

**ORAL MANIFESTATIONS AND THEIR RELATIONSHIP TO  
IMMUNESUPPRESSION IN HIV POSITIVE CHILDREN AT  
MILDMAY UGANDA**

**BY**

**DR. JULIET NABBANJA**

**A dissertation submitted to the School of Public Health in partial fulfillment of the  
requirements for the award of a Masters of Public Health degree of Makerere  
University**

**NOVEMBER 2009**

**Declaration**

I declare to the best of my knowledge that the work presented in this book is original. It has never been presented anywhere, either partially or in total, for any other award unless otherwise stated. I would therefore like to present it for the award of a degree of Master of Public Health of Makerere University.

**Author:** Dr. JULIET NABBANJA  
2004 /HD20/ 2123U

**Signature:** .....

**Date:** 16 NOVEMBER 2009.....

**SUPERVISORS:**

**Name; Prof. STEFAN PETERSON**

**Signature:** .....

**Date:** .....

**Name; Dr. SHEBA N. GITTA**

**Signature:**.....

**Date:** .....

### **Dedication**

I wish to dedicate this work to my loving husband Dr F.G Katumba and my three daughters Angelina, Bridget and Cynthia.

## **Acknowledgement**

I take this opportunity to thank the management of Makerere University School of Public Health that came up with the idea of a distance education programme. This arrangement has enabled many of us to achieve our academic goals that otherwise may never have been attained.

I wish to acknowledge as well as to express my sincere gratitude for the expert advice I received from my supervisors as I endeavoured to complete this task. I will always treasure your advice.

I am highly indebted to all the members of my research team who worked tirelessly towards the success of this project. Thank you all for the unfailing co-operation.

Finally I wish to acknowledge the support of my dear parents Mr & Mrs Dumba on whose educational foundation I still stand. May the good Lord bless them abundantly.

## Table of contents

DECLARATION .....	II
DEDICATION .....	III
ACKNOWLEDGEMENT .....	IV
TABLE OF CONTENTS.....	V
LIST OF ABBREVIATIONS.....	VIII
OPERATIONAL DEFINITIONS.....	IX
ABSTRACT.....	X
CHAPTER ONE INTRODUCTION AND BACKGROUND.....	1
1.1 INTRODUCTION .....	1
1.2. BACKGROUND .....	3
CHAPTER TWO LITERATURE REVIEW .....	5
2.1. PREVALENCE OF ORAL LESIONS IN HIV-POSITIVE CHILDREN.....	6
2.2 PREVALENCE OF DENTAL CARIES AMONG HIV PEDIATRIC CASES .....	8
2.3. EFFECT OF HIV-ORAL MANIFESTATIONS ON ORAL FUNCTIONS AND GENERAL HEALTH.....	9
2.4 RELATIONSHIP BETWEEN CD4+ CELL VALUES AND HIV- ORAL MANIFESTATIONS ....	9
CHAPTER THREE STATEMENT OF THE PROBLEM, JUSTIFICATION AND CONCEPTUAL FRAMEWORK.....	11
3.1 STATEMENT OF THE PROBLEM.....	11
3.2 JUSTIFICATION .....	12
3.3 CONCEPTUAL FRAMEWORK .....	13
3.4 RESEARCH QUESTIONS.....	14
CHAPTER FOUR OBJECTIVES.....	15
4.1 GENERAL OBJECTIVE.....	15
4.2 SPECIFIC OBJECTIVES.....	15
CHAPTER FIVE METHODOLOGY .....	16
5.1 STUDY AREA.....	16
5.2 ACCESSIBLE POPULATION .....	16
5.3 STUDY DESIGN .....	17
5.4 SAMPLE SIZE DETERMINATION.....	17
5.5 SAMPLING PROCEDURE .....	17
5.6 INCLUSION CRITERIA.....	18
5.7 EXCLUSION CRITERIA .....	18
5.8 VARIABLES.....	19
5.8.1 <i>Dependent variables</i> .....	19
5.8.2 <i>Independent variables</i> .....	19
5.9 DATA COLLECTION.....	19
5.9.1 TOOLS .....	19

5.9.2 TECHNIQUES.....	20
METHODOLOGICAL RIGORS.....	23
5.10 DATA MANAGEMENT AND ANALYSIS .....	23
5.11 QUALITY CONTROL.....	24
5.12. ETHICAL CONSIDERATIONS .....	25
5.13 STUDY LIMITATIONS.....	25
DISSEMINATION OF RESULTS .....	26
CHAPTER SIX RESULTS.....	27
PREVALENCE OF ORAL LESIONS .....	30
PREVALENCE OF DENTAL CARIES. ....	31
ORAL FUNCTIONS IMPAIRMENT BY PRESENCE OF ORAL MANIFESTATIONS. ....	33
LEVEL OF CD4+ CELLS RELATED TO PRESENCE OF ORAL LESIONS .....	35
CHAPTER 7 DISCUSSION.....	39
PREVALENCE OF HIV ASSOCIATED ORAL LESIONS .....	39
PREVALENCE OF CARIES .....	41
ORAL MANIFESTATIONS IMPAIRING ORAL FUNCTIONS.....	43
CD4+ CELL COUNT RELATED TO PRESENCE OF ORAL LESIONS. ....	44
CONCLUSIONS.....	45
RECOMMENDATIONS.....	46
REFERENCES .....	48
APPENDIX 1 RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM. ....	55
APPENDIX 2 W.H.O. RECORDING FORM FOR ORAL LESIONS ASSOCIATED WITH HIV- INFECTION.....	57
APPENDIX 3 DENTAL RECORD CARD .....	59
APPENDIX 4 PARTICIPANT’S INTERVIEW GUIDE.....	61

## LIST OF TABLES

- Table 1 Background characteristics of study participants
- Table 2 Children by drug combination and duration on ART
- Table 3 Prevalence of oral lesions commonly associated with HIV
- Table 4 Children with specific DMF and def scores
- Table 5 Children reporting oral function impaired due to presence of oral lesions.
- Table 6 Selected factors as they relate to presence of oral lesions
- Table 7 Logistic regression analysis of all factors with oral lesions

## LIST OF FIGURES

- Figure 1 Proportion of children by oral hygiene status
- Figure 2 Children by set of dentition
- Figure 3 Children with dental caries experience
- Figure 4 Children by level of CD4+ cell count.
- Figure 5 Proportion of children with oral lesions by their CD4+ levels

## **List of Abbreviations**

<b>AIDS</b>	Acquired immune deficiency syndrome
<b>ART</b>	Anti-retro-viral therapy
<b>ARVs</b>	Anti-retro virals
<b>deft</b>	decayed extracted and filled teeth
<b>DMFT</b>	Decayed Missing and Filled teeth
<b>HAART</b>	Highly active anti-retro viral therapy
<b>HIV</b>	Human immune-deficiency virus
<b>HIV-NUP</b>	HIV-Necrotizing Ulcerative Periodontitis
<b>LGE</b>	Linear Gingival Erythema
<b>OH</b>	Oral hygiene
<b>OI</b>	Opportunistic infection
<b>PMTCT</b>	Prevention of mother to child transmission
<b>TASO</b>	The AIDS Support Organisation
<b>UAC</b>	Uganda AIDS commission
<b>USAID</b>	United States Agency for International Development
<b>WHO</b>	World Health Organization



### **Operational definitions**

**CD4+ Cells:** These are cells of the body's immune system. In this study the number of cells/ml in the individual's body is used to categorize immune suppression into severe (<200cells/ml), moderate (500-200 cells/ml) and on-immune suppression (>500 cells/ml).

**Dental caries:** This is the terminology used to refer to tooth decay.

**DMFT caries index:** The index is a means of numerically expressing the caries prevalence and is obtained by adding the number of decayed (D), missing (M) and filled(F) Teeth in an individual. For the primary dentition the corresponding designation is "deft" where "e" indicates "extracted tooth".

**Immune- suppression:** The level to which the body's immunity has been lowered due to HIV infection. In this study it is indicated by CD4+ cell counts/ml.

**Oral -functions:** Functions within the oral cavity. This study considers teeth- brushing, swallowing drugs and chewing food.

**Oral- hygiene:** The cleanliness of the oral cavity. In this study cleanliness was assessed basing on the presence or absence of food deposits on indicator teeth surfaces. The indicator teeth surfaces included the cheek side of upper molars and the tongue side of the lower incisors. The status was classified as; Good = no food deposits on all teeth. Fair = food deposits on either cheek-side of upper molars or tongue-side of lower incisors. Poor = food deposits on all the teeth.

**Oral lesions:** Pathological conditions in the mouth that are closely associated with HIV infection according to the WHO criteria.

**Oral manifestations:** In this study manifestations considered include HIV –associated oral lesions and dental caries.

## **Abstract**

### **Introduction**

HIV/AIDS is a major global health problem affecting both low and high- income countries. Oral manifestations of HIV infection further threaten the usually poor health of HIV- positive children and lower their quality of life. HIV- oral lesions are frequently the first clinical sign of HIV infection and may interfere with oral functions. Dental caries may give rise to pain which affects feeding and general health among infected children. The Mildmay dental needs assessment (Kawuma et al 2006) reported that 94% of the children accessing care at the facility had dental problems and 80% of the patients had not visited a dentist in the previous three months. With that back- ground a dental clinic was commissioned on site in October 2006. Currently it is the only dental clinic in Uganda offering dental treatment to HIV positive children. However the magnitude of HIV-oral manifestations among children accessing care at the facility is yet to be documented. Yet it is important so that oral health care is well planned to improve the quality of life in this group of children.

### **Methodology**

The cross-sectional study was conducted at Mildmay Uganda, between November 2007 and February 2008. The study population was children attending the Mildmay dental and pediatric clinics. A sample of 368 children between 0 to 17 years was systematically selected. Examinations of the mouth, followed by a short interview were conducted in the dental clinic and medical records were reviewed for CD4 cell count. Data was collected using the WHO data form for oral lesions, the Mildmay dental record card and a pre-tested semi structured questionnaire. Analysis was done using the stata computer software version 11.0. The results are presented in text, tables and figures.

### **Results**

Female participants were 194 (52.7%), the mean age was 8.8 years (SD 4.180), 67% were on ART, and 66.6% had fair oral hygiene. 77.4% had some form of HIV associated oral lesion, oral candidiasis was the most prevalent, it was seen in 50% of the children, 54% had experienced dental caries, the mean DMFT was 2.7 while mean deft was 11.8. A total of 62% reported interference of oral functions due to presence of oral lesions and swallowing of drugs was the most affected oral function. At bivariate analysis having poor oral hygiene (COR 2.8, CI 1.0-7.7,  $p=0.004$ ), not taking ARVs (COR 1.8, CI;1.0-3.4,  $p=1.0$ ) and low CD4+ cell counts (COR 1.9, CI;0.8 - 4.3,  $p=0.3$ ) were associated with presence of oral lesions. On multivariate analysis, among all other factors the association of poor oral hygiene and presence of oral lesions was found to be statistically significant. (AOR 2.8, CI 1.0 - 7.7,  $p=0.014$ ).

