MOTOR DEVELOPMENT OF CHILDREN ATTENDING CRÈCHES IN THE PLATFONTEIN COMMUNITY

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DECLARATION

I, Miriam Steinberg, declare that this research report is my own work. It is being submitted for the degree of Master of Science (Physiotherapy) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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30 day of January 2017

ABSTRACT

Background: The early childhood years, is an important period in a person's formative life. These are the foundational years for development. There are many intrinsic and extrinsic factors that can negatively affect childhood development. Assessing the development of children is important. If a problem is detected, prompt intervention may prevent further impairments.

The Platfontein community is a San bushmen community consisting of the !Xun and Khwe tribes. This is a very poor community that faces many challenges. Of these challenges, many have the potential to hinder healthy childhood development. The current level of development of healthy children in the Platfontein community is not known.

This was a descriptive cross sectional study. A sample of convenience was used as all children that attended the crèches in the Platfontein community were invited to participate in the study.

The objectives of the study were as follows 1) to determine whether the children that attend the crèches in the Platfontein community present with motor developmental delay 2) to determine the demographics (including morbidities) and anthropometric data of the study participants, 3) to determine the level of motor development in children between the ages of three and six years who attended the local crèches in the Platfontein community, 4) to establish the nature of the relationship between the existing morbidities and the motor development of the children attending the crèches in Platfontein and 5) to establish if there was a difference in motor development of children assessed between the two crèches, the two tribes, 6) to compare the motor development of the children attending the crèches in the Platfontein community to that of children in other national or international studies.

Methods: The Movement Assessment Battery for Children-2 (M-ABC2®) was administered to determine the motor development of the children attending the !Xun and the Khwe crèches. Demographic and anthropometric data were also collected. Microsoft Office Excel 2007 and the SAS system statistical programme were used to analyse the data.

The Fishers exact test was used to compare the morbidities between the two crèches as well as the association between the morbidities and the M-ABC2® percentile rank.

The final M-ABC 2® categories were compared using the Chi-square test. A p-value of≤ 0.05 was deemed statistically significant.

Results: Demographic information was obtained for 64 participants, anthropometric data for 63 participants and 54 M-ABC-2® were successfully completed. In total 54% (n=29) participants did not have a risk for motor developmental delay, 24% (n=13) were at risk for motor developmental delay and 22% (n= 12) had a definite motor developmental delay. The test result of the manual dexterity subcategory was the task of most concern as 68.5% of the sample scored at or below the 5th percentile of the M-ABC2® manual dexterity components. Statistical analysis revealed no relationship between the following morbidities: malnutrition [p=0.19], stunting [p= 1.00] and a history of Tuberculosis (TB) [p=0.49] and motor development. There was no statistical significant difference between the M-ABC-2® scores of the children attending the Khwe and the !Xun crèches.

Comparing these results too other South African studies, this sample scored much lower. Buys (2014) reported that 85% did not have a risk for developmental delay and that 15% were at risk for, or had a developmental delay. Gritzman (2012) reported that 80% did not have a risk for motor developmental delay and that 20% were at risk or impaired. The socio economic statuses of the samples in both studies were of a higher status than those of the Platfontein sample.

Comparing the results to Brazilian studies, this sample also scored lower. Valentini et al (2012) reported that 64.2% of children in the study population did not have a risk for developmental delay and that 35, 8% were at risk for or had a developmental delay. Valentini, Clark and Whitall (2014) reported that 63.3% of children in the study population did not have a risk for developmental delay and that 36.7% were at risk for or had a developmental delay

Conclusion: There is a motor developmental delay of the children attending the crèches in the Platfontein community as measured by the M-ABC-2® and when compared to national and international studies. An intervention programme is advised.

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LIST OF ABBREVIATIONS

AIDS	- Acquired Immuno-Deficiency Syndrome
ADL	- Activities of Daily Living
BOT™-2	-Bruininks-Oseretsky Test of Motor Proficiency, Second Edition
CP	- Cerebral Palsy
CNS	- Central Nervous System
DDST II	-Denver Developmental Screening Test II
DCD	- Developmental Co-ordination Disorder
ECDC	- Early Childhood Developmental Centres
FASD	- Fetal Alcohol Spectrum Disorder
FAS	- Fetal Alcohol Syndrome
pFAS	- partial FAS
ARND	- Alcohol-related neurodevelopmental deficits
ARBD	- Alcohol related birth defects
HAART	- Highly Active Antiretroviral Therapy
HIV	- Human Immunodeficiency Virus
KHC	- Kimberley Hospital Complex
M-ABC®	- Movement Assessment Battery for Children
M-ABC2®	- Movement Assessment Battery for Children 2ndversion
NRTI	- Nucleoside reverse transcriptase inhibitors
PMTCT	- Prevention of mother to child transmission
SA	- South Africa
SD	- Standard deviation
TB	- Tuberculosis
UNICEF	- United Nations
USA	- United States of America
WHO	- World Health Organisation

CHAPTER ONE

1. INTRODUCTION

The early childhood years, are an important period in a person's formative life. These are the foundational years. In this period a child's physical growth is rapid, movement and mobility skills develop. The basis of communication, speech and social development begins and the start of cognitive and emotional skills is rooted here (Fernald, Kariger, Engle and Raikes, 2009; Campbell, Palisano and Orlin, 2012). A loving and well stimulated start to life is of great importance (Centre on the Developing Child Harvard University, 2009; Nicholson, et al., 2016). This is captured well by the South African Department of Social Development's slogan: 'Every child has the right to the best possible start in life' (Department of Social Development Republic of South Africa, 2006).

Assessment of childhood development in under-resourced communities is important to ensure timeous intervention for problems of development and for the prevention of potential delays (Department of Social Development Republic of South Africa, 2006). A milestone is a specific skill or task that a child is expected to achieve at a certain age. Each milestone and stage of the development continuum has a specific purpose and is the building block on which the next milestone is built (Telkin, 2008). The World Health Organisation (WHO) has developed the 'Windows of Achievement' for six gross motor milestones which represent a normal range for the timing of the achievement of these milestones (Martorell, et al., 2006). The aim of monitoring developmental milestones in young children is to identify developmental delays. A developmental delay is regarded as a child not reaching an age related milestone which 90% of children at that age have achieved (Kelly, et al., 2006; Telkin, 2008). A developmental delay is often a sign of an underlying neurological abnormality or lack of adequate and appropriate developmental stimulation. Early detection and intervention of children with mild developmental delay may prevent further delay and possible disability (Mayson, et al., 2007). Delay can be seen either in a single domain of development or across all the developmental domains which include motor, language, social and cognitive development. If there is a developmental delay in two or more of these domains, it is referred to as a global developmental delay (Telkin, 2008).

Poverty, poor health, poor nutrition and non-favourable social circumstances hinder the optimal development of approximately 200 million children in developing countries (Walker, et al., 2007). An article describing childhood development published by Grantham-McGregor et al. (2007) stated that there is a correlation between poverty and childhood development.

Other factors that may also negatively influence the age expected achievement of developmental milestones include:

- The medical health of the child (Couper, 2016; Walker, et al, 2007).
- Malnutrition and stunting (Walker et al., 2007; Walker et al., 2011; Gladstone, et al., 2008).
- Environmental factors, including not having access to clean water and adequate sanitation services that may influence exposure to infectious or toxic agents (Walker, et al., 2007).
- Poor stimulating home environment (Centre on the Developing Child Harvard University, 2009; Nicholson, et al., 2016)
- Maternal or caregiver depression (Centre on the developing child Harvard University, 2009; Walker et al., 2011).

The Platfontein community is based in the Northern Cape, South Africa. This is an amalgamated San bushmen community consisting of the !Xun and the Khwe tribes. These two groups were relocated from Angola via Namibia to Schmidsdrift in the 1970's and then to the Platfontein farm in 2004 (Fredericks, 2012).

It is a very poor community which faces many challenges and has high rates of violence, alcohol abuse and infection with the human immunodeficiency virus (HIV). Unemployment as well as a low level of education among the community is of concern (Becker, 2012).

1.1 PROBLEM STATEMENT

Many children from Platfontein that require admission to the Kimberley Hospital Complex (KHC) are admitted with moderate to severe malnutrition, gastroenteritis or lower respiratory tract infections. Several of these children also have underlying tuberculosis (TB) and are infected with HIV. Difficult social issues often prolong hospital admission.

It was observed that children admitted to KHC from the Platfontein community:

1. presented with some global developmental delay; and
2. appeared to have a different sequence of gross motor development to that which is described in literature. Currently the level of development of children in the Platfontein community is not known (whether there is a delay and whether they do catch up if there is a delay) and therefore the study aimed to provide some data.

1.2 RESEARCH QUESTION

Do children attending the crèches in the Platfontein community present with motor developmental delays?

1.3 RESEARCH HYPOTHESIS

Children attending the crèches in the Platfontein community present with motor developmental delay.

1.4 AIM OF THE STUDY

To determine if children attending the crèches in the Platfontein community present with motor developmental delay.

1.5 OBJECTIVES OF THE STUDY

There were five objectives of this study:

- To determine the demographics (including morbidities) and anthropometric data of the study participants.
- To determine the level of motor development in children between the ages of three and six years who attended the local crèches in the Platfontein community.
- To establish the nature of the relationship between the existing morbidities and the motor development of the children attending the crèches in Platfontein.
- To establish if there was a difference in motor development of children assessed between the two crèches, the two tribes.

1.6 JUSTIFICATION OF THE STUDY

The subjective experience of the researcher is that in general the group of children from the Platfontein community who are admitted to KHC have a higher tendency for motor developmental delay compared to other children admitted to the paediatric ward. The WHO milestone assessment was used (WHO Multicentre Growth Reference Study Group, 2006) when assessing the children during hospitalisation. The researcher however aimed to determine the prevalence of motor development delay of 'healthy' children in the Platfontein community attending the crèches in the community so as to determine the prevalence of motor developmental delay of children in the absence of acute pathology. This would contribute to the body of literature regarding the current motor development among the children coming from poor communities, in this case the Platfontein community.

1.7 SIGNIFICANCE OF THE STUDY

The study will give an indication of the current motor development of the children in Platfontein. This will give therapists and other healthcare professionals a better idea of what

the motor development for this group of children may be. This will be beneficial when interpreting findings of motor development assessments of children from this community. If the study confirms that there is a significant delay in the motor development of children from Platfontein, stimulation, teacher, caregiver and parent education groups can be implemented in the community.

The following chapter will outline literature relating to the study.

CHAPTER TWO

2. LITERATURE REVIEW

Motor Development of Children Attending Crèches in the Platfontein Community.

In this chapter current literature on childhood development, associated factors which influence development and which are relevant to this study together with assessment of development is discussed. The Platfontein community is described. Search engines and programs used on the worldwide web included: Pubmed, MEDLINE, Google scholar and Wiley Online library. Textbooks have also been referred too. Search words used included: childhood development, motor development, developmental delay, assessment of development, malnutrition, Movement Assessment Battery for Children, Movement Assessment Battery for Children-2, Platfontein.

2.1 HEALTHY CHILDHOOD DEVELOPMENT

The WHO defines health as ‘’a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’’ (Constitution of World Health Organisation, 1948).

Development is the process in which a child grows from a dependent infant and matures into an independent individual. This process starts at conception and continues throughout life. It has been described as a process from ‘womb to tomb’ (Telkin, 2008).

Prenatal development of organs and systems occur in a specific pattern within a set timeframe. These systems continue to mature after birth. A rapid progression of neurodevelopment across various domains is seen in the first two years of life. These domains include gross and fine motor functions, cognition, speech and language and socio-emotional functioning. Gross motor skills develop first as they encourage development in the other domains (Campbell, Palisano and Orlin, 2012). The domains are mutually dependent for healthy child development (Baker-Henningham and Boo, 2010). Skills become more exact and are refined. Different theories describe the process of the refining of these skills. These theories are reviewed in more detail later in this section, but the refining is mainly as a result of a combination of the maturation of the sensory and motor systems by the child’s needs and use and daily practice of these skills (Engel-Yeger, Rosenblum and Josman, 2010). Dr Milani-Comparetti referred to this as ‘appointments with functions’ (Telkin, 2008, p17). Development is thus said to be a continuous systematic process, occurring in a typical sequence (Yvonne, Sacker and Nazroo, 2006).

Each stage of the development continuum has a specific purpose and is the building block on which the next milestone is achieved. A milestone is a specific skill or task that one expects a child to achieve at a certain age (Telkin, 2008). There are specific milestones in the different domains of development. Milestones are used to monitor the sequence and rate of the developmental process. The timing of the attainment of the milestones varies between each individual child (Sharma, O'Sullivan and Baird, 2008). Many factors have an influence on the attainment of milestones as well as the timing thereof (Teklin, 2008; Walker, et al., 2007; Walker, et al., 2011). There is however a normal or typical time range in which the specific milestones need to be reached for development to be considered healthy. The WHO Multicentre Growth Reference Study Group (2006) compiled 'Windows of Achievement' for the timing of six gross motor milestones in infants. Eight hundred and sixteen healthy infants from Ghana, India, Norway, Oman and the United States of America (USA) were studied. Infants were monitored by caregiver report and regular assessment over a two year period. Assessments included the timing of achievement of six gross motor milestones. These milestones included 1) sitting without support, 2) crawling on the hands and knees, 3) standing with assistance, 4) walking with assistance, 5) standing alone and 6) walking alone. Every child must first achieve these six gross motor tasks in order to be able to mobilise independently. These tasks are not culturally specific. This study also found no significant difference between the timing of achievement of these milestones between male and female and therefore results are reported for both genders together. Figure 2.1 shows the normal time ranges of achievement of these six gross motor tasks.

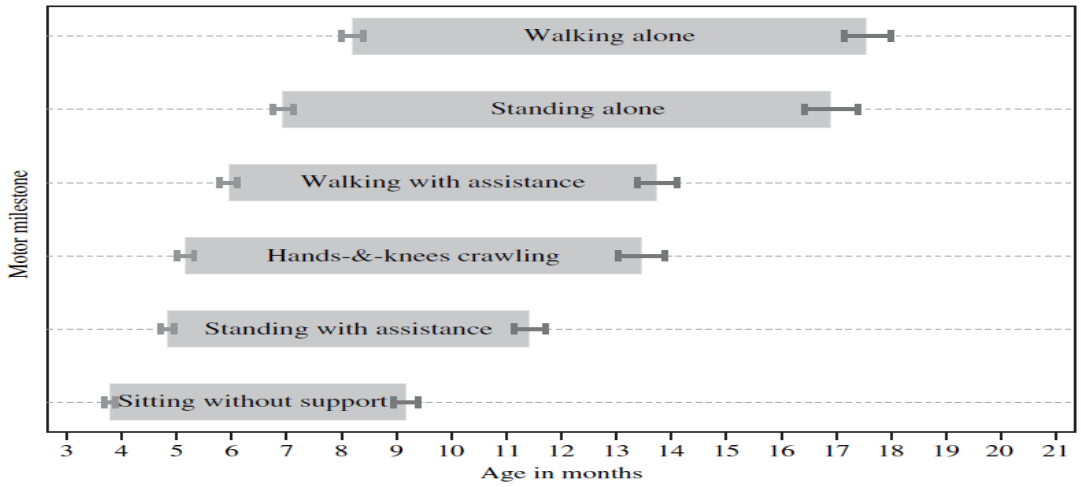

Figure 2.1: Windows of Achievement of Six Gross Motor Milestones as Reported by the WHO Multicentre Growth Reference Study Group (2006)

The grey block represents the percentile (1-95th) and the line indicates the confidence interval. It is interesting to note that 4.3% of the children did not crawl on hands or knees.

The gait cycle and other skills become more refined with time. The gait of a two year old child increases in speed. A typical two year old starts to climb on and off steps, kicks balls and pushes toys. A typical two year old also starts to partake in activities of daily living (ADL) such as feeding themselves and assisting with dressing of themselves (Campbell, Palisano and Orlin, 2012).

A typical three year old child has a better sense of speed, movement control and co-ordination than he had at the age when he started walking. Stair climbing continues to improve and riding of a tricycle begins. Hopping starts to develop. Feeding is nearly independent and a child is nearly able to dress himself independently with the exception of buttoning and tying of shoelaces. Urinary continence, during the day, becomes possible (Campbell, Palisano and Orlin, 2012).
A typical four year old is expected to walk down stairs, one step at a time and to catch objects with one hand. Running, jumping and climbing becomes more skilled (Campbell, Palisan and Orlin, 2012).
A typical five year old child is able to complete long jumps, skip and to throw objects overhead (Campbell, Palisano and Orlin, 2012).

Co-ordination of movement is an important component of normal function in everyday life (Engel-Yeger, Rosenblum and Josman, 2010). There are different theories that try to explain the process of movement development. The three main theories that have been described are the neural-maturation, cognitive and behavioural theories. These will be briefly discussed as described by Campbell in the second chapter of the book 'Physical Therapy for Children' (Campbell, Palisano and Orlin, 2012).

Neural-maturation, as initially described by Gesell states that the progression of task achievement occurs mainly due to the maturation of the central nervous system (CNS). He acknowledged the role of the environment in the process.
The behavioural cognitive theory, described by Skinners states that the environment is the primary motivator for motor and cognitive development. Piaget further stated that the interaction between the maturation of the central nervous system and responses that occur through environmental stimuli lead to movement and progression of movement.
Dynamical systems as defined by Thelen and colleagues as sited in Campbell, Palisano and Orlin, 2012 on pg 40, gives equal recognition to the role of the environment and various

bodily systems (CNS, muscular and sensory systems) in the achievement of tasks and progression thereof.

The first five years of a child's life are the 'golden years'. This is the period in which the foundation for further development is established. Fernald states that 'early childhood is the time of greatest risk and greatest opportunity'. It is thus important to monitor development to detect delays which can be an indication of infirmities or an underlying disease, abnormality or disability. If these are detected one can intervene timeously and appropriately (Fernald, Kariger, Engle and Raikes, 2009).

A good understanding of the typical development time frame is essential to detect, evaluate, manage and treat unhealthy or atypical development.

2.2 DEVELOPMENTAL DELAY

Developmental delay is defined when a child at a specific age does not achieve milestones which 90% of the children achieve at that specific age (Yvonne, Sacker and Nazroo, 2006). A delay can be seen either in a single domain of development or across all the domains, the latter is then referred to as a global developmental delay. There are many factors that impact and play a role in childhood development. These factors can either facilitate or hinder development.

2.2.1 Factors Associated with Developmental Delay

The Lancet review states that poverty, inadequate nutrition, illness and neglect prevent 200 million children under the age of five years from meeting their developmental potential (Grantham-McGregor, et al., 2007; Walker, et al., 2007). The sub- Saharan regions have the highest percentage of children who start life with a drawback (Grantham-McGregor, et al., 2007).

The factors associated with children presenting with developmental delay which bear relevance to this study, will be discussed in the section that follows.

2.2.1.1 Poor nutrition

According to the WHO, malnutrition is a state caused by deprived and inadequate nutrition. This is often accompanied by specific macro- and micronutrient deficiency. Malnutrition impairs physical and mental functioning of an individual (World Health Organisation and the United Nations Children Emergency Fund, 2009; United States Centres for Disease Control and Prevention, 2012). Malnutrition is classified as either acute (moderate or severe) or chronic (stunting).

Adequate nutrition in the early childhood years is crucial (Walker et al., 2011). Physical growth in the early years is a gauge of nutrition. Anthropometric measurements are used to define and categorise malnutrition (United States Centres for Disease Control and Prevention, 2012). For children between the ages of 6-59 months, moderate acute malnutrition is defined as a weight- for- height under two standard deviations of the median as plotted on the WHO growth charts (refer to Appendix A for the WHO growth charts). WHO Growth charts are universally used anthropometric charts to monitor growth. These are universal charts and are there are not specific charts available for specific ethnic groups. A measure of the left upper arm circumference of less than 115mm in children between 6-59 months is used to screen for malnutrition (United States Centres for Disease Control and Prevention, 2012).

Stunting is defined as height- for- age under two standard deviations of the median as plotted on the WHO growth charts (World Health Organisation and the United Nations Children Emergency Fund, 2009) (Appendix A). Stunting results from longstanding inadequate feeding (chronic malnutrition). Poor maternal health during pregnancy, repeated infectious diseases and poverty also contribute to the development of stunting (World Health Assembly Global Nutrition Targets, 2014). A Lancet review reported that a third of children in developing countries under the age of five years are stunted (Walker, et al., 2007). Currently approximately 159 million children globally under the age of five years are stunted. This equates to a prevalence of 23.8%. The global prevalence of stunting has reduced by 15.8% from 1990-2014. The prevalence of stunting in Africa has increased by 23% between 1990 and 2014 and is now estimated to be 58% (United Nations International Children's Emergency Fund, World Health Organisation and World Bank Group, 2015). In this report there are no suggestions as to why there has been an increase in the prevalence of stunting.

Malnutrition leads to neurodevelopmental delays (Gladstone, et al., 2008). Poor childhood growth has been associated with cognitive and gross motor developmental delay (Whithead, Potterton and Coovadia, 2014).

Stunting in children is irreversible and when it occurs before the age of two years it is associated with poor cognitive and scholastic outcomes (Grantham-McGregor, et al., 2007). This in turn has great implications for the community as this contributes to the intergenerational poverty cycle (Kuklina, et al., 2004; Grantham-McGregor, et al., 2007). In younger children stunting is associated with poor play and poor levels of attachment formation. Attachment formation is important for socio-emotional development (Walker et al., 2007).

