MALNUTRITION
AND
HUMAN IMMUNODEFICIENCY VIRUS (HIV)
IN CHILDREN ADMITTED TO
HARARE CENTRAL HOSPITAL

THESIS SUBMITTED AS PART FULFILLMENT FOR
THE MASTERS OF MEDICINE (PAEDIATRICS) DEGREE 1994

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Finally to my family - my wife Rahmat for the moral support and also re-writing my drafts several times, my children Kausar, Iqram and Taskeen who were so patient and good during the study; thank you.
Abbreviations:

A = Alive
D = Dead
AIDS = Acquired Immune Deficiency Syndrome
HIV = Human Immunodeficiency Virus
WHO = World Health Organisation
ESAP = Economic Structural Adjustment Programme
CFR = Case fatality rate
HT = Height
HA = Height for age
PEM = Protein Energy Malnutrition
WH = Weight for height
WT = Weight
SD = Standard Deviation
Z$ = Zimbabwe Dollar
mEq/l = milli-equivalent per litre
g/dl = grams per decilitre
g/l = grams per litre
MCV = mean corpuscular volume
PLT = platelets
ALB = albumen
K = potassium
NCHS = National Center for Health Statistics
ABSTRACT

To determine whether HIV infection has altered the presentation, hospital course and mortality of malnutrition in Harare Hospital, children between 2 and 96 months of age were studied. Their sociodemographic, clinical presentation and immediate outcome were documented. Anthropomorphic parameters and physical findings were recorded. HIV (ELISA), serum potassium and albumen plus haematologic indices were measured. These findings were compared between HIV positive and HIV negative children.

One hundred and eighty children were enrolled from December 1993 to February 1994. Mean age was 26.1 months (range 2-96) and the male to female ratio was 1.2:1. Fifty-four point five percent had kwashiorkor, 26.7% marasmic-kwashiorkor, 9.4% marasmus and 9.4% were underweight. During the study 73 children died giving an overall Case Fatality Rate (CFR) of 35% (73/210).

Thirty children with severe malnutrition died within 24 hours of admission and inadequate information was available therefore not included in the rest of the analysis. There was no significant difference in CFR between the different groups.

Seventy-nine children were HIV positive and 80 HIV negative (no result obtained in 21). The association of HIV positivity was significant in those with wasting and stunting (p<0.002) than with either stunting or wasting alone. Clinically, dehydration was more severe and oral thrush lymphadenopathy and ear discharge were present more frequently (p<0.001). Haemoglobin and mean corpuscular volume were significantly lower (p<0.03 and p<0.001 respectively). Their hospital course was characterised by persistence of diarrhoea, lack of appetite and apathy (p <0.04). Mortality was marginally greater (p=0.055).

These findings suggest that all children presenting with malnutrition should be screened for their HIV status and that prevention of AIDS needs to be included in efforts to reduce childhood malnutrition in Zimbabwe.
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</table>
INTRODUCTION

Malnutrition is a worldwide problem. An estimated 190 million children under five years of age are chronically malnourished, locked early into a pattern of ill-health, poor development and increased mortality (1).

In 1973 malnutrition was the leading cause of death in children at Harare Central Hospital (2). In 1983 in an urban area close to Harare Loewenson et al. found that in children under eight years of age whereas 25% were stunted, only 6% were wasted, suggesting there was more chronic than acute undernutrition (3). The reasons were thought to be poverty, maldistribution of food within the country plus family and social disruption in a post war situation. The other reasons were childhood illnesses, particularly measles and inappropriate weaning practices (3).

In 1992 the situation and level of malnutrition had improved compared with 1973, according to a nutritional survey conducted by Tagwireyi et al. The overall prevalence however, remained high (4). In this study 31% of children between the age of 24 and 59 months had moderate or severe stunting, suggesting little change over 10 years. However in 1993 the United Nations Children's Fund (UNICEF) reported only 20% of children between 12-23 months were wasted in Zimbabwe. The
reasons for stunting were probably due to the three drought seasons since independence (1983/4, 1986/87, 1991/92).

In addition, the human immuno-deficiency virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) pandemic and more recently the worsening economic climate following the Economic Structural Adjustment Programme (ESAP) in 1990 have further contributed to childhood malnutrition (5). The AIDS epidemic is causing devastating demographic consequences in Africa. The countries most badly affected are in Eastern and Southern Africa. By December 1992 211,032 HIV-1 cases had been reported from Africa, of these 15-20% were children (6). In 1992, Zimbabwe National Public Health Laboratory reported almost 4,000 AIDS/AIDS related cases (ARC) in children under 5 years and AIDS related deaths amounted to almost 25% of the total deaths in this age group (7).

In 1984 malnutrition was thought to be due to poverty, substitute parenting, poor access to health services and late introduction of solids to the diet (3). Today, in addition to the above causes, the AIDS epidemic appears to play a major role in the changing pattern of malnutrition. In 1973 the Paediatric Medical Wards in Harare Central Hospital admitted 2679 children, 22.4% of these were due to malnutrition (2). By 1991 an initial analysis indicated total admissions to the paediatric medical wards had increased twofold (8). Over an eleven month period in
the same year (1991) there were 255 cases of malnutrition admitted to one ward alone (data from ward admission book). Thus, at least 500 would have been admitted in the two medical wards out of total of 5318 during the year ie. approximately 9% were due to malnutrition (8). See Figure 1. It is not known how many of these children were HIV infected or HIV seropositive or both.