### **Conclusions and Recommendations**

HIV oral manifestations are common among children receiving care at Mildmay Uganda. Presence of HIV-oral lesions interferes with oral functions and the lower the CD4+cell-count the more likely the occurrence of oral lesions. The recommendations include training of health care providers in diagnosis and management of HIV-oral manifestations, regular dental check ups and regular CD4+ cell count for all children

## **CHAPTER ONE INTRODUCTION AND BACKGROUND**

### **1.1 INTRODUCTION**

The HIV and AIDS epidemic is tragically affecting the lives of children worldwide. Globally and especially in Africa, HIV and AIDS remain a serious cause of morbidity and mortality among children. By December 2004 a total of 2.5 million children under 15 years old were reported to be infected with HIV. A total of 500,000 deaths related to HIV and AIDS in the same age group was reported in 2004 (WHO 2004). Further still growing numbers of infants are being born with HIV. In an effort to protect the future generation, the theme for 2006 World AIDS Day was “Unite for children, unite against AIDS.” Subjects of the theme included promotion of pediatric care, support, treatment and protection of children and prevention of HIV infection in children (UAC 2006).

HIV infection can present with various oral manifestations that include oral lesions, dental caries especially the rampant form and poor oral hygiene. These may be the first and only sign of the infection. The prevalence of oral lesions and dental caries in children with HIV have been well documented in high-income countries like the USA, UK, Thailand and Brazil but there are fewer reports among children from low-income countries for example Tanzania, Uganda and South Africa. Currently a number of lesions are closely associated with HIV infection and oral candidiasis is the most commonly reported HIV-associated oral lesion in all continents among HIV positive children (Ramos-Gomez et al., 1999). HIV-associated salivary gland disease has a high prevalence in Africa among HIV-pediatric cases (Patton et al., 2000).

Dental caries or tooth decay is a conventional oral disease that can occur even in children without HIV infection. However Coogan et al., 2005 and Fine et al., 2003 have indicated that it is highly prevalent in HIV-positive compared to HIV-negative children.. It is possible to have poorly forming teeth in these children due to immune suppression and as a result the weak teeth are highly prone to decay.

Oral hygiene if not well maintained has been mentioned as a factor contributing to the development of HIV-oral manifestations (Tappuni et al.,2001, Acquirre et al. , 1999,). Brushing teeth in a very sick child is not a priority and this can result in poor oral hygiene. When the children do not have adequate social support, for example they are orphaned, have parents that are too sick, are not enrolled in school or are in the care of very old grandparents, the oral hygiene will most likely be compromised leading to rampant teeth decay.

HIV targets the body's immune system particularly the CD4+cells that are killed off thereby lowering the body's immunity. Development of oral manifestations has been found to be closely associated with low CD4+ count (Tappuni et Flemming 2001). It is therefore important to monitor the CD4+ cell levels among HIV positive children as a guide on the progress of the disease and to give an idea of when the oral manifestations are most likely to develop.

Given the current impact of the pandemic caused by HIV, it is the responsibility of dental professionals to prevent, detect, treat and control the oral manifestations of HIV infection so as to improve the quality of life and greater long-term survival for HIV infected children.

## **1.2. BACKGROUND**

### **Oral health in Uganda**

Currently there is inadequate data on the oral health situation in Uganda (MoH 2007).

A rapid assessment of oral health among the general population was done in 2004/2005 in 10 selected districts. The most prevalent conditions were reported to be tooth decay. Pain, tooth loss, bleeding gums and bad breath. The oral health situation of HIV infected individuals has barely been assessed. Currently Tiromwe et al., 2007 has documented the prevalence of HIV-oral manifestations clients at the TASO clinics.

#### **1.2.1 Oral health at Mildmay Uganda**

Mildmay Uganda is health-care facility that provides holistic- care to people living with HIV and AIDS using a multi-disciplinary and family oriented approach. The facility is affiliated to the U.K based Mildmay International which is an independent not-for-profit Christian organization involved in the provision of consultancy, training, AIDS patients' rehabilitation and palliative care services worldwide.

In 1993 Mildmay International was commissioned by the Ministry of Health in Uganda to develop a specialist AIDS rehabilitation, palliative care and training center. Following that request Mildmay Uganda was opened in September 1998. It is currently located in Lweza trading center 7miles from Kampala on Entebbe-road. The facility offers family centered comprehensive holistic care to children, adults and families infected with and affected by HIV and AIDS. Professionally services offered include specialist medical, dental and nursing care, counseling, pastoral care, physiotherapy, occupational therapy, laboratory and pharmacy services and community care.

The aim of the facility is to demonstrate excellence in the field of HIV- care and to train health-care providers in Uganda in the principles and practices of AIDS rehabilitation and palliative care. By the end of September 2007 a total of 5000 patients was accessing care from the facility; and of those 1507(approximately 21%) were children below 18years of age(Mildmay-Uganda,2007). A Mildmay dental needs assessment (Kawuma et al., 2006) reported that 94% of the children accessing care at the facility had dental problems and 80% of the patients had not visited a dentist in the previous three months. However the magnitude of HIV oral manifestations among children accessing care at the facility is yet to be documented.

Since 2004 a group of American dentists have annually visited Mildmay Uganda for a one-two weeks to offer dental treatment to all children accessing care at the facility as well as to those from other charity homes for children with HIV. With that back- ground a dental clinic was commissioned on site in October 2006. Currently it is the only dental clinic in Uganda offering oral-health care specifically to HIV positive children. The oral health care package offered at Mildmay Uganda includes Preventive oral health care where flouride gels are used to prevent dental caries and children are given oral health education talks to create awareness on maintenance of good oral hygiene. There are curative services where children with various complaints are given the appropriate dental treatment including extractions, fillings, medications for HIV associated lesions and referral for specialized management of any cancerous lesions that are detected

## **CHAPTER TWO      LITERATURE REVIEW**

In the western world the topic of oral manifestations of HIV in children has been fairly well established but there is very scanty literature on the same topic among the low income countries where very few studies have so far been done. The studies that have been done so far have revealed a number of facts. Ramos-Gomez et al., 2000 reported that oral manifestations of HIV are common in children and are possible predictors of progression to AIDS disease. Leggot, 1992 concluded that diagnosis of oral lesions in children is an auxiliary method to raise early suspicion of HIV/AIDS. Santos et al., 2001 reported that oral manifestations are common and directly related to the degree of immuno-suppression in HIV positive children.

Coogan et al., 2005 reported on the public health aspects of HIV-oral manifestations. The study reported that the presence of oral manifestations has a significant impact on general health and lowers oral health-related quality of life by impairing oral functionality resulting into lowering of the patient's quality of life. Tiromwe et al., 2007 reported that oral manifestations were associated with discomfort and interfered with oral functions of chewing and tooth brushing among HIV positive patients attending TASO clinics in Uganda.

Factors currently believed to play a role in the development of HIV-oral manifestations have been reported by Tappuni et al., 2001, Acquirre et al., 1999, Patton et al., 2000 and Chan et al., 1994 and these include low values for CD4+ cell count (<200 cells/ml) which characterize the presence of immune-suppression, viral load greater than 3000 copies/ml, xerostomia, poor oral hygiene and smoking.

## **2.1. Prevalence of oral lesions in HIV-positive children**

Previous studies have reported oral lesions to be very common in HIV positive children. Fine et al., 2003 in the study on Clinical implications of the oral manifestations of HIV infection in children in North America, reported that the HIV-infected group showed more oral lesions which included candidiasis, linear gingival erythema and medial rhomboid glossitis as compared to their HIV-free counterparts. Diz et al., 2000 reported that more than a third of the children living with HIV have oral lesions that arise because of their weakened immune- system.

Arendolf et al.,1998 and Patton et al., 2000 reported that HIV-associated oral lesions occur in approximately 30%- 80% of any affected population and are a fundamental component of the disease progression. Ramos-Gomez et al., 1996 reported oral lesions as indicators of HIV infection with a 7% predictive value of progression to AIDS. Valdez et al., 1994, Howell et al., 1996 and Khongkuntian et al., 2001 reported a 40%-50% frequency of oral manifestations in soft tissue while Katz et al.,1993 reported a 30% incidence rate of herpes simplex lesions in children five years after acquiring HIV infection .

Magalhaes et al., 2001 found 53% of Brazilian children presenting with at least one oral lesion related with HIV/AIDS. In the same population, angular cheilitis was reported to occur in 29%; parotid gland bilateral enlargement and candidiasis were reported in 19%, conventional gingivitis occurred in 14%, herpes simplex in 5.3% In Northern Thailand Anak et al., 2003 reported a high prevalence of oral lesions among HIV positive children.



There are fewer studies that have been done on the above topic done in the African countries. A Tanzanian based study Hamzar et al., 2006 revealed that oral candidiasis is the commonest oral lesion with a 24% prevalence followed by mucosal hyperpigmentation at 4.7%. In South Africa Naidoo et Chikte., 2004 studied Oro-facial manifestations in pediatric HIV-positive patients and comparison was made between hospital outpatients against Institutionalized patients. The most frequently encountered oral lesion was oral candidiasis. Among the hospital-out patients 39% had multiple lesions as compared with 28% in the institutionalized. In Uganda Tiromwe et al., 2007 documented the magnitude of the HIV-associated oral lesions among clients attending TASO Clinics and reported a 68% prevalence of oral manifestations. The magnitude of the problem among children infected with HIV is yet to be documented.

An influence of HAART. on the prevalence of oral manifestations has been studied. Patton et al., 2000 reported that the overall prevalence of oral manifestations of HIV has changed since the advent of HAART and Miziara et Weber.,2006 concluded that use of HAART could lead to a reduction in the prevalence of oral lesions in Brazillian children. Chen et al., 2003 reported that using anti-retro viral therapy was associated with decreased caries, but was not associated with decreased oral lesions. Reznik et al., 2002, Greenspan et al., 2001 and Acquirre et al.,1999 reported that even though combination antiretroviral therapy has made some oral problems less common, others like oral warts are becoming more prevalent while Patton et al., 2000 reported an increase in salivary gland disease to be emerging in the HAART era.

## **2.2 Prevalence of dental caries among HIV positive children**

It is widely believed that infection with HIV at birth makes children more vulnerable to dental caries because of their compromised immune system. Coogan et al., 2005 and Fine et al., 2003 reported that HIV infected children with oral manifestations also have a higher level of dental caries. Naidoo & Chikite., 2004 studied oral manifestations among HIV positive children in South Africa and concluded that HIV-positive children should be considered high risk for caries because of the continuous use of chronic sugar-based medications/syrups. The study compared hospital-out patients and institutionalized HIV positive children and the study findings revealed that average DMFT was considerably higher in the hospital-out-patient population compared to the institutionalized group. For both sets of dentition (permanent and primary), the decayed component (D/d) made up the major part of the DMFT/deft, followed by the missing (M/m) component.

Gelbier et al., 2000 studied dental diseases among 35 children in the U.K all participants were found to have some caries experience. The mean deft was 4.4 and the study concluded that there is significant treatment need for dental diseases among children infected with HIV. Chen et al., 2003 assessed HIV-infected Romanian children to establish the association of caries, plaque accumulation, gingival health, and antiretroviral therapy (AT) with oral lesion prevalence. The study findings revealed that using anti-retro viral drugs was associated with decreased caries prevalence, while fungal infections were found to be associated with poor oral hygiene and increased occurrence of dental caries. This has been supported by some microbiological studies (Murray et al 1992)

### **2.3. Effect of HIV-oral manifestations on oral functions and general health**

Currently not many studies have reported about the effect of oral manifestations on oral functions and on the general quality of life among patients with HIV/AIDS. There are a number of oral functions that can be compromised in the presence of oral manifestations. Coogan et al., 2005 reported that presence of oral manifestations is associated with dry mouth and taste problems thus making feeding difficult, altered facial appearance, impaired speech and more significantly may give rise to pain. All the above aspects lower the quality of life of HIV positive children. The pain often results into dysphagia which may lead to significant weight loss and malnutrition, rapid clinical deterioration and early death among infected children.

