

Chapter 3

Methods and materials

3.1 Study design

This comparative, longitudinal study aims to determine the neurodevelopmental and anthropometric measurements of HIV infected and HIV uninfected institutionalized children at two time points. This chapter details the ethical considerations, methodology, demographic information and assessment tools used in this study.

3.2 Ethical clearance

The Committee for Research on Human Subjects of the University of the Witwatersrand gave unconditional ethical clearance prior to the commencement of this study. Clearance certificate number M02-05-40 (see Appendix I).

Permission to conduct this study at Cotlands Baby Sanctuary was obtained from the Child Care Director of Cotlands, Ms J Schoeman. Dr F Christians, the Medical Director of Salvation Army, gave permission for the study to be carried out at Bethesda home (see Appendix II).

3.3 Sample selection

All children between the ages of 16 and 36 months, residing at these institutions were identified.

3.3.1 Inclusion criteria

- a) The HIV status of the children was confirmed either by polymerase chain reaction test at any age, or by the Elisa test after the age of 16 months. These children were committed to the institutions under Section 15 (1) (c) of the Child care act no 74/83, as amended, and the institution therefore had the right to test their HIV status.
- b) Children who needed parental consent to test their HIV status, and who showed no clinical signs or symptoms to warrant testing, were classified into the HIV uninfected group.
- c) HIV was vertically transmitted.
- d) Children were declared fit for neurodevelopmental evaluation by the sister-in-charge of each institution.

3.3.2 Exclusion criteria

- a) Children not residing in the institution because of placement into foster homes, adoption or having been returned to a family.
- b) Children with a history of brain injury as a result of a cerebral event, and children classified with a syndrome or

a muscular skeletal deficit.

- c) Children with an invalid BSID II score due to a refusal to complete 90% of the test items.
- d) Children on antiretroviral therapy prior to the commencement of the study.

3.3.3 Study population

The sample size was 40. At time 1, 16 children were HIV infected and 24 were HIV uninfected. Eight children were lost to follow up. At time 2, 12 children were HIV infected and 20 were HIV uninfected.

The two group t-test of equal means (unequal numbers), with a sample size of at least 10 and 20, had a power of 80% to detect a difference in means and a confidence interval of 95%. The sample size of this study was 12 and 24.

The children who were placed in the care of the institutions were from the same urban area. They were assumed to be from similar socio-economic and cultural backgrounds. All the children were black South Africans. Their placement was due to family circumstances that were not conducive to the well-being of the child.

3.4 Location

Both institutions were situated in the southern suburbs of Johannesburg, Gauteng, South Africa. The one was Cotlands, in Turffontein, South Johannesburg and the other, Bethesda, in Klipspruit, Soweto.

Both institutions had an average staff to children ratio of 1 to 6, had functioning pre-schools which catered for children from 2 years of age, and used Chris Hani Baragwanth hospital as their referring hospital.

3.5 Assessment tools used

3.5.1 Bayley scale of infant development, second edition (BSID II)

The children in this study were evaluated neurodevelopmentally using the BSID II. It is comprised of two scales with standardised norms: the mental development index (MDI) which assesses the child's cognitive abilities, and the psychomotor development index (PDI) which assesses the child's fine and gross motor skills. The BSID II was chosen because;

- it is widely used internationally and highly regarded in clinical and research circles,
- it is used in developed and developing countries,
- it is validated for children with special needs and developmental delays, including HIV infected children,
- it permits comparative performances of same-age peers,
- it permits comparisons over time.

3.5.2 Anthropometric measurements

A child's height and head circumference were measured using the BSID II measuring tape. The child's height was measured vertically. A calibrated digital, standing scale was used to measure the child's weight.

3.6 Procedure

The children identified for the study were evaluated neurodevelopmentally and anthropometrically at two time points, time 1 and time 2. At entry into the study, time 1, they were aged between 16-37 months and at time 2, they were 21-42 months of age. All children who met the inclusion criteria were selected. Page one of the form titled 'Child's details' (see Appendix III) was completed by the researcher, using the data obtained from the institutions. This detailed the name of the institution, the child's first name, date of birth and date of admission into the institution. Only the child's first name was used for anonymity reasons and a number was allocated to each child to assist with record keeping.

New admissions into the institutions were included in the study after a period of two months. This allowed time for the child to settle in and to get accustomed to the environment, caregivers and to the routine of the institution.

Every attempt was made to ensure that the researcher remained objective and unaware of the HIV status of the children. However, it could be assumed that those children who resided in the Cotlands Hospice section were more likely to be HIV infected than those in the Cotlands Sanctuary section. The researcher had no access to the child's full name or to their records.

The researcher completed all the BSID II and all anthropometry measurements. The evaluation was postponed if the child was acutely ill.

When evaluating a child using the BSID II, it was necessary to obtain the child's typical performance and it was thus essential for the researcher to establish a rapport with the child. When necessary, a caregiver accompanied the child initially, or throughout the evaluation. The evaluation began with the BSID II, followed by the child's anthropometry measurements. The evaluation was done in a separate room with few distractions. The room was large enough to complete the gross motor items. The evaluation was always carried out at a table, with the child seated in a position where the child was most comfortable. This was usually on the chair, but occasionally on the lap of the researcher or caregiver.

The test was administered in as short a time as possible, to ensure that the child's co-operation and attention was maintained. The time taken for an evaluation was approximately one hour. If the child tired, or became

unco-operative, the evaluation was abandoned and continued at another time.