The clinical diagnosis of HIV/AIDS is difficult to make in the presence of malnutrition. The World Health Organization's (WHO) case definition for Paediatric AIDS is inappropriate for Africa (9). Lepage et al found that the nine items included in the definition were difficult to remember and to use under practical field conditions and their sensitivity was low (9). In a review of Paediatric AIDS in Africa, Coulter suggested that the discriminating features of HIV infection in malnourished children were:

1. Oedema          - Absence
2. Lymphadenopathy - early infancy
                  - generalized
                  - large nodes
3. Dermatitis      - papules/nodules
                  - abscesses
                  - ulcers
                  - Herpes simplex and Herpes zoster
4. Candidiasis     - Widespread and recurrent
Malnutrition Harare Central Hospital
Ward B2 1991 (11 months)

Number of patients

Age groups (months)

Figure 1
5. Persistent respiratory and other infections

6. Failure to respond to nutritional rehabilitation.

(Adapted from Coulter JBS Ann Trop Paediatr 1993; 13;209)

Marasmic children were more likely to be HIV infected than those who were malnourished with oedema (Kwashiorkor)(6,10). The anthropometric indicator of chronic PEM (height for age) was more often reduced in HIV infected children than weight for age, which may be regarded as an indicator of acute or chronic PEM (10).

OBJECTIVES

1. To determine the sociodemographic features of malnourished children admitted to Harare Central Hospital Paediatric Nutrition wards.

2. To study the prevailing types of malnutrition.

3. To compare the nutritional pattern between HIV positive and HIV negative children.

4. To describe any differences in clinical presentation and clinical course in hospital between HIV positive and HIV negative children.

5. To document certain laboratory investigations in patients with or without HIV antibodies.

6. To determine the outcome of children with malnutrition with
or without HIV antibodies.

MATERIAL AND METHODS:
This was a descriptive study carried out between December 1993 and February 1994 in the Paediatric Nutrition wards of Harare Central Hospital. This is a referral hospital serving the population of Harare and the surrounding provinces. The upper age limit of admissions to the Paediatric wards is set at 8 years to prevent congestion.

INCLUSION CRITERIA
1. Patients admitted with malnutrition who fulfilled the criteria for the Wellcome or Waterlow's classifications (11,12). Patients above 80% of the 50th centile with oedema were diagnosed as acute kwashiorkor and were also included (13).
2. Age range 2 to 96 months.

EXCLUSION CRITERIA
Children with congenital malformations or cerebral palsy.
SUBJECTS

Consecutive children between the ages of 2-96 months admitted for malnutrition were included in the study. After obtaining verbal consent from the mothers or caretakers they were interviewed by the investigator either directly or through an interpreter. The child was then examined as soon as possible after admission. Weight was measured with a "Way Master" spring scale (Reading, UK) to the nearest 0.1 kilogram. Height was measured to the nearest 0.5 centimeter using a stadiometer (Holtain Ltd, UK) for children who could not stand or a measuring tape against the wall, for the standing height of children who could. Information on sociodemographic features, clinical presentation and clinical findings were recorded.

INVESTIGATIONS: Blood was drawn for serum potassium and albumen plus full blood count. In addition after precounselling an HIV Enzyme linked immunoabsorbent assay (ELISA) was done. The Abbott Laboratories Enzyme immuno-assay for detection of antibodies against HIV was utilised. Western blot confirmation (using Dupont Western Blot Kit) was sought on any doubtful result obtained by ELISA test.
The child was reviewed again within 3-5 days during admission. Improvement in appetite or apathy and reduction in frequency of diarrhoea was regarded as a sign of the onset of recovery. An attempt was made to record the weight at discharge or death. All data was recorded on a questionnaire. (Appendix).

SAMPLE SIZE

Previous data, prior to the AIDS epidemic indicated that mortality for hospitalised children with severe malnutrition was 23% (2). Assuming that the mortality is likely to be at least twice as high in infants who have HIV/AIDS in order to obtain a significant difference with an $\alpha=0.05$ and a power $(1-\beta)$ of 0.8 the required sample size was calculated to be at least 148 children.

ETHICAL ISSUES

1. Verbal consent was obtained from parents (usually mother) or caretaker.

2. In all cases pre and post counselling for HIV Enzyme linked immunoabsorbent assay was done by HIV counsellors.

3. If parents refused to consent for HIV testing on their child, the test was done, the result coded, but not disclosed to parents or recorded in the child's medical records.
DEFINITIONS OF TERMS

1. Diarrhoea was defined as more than 3 loose stools per day, persistent diarrhoea diagnosed if it was present for more than 2 weeks. Recurrent diarrhoea was defined as diarrhoea which stopped for 5 days and then recurred. (14).

2. Pitting oedema was local if confined to the feet and generalised if other parts of the body were involved.

3. Generalised lymphadenopathy was defined as nodes more than 0.5 centimeters in more than one anatomical site (15).

4. The liver and spleen were measured from the costal margin at the mid-clavicular line and defined as "hepatomegaly" if more than 2 centimeters, and "splenomegaly" if the spleen was palpable.

5. Type of respiratory infection was categorised using the WHO clinical criteria (16).

6. Residency: because our population is so mobile residency was defined as the area where the child had lived over the past six months prior to admission.

7. Clinical attendance: less than three clinic visits in the first year of life or less than five in older children was considered inadequate.

8. Growth faltering: static weight on 2 occasions or decreasing weight.

9. Wellcome classification used (11):
   - Underweight = weight for age 60-<80% of the 50th centile of NCHS standards, without oedema
   - Marasmus = weight for age <60% of the 50th centile of the NCHS standards without oedema.
Kwashiorkor = weight for age $\geq 60\%$ of the 50th centile of the NCHS standards, with oedema.

