et al., 2006; Wrubel et al., 2005). The successful treatment of a child is largely determined by the resources, commitment, and effectiveness of their caregivers (Marhefka et al., 2006; Simoni et al., 2007; Thorne et al., 2002; Vreeman et al., 2010). The HIV status of the caregivers, along with their beliefs and attitudes toward treatment, have been found to influence adherence levels (Paranthaman et al., 2009; Pontali, 2005; Simoni et al., 2007; Steele et al., 2007). Other important caregiver related factors include the type of the caregiver responsible for HIV treatment (e.g., parent, relative, institution based), characteristics of the caregiver (presence of anxiety and/or depression, active substance use, education level), and fear of disclosure of HIV status of the family (Pontali, 2005; Steele et al., 2007).

Family related factors that can impact pediatric treatment adherence include family disruption, which may be a consequence of adverse health or economic conditions (Pontali, 2005; WHO, 2010). Families affected by HIV often face other life stressors that affect adherence, including poverty, parental HIV disease, parental substance use, unstable housing, stigmatization, and limited social support (Brown et al., 2000; Davies et al., 2002; Dobrova-Krol et al., 2010; Forsyth, 2003; Malee et al., 2011; Naar-King et al., 2006; Shah, 2007; Simoni et al., 2007; Williams et al., 2006). This may help to explain why children receiving therapy from foster parents or adoptive parents are more adherent than those receiving medications from biological parents or relatives (Penazzato et al., 2010; Williams et al., 2006).

The fact that the biological parent of a child living with HIV may also be HIV positive increases psycholosocial and medical burdens and influences the ability to adhere to the treatment (Hammami et al., 2004; Pontali, 2005; Shah, 2007). In such a situation, issues such as disclosure, privacy, and caregiver’s feelings of guilt about MTCT of HIV may increase the possibility of nonadherence (Hammami et al., 2004). Caregivers’ fears of being isolated or stigmatized can lead to them to trying to hide the medication and everything associated with the HIV diagnosis (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Shah, 2007; Simoni et al., 2007; Vreeman et al., 2010). Many caregivers report delaying or skipping doses because they did not want to give their child medications in front of others (Vreeman et al., 2010). Persistent and unresolved feelings of guilt over having infected their children can make giving the medications difficult (Marhefka et al., 2008; Simoni et al., 2007; Wrubel et al., 2005). The medications can serve as a persistent reminder of the source of illness.

Compared to caregivers of children who do not have HIV infection, caregivers of children living with HIV are more likely to be addressing multiple non-illness related stressors including poverty and substance use (Marhefka et al., 2006). Caregivers who are living in poverty have difficulty maintaining stable home environments for their families. The result can be a chaotic, unstructured environment in which the long-term need for routine medication-taking may be overridden by the immediate needs of avoiding harm, feeding the family, maintaining stable housing, and financial stress (Marhefka et al., 2006; Elliott-DeSorbo, Martin, & Wolters, 2009).

Other common barriers faced by adult caregivers that can contribute to nonadherence in children include forgetting doses, changes in routine, and being too busy (Marhefka et al., 2008; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Vreeman et al., 2010; Wrubel et al., 2005). Decreased adherence has also been explained by mental fatigue, depression, and giving up hope for a future (Sacajiu et al., 2009; Wrubel et al., 2005). In an effort to deal with the mental fatigue caused by strict adherence, some caregivers may place too much responsibility for managing medications on older children before the children are developmentally able to take on such tasks (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). This can have a serious, negative effect on adherence levels.

While examining mental fatigue and the daily life experiences of caregiving mothers, Wrubel et al. (2005) found that consistent adherence often came at an emotional cost to the mothers. Even when mothers are fully committed to adherence, have resolved feelings of guilt, and are not concerned with stigma, they may still have to deal with negative feelings about having to upset their children and cause them pain through their treatment regimen. Mothers, and other caregivers, may have to repeatedly suppress their feelings of frustration, or they may feel worn down by their children’s repetitive resistance to taking the medications. In other words, adherence problems may not always be based on a lack of commitment or ability to adhere to the regimen. Instead, they may be based on compassion for the child’s resistance to and dislike for taking the medication (Marhefka et al., 2008; Wrubel et al., 2005).

It is important to understand the many barriers to treatment adherence experienced by caregivers so that interventions can be put in place to improve adherence to ART. The evidence for the clinical benefits of ART in children living with HIV is so strong that a demonstrated inability to provide needed care or complete parental refusal to treat children living with HIV is now a child protection issue in several countries (Penazzato et al., 2010; Roberts et al., 2004). In Saskatchewan, Child and Family Services can become involved in cases where proper treatment is not being obtained for children. 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 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 treatment. If appropriate treatment is not obtained for the child, 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 treatment is 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 treatment on behalf of the child.

4.2.4 Healthcare System Adherence Factors

Adherence can also be affected by factors not directly related to medication, patients, or their families. The healthcare system through which treatment is delivered is also important in determining correct adherence to ART (Paranthaman et al., 2009; Shah, 2007). Worldwide, institutions caring for pediatric patients with HIV infection are limited in number (Pontali, 2005). Usually there are only a few referral centres where specialist pediatric HIV care is available and where a specific care team may be present (Pontali, 2005). Absence of facilities to care and treat HIV close to home, non-availability of resources at local health centres to treat HIV, inability to pay for travel to appropriate facilities, and fear of stigma and discrimination if identified in the local community have been cited as examples of difficulties with access to effective HIV treatment (Haldar & Reddy, 2009).

Other factors related to the healthcare system include the availability of medications and appropriate formulations, cost of drugs, cost and availability of related medical and social services, availability of counselling services and other supports (e.g., social, economic, psychological), and the quality of the physician-patient/family relationship (Naar-King et al., 2006; Pontali, 2005; Shah, 2007). In terms of cost, all Saskatchewan residents living with HIV/AIDS, who are eligible for Prescription Drug Plan Benefits, receive drug benefits for all antiretrovirals listed in the Saskatchewan formulary. Normal deductibles and co-payments apply, with the Special Support Program helping individuals whose drug costs are high in relation to their income (see http://www.hivclinic.ca/main/drugs_reimbuse_files/Provincial%20Coverage%20of%20HIV%20medications.pdf for more information).

4.3 Strategies to Improve Treatment Adherence

As was previously discussed, rigorous adherence to ART, although difficult, is important because a decrease in drug levels due to inconsistent doses may cause viral resistance leading to poorer treatment outcomes (Brown et al., 2000; Williams et al., 2006). Better adherence typically results in decreased viral loads and improved immune status. Fortunately, research has indicated that many issues with adherence are related to variables that are amenable to intervention (Steele et al., 2007). Knowledge of the behavioural, health, and social influences affecting the family and the child should guide the development of appropriate, evidence-based interventions for medication adherence (Malee et al., 2011). Because many different types of factors influence adherence levels (e.g., medication, child, family, and healthcare factors), different strategies may need to be used for different patients (Pontali, 2005). Strategies to maximize adherence should be discussed before initiation of ART and prior to changing regimens (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). A structured program of adherence monitoring should be in place in order to allow healthcare providers to identify nonadherence early and to focus on families who have the most difficulty (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Simoni et al., 2007).

4.3.1 Medication Related Strategies

In order to counteract the barriers associated with the medication itself, researchers recommend the development of appropriate liquid formulations, smaller tablets, tablets in which the active drug is uniformly distributed and in shapes that can be easily and accurately divided, fixed dose combinations, capsule sprinkle formulations that can be opened and mixed with food, and tablets that can be crushed, dissolved in water, or chewed (Committee on Pediatric AIDS, 2007; Hazra et al., 2010; Lin et al., 2011; Little et al., 2008; Pontali, 2005; Shah, 2007). Problems with adherence due to medications cannot be solved by healthcare providers alone. Instead, pharmaceutical companies need to become more involved in coming up with innovative solutions (Pontali, 2005).

Bad tasting medications are a well-recognized factor in treatment failures in children, and lead healthcare providers to try many approaches to improve the palatability of these drugs (Marhefka et al., 2008). Such approaches to circumvent poor palatability issues in children include the addition of fruit-flavour additives to opened capsules, crushed tablets, and liquid generic ART drugs (Lin et al., 2011). Older children may also benefit from pill swallowing training sessions (AIDS InfoNet, 2011; Pontali, 2005). A retrospective study of children aged 4 – 21 years found that participation in pill-swallowing training sessions was associated with improved ART adherence at 6 months post-training (Garvie, Lensing, & Rai, 2007). When attempts such as these fail and children are still having difficulties ingesting medications (because of the taste, size of pills, medication volume, child refusal, or neurologic disease), some practitioners resort to the insertion of gastronomy tubes for medication administration (Committee on Pediatric AIDS, 2007; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Pontali, 2005). This intervention has been generally successful in obtaining better adherence to treatment and subsequently, in reaching good immunologic and virologic results. Usually after a variable period of time, children gradually become able to take medicines orally, thus making removal of the gastrostomy tube possible (Pontali, 2005).

In order to avoid conflicts between the requirements of the treatment regimen and the needs of the patient and caregiver, integration of the medication regimen into each specific family and patient situation is one of the most helpful potential interventions (Pontali, 2005). To the extent possible, ART regimens should be simplified with respect to the number of pills or volume of liquid prescribed, as well as frequency of therapy, and chosen to minimize drug interactions and side effects (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Paranthaman et al., 2009; Shah, 2007). In order to help improve adherence, once-daily ART should be prescribed whenever possible (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

4.3.2 Strategies Focused on the Child

In terms of adherence, a thorough evaluation of the ability and willingness of a child to take medications should be completed (Brown et al., 2000). When persistent medication refusal is a problem, it is suggested first to identify the main reasons of refusal and then to work out a possible solution with the child and caregiver (Pontali, 2005). The use of behaviour modification techniques, especially positive reinforcement and the use of small incentives for taking medications, can be effective tools to promote adherence (Pontali, 2005). Depending on their age and level of interest, children may be able to help with their HIV care. Caregivers can involve children in filling dosettes, preparing liquid formulations, and other medicine related tasks (CATIE, 2009). Sharing responsibility for these tasks can be an appropriate means of preparing children for self-care during adulthood (CATIE, 2009; Marhefka et al., 2008). The use of games or cell phone applications may also help to improve adherence. Examples of smartphone apps recommended by Women's Health.gov (2011) include an HIV glossary from AIDSInfo and texting reminders from Med Action Plan, Truvada, and others (see www.blog.aids.gov for more information).