Santos et al., 2001 reported that the oral lesions in the more immunologically suppressed can make teeth brushing painful, thus neglecting oral hygiene, which can result into dental caries. Dental caries is another painful experience that interferes with oral functionality and hygiene. Tiromwe et al., 2007 reported discomfort to be associated with teeth brushing, chewing and swallowing among HIV positive subjects who had oral lesions.

### **2.4 Relationship between CD4+ cell values and HIV- oral manifestations**

CD4+ cells are often used as a measure of the level of immune-suppression due to HIV infection. The lower the count the more suppressed the immunity. Some studies on the association between low CD4+ cell values with presence of oral manifestations have been done. In Brazil, Santos et al., 2001, Miziara et al., 2006 reported that the percentage of CD4+ cell was lower in children with oral manifestations compared to that

in lesion-free children. In U.S.A Ramos-Gomez et al., 2000 and in Tanzania, Hamzar et al (2006) reported that oral manifestations were positively associated with low CD4+ cell count among children with HIV. It is therefore very crucial to have this parameter well monitored to check on disease progress.

The ability to differentiate one manifestation from another and to manage some of the more common oral conditions is fundamental to the overall management of oral manifestations of HIV infection among children.

## **CHAPTER THREE STATEMENT OF THE PROBLEM, JUSTIFICATION AND CONCEPTUAL FRAMEWORK**

### **3.1 Statement of the problem**

Dental diseases are a significant public health problem in Uganda with child oral health as high priority (Nalweyiso et al., 2004) However, the magnitude of HIV- associated oral manifestations in pediatric cases has not been documented in Uganda.

Oral manifestations of HIV infection contribute to the morbidity of the infected children by reducing their quality of life and may led to their mortality as some present as life threatening conditions for instance Kaposi's sarcoma. Some of the lesions are often the underlying cause of early death in HIV infected children. Dental caries may give rise to pain thus affecting feeding which may lead to significant weight loss.

At Mildmay Uganda the oral manifestations pose a threat to adherence to ARVs, the nutritional status of the children and the oral hygiene among these usually sick children. The pain and discomfort associated with most of these oral conditions can lead to impairment of oral functions for instance difficulty in swallowing which in turn can encourage non-adherence to drugs and refusal to feed resulting into rapid progression to full- blown AIDS and early death of these children. Pain due to the oral manifestations will deter children from achieving and maintaining good oral hygiene which is paramount for good oral health and general wellbeing.

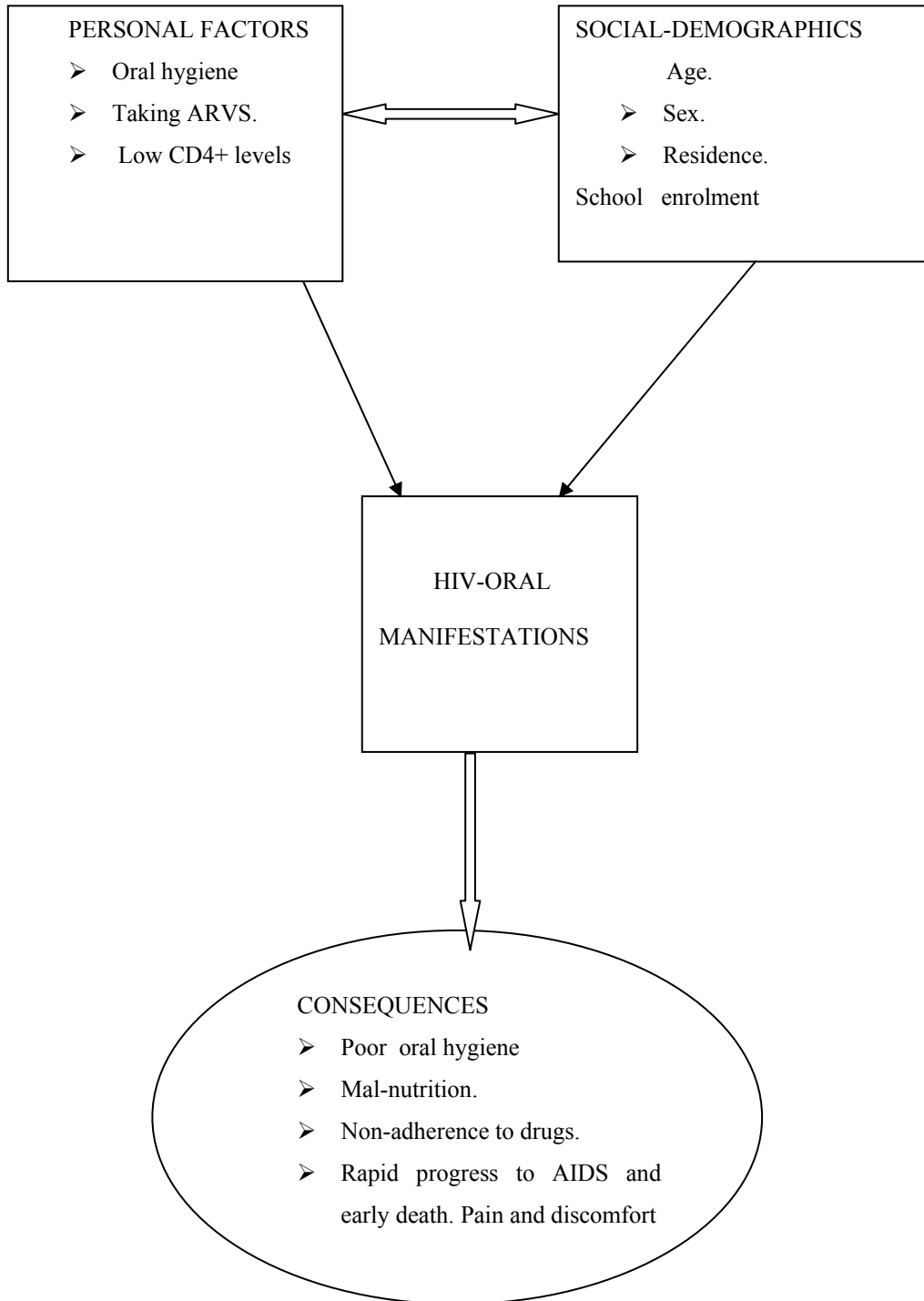
The knowledge gap on the magnitude of oral manifestations in pediatric cases may negate the achievement of holistic care and improved quality of life among children with HIV and AIDS.

### **3.2 Justification**

In order to address the above knowledge gap this study aims to generate and document information on the prevalence of HIV- associated oral manifestations among children accessing care at Mildmay Uganda. The study will generate information that will guide policy makers and implementers in the formulation of the appropriate policies on training health care providers and on oral health care service delivery at Mildmay Uganda. The study findings will also guide management in designing appropriate strategies to improve oral health care services and overall management of HIV associated oral manifestations in children.

At National level the findings of this study will act as baseline information for future research on prevalence of oral manifestations among HIV positive children in Uganda. The results of the study will also be informative to the developers of treatment guidelines for oral-health care of HIV positive children and may be used to improve on the content of oral health care in the Uganda minimum health care package.

### 3.3 Conceptual-frame-work



### Text about the conceptual frame work

The presence of HIV- oral manifestations is likely to be determined by personal factors as well as socio-demographic factors. These factors may operate independently or in a related manner to influence the development of oral manifestations. The presence of oral manifestations may lead to a number of consequences that lower the quality of the patient's life. These include pain, non-adherence to drugs, malnutrition and sometimes early death of children.

### **3.4 Research Questions**

1. What is the prevalence of HIV associated oral lesions in HIV-positive children below 18 years at Mildmay Uganda?
2. What is the oral hygiene and dental caries status in HIV-positive children below 18 years at Mildmay Uganda?
3. Does the presence of HIV oral manifestations interfere with oral functions in HIV-positive children below 18 years at Mildmay Uganda?
4. How is the presence of oral manifestations related to the level of immune- suppression (given by CD4+cell count) in HIV-positive children below 18 years at Mildmay Uganda?



## **CHAPTER FOUR OBJECTIVES**

### **4.1 General Objective.**

To determine the relationship between presence of HIV-oral manifestations and level of immune-suppression in children below 18 years at Mildmay Uganda, so that management can strategically plan for improved oral health care for this group of clients.

### **4.2 Specific Objectives**

1. To quantify HIV associated oral lesions prevalent among children below 18 years at Mildmay Uganda.
2. To quantify teeth that are affected by dental caries and also evaluate the oral hygiene status among children below 18 years at Mildmay Uganda.
3. To establish whether presence of oral manifestations impairs oral functions among children below 18 years at Mildmay Uganda.
4. To establish how levels of CD4+ cell/ml relate to presence of oral manifestations in children below 18years at Mildmay Uganda.

## **CHAPTER FIVE METHODOLOGY**

### **5.1 Study Area**

The study was conducted between November 2007 and February 2008 at Mildmay Uganda, an affiliate organization of Mildmay International which is based in the United Kingdom.

Mildmay Uganda as an HIV/AIDS-care providing institution is committed to giving holistic care to HIV positive patients, and is located in Lweza town which is seven miles from the capital city Kampala, on Entebbe-road. The centre cares for children and adults infected with and affected by HIV and AIDS. By the end of September 2007, 5000 patients were accessing care from the facility and 1507 of these were children below 18years old. Administratively the facility is managed by the Country Director together with four heads of directorates and below them are heads of various departments. Services offered at the facility include medical, dental, nursing and training in HIV-care. Therapies include nutritional, physiotherapy and counseling, while community care and rural clinic medical services are offered away from the main facility.

### **5.2 Study population**

All patients below 18 years attending Mildmay Uganda between November 2007 and February 2008. The study population comprised of patients below 18 years with a confirmed HIV positive sero-status and is receiving care from the pediatric and/or the dental clinics at Mildmay Uganda between November 2007 and February 2008.

### 5.3 Study design

The study was a Cross-sectional study and quantitative methods of data collection were used.

### 5.4 Sample Size Determination.

Sample size (n) was obtained using the formula below (Kish Leslie, 1965)

$$n = \frac{Z^2 pq}{d^2}$$

Where Z = 1.96 (95% confidence level)

p = 0.3 [proportion with oral lesions as in the study by Hamzar et al.,2006]

q = 1- p = 0.7

d = 0.05 (5% maximum error)

$$n = \frac{3.84 \times 0.3 \times 0.7}{0.0025}$$

Estimated sample size (n) =323 children.

### 5.5 Sampling Procedure

The participants were systematically selected from the children attending both the dental and pediatric clinics at Mildmay Uganda. A total of 368 HIV positive children below 18 years were enrolled in order to cater for non-response.

On the first day of recruitment the first two study participants were selected randomly, one from each of the participating clinics using the attendance lists for that day.

The subsequent participants were selected using an interval of five (this was obtained by dividing 1507/323). On average there are 40 children seen daily in the pediatric clinic and 15 are seen in the dental clinic. The clinic week is only 4 days and selection of the participants was done on all the clinic days.