In the case of malnutrition it is important that an early and correct diagnosis is made so that the child can be treated correctly and that long term effects are prevented (United States Centres for Disease Control and Prevention, 2012).

2.2.1.2 **Poverty/poorer socioeconomic status**

Poverty hampers optimal childhood development. This association has been detected at six months of age. Poverty is associated with poor sanitation, overcrowding and a lack of recourses, opportunities and stimulation. These are also risk factors that hamper optimal childhood development. An accumulation of these factors therefore further greatly hampers development. This setback increases as the child grows up and affects scholastic achievement. This in turn affects job opportunities and community well being. The cycle of intergenerational poverty thus continues (Grantham-McGregor, et al., 2007; Fernald et al., 2009).

2.2.1.3 **Illnesses**

Illnesses, especially infections, reoccurring illness and long and repeated hospitalization significantly affect timing of the development (Walker, et al, 2007). Tuberculosis (TB) and infection with the Human Immunodeficiency Virus (HIV) will be discussed. These infections are both global health concerns and are a high burden in the sub- Saharan area.

<u>Tuberculosis</u>

In 2014 there were 9.6 million new cases of TB worldwide. Twelve percent of these individuals were also infected with the HIV. Of the total group one million cases occurred in individuals 14 years and younger (World Health Organisation Global TB Report, 2015).

South Africa is one of the 22 high burden countries. The Global TB report of 2015 stated that there were 380 000 TB cases. New TB cases that were notified amounted to 318 193. Of which 33 522 were extra pulmonary TB and 261 955 were pulmonary TB. Ten percent (31 997) of these cases were individuals under the age of 15 years (World Health Organisation, 2015).

In this search no studies could be found listing developmental delay as a long term consequence of pulmonary TB. In the acute stage of the disease children will not perform on their optimal motor level.

On the contrary tuberculosis meningitis has severe long term neurological sequlae (Anderson, et al., 2010).

Human Immunodeficiency Virus

In the year 2013 it was estimated that there were 35 million people living with HIV/AIDS globally. Of these, 2.1 million were new infections. Globally HIV is the second most common cause of death among adolescents. In Africa it is the leading cause of death among adolescents. The sub –Saharan region has the highest proportion of individuals living with HIV/AIDS (Avert, 2015). Approximately 90% of the paediatric HIV population live in sub-Saharan Africa. The majority of paediatric infection, 95%, occur by mother to child transmission. This route of transmission takes place in utero, during the birth process or during breastfeeding. The prevention of mother-to-child transmission programme (PMTCT) has been implemented and is effective to reduce the chance of HIV transmission from the mother to the child during pregnancy, birth or breastfeeding. This programme was officially started in South Africa in May 2002 (Steinberg, 2016).

Other routes of transmission include sexual abuse, blood transfusions with infected blood and shared breastfeeding (Zeijlstra, 2008, Benton, Lachman and Seedat, 2013). Progression of the infection from HIV to AIDS occurs more rapidly in children than in adults. It is estimated that about half of the children infected with HIV progress to AIDS within a year (Adland, et al., 2015). The first sign of infection with the virus in infants is neurodevelopmental delay. This delay is seen in the domains of gross motor, cognitive and language (expressive more than receptive) development. Gross motor development is affected most severely with the other domains affected less severely in the order mentioned above (Whitehead, Potterton and Covadia, 2014). A South African study has reported a prevalence of gross motor delay of 87% and a cognitive delay of 78% in a group of 122 HIV positive children under two and a half years of age. Most of these children were not on antiretroviral therapy (Potterton, et al., 2009). Developmental delay results mainly from an HIV encephalopathy. Infants who develop the HIV encephalopathy in utero show signs of delay earlier than children who become infected later (Potterton, et al., 2009). Human immunodeficiency virus encephalopathy may be static or progressive but is potentially reversible. Early initiation of antiretroviral therapy (ART) is advised to prevent neurodevelopmental delays (Benton, Lachman and Seedat, 2013).

Whitehead, Potterton and Covadia (2014) compared the neurodevelopment of HIV-infected infants (before and during treatment with ARTs) to HIV-exposed-uninfected infants. Their findings suggested that even after six months of ARTs the HIV-infected group were still behind the HIV-uninfected group.

It is suggested that myopathies may also contribute to neurodevelopmental delay in HIV infected children (Zeijlstra, 2008). The association between myopathies and HIV/AIDS has

been well described in literature amongst the adult population. The following description is specific to the adult population. Myopathies may develop as a result of: 1) the effects of HIV infection or 2) the use of ARTs or 3) as a combination of the infection and the ARTs or 4) from a secondary cause such as altered metabolic pathways, opportunistic infections or neoplastic tissues. These secondary causes are however rare causes of myopathies. The HIV infection may lead to myopathies by 1) altering the structure of the myofibrils , 2) altering mitochondrial functioning, depending on the dose, Zidovudine (AZT) as well as nucleoside reverse transcriptase inhibitors (NRTI) affect mitochondrial structure and functioning and consequently lactic acid pathways. This causes a lactic acidosis and progressive myopathy and also a polyneuropathy (Estanislao, Thomas and Simpson, 2004; Patel, Patel, Espinoza, 2009). The clinical presentation of myopathies is sudden progressive weakness of the proximal muscles, the neck flexor muscles and symmetrical weakness of the limb muscles. Swallowing muscles are also affected. Functional limitations that result from myopathies may include difficulty climbing stairs, standing up from the seated position, lifting objects above the head and brushing hair (Estanislao, Thomas and Simpson, 2004; Tehranzadeh, Ter-Oganesyan and Steinbach, 2004 ; Chan, Kirton, Estanislao and Simpson, 2007.

Studies are currently being done to determine the muscular strength and endurance of HIV infected children (Potterton, 2015). Zeijlstra (2008) conducted a pilot study to investigate the muscle strength of children infected with HIV. This study was conducted during the era in which children only became eligible for treatment once the CD4 count had dropped to 15% of the normal concentration. The author thus studied two groups of children that were infected with HIV. A group that was on highly active antiretroviral therapy (HAART) and a group that was not on HAART. She found a relationship which was directly proportional between the CD4 counts and muscle strength in an HIV infected group who were not on HAART treatment. As the disease progressed and the CD4count dropped, so did the muscle strength. The muscle strength however did not increase, as does the CD4 count once HAART was started. Muscle strength is thus affected by the virus and the HAART. Poor muscle strength and endurance may hinder optimal gross motor development.

Orphaning, as a result of death of the caregiver due to AIDS also affects the healthy development of children (Department of Social Development Republic of South Africa and United Nations International Children's Emergency Fund, 2006).

2.2.1.4 **Other factors that may influence development**

Culture is an important aspect influencing childhood development. Culture is a way of life particular to an ethnic group and is the foundation for interaction with the environment and within a social environment (Oxford dictionary Electronic version, 2016).

The concept of culture has been studied for decades and varying definitions emphasising various facets of culture have been made. Kagitcibasi (2007) describes culture as 'shared learned behaviour and meanings that are socially transferred in life-activity settings', and 'different experiences of groups that lead to predictable and significant differences in behaviour'. Herskovits defines culture as 'the man made part of the environment' (Kagitcibasi, 2007). It can thus be concluded that culture is a way of life particular to an ethnic group and is the foundation for interaction with the environment and within a social environment. It influences the way the parents interact with and stimulate their child. This will have an influence on the child's global development.

Environmental factors which may negatively affect childhood development include lack of access to clean water, inadequate sanitation services and the overcrowding of houses (Walker, et al, 2007). The circumstances in the community and in the country in which the child is growing up in can also affect development. A child growing up in a country where there is continuous exposure to war and limited recreational activities and disruption of normal daily activities is at risk of some form of developmental delay. A child growing up in the Bushmen community will need to learn to hunt; development will be centred on learning skills to hunt and physical agility. A child living in Iceland will need to develop skills that are centred on learning how to function in different forms of snow.

Parental factors play a vital role in child development. These include the mental health of the parents or the primary caregiver, parenting styles, parental involvement and interaction, attachment formation with parents, and the general family setup (Centre on the Developing Child Harvard University, 2009). General stimulation and interaction is compromised when children grow up in an environment in which the main caregiver is suffering from a mental illness as this may lead to neglect. The consequence may be diminished stimulation in the home environment which hampers optimal motor and cognitive development (Baker-Henningham and Boo, 2010). These children are also prone to developing mental illnesses themselves later in life (Center on the Developing Child Harvard University, 2009).

<u>Prenatal and perinatal factors influencing development</u>

Alcohol abuse of the mother during pregnancy has harmful effects on the developing foetus. These effects are lifelong and irreversible but are completely preventable (Olivier,

Curfs and Viljoen, 2016). Effects are classified according to the foetal alcohol spectrum disorder (FASD). There are four categories of FASD as listed by the Institute of Medicine 1996 of which foetal alcohol syndrome (FAS) is the most severe form. The remaining three categories include partial foetal alcohol syndrome (pFAS), alcohol-related neurodevelopmental deficits (ARND) and alcohol related birth defects (ARBD). Foetal alcohol spectrum disorder is a major public health concern in the Northern Cape (Olivier, Curfs, and Viljoen, 2016). Ongoing prevalence studies in the Northern Cape revealed a high prevalence in Upington, Kimberley and in De Aar. The most recent prevalence rates, as measured among grade one learners, was 64/1000 in Kimberley, 74.7/1000 in Upington and 119.4/1000 in de Aar (Olivier, Curfs, and Viljoen, 2016). South Africa has one of the highest rates of alcohol consumption per alcohol user (Olivier, Curfs, and Viljoen, 2016).

A low birth weight has been associated with an increased risk for delayed development and behavioural problems during the adolescent years (Walker, et al., 2007).

Perinatal asphyxia and hypoxia may result in severe neurological sequalae (Telkin, 2008).

Congenital abnormalities and syndromes may also contribute to developmental delays (Couper, 2016).

The issue of nature (genetics) versus nurture and the role of epigenetics (how the environment brings out certain genetic features) also need to be considered when looking for factors influencing the development of a child. These are however difficult to measure.

2.3 EARLY CHILDHOOD INTERVENTION

To be effective in preventing developmental delays it is important to identify risk factors that have the potential to negatively affect childhood development (as discussed above) and then to intervene accordingly, as early as possible. It has also been proven that offering caregiver support is effective. Intervening early may decrease the need for later interventions which may often be more complex, more expensive and less effective (Baker-Henningham and Boo, 2010).

2.3.1 Early Childhood Development Centres

The Department of Social Development of South Africa has established Early Childhood Development Centres (ECDC) with the aim of providing early childhood stimulation. As per the definition an ECDC is the collective name given to a day care centre, a crèche or a play group that offers temporary day care and protection to a group of children. This group

needs to consist of at least six children (Department of Social Development Republic of South Africa and United Nations International Children's Emergency Fund, 2006).

Heckman (2006) gives priority to the family environment in childhood stimulation. Heckman (2006) argues that differences in scholastic achievements reflect more on the family and home setup than on the school set up.

A healthy family environment and adequate stimulation in the family setup is important for healthy childhood development (Heckman, 2006).

2.4 ASSESSMENT OF DEVELOPMENT

Assessing development is important as it helps detect possible developmental delays. Delays need to be addressed early for intervention to be beneficial and to prevent complications (Mayson, et al., 2007). Assessment of development needs to be done across the different domains of development, namely gross and fine motor, cognitive, speech and language and socio- emotional.

Developmental assessments are done subjectively, asking the caregiver about the developmental history, as well as objectively, by observing skills and by using standardised tests. The majority of the standardized tests available have been developed, standardized and validated in Western countries. The most popular ones with a short description of each include the following (Gladstone, et al., 2008):

- Bayley Scales of Infant Development assesses cognitive, language, motor, socio-emotional and adaptive behaviour between the ages of birth to 42 months (Texas Education agency, 2015).
- Denver Developmental Screening Test II (DDST II) assess 125 items in the categories of fine motor function, gross motor function, language and social personal aspects from birth up to an including 6 months (Texas Education agency, 2015).
- Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT™-2). Assess fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, running speed and agility, upper extremity co ordination, strength between the ages of 4 and 21 years (Texas Education agency, 2015)
- Movement Assessment Battery for Children (M-ABC). The M-ABC will be discussed in more detail in section 2.4.1.

There are challenges when using some of the above mentioned western standardize tests in non-western countries, these include; the tasks are often translated into another very different language, which may influence the interpretation of instructions and thus the reliability and validity of the results. The test is often not administered in the mother tongue of the child, if the therapist is unable to speak the child's mother tongue. This also has an effect on the reliability of the results. Some of the tasks in the test may not be culturally appropriate or may even be inappropriate for children not from Western countries. The scores obtained during these tests need to be compared to a 'normal value'. The normal values are obtained from the sample on which the test has been standardized. 'Normal values' need to be systematically adjusted based on research, so as to become a fair representation of the population in which the child is growing up.

2.4.1 **Movement Assessment Battery for Children-2**

The Movement Assessment Battery for Children-2 (M-ABC2®) is an internationally known assessment tool used in clinical settings as well as in research. The M-ABC2® consists of a checklist and a standardised test. It provides qualitative and quantitative data in the assessment of movement in children between the ages of three to 16 years. The M-ABC2® was published in 2007 and is the revised version of the M-ABC®, which was first published in 1992. The M-ABC® assessed gross and fine motor function in children between the ages of four to 12 years (Henderson, Sugden and Barnett, 2007). The M-ABC® and M-ABC2® are the most popular tools used to diagnose developmental coordination disorder (DCD) (Engel-Yeger and Josman, 2009).

Developmental coordination disorder is an impairment in the development of motor coordination (Engel-Yeger and Josman, 2009). It is not related to a medical or intellectual disorder. This disorder is said to be more prevalent among boys and the prevalence is estimated at 6-13% of school going children (Engel-Yeger and Josman, 2009).

The M-ABC2® checklist is relevant for children between the ages of five to 12 years. It is completed either by the teacher, the parent or a caregiver. It relates questions to movement of the child in the home and school environment (Henderson, Sugden and Barnett, 2007).

The M-ABC2® standardised test assesses the ability of a child to perform certain motor skills and as well as the quality of these motor skills. The three components of motor skills that are assessed include manual dexterity, aiming and catching and balance. These are assessed in three age bands. The age bands are grouped as follows; age band 1: three to six years, age band 2: seven to ten years and age band three: 11 to 16 years (Henderson, Sugden and Barnett, 2007).

The components of the motor skills assessed in the M-ABC2®, namely manual dexterity, aiming and catching and balance will be defined in the section that follows:
Manual dexterity, the ability to use the hand and fingers in a controlled and coordinated manner is necessary to for many everyday activities. These include holding a pencil and writing and drawing, tying shoelaces, fastening buttons and cutting with a scissors (Engel-Yeger, Rosenblum and Josman, 2010).

Engel-Yeger, Rosenblum and Josman, (2010) conducted a study were one of the aims were to assess the difference in motor performance in children from different socioeconomic backgrounds. They reported that children with a higher socioeconomic background scored better in the manual dexterity component of the M-ABC2® than a group of children from a lower scocioeconomic background. It was suggested that the reason of this finding is that parents from higher socioeconomic statuses expose their children to varying games focusing on fine motor activity.

The M-ABC2® age band 1 assesses manual dexterity by assessing coordinated hand function while performing a task (positioning coins and threading beads) and hand eye co-ordination during a drawing trial. The speed of this movement is also assessed (Henderson, Sugden and Barnett, 2007).

Aiming and catching, the ability to throw and aim at a target as well as to grasp a moving beanbag is assessed. This reflects hand eye co-ordination as well as the ability to plan and execute a task (Henderson, Sugden and Barnett, 2007).

Balance is a state in which the body is in equilibrium and the sum of the resultant forces acting on a body is zero. The centre of gravity of the body falls in its centre of support. Static balance is the maintenance of the state of equilibrium in a stationary position, such as the maintenance of posture. Dynamic balance is the maintenance of the state of equilibrium while in motion. Maintaining balance is necessary for controlled and coordinated movement. Balance improves and becomes more refined up to the age of 18 years (Jones and Barker, 2002; Henderson, Sugden and Barnett, 2007; Engel-Yeger, Rosenblum, and Josman, 2010). Nolan, Grigorenko and Thorstensson (2005) reported a difference in the development of balance and postural control between girls and boys. Girls seemed to develop balance slightly earlier than boys. Cappellini, et al. (2008) found that children growing up in rural areas scored better than children from urban areas in a balance task.
The M-ABC2® assesses both static balance (standing on one leg) and dynamic balance (walking on a line with heels raised and jumping on five consecutive mats) (Henderson, Sugden and Barnett, 2007).

Age appropriate norms are given for each component. From these total test scores are calculated and converted to age appropriate percentiles. The percentiles are interpreted by a ''traffic light system''. The green zone, above the 15th percentile represents the normal motor development range; the amber zone ranges from the sixth-15th percentile and indicates a risk for motor impairment. The red zone which is less or equal to the 5th percentile indicates a definite risk of motor impairment (Henderson, Sugden and Barnett, 2007).

Structural and content changes were made to some of the tasks during the adjustment of the M-ABC® to M-ABC2®. The materials of the M-ABC® were made of wood and those of the M-ABC2® are made of plastic. Content changes of the tasks in M-ABC® age band 1 include 1) changing the shape in the drawing trail, 2) throwing a beanbag onto a mat (instead of rolling a beanbag into a goal) and 3) jumping onto mats (instead of jumping over chords).The tasks remained similar, therefore in the literature search studies evaluating the reliability of the M-ABC® were considered to still be relevant and to reflect reliability of the M-ABC2® (Henderson, Sugden and Barnett, 2007). Population studies in which the M-ABC® was administrated were also considered.

The formulation of the normative data and standardization of the M-ABC2® was completed in the United Kingdom (UK) in 2005 and 2006. A sample size of 1172 English speaking children was recruited from main stream schools. The sample was representative of the UK population in terms of the respective age bands, socioeconomic groups and cultural groups, as per the 2001 UK Census. Cultural groups included the white, African, Caribbean, Chinese and Asian children. The Asian group included Indian, Pakistan and Bangladeshi children. The normative data is described at six month intervals for three and four year olds and then by year intervals onwards (Henderson, Sugden and Barnett, 2007).

Cross-cultural studies have been done and some researchers suggested that normative data for certain tasks need to be adjusted. In a Czech population of 11-15 year olds it has been suggested to adjust the norms of the drawing trial, the two-board balance test and the zig-zag hopping test (Psotta and Hendl, 2012). This age band is however not relevant for this study. Engel-Yeger, Rosenblum and Josman, (2010) suggested that the normative data of the M-ABC2® should be adjusted to different cultural contexts and socioeconomic groups.

Valentini, Ramalbo and Oliveria, (2014) proved that the normative data is valid for Brazilian children. This study included 844 children between the ages of three and 13 years. The

test was translated into Portuguese by an expert panel. High intra- and inter-rater reliability was shown.

The M-ABC2® has been shown to be valid and reliable (Henderson, Sugden and Barnett, 2007; Ellinoudis, et al, 2011).

Reliability refers to the accuracy and consistency of test results to be produced between different examiners and over time (Henderson, Sugden, and Barnett, 2007). The M-ABC2® has been shown to be reliably used by paediatricians, psychologists, physiotherapists, occupational therapists and human movement scientists. In 2003 Chow and Henderson showed a strong inter-rater reliability with an intra class correlation of 0.95 (Henderson, Sugden and Barnett, 2007).

Validity refers to how well the test measures what it states to measure (Henderson, Sugden and Barnett, 2007).

Henderson, Sugden and Barnett, (2007) stated that the test-retest reliability for the aiming and catching component in the age band one of the M-ABC® is of a concern, but another study suggested that this instrument is valid and reliable to assess movement difficulties in all components of age band 1 (Ellinoudis, et al., 2011). The M-ABC2® has been shown to have good content, face and criterion related validity (Henderson, Sugden and Barnett, 2007).
Ellinoudis, et al (2011) studied 183 Greek preschool children and concluded that the M-ABC2® is a reliable and valid tool for assessing of movement difficulties among three to five year old children (age band 1).

The M-ABC2® has been used in South African studies, of these studies have researched developmental co-ordination disorder (Gritzman, 2012; Buys 2014).

2.5 PLATFONTEIN

The Platfontein community is a San community in South Africa. It is situated 21 km west of Kimberley (GPS coordinates: 28.7074 S, 24.6477 E) and falls into the Frances Baard district. This is an amalgamated San bushmen community consisting of the !Xun and the Khwe tribes, of which there are approximately three times more !Xun than Khwe (Fredericks, 2012). These two groups were relocated from Angola to Namibia between 1973 -1975 and then to Schmidsdrift in March 1990 (Van Wyk, 2014). Schmidsdrift is situated 80km west of Kimberley in the Pixleyka Seme district. In 2003 and 2004 the !Xun and Khwe were relocated to the Platfontein farm (Fredericks, 2012). The total Platfontein

population amounts to 5185 (Census, 2011). Table 2.1 is taken from Statistics South Africa, Census 2011 and contains some of the relevant statistics relating to the Platfontein community.

Table 2.1: Statistics of the Platfontein Community as per Statistics South Africa (Census 2011)

Characteristics	Percentage
Total population	5,185
Population between 0-14 years of age	41,4%
Population in the working age (15-64 years)	51,7%
Population aged 65+	6,9%
Population density	2933 persons/km2
Population above 20 years that do not have schooling	57%
Population above 20 years of age that has a higher education	0,3%
Population above 20 years that has a matric pass	6,9%
Number of households	1,277
Average household size	4,1
Female headed households	48,7%
Formal dwellings	83,7%
Housing owned/paying off	0,8%
Flush toilet connected to sewerage	0,5%
Weekly refuse removal	0,5%
Piped water inside dwelling	3,6%
Electricity for lighting	60,4%

The Platfontein community is a very poor community which faces many challenges. Many of these challenges have been ascribed to the difficulty of integrating into the different lifestyle after the relocation from Angola via Namibia to Schmidsdrift, these include (Bahta, 2014):

- Violence (Becker, 2012)
- Alcohol abuse which includes hard liquor as well as homemade beer (Becker, 2012).
- A high incidence of HIV infection (Becker, 2012).
- A high incidence of unemployment.