Marasmic/kwashiorkor = weight for age $< 60\%$ of the 50th centile of the NCHS standards with oedema.

10. Waterlow's classification (12):

<table>
<thead>
<tr>
<th>Height for age</th>
<th>Weight for height</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\geq 90%$</td>
<td>$\geq 80%$ +</td>
</tr>
<tr>
<td>$&lt; 90%$</td>
<td>Stunted</td>
</tr>
<tr>
<td></td>
<td>Wasted</td>
</tr>
</tbody>
</table>

+ of the 50th centile of the NCHS standards

* These children classified as "normal" all had weight for age $< 80\%$ on Wellcome's classification, and were therefore included in the analyses.

11. In children less than 15 months of age clinical HIV infection was suggested by two of the following: generalised lymphadenopathy, hepatosplenomegaly and oral thrush (15).

DATA ANALYSIS

Data was analysed using the computer programme Epi-Info 5.01 from Epidemiology and Disease Surveillance (17). The data collected on the questionnaire was analysed for differences between children with and without kwashiorkor and with and
without a positive HIV ELISA test using chi-square analysis. Fisher's exact test was used for expected numbers less than 5. Data was stratified where appropriate. For laboratory data Student's unpaired t test was also used to compare the different groups. A p value of less than 0.05 was considered significant. Predisposing causes, clinical and laboratory investigations were compared with the type of malnutrition and HIV status.

Problems in the Study

The diagnosis of HIV infection in children under 15 months of age could not be made with certainty on the basis of presence of HIV antibody alone. Some of them may have had persistence of passively transferred maternal antibodies and tests for detecting HIV antigen were not available. However, there were only twelve children less than 15 months who were HIV antibody positive and they all had clinical features suggestive of HIV infection. Furthermore, results would not have been affected by excluding these children.

Inadequate information was available for thirty children with severe malnutrition who died soon after admission. Therefore they were not included in the analysis except for calculating the overall case fatality rate for severe malnutrition. The number of children with marasmus was noted to be low. This was probably due to many of them being managed as outpatients whereas children with kwashiorkor are invariably admitted.

Duration of the study was possibly too short to assess mortality and long term morbidity. In fact four mothers
requested immediate discharge after post-counselling and finding out that their child was HIV positive.

Not all the children had all the laboratory investigations because of logistic reasons.
RESULTS

SUBJECTS

One hundred and eighty (N=180) children were enrolled in the study. The male to female ratio was 1.2:1. The mean age was 26.1 months. Sixty-three children (35%) were below 18 months and 117 (65%) were over 18 months of age. Seventy-eight (43.3%) had had at least one previous admission. The main reason for re-admission was malnutrition and diarrhoea.

SOCIODEMOGRAPHIC

1. RESIDENCE

One hundred and ten (61.1%) of the children were resident in an urban area and 70 (38.9%) in a rural area. Change of address was more commonly either to or within an urban area (56/66), rather than to a rural area (10/66). Twenty-three (12.8%) of these urban residents lived in Epworth - this is a low socioeconomic suburb bordering Harare.

2. EDUCATION

Seventy-five mothers (47.5%) had received primary education (grade 1-7) and 67 (42.4%) had received secondary education, sixteen mothers (10.1%) had had no education. Information was incomplete in 22.

3. MARITAL STATUS

One hundred and eleven mothers (64.7%) were married and 23 (13.6%) were divorced. The others were either single or
widowed. The average age of the mothers was 25.7 years (range 17-56, SD 6.0). Information was incomplete in 11 mothers.

4. CARETAKERS

The caretaker was predominantly the mother (66.7%, 120/180). In 20.6% it was the grandmother. In ten cases the mothers were reported to have died. Whether the mothers were or were not the caretakers, did not effect the severity of or mortality from malnutrition.

5. SIBLINGS AND BIRTH ORDER

In 42.2% of the cases (76/180) the patient was the first born child in the family and in 35.5% (64/180) he\she was the only child. There were 43.9% (79/170) of the cases who had 1-2 siblings and 20.6% (37/180) had 3 or more in the family. There was no increased mortality in those who had a high birth order of more than 3 siblings.

6. EMPLOYMENT

Only 2.8% (5/180) of the mothers were employed full time as compared to 45.4% (69/152) of fathers. The rest were housewives either self employed as vendors or in part-time employment as farm labourers. The average annual amount earned by the mothers was Z$2 316 (range 240 - 8 640) and was Z$5 443 (range 720 - 41 000) by the fathers. In nine cases the data was incomplete.
7. ATTENDANCE AT CLINICS

Forty-nine (36.0%) of the children had inadequate clinic visits (see definitions). Seventy percent of the children had a road to health card available. In the majority of these children (90%) growth faltering was observed. In 9.4% growth was static. According to the road to health card 125 children had had appropriate immunisations, 3 had none and in immunisations were incomplete. Almost a third of the children (29.1%) had no road to health card available at the time of presentation. The clinic was within an hour's distance from the house in the majority of the cases (143/180). However, the reason commonly given for non-attendance was that it was "too far" (18/88, 22.2%). The majority of the mothers did not attend any feeding schemes (112/176) and were not aware of their existence (84/176). In 4 data was incomplete.

8. ENVIRONMENT

One hundred and fifteen (63.9%) had a garden patch in their yard and most grew vegetables. Protected water was from either a tap (50%) or well (50%). Over half had a pit latrine (51.1%) and 28.9% had a flush toilet. Twenty percent had no toilet and used the bush. These were all from the rural area.