In order to get 368 children, 11 children were recruited per day, for a period of nine weeks. Every fifth child that entered the pediatric clinic and every third child in the dental clinic were recruited, so that at the end of each week, 44 children were recruited. The children selected from the pediatric clinic were accompanied from the pediatric clinic by the dental-nurse who led them to the dental clinic for the oral examination and interviews. Children on repeat visits were not recruited again into the study instead the next new client was recruited. The acceptance rate was 100%.

The challenge in recruiting was that the dental and pediatric clinics were not close to each other, so it meant if a selected child is not immediately directed to the dental clinic, it would mean tracking them down at the next various points of getting service (Pharmacy, laboratory and X-ray). However, the challenge was overcome by ensuring that the selected child sees the dentist before the pediatrician and to cater for non-response or loss of participant another 45 participants on top of the calculated sample size were recruited in the same way as described above.

### **5.6 Inclusion Criteria**

All HIV positive children below 18 years accessing care from the dental and pediatric clinics at Mildmay Uganda.

### **5.7 Exclusion Criteria**

Children that were too ill to participate in the oral examination and the interview.

## **5.8 Variables**

### 5.8.1 Dependent variables

1. Presence of oral lesions (Yes/No).
2. The total number of decayed, missing and filled teeth.

### 5.8.2 Independent variables

1. Personal factors; levels of CD4+ cell count, oral hygiene.
2. Socio-demographic factors; age, sex, residence, orphan/not orphan, school - enrolment.
3. Drug related factors; is the participant on Anti-retro viral drugs yes/no.

## **5.9 Data Collection**

### **5.9.1 Tools**

The W.H.O recording form for oral lesions possibly associated with HIV infection (Appendix No.2 ) and the soft tissue record card routinely used for recording oral lesions in the Mildmay dental clinic were jointly used for collecting data on prevalence of oral lesions.

The dental record card routinely used to assess dental caries in the Mildmay dental clinic (Appendix No. 3) was used to collect data on the prevalence of dental caries and oral hygiene

A short semi-structured questionnaire (Appendix No.4) was adopted from the W.H.O form (mentioned above) and redesigned to suite the objectives of the current study. It was then used to collect data on the impact of HIV-oral lesions on oral functions.

The participant's medical records were reviewed to get data on their CD4+ cell count.

### **5.9.2 Techniques**

The research team comprised of six persons. The principle investigator (P.I) a qualified dentist, four research assistants (1 dental nurse, 2 data entrants, 1 child-counselor) and all were members of staff at Mildmay Uganda. A Visiting American oral-pathologist from the University of Texas-Houston who was on a one week dental camp at the facility had earlier on trained the P.I. in diagnosing the “difficult to identify” oral lesions.

The research team was selected on the criteria that they had the background training for the various roles expected of them during the implementation of the study. Being staff members of Mildmay Uganda (the study area) was an added advantage because this made them readily available when the principle investigator needed to contact them and another advantage was that their movements at the facility were not as restricted as it would be for non-staff members.

The P.I instructed the research team for two days on the various codes of conduct and roles they were to play during the study. Confidentiality was emphasized after informed consent was obtained. The role of the P.I was to obtain all the relevant permissions, consents and assents before doing the recruitment, the oral-examinations, interviews, and review of medical records for all the study participants. The P.I was also the overall supervisor of the research team. The dental nurse assisted the P.I in assuring that the children recruited from the pediatric clinic go to the dental clinic for the oral examination. The nurse also worked as the chair-side assistant for the P.I. during the oral examinations in the clinic. The counselor was to assist with counseling the participant or their care taker whenever the need for the service arose and the data entrants were to record particulars of children recruited from the pediatric clinic, record

the findings of the P.I on the data sheets and the dental-record cards in the dental clinic and also to enter the data daily into the computer.

The study participants underwent an examination of their mouth that was done by the P.I in the dental clinic at Mildmay Uganda. With the participant/child laying in a dental chair the principal investigator performed the inspection of both hard and soft tissues of the oral cavity. A mouth mirror and visual inspection were used during the examination. The headlamp on the dental chair was the source of light to illuminate the oral cavity. The soft tissues were assessed for presence or absence of HIV- associated oral lesions. Any lesion detected was clinically diagnosed according to the WHO diagnostic criteria (WHO/EEC, 1993) for oral lesions possibly associated with HIV infection. In case no lesion was detected it was noted as such. The P.I. also performed bi-digital palpation on the cervical, sub-mandibular and parotid glands to inspect for lymphadenopathy. The findings were communicated to the research assistant who recorded it on the data sheet. Any other oral pathology detected was recorded in the category of “Others”.

After assessing for oral lesions, the P.I then assessed for the status of the oral hygiene. This was done basing on the presence or absence of food deposits on the chosen indicator teeth surfaces. The indicator teeth chosen for assessing oral hygiene included the first two upper molars and the four lower incisors while the surfaces of the indicator teeth were the cheek side of the upper molars and the tongue side of the lower incisors. The above indicator teeth and surfaces were chosen for assessing the oral hygiene status because they represent the hard to clean areas of the oral cavity. These surfaces were checked for food deposition and the oral hygiene status was then classified as;

Good = no food deposits on all indicator teeth surfaces.

Fair = food deposits on either cheek-side of upper molars or tongue-side of lower incisors.

Poor = food deposits on all the indicator teeth surfaces.

Next to oral hygiene assessment the P.I assessed the participant's teeth for dental caries, and this was done using a dental mirror and explorer. The teeth were examined to establish if they had cavities due to decay, or were missing due to extraction as a result of dental caries or had been filled with an artificial material following decay. The findings by the P.I were communicated to the data entrant based in the dental clinic (The other was based at the pediatric clinic) who filled them in the dental record card. The total number of teeth examined was also noted.

After the oral examination the children were interviewed using a short semi structured questionnaire to find out whether the presence of oral lesions interferes with their ability to chew food well, brush their teeth properly and to swallow their drugs.

The P.I. obtained permission from the head of records department to access and review the medical records of the study participants. In each file, there is a chart showing the most recently recorded blood test- results. This chart was reviewed and absolute values of CD4+cell count were obtained for each participant and this value was recorded on the data collecting sheet.



## **Methodological rigors**

The caretakers of the participating children had to be present during the inspection of the mouth and in the short interview session. This was aimed at reassuring children about their safety. The P.I and the research team were fluent in both English and Luganda. Since these were the commonest languages spoken and understood by the participants the research team was able to communicate to the study participants efficiently without language barriers. All clients under the care of Mildmay Uganda are informed that the information obtained from them during care may at some point be used for purposes of planning for and delivery of better services and their consent to participate in these activities by signing the relevant forms will always be required of them.

### **5.10 Data Management and Analysis**

The data was checked daily for consistency and completeness before it was coded and entered into the computer using Microsoft excel computer programme. Then from the excel programme the entered data was exported to the Stata – statistical programme for analysis. The population distribution and characteristics were described in form of frequencies and percentages and are presented in text, tables and figures.

At univariate analysis the dependent variables were analyzed, the frequencies and proportions of children with and those without oral lesions were computed and findings are presented in figures and text. The proportion of children with each specific HIV oral lesion were computed and are presented in tables.

The percentages of children with dental caries were computed and are presented in figures. The sum of decayed, missing and filled teeth was computed for each participant,

and the mean def<sup>t</sup>/DMFT for both primary and secondary dentitions was obtained by dividing the sum of all d+m+f/total number of teeth examined in the dentition.

The frequency of the scores (for D+M+F and d+e+f) and the means for both dentitions are presented in tables and text.

The percentage of children with their respective oral hygiene status was computed and is presented in figures.

The proportions of children reporting interference of oral functions due to the presence of oral lesions were computed and are reported in text, tables and figures.

For the independent variable the levels of immune suppression were analyzed and proportions of children with the different levels are presented in text and figures.

At bi- variate analysis cross tabulations were made between the presence of oral lesions against CD4<sup>+</sup> cell count with some other selected independent factors and the chi- square test was used to determine how presence of oral lesions relates to the various independent factors. The findings are presented in graphs and text.

At multi-variate analysis a logistic regression for presence of oral lesion and some selected independent factors was run to establish their relationship when all factors are in operation. The findings are presented in tables.

### **5.11 Quality Control**

Data was checked for consistency and completeness at the end of each day. The research team was trained in their roles before the study. A maximum of 11 participants was recruited per day so as to avoid mistakes by the P.I due to fatigue. A qualified oral pathologist trained the principle investigator in the identification and diagnosis of oral

pathology. The data collection tools were standard tools previously used in other studies.

### **5.12. Ethical Considerations**

Written informed consent to participate in the study was obtained by the P.I from the parents or guardians on behalf of their minors and the participants were requested for their assent. All information collected was kept under lock and key, and access was denied to non-members of the research team. As standard procedure permission was sought and obtained from the Mildmay research committee and the Makerere University School of Public Health Higher Degree Research and Ethics review committee before conducting the study. The appropriate dental care was given to all participants found with that treatment need and appropriate referrals to the relevant health units were made for those who needed further management .

### **5.13 Study Limitations**

The limitation of this study is that the population studied was clinic based and recruited at only one health facility so the findings can not be generalized to other HIV care centres nor to non-attendees of Mildmay Uganda. This is because services offered and population social demographics may differ from one institution to another.

Secondly the study relied on clinical diagnosis of the oral lesions and responses of the participants about the effect of oral lesions on oral functions. The participants being minors, some could not express their experiences very well. The P.I then had to rely on non-personal experiences as given by the guardian which could have influenced the findings.

The use of secondary data for CD4+ values that were obtained by reviewing the patients' charts could have influenced the study findings.

The health effects of impaired oral functions like malnutrition, poor adherence to ARVs, pain, were not measured.

### **Dissemination of Results**

The results of this study will be disseminated as a dissertation in part fulfillment for the award of a Masters degree in Public Health to the school of postgraduate studies and School of Public Health of Makerere University. The findings will also be disseminated to Mildmay Uganda in form of research report and to the rest of the public as a publication or conference paper presentation.

## CHAPTER SIX RESULTS

A total of 368 HIV-positive children between the ages of 0 to 17 years participated in the study. The female participants were 52.7% (194/368) the mean age was 8.8 years (SD 4.180). The age group 6-10 years constituted the largest proportion 39% (142/368) of the study population. The rural residents were 51.9% orphaned children made 70.7% of the participants and school enrolment showed that 77.7% (286/368) of the participants were enrolled in school as shown below in Table .1.