Platfontein is situated in the Frances Baard district. This district has a 41 % unemployment rate compared to a national unemployment rate of 29, 8% (Census, 2011). Of the 49% of the people in the Frances Baard district that are employed 81% earn a monthly salary of

under R3200. The Platfontein community receive a monthly subsidy from the Department of Defence (Becker, 2012).

There is a very low level of education in the Frances Baard district. Only 25.4% of people in the district have a level of education above grade 10 (Becker, 2012) compared to 28.4% of the South African population having an education of grade 12 (Census, 2011).

A newspaper report on 20 June 2016 titled “San must adapt’ expressed the concern raised by Alvin Botes (MEC for Cooperative Governance, Human Settlements and Traditional Affairs) on the slow integration of the San community into the ‘new community’. This article stated that a government programme is being developed to assist with integration, skill development and employment opportunities (Kumalo, 2016).

There are two crèches in the Platfontein community, one among the Khwe tribe and the other among the !Xun tribe. Both crèches are overseen and managed by the Caritas community focus. Both crèches are listed as ECDC and comply with the nrms and standards of the Children’s Act 38 of 2005. There are between 30 and 40 children at each facility ranging from age three to six years. The exact percentage of the communities’ children that use the ECDC is not known, but it is known that the majority of the community’s children do not have access to these centres, due to financial and limited space available at the crèches. The commitment to daily crèche attendance of the children at the crèches is also of concern. At both crèches there is one trained local teacher from the representative tribe, who has done a basic training course in pedagogue, one classroom assistant and one cook. The children receive a snack and a cooked lunch every day. Both crèches have two small classrooms with limited play equipment and an outdoor playground. Children are taught in both Afrikaans and either Khwe and !Xun. These two crèches are structured similarly with regard to the daily educational programme they provide. The monthly fees are R50 per child attending the crèche (Nomm, 2015).
Caritas Community Focus manages and oversees both crèches. Caritas Community Focus is part of the Caritas International group, a global charity organistation of Catholic origin that aims to end poverty, promote justice, restore dignity and assist with development of communities (Caritas, 2016). See Appendix B for photos of Platfontein and of the crèches. As seen on the photos, playgrounds are available for play at the crèches. To the researchers best knowledge these are the only form of playgrounds of this sort available in the community.

2.6 CONCLUSION

Childhood development is an important and dynamic process and is the foundation for further development and lifelong learning. Internal and external factors affect development. Many of the detrimental factors that may hinder healthy childhood development are prevalent in sub-Saharan Africa and in the Platfontein community. Describing, assessing and understanding these factors would assist to provide a structured intervention program.

The following chapter describes the methodology of this study.

CHAPTER THREE

3. METHODOLOGY

This chapter describes the study population, methodology and procedures related to the study.

3.1 STUDY DESIGN

This was a descriptive cross-sectional study.

3.2 STUDY POPULATION

3.2.1 Source of Participants

The study population included children between the age of three and six years who attended the !Xun and the Khwe crèches in the Platfontein community during the study period.

3.2.2 Sample Selection and Size

A sample of convenience was used as all children that attend the crèches were invited to participate in the study. Information regarding the number of children attending the respective crèches was received from the main teacher of each crèche. The sample size was thus estimated to be 70 children, 30 children attending the Khwe crèche and 40 children attending the !Xun crèche.

A sample of convenience was used due to safety and practical reasons.

3.2.2.1 Inclusion criteria

The inclusion criteria were:

Children between the age of three and six years that attend one of the two crèches.

3.2.2.2 Exclusion criteria

The exclusion criteria were:

A parent or the primary caregiver of the child who did not consent for their child to participate in the study.

A child who was absent during the data collection period.

3.2.3 Study Period

The data collection period of this study was from the 19-30 October 2015.

3.3 MEASURING INSTRUMENTS

A demographic and anthropometric data collection sheet was drawn up and used to capture data (see Appendix C). The measuring instrument used in the study was the standardized test of the M-ABC2®. The test record form of the M-ABC2® is attached in Appendix D. Details of the data collection sheet and the M-ABC2® will be outlined below. A research assistant, who is a professional health care provider and is trained and experienced in measuring anthropometry in children, was responsible for the anthropometric measurements in this study. The researcher was responsible for administrating the M-ABC2®.

3.3.1 Demographic and Anthropometric Data Collection Sheet

Demographic information collected included: the child's date of birth, gender, TB status (currently on TB treatment or history of TB disease), who the primary caregiver is, the parental or primary caregiver's level of education and the parental or primary caregivers employments status. This information was collected verbally from the parents or the primary caregiver, once consent was given. This was captured on the self-constructed data collection sheet (Appendix C).

Anthropometric data were collected and captured on the same data collection sheet. This data included the height and weight of the child, the head circumference as well as the left mid upper arm circumference.

In the problem statement it was stated that lower respiratory tract infections are one of the reasons children form the Platfontein community to are admitted to KHC. Lower respiratory tract infections were how ever not considered to be a co morbidity that was to be considered in this study, as it was expected that if children are acutely ill and have a lower respiratory tract infection they would most probably not attend the crèche for the period of illness.

3.3.2 Anthropometric Measuring Equipment

The following equipment was used for the anthropometric measurements:

3.3.3.1 Scale

A precalibrated slimline electronic scale (ELEKTRA CARE) was used to determine the weight of the children.

3.3.3.2 **Stadiometer**

A stadiometer is a device used to measure the height of a human being (Collins English Dictionary, 2014). A body meter measuring tape with a wall stop, a form of stadiometer, was used to measure the height of the children.

3.3.3.3 **Tape measure**

A flexible non-stretch tape measure was used to measure the head and left mid upper arm circumference. The head circumference (occipito-frontal circumference) was measured around the furthest circumference, which is approximately two fingers below the eyebrows to the widest part of the back of the head (University of Minnesota, 2014).The left mid upper arm circumference was measured at the midpoint between the olecranon and acromion (Collins, Duffield and Myatt, 2000). See Appendix J.

3.3.3 **The Movement Assessment Battery for Children-2**

The M-ABC2 ®was used to assess motor performance of the sample. The M-ABC2® is the revised version of the M-ABC®. This tool assesses the ability of a child to perform certain motor skills and the quality of the motor skills (Henderson, Sugden and Barnett, 2007). For this study only the first age band was used when collecting data due to the specified inclusion criteria. This age band assesses eight tasks, which are divided into three subcategories. The sub categories are manual dexterity, aiming and catching and balance. Age appropriate norms are given for each task for each age band in the instructional manual. The normative data is described at six month intervals for three and four year olds and then by yearly intervals onwards. These age appropriate norms are converted to component scores and percentiles for each subcategory (Appendix D). The total test score is the sum of the three component scores of the three subcategories. These sub-scores are then converted to a percentile and this is an indication of whether the child's motor performance is at risk for impairment. The percentiles are represented by a traffic light system. The green range, above the 15^{th} percentile represents the normal range; the amber range between the 6-15^{th} percentile indicates a risk for motor impairment. The red zone, less or equal to the 5^{th} percentile, indicates a definite risk of motor impairment.

The M-ABC2® has been shown to be valid and reliable (Henderson, Sugden and Barnett, 2007; Ellinoudis et al, 2011). Good inter-rater reliability ratio and a good test-retest reliability have been documented (Henderson, Sugden and Barnett, 2007). A study suggested that this instrument is valid and reliable to assess movement difficulties in all components of age band 1 (Ellinoudis, et al., 2011). The M-ABC has been shown to have good content, face and criterion-related validity (Henderson, Sugden and Barnett, 2007).

It was decided to use this test for the study as this instrument was available and was practical to implement at the crèches and it has been used in the South African context before.

3.4 ETHICAL CONSIDERATIONS

Permission to conduct the study was obtained from:
Caritas Community Focus (Overseer and manager of both crèches) (See Appendix E for written permission from Caritas Community Focus).

Northern Cape Department of Education as they are responsible for ECDC in the Northern Cape (See Appendix F for written permission from the Northern Cape Department of Education)

Informed consent from one of the parents or the main caregiver of the child (See Appendix G for the information letter and the consent form).

This study protocol was submitted to the Human Research Ethics Committee of the Faculty of Health Sciences of the University of the Witwatersrand and the clearance number issued was M150718 (Appendix H). All study participants received a study code and this code was used, instead of their name on assessment documents.

Medical concerns that were picked up during the assessment were noted and the child was referred appropriately for further assessment and care.

Participants were not remunerated as the researcher assessed the children at crèche during normal school days and it was not suggested by the ethics department of Witwatersrand University.

3.5 PILOT STUDY

3.5.1 Aim of the Pilot Study

The aim of the pilot study was to evaluate whether the demographic and anthropometric data collection sheet (Appendix C) fulfilled its function, whether the implementation of the method was doable and practical and to determine the intra-rater reliability of the assessor when doing the anthropometric assessment.

3.5.2 Sample Size of the Pilot Study

Literature suggests that a pilot study should contain approximately 10% of the estimated study sample, but should also consider costs and time involved (Hertzog, 2008). This study

had a potential sample size of 70 children, it was however anticipated that not all children would be present at school during the time of the testing and so the pilot study was conducted using five children from the one crèche. These participants were selected on a first come first serve basis according to the set inclusion and exclusion criteria stated in section 3.2.2.1 and 3.2.2.2.

3.5.3 **Procedure of the Pilot Study**

The procedure used in the pilot study was as follows:

Information regarding the aim and contents of the study was given to one of the parents or to the primary caregiver. This was done in the morning when the child was brought to the crèche. This was done verbally by the researcher herself. The teacher of the children assisted with translation (to Khwe or !Xun) if the parent or caregiver did not understand either English or Afrikaans. A written information sheet (Appendix G) was issued to parents or main caregivers who were literate. The parents or caregivers were given some time to decide and ask questions. One parent or the main caregiver who consented for their child to participate in the study then signed an informed consent form (Appendix G). If the parent or the main caregiver was illiterate, consent was documented by means of a thumb print or marked by means of a cross. After consent was obtained, demographic data were collected by means of an interview. The data collection sheet (Appendix C) was completed. The anthropometric data collection and the motor assessment were done in a quiet classroom. Only the study participant, the researcher and the research assistant were in the room during the time of the testing. The teacher assisted with translation as was needed.

Anthropometric data was collected in the following manner:

Weight: The research assistant put the scale on by applying light pressure to it. He asked the child to take off his or her shoes and to step onto the scale. Once the measurement had been stabilized the research assistant recorded this measurement and asked the child to step off the scale (See Appendix I for specific instructions).

Height: The research assistant asked the child to take off their shoes and to stand up straight against the wall with the heels touching the wall. The body meter measuring tape was placed at the two meter mark on the wall and was then pulled down to the level of the child's head. The measurement was then taken (see Appendix I for specific instructions).

Head circumference: The head circumference (occipito-frontal circumference) was taken around the furthest circumference of the head, which is approximately two fingers below the eyebrows to the widest part of the back of the head (University of Minnesota, 2014). A flexible non-stretch tape measure was used (See Appendix I for specific instructions).

Left mid upper arm circumference was measured on the left arm at the midpoint between the olecranon and acromion (Collins, Duffield and Myatt, 2000). A flexible non-stretch tape measure was used (See Appendix I for specific instructions).

Two measurements were taken of the height, head circumference and left upper arm circumference. This was done to establish intra-rater reliability of the assessor.

The body mass index (BMI) was calculated manually using the calculation of person's weight in kilograms divided by the square of height in meters (World Health Organisation, 2006). This was then interpreted using the BMI charts of the WHO for boys and girls (z-scores). The weight-for-height was also plotted on the WHO child growth standards chart. This was used to classify the nutritional status according to the z-scores: moderate malnutrition (-3< z-score <-2) severe malnutrition (z-score ≤-3) adequate nutrition (-2< z-score < +2) (World Health Organisation and United Nations International Childrens Emergency Fund, 2009). In this report the distinction is made only between malnutrition and adequate nutrition. The severity of the malnutrition is not reported on. The left mid upper arm circumference cut-off for malnutrition was taken as 115mm (World Health Organisation and United Nations International Childrens Emergency Fund Guidelines, 2009). Stunting was determined as height-for-age under two standard deviations of the median as plotted on the WHO growth charts (World Health Organisation and United Nations International Childrens Emergency Fund Guidelines, 2009). (Appendix A)
The WHO charts for head circumference were used to chart the measurement. These charts have data available for children up to five years of age.

The eight tasks of the M-ABC-2® were carried out as described in the instruction manual (2007) on pages 24-38. Due to copyright of the M-ABC-2® only a brief overview of the tasks is included (Henderson, Sugden and Barnett, 2007).

<u>Manual dexterity 1: Positioning coins</u>

The study participant was asked to place coins into a bank box using one hand. Six coins were used for study participants between three and four years of age. Twelve coins were used for study participants between the ages of five and six years. The researcher demonstrated the task. This was followed by a practise attempt, with the preferred hand first. Two formal trials with each hand were tested. The number of seconds the study participant needed to perform the test was timed using a stopwatch and recorded, rounded off to two decimals.

Manual dexterity 2: Threading beads

The study participant was asked to thread beads onto a lace. Six beads were used for study participants between three and four years of age. Twelve beads were used for study participants between the ages of five and six years. The task was demonstrated by the researcher. A practice attempt was given. Two formal trials with were given. The number of seconds the study participant needed to execute the task was timed using a stopwatch and recorded, rounded off to two decimals.

Manual dexterity 3: Drawing trail

The study participant was asked to draw a continuous line through a drawing trail. The task was demonstrated to the participant by the researcher. The participant had one practice round and a maximum of two drawing trails were given. The number of errors was recorded.

Aiming and catching 1: Catching beanbag

The researcher and the study participant stood on a mat 1.8m apart, facing each other. The researcher threw a bean bag and the study participant had to catch the beanbag. A practice trial was given followed by a formal trial of ten attempts. The number of correct attempts were recorded.

Aiming and caching 2: Throwing beanbag onto mat

The study participant stood on a mat 1.8m apart from another mat. The study participant was instructed to throw a bean bag onto the other mat. A practice trial was given followed by a formal trial of ten attempts. The number of correct attempts was recorded.

Balance 1: (Static) One leg balance

The study participant was asked to stand on one leg on a mat for as long as possible, but for a maximum of 30 seconds. The right leg and the left leg were tested. A practice round was given, followed by a formal trial of a possible two attempts.

The instruction manual states that for this task the child needs to wear gym shoes. For the purpose of this study the study participant was asked to perform the task barefoot as many of the children did not have shoes and did not have gym shoes.

Balance 2: (Dynamic) Walking heels raised

The study participant was asked to walk on a 4.5m line on the floor with their heels raised. The number of consecutive steps in which the child stayed on the line and where the heel

was not lowered was recorded. A practice attempt was given followed by two formal attempts.

Balance 3: (Dynamic) Jumping on mats

The study participant was asked to stand on a mat and then to jump on five mats that were placed consecutively next to each other on the floor. The task was demonstrated and then a practice attempt was given. A maximum of two formal trials were given. The number of consecutive jumps, of which the maximum was five jumps, was recorded. There were separate specific criteria for evaluating a jump as correct for the three and four year olds as well as for the five and six year olds. As quoted directly from the instruction Manual: ''At age 3 and 4 years, it does not matter how the child jumps or lands, as long as there is some lift from the ground with the two feet and the feet stay within the boundaries of the mats. Also, the foot position may be adjusted after each jump. At age 5 and 6 years, the child must make five consecutive, continuous jumps, taking off and landing each time with the feet together on the mat. The foot position may not be adjusted between jumps and only one jump per mat is permitted.''

3.5.4 Data Analysis of the Pilot Study

Data collected during the pilot study was captured in Microsoft Excel 2007. The intra-rater reliability of the assessor was evaluated by calculating a correlation co-efficient using Microsoft Excel 2007. To determine if there was a significant difference between values obtained, a Student's t-test was calculated in Microsoft Excel 2007. A p-value ≤ 0.05 was deemed statistically significant.

3.5.5 Results of the Pilot Study

The anthropometric measurements were recorded for the five children in the pilot study. The correlation co-efficient calculated are presented in Table 3.1 for review.

Table 3.1: Correlation Values of Anthropometric Measurements as Assessed by the Assessor

Anthropometric Measurement	R	p-Value
Height in cm	0.99	0.53
Head circumference in cm	0.99	0.59
Left upper arm circumference in cm	0.99	1.00

R: correlation value

All three anthropometric measurements show a strong linear correlation between the two measurements. This indicates good intra-rater reliability for these measurements. No statistical significant differences were observed in anthropometric measurements taken.

There were two minor changes that were made after the pilot study. These were: to include the gender of the study participant on the demographic collection sheet. It was decided to leave out the HIV status of the study participant as most parents and caregivers were reluctant to volunteer this information, the Road-to-Health books were not always available and the teachers did not have a complete list of the medical conditions of the children.
No problems were encountered in the measurements of the five children in the pilot study and so these measurements were included in the results of the main study. It took approximately 30 minutes per child to complete the entire data collection procedure.

3.6 MAIN STUDY

The method as described in the pilot study in section 3.5 was used to conduct the main study.

The data collection was done at the !Xun and the Khwe crèches in the mornings between 8h00 and 13h00. Data was collected at the Khwe crèche from the 19-21 October 2015 and at the !Xun crèche from the 26-30 October 2015. A research assistant, who is a professional health care provider and is trained and experienced in measuring anthropometry in children, was available. The research assistant was responsible to measure weight, height and upper arm and head circumferences.

The M-ABC2® was conducted by the researcher at both the crèches.

3.7 STATISTICAL ANALYSIS

All data were entered into Microsoft Office Excel 2007. Results of categorical data were presented as percentages and frequencies. Numerical variables were presented as means, standard deviations or percentiles.

A biostatistician of the University of the Free State assisted with the statistical analysis and made use of SAS system statistical programme.

The association between the morbidities (malnutrition, stunting and history of tuberculosis) and the percentile rank (green, yellow, red) was assessed using the Fishers exact test.

The comparisons of the morbidities between the two crèches Fishers was compared using the Fishers exact test.

The final M-ABC 2® categories (percentile rank) obtained from the Khwe and !Xun crèches were compared using the Chi squared test. For the analysis of the statistics a p-value ≤ 0.05 was deemed statistically significant.

The following chapter will present the results of the main study.

CHAPTER FOUR

4. RESULTS

In this chapter the sample and the results relating to each one of the four research objectives will be presented.

The results will be given under the following sub-headings:

4.1 Sample size

4.2 Objective 1: Demographic and anthropometric profile of study participants

4.3 Objective 2: Motor development of study participants

4.4 Objective 3: Relationships between motor development and existing morbidities

4.5 Objective 4: Motor development differences/ similarities of the two crèches

4.1 SAMPLE SIZE

The flow chart in figure 4.1 outlines the final sample size of the study.

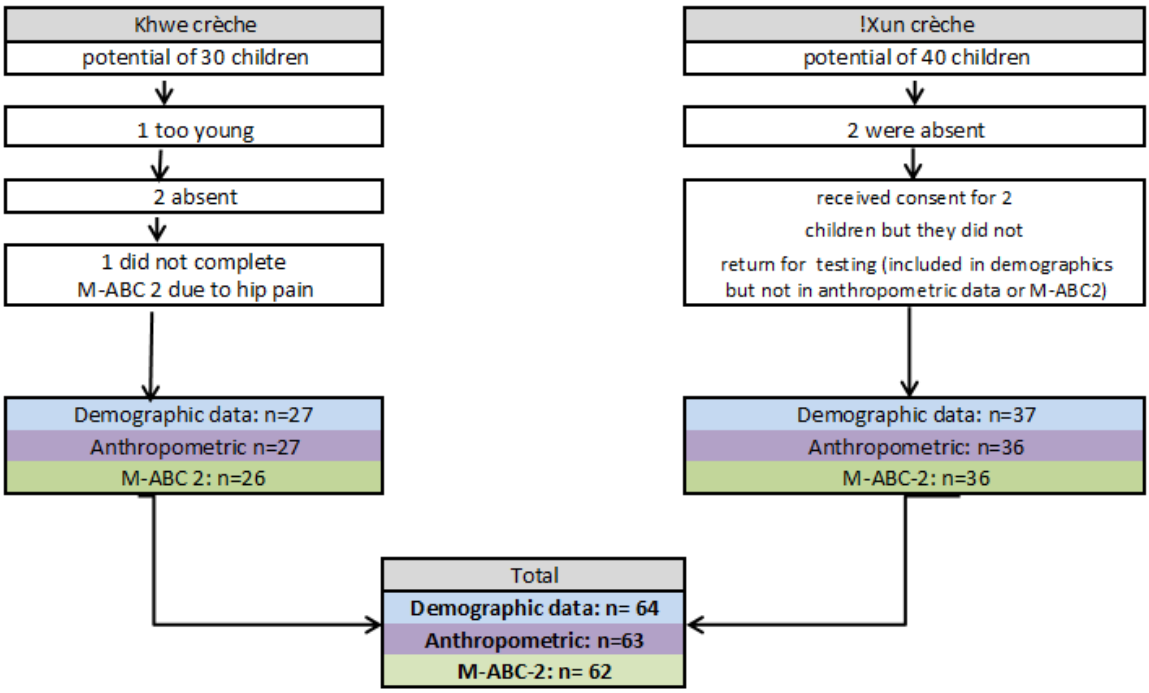

Figure 4.1: Flow Chart of the Final Study Sample

Of the potential 70 study participants, six did not meet the inclusion criteria. Consent and demographic data were received for 64 participants. Two of the participants for whom consent was received did not return to school during the time of testing of the M-ABC2®, however for one of these participants anthropometric data was recorded.