9. NUTRITION

There were 64 children whose birth weight was below 2 kilograms. Only 33.3% (20/60) of the mothers whose children were below 18 months were still breast feeding and all had started solids by age 4 months. The average age at which
breastfeeding had been stopped in those under 18 months was 15.6 months (SD 2.26)). Of the total group 15% (27/180) were still breastfeeding. The reasons for discontinuing breastfeeding were related to the child being ill or "child too old", in 50 (77/153) of cases. Thirty-two of the mothers (20.9%) decided to stop for personal reasons, for example ill health or pregnancy.

Solids were introduced at an average age of 4.7 months (SD 3.1). Twenty-one mothers introduced solids before the age of months (nine of these had solids at one month of age). It was difficult to document the feeding pattern prior to the illness of the child.

The type, severity or mortality of malnutrition was not affected by the above variables.
PATTERN OF MALNUTRITION

Tables I to V illustrate the type of malnutrition, age distribution, and mortality in all 180 children.

a) Wellcome classification

Table I and Figure 2 illustrate the age ranges and type of malnutrition.

**TABLE I  AGE VERSUS TYPE OF MALNUTRITION***

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Marasmus</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>32</td>
<td>60</td>
<td>6</td>
<td>98</td>
</tr>
<tr>
<td>Marasmic-Kwashiorkor</td>
<td>16</td>
<td>23</td>
<td>9</td>
<td>48</td>
</tr>
<tr>
<td><strong>Total(%)</strong></td>
<td>63(35.0)</td>
<td>94(52.2)</td>
<td>23(12.8)</td>
<td>180</td>
</tr>
</tbody>
</table>

* see definitions pages 9 & 10

The commonest type of malnutrition seen was kwashiorkor. I children of 19-36 months when kwashiorkor plus marasmic kwashiorkor were compared with underweight plus marasmus there were significantly more children in this age group ($X^2 = 7.96$ $p<0.02$).
Age versus type of malnutrition
(Wellcome classification)

Figure 2
MORTALITY

a) Wellcome classification

**TABLE III MORTALITY AND CLASSIFICATION OF MALNUTRITION**

<table>
<thead>
<tr>
<th>Type of Malnutrition</th>
<th>Total</th>
<th>%</th>
<th>Alive</th>
<th>Dead</th>
<th>CFR %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>17</td>
<td>9.4</td>
<td>13</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>Marasmus</td>
<td>17</td>
<td>9.4</td>
<td>11</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>98</td>
<td>54.5</td>
<td>79</td>
<td>19</td>
<td>19.4</td>
</tr>
<tr>
<td>Marasmic-Kwashiorkor</td>
<td>48</td>
<td>26.7</td>
<td>34</td>
<td>14</td>
<td>29.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
<td><strong>100.0</strong></td>
<td><strong>137</strong></td>
<td><strong>43</strong></td>
<td><strong>23.9</strong></td>
</tr>
</tbody>
</table>

* see Definitions pages 9 & 10

CFR = Case Fatality Rate

Table III illustrates the type of malnutrition and mortality of the 180 children. Mortality was similar in the four groups.
b) Waterlow’s classification*

<table>
<thead>
<tr>
<th>Type of Malnutrition</th>
<th>Total</th>
<th>%</th>
<th>A</th>
<th>D</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;+</td>
<td>41</td>
<td>22.8</td>
<td>34</td>
<td>7</td>
<td>17.0</td>
</tr>
<tr>
<td>Stunted</td>
<td>30</td>
<td>16.7</td>
<td>23</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>Wasted</td>
<td>58</td>
<td>32.2</td>
<td>42</td>
<td>16</td>
<td>27.6</td>
</tr>
<tr>
<td>Wasted and stunted</td>
<td>51</td>
<td>28.3</td>
<td>38</td>
<td>13</td>
<td>25.5</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>137</td>
<td>43</td>
<td>Average 23.9</td>
</tr>
</tbody>
</table>

* see Definitions pages 9 & 10

A=Alive, D=Dead, CFR=Case fatality rate

+ see comment Table II

Table IV summarises the nutritional status of the 180 children according to Waterlow's classification and compares mortality rates with severity of acute (wasting) or chronic (stunting) undernutrition. There were no significant differences between the four groups.
b) Waterlow's classification

TABLE II  AGE VERSUS TYPE OF MALNUTRITION*

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;+</td>
<td>17</td>
<td>20</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Stunted</td>
<td>8</td>
<td>16</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Wasted</td>
<td>25</td>
<td>30</td>
<td>3</td>
<td>58</td>
</tr>
<tr>
<td>Stunted and wasted</td>
<td>13</td>
<td>28</td>
<td>10</td>
<td>51</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>94</td>
<td>23</td>
<td>180</td>
</tr>
</tbody>
</table>

* see Definitions pages 9 & 10

+ All these children had a weight for age below 80% of 50 centile on the NCHS standards.