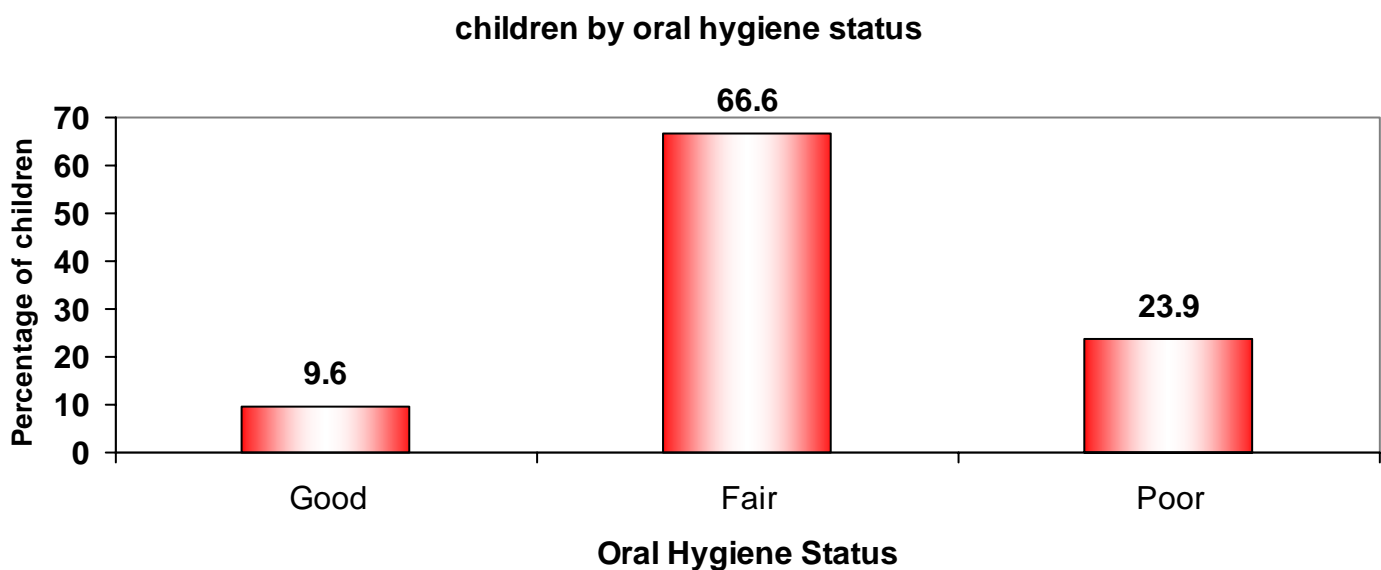
**Table 1 Background characteristics of study participants**

Variable	Frequency (n=368)	Percentage (100)
Age (years)		
0 - 5	97	26.4
6 - 10	142	38.6
11 - 15	102	27.7
16+	27	7.3
Gender		
Male	174	47.3
Female	194	52.7
Residence*		
Rural	191	51.9
Urban	177	48.1
Orphan		
Yes	260	70.7
No	108	29.3
In School		
Yes	286	77.7
No	82	22.3

- \*Rural = >60km from the study area center

In this study, the oral hygiene status of 335 children was assessed and was categorized into good, fair and poor status (Figure .1). There were 9% (33/368) of the children below one year that were purposively exempted from this assessment due to the fact that most of them had less than four teeth that could have been used as the indicator teeth.

**Figure 1 Proportion of children by different oral hygiene status**



Medical records of 368 children were reviewed in order to ascertain who was, and who was not on anti-retro-viral therapy (ART). The findings showed that 67% (248/368) were on ART and 33% (120/368) were not.

The children on anti-retroviral therapy had different drug combinations for a period ranging from less than a year to nine years as shown in Table 2 below.

**Table 2 Children by drug combination and duration on ART**

Drug Combination (n=248)	Frequency	Percentage (%)
Combivir and Efavirenz	47	19.0
Zidovudine, Lamivudine and Neverapine	39	15.7
Zidovudine, Lamivudine and Efavirenz	35	14.1
Stavudine, Lamivudine, Efavirenz	34	13.7
Combivir and Neverapine	32	12.9
Stavudine, Lamivudine and Neverapine	26	10.5
Triomune-30	08	3.2
Drug holiday*	27	10.9

Duration on ART in years (n=221)	Frequency	Percentage (%)
• ≤1	43	17.3
• 2	43	17.3
• 3	38	15.3
• 4	38	15.3
• 5	24	9.7
• 6	28	11.4
• 7	21	8.5
• 8	10	4.0
• 9	3	1.2

\*Drug holiday = Has a brief interruption in ART awaiting change of drug combination

### Prevalence of oral lesions

A total of 368 children under went an examination of their oral cavity for presence or absence of HIV associated oral lesions. Among the children examined 77.4% (285/368) had some form of HIV associated oral lesion as defined by the WHO clinical diagnostic criteria while 23% (83/368) had no lesions detected.

In this study it was a common occurrence for one participant to present with more than one type of oral lesion. The prevalence of each specific lesion was determined and the findings are presented below in Table 3.

**Table 3 Prevalence of oral lesions commonly associated with HIV**

<b>Oral lesion</b>	<b>Frequency (n=368)</b>	<b>Percentage</b>
<b>Oral candidiasis</b>		
• Pseudo membranous	186	50.5
<b>Cervical lymphadenopathy</b>	105	28.5
<b>Parotid enlargement</b>	92	25.0
<b>Molluscum contagiosum</b>	49	13.3
<b>Angular chelitis</b>	38	10.3
<b>Hairy leukoplakia</b>	16	4.3
<b>Recurrent aphthous</b>	15	4.1
<b>Necrotizing gingivitis</b>	15	4.1
<b>Oral Kaposi's sarcoma</b>	12	3.3
<b>Chapped lips</b>	7	1.9
<b>Warts</b>	6	1.6
<b>Herpes lesions/scaring</b>	2	0.5
<b>Submandibular enlargement</b>	2	0.5
<b>Necrotizing periodontitis</b>	1	0.3
<b>Other lesions*</b>		
<b>Geographic tongue</b>	1	0.3
<b>Median Rhomboid glossitis</b>	1	0.3
<b>No oral lesion</b>	83	22.6

\*Detected lesions that are not closely associated with HIV /AIDS.

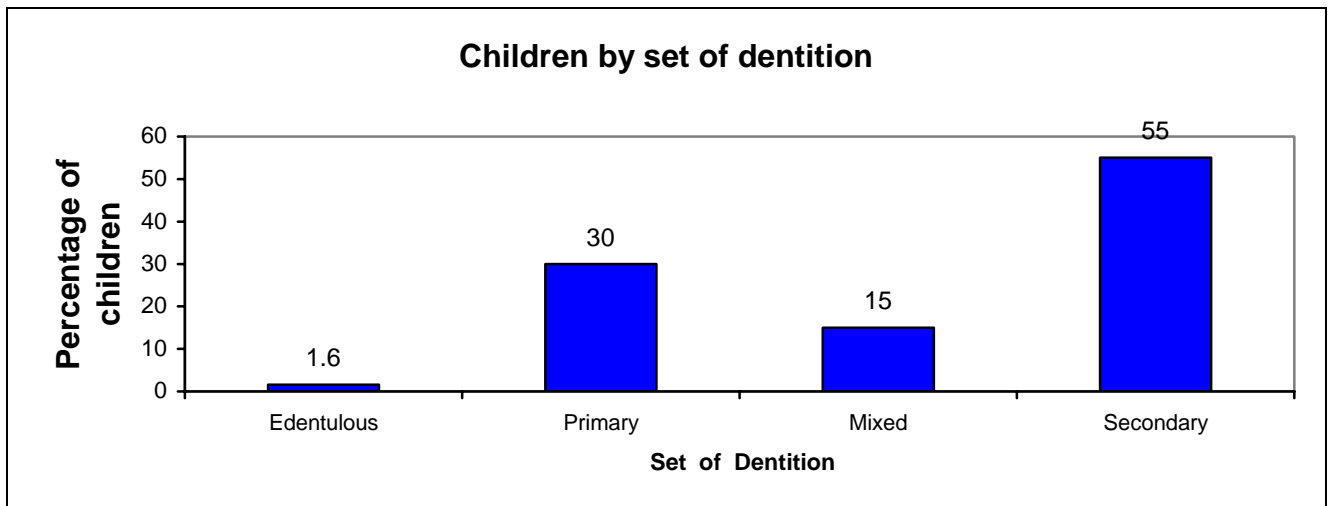


### Prevalence of dental caries.

A total of 362 HIV-positive children had their teeth examined for prevalence of dental caries. Six (1.6%) children were found completely edentulous (no teeth at all) and they were all below 6 months old.

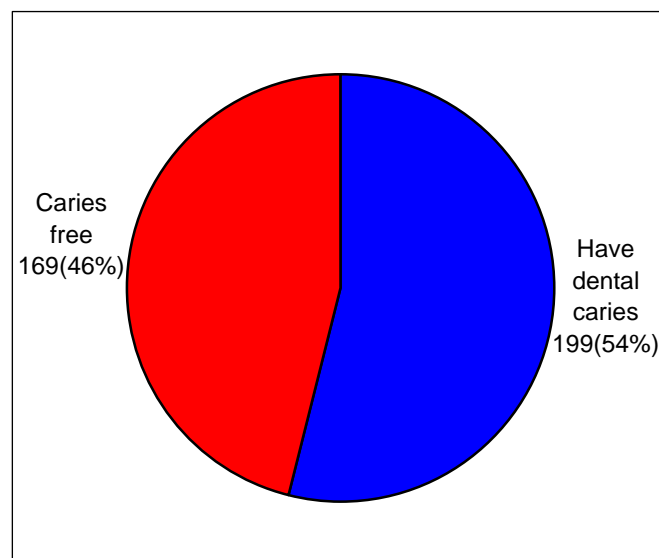
The children were found to have different sets of dentition as shown below in figure 2.

**Figure 2 Children by set of dentition**



Among all the children examined more than 50% had dental caries as shown in figure 3 below. Rampant dental caries was found in 26% (95/368) of the children, especially those with only primary dentition.

**Figure 3 Children with dental caries experience (n=368)**



The index for caries prevalence DMFT (for secondary teeth) and deft (for primary teeth) were used to assess if the caries prevalence among the children is high or low.

The different index scores attained are shown below in Table 4

**Table 4 Children with specific DMF and def scores (>1.1=high prevalenceWHO)**

Total DMF/def scored.	*Mean def =11.8		*Mean DMF =2.7	
	Frequency	%	Frequency	%
0	15	6.9	62	34.1
1	11	5.0	17	9.3
2	17	7.9	29	15.7
3	11	5.0	13	7.1
4	26	12.0	25	13.7
5	9	4.3	11	6.0
6	16	7.4	7	3.9
7	6	2.8	7	3.9
8	6	2.8	2	1.1
9	2	0.9	0	0.0
10	2	0.9	3	1.7
12	1	0.5	1	0.6
13	0	0.0	1	0.6
14	0	0.0	1	0.6
15	0	0.0	1	0.6
18	0	0.0	2	1.1
19	0	0.0	0	0.0
20	44	20.4	0	0.0
24	50	23.2	0	0.0
Total	216 (2543)	100.0	182 (496)	100.0

### **Oral functions impairment by presence of oral manifestations.**

In this study a short interview was conducted with the children in the presence of their guardians to establish if presence of HIV-oral manifestations interfered with their oral functions of chewing food, swallowing drugs and brushing teeth.

There were 62% (227/368) of the children that reported some form of discomfort as a result of oral lesions.

The presence of HIV-associated oral lesions often impairs more than one oral function. Among the children reporting interference with oral functions 8% (18/227) reported some form of discomfort for all the three oral functions, 25% (57/227) children reported discomfort for only two of the oral functions while 67% (152/227) children reported discomfort for only one of the oral functions.

