

**TO EVALUATE THE SENSITIVITY OF W.H.O PRESUMPTIVE DIAGNOSTIC
CRITERIA IN DIAGNOSIS OF HIV INFECTION IN CHILDREN <18 MONTHS
ADMITTED TO UTH**

By

DR. MUTESU-KAPEMBWA KUNDA
BSc (HB) MB.ChB. (UNZA)

**A Dissertation submitted to the University of Zambia in a partial fulfillment of the
requirement for the degree of Master of Medicine in Paediatrics and Child Health.**

(School of Medicine)
THE UNIVERSITY OF ZAMBIA
2009

DECLARATION

I declare that this dissertation represents my own work and that it has not previously been submitted for a degree, diploma or other qualification at this or another University.

Signed.....

Date.....

Candidate

APPROVAL

This dissertation of **Kunda Mutesu-Kapembwa** is approved as fulfilling the requirements for the award of the Master of Medicine in Paediatrics and Child Health of the University of Zambia.

Signed

(Head of Department)

Date.....

Signed

(Supervisor)

Date.....

ABSTRACT

Title: To evaluate the sensitivity of WHO presumptive diagnostic criteria in diagnosis of HIV infection in children <18 months admitted to UTH.

Background: Making a diagnosis of HIV infection in children aged less than 18 months remains a challenge in low resource set ups like Zambia due to scarcity of DNA PCR testing equipment which is the gold standard. Clinicians in rural areas have to depend on HIV ELISA tests and clinical diagnosis to start HAART as they wait for the DBS for DNA PCR results sent from the urban centers.

Methods: This descriptive cross-sectional study was performed at the University Teaching Hospital, Lusaka, Zambia. 299 HIV exposed children aged less than 18 months were enrolled following a consent procedure. Information was gathered from caregivers by means of an interviewer administered questionnaire and the attending paediatrician's case notes. Two milliliters of blood was then drawn for CD4% and HIV-DNA PCR assessment. Data was analyzed using SAS, version 9.1.3.

Results: Of the 299 exposed patients analyzed 111(37%) were HIV infected by DNA PCR. The median CD4% in the infected children was 18%. WHO presumptive diagnostic criteria (PDC) used on its own proved unreliable especially in infants younger than 6 months (46% with a specificity of 84%, 62% PPV and 72% NPV). Multivariate analysis was used to identify the most sensitive predictors when combined with the WHO PDC. WHO PDC with CD4% improved the sensitivity to 81% (95% CI 0.74 to 0.88) and specificity to 77% (95% CI 0.71 to 0.83), PPV of 67% and NPV of 87%. Assessed but did not improve the sensitivity were weight < 3rd percentile (56%), lymphadenopathy (50%), hepatomegaly (47%), Splenomegaly (47%) and nappy rash (47%). When the WHO-PDC, weight<3rd percentile, hepatomegaly, Splenomegaly, lymphadenopathy and CD4% were combined, the sensitivity improved to 86%, specificity 63% , PPV 58% and NPV of 88%.

Conclusion: The WHO-PDC clinical algorithm which has a sensitivity of 46% can be improved to 81% when combined with a CD4% <25% in children less than 12 months and CD4 %< 20% in those >12 months and <18 months also with increase in age above 6 months. However, DNA PCR still remains the most reliable in detecting HIV infection especially in the 0-6months age group.

DEDICATION

This study is dedicated to my husband Kenneth, my daughters Mutale and Musawa, and to my son, Kenneth Chali Kapembwa Jr, for the support they gave me during the performance of this study.

ACKNOWLEDGEMENTS

Special thanks to Fogarty International Center and University of Alabama for funding this study. I sincerely thank Dr Chipepo Kankasa, Dr Benjamin Chi and Dr. Veronica Mulenga for diligently supervising my dissertation and for being there to offer guidance during the study process. To study nurses, Sandra Mwanza, Easter Sigwidi and Peggy Mwikisa, it was a pleasure working with you on this study as you were very much involved in the study execution through patient enrollment and ensuring the laboratory specimen got to the laboratory where David Rutagwera, John Chisoso and Charles Bwalya were of much help. My sincere gratitude goes to Mr. Yolán Banda for his assistance with data analysis and to Kenneth Kapembwa for the manuscript preparation. Finally, I thank the subjects who participated in this study as without their participation, this study would not have been possible.