One participant was unable to complete the M-ABC2® due to hip pain (demographic and anthropometric data was however collected). The researcher assessed the participant's hip and the participant was subsequently referred for medical review and management. Therefore demographic information was obtained from 64 (91.4%) participants and anthropometric data from 63 (90%) participants.

M-ABC2 ® scores were available for 62 participants (88.6%).

During the administration of the M-ABC2® one study participant was noted to have an ear infection. This participant was referred to the local clinic. This participants data was included in the analyses of the results as this condition was not listed as an exclusion criteria in the study methodology.

4.2 OBJECTIVE 1: DEMOGRAPHIC AND ANTHROPOMETRIC PROFILE OF STUDY PARTICIPANTS

4.2.1 Gender Distribution

There was a total of 28 (43.8%) female participants in the study sample, 11 of which were from the Khwe crèche and 17 from the !Xun crèche.

There were a total of 36 (56.3%) male participants in the study sample, 16 of which were from the Khwe crèche and 20 from the !Xun crèche. The ratio of females to males was: 1:1.2.

4.2.2 Age of the Study Participants

The age of the study participants ranged from three years and two months (38 months) to five years eleven months (71months).

The mean age of the study sample was four years and ten months (SD+/- 8.3 months). The mean age of study participants at the Khwe crèche was four years and six months (SD +/- 7.9 months) and at the !Xun crèche the mean age was five years (SD+/- 7.5 months).

4.2.3 Caregiver Details

Information on who the primary caregiver is, their marital status, their level of education and employment status is displayed in the tables below:

Table 4.1: Representation of the Primary Caregiver

Primary Caregiver	Khwe (n=27)	!Xun (n=37)	Study Sample (n=64)
Parent	20 (74.07%)	32 (86.5%)	52 (81.3%)*
Grandparent	6 (22.2%)	4 (10.8%)	10 (15.6%)
Parent and grandparent	1 (3.7%)	0	1 (1.5%)
Extended Family	0	1 (2.7%)	1 (1.5%)

*Most of the study participants are being raised by their parents (n=52; 81.3%).

Table 4.2: Marital Status of the Primary Caregiver

Marital Status	Khwe (n=27)	!Xun (n= 37)	Study Sample (n= 64)
Married	5 (18.5%)	2 (5.4%)	7 (10.9%)
Unmarried	13 (48.1%)	28 (75.7%)	41 (64.1%)*
Co-habitate	9 (33.3%)	7 (18.9%)	16 (25.0%)

*Most primary caregivers of the sample were unmarried (n=41; 64.1%).

Table 4.3: Level of Education Achieved by the Primary Caregivers

Level of Education	Khwe (n=27)	!Xun (n=37)	Study Sample (n=64)
Grade 7	8 (29.6%)	16 (43.2%)	24 (37.5%)*
Matric	6 (22.2%)	3 (8.1%)	9 (14.0%)
University	0	1 (2.7%)	1 (1.5%)
None	5 (18.5%)	17 (45.5%)	22 (34.4%)
Currently studying for matric	8 (29.6%)	0	8 (12.8%)

*The majority of primary caregivers had a grade 7 education level (n=24; 37.5%). Noteworthy is that 22 (34.4%) of primary caregivers had no formal school education.

Table 4.4: Employment Status of the Primary Caregiver

Employment	Khwe (n=27)	!Xun (n=37)	Study sample (n=64)
Not employed	14 (51.9%)	34 (91.9%)	48 (75.0%)*
Employed	13 (48.1%)	3 (8.1%)	16 (25.0%)

*The majority of primary caregivers were unemployed (n=48; 75.0%).

4.2.4 Prevalence of tuberculosis History among the Sample

Prevalence of current or previous TB amongst the sample is 9.38% (n=6). Three (11.11%) of the children at the Khwe crèche had TB previously and successfully completed treatment. One child was still on TB treatment during the time of testing.

Two of the 37 children (5%) at the !Xun crèche had previous TB and had successfully completed treatment.

According to the WHO revised guidelines the current recommended anti-TB medication and dosages report that side effects of this medication is uncommon and mild. It is also documented that children are better able to endure the anti TB treatment than adults (Graham, 2010). For this reason, and considering that the child was well enough to attend the crèche, the results were included in the analysis.

4.2.5 Anthropometric Measurements

Anthropometric measurements that were recorded include the left mid upper arm circumference, the head circumference, weight and height. The BMI scores were calculated from the weight and height. These findings were plotted on and interpreted using the respective WHO growth charts (z scores). Refer to appendix A for the WHO growth charts.

Head circumference normative data is available up to the age of five years. Results of these findings are not reported on as there was no clinically significant difference. Left mid upper arm circumference normative data is available up to age five. Table 4.5 contains the data of the z scores of the left mid upper arm circumference of the 31 children five and under.

Table 4.5: Z Scores of Left Mid Upper Arm Circumference

Between The Z-Score Values						
z scores	**[3 ; 2]**	**[2; 1]**	**[1; 0]**	**[0; -1]**	**[- 1; -2]**	**[- 2; -3]**
Total group	0	0	4	9	12	0
Khwe	0	0	2	4	8	0
!Xun	0	0	2	5	4	0

On the Specific Z-Score Values							
	3	2	1	0	-1	-2	-3
Total group	0	0	0	0	5	1	0
Khwe	0	0	0	0	3	0	0
!Xun	0	0	0	0	2	1	0

The area highlighted by the red blocks display z-scores which indicate malnutrition by left mid upper arm circumference.

For the purpose of the study malnutrition was determined using weight-for-height (z scores) under two standard deviations of the median as plotted on the WHO growth charts.

Stunting was determined as height-for-age under two standard deviations of the median as plotted on the WHO growth charts. See appendix A (World Health Organisation and United Nations International Childrens Emerecency Fund Guidelines, 2009).

4.2.5.1 **Malnutrition rate within the sample**

Table 4.6 shows the nutritional state of the children in the sample as a whole as well as per crèche.

Table 4.6: Prevalence of Malnutrition

Nutritional status	Khwe (n= 27)	!Xun (n=36)	Study Sample (n=63)
Malnourished	1 (3.7%)	5 (13.9%)	6 (9.5%)
Adequately nourished	26 (96.3%)	31 (49.2%)	57 (90.5%)

The majority of study participants (n=57; 90.5%) from both crèches received adequate nutrition and were not considered malnourished.

The nutritional status of the children of the two crèches was compared using the Fisher's exact test and was calculated to be p=0.39. There was thus no statistical significant difference between the two crèches with regard to nutritional status of study participants.

4.2.5.2 **Stunting among the sample**

Table 4.7 shows the prevalence of stunting for the sample as well as per crèche.

Table 4.7: Prevalence of Stunting

Nutritional status	Khwe (n= 27)	!Xun (n=36)	Study Sample (n=63)
Stunted	3(11.1%)	8 (22.2%)	11 (17.5%)
Not stunted	24 (88.9%)	28 (77.8%)	52 (82.5%)

The majority of study participants (n=52; 82.5%) were not considered to be stunted with regards to their growth.

The prevalence of stunting between the two crèches was compared using the Fisher's exact test and was calculated to be p=0.33. There was thus no statistical significant difference between the two crèches with regards to the prevalence of stunting of study participants.

4.3 OBJECTIVE 2: MOTOR DEVELOPMENT OF STUDY PARTICIPANTS

The results of the M-ABC2® are represented per subcategory (manual dexterity, aiming and catching and balance) and per traffic light colour system (green, amber, red). The traffic light colour system is a representation of the age appropriate percentile norms. All three categories need to be completed in order for the final score be categorized into the colour traffic light system. The green range, above the 15th percentile represents the normal range; the amber range between the 6-15th percentile indicates a risk for motor impairment. The red zone, less or equal to the 5th percentile, indicates a definite risk of motor impairment (Henderson, Sugden and Barnett, 2007).

4.3.1 M-ABC2® Results per Category

Sixty two M-ABC2® tests were carried out. Figure 4.2 shows how the successfully completed component scores were calculated per category, as well as the reasons why some scores could not be determined.

62 M-ABC2® Test were Carried Out

	Manual Dexterity			Aiming and Catching			Balance		
	Total	Khwe	!Xun	Total	Khwe	!Xun	Total	Khwe	!Xun
Failed	1	0	1	0	0	0	1	0	1
Inappropriate	3	0	3	0	0	0	5	1	4
Refused	0	0	0	1	1	0	0	0	0
Successfully completed	58 (93.5%)	26	32	61 (98.4%)	25	36	56 (90.3%)	25	31

Figure 4.2: Successfully Completed Subcategories of the M-ABC2®

In total 54 out of the 62 (87.1%) completed M-ABC2® test scores could be calculated. The flow diagram in Figure 4.3 shows the spread thereof. Of the eight study participants to which a colour zone could not be given two study participant had two categories that they either failed or inappropriately completed. Six study participants each had only one component which they either failed or executed incompletely.

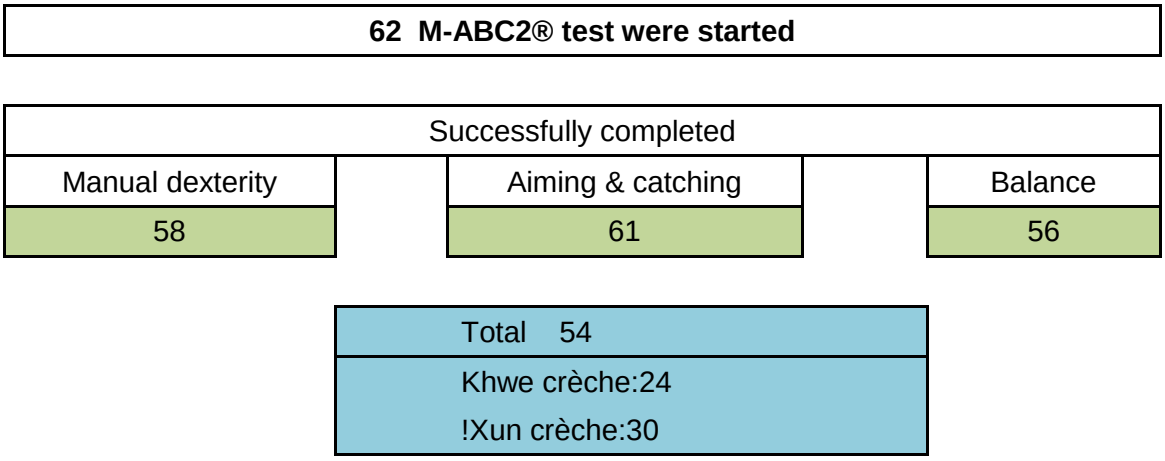

Figure 4.3: Total successfully completed M-ABC2®

For the purpose of this study, only the 54 completed M-ABC2® results are presented and analyzed.

4.3.1.1 **Manual dexterity**

Table 4.8 tabulates the maximum, minimum, mean, median, standard deviation and middle quartiles of the manual dexterity percentiles scored. Figure 4.4 shows the distribution of the manual dexterity percentiles scored.

Table 4.8: Percentiles of the Manual Dexterity Category of the M-ABC2®

	Study Sample (n=54)	**Khwe Crèche (n=24)**	**!Xun Crèche (n=30)**
[Min; Max] percentile	01; 50	0.1; 50	0.1; 16
[Mean; SD]	7.8; ±10.6	11.6 ±14.0	4.8; ±5.2
Median percentile	5	5	2
Middle quartiles	1;9	2;16	1;5

*SD: standard deviation

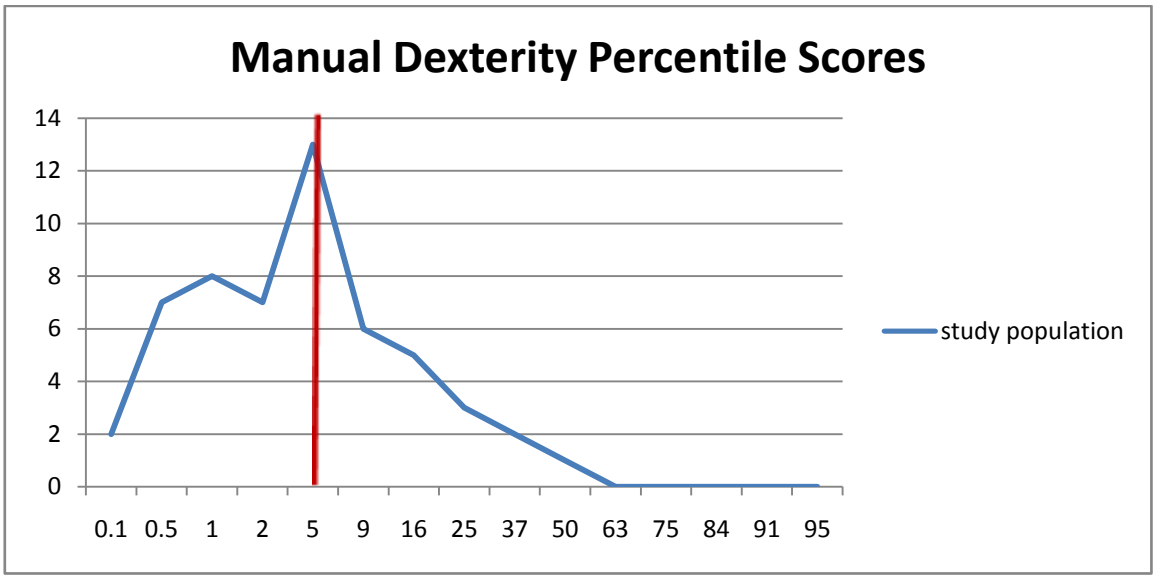

Figure 4.4: Range of Percentile Scores of the Manual Dexterity Component of the M-ABC2®

[The x- axis represents the M-ABC2 percentile scores and the y axis represents n]

Sixty eight point five percent of the sample scored at or below the 5th percentile. This is indicated by the red line on figure 4.4.

4.3.1.2 **Aiming and catching**

Table 4.9 shows the maximum, minimum, mean, median, standard deviation and middle quartiles of the aiming and catching percentiles results. Figure 4.5 shows the distribution of the aiming and catching percentiles scored.

Table 4.9: Percentiles of the Aiming and Catching Category of the M-ABC2®

	Study sample (n=54)	**Khwe crèche (n=24)**	**!Xun crèche (n=30)**
[Min; Max] percentile	2; 98	5; 75	5;95
Mean; SD	37.4;±25.3	29.5;±19.3	43.6;±28,0
Median	50.0	56.5	50.0
Middle quartiles	37;75	37; 84	37; 75

*SD: standard deviation

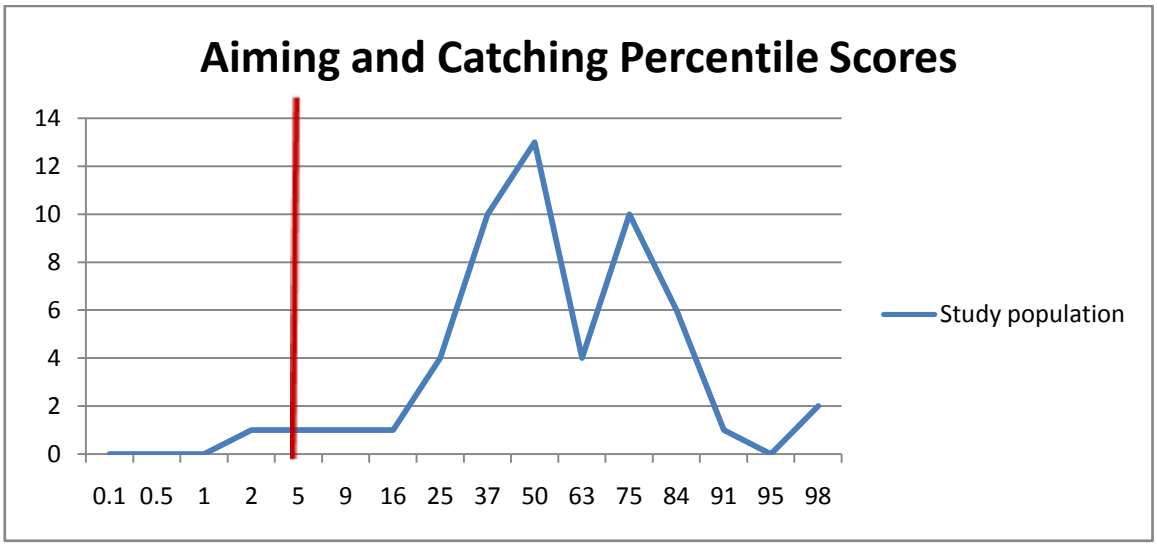

Figure 4.5: Range of Percentile Scores of the Aiming and Catching Component of the M-ABC2®

[The x- axis represents the M-ABC2® percentile scores and the y axis represents n]

Three point seven percent of the sample scored at or below the 5th percentile. This is indicated by the red line on figure 4.5.

4.3.1.3 **Balance**

Table 4.10 shows the maximum, minimum, mean, median, standard deviation and middle of the balance percentiles scored. Figure 4.6 shows the distribution of the balance percentiles scored.

Table 4.10: Percentiles of the Balance Category of the M-ABC2®

	Study sample (n=54)	**Khwe crèche (n=24)**	**!Xun crèche (n=30)**
[Min; Max] percentile	5; 95	5; 75	5; 95
[Mean percentile; SD]	37.4; ±25	29. 5; ±19.3	43.6; ±28.0
Median	31	25	37
Middle quarters	25;75	16;3 7	25; 63

*SD: standard deviation

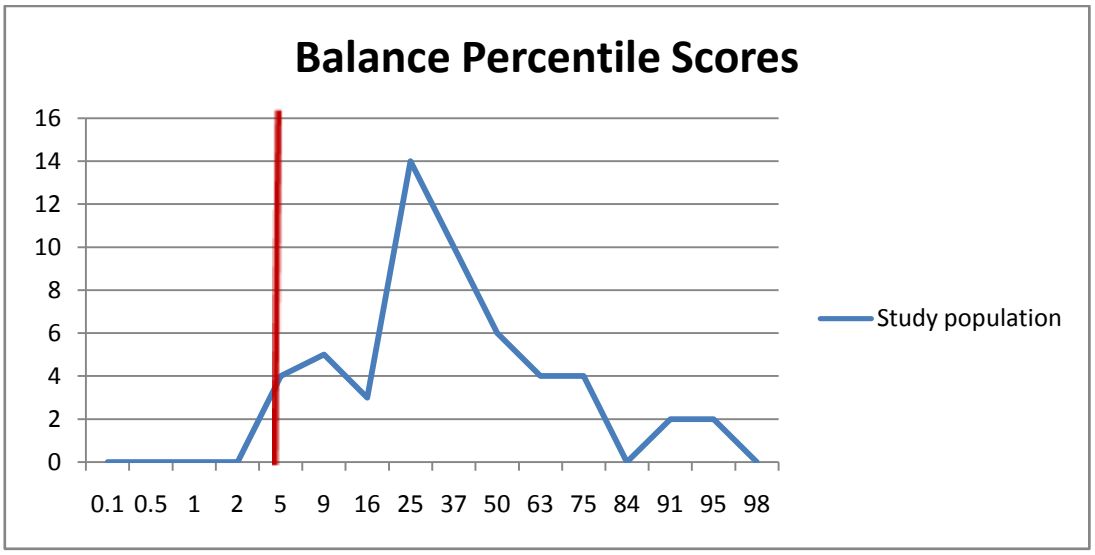

Figure 4.6: Range of Percentile Scores of the Balance Component of the M-ABC2®

[The x- axis represents the M-ABC2® percentile scores and the y axis represents the n] Seven point four percent of the sample scored at or below the 5th percentile. This is indicated by the red line on figure 4.6.

4.3.2 M-ABC2® Zones

Table 4.11 shows the zones of the total scores per sample and per crèche. Figure 4.7 shows the percentage of M-ABC2® colour zones for the sample rounded off to the nearest whole number in a pie chart. Figure 4.8 and 4.9 show the percentage of M-ABC2® colour zones per crèche in a pie chart.

Table 4.11: Traffic light spread of the M-ABC2®

M-ABC2®	Zones	Green	Amber	Red
	Study population(n=54)	29 (53.7%)	13 (24.1%)	12 (22.2%)
	Khwe crèche (n=24)	13 (54.2%)	7 (29.2%)	4 (16.7%)
	!Xun crèche (n=30)	16 (53.4%)	6 (20.0%)	8 (26.6%)

Majority (53.7%, n=29) of the study participants scored in the green zone of the M-ABC2® test. This was followed by the amber (24.1%, n=13) and then the red zone (22.2%, n=12).

Table 4.12 tabulates the maximum, minimum, mean and standard deviation of the total test score percentiles. Figure 4.10 show the range of percentiles scores of the total test score of the sample.

