Chapter 5

Discussion

5.1 Introduction

In this chapter, the anthropometric and neurodevelopmental results of this study are discussed, and are compared with research findings. The possible reasons for the similarities and differences are mentioned.

This study examines the effects of HIV infection on the child's neurodevelopment and anthropometric measurements at two time points. The findings are that the HIV infected group shows lower mental and motor developmental scores, than the HIV uninfected group, at both time points with no significant changes between these two time points. The HIV infected group show lower anthropometric measurements than the HIV uninfected group. The HIV infected group show significant improvements over time in weight-for-age, weight-for-height and head circumference-for-age, but not in height-for-age. The HIV infected children are therefore not only at risk of neurodevelopmental delays, but also growth delays, particularly that of height-for-age.

Institutionalised children were chosen for this study because their living environmental conditions were standardised and fewer variables were needed to be taken into consideration when analysing the results. The children were easily accessible and were likely to be available for follow up evaluations.
The children in this study require alternative placement and this indicates that they are children in need. There is therefore a possibility that these children’s nutritional and medical requirements were probably not met prior to admission to the institutions.

Four children, who needed parental consent to test their HIV status, were assumed not to be infected and classified into the HIV uninfected group. They did not show any clinical signs or symptoms to warrant testing. There is a possibility that some of these children could have been HIV infected. Since there were only four such children, a different group allocation would only marginally alter the results and the overall statistical effect would likely to have been minimal.

The follow-up evaluations of this study were completed at six to eight months after the initial evaluation because this allowed enough time to note a change in the children’s anthropometric and neurodevelopment measurements. All the children were under the age of 42 months of age as this is when growth and neurodevelopmental changes occur rapidly. In addition, the South African government was due to initiate the “roll-out” of ART, which could have included children in this study who were HIV infected. This intervention could have had an influence on the results.

The BSID II does not accommodate index scores below 50, so extrapolated index scores were used for the children whose index scores were below 50. The extrapolated scores range from 50 to 30 (Robinson
and Mervis 1996) and an index score of below 30 is allocated a score of 29 (Macmillan et al. 2001, Smith et al. 2000). This allocation may result in an overestimation of results. It is, however, unlikely that a child could score any less than the observable minimum and a score of zero is highly unlikely. This allocation also reduced the influence of the extremely low scores and allowed for a more appropriate estimation of the mean value (Smith et al. 2000).

5.2 Neurodevelopmental discussion

This study is based on the mean scores and shows that HIV infected children score significantly lower than HIV uninfected children in both the mental and motor development at both time points. This is supported by the analysis of covariance results. These findings are similar to those of other researchers and indicate that HIV has an influence on the neurodevelopment of HIV infected children (Belman et al. 1988, Msellati et al. 1993, Nozyce et al. 1994, Chase et al. 1995, Drotar et al. 1997, Knight et al. 2000, Chase et al. 2000, Gay et al. 1995, Blanchette et al. 2002). In addition, past and present opportunistic infections could also have an impact on their neurodevelopmental scores (Drotar et al. 1997). Even though, at the time of all neurodevelopmental evaluations, the HIV infected children in this study were deemed ‘healthy’ by the sister in charge, their immunological state and viral load was not tested and this could have interfered with optimal neurodevelopmental performance. The mental and motor delays may have been as a result of the child’s
systemic illness rather than due to the direct effects of HIV infection on the CNS (Drotar et al. 1997).

In this study, there is a difference (greater than one standard deviation) in the mental and motor mean scores of the HIV infected children when compared to those of other studies (Nozyce et al. 1994, Chase et al. 1995, Drotar et al. 1997, Knight et al. 2000, Blanchette et al. 2002). The differences in the mean scores of this study are greater than minus three standard deviations when compared to the minus two standard deviations of other studies for children who did not have neurological impairments (Nozyce et al. 1994, Chase et al. 1995, Drotar et al. 1997, Knight et al. 2000, Blanchette et al. 2002). Knight et al. (2000) and Chase et al. (2000). The above authors also mention that neurodevelopmental scores greater than two standard deviations below the mean are indicative of children with neurological concerns. These children are described as showing “abnormal neurological signs” (Knight et al. 2000) or “neurological impairments” (Chase et al. 2000). Although the children in this study have scores greater than three standard deviations below the mean, they show no signs of neurological impairment, however, a comprehensive neurological examination was not conducted. The greater delay found in this study indicates that there may be other factors, besides the HIV, that are affecting their neurodevelopment (Chase et al. 2000).
The HIV infected children in this study, show no significant change between time 1 and time 2 with regards to their mental development. Their mean score did, however, improve slightly. They could therefore probably be classified as children with static encephalopathy, because their development, although delayed, followed their own developmental curve, achieving new milestones at their own rate. This is similar to other research findings (Epstein et al. 1988, Msellati et al. 1993, Spitaels 1994, Chase et al. 1995, Gay et al. 1995, Emodi and Okafor 1998). However, for the children in this study, the encephalopathy needs to be confirmed by CT scan and/or further follow-ups over a longer period of time.