TABLE OF CONTENTS

CHAPTER	PAGE
CHAPTER 1	1
1.0 Background	1
1.1 Statement of the problem	4
1.2 Study justification	4
1.3 Hypothesis	5
1.4 Study question	5
1.5.0 Objectives	5
1.5.1 Main objective	5
1.5.2 Specific objectives	5
CHAPTER 2	6
2.0 Literature review	6
2.1 Epidemiology of HIV	6
2.2 Transmission	6
2.3 Diagnosis of HIV in children <18 months	8
2.4 Presumptive diagnosis of HIV infection	8
2.5 Recent developments	11

CHAPTER 3	12
3.0 Methodology	12
3.1 Study design	12
3.2 Study site	12
3.3 Selection of subjects	13
3.3.1 Study population	13
3.3.2 Inclusion criteria	13
3.3.3 Exclusion criteria	14
3.4 Sampling and sample size calculation	14
3.5 Procedures	16
3.6 Data management and data analysis	16
3.6.1 Measurement of variables	16
3.6.2 Statistical methods	16
3.6.3 Data analysis	16
3.7 Ethics	17
CHAPTER 4	18
4.0 Laboratory	18
4.1 Introduction	18
4.2 Sample processing	18
4.2.1 CD4% estimation	18
4.2.2 HIV DNA PCR testing	19
4.3 Scoring of global results	20
4.4 Result documentation	20
4.5 Disposal of blood samples	20
CHAPTER 5	21
5.0 General description of results	21
5.1 Prevalence of HIV by DNA PCR	21
5.2 Baseline characteristics of caregivers	23
5.3 Baseline characteristics of children	23

5.4. Performance of Different Algorithms on Diagnosis of HIV	23
5.5 Effects of PMTCT	24
5.6 Effects of breastfeeding	24
CHAPTER 6	29
6.0 Discussion	29
6.1. Prevalence of HIV infection	29
6.2. Performance of Different Algorithms on Diagnosis of HIV	29
6.3. Effect of PMTCT	33
6.4. Effects of breastfeeding	33
CHAPTER 7	34
7.0 Conclusions	34
7.1 Limitations	34
7.2 Benefits of the study	34
7.3 Recommendations	34
REFERENCES	35
APPENDIX	43
APPENDIX 1 Questionnaire	44
APPENDIX 2 Patient Information Sheet	52
APPENDIX 3 Nyanja Consent Form	57
APPENDIX 4 Bemba Consent Form	62
ANNEX A WHO presumptive criteria	68
ANNEX B IMCI case definitions	69
ANNEX C Developmental milestones	70

LIST OF TABLES

Table 1 Baseline characteristics of caregivers	25
Table 2 Baseline characteristics of children	26
Table 3 Sensitivity, Specificity and predictive values	27
Table 4 Performance of WHO-PDC of HIV-1 infections in infants by age	28
Table 5 Positive PCR results by age group	28

LIST OF FIGURES

Figure 1 Flow chart for the selection of Study subjects	22
Figure 2 Receiver Operating Curves for HIV Diagnostic Algorithms	24

ABBREVIATIONS

ART- Anti-Retroviral Therapy

CDC- Centre for Disease Control and Prevention

CHER- Children with HIV Early Antiretroviral Therapy

DNA- Deoxyribonucleic Acid

EID- Early Infant Diagnosis

FBC- Full Blood Count

HAART- Highly Active Anti-Retroviral Therapy

IMCI- Integrated Management of Childhood Illnesses

MTCT- Mother to Child Transmission of HIV

NPV- Negative Predictive Value

PCR- Polymerase Chain Reaction

PITC- Provider Initiated Testing and Counseling

PMTCT- Prevention of Mother to Child Transmission

PPV- Positive Predictive Value

UTH- University Teaching Hospital

WHO- World Health Organization

WHO-PDC- World Health Organization- Presumptive Diagnostic Criteria

DEFINITIONS

Infants – children less than 12 months of age but the WHO context of infants can be 12 or 18 months and therefore appeared as such in some parts of this document quoting WHO

Reference test – DNA PCR for diagnosis of HIV infection

Index test – WHO presumptive diagnostic criteria

Sensitivity in this study was defined as the percentage of the participants who were identified as HIV infected by DNA PCR and correctly identified as being infected by use of WHO presumptive diagnostic criteria.

Specificity was defined as the percentage of the participants who were identified as being free of HIV disease by DNA PCR and correctly identified as being HIV uninfected by use of the WHO presumptive diagnostic criteria

Positive predictive values were used to tell the probability that HIV is present if the presentation of the patient fits the WHO presumptive diagnostic criteria

Negative predictive values were used to tell the probability that HIV is absent if the patients does not fit into the WHO presumptive diagnostic criteria