Table 4.12: Percentiles of the Total Test Score of the M-ABC2®

	Study Sample	Khwe Crèche	!Xun Crèche
[Min; Max] percentile	0.5; 63	2; 63	0.5; 50
[Mean; SD]	19.1; ±15,2	20.8; ±16.9	17.8; ±13.9
Median percentile	16	16	16
Middle quarters	9; 25	9; 25	5; 25

*SD: standard deviation

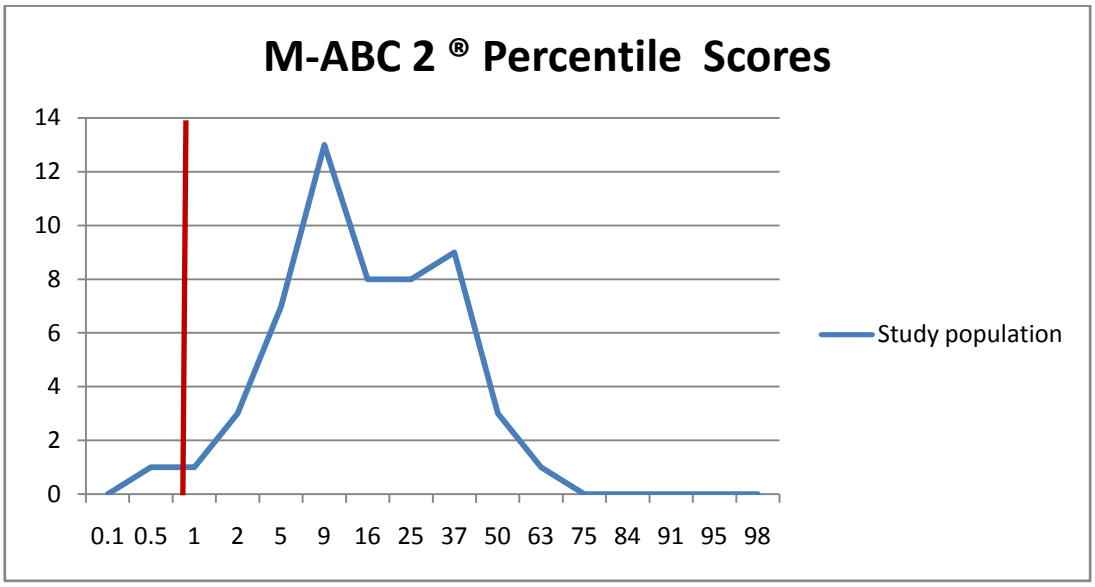

Figure 4.7: Range of Percentile Scores of the M-ABC2® Test Scores

[The x- axis represents the M-ABC2® percentile scores and the y axis represents the n]

Twenty two percent of the sample scored at or below the 5th percentile. This is indicated by the red line on figure 4.10

4.4 OBJECTIVE 3: RELATIONSHIPS BETWEEN MOTOR DEVELOPMENT AND EXISTING MORBIDITIES

4.4.1 TB History

Of the 54 M-ABC2® test that were completed, four participants had TB previously and one was currently on treatment. Forty nine did not have TB and did not have a history of TB. Table 4.13 shows the results of the M-ABC2® zones for the TB and non TB group.

Table 4.13: M-ABC2® Zones by TB History

M-ABC2®	Zones	Green	Amber	Red
	TB history (n=5)	4 (80.0 %)	0	1 (20.0%)
	No TB history (n=49)	24 (44.4%)	14 (25.9%)	11 (20.4%)

Majority (80.0% n=4) of the children with a history of TB or current TB scored in the green range of the M-ABC2®. The participant on the TB treatment was not the participant who scored in the red zone.

The Fischer's exact test was used to compare the zones for the TB history. A p-value of 0.49 was calculated. No statistical difference was found between history of TB and the M-ABC2® zoning.

4.4.2 Malnutrition

All five malnourished children started the M-ABC2®. Table 4.14 shows the results of the M-ABC2® zones by malnutrition.

Table 4.14: M-ABC2® Zones of the Malnourished and Non Malnourished Group

M-ABC2®	Zones	Green	Amber	Red
	Malnourished (n=5)	5 (100.0%)	0	0
	Adequately nourished (n=49)	24 (49.0 %)	13 (26.5%)	12 (24.5%)

All of the children with malnutrition (n=5) scored in the green range of the M-ABC2®
The Fischer's exact test was used to compare the zones to the nutritional status. A p-value of 0.19 was calculated. No statistical difference was found between malnutrition and the M-ABC2® zoning.

4.4.3 Stunting

Table 4.15.displays the M-ABC2® results by stunting.

Table 4.15: M-ABC2® Zones of the Stunted and Non-Stunted Group

M-ABC2®	Zones	Green	Amber	Red
	Stunted (n=9)	5 (55.6%)	2 (22.2%)	2 (22.2%)
	Not-stunted (n=45)	24 (53.3%)	11 (24.4%)	10 (22.2%)

Majority of the children who are stunted scored in the green range of the M-ABC2® (55.6%, n=5). The Fischer's exact test was used to compare the M-ABC2 ® zones to the nutritional status. A p-value of 1 was calculated. No statistical difference was found between stunting and the M-ABC2® zoning.

4.4.4 Development Differences between national and international studies

The following tables tabulate the difference in the final M-ABC2® scores between national (Table 4.16) and international studies (Table 4.17).

Table 4.16 : Difference between three South African Studies

	Platfontein n=54	Buys (2014) n=323	Gritzman (2012) n=81
Green	54%	85%	80%
Amber	24%	7%	20%
Red	22%	8%	

Table 4.17: Difference between the Platfontein Sample and the Brazilian Studies

	Platfontein	Valentini, et al. (2012) (n=151)	Valentini, Clark and Whitall (2014)
Green	54.0% (n=29)	64.2% (n=97)	63.3% (n=95)
Amber	24.0% (n= 13)	19.9% (n=30)	20.0% (n=30)
Red	22.0% (n=12)	15.9% (n=24)	16.7% (n=25)

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4.5 OBJECTIVE 4: MOTOR DEVELOPMENT DIFFERENCES/ SIMILARITIES OF THE TWO CRÈCHES

The M-ABC2 ® 'traffic light zones' of the Khwe and !Xun crèches were compared using the Chi-square test. A p-value of 0.59 was calculated. There is therefore no statistical difference between the scores of the two crèches.

These findings will be discussed in chapter 5.

CHAPTER FIVE

5. DISCUSSION

In this chapter the findings will be discussed under the four research aims; namely

5.1 Sample size

5.2 Objective 1: Demographic and anthropometric profile of study participants

5.3 Objective 2: Motor development of study participants

5.4 Objective 3: Relationships between motor development and existing morbidities

5.5 Objective 4: Motor development differences/ similarities of the two crèches

5.1 SAMPLE SIZE

The exact number of children in the Platfontein community under the age of five years is unknown. In South Africa 31,3% of the population are aged between 0-14 years and 10.8 % under 5 years of age (Census, 2011). It is unknown what percentage of children in Platfontein are under 5 years of age, but if one estimates it according to the ratios in the South African population, 14,3% of the population is under 5 years of age, this would equal to 740 children under the age of five years.

It is not known what percentage of the children in the community attended the ECDC. This figure however is expected to be small considering that in the Northern Cape only 33% of children between the ages of zero to four years attend ECDC (Manoko, 2016). No reasons were given in this newspaper article (The New Age Newspaper, Friday 3 June 2016) suggesting as to why such a small percentage of the Northern Cape children attend ECDC Centres. Together with Kwa zulu Natal these two provinces had the lowest percentage of children attending ECDC in the country. These figures were quoted from the general household survey 2015 (Manoko, 2016). Jaganath, et al. (2015) found an association between low rates of pre-primary school attendance and a low socioeconomic status in rural Nepal. However 56% of children in rural Nepal had accesses to ECDC (Jaganath, et al., 2015). This is higher than that reported in the Northern Cape. The most recent statistics of UNICEF (2013) state that in South African 76,5% of male and 76,6% of female children attend pre-primary schools (United Nations International Childrens Emergency Fund, 2013), this is nearly double the amount reported in the Northern Cape. It can be hypothesized that the low socioeconomic status of the Platfontein community, limited space at the ECDC (due to limited resources) together with cultural perspectives of the relevance regarding schooling contribute to the small rates of children attending ECDC.

5.2 OBJECTIVE 1: DEMOGRAPHIC AND ANTHROPOMETRIC PROFILE OF STUDY PARTICIPANTS

Exposure to several risk factors increases the risk for developmental delay (Baker-Henningham and Boo, 2010). There is an increase in the amount of risk factors that children in poorer socioeconomic environments are exposed to. These risk factors negatively impact brain composition and brain function. All domains of development are thus affected. Long term consequences include poorer academic performance, unemployment and anti-social behaviour (Baker-Henningham and Boo, 2010). The risk factors in this community that were identified during this study include poverty, malnutrition (9.5%), stunting (11.1%), a low educational level of the primary caregiver (14% completed matric).

These risk factors will be discussed individually. Underlying pathological conditions that were not directly measured in this study still need to be considered when reviewing the results. These include, among others, FASD, HIV and inbreeding of the families.

A home environment that provides consistent healthy parent child interaction, age appropriate stimulation and play nurtures early childhood development (Centre of the Developing Child Harvard University, 2009; Nicholson, et al., 2016). Mothers, or primary caregivers of children who struggle financially, have poor social support, have a low level of education, abuse substances, are exposed to stressful family and environmental situations and who are in a poor health condition themselves, struggle to create a nurturing environment for their children. This increases the risk that their children will not obtain their developmental potential (Centre of Developing Child Harvard University, 2009).

Of the sample, 75% of the caregivers are unemployed. This is substantially higher than the 41% unemployment rate in the Frances Baard district as well as the national unemployment rate of 29.8% (Census, 2011). Unemployment contributes to poverty. Previously the men were employed by the National Defence Force and worked as trackers. Since the relocation to the Platfontein farm, finding jobs has been a struggle.
Compared to a middle and high socioeconomic status, a low socioeconomic status increases the likelihood of a moderate neurological disorder four times. This in turn directly affects child development (Valentini, Clark and Whitall, 2014). There is also an association between DCD and a lower socioeconomic status (Valentini, Clark and Whitall, 2014).

The level of education of the primary caregivers in this study is of a concern. Of the caregivers in the sample, 14% had successfully completed matric. This is much higher than

the overall percentage of the Platfontein population (6.9%) that have a matric pass (Census 2011). It is however lower than the national figure of 28.4% (Census 2011). There is an attempt to improve the educational level among the community by enrolling the adults into an adult education centre. Currently 12.8 % of the parents or primary caregivers are busy with a matric program at the adult education centre in Platfontein. It must however be kept in mind that prior to the relocation the tribes were living as traditional hunter-gatherers and therefore did not have access to school facilities (Bahta, 2014). This contributes the low levels of matric in the community.

The TB history in this study was 9.4%. Only one participant (1.6%) was currently being treated for active TB. The World Health Organisation Global TB report (2015) reported that 10% of the new notified TB cases in South Africa were in individuals under the age of 15.

Of the sample 9.5% were classified to have moderate acute malnutrition as plotted on the WHO growth charts (Appendix A) (World Health Organization and United Nations International Childrens Emergency Fund, 2009). The WHO growth charts were formulated during a longitudinal study carried out by the WHO Multicentre Growth Reference Study group stretching from July 1997 to December 2003. The sample consisted of 1737 children (894 boys and 843 girls) from different cultural groups including children from California in the United States of America (USA), Oman, Norway, Brazil and areas in Ghana and India with no food insecurity. These children lived in good socioeconomic conditions, were single term children, did not have a medical condition leading to growth retardation and followed the recommended nutritional guidelines by the research group. Anthropometric data as well as motor development, feeding habits, socioeconomic and demographic data were collected by trained professionals on a continuous basis starting from birth. This was followed up by home visits at weeks one, two, four and six, monthly from the second to twelfth month and every second month in the second year of life (World Health Organisation Multicentre Growth Reference Study Group, 2006).
The Bushmen are small of stature (Wilson and Lundy, 1994). Anthropometric studies comparing stature of the San and the Khoikoi groups in southern Africa have shown that the San have a smaller mean stature than the Khoikoi. It is suggested that these differences are of genetic origin and not as a result of diet (Wilson and Lundy, 1994). This report also had a comparison of the San and the Negro group. The San group had smaller stature means compared to the Negro groups for both genders. Table 5.1 tabulates these differences.

Table 5.1: Differences in Stature of the San and the Negro (Wilson and Lundy, 1994)

	Range (in cm)	Mean (in cm)	Standard deviation (in cm)
Negro female	1413-1669	1541	±63.0
San female	1356-1594	1461	±59.3
Negro male	1494-1765	1629	±67.8
San male	1441-1648	1558	±55.1

Considering that the San are smaller in stature than the average population, it is possible that the 9.5% of this sample that are classified as malnourished according to the WHO growth charts, are not truly malnourished. There are however no separate growth charts available for the San communities and this sample was thus compared to the anthropometric data from a cultural diverse normative data but not specific to the San group.

Eleven point one percent of the sample was classified as stunted as plotted on the WHO growth charts (Appendix A). This prevalence is lower the regional rate of 58% as well as the global rate of 23.8% (United Nations International Childrens Emergency Fund, World Health Organisation and Worldbank group, 2015). However the San are known to be small in stature and therefore the same argument holds as discussed with regards to the findings of malnutrition.

5.3 OBJECTIVE 2: MOTOR DEVELOPMENT OF STUDY PARTICIPANTS

5.3.1 South African Studies

There are no separate norms for the M-ABC2® for the South African population.

The M-ABC2® has been used in several South African studies; the normative data for the M-ABC2® has been used in these studies. The majority of these studies however were conducted in the older age bands of the M-ABC2®.

In this study, the majority of the sample, 54% scored in the green zone. The green range, above the 15th percentile represents the normal range, no risk for motor developmental delay. However comparing this to other South African studies, this is much lower than that reported by Buys (2014) and Gritzman (2012).

Buys (2014), as stated in her own words, aimed to: ‘’determine the agreement between identifying motor difficulties with the M-ABC2® and the identifying of motor difficulties with the MABC-Checklist-2’’. The sample consisted of 323 grade one learners from six different schools in the surroundings of Bloemfontein, Free State. The learners were between the

ages of five and eight years. Findings of theM-ABC2® test were as follows: 85% had no motor difficulties and were placed in the green zone, seven percent had moderate motor difficulties and were place in the amber zone and eight percent had severe motor difficulties and were placed in the red zone. This study does not record that children with known mental, physical and neurological impairments were excluded from the study.

Grtizman (2012) conducted a study of which one of the aims was to determine the prevalence of motor impairment as measured by the M-ABC2® in grade R learners. Learners were sampled from seven schools in the Johannesburg area. The sample included 42 males and 39 females from middle and upper-class areas ranging between 60-83 months of age. This study excluded children known with mental, physical and neurological impairments. Grtizman reported a 20% impairment and at risk (amber or red) for motor performance.

The difference between these three studies are shown in table 5.2.

Table 5.2: Difference between three South African Studies

	Platfontein n=54	**Buys (2014) n=323**	**Gritzman (2012) n=81**
Green	54%	85%	80%
Amber	24%	7%	20%
Red	22%	8%	

Comparing the results of this study to the study by Gritzman (2012) and Buys (2014) as seen in table 5.2 this sample performed significantly lower as measured by the M-ABC2® It must be remembered that the socio economic status of this sample is lower that the sample in the other two studies. It is known that a lower socioeconomic status hinders optimal motor development (Jaganath, et al., 2014). This study did not exclude children with mental or neurological impairments as did the study by Gritzman (2012).

The prevalence of children with FASD was not determined in this study. It would however be expected that some children could have a diagnosis of FASD. This assumption was made as there is a concern of alcohol use in the community and the Platfontein community is situated in the Northern Cape which is known to have high rates of FASD (Olivier, Curfs, and Viljoen, 2016). It can thus be expected that FASD may have contributed to the lower findings of motor development in this study.

5.3.2 International Studies

Valentini, Ramalbo and Oliveria, (2014) proved that the normative data of the M-ABC2® is valid for Brazilian children. Brazil and South Africa are both developing countries and of a similar socioeconomic status and therefore two similar studies conducted in Brazil were compared to this study.

Valentini, et al., (2012) administered the M-ABC® to determine the prevalence of probable DCD in children between the ages of four to 12 years in south Brazil. The M-ABC® norms were used in this study. The 1587 children in the sample were recruited from public schools. Children with pathologies and known motor difficulties were excluded from the study, as per the diagnosis of DCD. In the total sample of children four-12 years, 19.9% were listed as probable DCD (amber zone) and 16.8% as at risk (red zone). In age group 1 (age 4-6 years) there was a total of 151 children. Of these, 15.9% (n=24) were categorized as probable DCD (amber zone) and 19.9% (n=30) as at risk for DCD (red zone).Valentini, et al, (2012) found that manual dexterity was the most challenging of the motor tasks, followed by balance. The researchers noted that there was a higher prevalence for DCD among girls than boys. The prevalence of probable and at risk for DCD was higher in the age band three and four. It is suggested that the lack of identification and intervention of these motor difficulties at a younger age may have contributed to the higher findings of motor difficulties at the older age groups. This finding strengthens the importance of intervening timeously to prevent potential further delays.

A similar study by Valentini, Clark and Whitall, (2014) aimed to determine the prevalence of DCD in socially disadvantaged Brazilian children by using the M-ABC2® . In total, 1056 children between the ages of four to 10 years were assessed. The total M-ABC2® scores were18% in the red zone and 15% in the amber zone. The results for age band 1 are found in table 5.3. The low socioeconomic status was the risk factor most strongly associated with motor impairment.

Table 5.3: Difference between the Platfontein Sample and the Brazilian Studies

	Platfontein	**Valentini, et al. (2012) (n=151)**	**Valentini, Clark and Whitall (2014)**
Green	54.0% (n=29)	64.2% (n=97)	63.3% (n=95)
Amber	24.0% (n= 13)	19.9% (n=30)	20.0% (n=30)
Red	22.0% (n=12)	15.9% (n=24)	16.7% (n=25)

In the Platfontein sample manual dexterity was the category of most concern (68.5 % of the sample scored in the red zone) followed by balance (7.4% of the sample scoring in the red zone). Interestingly this order is identical to the study by Valentini, et al. (2012) as well as

Valentini, Clark and Whitall (2014). In a group of Israeli children, children from a lower socioeconomic status scored lower in the manual dexterity category than did the group of children from the higher socioeconomic status. These authors suggest that the parents in the higher socioeconomic status group may be exposing their children to games that promote manual dexterity skill refinement (Engel-Yeger and Josman, 2009).

In this study the high rates of difficulty in the manual dexterity tasks possibly contributed to the overall higher rates of red and amber zones, when comparing overall zones to the other studies. This raises the question as to whether the test is sensitive to measure manual dexterity in this cultural group. Manual dexterity as defined by the M- ABC-2® instruction manual (2007) is the ability to use the hand and fingers in a controlled and coordinated manner. Manual dexterity is necessary for many everyday activities and becomes important for writing activities at school.

5.4 OBJECTIVE 3: RELATIONSHIPS BETWEEN MOTOR DEVELOPMENT AND EXISTING MORBIDITIES

No statistically significant difference was found between TB history, malnutrition, stunting and the motor development in this sample. It is however well known that malnutrition leads to neurodevelopmental delays and has been associated with cognitive and gross motor developmental delay (Whithead, Potterton and Coovadia, 2014). Stunting, especially if it occurs before the age of two years, is associated with poor cognitive and scholastic outcomes (Grantham-McGregor, et al., 2007). Eleven point one percent of this sample is stunted according to the WHO growth charts. It is however not possible to determine when the stunting became evident in these participants. This small sample size probably lead to the finding that there is no statistical significance between the motor development and the morbidities. It is important when reviewing this finding to keep in mind that malnutrition and stunting both impact child development.

Other factors such as poverty, poor maternal (or caregiver) educational level and the lack of stimulation also contribute to developmental delays. In this study the higher risk for motor impairment as indicated by the amber and red zones of the M-ABC 2® is probably related to the problems of poverty with multiple risk factors and not being familiar with these tasks, especially the positioning coins, threading beads and drawing trial of the manual dexterity component.

Engel-Yeger and Josman (2009) suggested that socio-demographic and environmental factors should be taken into account when using the M-ABC2® to asses motor functioning.

They also suggest that the normative data of the M-ABC2® should be adjusted to different cultural contexts and socioeconomic groups.

However, considering the above, it should be noted that there are still definite delays (22% motor impairment and 24% at risk for impairment as measured by the M-ABC2®) present in this population that are not being picked up and addressed in the absence of illness and hospital admission. The physiotherapy screening service within the community is thus lacking.

5.5 OBJECTIVE 4: MOTOR DEVELOPMENT DIFFERENCES/ SIMILARITIES OF THE TWO CRÈCHES

There is statistically no difference between the M-ABC2® scores between the Khwe and the !Xun crèches in Platfontein. Socio economic statuses, caregiver education and employment, nutritional status are all similar. Both crèches have the same oversearers (Caritas Community Focus) . This could have been the reason as to what there is no statistical difference between the M-ABC2® scores between the Khwe and the !Xun crèches in Platfontein .
The implication of this finding is that the same recommendations and intervention strategies can be implemented at both EDC.

Suggestions arising from the study findings as well as recommendations will be made in the following chapter.

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATIONS

Implications of the results as well as recommendations will be made.

6.1 CONCLUSION

The main aim of this study was to determine whether the children that attend the crèches in the Platfontein community present with motor developmental delay. Secondary objectives for this study were 1) to determine the demographics (including morbidities) and anthropometric data of the study participants, 2) to determine the level of motor development in children between the ages of three and six years who attended the local crèches in the Platfontein community, 3) to establish the nature of the relationship between the existing morbidities and the motor development of the children attending the crèches in Platfontein and 4) to establish if there was a difference in motor development of children assessed between the two crèches, the two tribes.