Blanchette et al. (2002) and Gay et al. (1995) explain that, with time, the HIV affects the children’s mental abilities and they show more regression with time because they are expected to reach more complex and integrative language and cognitive levels. Gay et al.’s (1995) findings indicate that as the child gets older, more language related skills are required on the MDI, whereas on the PDI the child learns through imitation rather than via verbal instructions. HIV infected children are known to experience difficulty with speech, language and communication (Layton and Scott 2000). They have difficulty in carrying out verbal instructions without the associated physical demonstration and also have difficulty with verbal responses. Since the BSID II has more language based items after the age of 18 months, this impacts more on the mental than on the motor scores (Gay et al. 1995). Follow-up evaluation of the subjects in this study would thus be of interest and value to determine if
further developmental delays, particularly in their mental abilities, are likely to evolve as they get older.

It is not known whether the length of stay at the institution has a positive or negative effect on the children and further investigation is required.

This study shows that the HIV infected children’s motor scores at both time points were also markedly delayed, this delay being even more than their mental scores. Numerous research studies have reported the same findings, namely that in HIV infected children, motor development was more affected than mental development (Epstein et al. 1986, Drotar et al. 1997, Chase et al. 1995). Blanchette et al. (2002) found that HIV infected children showed a mean score that is mildly delayed on MDI, but significantly delayed on PDI. This is in contrast to Macmillan et al. (2001) who reports equally reduced mental and motor scores, but states that they were based on a small sample size. Although the onset of motor disability is found to be earlier than the onset of mental disability (Msellati et al. 1993, Chase et al. 1995), early mental delays have more significance on developmental outcome than motor delays (Chase et al. 2000).

A factor that could affect the motor abilities of HIV infected children is that they have a higher resting-energy-expenditure than HIV uninfected children. They are therefore in need of more calories (Miller 2000, Laufer and Scott 2000). The HIV as well as previous and present opportunistic
infections has an impact on energy expenditure. This is because these children need more calories when they are fighting an infection, have a raised temperature and/or have acute diarrhoea (Miller 2000, Laufer and Scott 2000). Other factors that would affect calorie intake are; the availability of enough nutritional food to meet the child’s metabolic needs (Laufer and Scott 2000), the ease/difficulty the child has in ingesting the food and the subsequent absorption/malabsorption of this food. An imbalance between energy intake, absorption and metabolic needs of the child may impact on their muscle strength and hence their motor development.

In this study, not only are the HIV infected children’s mental abilities more delayed than in other studies, but this is also the case with the results of the HIV uninfected children. The mean mental scores of the HIV uninfected children are within two standard deviations from the mean and there is no significant change with time albeit that there is a slight improvement. These scores are lower than other research findings which are within one standard deviation (Nozyce et al. 1994, Chase et al. 1995, Drotar et al. 1997, Knight et al. 2000, Blanchette et al. 2002). This suggests that there were factors influencing the mental abilities of both the HIV infected and HIV uninfected institutionalised children in this study. One such factor could be the home circumstances from whence the child originated, prior to admission to the institution. This could have had a negative influence on their mental development. This was the finding of Coscia et al. (2001), who mentioned that HIV infected children
living in a deprived environment are less stimulated and show an associated impairment in their cognitive functioning. There is a greater association when the state of the child’s health is poor. In contrast to this, Drotar et al. (1997) shows no correlation between cognitive development and home environment.

In contrast to the mental development of the HIV uninfected children, their motor development is within one standard deviation from the norm and this is the same as in other research findings (Chase et al. 1995, Drotar et al. 1997). Over time, this study shows further improvement in motor development which is statistically significant but still only within one standard deviation. This indicates that the HIV uninfected children in this study were not deprived of motor stimulation prior to admission to the institution, and that their motor development improved further when institutionalised. This is based upon changes in this measurement as can be seen in the results. No studies were found which describe the difference between the mental and motor functioning of children from deprived socio-economic environments.