Table II and Figure 3 illustrate the type of malnutrition. Wasting was the most common presentation. The types of malnutrition did not differ significantly in terms of age and distribution.
Age versus type of malnutrition
(Waterlow's classification)

Number children

- 2-18 months
- 19-36 months
- >36 months

Figure 3
### TABLE V  MORTALITY VERSUS AGE

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>Alive</th>
<th>Dead</th>
<th>Total</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-18</td>
<td>46</td>
<td>17</td>
<td>63</td>
<td>27.0</td>
</tr>
<tr>
<td>19-36</td>
<td>71</td>
<td>23</td>
<td>94</td>
<td>23.2</td>
</tr>
<tr>
<td>&gt;36</td>
<td>20</td>
<td>3</td>
<td>23</td>
<td>13.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>137(76.1%)</strong></td>
<td><strong>43(23.9%)</strong></td>
<td><strong>180</strong></td>
<td><strong>Average 23.9</strong></td>
</tr>
</tbody>
</table>

Table V illustrates the mortality versus age. It was similar for children above and below 18 months. There were no deaths over 60 months.
ASSOCIATION WITH HIV STATUS

Of the 159 children with HIV-1 ELISA tests available, 79 were positive and 80 were negative. Tables VI to XIX illustrate the type, age, mortality, clinical parameters, laboratory data and course in hospital.

TYPE AND AGE OF MALNUTRITION

TABLE VI AGE DISTRIBUTION VERSUS TYPE OF MALNUTRITION
(Wellcome classification)
(HIV POSITIVE CHILDREN, N = 79)

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>8.9</td>
</tr>
<tr>
<td>Marasmus</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>14</td>
<td>17.7</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>9</td>
<td>21</td>
<td>0</td>
<td>30</td>
<td>38.0</td>
</tr>
<tr>
<td>Marasmic-Kwashiork</td>
<td>9</td>
<td>16</td>
<td>3</td>
<td>28</td>
<td>35.4</td>
</tr>
<tr>
<td>Total (%)</td>
<td>27</td>
<td>43</td>
<td>9</td>
<td>79</td>
<td>100.0</td>
</tr>
</tbody>
</table>

TABLE VII AGE DISTRIBUTION VERSUS TYPE OF MALNUTRITION
(HIV NEGATIVE CHILDREN, N = 80)

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>20.0</td>
</tr>
<tr>
<td>Marasmus</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>17</td>
<td>31</td>
<td>6</td>
<td>54</td>
<td>57.5</td>
</tr>
<tr>
<td>Marasmic-Kwashiork</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>16</td>
<td>20.0</td>
</tr>
<tr>
<td>Total (%)</td>
<td>27</td>
<td>41</td>
<td>12</td>
<td>80</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table VI and VII illustrate the age versus the type of malnutrition for HIV positive and HIV negative children.
malnutrition for HIV positive and HIV negative children respectively. The differences were not significant however the prevalence of marasmus was highest amongst the HIV positive children with marasmus (14/79 versus 2/80; p<0.002).

b) Waterlow's classification

**TABLE VIII**  
AGE DISTRIBUTION VERSUS TYPE OF MALNUTRITION  
(HIV POSITIVE CHILDREN, N = 79)

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;*</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Stunted</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Wasted</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Stunted and Wasted</td>
<td>8</td>
<td>23</td>
<td>2</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>Total (%)</td>
<td>27</td>
<td>43</td>
<td>9</td>
<td>79</td>
<td>100</td>
</tr>
</tbody>
</table>

* see comments Table II

**TABLE IX**  
AGE DISTRIBUTION VERSUS TYPE OF MALNUTRITION  
(HIV NEGATIVE, N = 80)

<table>
<thead>
<tr>
<th>Age Range (months)</th>
<th>2-18</th>
<th>19-36</th>
<th>&gt;36</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;*</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>25</td>
<td>31.2</td>
</tr>
<tr>
<td>Stunted</td>
<td>4</td>
<td>8</td>
<td>3</td>
<td>15</td>
<td>18.8</td>
</tr>
<tr>
<td>Wasted</td>
<td>10</td>
<td>12</td>
<td>3</td>
<td>25</td>
<td>31.2</td>
</tr>
<tr>
<td>Stunted and Wasted</td>
<td>3</td>
<td>11</td>
<td>1</td>
<td>15</td>
<td>18.8</td>
</tr>
<tr>
<td>Total (%)</td>
<td>27</td>
<td>41</td>
<td>12</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

* see comment Table II
Age distribution between the HIV positive and HIV negative children was similar. However the combination of stunting and wasting was more common in HIV positive children than in HIV negative children (p<0.003).

### TABLE X PERCENT WEIGHT FOR HEIGHT

**HIV POSITIVE vs HIV NEGATIVE**

<table>
<thead>
<tr>
<th>% WT/HT</th>
<th>HIV POSITIVE (N=79)</th>
<th>HIV NEGATIVE (N=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>73.14</td>
<td>79.70</td>
</tr>
<tr>
<td>Range</td>
<td>52 - 101</td>
<td>55 - 110</td>
</tr>
<tr>
<td>S.D</td>
<td>10.53</td>
<td>11.02</td>
</tr>
</tbody>
</table>

\( t=3.813; \ p<0.001 \)

### TABLE XI PERCENT HEIGHT FOR AGE

**HIV POSITIVE vs HIV NEGATIVE**

<table>
<thead>
<tr>
<th>% HT/AGE</th>
<th>HIV POSITIVE (N=79)</th>
<th>HIV NEGATIVE (N=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>88.00</td>
<td>90.34</td>
</tr>
<tr>
<td>Range</td>
<td>55 - 98</td>
<td>62 - 103</td>
</tr>
<tr>
<td>S.D</td>
<td>6.44</td>
<td>6.26</td>
</tr>
</tbody>
</table>