The most commonly reported forms of discomfort was pain, reported among 55% (125/227) of the children, followed by burning sensation reported by 35% (78/227)

For each of the above three oral functions, the children with oral lesions were compared with children without oral lesions to assess how the reporting of discomfort differs in the two groups. The findings are shown in Table 5 below

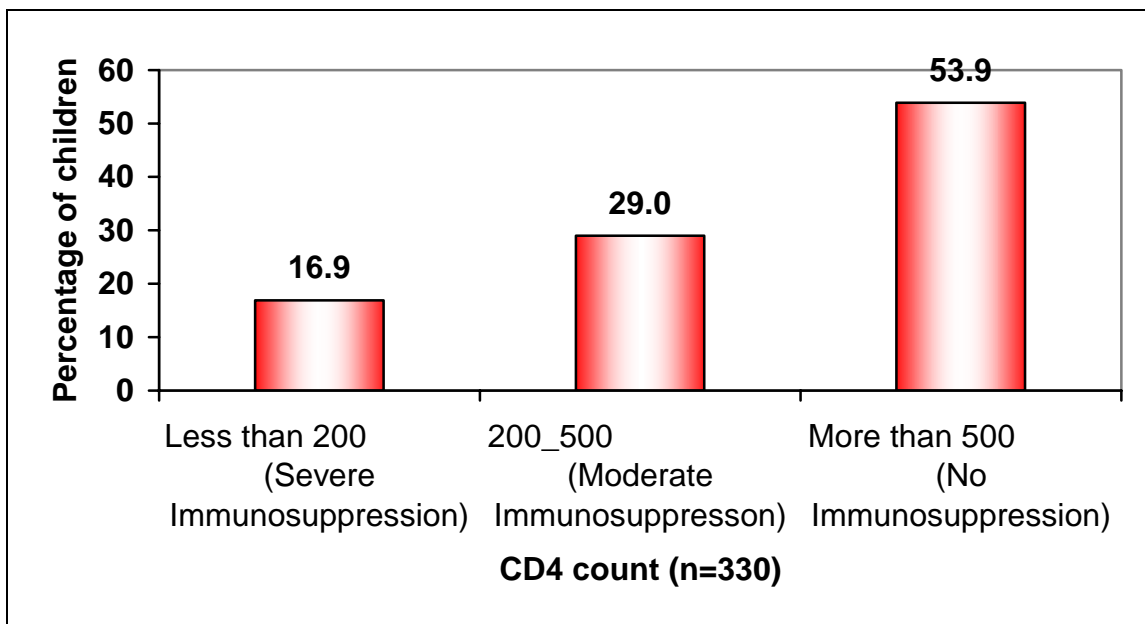
**Table 5: Children reporting oral function impaired due to presence of oral lesions.**

Oral function				
Factor	Tooth brushing			
Has oral lesions	YES	%	NO	%
Yes(285)	99	34.7	186	65.3
No(83)	0	0.0	83	100
Swallowing drugs				
Yes(285)	162	56.8	123	43.2
No(83)	0	0.00	83	100
Chewing food				
Yes(285)	28	20.3	227	79.7
No(83)	1	1.2	82	98.8

### Level of CD4+ cells related to presence of oral lesions

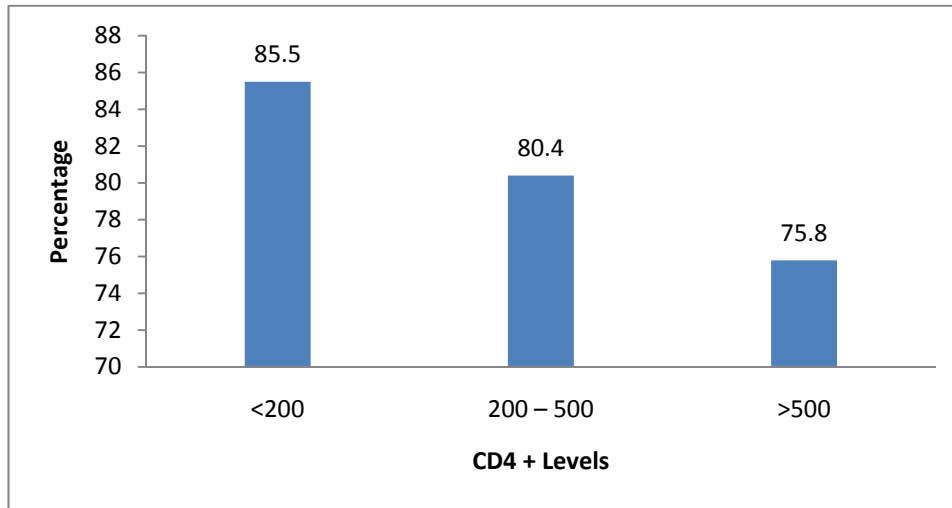
In this study, medical records of 368 children were reviewed and the absolute CD4+ cell counts were noted. The findings were as shown in figure 4 below. There were 10% 38/368 CD4+ cell values recorded more than one year ago these were not usable for analysis because the oral lesions detected are not likely to be correlated to a CD4 value taken one year ago since the cell count changes with factors like starting ARVs .

**Figure 4 Children by level of CD4+ cell count.**



The levels of immune suppression were tabulated against presence of oral lesion and the proportion of children in each group was determined. (Figure 5)

**Figure 5 Proportion of children with oral lesions by their CD4+ levels (n=330)**



At bivariate analysis, the association of each of the independent factors with the dependent factor of presence oral lesion as the outcome was tested using the chi-square statistical test as shown below in Table 6.

**Table 6 Selected factors as they relate to presence of oral lesions.**

Factor		Yes	No	OR	C.I	p- value
CD4+ cells	Less than 200 (n=55)	47	8	1.9	0.8- 4.3	0.3
	200-500(n=97)	78	19	1.3	0.7-2.4	
	More than 500(n=178) (Ref)	135	43	1	NA	
Age group	0 - 5(Ref)	66	31	1	NA	0.08
	• 6 - 10	115	27	2.0	1.1-3.6	
	• 11 - 15	81	21	1.8	0.9-3.4	
	• 16+	23	4	2.7	0.9-8.5	
Taking ARVs	○ Yes (Ref)	184	64	1	NA	0.02*
	○ No	101	19	1.8	1.0-3.4	
Sex	Male	134	40	1	0.6-1.6	0.9
	Female (Ref)	151	43	1	NA	
Oral hygiene	Good (Ref)	18	14	1	NA	0.004*
	Fair	185	38	3.8	1.5 - 9.2	
	Poor	64	16	2.8	1.0 - 7.7	

\*p< 0.05 = statistically significant

At multi variate analysis all independent factors where combined into a logistic regression with the factor of presence of oral lesion as the outcome. The association between having poor oral hygiene and presence of oral lesions was found to be statistically significantly. The findings are presented in Table 7 below.

Table 7 Logistic regression analysis of all factors together with Oral lesions

Factor	Levels	COR	CI	AOR	CI	P-Value
CD4 levels	Less than 200(55)	1.9	0.821- 4.268	2.1	0.78-6.0	0.3
	200 – 500(97) (Ref)	1.3	0.712-2.400	1.0	0.5-1.9	
	More than 500(178)	1	NA	1	NA	
Age group	0 - 5(Ref)	1	NA	1	NA	0.7
	6 - 10	2.0	1.100-3.638	1.4	0.6-2.9	
	11 - 15	1.8	0.953-3.443	1.5	0.7-3.5	
	16+	2.7	0.860-8.481	1.3	0.4-4.5	
Taking ARVs	Yes (Ref)	1	NA	1	NA	0.2
	No	1.8	1.023-3.452	1.5	0.7-2.9	
Sex	Male	1	0.568-1.605	1.2	0.6 -2.2	0.6
	Female (Ref)	1	NA	1	NA	
Oral hygiene	Good (Ref)	1	NA	1	NA	0.01*
	Fair	3.8	1.547-9.293	3.8	1.5-9.3	
	Poor	2.8	1.006-7.670	2.8	1.0-7.7	

\*p< 0.05 = statistically significant



## **CHAPTER 7 DISCUSSION**

### **Prevalence of HIV associated oral lesions**

**A total of 368 children were examined and 77.4% (285/368) were found with some form of HIV associated oral lesion. The 77.4% prevalence found in this study lies within the range reported by other studies Patton et al., 2000, Diz et al., 2000 and Arendolf et al.,1998 which reported that prevalence of oral lesions among any group of HIV infected children ranges between 30 - 80% of the study population. Santos et al., 2001, Ramos-Gomez et al., 2000 and Leggot 1992 have also reported that oral- lesions are common among HIV-positive children. Magalhaes et al., 2001 and Anak et at., 2003 reported a 52.6% and 57.5% prevalence of oral lesions among children in Brazil and Thailand respectively.**

**The relatively high prevalence of oral lesions found among the population in the current study may be attributed to the fact that only 1.2% of the participants have been on treatment for nine years and 17.3% of the participants have been on ARVs for less or equal to one year. It has been found that taking ARVs reduces the chances of developing oral lesions. So a large percentage of the participants having been on treatment for a short period may explain the high prevalence of oral lesions. Other possible explanations for this high prevalence may be the fact that only 9.6% of the children had good oral hygiene the rest had a fair or poor oral hygiene factors that have been pointed out to contribute to the development of oral lesions.**

**The percentage of children with severe to moderate immune suppression was high (45%) this may also explain the high prevalence of oral lesions since the more suppressed the immunity is, the more likely for the lesions to develop.**

Oral candidiasis was found to be the most prevalent oral lesion. It occurred in 50.2% (186/368) of the children. Naidoo et Chikte 2004, Hamzar et al.,2006 and Khongkunthian et al.,2001 also found oral candidiasis as the most prevalent oral lesion in their study populations. The pseudo-membranous form of oral candidiasis was the most

prevalent and it occurred among 35% (128/368) of the children. Valdez et al., 1994 and Santos et al., 1997 reported a similar finding. High prevalence of Oral candidiasis has been associated with poor oral hygiene. Murray et al 1992 indicated that the plaque found on un-cleaned teeth contained the fungi responsible for candidiasis. The big percentage of the children (45%) with fair or poor state of oral hygiene may have contributed to the high prevalence of oral candidiasis in this group.

At least 29% (105/368) of the children were found with some form of salivary gland disease. Parotid gland enlargement which is now recognized as a distinctive feature of HIV infection (Ramos-Gomez et al., 1999) was found prevalent in 4% of the children. Patton et al., 2000 reported an high prevalence salivary gland diseases African HIV positive pediatric cases and an increase in the presentation of the condition in the HAART era which may be related to a reconstitution syndrome. The fact that 18% of the children in this study have been on ARVs for not more than one year may explain the high prevalence of the salivary gland disease as a result of immune reconstitution among these children that have recently started treatment.

Kaposi's sarcoma (K.S) was found in 3.3% of the children in this study. K.S is not very commonly associated with HIV in children ((Ramos-Gomez et al., 1999) and the prevalence has further decreased in the era of using anti-retro viral drugs. (Miziara et Weber.,2006). In this group of children, for an average period of 6 years they have

accessed and utilized ARVs and this may have contributed to lowering the prevalence of the condition.

Oral hairy leukoplakia was found among 4.3% (16/368) of the study participants. Greenspan et al., 1994 reported that oral hairy leukoplakia which is a pre-cancerous lesion is rarely manifested in children with HIV. The high prevalence in this study group may be attributed to the children that had very low CD4+ cell counts which could potentially expose them to the danger of developing cancerous lesions.