The motor development of study participants as measured by the M-ABC2® showed a concern in the area of manual dexterity (68.5 % of the sample scored in the red zone) as well as overall concern of the motor development of children attending the crèches in the Platfontein community (22.2% of the sample scored in the red zone). These percentages differ compared to those of the national and international studies.

In this study there was no statistically significant relationship between the motor development as measured by the M-ABC2® and existing morbidities (malnutrition, stunting). These are however well known factors that affect childhood development.

The San are known to be small in stature and their genetic predisposition to shorter heights could have contributed to over identification of malnutrition and stunting.

There were no motor development differences between the two crèches in the Platfontein community.

The motor development of the children attending the crèches in the community is of a concern, there are definite delays present in the community that are not picked up and addressed in the absence of illness and hospitalisation. These should however be addressed to prevent further difficulties and further consequences.

6.2 RECOMMENDATIONS

The following recommendations are made.

6.2.1 Recommendations to Ensure Longer and Lasting Outcomes: Community Based Intervention

Early intervention can be defined as intervening as soon as possible after the factors contributing to the delay have been identified. Alternatively, intervention can take place very early in the child's life to avert problems later on (Couper, 2016). Considering the lack of physiotherapy screening services within the community, it is recommended that a community health care worker, based at the clinic is to be trained to screen children for developmental delays during the clinic visits and to then refer appropriately.

As stated in chapter two, the family environment and stimulation that takes place at home are more important than the school environment (Heckman, 2006). Early intervention programmes that address risk factors that can be changed are of benefit to disadvantaged children and a benefit to the community (Maulik and Darmstadt, 2009; Baker-Henningham and Boo, 2010). A literature review done by Maulik and Darmstadt (2009) suggested that intervention programmes that were successful in developing countries included organized play and reading. These findings were however specific to the age group of 0-3 years. Intervention programmes that support caregivers and include participation of the child and the caregivers have also been shown to be effective in improving child development and parenting skills (Baker-Henningham and Boo, 2010). Characteristics of such intervention programs are that they are of high quality and intensity and that they are integrated into professional health, educational and family supportive services. Interventions aiming at the younger children are of good benefit (Baker-Henningham and Boo, 2010).

It is therefore recommended that a small group intervention program should be implemented in the Platfontein community. This program should aim at equipping and educating the primary caregivers of the children attending the crèches. The program should have the following features: well designed, structured, goal directed, involving professional multi-disciplinary contact sessions, be culturally sensitive and cost-effective. The focus should be on creating and sustaining a healthy family unit. Within this program the different disciplines can each address the various risk factors that are evident in the community, give individual assistance and advice how to address and overcome them within the family. The Caritas Community Project is active in this regard. It is however recommended that different disciplines participate and work in partnership to offer their knowledge and their area of expertise. For example: The dietician can teach about good and adequate nutrition and can

help with acquiring the food, the occupational therapist can use activities and games (also making use of locally available games) to stimulate manual dexterity. The physiotherapist can also use games to stimulate gross motor development.

It is also recommended that a similar form of early identification intervention program is to be implemented for the children and their parents in the younger age category (0-3 years) in order to prevent some of the delay seen in the pre-school years.

6.2.2 **Recommendations to be made at the Individual Crèches**

The following recommendations are made to the teachers as well as to the overseers of the crèches:

Set time aside, daily, for drawing, colouring in and copying or tracing shapes of different sizes. It is important that these activities are monitored and that children who struggle are helped and encouraged.

Repeated and regular play with toys involving handling of fine objects is recommended. Examples of these activities include: threading of beads, playing four in a row, puzzle building, finger painting, origami, Lego ® and sculpturing with play dough.

Hop scotch games and ball games should be implemented and supervised so that all children get exposure. Children who struggle may not be left out.

6.2.3 **Suggested further Research**

It is suggested that a similar but larger study involving children of similar ages who do not attend the ECDC is conducted and that the prevalence of motor development delay is compared in the group of children attending ECDC and the group not attending ECDC.
It is recommended that the development of children younger and older than those in this study should be measured and that pattern and time period of development across these age ranges should be reported..

Another study can be conducted which identifies possible antenatal risk factors and their prevalence in the community.

It is suggested that the anthropometric measures of the community should be studied in order to get a better understanding of the anthropometric normative data of this population.

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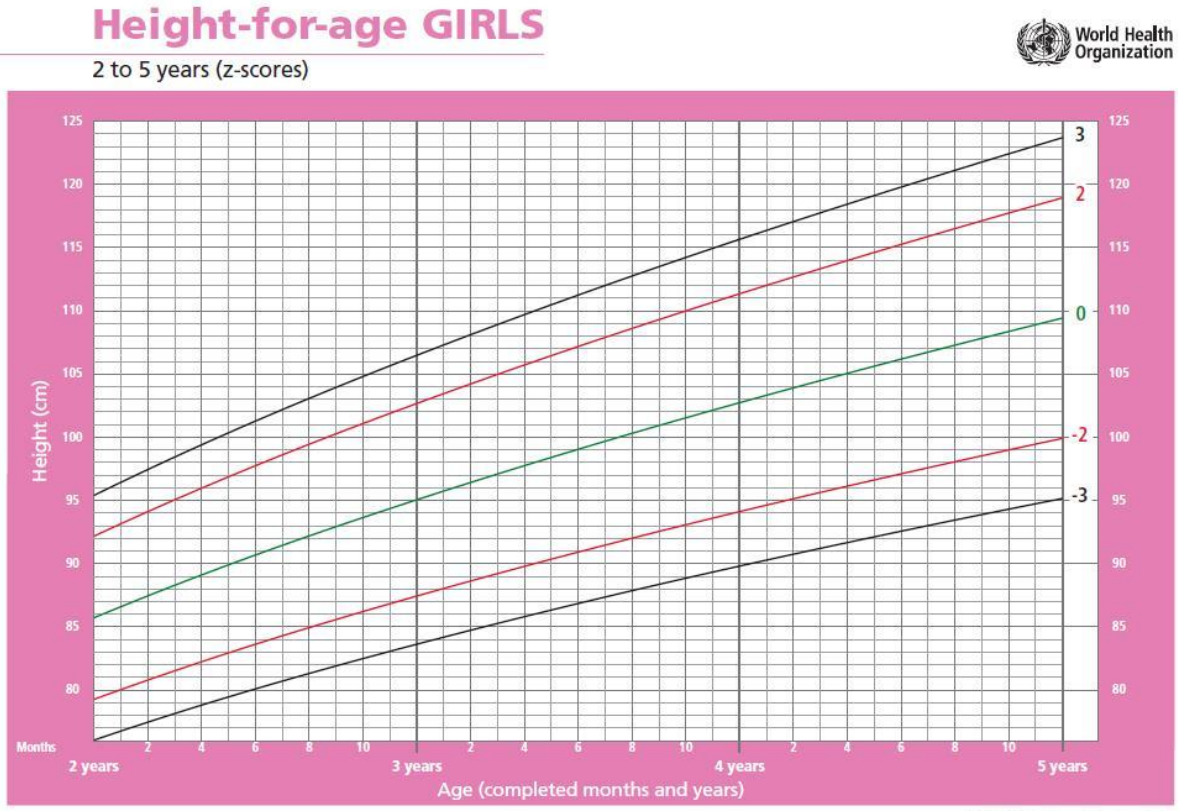
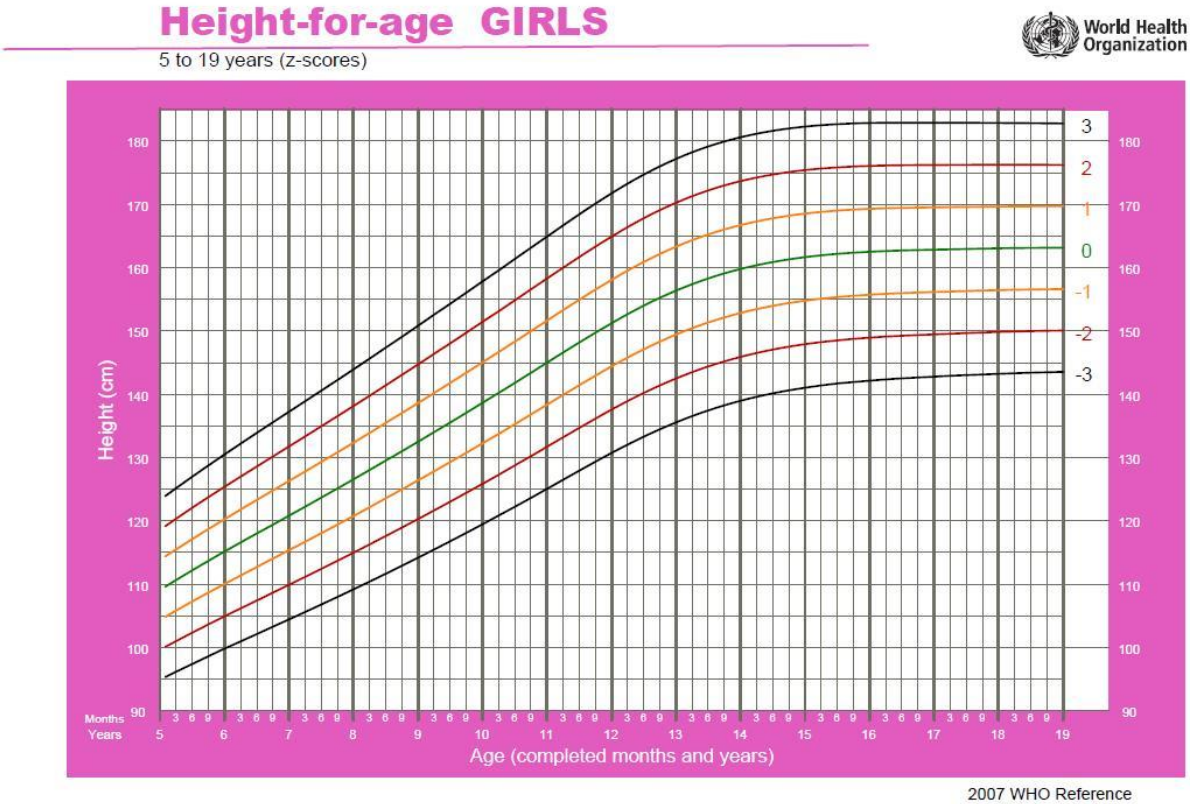
APPENDIX A

- **ANTHROPOMETRIC CHARTS (GIRLS AND BOYS)**



WHO Child Growth Standards

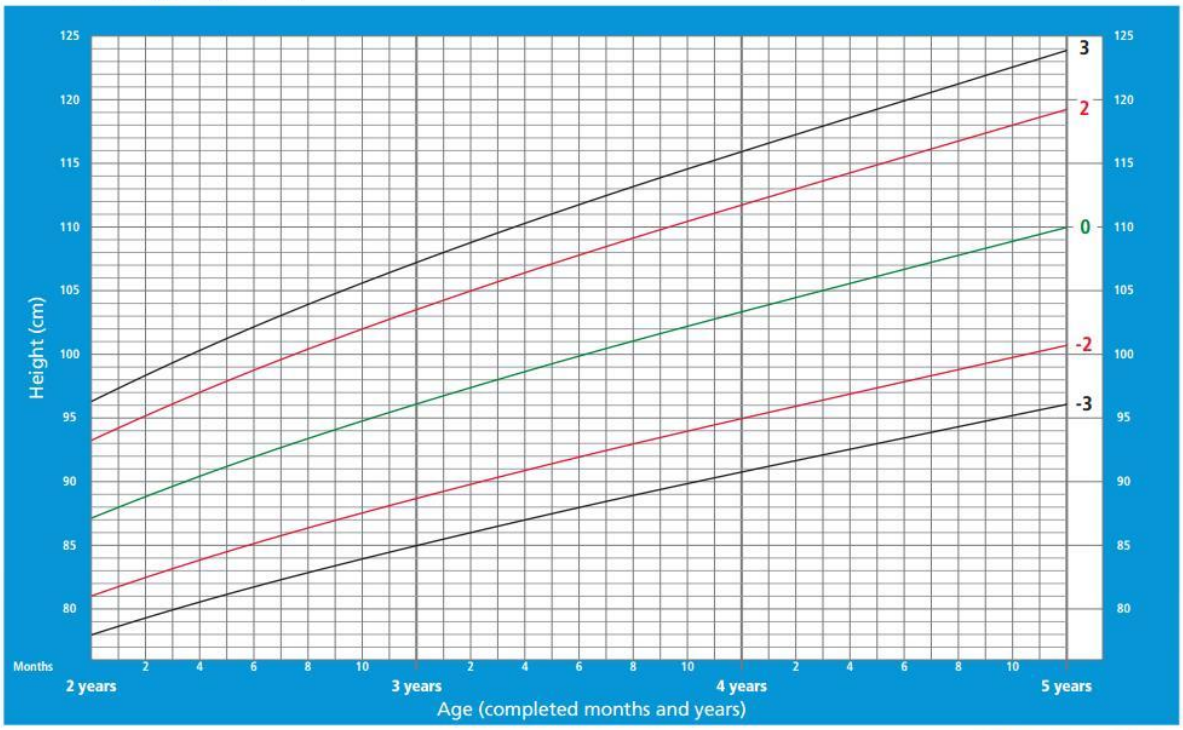


2007 WHO Reference

Height-for-age BOYS

2 to 5 years (z-scores)

World Health Organization

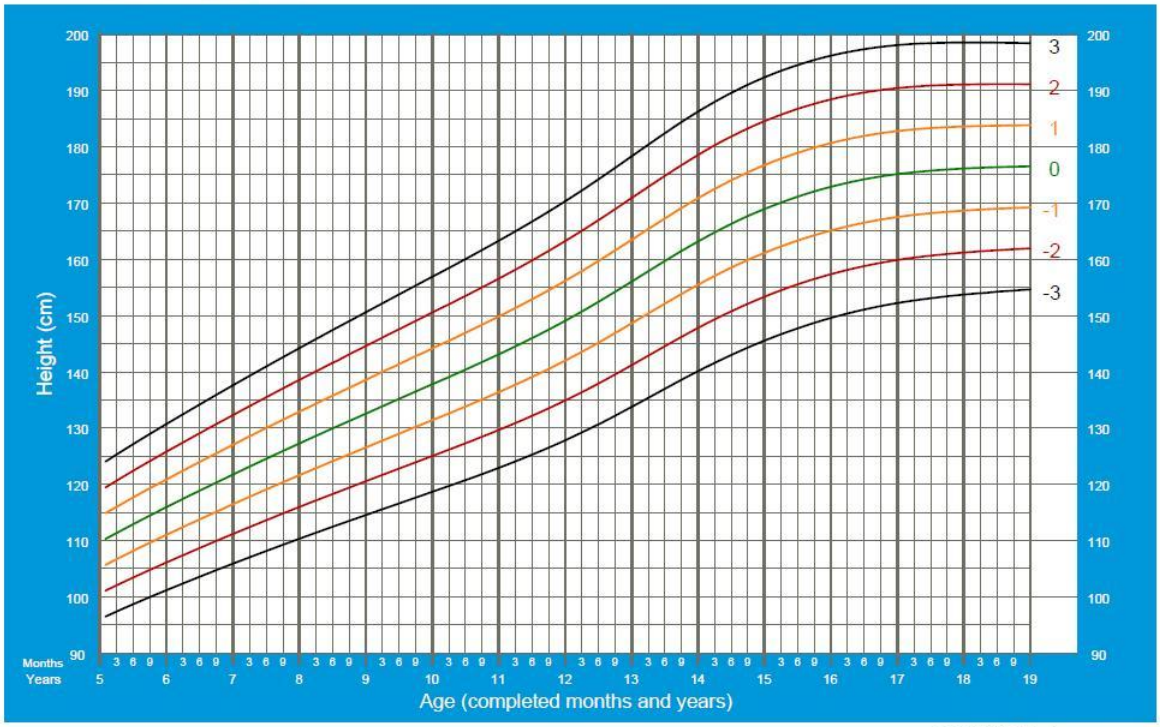


WHO Child Growth Standards

Height-for-age BOYS

5 to 19 years (z-scores)

World Health Organization

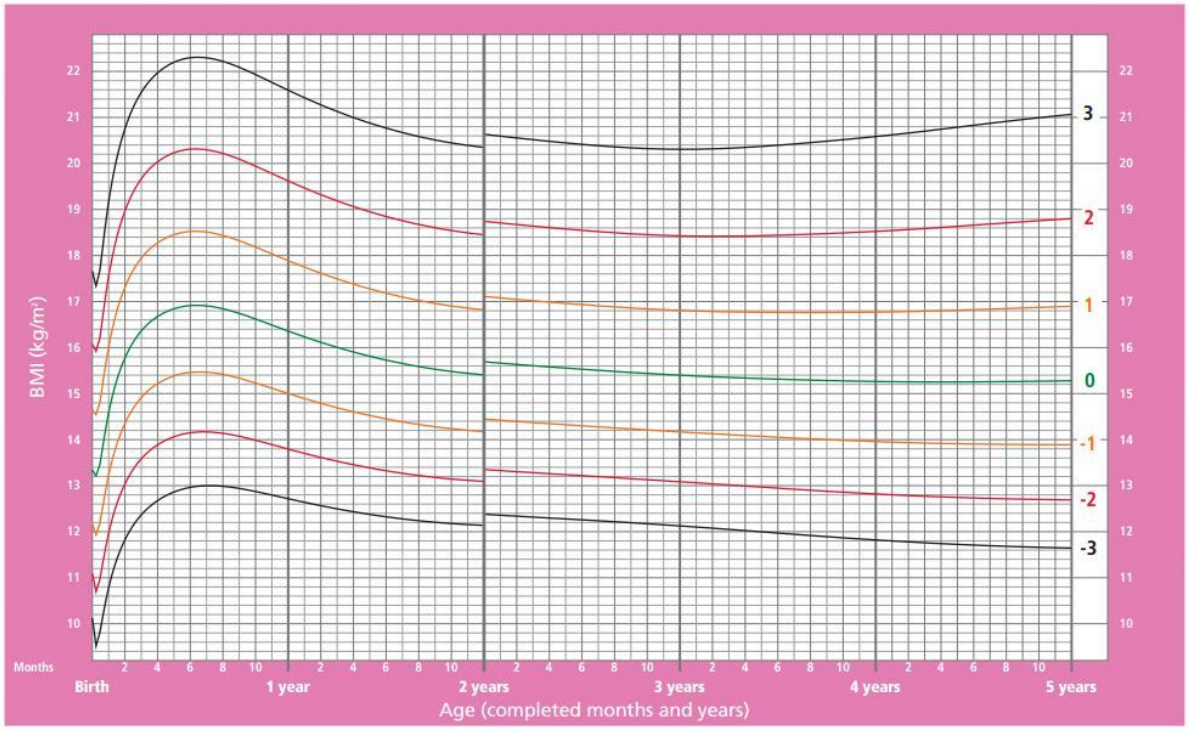


2007 WHO Reference

BMI-for-age GIRLS

Birth to 5 years (z-scores)

World Health Organization

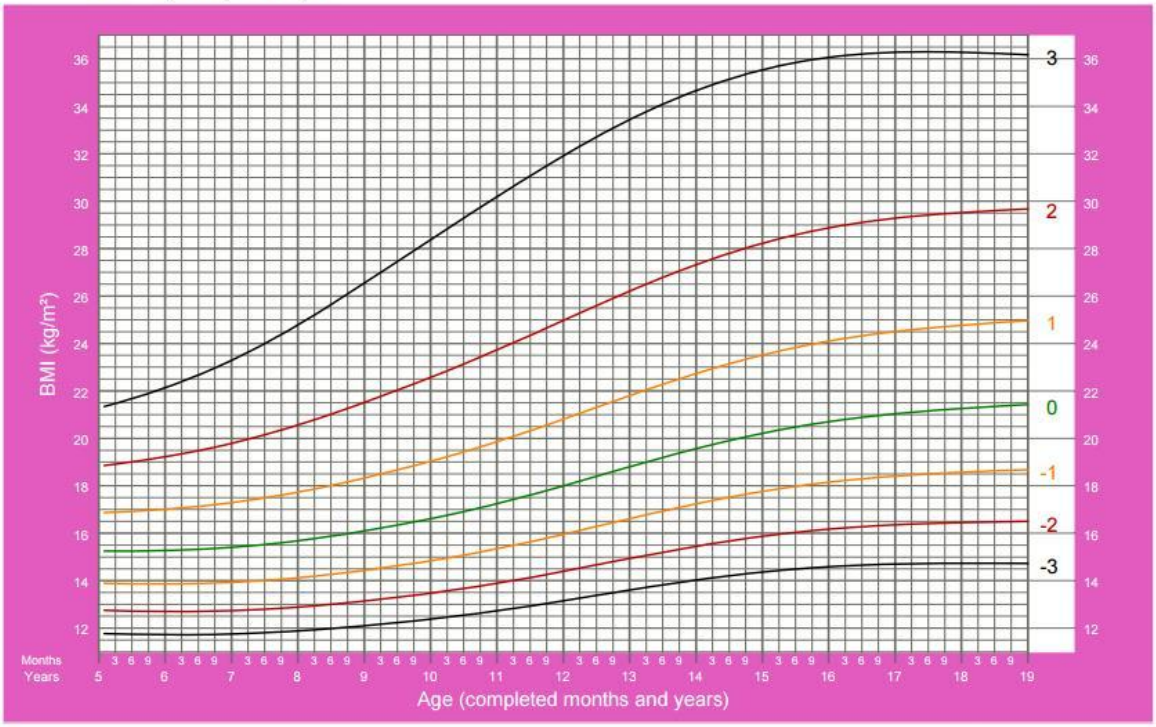


WHO Child Growth Standards

BMI-for-age GIRLS

5 to 19 years (z-scores)