\( t=2.309 \quad p<0.05 \)
TABLE XII PERCENT WEIGHT FOR AGE

HIV POSITIVE vs HIV NEGATIVE

<table>
<thead>
<tr>
<th>% WT/AGE</th>
<th>HIV POSITIVE (N=79)</th>
<th>HIV NEGATIVE (N=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>58.53</td>
<td>67.66</td>
</tr>
<tr>
<td>Range</td>
<td>38 - 79</td>
<td>39 - 102</td>
</tr>
<tr>
<td>S.D.</td>
<td>9.95</td>
<td>12.00</td>
</tr>
</tbody>
</table>

t=5.186; p<0.0001

Tables X, XI and XII plus Figure 4 illustrate the anthropometric parameters. The mean of weight for height, height for age, and weight for age were compared between HIV positive and HIV negative children. All three parameters were significantly reduced in children with HIV positive antibodies.
HIV status and malnutrition in children

Figure 4
MORTALITY

During the study period 30 children with severe malnutrition died soon after admission and data were not available on these children. They were only included in the overall analyses where the case fatality rate was 35% (73/210). Data was analysed from 180 children of whom 159 had HIV results available.

a) Wellcome classification

TABLE XIII MORTALITY AND CLASSIFICATION OF MALNUTRITION
(HIV POSITIVE CHILDREN, N = 79)

<table>
<thead>
<tr>
<th>Type of Malnutrition</th>
<th>Alive</th>
<th>Dead</th>
<th>Total(%)</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>5</td>
<td>2</td>
<td>7 (8.9)</td>
<td>28.6</td>
</tr>
<tr>
<td>Marasmus</td>
<td>8</td>
<td>6</td>
<td>14 (17.7)</td>
<td>42.9</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>24</td>
<td>6</td>
<td>30 (38.0)</td>
<td>20.0</td>
</tr>
<tr>
<td>Marasmic-Kwashiorkor</td>
<td>18</td>
<td>10</td>
<td>28 (35.4)</td>
<td>35.7</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>24</td>
<td>79</td>
<td>Average 30.4</td>
</tr>
</tbody>
</table>
TABLE XIV MORTALITY AND CLASSIFICATION OF MALNUTRITION
(HIV NEGATIVE CHILDREN, N = 80)

<table>
<thead>
<tr>
<th>Type of Malnutrition</th>
<th>Alive</th>
<th>Dead</th>
<th>Total %</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>7</td>
<td>1</td>
<td>8 (10.0)</td>
<td>12.5</td>
</tr>
<tr>
<td>Marasmus</td>
<td>2</td>
<td>0</td>
<td>2 (2.5)</td>
<td>0</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>45</td>
<td>9</td>
<td>54 (67.5)</td>
<td>16.7</td>
</tr>
<tr>
<td>Marasmic-Kwashiorkor</td>
<td>13</td>
<td>3</td>
<td>16 (20.0)</td>
<td>18.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>67</td>
<td>13</td>
<td>80</td>
<td>Average 16.3</td>
</tr>
</tbody>
</table>

Tables XIII and XIV and Figure 5 illustrate the mortality versus type of malnutrition in HIV positive and HIV negative children respectively. The total mortality was almost double in the HIV positive children compared to the HIV negative children (30.4% versus 16.3%). The difference was marginally significant ($X^2=3.69; p=0.055$).
MORTALITY

Figure 5
b) Waterlow's classification

**TABLE XV MORTALITY AND CLASSIFICATION OF MALNUTRITION**

(HIV POSITIVE CHILDREN, N = 79)

<table>
<thead>
<tr>
<th></th>
<th>Alive</th>
<th>Dead</th>
<th>Total</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>25.0</td>
</tr>
<tr>
<td>Stunted</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>30.0</td>
</tr>
<tr>
<td>Wasted</td>
<td>21</td>
<td>7</td>
<td>28</td>
<td>25.0</td>
</tr>
<tr>
<td>Stunted and wasted</td>
<td>21</td>
<td>12</td>
<td>33</td>
<td>36.4</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>24</td>
<td>79</td>
<td>Average 30.4</td>
</tr>
</tbody>
</table>

**TABLE XVI MORTALITY AND CLASSIFICATION OF MALNUTRITION**

(HIV NEGATIVE CHILDREN, N = 80)

<table>
<thead>
<tr>
<th></th>
<th>Alive</th>
<th>Dead</th>
<th>Total</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Normal&quot;</td>
<td>22</td>
<td>3</td>
<td>25</td>
<td>12.0</td>
</tr>
<tr>
<td>Stunted</td>
<td>13</td>
<td>2</td>
<td>15</td>
<td>13.3</td>
</tr>
<tr>
<td>Wasted</td>
<td>17</td>
<td>8</td>
<td>25</td>
<td>32.0</td>
</tr>
<tr>
<td>Stunted and wasted</td>
<td>15</td>
<td>0</td>
<td>15</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>13</td>
<td>80</td>
<td>Average 16.3</td>
</tr>
</tbody>
</table>

Table XV and XVI illustrate the case fatality rates for HIV positive and HIV negative children using Waterlow's classification. Mortality was higher in children who were HIV positive and both stunted and wasted ($X^2 = 5.46$, $p<0.02$).
Table XVII compares the presenting symptoms and signs with the HIV status of the child. Significant findings in those with HIV positive antibodies were: vomiting, cough, obvious dehydration, oral thrush, lymphadenopathy and ear discharge. HIV negative children had more dermatoses.
LABORATORY DATA

In 137 children all laboratory investigations were obtained. Comparing those with and without oedema (i.e. kwashiorkor) there were no significant differences. Haematological indices were compared between HIV positive and HIV negative children. The haemoglobin and mean corpuscular volume (MCV) were significantly lower in HIV positive children.