It is important to ensure that children are developmentally ready to take on responsibility for their own medication regimen before they are asked to do so (Thorne et al., 2002; Williams et al., 2006). Children with such a responsibility need to be identified so that they are given appropriate information and support. Marhefka et al. (2008) suggest that in order to achieve adequate levels of adherence, caregivers may need to retain responsibility for some tasks, such as refilling medications and providing reminders. Although adolescents may like greater control over whether or not they take their medications and caregivers may be relieved to relinquish some responsibility, data consistently shows that adolescence is a time of poor adherence to medical regimens (Marhefka et al., 2008). Therefore, it may be important for clinicians to stress the importance of supervising and monitoring children's completion of medication related tasks, even when they allocate primary responsibility for medication-taking to the child or adolescent (Marhefka et al., 2008; Thorne et al., 2002; Williams et al., 2006).

Although directly observed therapy has been proposed for ART, this is often already routine in children (Pontali, 2005). In fact, for younger children, each dose is directly observed, since caregivers watch children taking their medicine. However, when dealing with older children and adolescents, watching the patient while taking therapy may become extremely difficult. Research has shown that a few days of directly observed therapy in older children can help in assessing their adherence to ART and can significantly and rapidly decrease viral loads

(Gigliotti, Murante, & Weinberg, 2001). When used, directly observed therapy should be educational and supportive in nature rather than punitive (Pontali, 2005). It is important for caregivers to find the right balance between watching their children taking their medications and the need to educate them to be responsible for their actions (Pontali, 2005). One of the major goals of caregivers and healthcare providers should be to gradually prepare children and adolescents for adherence in adulthood.

4.3.3 Strategies Focused on the Family

Many studies of adherence focus on individual characteristics of the child or caregiver that may directly impact adherence. Because children rely heavily on their families for their medication and caregiving, it is important to understand family characteristics, including who is responsible for medication related tasks, and what helps them succeed and fail at those tasks (Brown et al., 2000; Marhefka et al., 2008; Mellins et al., 2004; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Steele et al., 2007). Strategies to improve and support adherence include the development of patient-focused treatment plans to accommodate specific patient and family needs, integration of medication administration into the daily routines of life (e.g., associating medication administration with daily activities such as brushing teeth), and use of social and community support services (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

Another simple yet significant intervention is to regularly assess adherence to treatment with the caregiver and/or the child (Pontali, 2005; Shah, 2007; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2009). Such assessments can help identify the need for ongoing case management to address situational barriers such as mental health issues, housing instability, and substance use (Chantry et al., 2010). Strategies for remembering medications can also be highlighted. These strategies include using reminder devices (e.g., calendars, timers, beepers), using physical reminders such as putting bottles in an obvious location or posting reminder notes, asking other family members to help with reminding, and incorporating medication-taking into daily routines (Marhefka et al., 2008; Pontali, 2005; Shah, 2007).

Intensive education of caregivers is another key intervention facilitating adherence in the longer term (Beals et al., 2006; Paranthaman et al., 2009; Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Pontali, 2005; Roberts et al., 2004; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2009). These discussions should include the goals of therapy, the reasons for making adherence a priority, and the specific plans for supporting and maintaining the child’s medication adherence (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2009). Education strategies for caregiver adherence could include the provision of both information and adherence tools, such as written and visual materials; a daily schedule illustrating both times and doses of medications; and demonstration of the use of syringes, medication cups, and pill boxes (Shah, 2007; Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2009).

A caregiver's knowledge of and belief in ART is crucial to obtaining his/her commitment to administering the prescribed therapy, and in ensuring correct adherence to ART (Pontali, 2005; Roberts et al., 2004; Shah, 2007). Caregivers' attitudes toward ART can be improved if they are made aware of the virologic and immunologic results, as well as the association of ART with a sustained positive effect on their child's health (Pontali, 2005). Caregivers' attitudes are particularly important as research has shown that their views of treatment can be adopted by even very young children (Wrubel et al., 2005). Given the significance of caregivers' belief in treatment, it may be necessary to regularly assess a caregiver's attitudes and reinforce their commitment towards ART (Pontali, 2005; Williams et al., 2006). Caregivers living with HIV themselves may also need additional support to cope with their own illness as well as that of their children (Naar-King et al., 2006). In extreme cases, where lack of adherence is a family issue, a legal guardian can be appointed to be responsible for the child's health until the caregiver is able to guarantee appropriate care for the child (Pontali, 2005).

Although research has shown that families rarely disclose their child's HIV status to others, research has also shown that disclosure can be beneficial in terms of adherence and support for the caregiver (Paranthaman et al., 2009). For example, disclosing the diagnosis to others may give the caregiver more freedom in administering the medications (Shah, 2007; Vreeman et al., 2010). For younger children, other household members or school staff having knowledge of their HIV status can be very helpful in providing further support in remembering administration of ART, reducing difficulties in storing medications, and obtaining direct observation of treatment (Paranthaman et al., 2009; Pontali, 2005).

Hammami et al. (2004) state that a caregiver's ability to be adherent depends on three components: the necessary cognitive and technical skills to follow a medication regimen, a caregiver's perceived ability to make a difference (self efficacy), and a caregiver's problem-solving ability to overcome new challenges to adherence. Therefore, in order to improve adherence, healthcare providers are advised to work continuously on all three factors. Making the caregiver a partner in treatment decisions should prevent him or her from considering the information in an external manner. It is also important for care providers to maintain a non-judgemental attitude, establish trust with the patient/caregiver, and identify mutually acceptable goals for care (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

4.3.4 Strategies Focused on the Healthcare System

All components of the healthcare delivery system play an important role in determining adherence (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected

Children, 2011). Shah (2007) suggests that the establishment of long-term relationships between children, families, and clinic staff is important. This increases trust in healthcare providers, facilitates communication, and makes counselling easier. Wherever possible, healthcare institutions should be as family and child-friendly as possible. They should offer staff experienced in managing pediatric HIV, pediatric ART formulations, counselling, and adherence programs. Healthcare provider characteristics that have been associated with improved patient adherence include consistency, giving information, asking questions, technical expertise, and commitment to follow-up (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011).

5. Health Effects of Pediatric HIV

Although ART has been extremely effective in reducing morbidity and mortality related to pediatric HIV infection, it is important to be cognizant of the many potential health effects of HIV on pediatric patients (Hazra et al., 2010). As previously discussed, HIV is now often considered a chronic illness rather than a life threatening disease (Rao et al., 2007). The term “chronic illness” is generally applied to an illness that requires at least six months of continuous medical care, permanent lifestyle changes, and continuous behavioural adaptation (Rao et al., 2007). In this regard, HIV may be comparable to other chronic illnesses such as asthma and diabetes. However, HIV is also unique in certain aspects. In addition to the direct damage HIV has on the immune system, HIV can damage several organ systems simultaneously including renal, cardiac, and central nervous systems (Hochhauser et al., 2008; Laufer & Scott, 2000; Rao et al., 2007). Therefore, in order to enhance well being and quality of life for children with HIV infection, attention needs to be given to monitoring all aspects of development (physical, cognitive, behavioural, social, and emotional) (Melvin & Biggs, 2009).

5.1 Physical Effects of Pediatric HIV

Children living with HIV have been found to have altered bone metabolism, evidenced by lower bone mineral density or bone mineral content than their unexposed peers (Hazra et al., 2010). Pediatric HIV has also been associated with noticeable physical features such as poor weight gain, growth stunting, lipodystrophy, and chronic dermatological conditions (AIDS Info, 2011; Rao et al., 2007; Laufer & Scott, 2000). Growth failure is one of the most common presenting symptoms among children living with HIV (Aurpibul et al., 2009; Chantry et al., 2010; Verweel et al., 2002). It may be caused by the HIV itself, opportunistic infections, inadequate nutritional intake, or other HIV-related factors. Researchers suggest that growth is one of the most sensitive indicators of disease progression in children living with HIV, and may be one of the first signs of symptomatic disease (Laufer & Scott, 2000; Verweel et al., 2002). While ART has been associated with a sustained improvement in growth (including both height and weight) and lean body mass (Chantry et al., 2010; Verweel et al., 2002), it has also been found to contribute to bone loss (Hazra et al., 2010). Impaired bone mineralization, caused by HIV infection in combination with the negative impact of ART, may lead to substantially higher rates of osteoporosis and fractures in later adulthood (Hazra et al., 2010).

The altered fat distribution (i.e., lipodystrophy) reported in children living with HIV is a concern because of its association with cardiovascular problems (Chantry et al., 2010). Miller et al. (2008) stated that, although long-term follow-up of children living with HIV has been insufficient to determine the magnitude of cardiovascular problems, research has clearly shown that these children are at risk. Therefore, these authors recommend that all children living with HIV should be closely monitored at regular intervals for metabolic and cardiac problems. Older children should also be advised of the additional cardiovascular risks of cigarette smoking and recreational substance use (Miller et al., 2008). Children living with HIV who are found to have identifiable metabolic and cardiovascular risks should first undergo a complete assessment of their ART regimen. Certain drugs are known to carry more adverse effects, and often a switch to another medication of the same or different class can minimize these effects. In the instances in which a child must receive medications for their metabolic or cardiovascular problems, healthcare providers should be aware that these medications may interact with ART (Miller et al., 2008).

Findings from the Pediatric HIV/AIDS Cohort Study have shown that being perinatally exposed to HIV may also have a negative effect on hearing (Torres et al., 2012). Specifically, the study found that children exposed to HIV perinatally were more likely to experience hearing loss by age 16 than their unexposed peers. The researchers estimated that hearing loss affected 9 to 15 percent of children living with PaHIV. As well, 5 to 8 percent of children who did not have HIV at birth but whose mothers had HIV infection during pregnancy also had hearing loss. Compared to national averages for other children their age, children living with PaHIV were found to be 200 to 300 percent more likely to have a hearing loss, while those born to mothers living with HIV but who were not HIV positive themselves, were 20 percent more likely to have hearing loss. It is thought that this hearing loss may occur from damage to the bones and structures in the ear canal and inner ear, or from damage to the nerves leading to the brain. The authors stated that although ear infections are also more common among children living with HIV, these infections do not appear to be the reason their hearing is compromised.