Although Chapped lips and warts are not so closely associated with pediatric-HIV infection (Ramos-Gomez et al., 1999) they were found prevalent among 1.9% and 1.6% of the children respectively. Reznik et al., and Greenspan et al., 2001 reported that the prevalence of the two conditions is associated with prolonged use of antiretroviral therapy. In this study group because the period for which ARVs are being utilized is increasing the prevalence for these otherwise rare conditions may also increase.

### **Prevalence of caries**

Among the children examined 54% (199/368) had experienced tooth decay. Naidoo and Chikte 2004 concluded that HIV infected children are a high risk group for dental caries while Gelbier et al., 2000 reported that three quarters of any study population is likely to have some form of caries experience. The state of oral hygiene among this study population was a potential threat to oral health, with less than 10% exhibiting good oral

hygiene thus poor oral hygiene may have contributed to the high caries experience in this study.

The index for caries prevalence indicated high caries prevalence in both dentitions with an average deft of 11.8 an average DMFT of 2.7. The World Health Organization has given an average score of 1.1 as the cut off for low caries prevalence. This implies that in both dentitions there was high caries prevalence. The finding of this study concurs with findings of previous studies Gelbier et al., 2000, Naidoo et Chikte.,2004 and Anak et al.,2003 which reported high caries prevalence among children infected with HIV, and the index average score compare relatively well with findings by Anak et al 2003 that found an average deft of 10.9 and an average DMFT of 2.1 among children in northern Thailand. The high prevalence of dental caries (mean 'deft'=11.0) in the primary dentition could be explained by the fact that most of the children with primary teeth and are below five years have a condition called Rampant dental caries.

Rampant caries is the term used to describe a condition of extensive tooth decay and is highly associated with pediatric HIV infection. In this study rampant dental caries was found in 26% (95/368) of the children, especially those with only primary dentition..

Medicines in Syrup form and low immunity are currently considered to be the culprit in causing rampant decay .(Naidoo and Chikte, 2004; Tappuni and Flemming, 2001)

Other factors that may explain the high caries prevalence in this group could be poor oral hygiene because only 9.6% of the children had good oral hygiene which is a pre-requisite for preventing dental caries while over 60% had a fair to poor oral hygiene.

### **Oral manifestations impairing oral functions**

In the current study 62% (227/368) of the children reported impairment of oral functions due to the presence of oral lesions. Coogan et al. 2005 reported interference of oral functions resulting from the presence of oral manifestations and this was found to have a significant impact on health and to lower oral health-related quality of life. The study also concluded that the presence of oral lesions heavily impacts on the general well-being of the children leading to a low quality of life and sometimes they may be the underlying cause of death in children with HIV/AIDS. The 62% of the children that reported impairment of oral functions compares fairly well with 68.4% that was reported by Tiromwe et al., 2007.

The presence of oral manifestations can affect more than one oral function in the same person. Among the respondents in this study 8% (18/227) reported some form of discomfort in all the three oral functions of chewing food, swallowing drugs and brushing teeth. While 67% (152/227) reported some form of discomfort with only one of the functions.

Pain reported in 55% and burning sensations in 34% of the respondents were the most frequently reported symptoms associated with oral lesions. In the scope of current study it was not possible to relate the symptoms reported to the other study findings. Preferably a more detailed study on the topic of the effect of oral manifestations on the oral functions and quality of life would detail the relationship

### **CD4+ cell count related to presence of oral lesions.**

The CD4+ cell level was used as an indicator of the degree of immune suppression that was considered as a measure of the quality of life and this was categorized into severe (< 200 cells/ml,) moderate (200-500 cells/ml) and no-immune suppression (> 500cells/ml) among the study participants 54% were found to have no immune suppression.

In this study the level of CD4+cell counts were compared to the presence of oral lesions and it was found that the lower the cell count the more likely for the oral lesions to be present (OR =1.9). This finding is in agreement with other studies (Santos et al.,2001; Tappuni and Flemming, 2001 and Chan et al., 1994) which reported that the occurrence of oral lesions is closely linked to low CD4+ cell levels or severe immune suppression. The 54% of children found not to be immune -suppressed may be attributed to the fact that 60% of the study participants are currently on anti retroviral therapy which boosts the immune system and protects against opportunistic diseases like oral lesions.

The relationship between presence of oral lesion and level of CD4+ cell count in this study was not statistically significant ( $p = 0.3$ ). This differs from findings by Hamzar et al., 2006 that reported a significant association between the presence of oral lesions and CD4+ cells count of less than 200 cells/mls. The difference may be due to the fact that absolute CD4+ cell count in children are not very accurate measures of immune suppression as compared to adults.

Oral hygiene was found to have a significant influence on the development of oral lesions. This is in agreement with Acquirre et al., 1999, Patton et al., 2000 and Chan et al., 1994 that reported poor oral hygiene as a factor in the occurrence of oral lesions.

In this group of children less than 10% had good oral hygiene. The poor status of the oral hygiene in a big percentage of these children may have had a significant influence in their having oral lesions.

### **Conclusions.**

HIV associated oral lesions are highly prevalent among children 0-17 years old, receiving care at Mildmay Uganda. More than two thirds of the children had some form of HIV- associated oral lesion

Dental caries is highly prevalent among HIV-positive children receiving care from Mildmay Uganda. The children with primary dentition are most affected. The rampant form of dental caries occurs in more than one quarter .

The oral hygiene among this group of children is generally not good

Presence of HIV associated oral lesions interferes with brushing-teeth, chewing food and swallowing drugs among children receiving care from Mildmay Uganda.

The lower the CD4+cell-count the more likely the occurrence of oral lesions among HIV-positive children getting care at Mildmay Uganda

### **Recommendations.**

- 1) Training in early diagnosis and management of HIV-oral manifestations.



The directorate of Education and Training of the Mildmay Uganda should arrange seminars or workshops where all cadres of health care providers can be trained by the relevant dental professionals in the identification of oral manifestations of HIV infection.

The managers of the clinical department should ensure that all clinicians have access to diagnostic and treatment guidelines for oral conditions in HIV patients. This will help them to diagnose and manage or refer to the dentist those clients presenting these conditions for quick and complete oral health care so as to prevent the lesions from interfering with adherence to drugs, nutrition status and general well being of the children. If the conditions are properly managed the patient's quality of life will be improved, and early deaths associated with these conditions averted.

## 2) Oral Health Education and regular dental check- ups

Given that this study group has high caries prevalence the dental team at Mildmay-Uganda should emphasize preventive strategies in the service delivery.

During the oral health education talks importance of good oral hygiene to both the children and their care-takers should be stressed.

A dental care-system aiming at encouraging children to come for regular dental check ups for early detection of dental caries should be put in place. This way interventions will be made before oral functions are affected.

## 3) Routine CD4+ cell count

The director clinical services at Mildmay Uganda should ensure that all clients get a CD4+ cell count done at a regular period of at least six months. This record will be a

good guide on disease progress and an indicator of when the oral manifestations are likely to develop.

### **References**

Acquirre JM, Echebarria MA, Ocina E, Ribacoba L, Montejo M, 1999 Reduction of HIV-associated oral lesions after highly active antiretroviral therapy. Oral Surgery/Oral Medicine/ Oral Pathology/Oral Radiology/Endodontics, Aug 88(2): 114-5.

Anak I, Surawut P, Suparat K, Komkhan P, Sutthichai K., 2003 . Oral lesions in mother to child HIV Infected children Int. Journal of Pediatric dentistry May 13(3):180-5 .

Arendorf T.M, Bredekamp B, Cloete C.A, Sauer G, 1998, Oral Manifestations of HIV infection in 600 South African patients. Journal of Oral Path/Oral Med. April; 27(4): 176-9.

Chan A, Milnes A, King SM, Read S, 1994 The relationship of oral manifestations to parameters of immune function and CDC stage in children born to HIV positive women, pediatric AIDS and HIV infection: fetus to adolescent. Vol.5, 101-7

Chen JW, Flaitz CM, Wullbrandt B, Sexton J 2003 Association of dental health parameters with oral lesion prevalence in human immunodeficiency virus-infected Romanian children. Pediatric Dental Journal Sep-Oct; 25(5): 479-84.

Coogan MM, Greenspan J, Challacombe SJ, 2005 Oral lesions in infection with human immunodeficiency virus, Bulletin of WHO 83:700-706

Diz P, Ocampo A, Miralles C, 2000 Changing prevalence of human immunodeficiency virus-associated oral lesions. Journal of Oral Surg/Oral Med/Oral Pathol/Oral Radiol/Endod October 403-4.

Fine DH, Tofsky N, Nelson E, Schoen D, Barasch A 2003 Clinical implications of the oral manifestations of HIV in children. Dental clinics of North America Vol. 47 No 1 pgs 159-74.

Gelbier M, Luas VS, Zervou N Roberts GJ, Novelli V 2000, A preliminary investigation of dental disease in children with HIV infection, Int. Journal Pediatric Dentistry March 10; 1: 13-8

Greenspan D, Canchola AJ, MacPhail LA, Cheikh B, Greenspan JS 2001 Effect of highly active antiretroviral therapy on frequency of oral warts. Lancet May 5; 357(9266): 1411-2.

Greenspan D, Greenspan JS. 1994 Oral manifestations of HIV infection and AIDS, A text book of AIDS medicine pgs 525-39

Hamzar OJM, Mecky IN, Elison NM, Emil KM, 2006 Oral lesions of HIV infection in children and adults on highly active anti-retroviral therapy. BMC Oral Health 6:12

Howell RB, Jandinsk JJ, Palumbo P, Shey Z, Houpt MI 1996 Oral soft tissue manifestations and CD4 lymphocyte counts in HIV infected children. Journal of Pediatric Dentistry 18:117-120.

Kawuma E, Nabbagala J, 2006 Mildmay dental needs assessment, department of research- as aresearch report.

- Katz MH, Matrucci MT, Leggot PJ, Westenhouse J, Greenspan JS, Scott GB 1993  
Prognostic significance of oral lesions in children with perinatally acquired human immunodeficiency virus infection. American Journal of children dentistry 147:45-48,
- Khongkuntian P, Grote M, Isaratanan W, Piyaworawong S, Reichart PA, 2001  
Oral manifestations in 45 HIV-positive children from Northern Thailand. Journal of Oral pathology/ Medicine. Oct 30 (90): 549-52.
- Leggot P.J, 1992 Oral manifestations of HIV infection in children. Journal of Oral Surgery Oral Medicine and Oral Pathology 73:187-193.
- Magalhaes MG, Bueno DF, Serra E, Goncalves R 2001, Oral manifestations of HIV positive children. Journal of Clinical Pediatric Dentistry 25(2) pgs 103-6.
- MildMay-Uganda.,2007 MU Active clients (00-18yrs) age group on art/not on art  
Department of Monitoring and Evaluation report.
- Ministry of Health 2007, National oral health policy Jan; pg 6-7
- Miziara ID, Weber R, 2006 Oral candidosis and oral hairy leukoplakia as predictors of HAART failure in Brazilian HIV-infected patients, Oral Diseases July 12 pg 402-7.

Miziara ID, Filho BC, Weber R., 2006 Oral lesions in Brazilian HIV-infected children undergoing HAART Int. J. Pediatric Otorhinolaryngol. Jun; 70 (6): 1089-96.