**TABLE XVIII LABORATORY DATA**

<table>
<thead>
<tr>
<th>INVESTIGATIONS</th>
<th>LABORATORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIV POSITIVE</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>K(mEq/l)</td>
<td>3.52</td>
</tr>
<tr>
<td>Hb(g/dl)</td>
<td>8.7</td>
</tr>
<tr>
<td>MCV(fl)</td>
<td>72.2</td>
</tr>
<tr>
<td>PLT (x10⁹/l)</td>
<td>312</td>
</tr>
<tr>
<td>ALB(g/l)</td>
<td>27.7</td>
</tr>
</tbody>
</table>

COURSE IN HOSPITAL

Children were reviewed on third or fifth day after admission. Lack of improvement in clinical status was assessed by persistence of diarrhoea, poor appetite or apathy.
<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>HIV POSITIVE</th>
<th>HIV NEGATIVE</th>
<th>$X^2$</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent diarrhoea</td>
<td>No</td>
<td>43</td>
<td>59</td>
<td>4.36</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>27</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Appetite</td>
<td>Good</td>
<td>27</td>
<td>48</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>48</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Apathy</td>
<td>Poor</td>
<td>44</td>
<td>27</td>
<td>7.58</td>
</tr>
<tr>
<td></td>
<td>Improved</td>
<td>31</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*Not all the children were included in the analysis.

In all three parameters HIV positive children showed a significantly poorer response to management compared to HIV negative children.
SUMMARY OF SIGNIFICANT FINDINGS

Comparison of HIV positive versus HIV negative children

In the HIV positive children the following was found:

1. Mortality higher (borderline significance)  \( p=0.055 \)
2. Proportion of marasmic children greater  \( p<0.002 \)
3. Anthropometric indicators lower:
   (a) weight for height percent  \( p<0.001 \)
   (b) height for age percent  \( p<0.05 \)
   (c) weight for age percent  \( p<0.0001 \)
4. Significant symptoms:
   (a) vomiting  \( p<0.001 \)
   (b) cough  \( p<0.004 \)
5. Significant signs:
   (a) dehydration  \( p<0.001 \)
   (b) oral thrush  \( p<0.001 \)
   (c) lymphadenopathy  \( p<0.001 \)
   (d) ear discharge  \( p<0.001 \)
6. Course in hospital
   The following were more prolonged:
   (a) persistent diarrhoea  \( p<0.04 \)
   (b) poor appetite  \( p<0.003 \)
   (c) apathy  \( p<0.01 \)
7. Laboratory data:
   Mean corpuscular volume lower  \( p<0.001 \)
   Haemoglobin lower  \( p<0.03 \)
DISCUSSION

Malnutrition is a worldwide problem which has been in existence for many centuries. Lack of food is a major cause of malnutrition but clearly not the only one (18). In Zimbabwe substitute parenting, inappropriate feeding practices, inadequate health supervision and recent illnesses were some of the commonest factors associated with malnutrition. This was particularly true with rapid urbanisation of families (3,19). Figure 6 outlines the interaction of factors which predispose them to malnutrition (20).
Figure 6: Interaction of adverse factors and malnutrition

Adverse factors
- Famine
- Ignorance
- Poverty

Malnutrition
- Hospitalisation
- Defective host defences

Infection
- Anorexia
- Catabolism
- Malabsorption
- Poor sanitation
- Unclean water
- Over crowding
- Armed conflict
- Migration

In addition to the factors listed above the AIDS epidemic is emerging as a cause of malnutrition. In Zimbabwe the prevalence of HIV seropositivity is estimated to be approximately 20% in pregnant women in the periurban population (21). Children are usually infected by vertical transmission through the mother. This is now becoming a major public health problem in Africa (22).

There are similarities between children with HIV/AIDS and malnutrition which make diagnosis difficult. These include the signs and symptoms plus defects in immune mechanisms (23,24). Clinically, malnutrition or early growth faltering is very common in children with HIV/AIDS. Differential diagnosis can be difficult in the absence of definitive clinical criteria for HIV/AIDS. These have altered several times (9,10). However, Coulter has suggested that there are some clinical features that may help to identify HIV infection in malnourished children (6). He found that children with marasmus were more frequently infected with HIV/AIDS than children with kwashiorkor, and felt that absence of oedema was a useful indicator (6). However, even before the AIDS epidemic there were surprising regional differences in the pattern of P.E.M.. For example in Chile 97% of hospitalized children with malnutrition were marasmic whereas in South Africa and Sudan 96% were admitted with kwashiorkor (25).

This study was therefore designed to determine the sociodemographic features, type of malnutrition and clinical features in hospitalised children in Zimbabwe and the effects of
HIV seropositivity on presentation, course in hospital and outcome.

Sociodemographic features

In general, children admitted to the study were 18-36 months and most had kwashiorkor. The average mortality was 23.9%. These findings are similar to other reports from Africa (25,26,27). The children in the study were commonly from urban areas reflecting our general hospital population. There were usually less than 3 siblings and the patient was frequently the first born in the family. This finding is in contrast to previous work suggesting that large families are associated with malnutrition and family size is inversely proportional to nutritional status of children under 5 years (28). However, Tolboom and associates in Lesotho found no significant differences in family size and malnutrition (29). In most instances the caretaker was the mother. There was no difference in type or severity of malnutrition if the caretaker was not the mother. However a previous case control study in 1984 found that substitute parenting was a significant risk for developing malnutrition (19). In most cases poverty was clearly an important factor. The total average family income was approximately Z$8 000 per annum. Only half of the fathers had a full time job. Mothers supplemented the income by vending. This was most likely only an estimate as economic status is very difficult information to obtain accurately. Although 70% of the mothers had a road to health card, only one third of them
actually attended clinic regularly. Most houses were within an hour's distance from the clinic. However the reason for non-attendance was given as clinic being "too far". The concept of distance in hours may be inaccurate. Waterston's study found significant malnutrition in those who lived more than 10 kilometers away from the clinic (19).