Developmental and functional weaknesses associated with HIV in children, particularly in the absence of neurologic signs, cannot be attributed solely to central nervous system damage or physical health changes caused by HIV (Melvin & Biggs, 2009). Other factors such as temperament, experiences and opportunities, illness episodes, nutritional status, and the type of treatment affect children's development. However, the consistencies in the kinds of developmental weaknesses reported across different populations of children living with HIV suggest that there are some organic factors at play which increase developmental vulnerability.

5.2 Cognitive Effects of Pediatric HIV

Since the first reports of HIV/AIDS, it has been clear that the central nervous system (CNS) is frequently a direct target of the disease. Before the advent of combination ART, pediatric HIV commonly led to encephalopathy with severe deficits in cognitive functioning (Hazra et al., 2010; Steele et al., 2007). While ART is associated with a decline in the incidence of more severe forms of CNS disease, mild neurocognitive disorders are still detectable in a significant proportion of the population (Allison et al., 2009; Garvie et al., 2009; Hochhauser et al., 2008; Paul et al., 2009; Wachsler-Felder & Golden, 2002). The impact of pediatric HIV on the developing brain is directly related to cognitive, language, motor, and behavioural functioning (Nozyce et al., 2006; Paul et al., 2009). Even though these cognitive deficits have less of an impact than encephalopathy, they still effect functioning and quality of life for children living with HIV (Hazra et al., 2010; Martin et al., 2006; Steele et al., 2007).

HIV affects children cognitively and developmentally due to the immaturity of their nervous and immune systems and the fact that HIV can permeate the blood-brain barrier (Wachsler-Felder & Golden, 2002; Sherr, Mueller, & Varrall, 2009). Neuroimaging techniques have shown evidence of HIV involvement in functioning of the frontal cortex, basal ganglia, and connecting structures in the central nervous system (Nozyce et al., 2006). These structures are associated with regulation of attention, concentration, and other regulatory behaviours. A number of deficits and conditions have been associated with pediatric HIV infection, including: lower overall cognitive functioning; difficulties with attention, language, and fine motor skills; and problems with behavioural and academic functioning (Blanchette et al., 2002; Nozyce et al., 2006; Rao et al., 2007; Steele et al., 2007; Wachsler-Felder & Golden, 2002). Cognitive deficits appear to be more common than motor deficits (Forsyth, 2003; Nachman et al., 2012; Nozyce et al., 2006).

Children with greater degrees of HIV-related immune deficiency have been shown to have more severe cognitive deficits than those without HIV (Franklin et al., 2005; Martin et al., 2006; Rao et al., 2007). Martin et al. (2006) found that children living with HIV who were more immunocompromised scored lower on subtests measuring processing speed than those who were less immunocompromised, showing that even those on ART are at risk for developing central nervous system impairments. Franklin et al. (2005) also found that children living with HIV showed a drop in mean mental development scores over time, along with weaker verbal skills for their age over time, suggested that HIV disease may be neurodegenerative. Taken together, these findings suggest that although many children living with HIV who are being treated with ART may be functioning within normal limits, a subset of children with CNS involvement continue to exhibit a distinct pattern of low average to below average cognitive functioning (Rao et al., 2007). These deficits may be the result of ongoing viral replication in the CNS despite virologic control in the rest of the body, or residual effects of static HIV-related CNS disease (Martin et al., 2006).

It is important to point out that the amount and types of cognitive impairment reported for children living with HIV is variable and sometimes contradictory. Some studies show meaningful differences in IQ, while others show that full scale IQ scores are normal in those living with HIV (Blanchette et al., 2002; Franklin et al., 2005; Martin et al., 2006). Sherr et al.’s (2009) review of the literature on cognitive development and childhood HIV identified a lack of systematic measures, controlled trials, and age-specific investigations, making interpretations of the data difficult. Further complicating interpretations is the fact that cognitive development is not purely biologically determined. Environmental factors may play a confounding role in such development, either by mitigating or increasing adverse impacts of HIV (Franklin et al., 2005; Sherr et al., 2009). Although estimates of the prevalence of CNS manifestations in children living with HIV range from 20-65%, many of these children have other risk factors for poor performance including poor nutrition, neglect, maternal substance use, substance exposure in utero, poverty, unstable home environments, and life stress (Allison et al., 2009; Blanchette et al., 2002; Davies et al., 2002; Franklin et al., 2005; Hochhauser et al., 2008; Melvin & Sherr, 1995; Nozyce et al., 2006). The direct negative effects of HIV on the CNS may also be increased by hospitalizations, reduced opportunity to learn, bouts of illness, medications and ART toxicity, emotional rejection, isolation, and stigma (Hazra et al., 2010; Hochhauser et al., 2008; Sherr et al., 2009).

Most of the detrimental effects reported in the literature appear to be subtle, and could be missed or overlooked in community settings (Sherr et al., 2009). Detecting these more subtle deficits requires the use of more intensive examination, including assessments of many different domains of functioning (Allison et al., 2009). Because HIV is progressive and children's neuropsychological functioning may change over the course of the illness, frequent neuropsychological evaluations are recommended (Davies et al., 2002). Further, Hochhauser et al. (2008) suggest that concrete actions to improve the child's home or family environment and interventions to reduce familial stress may be beneficial for cognitive functioning.

5.3 Psychological Effects of HIV Infection

Children living with HIV are also at particular risk for psychological issues due to both the direct effects of HIV infection on the brain structures involved in the regulation of emotion, behaviour, and cognition; and the indirect effects related to coping with the range of medical, psychological, and social stressors associated with HIV disease (Bachanas et al., 2001; Das et al., 2010; Davies et al., 2002; Malee et al., 2011). For example, higher rates of behavioural impairment, conduct disorders, and attention deficit hyperactivity disorder (ADHD) have been reported (Brown et al., 2000; Malee et al., 2011; Mialky et al., 2001; Misdrahi et al., 2004; Rao et al., 2007). Allison et al. (2009) report that approximately 40% of children living with HIV meet the criteria for ADHD. While this rate is higher than that found in the general population (3 – 7%), it is unclear whether this increased prevalence is directly attributable to HIV. Anxiety, depression, oppositional defiant disorder, and problems in social functioning are also common among children with HIV (Bachanas et al., 2001; Brown et al., 2000; Davies et al., 2002; Elliott-DeSorbo et al., 2009; Mialky et al., 2001; Nozyce et al., 2006; Rao et al., 2007).

As children live longer with HIV, they may be at greater risk of increased incidence and severity of these psychological concerns (Rao et al., 2007). Gaughan et al. (2004) found that children living with HIV are at increased risk for psychiatric hospitalizations during childhood and early adolescence as compared to the general pediatric population. Depression and behavioural disorders were the two most common reasons for psychiatric hospitalizations in youth living with HIV (Gaughan et al., 2004; Mialky et al., 2001). Depression is particularly likely to be experienced by children living with HIV who have lost a parent in their lifetime (Battles & Wiener, 2002) and by those whose own parents experienced depression (Nachman et al., 2012).

Gaughen et al. (2004) point out that the relationship between HIV and psychological issues is likely a multifactorial one, defined by the disease, the degree of social support, familial genetic factors, and the quality of and access to medical care. Other risk factors, such as poverty, unstable home environment, and maternal substance use, may increase the risk of psychological and psychiatric complications (Allison et al., 2009). Other possible risk factors that are more specific to HIV infection include: adverse effects of HIV medications; forced disclosure of HIV status; discrimination and stigma; fear of disease progression to AIDS; and body image concerns resulting from delayed development, growth stunting, chronic dermatologic conditions, or lipodystrophy (Allison et al., 2009; Das et al., 2010; Elliott-DeSorbo et al., 2009; Fielden et al., 2006; Gaughan et al., 2004; Nozyce et al., 2006; Rao et al., 2007). In general, children with more risk factors appear to be at greater risk of negative psychological consequences (Brown et al., 2000; Steele et al., 2007).

HIV infection may also disrupt many of the social support systems that children depend on for optimal development (Steele et al., 2007). Unlike many other illnesses, children living with HIV are more likely to experience parental illness and possible death and stigmatization (Brown et al., 2000; Elliott-DeSorbo et al., 2009; Steele et al., 2007). In addition to higher levels of depression and anxiety, research has shown that children living with HIV have low involvement in activities, fewer social interactions, more absences from school, and less overall positive affect (Steele et al., 2007). Attempting to cope with HIV may trigger social withdrawal, depression, loneliness, anger, confusion, fear, numbness, and guilt (Brown et al., 2000). Repeated hospitalizations and isolation from peers are known to have an adverse effect on children’s social and communicative development (Brown et al., 2000). The impact of factors listed above are moderated by perceived social support from peers and adults (i.e., increased levels of social support are associated with improved functioning). Specifically, social support has been found to help children deal with the stigma of HIV, increase adherence in ART, and increase overall coping abilities (Das et al., 2010; Goldstein & Morewitz, 2011; Sacajiu et al., 2009).

Because increased levels of support can improve outcomes for children living with HIV, it is important to assess the support needs of children and their families. Screening for warning signs of psychological problems should be provided within the context of comprehensive primary care, particularly at important points of transition in a child’s life (Gaughan et al., 2004). Parent and self-report instruments can be used to identify and monitor emotional and behavioural problems. Referrals for mental health services should be provided when issues become apparent. Accurate diagnosis and treatment of psychological issues are critical not only for the general health and well-being of the child but also in the context of medication adherence (Williams et al., 2006).

Rao et al. (2007) suggest that there are a number of factors that make diagnosing psychological and psychiatric disorders in children living with HIV difficult. First, there are a number of normal, non-pathological states, such as grief and mourning in relation to personal loss, which need to be differentiated from illnesses like depression and anxiety. Second, many children presenting with symptoms resembling psychological illnesses may have these symptoms because of organic conditions ranging from CNS infections to malnutrition and growth stunting. Finally, signs and symptoms resembling psychological illnesses may be side effects of medications used to treat HIV and related conditions. Therefore, one must take a number of factors into account before making a diagnosis of psychiatric illness. Because families with fewer financial resources often face greater than average barriers to mental health care, it is important for HIV programs to provide family focused, developmentally appropriate intervention services within the context of comprehensive medical care (Williams et al., 2006).