World Health Organization

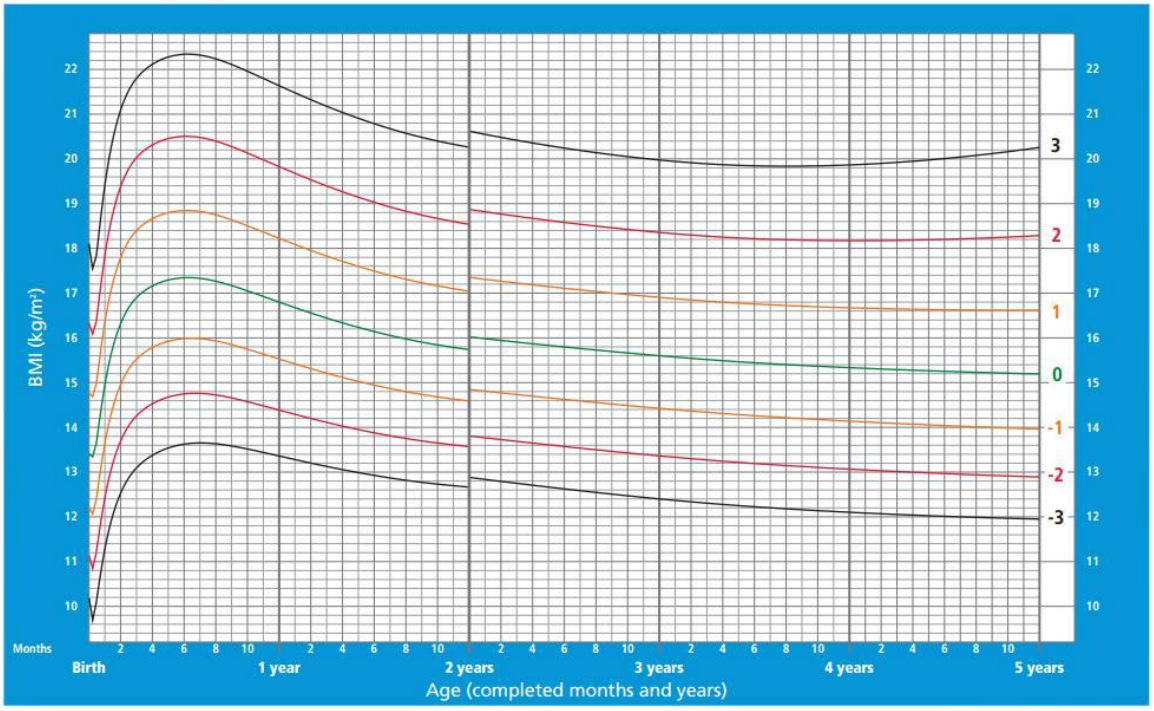


2007 WHO Reference

BMI-for-age BOYS

Birth to 5 years (z-scores)

World Health Organization

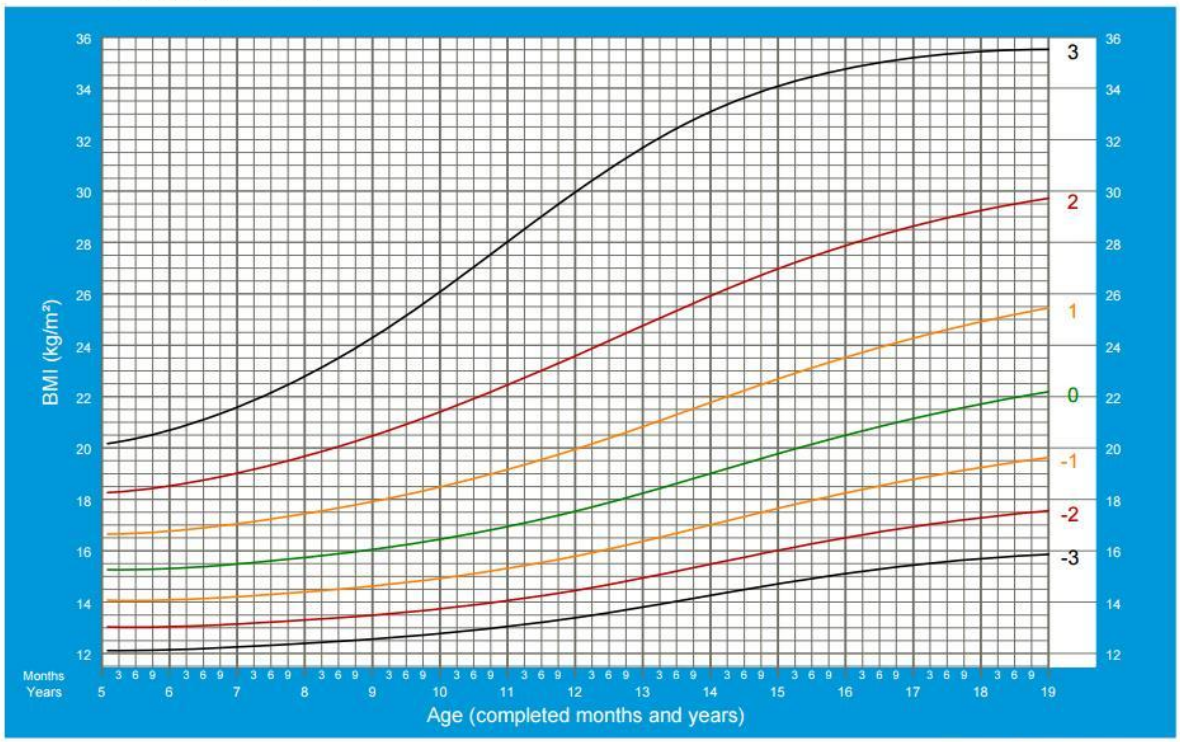


WHO Child Growth Standards

BMI-for-age BOYS

5 to 19 years (z-scores)

World Health Organization

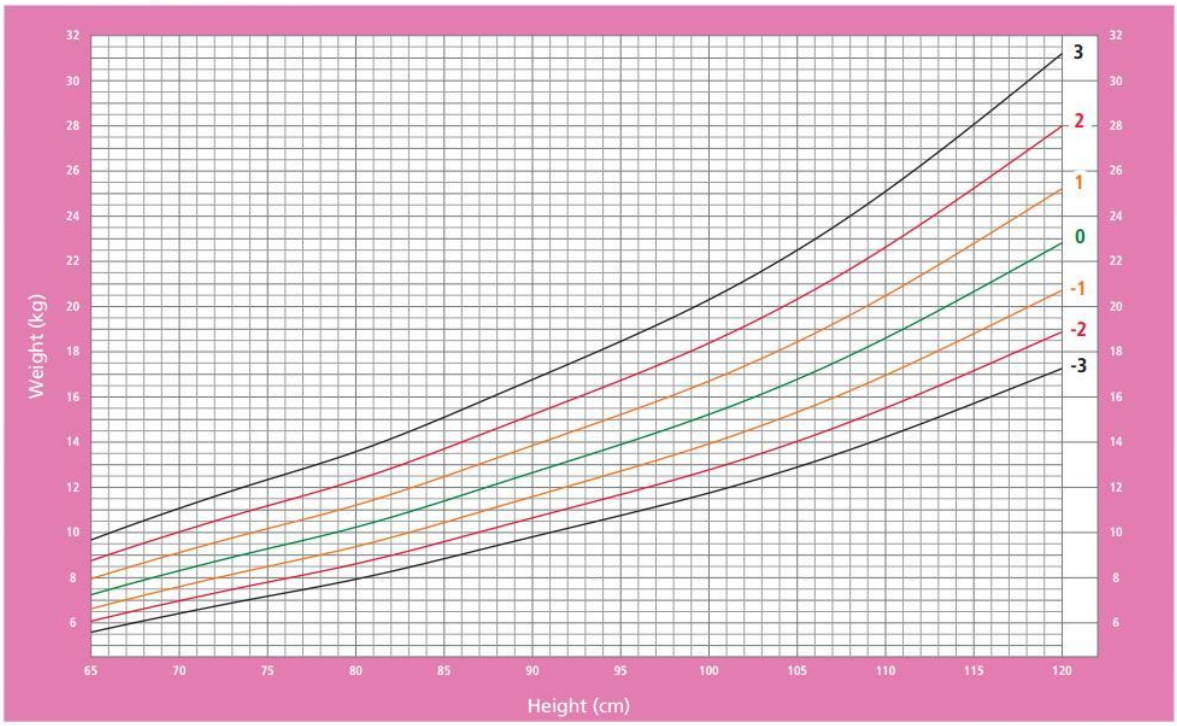


2007 WHO Reference

Weight-for-Height GIRLS

2 to 5 years (z-scores)

World Health Organization

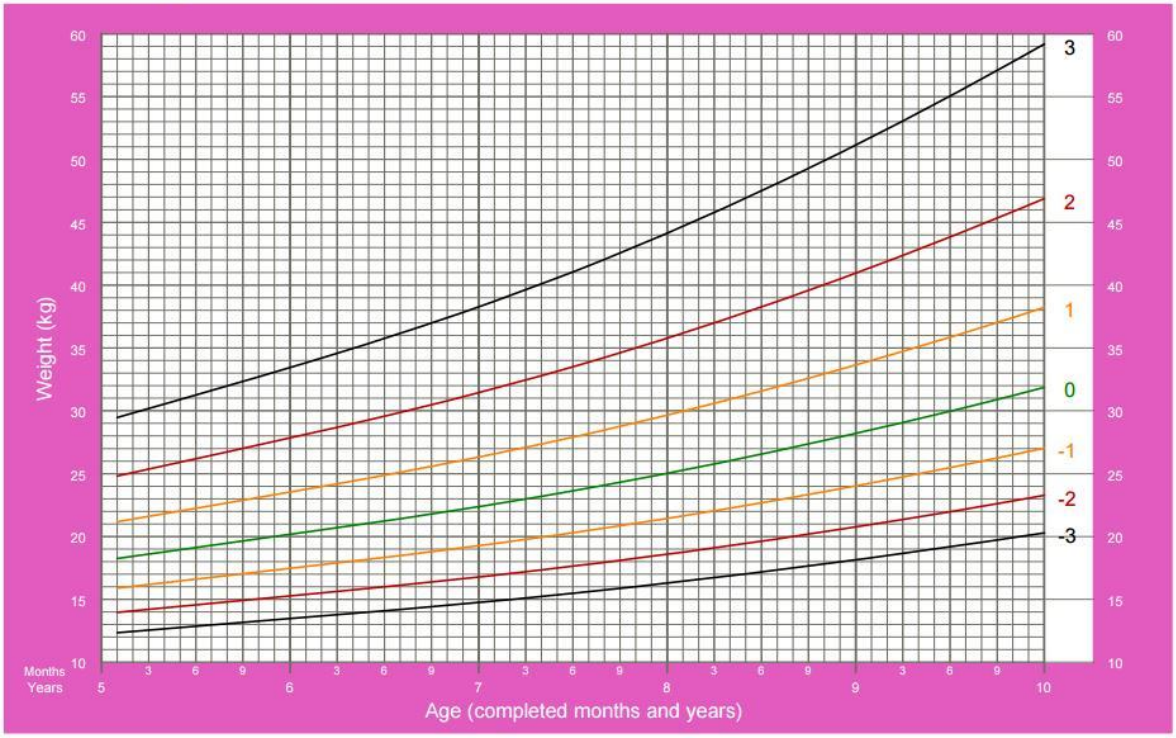


WHO Child Growth Standards

Weight-for-age GIRLS

5 to 10 years (z-scores)

World Health Organization

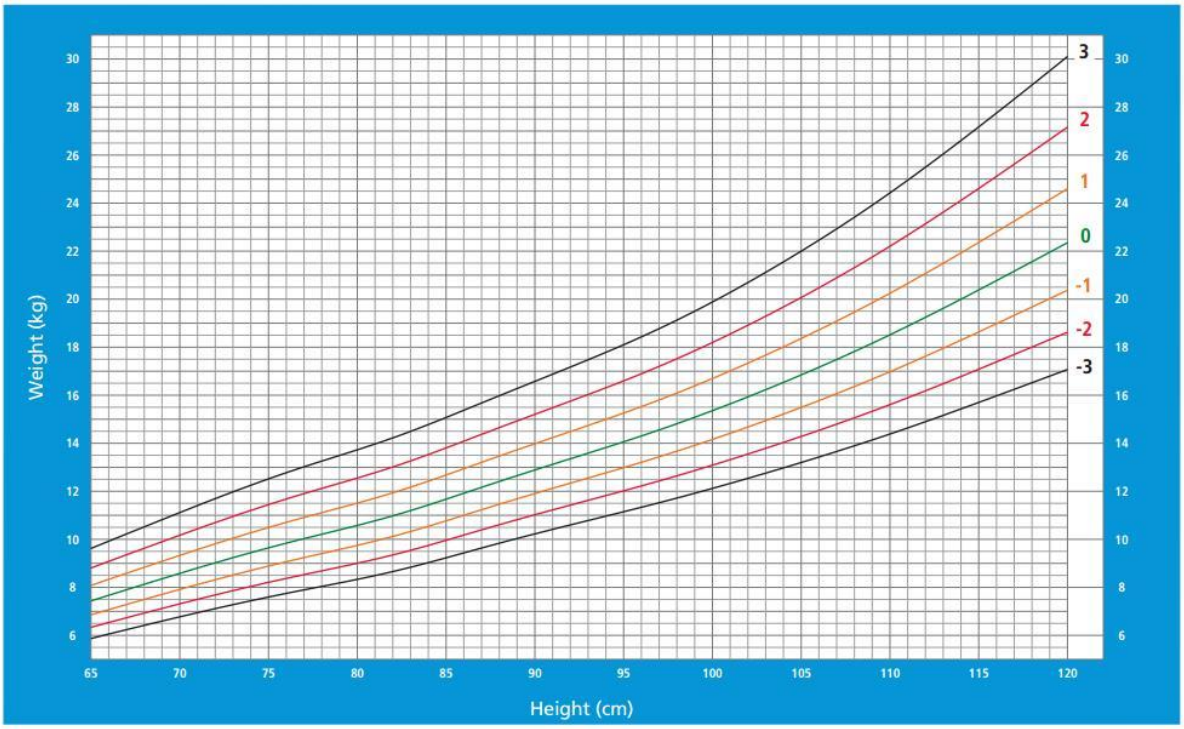


2007 WHO Reference

Weight-for-height BOYS

2 to 5 years (z-scores)

World Health Organization

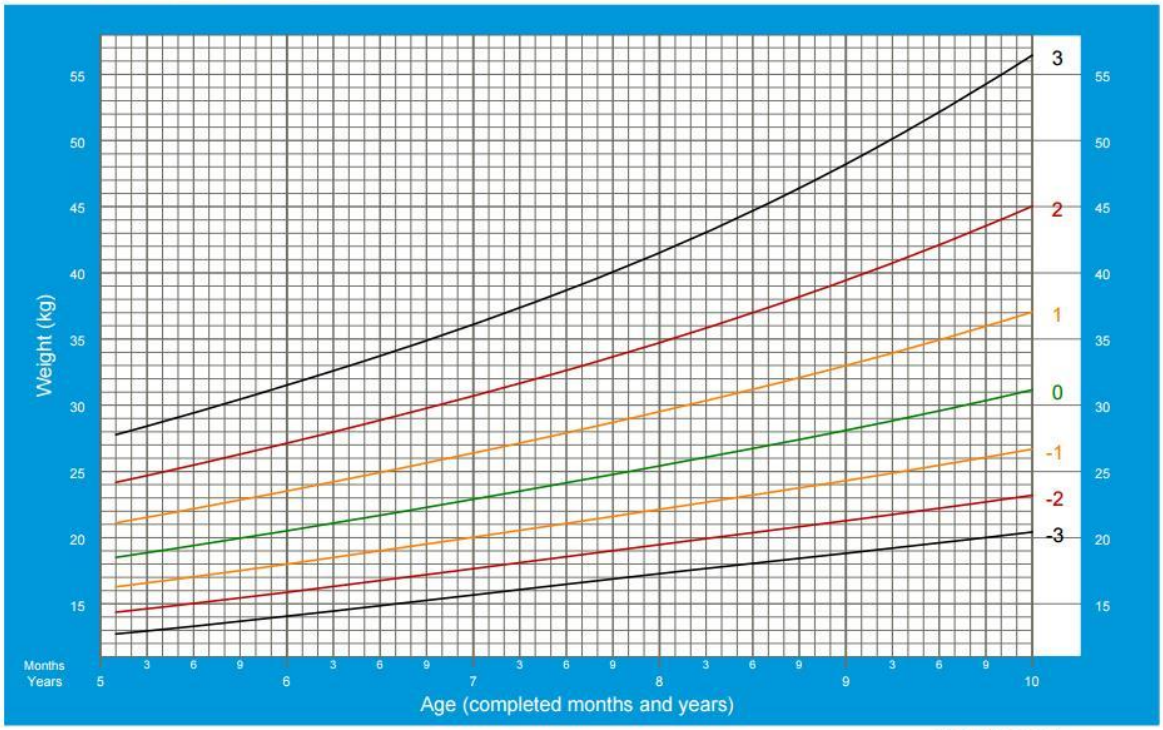


WHO Child Growth Standards

Weight-for-age BOYS

5 to 10 years (z-scores)

World Health Organization



2007 WHO Reference

APPENDIX B

- **PHOTOGRAPHS OF PLATFONTEIN**

Figure B.1: Entrance to Platfontein

Figure B.2: The landscape of Platfontein

Figure B.3: Residential area

Figure B.4: Residential area

Figure B.5: Front view of classroom at the !Xun crèche

Figure B.6: Side view and hand washing facilities of the !Xun classroom

Figure B.7: Playground of the !Xun crèche

Figure B.8: Caritas manages the crèches in Platfontein

Figure B.9: Entrance to the Khwe crèche

Figure B.10: Residential area surrounding the Khwe crèche

Figure B.11: Playground at the Khwe crèche

Figure B.12: Playground at the Khwe crèche

APPENDIX C

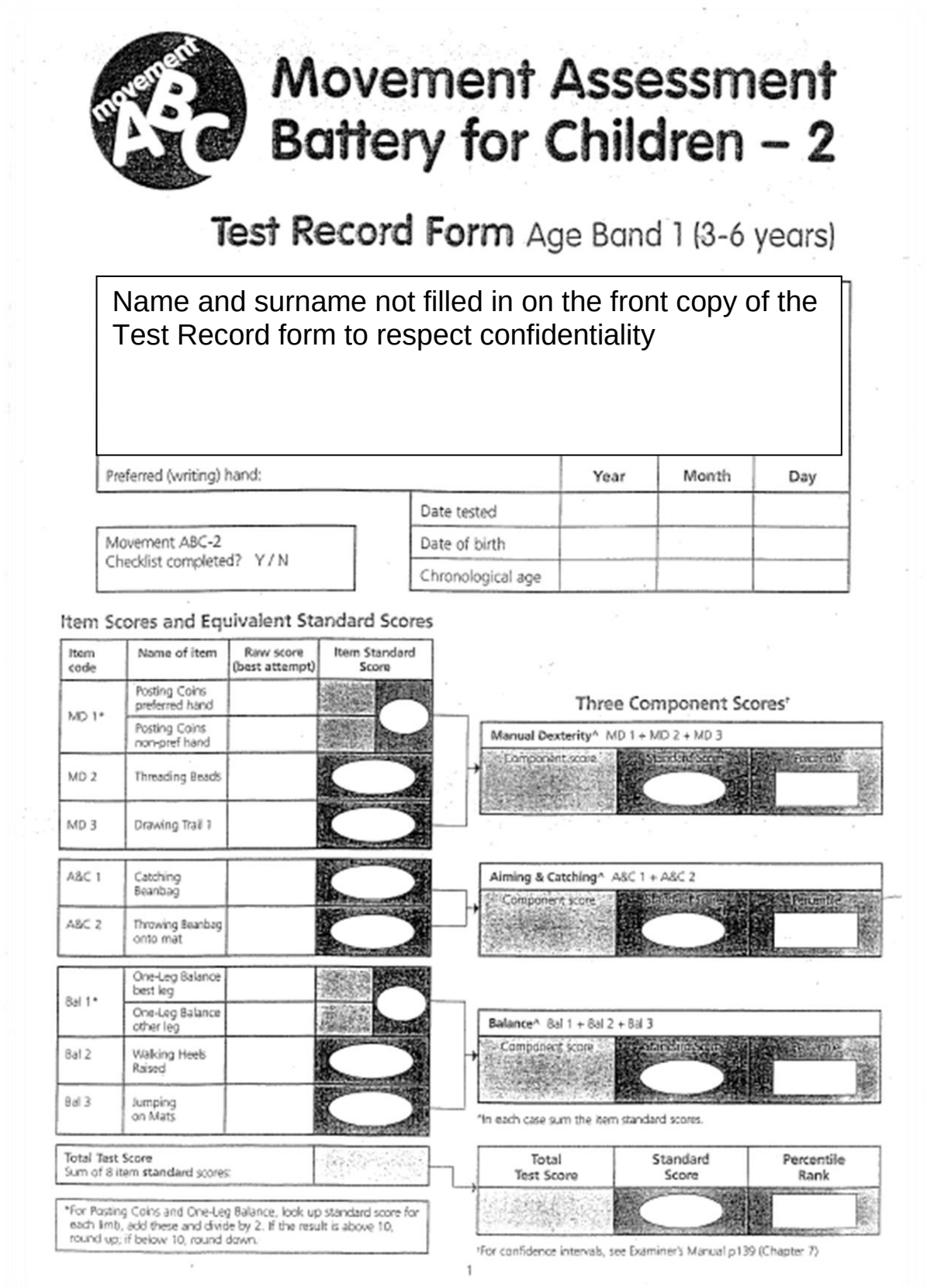
- **DATA COLLECTION SHEET**

MOTOR DEVELOPMENT OF CHILDREN ATTENDING CRÈCHES IN THE PLATFONTEIN COMMUNITY

					Official Use	
Data capturing form no:						1
Creche	!Xun	Khwe				2
Date						3
Time started						
Time ended						
Study participant						
Date of birth of study participant	year	month	day			4
Age of study participant	years	months	days			5
Gender	male	female				6
Care giver information						
Main caregiver	Parent	Grandparent	Extended family member	Other		7
Is caregiver	Single	Married				8
Care giver age						9
Caregiver employed	Yes	No				10
Caregiver educational level	Grade 7	Matric	University	None		11
Morbidities						
TB	Y	N	Unknown			12
HIV	Y	N	Unknown			13
Anthropometric data						
Height		cm				14
Weight		kg				15
BMI						16
Head circumference						17
Upperarm circumference						18
Scores						
Manual Dexterity						19
Aiming and Catching						20
Balance						21
M-ABC2 total score and percentile						22
Traffic light system	Red	Yellow	Green			23
Referral to therapist/dr	PT	OT	Dr	Not indicated		24

APPENDIX D

- **M-ABC2® TEST RECORD FORM AND NORMATIVE DATA OF M-ABC2®**



Movement Assessment Battery for Children – 2

Test Record Form Age Band 1 (3-6 years)

Name and surname not filled in on the front copy of the Test Record form to respect confidentiality

Preferred (writing) hand:		Year	Month	Day
Movement ABC-2 Checklist completed? Y / N	Date tested			
	Date of birth			
	Chronological age			

Item Scores and Equivalent Standard Scores

Item code	Name of item	Raw score (best attempt)	Item Standard Score
MD 1*	Posting Coins preferred hand		
	Posting Coins non-pref hand		
MD 2	Threading Beads		
MD 3	Drawing Trail 1		
A&C 1	Catching Beanbag		
A&C 2	Throwing Beanbag onto mat		
Bal 1*	One-Leg Balance best leg		
	One-Leg Balance other leg		
Bal 2	Walking Heels Raised		
Bal 3	Jumping on Mats		
Total Test Score Sum of 8 item standard scores:			

*For Posting Coins and One-Leg Balance, look up standard score for each limb, add these and divide by 2. If the result is above 10, round up; if below 10, round down.