The language used during the test was either English or the child's own South African language. Because the researcher was only able to converse in English, if it was necessary, an interpreter was used. The interpreter was one of the child's caregivers.

The BSID II test was administered using the standard test procedures as specified in the BSID II manual. The test items were started at the child's chronological age (Mayes 1997, Gauthier et al. 1999). Flexibility was permitted in the order of presentation of the test items. The researcher presented the items in the manner she felt would elicit the child's typical performance. Scoring was completed on either the cue sheets or record forms. Raw scores were obtained and converted to standardised, age-related index scores in both the mental (MDI) and psychomotor (PDI) scales. Extrapolated index scores were used for children who received a BSID II index score of 'below 50' (Robinson and Mervis 1996).

Extrapolated scores ranged from 50 to 30. An extrapolated index score below 30 was allocated an index score of 29 (Macmillan et al. 2001, Smith et al. 2000). The standard scores have an arithmetic mean of 100 and a standard deviation (SD) of 15.

The distribution of neurodevelopment index scores within the MDI and PDI was classified according to Interpretive Guidelines of the BSID II (1994) using index scores (see table 3.1).

For clinical significance purposes, the MDI and PDI scores were divided into acceptable scores, i.e. within two standard deviations from the mean and delayed scores, i.e. those greater than two standard deviations from the mean (see table 3.1).

Table 3.1

Distribution and clinical significance of the BSID II index scores

Index score	Distribution of index scores	Standard deviation	Clinical significance
115 and above	Accelerated performance	> +2 SD	acceptable
85-114	Within normal limits	± 1 SD	acceptable
70-84	Mildly delayed performance	-2 SD	acceptable
69 and below	Severely delayed performance	> -3 SD	delayed

After completion of the BSID II, the child's anthropometry was recorded. Height and head circumference were measured in centimeters to the nearest millimeter. Weight was measured in kilograms to the first decimal place.

The child's height was measured, whilst he/she stood erect, in bare feet, with his/her back against the wall. The child's heels were comfortably

positioned a few centimeters from the wall. A firm board with 90-degree corners was placed vertically on top of the child's head and aligned at 90 degrees against the wall to obtain a reliable horizontal reading of the child's height. A mark was made on the wall. The height was measured from the floor to the mark using the BSID II tape measure. This is a strong, two centimeter wide, non-stretch, plastic measuring tape.

The child's head circumference was measured using the same measuring tape. The tape was placed horizontally across the child's forehead and around the occiput. Three measurements were taken and the average recorded.

The child's weight was recorded using a calibrated digital standing weight scale. The child's shoes and all heavy clothing were removed prior to weighing. The scale was calibrated prior to the commencement of the study and twice during the study. It was zeroed before each weighing.

The follow-up evaluations, referred to as time 2, were completed between six to eight months after the child's initial evaluation, and referred to as time 1. The procedures for recording the neurodevelopmental scores and anthropometric measurements were the same as at time 1.

On completion of the child's follow-up evaluations, page 2 of the form 'Child's details' was completed (see Appendix III). This details the child's HIV status, type of HIV test used, the child's age at time of testing as well as whether any anti-retroviral treatment had been given, and if so, when the treatment commenced. Antiretroviral treatment was an exclusion criterion prior to commencement of the study. Since the researcher was blinded to the HIV status of the study participants, those who began antiretroviral therapy during the study were not known and could therefore not be excluded.

3.7 Statistical Analysis

All data collected were analysed with the assistance of Professor P. Becker of the Medical Research Council of South Africa (Stata 2003).

The data recorded included the child's allocated number, HIV status, age at evaluation, mental (MDI) and psychomotor (PDI) index scores, height, weight and head circumference. These recordings were made at time 1 and time 2.

A two sample t-test, with equal variance, was used within the HIV infected group, at time 2, to compare the children treated with antiretroviral therapy (ART) and those not on ART.

A two sample t-test, with equal variance, was used to compare the demographic data of the HIV infected and HIV uninfected groups. The

demographic data included the children's sex, their age, length of stay at the institution before time 1 and the time elapsed between evaluations.

The child's weight, height, weight-for-height and head circumference measurements were calculated into standardised z-score anthropometric indexes, and were referred to as weight-for-age z-scores, weight-for-height z-scores and height-for-age z-scores.

They were calculated as follows:

The anthropometric z-score equals (actual anthropometric measurement) minus (mean of the measurement) divided by (reference standard deviation).

The anthropometric z-scores and the neurodevelopmental index scores were compared "within each group" using a paired t-test and "between the groups" using a two-sample t-test with equal variance. This was followed by an analysis of covariance.

A paired t-test was also used to compare, "within each group" (HIV infected and HIV uninfected), mean changes between time 1 and time 2 in anthropometric z-scores and neurodevelopmental index scores.

A two sample t-test, with equal variance, was used to compare, "between the groups" (HIV infected and the HIV uninfected) with respect to the

mean differences at time 1 and time 2 in anthropometric z-scores and neurodevelopmental index scores.

An analysis of covariance, with adjusted baseline, was used when comparing the groups with regards to mean anthropometric z-scores as well as neurodevelopmental index scores.

The Pearson correlation coefficient was used to assess the association that existed between head circumference-for-age, z-scores and neurodevelopment index scores.

In all the statistical analyses in this study a p-value (probability value) of less than 0,05 was considered to indicate statistical significance.