If psychotropic drug treatment is deemed necessary, there are some important points to consider. Children in the advanced stage of HIV disease may have decreased brain function. Therefore, only low doses of psychotropic drugs need to be prescribed (Brown et al., 2000; Rao et al., 2007). Even low doses may cause side effects that are not expected normally. Also, since children living with HIV are on multiple drug regimens for treatment of HIV and related conditions, there is a possibility of drug interactions (Rao et al., 2007).

5.3.1 Coping with Pediatric HIV

Children living with HIV have to deal with their own mortality and uncertain future; they may suffer trauma and grief as they watch other family members live with the same disease; many experience stigma and discrimination; and many live in poor households (Domek, 2006; Brown et al., 2000; Steele et al., 2007). Children living with HIV also have to face other stressors such as isolation and hopelessness, forced disclosure, physical appearance changes, and body image concerns (Brown et al., 2000).

To cope with the medical and social consequences of a pediatric HIV diagnosis, children living with HIV use a wide range of coping strategies (Steele et al., 2007). Research has shown that coping style is significantly related to child self-reported adjustment, such that children using more emotion-focused coping strategies report more emotional and behavioural problems than children using more problem-focused approaches (Bachanas et al. 2001). Children using emotion-focused strategies may dwell excessively on negative feelings like frustration and hopelessness, resulting in greater distress. Therefore, facilitating problem-focused coping approaches is an important part of promoting healthy emotional and behavioural development in children with HIV (Steele et al., 2007). Parent adaptation has also been seen as an important factor in their child’s coping. Therefore, support must be given not only to the child but also to his/her parents (Brown et al., 2000).

It is important to note that while children with HIV may be at higher risk of psychological problems and distress, the majority of children function fairly well emotionally and behaviourally (Bachanas et al., 2001). Children receiving appropriate care often have increased access to multidisciplinary services such as case management, social services, mental health support groups, and individual and family therapy. Access to such services provides much needed support, improving children's ability to cope. It also allows early identification of children who may require more in-depth support and services.

5.4 HIV-Associated Infections, Illnesses, and Co-Infections

Although there is not a lot of available research on the impact of HIV infection on children's developing immune systems, it is known that children living with HIV are more prone to certain kinds of illnesses and infections (CATIE, 2009). Some examples include bacterial infections like pneumonia, sinusitis, diarrhea, thrush, ear infections, meningitis, and urinary tract infections (CATIE, 2009; Women's Health.gov, 2011). Other common infections and their symptoms are included in the table below. Researchers have found that although ART reduces the risk of many opportunistic infections, some bacterial infections (particularly pneumonia) remain frequent (Chiappinni et al., 2007; Mofenson et al., 2009; Resino et al., 2006; Viani et al., 2004).

Table 1: Common HIV-Associated Infections

TYPE OF INFECTION	SYMPTOMS OF THE INFECTION
Candidiasis (yeast infections)	• Causes discomfort, whitish discharge, burning sensation during urination, and pain during intercourse.
Cytomegalovirus (CMV)	• Causes lung problems, slow weight gain, swollen glands, rash, blood problems, infections, and blindness.
Lymphoid interstitial pneumonitis (LIP)	• Affects the lungs and causes coughing, wheezing, shortness of breath, and tightness in the chest.
Mycobacterium avium complex (MAC)	• Infects people through their lungs or intestines and can spread quickly throughout the body causing fever, night sweats, weight loss, stomach pain, tiredness, and diarrhea.
Pneumocystis jiroveci pneumonia (PCP)	• Infects people through their lungs and is associated with a dry cough, fever, rapid breathing, and shortness of breath. • This is the leading cause of death in children living with AIDS.

5.4.1 Associated Cancers

Children living with HIV infection are also at increased risk (approximately 40 times higher) of developing malignancies (cancer) (Mehta, 2009). Non-Hodgkin's lymphoma (NHL) is the most common HIV-related malignancy in children living with HIV, accounting for more than 80% of HIV-related cancers (Mehta, 2009). Symptoms of cancer, including NHL, can be indistinguishable from symptoms of chronic HIV infection. Symptoms such as fever, fatigue, weight loss, and night sweats may reflect underlying HIV infection, but they may also reflect the presence of lymphoma.

In the 1980's, Kaposi's sarcoma (KS) became the first AIDS-defining illness. In the United States, KS is an AIDS-defining illness in less than 1% of children younger than 13, increasing to 3% in the adolescent years (Mehta, 2009). Immunosuppression is believed to be an integral factor in the pathogenesis of KS. KS most commonly affects the skin and oral mucosa. Its lesions are often found on the tip of the nose, on the trunk, arms or neck, or in the mouth. KS may spread to the lymphatic system, the lungs, and the digestive tract. Most forms of KS will regress with the initiation of ART, with response rates of 60 – 80%. Thus, one should always incorporate treatment with ART in the treatment of KS. For patients who do not respond adequately to ART alone, other forms of treatment are effective.[5] For patients with widespread disease or organ involvement, systemic chemotherapy is often required. Though treatment of KS has evolved tremendously since the onset of the HIV epidemic, there is no effective cure for this cancer. Therefore, treatment of KS focuses on managing symptoms.

Smooth-muscle tumours (leiomyosarcoma) rarely occur in children without HIV infection but increased numbers have been reported in children living with HIV (Mehta, 2009). These tumours tend to present late in the course HIV disease, suggesting a role of chronic immune suppression in tumour pathogenesis. Although leiomyosarcoma most commonly presents within the gastrointestinal tract, children with HIV may present with tumours in unusual places like the lungs, spleen, adrenal glands, or intracranially. Surgery is the treatment of choice, as smooth muscle tumours are not responsive to chemotherapy or radiotherapy.

Treatment for malignancies in children living with HIV may be complicated by HIV-associated organ dysfunction, infectious complications, drug interactions, and increased immunosuppression caused by both HIV and chemotherapy (Mehta, 2009). Prognosis is better in children with CD4+ counts greater than 100 per micro litre, no history of opportunistic infections, and the ability to function at a near-normal ability during daily activities (Mehta, 2009). Childhood chemotherapy and radiation can also have late effects in long-term survivors, including neurocognitive deficits, neuroendocrine disturbances, gonadal dysfunction, secondary tumours, and multiorgan damage.[6]

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[5] Refer to http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2821196/pdf/nihms171151.pdf for information on treatment recommendations for each of the opportunistic pathogens, information on pediatric drug preparations and major toxicities, and information about clinically significant drug interactions for the drugs recommended for treatment of individual opportunistic infections among children.

[6] Refer to Mehta (2009) for information about supportive care for children living with HIV who are receiving chemotherapy (Table 2), and information about the side effect profiles of different chemotherapy agents (Table 3).

5.4.2 Tuberculosis

According to PHAC (2007), the HIV epidemic has had a dramatic impact on tuberculosis (TB) rates and control globally. TB is caused by bacteria that are spread when a person with infectious TB coughs, sneezes, or has close face-to-face contact with other people (Saskatchewan Ministry of Health, 2010b). TB bacteria grow in the lungs and can permanently damage the lungs, while also potentially affecting other parts of the body like the glands, kidneys, bones, and brain. In 2010, there were 1577 new active and re-treatment cases of TB reported to the Canadian TB Reporting System (PHAC, 2012). High risk groups for TB are similar to those at high risk of HIV infection: homeless people, people who use substances, immigrants from areas with a high prevalence of TB, and Canadian-born Aboriginal people (PHAC, 2004). It is for this reason that co-infection of HIV and TB is common.

Coinfection of HIV and TB can result in the reactivation of latent TB infection, rapid progression of new infections to active disease, and recurrence of infection in cured TB cases (Muralidhar & Nair, 2010). TB occurs in people living with HIV at all CD4+ cell count levels. Just as HIV has a negative impact on TB, TB has an adverse effect on HIV. Specifically, TB increases morbidity and mortality among those living with HIV by accelerating the progression of HIV related immunosuppression (Muralidhar & Nair, 2010).

There is only one TB vaccine currently available in Canada (the Bacillus Calmette-Guerin, BCG, vaccine). There is concern that the use of the BCG vaccine in children who are immune compromised, such as those living with HIV, could result in TB infection caused by the vaccine itself (Global Health Education, 2012; PHAC, 2004; 2007). This is because the vaccine contains a live, but very weakened form of a TB-related bacterium. Researchers are currently working to develop a new vaccine that would be safe for use in people who are co-infected with TB and HIV.

TB can be cured, and all testing and medications are free of charge in Saskatchewan. Saskatchewan Health is responsible for tuberculosis control in the province. The program is based at the Royal University Hospital in Saskatoon and includes clinics in Regina and Prince Albert as well as numerous mobile clinics, particularly in northern Saskatchewan. It is important that people living with TB receive treatment. Treatment consists of taking several types of pills for six to nine months (Saskatchewan Ministry of Health, 2010b). During this time, chest x-rays and sputum samples are used to check treatment progress. Healthcare providers will need to be aware of the potential for toxicities and drug interactions between ART and TB treatment (Little et al., 2008; WHO, 2010). More detailed and updated information can be found at http://www.cdc.gov/tb_HIV_Drugs/default.htm. The complete Canadian Tuberculosis Standards can be found at http://www.phac-asp.gc.ca/tbpclatb/pubs/pdf/ tbstand07_e.pdf.

5.4.3 Hepatitis C

MTCT rates of the hepatitis C virus (HCV) range from 3.6 to 9.5% (England et al., 2009). HCV co-infection with HIV is a leading cause of morbidity and mortality in individuals living with HIV. If co-infection is identified when the child is already receiving HIV therapy, delaying HIV progression takes priority over HCV treatment (England et al., 2009). Treatment of HIV/HCV co-infected children is complex; pediatric guidelines focus on which HIV medications should be avoided in this subgroup in order to avoid further damage to the liver. HCV treatment is further complicated by the possible interactions between common pediatric HIV drugs with ribavarin, which is a major component of the most efficient HCV treatment regimen for children (England et al., 2009). As a result of these complex interactions, few clinicians state that they would administer HIV and HCV treatment concurrently (England et al., 2009).