5.3 Anthropometric discussion

The anthropometric norms are based on international standards. For this reason, the comparison of anthropometric measurements in this study is of children from similar socio-economic backgrounds and environmental circumstances, as recommended by Lepage et al. (1996).
5.3.1 Weight-for-age

This study shows that HIV infected children are significantly more undernourished (low weight-for-age) than the HIV uninfected children, at both time points (-2.7; -0.9 and -1.8; -0.6 respectively) and these results are similar to the study by Lepage et al. (1996). However, in this study, over time, there was a significant improvement in the HIV infected children’s weight-for-age which is unlike the findings of the study by Lepage et al. (1996) and also those in the study of Moye et al. (1996) where they found a decrease in weight-for-age of HIV infected children between the ages 12-36 months. This study shows that the HIV virus has an impact on the weight-for-age of HIV infected children, but it also shows that there are other factors affecting the weight of the HIV infected children because there is a significant improvement over time. This is supported by the fact that, during the same time period, there was also a significant improvement in weight-for-age of the HIV uninfected children. Therefore, because both groups showed an improvement over time, it indicates that there is a common factor influencing their weight-for-age measurements. This is likely to be due to better nutrition and absorption during the time of the study because malnutrition impacts on weight-for-age (Nathan et al. 2003, Moye et al. 1996). Severe malnutrition and the effects of the HIV have similar effects on the gastrointestinal tract that results in malabsorption of food. Therefore, a child who is HIV infected and also malnourished has a worse outcome regarding growth than if they had only one of the conditions (Miller 2000). The children in this study originated from similar situations as the
subjects in the study by Meyers (2000). In that study, the percentage of malnutrition in HIV infected children is double that of HIV uninfected children which results in the main reason for hospital admission of HIV infected children is due to malnutrition and infectious diseases. The findings are also similar to the study in West Africa, which shows that malnutrition and respiratory infections dominate admissions of HIV infected children into their hospitals (Vetter et al. 1996).

5.3.2 Height-for-age

This study shows that HIV infected children are significantly more stunted (low height-for-age) than the HIV uninfected children at both time points (-3.0; -2.0 and -3.5; -1.4 respectively). This is supported in the analysis of covariance. This was also the finding of other researchers (Lepage et al. 1996, Moye et al. 1996, Nathan et al. 2003). In this study, over time, the height-for-age did not change significantly and this is similar to the finding of Nathan et al. (2003). They mentioned that despite adequate and appropriate nutrition, severe stunting in HIV infected children was present over time. Moye et al. (1996) found a progressive decrease in linear growth of HIV infected children. This study shows that the HIV virus has an impact on the height-for-age of HIV infected children which does not change with time. It is supported by the analysis of covariance results that shows a marginally significant difference between the HIV infected and HIV uninfected children despite both groups having the same care during the time of this study. The HIV infected children did not
show a significant change in height-for-age over time, whereas the HIV uninfected children did show a significant change.

5.3.3 Weight-for-height

In this study, over time, there is a significant increase in the means scores (-0.6; 0.4 and 0.2; 0.3 respectively) of weight-for-height in the HIV infected children because of an improvement in their weight-for-age but not their height-for-age. This is supported by the analysis of covariance results. At time 1, the HIV infected children were not only stunted (low-height-for-age) but also undernourished (low weight-for-age) which resulted in them being wasted (low weight-for-height). However, at time 2, there was a significant change in weight-for-height because of the significant change in their weight-for-age but not height-for-age. This was also the finding of other researchers who state that HIV infected children are stunted, but not wasted (Nathan et al. 2003, Lepage et al. 1996) and Miller (2000) who mentions that malnutrition is the likely cause of wasting (low weight-for-height). This is supported by the fact that, in this study, because the mean scores of weight-for-age of both HIV infected and HIV uninfected children improved significantly with time, the children were possibly undernourished (low weight-for-age) at time 1 and experienced some “catch-up” growth by time 2.

5.3.4 Effect of HIV on weight- and height-for-age

The HIV, in an infected child, can cause a low weight-for-age and height-for-age mean scores for the following reasons. Firstly, an HIV infected
child has an increase metabolism with a higher resting energy expenditure that requires more calorie input than an uninfected child (Miller 2000, Laufer and Scott 2000). Secondly, during an infection, the child’s temperature is raised causing more calories to be needed which further increase energy expenditure (Lepage et al. 1996, Moye et al. 1996, Miller 2000). Thirdly, the nutritional status of a HIV infected child is dependent on the availability of nutritious food and the ability of the child to ingest and absorb the food to meet their required energy needs (Miller 2000).