HIV status and malnutrition

In contrast to Coulter's review which suggested that kwashiorkor was uncommon in children with HIV/AIDS in this study it was very common and could not be used as a discriminating factor. In addition unlike Coulter's suggestions dermatoses were more common in HIV negative children. In agreement with Coulter, marasmus was more common in HIV positive children. These children were also more likely to be admitted.

The significant signs and symptoms found in this study are similar to other reports (10,21,30). It should be noted however that bacterial, viral and parasitic infections can present in a similar manner particularly in underdeveloped countries. Mann and others in Zaire identified 3 distinct groups of symptoms in a population of hospitalised HIV positive children: gastrointestinal symptoms, malnutrition and measles (31). The findings in this study of prolonged symptoms during the course of their hospital stay are in agreement with those of Coulter, who suggested failure to respond to nutritional rehabilitation is a discriminating feature. In fact Prazuck found in 10% of
the cases severe malnutrition was a late manifestation of AIDS and not the result of lack of quantity or quality of food (21). The haemoglobin and mean corpuscular volume were significantly lower in children with HIV infection. The anaemia in patients with HIV infection and in those with malnutrition per se is mainly normochromic and normocytic (32,37). In this study microcytosis was common.

In Central Africa, Pavia and Lepage et al found that the leading causes of death of children born to HIV infected women were failure to thrive, pneumonia, and chronic diarrhoea (33,34). These are also common causes of death in severe malnutrition (20). Nutritional factors and high rates of mother to child transmission were among some of the reasons suggested for the higher morbidity and mortality in children born to HIV positive mothers in prospective studies in Africa compared with European studies (34). The mortality after 24 hours in hospital was marginally greater in HIV positive children in this study. Other studies have shown higher mortality (21). There was a higher prevalence of marasmus amongst the HIV positive children. In addition patients were significantly stunted and wasted with a low weight for height suggesting acute malnutrition. This is in contrast to the findings of Kurawige in Rwanda where chronic malnutrition (low height for age) was more common (10).

There are far reaching social and economic consequences of the devastating pandemic. Some of these are the AIDS orphans, many of whom are malnourished, worsening the burden on health care resources. The WHO has estimated that at least three
million women and children will die of AIDS in the 1990's and that more than one million unaffected children will be orphaned because of HIV-1 infection in their parents (34). In March 1994 the Herald (a local newspaper) reported that there were 60,000 malnourished children in Harare. The reasons for malnutrition were thought to be drought, ESAP and AIDS (35). Mortality from HIV was also on the increase (36). The finding that 50% of children admitted to Harare Hospital with malnutrition are HIV positive suggests that HIV/AIDS is becoming a major cause of malnutrition for hospitalised children in Zimbabwe. Furthermore, their failure to respond to routine nutritional rehabilitation poses further problems in longterm management. The problem is highlighted by Prazuck (19): "The cost of hospitalization and drugs is extremely high and the cost effect ratio extremely poor for these low income families. Should paediatric wards undertake a more specific management of malnourished children in HIV?"
CONCLUSIONS

1. Kwashiorkor and marasmic-kwashiorkor were the commonest diagnoses in malnourished children admitted to Harare Central Hospital nutrition wards.

2. Approximately half of the malnourished children tested were HIV positive.

3. Malnutrition with HIV/AIDS was difficult to differentiate from malnutrition alone but oral thrush, ear discharge and lymphadenopathy were useful distinguishing features.

4. Kwashiorkor occurred in both seropositive and seronegative children.

5. Children with HIV infection were more stunted and more wasted than those without HIV.

6. Children with HIV infection had prolonged symptoms in hospital, namely persistent diarrhoea, poor appetite and apathy.

7. The overall Case fatality rate was 35% while the study mortality was 23.9%. The mortality in children who were HIV infected was marginally significantly higher.
RECOMMENDATIONS

1. All malnourished children should be screened for HIV antibodies. This will enable those who are HIV positive to be given early nutritional rehabilitation in hospital.

2. Home-based care programmes need to be established to prevent costly hospital admissions and also to try to encourage the relatives to participate in the care-giving.

3. HIV seropositivity is a significant factor causing stunting and wasting. Anthropometric measurements (especially height which is frequently omitted) need to be plotted accurately to detect stunting and wasting early. This will enable early nutritional rehabilitation.

4. Simple measures like starting salt sugar solutions early in diarrhoea will reduce the severity of dehydration, which was a significant finding in HIV infected children.

5. Health personnel need to have an objective rather than a discriminating attitude towards HIV/AIDS patients. Counselling of mothers whose children are HIV positive should be done with confidentiality, sympathy and concern.

6. Social and psychological support of the parents of children with HIV infection is necessary.
REFERENCES


17. Epi-info Version 5.00. Centers for Disease Control. Epidemiology Programme Office Atlanta Georgia. World Health
 Organisation, Global Programme on AIDS, Geneva, Switzerland.


34. Lepage P, Hitimana DG. Natural history and clinical presentation of HIV-1 infection in children. AIDS 1991 (suppl 1) S117-S125.