5.5 Pain in Pediatric HIV

In addition, children living with HIV also experience high rates of pain. One study found that almost 60% of children living with HIV regularly experience pain that negatively affects their quality of life (Brown et al., 2000). According to the Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children (2011), pain in children living with HIV/AIDS is a “multifactorial, biologically complex problem associated with diminished quality of life and increased mortality” (p. 1 of Supplement 2). Children living with HIV may experience pain from a number of different sources including invasive medical procedures, drug toxicities, adverse drug reactions, invasive secondary infections, or other non-HIV-associated pain (Leelanukrom & Pancharoen, 2007). Environmental stressors (e.g., poverty, unstable home environment, poor health or caregivers) may amplify pain.

In order to effectively manage pain, it is important to first diagnose and treat any underlying medical conditions (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). Consultation with a pediatric pain specialist may need to be considered, along with both pharmacologic and nonpharmacologic pain therapies. While analgesic medications should be used following patient assessment and concurrent with efforts to diagnose and treat the underlying conditions causing pain, caution must be used when these medications are used in conjunction with ART. The simultaneous use of certain analgesics and ART medications can result in increased plasma drug levels, toxicity, or overdose for the pain medications. Additionally, certain pain medications can alter the metabolism or elimination of certain ART medications (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). For more information about potential drug interactions between pain medications and ART, please refer to http://www.hiv-druginteractions.org and HIV InSite (http://hivinsite.ucsf.edu/arvdb?page=ar-00-02).

Nonpharmacologic pain management interventions include relaxation techniques, nutritional support, adequate hydration, electrolyte replacement, gentle massage, whirlpool baths, physical therapy, and acupuncture (Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, 2011). More information about the treatment of specific pain syndromes, as provided by the Panel on Antiretroviral Therapy and Medical Management of HIV-Infected Children, can be found at http://www.aidsinfo.nih.gov/contentfiles/PediatricGL_SupII.pdf (refer to Table 2).

5.6 Anaesthesia in Pediatric HIV

Related to issues around the treatment of pain in children living with HIV is the issue of anaesthesia. As rates of survival continue to improve, children living with HIV may require anaesthesia in higher numbers (Leelanukrom & Pancharoen, 2007). It has been estimated that 20-25% of patients living with HIV will require surgery during their lives. Anaesthesiologists face a complex disease, which can vary from asymptomatic patients to multi-organ disease with opportunistic infections. Considerations include: involvement of multiple organ systems, adverse reactions and drug interactions, and adequate infection control (universal precautions) (Leelanukrom & Pancharoen, 2007). Pre-anaesthesia assessments are needed in order consider each of these possibilities and the effect they could have on surgery outcomes.

6. HIV and Social Determinants of Health

As has been highlighted in the previous sections, factors other than the direct effects of HIV greatly impact the health and quality of life of children living with HIV. A person's overall health is determined by complex interactions between social and economic factors, the physical environment, and individual behaviours (PHAC, 2011b). These factors are referred to as social determinants of health and include: income and social status, gender, culture, housing, food insecurity, education, employment, social and physical environments, personal health practices and coping skills, and health services (Mikkonen & Raphael, 2010; PHAC, 2011b). The social determinants of health demonstrate that the conditions in which children live and play directly affect their quality of health.

For people living with HIV, including children, medical and social issues are highly interrelated (Brown et al., 2000; Marais et al., 2008). Therefore, one of the challenges of understanding HIV in children and adolescents is determining which of the biological, psychological, neuropsychiatric, and social factors is most relevant at any given moment (Brown et al., 2000). For example, it is difficult to determine whether the cognitive delays seen in some children living with HIV are due to HIV disease or the impact of environmental variables (e.g., poverty, lack of resources, maternal substance use) on cognitive functioning. It has been argued by several authors that many of the delays seen in children living with HIV may be caused more by adverse environments than the infection itself (Brown et al., 2000; Dobrova-Krol et al., 2010; Malee et al., 2011). Because of the strong association between HIV and substance use, families often have a number of other risk factors that can adversely affect the child's environment (Domek, 2006; Forsyth, 2003; Lee & Johann-Liang, 1999; Miller, 2003). Adverse environments can then impact adherence to medications, delivery and utilization of treatment services, family relationships, bereavement, and disclosure of illness (Brown et al., 2000; Davies et al., 2002; Forsyth, 2003; Miller, 2003).

6.1 The Impact of Stigma

HIV is not only a medical problem. It is also a social problem. The diagnosis carries a stigma that has profound psychological, social, and emotional ramifications (Chenneville et al., 2010; Rao et al., 2007; Tasker, 1995). Stigma and discrimination remain realities for people living with the disease and for groups associated with the epidemic (Elliott & Gold, 2005; Forsyth, 2003). Concern about stigma can influence medication adherence, and disclosure of HIV status to the child and to others (Marhefka et al., 2008; Naar-King et al., 2006; Wrubel et al., 2005). Stigma may also prevent caregivers from accessing special support and services geared specifically toward people living with HIV (Forsyth, 2003; Kimani-Murage et al., 2010; Simoni et al., 2007; Wrubel et al., 2005).

Although the needs of children living with HIV are diverse, issues of stigma are a major area of current and future concern (Fielden et al., 2006). Parents and children in Fielden et al.'s (2006) study emphasized social stigma as a negative and destructive influence on their own well-being. Children and their caregivers associated stigma with concepts of fear, secrecy, disclosure, and isolation. Social stigma and fear of disclosure may be the most important factors influencing adherence, particularly for older children and adolescents (Brown et al., 2000; Hammami et al., 2004; Marhefka et al., 2008). Caregivers who were found to be more adherent often came up with ways to avoid this problem (e.g., giving medications very early in the morning, pretending the medications were vitamins, avoiding social situations that might make adherence difficult like overnight stays with friends) (Marhefka et al., 2008).

Efforts have been made to reduce stigma through education (Ayres et al., 2006). The Stigma Project (see www.thestigmaproject.org) seeks to reduce the judgement, fear, discrimination, and alienation associated with HIV through knowledge, awareness, effective marketing, and advertising. The Government of Saskatchewan, as part of Saskatchewan's HIV Provincial Strategy 2010-2014, is also currently launching an awareness campaign with the goal of challenging HIV-related stigma (see http://www.gov.sk.ca/news?newsId=9c6eeb86-3ce9-4610-ba77-4a33d2b58fb0 for more information).

7. Nutrition and Pediatric HIV

According to DeGennaro and Zeitz (2009), nutrition can be as important as medication for children living with HIV. While HIV infection can directly impact nutritional status, there is a cyclical effect; malnutrition can intensify the effects of HIV on the immune system, thus leading to a downward vicious cycle of malnutrition, immune dysfunction, and advancing HIV disease (AIDS Info, 2011; Miller et al., 2008; WHO FAO, 2002). Malnutrition in children living with HIV can be attributed to reduced food intake, malabsorption, and altered metabolic state (CATIE, 2007; Miller et al., 2008). Although there are far fewer cases of Canadian children living with HIV and malnutrition in the ART era, nutritional deficiencies and their effects remain a problem.

On top of the normal demands for growth, children living with HIV must cope with the extra demands that the virus places on their body (CATIE, 2007; Haldar & Reddy, 2009). Specifically, the body's immune system works harder fighting infection when a person is living with HIV. This increases energy and nutrient requirements, while further infection and fever also increase the body's demand for food (WHO FAO, 2002). Meeting these demands can sometimes be difficult because the illness and/or the medicines taken for it may reduce appetite, modify the taste of food, and/or prevent the body from absorbing the food that is eaten (WHO FAO, 2002). Many medications that patients need to take for their HIV infection can result in gastric irritation, vomiting, nausea, and diarrhea (CATIE, 2007). In young children, diarrhea can quickly become serious, particularly if food intake is reduced. As much as possible, it is important to drink fluids, replace the salts that have been lost, and provide energy through food. The potential adverse effects of ART and opportunistic infections may result in limited improvements in growth and the potential for decreased adherence to therapy (Haldar & Reddy, 2009).

Therefore, experts in pediatric HIV care suggest that children living with HIV should be assessed routinely for nutritional status, including weight and height, to make sure they stay healthy and grow properly (CATIE, 2007; Miller, 2003; WHO, 2010). When a nutritional risk has been identified, a nutritional assessment may help determine the factors that are affecting growth and nutritional status (AIDS Info, 2011). The components of routine nutritional monitoring and assessment should include repeated measurements over time; recording of height and weight; assessment of diet and physical activity, including use of dietary supplement and herbal therapies; review of medical data including food allergies; and psychosocial assessment. If growth is slow, boosting nutrition will be a vital part of the treatment plan. In these cases, knowledge and implementation of effective nutritional therapies is important to improve medical outcomes and quality of life (Laufer & Scott, 2000; Little et al., 2008; Miller, 2003).

Chaotic family lifestyles and poverty may impact nutritional status (AIDS Info, 2011; WHO FAO, 2002). Thus, it is important to consider and target the socioeconomic factors that influence the development of nutritional deficiencies in children living with HIV (Miller, 2003). Limiting factors that may be present include poor health of the caregiver or family members because of their own HIV infection, inadequate cooking facilities, poverty and limited food availability, emotional deprivation, and inexperienced parenting. Offering support and appropriate services to those families requiring them may have a strong impact on the nutritional condition of children living with HIV (Miller, 2003).

Children who cannot consume adequate vitamins and minerals in a well-balanced diet might benefit from the regular intake of a multivitamin (Laufer & Scott, 2000; Little et al., 2008). Although it is preferable to get the needed vitamins and nutrients from a balanced diet, supplements are sometimes necessary. If supplements are used, the following recommendations should be adhered to: 1. discuss vitamin and mineral supplements with a doctor or nutritionist knowledgeable about pediatric HIV; 2. take vitamins on a full stomach and take them regularly; 3. try to avoid supplements containing iron as it can increase the activity of bacteria which may be harmful to those living with HIV; and 4. take vitamins as prescribed (WHO FAO, 2002). Over-supplementation should be avoided as several micronutrients (vitamins A and D, iron, and possibly vitamins E and C, zinc and selenium) appear to have a U-shaped curve of risk versus dose, causing harm in both deficiency and excess (AIDS Info, 2011). High doses of some vitamins can cause nausea, vomiting, decreased appetite, and liver and kidney problems (WHO FAO, 2002).