5.3.5 Head circumference-for-age

This study shows that the mean z-scores for head circumference-for-age (-1.6; -0.5 and -1.2; -0.3 respectively) of HIV infected children were significantly lower than HIV uninfected children at both time points. These findings are similar to those of other researchers (Lepage et al. 1996, Moye et al. 1996) and indicative of the neurotrophic effects of the HIV (Moye et al. 1996). However, in this study, over time, there is a statistically significant improvement in the head circumference-for-age in the HIV infected. This is in contrast to the findings of Moye et al. (1996) who found a decrease in head circumference-for-age till 18 months; and even until 24 months in the study by Macmillan et al. (2001). The children in this study had a reduced but not regressing head circumference-for-age score, indicating that there may have been neurothrophic effects that stabilized, and that there are other factors involved. This finding is supported by the fact that, over time, the HIV
uninfected children also showed an improvement in their head circumference for-age mean scores.

5.3.6 Association between head circumference-for-age and neurodevelopment

In this study there is a significant association that exists between head circumference-for-age and neurodevelopmental measurements at both time points. Researchers Dolk (1991) and Chase et al. (1995) have different opinions regarding the relevance of the finding is this study is thus unclear. A reduced head circumference could be interpreted as impaired brain growth which is associated with developmental delays (Dolk 1991). However, researchers like Dolk (1991) and Chase et al. (1995) are unable to correlate the relationship between head size and neurodevelopment. This requires further investigation.

5.5 Summary

The HIV infected children show severe delays in both mental and motor abilities, and scored lower than the HIV uninfected groups. This implies that the HIV affects the neurodevelopment of HIV infected children. However, there is also a delay in the mental, but not motor abilities of the HIV uninfected children. This indicates that possibly past and present living circumstances encouraged gross motor development more than mental development.
The HIV infected children showed greater delays in weight-for-age, height-for-age, weight-for-height and head circumference-for-age than HIV uninfected children. They remained stunted (low height-for-age) but less undernourished (low eight-for-age) and less wasted (low weight-for-height) over time. The HIV uninfected children showed significant improvements in weight-for-age, height-for-age and head-circumference-for-age, indicating that both groups were exhibiting “catch-up” during the time of the study.

This study represents a population of orphaned children in South Africa. The HIV infected children are at a higher risk of neurodevelopmental and growth delays but the HIV uninfected children’s results indicate that they are also at risk of growth and mental developmental delays.

5.6 Limitations of the findings

The following are some of the limitations of this study.

1. Since mean values for neurodevelopment were used, no allowance was made for the identification of individual changes in children. Therefore, those individual children who, over time, showed a substantial change or who showed minimal or no change, were not identified nor discussed.

2. The children in this study could be classified as “high risk” because of their need to be placed in an institution. This placing is an indication that their families were not able to cope with their needs. This factor could have affected the results, to a certain degree, in both the HIV infected and the HIV uninfected groups.
3. Since Cotlands has a hospice facility, the children admitted into this facility would be those requiring medical and specialist care. These children would be at greater risk of opportunistic infections and neurological involvement. The results of this study should not be applied in general to all institutions especially if they do not have a hospice facility.

4. The emotional and psychological affects of institutionalisation were not measured as they lay outside the scope of this study.

5. With larger sample sizes, a more detailed analysis of the areas within the BSID II would be possible in order to determine which facets of mental and motor skills are involved. The specific areas of strengths and weaknesses within each group were not identified nor discussed.

6. The use of an interpreter could have had some influence on the BSID II results, because she/he may not have adhered to the requests from the examiner to abide strictly to by the specified procedures set out in the BSID II manual. Any such influence is considered to be marginal.

5.7 Implications

The results from this study documents delays in the growth of HIV infected and HIV uninfected children with significant changes in time during the study. Although institutionalisation is not an internationally recognized method of assisting orphans, these children did benefit from the placement in respect their growth. This implies that the children from this study probably originated from an environment that was nutritionally deprived.
The low mental developmental scores of the HIV infected children and the HIV uninfected children, which did not show a significant “catch up” in time, implies that the children probably originated from an environment which provided limited mental stimulation, and the institutionalised placement did not have an influence on this measurement.

Continued neurodevelopmental assessment and growth recordings of HIV infected children need to be integrated into their routine care. This will ensure prompt and reliable identification of children at risk of neurological involvement and growth impairment.

5.8 Further research

Follow up research over a longer period of time, within the institutional setting, of both HIV infected and HIV uninfected children should provide clarity as to the effects of institutionalisation on the children’s growth and neurodevelopment.

Follow-up research comparing the growth and neurodevelopment of institutionalised and community supported HIV infected children could indicate which means of support are more beneficial to the child.

Follow up research of the HIV infected children’s neurodevelopment and growth outcome after the implementation of antiretroviral therapy.
Follow up research of the HIV infected children’s neurodevelopmental outcome after the implementation of an early stimulation programme.

These follow-up investigations are of great importance in order to add to the research done in South Africa, and also to better understand and deal with this problem in the South African context.