Murray PA, Jandinsky JJ, Heir J, Singh J, San Martin T 1992 Microbiota of HIV associated periodontal diseases. J Dent Res 71(special issue): 51(abstract 367).

Naidoo S, and Chikte U, 2004 Oro-facial manifestations in pediatric HIV: A comparative study of institutionalized and hospital outpatients. Journal of Oral diseases Jan;10(1)13

Nalweyiso N, Busingye J, Whitworth J, Robinson PG, 2004. Dental treatment needs of children in a rural sub-county of Uganda. Int. journal of pediatric Dent. 14: 27-33.

Patton LL, McKaig R, Straauss R, Rogers D, Enron JJ Jr. 2000 Changing prevalence of oral manifestations of human immunodeficiency virus in the era of protease inhibitor therapy. Oral Surg/Oral Med/Oral Pathol/Oral Radiol/Endod 90: 299-304.

Ramos-Gomez FJ, Hilton JF, Canchola AJ, Greenspan D, Greenspan JS, Maldonado Y, 1996 Risk factors for HIV-related orofacial soft-tissue manifestations in children. Journal of clinical Pediatric Dentistry 18:143-146

Ramos-Gomez FJ, Catherin Flaitz, Peter Catapano, Patricia Murray, Alan R. M., Alejandro Dorenbaum, 1999 Collaborative workshop on oral manifestations of pediatric HIV infection. Journal of clinical Pediatric. Dentistry 23(2):85-96

Ramos-Gomez FJ, Petru A, Hilton JF, Canchola AJ, Wara D, Greenspan JS, 2000, Oral manifestations and dental status in pediatric HIV infection. Int. Journal of pediatric dent. March 10(1): 3-11

Reznik DA, King MD, O'Daniels CM, Larsen NM, Osterholt DM, Blumberg HM. 2002 Human Papillomavirus-Associated Oral Warts among HIV-Seropositive Patients in the Era of Highly Active Antiretroviral Therapy: An Emerging Infection. Clin Infect Dis 34:641-8.

Santos L.C, Souza I.P, Castro G.F, Oliviera R.H, 2001 Oral manifestations related to immunosuppression degree in HIV positive children. Brazillian. Dental Journal 12(2): 135-8

Santos LC, Souza IP, Bundzman ER, Abreu TA 1997 Blood immunologic parameters related to oral candidiasis in HIV+ children. J Dent Res ;76(special issue):1001(abstract).

Tappuni AR, Flemming GJ, 2001 The effect of antiretroviral therapy on the prevalence of oral manifestations in HIV-infected patients: a UK study. Oral Surg/Oral Med/Oral Pathol/Oral Radiol/Endod. Dec; 92(6):623-8.

Tiromwe JF, Rwenyonyi CM, Muwazi LM, Besigye b, Mboli F, 2007 Oral manifestations of HIV/AIDS in clients attending TASO clinincs in Uganda. Journal of Clinical Oral Investigations 11:289-292

Uganda AIDS Commission, 2006 The HIV/AIDS epidemic; Prevalence and Impact 2006-report.

Valdez IH, Pizzoz PA, and Atkinso 1994 Oral health of pediatric AIDS, patients: A hospital based study. J Dent Child 61:114-118.

WHO 2004 UNAIDS/WHO AIDS epidemic update December report.

WHO Collaborating Center on oral manifestations of the Human Immunodeficiency Virus and EEC Clearinghouse on oral problems related to HIV infection 1993. Classification and diagnostic criteria for oral lesions in HIV infection. Journal of Oral Patho/ Med 22: 289-291.



**Appendix 1      Research participant information and consent form.**

Title of the study; Oral manifestations and their relationship to immune suppression in HIV positive children at Mildmay Uganda.

**Student Research by**

Dr. Juliet Nabbanja,

Makerere University School of Public Health

P.O.Box 7062,

Kampala.

Phone: 0712 495710

Email address 1:      [Juliet.nabbanja@mildmay.or.ug](mailto:Juliet.nabbanja@mildmay.or.ug)

2      [docnabbs@yahoo.com](mailto:docnabbs@yahoo.com)

**DESCRIPTION OF RESEARCH TO THE PARTICIPANTS AND THEIR CARE-TAKERS .**

You are hereby invited to participate in a research study about oral manifestations and their relationship to immune suppression in HIV positive children at Mildmay - Uganda. The purpose of the research is to determine the magnitude of HIV associated oral lesions and tooth decay among HIV positive children receiving medical care at Mildmay-Uganda. The study will include children below 18 years of age attending the Mildmay-Uganda pediatric and dental clinics. The research will take place at Mildmay Uganda during patients' visits.

**WHAT WILL YOUR PARTICIPATION INVOLVE?**

As the guardian/care taker of the child-participant, you will be requested to give consent on behalf of your minor to participate in the study. Your child's mouth will be examined by a qualified dentist for presence of oral lesions associated with HIV and AIDS as well as for presence of tooth decay. As the child-participating in the study, you will be asked to allow the dentist to examine your mouth and you will also be asked few questions about how you feel when swallowing drugs brushing teeth and chewing food when you have lesions in your mouth.

**ARE THERE ANY RISKS TO YOU AS A PARTICIPANT?**

We don't anticipate any risks to you as a result of your participation in this study.

**ARE THERE ANY BENEFITS TO YOU FOR PARTICIPATING?**

No material benefits will be offered for being part of the study. However you will get treatment for any condition detected. For those who need further care than we give here the referral will be given to you. At the same time no care will be denied to anyone who declines to participate or decides to get out of the study.

**HOW WILL YOUR CONFIDENTIALITY BE PROTECTED?**

Your name will not be used. Instead codes will be designed to conceal your identity. Only group characteristics will be published. All information will be locked up and will only be used by the research team for purposes of this study.

**WHOM SHOULD YOU CONTACT IF YOU HAVE QUESTIONS?**

You may ask any questions about the research at any time. If you have questions about the research after you leave today you should contact Dr. Nabbanja Juliet, the principal researcher on Tel no. 0712 495710. If you have any questions about your rights as a research subject, please contact The Mildmay-Uganda Research Officer on Telephone no. 0312 210200

Your participation is completely voluntary. If you decide not to participate or to withdraw from the study it will have no effect on any services or treatment you are currently receiving.

Your signature on this form indicates that you have read this consent form, had an opportunity to ask any questions about your participation in this research and voluntarily consented to participate. A copy of this form will be filed for your record.

Name of study participant \_\_\_\_\_ Signature.....  
Name of Care taker \_\_\_\_\_ Signature.....  
Relationship to participant \_\_\_\_\_ Telephone No.....  
Principal Investigator \_\_\_\_\_ Signature.....  
Witness..... signature.....  
Date.....

**Appendix 2 W.H.O. recording form for oral lesions associated with HIV-infection.**

**Study Title:** Oral manifestations and their relationship to immune-suppression in HIV positive children at Mildmay Uganda.

**Part one**

**Participant identification and drug history.**

Circle what is applicable to the study participant.

Participant's Identification code (Initials & Study No.)..... (1)

e.g. JN 1

2. Date of birth (MM/YY)..... (2)

3. Gender      Male = 1              Female = 2

4. Village of residence..... (3)

5. Is the child an Orphan              Yes = 1              No = 0..... (4)

6. Is the child in school              Yes = 1              No = 0..... (5)

7. CD4+ Cells/ml..... (6)

(Read from his/her medical file the absolute value taken not more than 12 months ago.)

8. Is the child taking Anti- Retroviral drugs?    Yes=1    No = 0. .... (.7)

9. What is the drug Combination being taken..... (8)

10. For how long have you taken Anti-retroviral therapy..... (9)

**Part two.**

**CLINICAL ORAL EXAMINATION FOR ORAL LESIONS**

Oral Lesions/Condition Present 1= Yes 2=No..... (10)

**Candidiasis**

Pseudo membranous 1= Yes 2= No..... (11)

Erythematous 1= Yes 2=No..... (12)

Angular chelitis 1= Yes 2=No..... (13)

Erythematous gingival banding / Erythema 1= Yes 2=No..... (14)

Necrotizing gingivitis 1= Yes 2=No..... (15)

Necrotizing periodontitis 1= Yes 2=No..... (16)

**Ulcerations**

Recurrent Herpes labialis 1= Yes 2=No..... (17)

Recurrent Aphthous 1= Yes 2= No..... (18)

Atypical oral ulcerations 1= Yes 2= No..... (19)

Hairy leukoplakia 1= Yes 2= No..... (20)

Oral Kaposi's sarcoma 1= Yes 2= No..... (21)

Non-Hodgkin's lymphoma 1= Yes 2= No..... (22)

Others.....

**Un-known lesion**

Color 1=Red 2=White

Topography 1= Raised 2= Flat

**Appendix 3 Dental record card**

**Study Title:** Oral manifestations and their relationship to immune-suppression in HIV positive children at Mildmay Uganda.

**Oral hygiene status and the prevalence of dental caries.**

**A) IN PRIMARY DENTITION**

Indicate the **Oral hygiene** status following the indicator teeth surfaces

Good (G) Fair (F) Poor (P)

**Dental caries**

Indicate the status of the tooth as follows

**d** = decayed

**e** = extracted (only those extracted due to tooth-decay)

**f** = Filled (filled due to decay)

d + e + f = .....

Total number of teeth examined.....

UPPER RIGHT JAW

UPPER LEFT JAW

55	54	53	52	51	<b>M I D L I N E</b>	61	62	63	64	65
85	84	83	82	81		<b>71</b>	72	73	74	75

LOWER RIGHT JAW

LOWER LEFT JAW

The numbers 51 to 85 depicted on the card above denote the standard nomenclature given to each tooth in the primary dentition starting from the upper right central incisor through to the lower right second molar.

**B) IN SECONDARY DENTITION**

Oral hygiene and the prevalence of dental caries

Indicate the **Oral hygiene** status following the indicator teeth surfaces

Good (G) Fair (F) Poor (P)

**Dental caries**

Indicate the status of the teeth h as follows

D = Decayed.

M = Missing (only those missing due to caries).

F = Filled (only those filled due to caries).

D + M + F=.....

T=Total number of teeth examined.....

UPPER RIGHT JAW

UPPER LEFT JAW

18	17	16	15	14	13	12	11	M I D L I N E	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

LOWER RIGHT JAW

LOWER LEFT JAW

The numbers 11 to 48 on the card above denote the standard nomenclature given to each tooth in the permanent dentition starting from the upper right central incisor through to the lower right third molar.

**Appendix 4 Participant's interview guide**

**Study Title:** Oral manifestations and their relationship to immune-suppression in HIV positive children at Mildmay Uganda.

Participant I.D no.....

CIRCLE THE RESPONSE GIVEN BY THE PARTICIPANT.

1) Have you ever had discomfort or pain in your mouth?

1 = yes 2 = No

2) When you had pain or discomfort what was the problem in your mouth?

a) Wounds / ulcers b) Swellings c) Bad tooth d) Bleeding e) others

3) Do you currently have any wounds or swellings causing you any problem in your mouth?

1=yes 2=No

4) Describe the current problem you are having

a) Pain, b) Bleeding c) Burning, d) Sensitivity in teeth e) Numbness f) other

5) If yes in 3 and 4 above, do you have problems doing any of these things?

1. chewing food Yes No

2. Swallowing medicines Yes No

3. Teeth-brushing. Yes No