If oral ingestion of nutrients fails (i.e., the child cannot consume or absorb adequate calories to sustain growth), enteral supplementation should be considered (Laufer & Scott, 2000; Miller, 2003). Nasogastric tube feedings should be tried first. The child's ability to gain weight with supplemental enteral feedings should be assessed. If such feeding improves growth, the placement of a more permanent device (e.g., gastrostomy tube) should be considered (CATIE, 2007). This tube provides easy access to the stomach with less physical and emotional trauma to the child than the nasogastric tube (Laufer & Scott, 2000). In addition, compliance with medical therapy can be improved, due to children more reliably receiving their ART via the gastrostomy tube (Miller, 2003).

For additional information about nutrition and HIV/AIDS, please refer to the World Health Organization/Food and Agriculture Organization's (2002) "Living Well with HIV/AIDS: A Manual on Nutritional Care and Support for People living with HIV/AIDS" (see http://www.fao.org/docrep/005/Y4168E/Y4168E00.HTM). This manual contains technical information and forms to monitor food intake and weight. Also see this guide for more information about food to eat (and what to avoid) when experiencing problems commonly associated with HIV (e.g., nausea, poor appetite, diarrhea, other digestive problems, sore mouth, etc.).

8. The Role of Healthcare Professionals

While all healthcare professionals cannot and should not be expected to be knowledgeable about every aspect of care and treatment for HIV/AIDS, their assistance can greatly improve the care received by children living with HIV. As well, their involvement can reduce the burden faced by pediatric infectious disease specialists. Therefore, it is important to establish and strengthen a system of linkages and two-way referrals between specialists and other healthcare professionals (Haldar & Reddy, 2009). According to Haldar and Reddy (2009), healthcare professionals can be trained to supplement the work done by pediatric infectious disease specialists. For example, healthcare professionals can:

- monitor the child's growth and development;
- provide information about feeding and nutritional care;
- ensure immunizations are given according to the routine recommended schedule;
- provide psychosocial support to the family as required;
- actively look for and treat minor infections early; reinforce the importance of adherence to ART;
- identify HIV complications and opportunistic infections;
- refer the child for specialized HIV care and treatment as needed; and
- communicate with pediatric HIV specialists to optimize joint care (British Columbia Centre for Excellence in HIV/AIDS, 2009; Haldar & Reddy, 2009).

Such work by healthcare providers would reduce the burden of specialists who can then concentrate on children's treatment regimens and on children with serious complications. Being able to access such care within the communities in which the children reside would increase accessibility of care, thereby reducing the burden experienced by caregivers.

Pontali (2005) suggests that trained and committed staff and institutions can greatly improve adherence and treatment outcomes in children living with HIV. In order to achieve these outcomes, the establishment of long-term relationships between children, families, and clinic staff is key. It is also recommended that healthcare settings be as family and child-friendly as possible. They should offer staff experienced in HIV care; pediatric formulations of ART agents; psychological, social, and community support; and convenient and pleasant appointments (Pontali, 2005). Given the complex care needed by children living with HIV, multidisciplinary treatment teams are warranted (Steele et al., 2007). Research has identified key healthcare providers who could benefit from advanced education and training on the latest treatment and standards of care for children living with HIV, which would, in turn, greatly improve the care received by these children. Examples include pediatricians, family physicians, behavioural and early childhood specialists, neurologists, child development specialists, and school nurses (Mawn, 2012; Steele et al., 2007).

Gerson et al. (2001) point out the impact that providing treatment and care for children living with HIV can have on healthcare providers. Providing such care can be professionally and personally challenging for healthcare providers. Therefore, these authors recommend that healthcare providers discuss their experiences with other experienced healthcare providers. This can allow for debriefing in order to reduce the stress and sadness that can be associated with pediatric HIV.

9. Issues Faced by Caregivers

Caregivers of children living with HIV face the stress and sadness associated with pediatric HIV on a daily basis. These feelings may be heightened by the fact that HIV is commonly a multi-generational "family infection" (DeMatteo, Wells, et al., 2002; Hansell et al., 1999; Steele et al., 2007). Therefore, family relationships must be negotiated around HIV, treatment, and the stresses often associated with chronic illness, including the possibility of death and bereavement (Steele et al., 2007). These considerations can make providing care for a child living with HIV especially challenging for the child's caregiver. Caregiving is often associated with a multitude of stressors and psychological distress, which is referred to as caregiver burden (Mitchell & Knowlton, 2009). Potential sources of stress for caregivers of children living with HIV include social stigmatization, financial limitations, and emotional strain (Kimani-Murage et al., 2010; Mitchell & Knowlton, 2009; Steele et al., 2007). Caregivers may also experience stress due to feelings of isolation, shame, and anger; decisions about disclosure; and having to deal with the child's chronic illness (Hansell et al., 1999).

Although most caregivers are determined to provide the best care for their children possible, caregivers may face financial barriers, poor access to health services, and compromised physical abilities due to their health issues (Kimani-Murage et al., 2010). These barriers can limit the effectiveness of the care provided and often cannot be overcome without support. The support required by caregivers includes emotional support or empathy; instrumental support such as counselling or advice; encouragement to seek care and further support; practical support such as with work; and material support including acquiring other sources of food and money (Kimani-Murage et al., 2010). Research has demonstrated that social support has the potential to buffer caregiver stress, facilitate caregiver coping, increase positive attitudes toward parenting, and decrease levels of child-related stress (Hansell et al., 1999). This support is likely even more important for seropositive caregivers, who face a situation in which HIV is both a personal health problem and a caregiver problem (Hansell et al., 1999). Therefore, garnering social support for caregivers of children living with HIV should be seen as an essential component of holistic care for families affected by pediatric HIV (Hansell et al., 1999).

10. Disclosure and Pediatric HIV

As HIV has become a chronic disease, disclosure has become one of the most important aspects of raising a child living with HIV. Families facing disclosure have to deal with numerous decisions about disclosure from the moment of the child's diagnosis (e.g., disclosure to family members, friends, the child, other people) (Blasini et al., 2004; Mawn, 2012; Vaz et al., 2010). The paramount concern of caregivers is typically when and what to tell the child (Mawn, 2012). In other life-threatening illnesses such as cancer, there has been a trend towards openness and truth-telling to children about their illnesses (DeMatteo et al., 2002). This model of early disclosure has not generally been adopted for pediatric HIV (Butler et al., 2009; DeMatteo et al., 2002; Domek, 2010). Disclosure is more difficult than in other chronic childhood diseases for a number of reasons: infectious disease transmissibility, the potential for stigma and isolation from peers, vertical transmission with potential maternal guilt, and more than one family member with the virus (Blasini et al., 2004; Brown et al., 2000; Krauss et al., 2012; Lee & Johann-Liang, 1999; Lesch et al., 2007; Lester et al., 2002; Vreeman et al., 2010).

Disclosure is particularly difficult for biological parents who may be the source of the child's infection as it may heighten feelings of guilt (Lee & Johann-Liang, 1999; Lesch et al., 2002; Mellins et al., 2002). In these situations, discussing the child's infection may equate to discussing the parent's own infection. Although there is no single, easy guide to deciding when and to whom HIV infection should be disclosed, disclosure is a vital part of comprehensive care for children living with HIV (Lee & Johann-Liang, 1999). Disclosure is directly related to medication adherence, treatment compliance, sexual exploration, and the child's developing autonomy (Lee & Johann-Liang, 1999). Therefore, the importance of appropriate disclosure cannot be understated.

10.1 Disclosure to the Child

As children living with HIV are living longer, healthier lives, disclosure has become an essential aspect of overall care (Blasini et al., 2004; Domek, 2010; Hazra et al., 2010; Lesch et al., 2007). Unlike adults living with HIV, who can decide when to be tested for HIV, children usually have little control over when and how they are informed of their HIV status (Lesch et al., 2007).

Caregivers typically control the flow of information about children's HIV-status to children and others. Therefore, caregivers are faced with an array of challenges around disclosure, including deciding what is in the child's best interest and when and how information about his/her HIV status will be shared with him/her. Complete unawareness of their HIV status by a certain age is doubtful (Lee & Johann-Liang, 1999), and many children already know or suspect their diagnosis even if no one has actually discussed it with them (Cohen et al., 1997; Vaz et al., 2008). Without appropriate information and support, erroneous information assumed by the child or acquired from unreliable sources may be harmful and distressing (Lesch et al., 2007).

10.1.1 Fears about Disclosure

Among the many reasons reported for keeping children's HIV status from them, fear of stigma and discrimination is one of the main reasons (Gerson et al., 2001; Kouyoumdjian, Meyers, & Mtshizana, 2005; Lester et al., 2002; Steele et al., 2007). This fear is related to parental concerns about children sharing HIV-related information impulsively with strangers (Lester et al., 2002; Vreeman et al., 2010), resulting in potential consequences such as isolation of the family, loss of friends, and loss of support (Gerson et al., 2001; Lee & Johann-Liang, 1999). Many parents report feeling that asking their child to keep such a secret was an inappropriate burden to put on their child (Lesch et al., 2007; Lester et al., 2002; Vreeman et al., 2010).

Other concerns about disclosure include fear of adverse psychological consequences for the child, believing the child is not developmentally ready to understand the implications of the HIV diagnosis and parents' own feelings of distress (Steele et al., 2007; Vreeman et al., 2010). For parents living with HIV themselves, parental discomfort about discussing their own HIV infection and parental feelings of guilt and shame may cause them to delay disclosure (Gerson et al., 2001; Kouyoumdjian et al., 2005; Steele et al., 2007). Disclosure in these cases may inadvertently reveal more than intended (e.g., maternal substance use or maternal high risk sexual behaviour) (Sherman et al., 2000). For those children not living with their biological families, disclosure involves less blame and guilt (Lee & Johann-Liang, 1999). Many caregivers also fear that disclosure will result in negative reactions (e.g., worry, sadness, self-harm, distress, anxiety, depression), which may then result in a decline in health (Brown et al., 2000; Vaz et al., 2010; Vreeman et al., 2010).

10.1.2 Risks of Nondisclosure

Although caregivers of children living with HIV express many fears about disclosing their child's HIV status to their child, delaying disclosure can have negative consequences. Research has shown that withholding disclosure may be harmful because children are often aware that they have some type of illness, but they are not able to openly discuss their anxieties (Bachanas et al., 2001; Domek, 2010; Gerson et al., 2001). Lack of disclosure has also been found to impair treatment understanding and participation (Butler et al., 2009; Domek, 2010). Specifically, some authors have suggested that children living with HIV who are unaware of their status may experience more difficulty adhering to complex treatment regimens and decreased support services (Lester et al., 2002).

The possibility of a child learning his/her HIV status from sources other than the caregiver increases dramatically with age. This could lead to misinformation, confusion, bitterness, and limited opportunities for processing the information in a supportive environment (Mellins et al., 2002). As children reach adolescence and begin risk-taking behaviours, open communication about their HIV status also becomes essential for both personal health maintenance and HIV transmission prevention (Butler et al., 2009; Domek, 2010). Timely disclosure is particularly important as recent research has shown that approximately 20% of youth living with HIV did not know their HIV status when they first became sexually active (Tassiopoulos et al., 2012). Disclosure is vital to children's understanding of safer sex practices and the importance of disclosing their HIV status to prospective sexual partners. Tassiopoulos et al. (2012) found that among those who had initiated sexual activity, 14 was the median age at initiation. Because of the potential for HIV transmission to others, it is extremely important that disclosure takes place before sexual behaviours begin.

10.1.3 Reasons for Disclosure

In a recent review of pediatric disclosure literature, the most frequently reported reasons for HIV disclosure to the child were the child's age and cognitive development (Wiener et al., 2007). Disclosure does become particularly important as children age, both to allow them to assist in their care and to reduce the likelihood of unprotected sex (Blasini et al., 2004; Domek, 2006; Gerson et al., 2001; Hazra et al., 2010; Lester et al., 2002; Vaz et al., 2010). Specific education and focused counselling (e.g., about sexual activity) can be instituted with children living with HIV once disclosure has been accomplished (Lee & Johann-Liang, 1999).

Adherence to treatment is another common reason provided for disclosing a child's HIV status to the child. Disclosure is sometimes seen as a necessary step in order to overcome a child's resistance to taking his/her medications (Blasini et al., 2004; Gerson et al., 2001; Hammami et al., 2004; Lesch et al., 2007; Lester et al., 2002; Steele et al., 2007; Vaz et al., 2010). It can be difficult to get children to take medication when they do not feel sick and when they do not know they are living with HIV. Without disclosure, the importance of compliance can be difficult to communicate (Lee & Johann-Liang, 1999). Children also tend to ask more illness-related questions as they age, which can lead to caregiver disclosure (Gerson et al., 2001; Lester et al., 2002; Steele et al., 2007; Vreeman et al., 2010). Disclosure is often related to health status, where caregivers are more likely to disclose to children, as well as to others, when the child is more symptomatic or more immune compromised (Mellins et al., 2002; Steele et al., 2007; Vaz et al., 2008).

Caregivers also report wanting to participate in the disclosure process due to fears that their child would learn their status from other sources and that they were tired of the secret's burden (Blasini et al., 2004). Other factors influencing parental decisions to disclose include a desire for family openness, impulsive disclosure due to frustration, parental illness, and pressures from the provider (Lester et al., 2002; Steele et al., 2007; Thorne et al., 2002).

10.1.4 Benefits of Disclosure

Children in developed countries typically fare well after disclosure, often better than those who are unaware of their HIV infection (Mellins, 2002; Steele et al., 2007; Vaz et al., 2010). Similarly, Butler et al. (2009) found that HIV disclosure does not negatively impact quality of life scores, suggesting that disclosure should not be delayed over fears of a negative impact on quality of life. Domek (2010) summarizes studies outlining the positive effects of disclosure on children's mental health, contributing to improved self-esteem, decreased problematic behaviour, increased adherence to treatment, and less psychological distress. Children who are informed about their diagnosis in the context of a supportive environment may feel a sense of empowerment in their families following disclosure (Blasini et al., 2004; Mellins et al., 2002). When done in this way, disclosure can also promote trust, engage children in their own medical care, promote adherence to medication regimens, and enhance long-term health and emotional well-being.

Researchers have argued that in order to meaningfully participate in treatment, children need to know their HIV status (Chenneville et al., 2010). Such participation in treatment has been associated with more positive medical outcomes. While not all children are developmentally ready to take on such responsibility (e.g., decisions about doctor's appointments, medication adherence, disclosure to others), Chenneville et al. (2010) suggest that efforts should be made to involve children in a developmentally appropriate way so that they may also participate in their medical treatment. Disclosure also allows children to be able to participate in specialised programming for children living with HIV (Gerson et al., 2001), which can help with feelings of social support and self-competence (Battles & Wiener, 2002; Vreeman et al., 2010).

There is general agreement among people researching disclosure that children of normal cognitive development benefit from the opportunity to openly discuss their illness with adults whom they trust (Cohen et al., 1997). Being able to discuss their HIV illness with trusted adults can improve children's school attendance and performance, self concept, behaviour problems, stress, social functioning, and depression and anxiety (American Academy of Pediatrics, 1999; Blasini et al., 2004; Kouyoumdjian et al., 2005; Steele et al., 2007; Vaz et al., 2010).

10.1.5 Recommendations for Disclosure to Children

Based on the many positive outcomes of disclosure to children living with HIV, Lesch et al.

(2007) suggest there is a need to move away from viewing disclosure as a traumatic point in time. Instead, these authors suggest that disclosure should be viewed as an ongoing, dynamic process. As such, disclosure should involve multiple conversations that are tied to the child's cognitive development, clinical status, and social circumstances and should facilitate a gradual deepening of understanding of the impact of HIV infection (American Academy of Pediatrics, 1999; Butler et al., 2009; Hazra et al., 2010; Lee & Johann-Liang, 1999; Lesch et al., 2007; Lester et al., 2002; Vreeman et al., 2010). Caregivers and healthcare professionals can start by teaching children about the immune system and the ways that their immune system is affected. As children age, this information can be expanded and made more explicit (e.g., naming the virus as HIV, including information about modes of transmission) (Cooper et al., 2007; Domek, 2010). This process will likely require repeated information, discussions, questions, reassurance, and planning (Krauss et al., 2012).

The course of disclosure is affected by multiple factors including the child's developmental level, questions about reasons for medications and medical visits, health status, approaching age of potential sexual debut, and the caregiver's readiness for disclosure to the child (Hazra et al., 2010; Lesch et al., 2007). The process for disclosure should be discussed and planned with caregivers and be guided by health professionals who are knowledgeable about developmentally appropriate disclosure (Blasini et al., 2004; Lee & Johann-Liang, 1999; Tasker, 1995). Preparation of caregivers for disclosure entails training caregivers to respond honestly to all of the child's questions, using information that is tailored to his/her age and cognitive level (Hazra et al., 2010). Parental preparation through peer support groups and longitudinal, educational sessions with staff are important, as is support throughout the entire disclosure process (Blasini et al., 2004).

There is not a specific age at which disclosure should happen (Domek, 2006). Researchers have stated that the majority of children are told their HIV status (i.e., the virus is named to the child) between 8 and 18 years old, with the mean age of disclosure being approximately 12 years old (DeMatteo et al., 2002; Di Risio et al., 2011; Vaz et al., 2008). Hazra et al. (2010) suggest that children should be old enough to understand that their medical information is private before they learn the name of their virus, so that their parents can discuss who in turn they can disclose to (Hazra et al., 2010). Blasini et al. (2004) state that it is also important to avoid disclosure during a medical crisis or acute illness. Fear, pain, and fatigue can further compromise the family and child's emotional energy levels during the disclosure process.

10.1.6 Role of Healthcare Professionals in Disclosure

There are a number of ways that healthcare professionals can provide more disclosure support to caregivers and children living with HIV (Vaz et al., 2010). First, they can prepare caregivers to answer children's questions and concerns. Second, they can engage in conversations with children about their health, both before and after they are told their

HIV status, providing them with accurate information that will help prepare them to learn of their diagnosis. Third, healthcare professionals can help children and adolescents feel comfortable to ask questions and obtain more information as their understanding of HIV. Finally, they can provide psychosocial support, create opportunities for children to express themselves during regular clinic visits, and develop support group sessions for children. It may be necessary for healthcare providers to receive additional training in order to provide appropriate support (Vaz et al., 2010).

As previously discussed, it is important that healthcare providers view the disclosure process longitudinally, not as a single event (Blasini et al., 2004). It is also important that healthcare providers guide the process of informing children about their HIV status (Vreeman et al., 2010), while also taking parental wisdom and knowledge about their children into account (Tasker, 1995). Appropriate and effective disclosure requires the involvement of a multidisciplinary support team that assists caregivers in continually adapting the disclosure discussion to meet the developmental needs and understanding of each individual child over time (Domek, 2006).

10.1.7 Post Disclosure Considerations

After disclosure has taken place, it is important to monitor the impact of disclosure on the child. For example, children can be observed for reactions during clinic examinations, during interactions with their caregivers, or in the waiting room (Gerson et al., 2001). Children can also be directly questioned about their feelings about their diagnosis. Reactions following disclosure vary from child to child (Gerson et al., 2001). Immediate reactions after disclosure can include sadness, worrying, crying, anger, discouragement, and inquisitiveness about their condition (Blasini et al., 2004). Vaz et al. (2008) found that the moment of disclosure can be difficult with immediate reactions ranging from shock to heartbreak. Acute grieving reactions seem to be less common in preadolescent children, likely because their cognitive development has not reached a stage where they are projecting toward the future in the same way (Blasini et al., 2004).

While some parents have reported negative reactions immediately after disclosure, these are uncommon in children 6 months following disclosure (Lester et al., 2002). Most children in this study reported feelings of normalcy, and felt that knowing their status was a benefit rather than a harm. Supporting this are several other studies showing that the vast majority of both parents and children believe that the disclosure process was positive for their child and their family (Blasini et al., 2004; Vaz et al., 2008). For example, children have reported that the disclosure process helped them feel more supported by parents, grandparents, clinic staff, and other family members (Blasini et al., 2004).

Only those who learned about their diagnosis accidentally considered disclosure a negative event and wished they had been told by a family member or staff member (Blasini et al., 2004; Forsyth, 2003). When accidental disclosure occurs, children can become isolated in their grief if they do not ask for confirmation or support (Blasini et al., 2004). Because some children continue to experience negative emotions post-disclosure, particular attention should be paid to children who do not resolve the normal grieving process after 6 months. Risk factors identified for poorer adjustment include dysfunctional family relationships and non-adaptive coping skills (Blasini et al., 2004).

Post-disclosure counselling by those knowledgeable about pediatric HIV is a vital part of the disclosure process (Blasini et al., 2004; Vreeman et al., 2010). Such counselling can help to address feelings, reactions, and family and community dynamics. Post-disclosure issues that should be addressed include coping skills; confidentiality; risks and benefits of disclosing the diagnosis to others; themes of puberty, sexuality, and the risk of transmitting the virus to others; adherence to treatment; healthy habits; and self-esteem (Blasini et al., 2004). Once disclosure has taken place, children may be able to start taking on responsibility for their medication regimens (Thorne et al., 2002). In order to do this, they will need appropriate information and support (e.g., about the importance of ART adherence). Support groups for young people with HIV can provide an opportunity to talk to peers, obtain answers to questions about HIV and its treatment, and to discuss issues such as disclosure, developing intimate relationships, and sexual health maturity in a supportive environment (Thorne et al., 2002).

10.2 Disclosure to Others

Children living with HIV who are aware of their status face the dilemma of who to tell among their social networks and often fear rejection (Thorne et al., 2002). The same can be said of caregivers, even when they have not yet disclosed to their children (Vreeman et al., 2010). Disclosure to others is a personal and complex issue. As the social stigma surrounding HIV infection persists, so do families' concerns about confidentiality and discrimination (Mialky et al., 2001). This is particularly true for children with PaHIV, where disclosure of the child's status may result in disclosure of the mother's HIV status as well. It is because of these concerns that many caregivers and children choose not to disclose their child's HIV status to others even after disclosure to the child has taken place (Lester, 2002; Mellins et al., 2002). When disclosure does take place, it is most often to family members (e.g., grandparents and siblings). Disclosure to those outside of the family is most likely to occur when the child is in a more advanced disease stage, when the caregiver is not living with HIV, and when the caregiver is not the biological parent (Steele et al., 2007).

Although caregivers may prefer not to share their child's HIV status to others, there are a few people who should be informed. Kimani-Murage et al. (2010) suggest that there is a need, at the very least to disclose a child's HIV status to potential next-line caregivers, particularly for single parents and in cases where parents are also living with HIV. Kennedy (2003) suggests that parents should also inform their family doctors and health nurses. Such knowledge can help healthcare professionals base health assessments on appropriate information, and provide additional support if parents have any concerns relating to their child's health.

Research has shown that disclosure to others can result in benefits like shared childcare, sustained adherence, and improved psychological and physical health (Hammami et al., 2004; Mellins et al., 2002; Sherman et al., 2000; Steele et al., 2007; Vreeman et al., 2010). Nondisclosure can make these outcomes less likely. For example, nondisclosure can make childcare and maintaining adherence more difficult because caregivers do not have other people who can support them or assist with administering the medications (Steele et al., 2007; Vreeman et al., 2010). Authors have also suggested that there is a potentially detrimental burden, in terms of the child's psychological well-being, when they are asked to keep their HIV status a secret (Mellins et al., 2002; Sherman et al., 2000). In contrast, Battles and Wiener (2002) found that disclosure to larger networks of family and friends is related to greater social support, higher perceived self-competence, and fewer behavioural problems in children. Therefore, it may be important for healthcare professionals to counsel parents and children about the potential benefits of appropriate disclosure to others.

11. School Issues

Education is now an important issue for children living with HIV. Because children living with HIV are living longer, healthier lives, they often attend school and are faced with a number of potentially complex medical, social, and educational issues (along with their caregivers and school personnel). These issues include: the impact of illness on school attendance, disclosure of HIV infection status to teachers and peers, confidentiality surrounding disclosure, medication use during school hours, and transmission concerns (Cooper et al., 2007; Cohen et al., 1997; Domek, 2006). Also important to school functioning for children living with HIV is the fact that children living with HIV are more likely to face health and educational challenges, including learning difficulties, special educational needs, and behavioural or psychological problems (Franks et al., 2004; Mialky et al., 2001).

11.1 Academic Issues

The academic performance of children living with HIV may be affected by a number of factors including the cognitive deficits discussed previously (e.g., effects of HIV disease, social determinants of health, and ART on the brain), absenteeism due to medical treatment and/or illnesses, and illness of siblings and/or caregivers (Blanchette et al., 2002; Cooper et al., 2007; Franks et al., 2004; Mialky et al., 2001). When long-term academic problems are identified, they are usually the result of either the neurologic impact of the virus, frequent absences from school because of illness or medical appointments, or inappropriate educational placements (Franks et al., 2004; Gerson et al., 2001). Secondary factors, besides the possibility of specific cognitive impairments, must also be examined. For example, the multigenerational impact of HIV infection, and the social stigma associated with it, can largely affect how children are able to perform in school (Blanchette et al., 2002).

Providing appropriate support to children living with HIV attending school is important for their overall quality of life. In a study of stressful life events, Elliott-DeSorbo et al. (2009) found that school-related stressful events were most common, and included both academic and behavioural problems. Beyond affecting academic outcomes, school-related stressful life events were also found to be predictive of a child's report of depression. Therefore, school personnel working with children living with HIV need to be aware of the fact that these children are vulnerable to educational difficulties (Melvin & Biggs, 2009). Early identification of difficulties enables access to appropriate assessment and intervention when needed. Decisions about the child's placement within the school setting should be made using a team approach, including the child's caregivers, their physician, public health personnel, and staff who will be working with the child in the educational setting (Alberta Education, 2012).

11.2 Disclosure and Confidentiality at School

Issues such as confidentiality breaches and public controversies about children with HIV in schools and daycare settings can hugely impact children's success in these settings (Franks et al., 2004). The decision to inform school personnel of a child's HIV status is often associated with tremendous anxiety for the family, who needs to weigh the potential benefits of disclosure with the fear of discrimination or loss of privacy. In order to avoid these issues, the majority of caregivers do not disclose their children's HIV status to school personnel (Cohen et al., 1997; Mialky et al., 2001). In instances where school personnel have been informed, school nurses are the most frequently notified, followed by principals and classroom teachers. The age of the child and the need to take medications at school are most often associated with disclosure to school officials (Cohen, 1997).

In 2000, the American Academy of Pediatrics: Committee on Pediatric AIDS voiced their support for a family's right to choose to disclose or not disclose a child's HIV status to school personnel. They stressed the importance of respecting and confidentiality in either scenario. Alberta Education (2012) states that HIV/AIDS is covered under the Communicable Diseases Regulation of the Alberta Public Health Act, and that there are no public health reasons to exclude a child living with HIV from attending school. Further, a child's medical record is confidential and cannot be released by medical or health personnel without the permission of the parent. School personnel are not notified of a child's HIV status unless it is determined that the child or the public require protection. Similarly, there is no basis on which to exclude teachers or other school staff living with HIV from the work setting, provided they are well enough to perform their usual duties.

When disclosure is made to school personnel, it is important that any concerns raised are also addressed. Therefore, close communication between the caregivers, the child's healthcare team, and school personnel is important (Cohen et al., 1997). It is common for the healthcare team to share information about medical issues, including immunizations, medications, absences, illnesses, and participation in school activities.

11.3 Transmission Concerns and Prevention

While school personnel cannot be expected to become medical experts, they should understand the basic facts about HIV, how it affects children, and the practical steps they can take to prevent infection in their classrooms (Franks et al., 2004). Such knowledge will benefit the children living with HIV who are in the classroom, and can serve to reduce any anxiety felt by school personnel and other parents. While parents may worry about their child contracting HIV through contact at school or daycare with a child living with HIV, there have been no cases of transmission through casual contact in such a setting anywhere in the world (Canadian Child Care Federation, 2001; Canadian Paediatric Society, 2008). Therefore, a child's educational setting should not be restricted on the basis of these kinds of fears.

Universal precautions should be consistently adhered to by all school personnel (Franks et al., 2004). Precautions should include policies on caring for wounds, cleaning up blood spills, and disposing of medical supplies (e.g., wearing gloves, stopping bleeding, washing surfaces exposed to body fluids immediately and thoroughly with antiseptic or a fresh bleach solution) (Alberta Education, 2012; UNESCO, 2004). UNESCO (2004) points out that although normal teaching and learning activities do not place anyone at risk for HIV infection, accidents and injuries at school can produce situations where students or staff might be exposed to another person's body fluids. Because it is not possible to tell if someone is living with HIV, school personnel should apply universal precautions to every person and every body fluid in every situation (Alberta Education, 2012). A detailed explanation of standard precautions to take in the event of an accident or injury can be found at http://www.ibe.unesco.org/fileadmin/user_upload/HIV_ and_AIDS/publications/FRESH_ schoolhealth_services_all.pdf.

12. Conclusions

Children who are born with HIV through MTCT are now facing a chronic medical condition, rather than an acute, fatal disease. The use of ART has resulted in a drastic decrease in mortality and morbidity, meaning that children are living longer, healthier lives. Children living with HIV still face a number of challenges. These challenges relate to illnesses and deficits caused by HIV infection itself, the multigenerational aspects of HIV, and the social determinants of health commonly associated with those living with HIV. As with other chronic illnesses, disease-related and psychosocial factors are tightly interwoven in the child's overall health and well-being (Brown et al., 2000). Effective management of these issues and appropriate support for children and their families requires a committed, educated, multidisciplinary team.

The education sector is becoming increasingly important to the response to pediatric HIV, and has been called the social vaccine against HIV infection (Cooper et al., 2007). The preventative role of education is, firstly, in teaching children age-appropriate knowledge of the existence of HIV from an early age and, secondly, in providing age-appropriate life skills to help children protect themselves from HIV infection. Based on research about the impact of stigma and discrimination on children and their families, such education has another important role to play; namely that of reducing stigma and discrimination against HIV among children’s peers and school environments. Reducing stigma and discrimination will go a long way towards improving children’s overall health (e.g., by improving adherence to medication) and their quality of life. These improvements also require appropriate care and support from knowledgeable professionals. The goal of the present review was to highlight common issues faced by children living with HIV, in the hopes of further educating health and allied health professionals in Saskatchewan who may work with children living with HIV.

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