Three Component Scores†

	Component score	Standard Score	Percentile
Manual Dexterity^ MD 1 + MD 2 + MD 3			
Aiming & Catching^ A&C 1 + A&C 2			
Balance^ Bal 1 + Bal 2 + Bal 3			

^In each case sum the item standard scores.

Total Test Score	Standard Score	Percentile Rank

†For confidence intervals, see Examiner's Manual p139 (Chapter 7)

1

Manual Dexterity 1: POSTING COINS

Note: 6 coins for 3-4 years, 12 for 5-6 years

Record: Preferred hand: R / L (should be same as for Drawing Trail); Time taken (secs); **F** for failure; **R** for refusal; **I** if inappropriate (note reasons below)

Preferred hand	
Trial 1	
Trial 2	

Non-preferred hand	
Trial 1	
Trial 2	

Qualitative observations

Posture/body control

- Sitting posture is poor ☐
- Holds head too close to task ☐
- Holds head at an odd angle ☐
- Does not look at slot while inserting coins ☐
- Does not use pincer grip to pick up coins ☐
- Exaggerates finger movements in releasing coins ☐
- Does not use the supporting hand to hold box steady ☐
- Does extremely poorly with one hand (asymmetry striking) ☐
- Changes hands or uses both hands during a trial ☐
- Hand movements are jerky ☐
- Moves constantly/fidgets ☐

Adjustment to task requirements

- Misaligns coins with respect to slot ☐
- Uses excessive force when inserting coins ☐
- Is exceptionally slow/does not change speed from trial to trial ☐
- Goes too fast for accuracy ☐
- **Other** _____

Comments: _____

Manual Dexterity 2: THREADING BEADS

Note: 6 beads for 3-4 years, 12 for 5-6 years

Record: Time taken (secs); **F** for failure; **R** for refusal; **I** if inappropriate (note reasons below)

No. of seconds	
Trial 1	
Trial 2	

Qualitative observations

Posture/body control

- Sitting posture is poor ☐
- Holds materials too close to face ☐
- Holds head at an odd angle ☐
- Does not look at bead while inserting tip of lace ☐
- Does not use pincer grip to pick up beads ☐
- Holds lace too far from tip ☐
- Holds lace too near tip ☐
- Finds it difficult to push tip with one hand and pull it through with the other ☐
- Changes threading hands during a trial ☐
- Hand movements are jerky ☐
- Moves constantly/fidgets ☐

Adjustment to task requirements

- Sometimes misses hole with tip of lace ☐
- Picks up beads the wrong way round ☐
- Is exceptionally slow/does not change speed from trial to trial ☐
- Goes too fast for accuracy ☐
- **Other** _____

Comments: _____

Manual Dexterity 3: DRAWING TRAIL 1

Note: Berol pen to be used

Record: Hand used: R/L/Both; No. of errors; **F** for failure; **R** for refusal; **I** if inappropriate (note reasons below)
Number of errors should be counted after testing using scoring criteria provided in Appendix A of the Manual.

	No. of errors
Trial 1	
Trial 2	

Do not administer a second trial if the child completes the first trial perfectly (i.e. no errors).

Qualitative observations

Posture/body control

- Sitting posture is poor ☐
- Holds head too near paper ☐
- Holds head at an odd angle ☐
- Does not look at trail ☐
- Holds pen with an odd/immature grip ☐
- Holds pen too far from point ☐
- Holds pen too close to point ☐
- Does not hold paper still ☐
- Changes hands during a trial ☐
- Moves constantly/fidgets ☐

Adjustment to task requirements

- Progresses in short jerky movements ☐
- Uses excessive force, presses very hard on paper ☐
- Is exceptionally slow ☐
- Goes too fast for accuracy ☐
- **Other** _____

Comments: _____

Aiming & Catching 1: CATCHING BEANBAG

Note: Trapping allowed for 3-4 year olds, not for 5-6

Record: Number of correctly executed catches out of 10; **R** for refusal; **I** if inappropriate (note reasons below)

Practice: ☐☐☐☐☐ 10 Trials: ☐☐☐☐☐☐☐☐☐☐ Total: _____

Qualitative observations

Posture/body control

- Standing posture is poor ☐
- Does not follow trajectory of beanbag with eyes ☐
- Turns away or closes eyes as beanbag approaches ☐
- Arms are not raised symmetrically for catching ☐
- Holds hands out flat with fingers stiff as the beanbag approaches ☐
- Hands and arms held wide apart, fingers extended ☐
- Fingers close too early or too late ☐
- Does not move until beanbag strikes body ☐
- Movements lack fluency ☐

Adjustment to task requirements

- Does not adjust body position for catching ☐
- Does not adjust position of feet as necessary ☐
- Does not adjust to height of throw ☐
- Does not adjust to direction of throw ☐
- Does not adjust to force of throw ☐
- **Other** _____

Comments: _____

Aiming & Catching 2: THROWING BEANBAG ONTO MAT

Note: Target is the whole mat, not just the orange circle

Record: Hand used: R / L / Both; Number of successful hits; **R** for refusal; **I** if inappropriate (note reasons below)

Practice: ☐☐☐☐☐ 10 Trials: ☐☐☐☐☐☐☐☐☐☐ Total:_____

Qualitative observations

Posture/body control

- Balance while throwing is poor ☐
- Does not keep eyes on target ☐
- Does not use a pendular swing of the arm ☐
- Does not follow through with the throwing arm ☐
- Releases beanbag too early or too late ☐
- Changes hands from trial to trial ☐
- Movements lack fluency ☐

Adjustment to task requirements

- Errors are consistently to one side of target (asymmetry striking) ☐
- Control of direction variable ☐
- Judges force of throw poorly (too much or too little) ☐
- Control of force is variable ☐
- **Other** _____

Comments: _____

Balance 1: ONE-LEG BALANCE

Record: Time balanced (secs); **R** for refusal; **I** if inappropriate (note reasons below)

		No. of seconds			No. of seconds
Right Leg	Trial 1		Left Leg	Trial 1	
	Trial 2			Trial 2	

Do not administer a second trial if the child maintains balance for 30 seconds

Qualitative observations

Posture/body control

- Body appears rigid/tense ☐
- Body appears limp/floppy ☐
- Sways wildly to try to maintain balance ☐
- Does not hold head and eyes steady ☐
- Makes no or few compensatory arm movements to help maintain balance ☐

- Exaggerated movements of arms and trunk disrupt balance ☐
- Does extremely poorly on one leg (asymmetry striking) ☐
- **Other** _____

Comments: _____

Balance 2: WALKING HEELS RAISED

Record: Number of correct consecutive steps from the beginning of the line; Whether entire line was walked successfully; **R** for refusal; **I** if inappropriate (note reasons below)

	No. of steps	Entire line?
Trial 1		YES / NO
Trial 2		YES / NO

Do not administer a second trial if the child completes 15 steps OR completes the whole line in fewer than 15 correctly executed steps.

Qualitative observations

Posture/body control

- Body appears rigid/tense ☐
- Body appears limp/floppy ☐
- Sways wildly to try to maintain balance ☐
- Does not keep head steady ☐
- Does not compensate with arms to maintain balance ☐
- Exaggerated arm movements disrupt balance ☐
- Is very wobbly when placing feet on line ☐

Adjustment to task requirements

- Goes too fast for accuracy ☐
- Individual movements lack smoothness and fluency ☐
- Sequencing of steps is not smooth/pauses frequently ☐
- **Other** _____

Comments: _____

Balance 3: JUMPING ON MATS

Note: Need only be continuous at 5-6 years

Record: Number of correct consecutive jumps (maximum of 5); **R** for refusal; **I** if inappropriate (note reasons below)

	No. of jumps
Trial 1	
Trial 2	

Do not administer a second trial if the child completes 5 perfect jumps on the first trial

Qualitative observations

Posture/body control

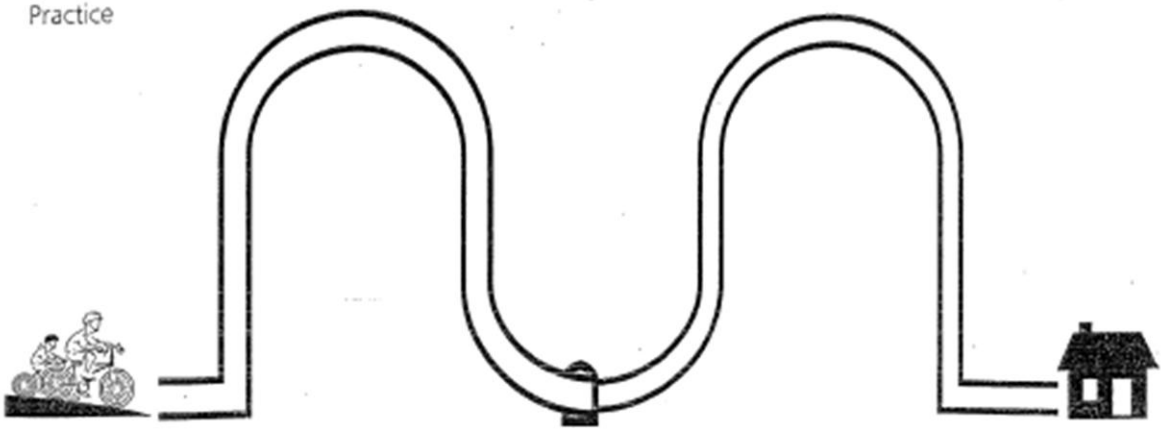
- Body appears rigid/tense ☐
- Body appears limp/floppy ☐
- Makes no preparatory crouch ☐
- Jumps with stiff legs/on flat feet ☐
- Arms swing out of phase with legs ☐
- Arm movements are exaggerated ☐
- Does not use arms to assist jump ☐
- Lacks springiness/no push-off from feet ☐
- Uneven take off and loss of symmetry in flight and landing ☐
- Stumbles on landing ☐

Adjustments to task requirements

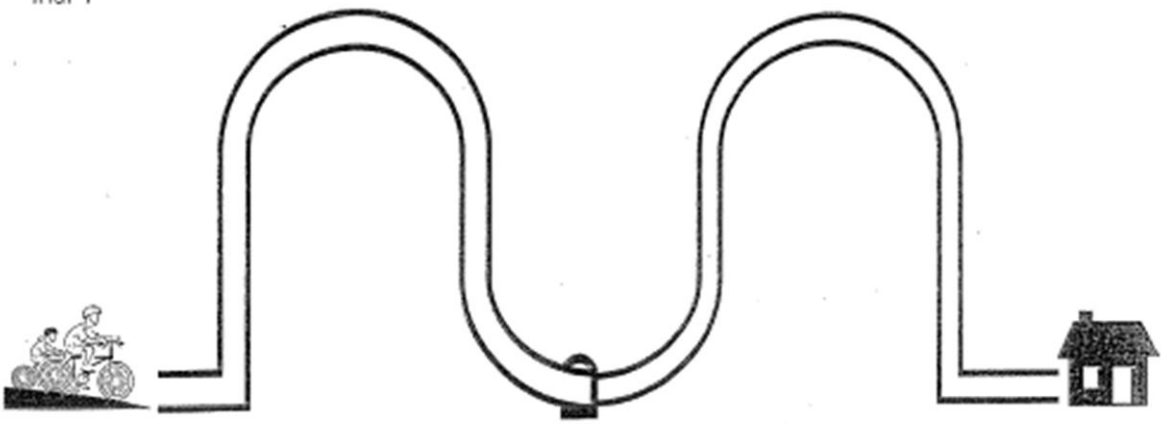
- Goes too fast for accuracy ☐
- Does not combine upward and forward movements effectively ☐
- Uses too much effort ☐
- Movements are jerky ☐
- **Other** _____

Comments: _____

AB1
Practice



Trial 1



Trial 2

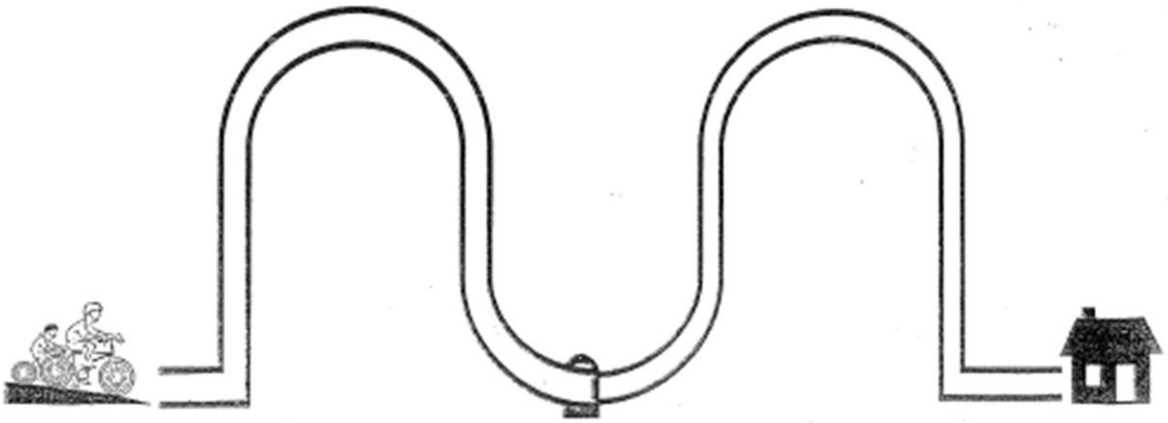


Table 2: Standard score and percentile equivalents for three component scores

Standard Score	Manual Dexterity	Aiming & Catching	Balance	Percentile
19	43+	33+	44+	99.9
18	42	31-32	42-43	99.5
17	41	30	40-41	99
16	40	29	38-39	98
15	38-39	27-28	37	95
14	37	26	36	91
13	35-36	24-25	-	84
12	33-34	22-23	35	75
11	31-32	21	33-34	63
10	29-30	19-20	31-32	50
9	26-28	17-18	28-30	37
8	24-25	15-16	25-27	25
7	22-23	14	23-24	16
6	19-21	13	19-22	9
5	16-18	11-12	15-18	5
4	13-15	10	13-14	2
3	9-12	9	11-12	1
2	4-8	7-8	9-10	0.5
1	<3	<6	<8	0.1

Table 3a: Standard score and percentile equivalents for Total Test Score

Standard Score	Total Score	Percentile
19	108+	99.9
18	105-107	99.5
17	102-104	99
16	99-101	98
15	96-98	95
14	93-95	91
13	90-92	84
12	86-89	75
11	82-85	63
10	78-81	50
9	73-77	37
8	68-72	25
7	63-67	16
6	57-62	9
5	50-56	5
4	44-49	2
3	38-43	1
2	30-37	0.5
1	<29	0.1

Movement ABC-2 Test 'Traffic Light' System

Some users might find a simple 'Traffic Light' system useful when explaining a child's Test score to parents, teachers or learning support staff. This system is based on percentiles only. The definition of each zone is as follows:

Table 3b: Traffic Light system for Total Test Score

Child's score	Total Test Score	Percentile range	Description
Red zone	up to and including 56	at or below the 5th percentile	denotes a significant movement difficulty
Amber zone	between 57 and 67 inclusive	between the 5th and 15th percentile inclusive	suggests the child is 'at risk' of having a movement difficulty; monitoring required
Green zone	any score above 67	above the 15th percentile	no movement difficulty detected

Note: as there is no direct correspondence between the 15th percentile and a standard score, in this instance the 16th percentile point has been taken as the upper end of the 'amber' range, equivalent to a standard score of 7.

In the Movement ABC-2 Test, **poor** performance is represented by **low** standard scores. In contrast, in the Movement ABC-2 Checklist, **high** scores represent **poor** performance. In this case, the red zone represents scores at or above the 95th percentile, the amber zone between the 85th and the 94th percentile inclusive, and the green zone any score below the 85th percentile. (See page 96 for the equivalent table for the Checklist).

APPENDIX B
NORMATIVE DATA

Table 1: Standard score equivalents of raw scores on each test item

Age 3:0 to 3:5

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	8-10	7-10	17-30	11-30	-	-	19
18	-	-	-	-	-	-	-	-	-	-	18
17	-	-	-	-	-	-	-	-	15	-	17
16	<9	-	<26	0-1	-	-	15-16	10	-	-	16
15	-	<9	27-32	-	7	6	14	9	-	-	15
14	10	10-11	33-35	2	-	5	9-13	6-8	12-14	5	14
13	11	-	36-40	3	-	-	7-8	5	10-11	-	13
12	12	12	41-47	4	6	-	6	4	8-9	-	12
11	13	13-14	48-52	5	5	4	5	3	7	4	11
10	14	15-16	53-56	6	-	-	4	-	-	-	10
9	15	17-18	57-65	7-8	4	3	-	2	6	3	9
8	16	19	66-70	9	3	2	3	-	4-5	-	8
7	-	20-21	71-78	10-11	2	1	2	1	3	2	7
6	17	22-23	79-83	12-14	1	0	1	-	2	1	6
5	-	24-28	84-87	15	0	-	-	0	0-1	-	5
4	18	29	88-96	16-17	-	-	0	-	-	0	4
3	-	-	-	-	-	-	-	-	-	-	3
2	-	-	-	-	-	-	-	-	-	-	2
1	19+	30+	97+	18+	-	-	-	-	-	-	1

Age 3:6 to 3:11

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	10	9-10	24-30	15-30	-	-	19
18	-	-	-	-	-	-	-	-	-	-	18
17	-	-	-	-	-	8	21-23	13-14	-	-	17
16	<6	-	-	-	-	-	20	12	-	-	16
15	7-8	<9	<23	-	9	7	18-19	9-11	-	-	15
14	-	-	24-28	0	-	6	14-17	7-8	-	-	14
13	9	10	29-35	1-2	-	-	10-13	6	15	-	13
12	10	11-12	36-38	3-4	7-8	5	7-9	5	14	5	12
11	11	13	39-40	5	-	4	5-6	3-4	12-13	-	11
10	12	14	41-47	6	6	-	4	-	-	-	10
9	13	15	48-56	7	-	3	-	-	7-11	-	9
8	14	16	57-65	8	5	2	3	2	6	4	8
7	15	17-18	66-73	9	4	1	2	1	4-5	-	7
6	16	19-20	74-78	10-12	3	-	1	-	3	3	6
5	17	21	79-81	13-15	2	0	-	0	0-2	2	5
4	18	22	82-96	16-17	1	-	0	-	-	1	4
3	-	23-26	-	-	0	-	-	-	-	0	3
2	-	-	-	-	-	-	-	-	-	-	2
1	19+	27+	97+	18+	-	-	-	-	-	-	1

Age 4:0 to 4:5

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	-	9-10	-	26-30	-	-	19
18	-	-	-	-	-	-	-	-	-	-	18
17	-	-	-	-	10	8	-	24-25	-	-	17
16	<6	-	-	-	-	-	27-30	-	-	-	16
15	7	<8	<21	-	-	-	-	18-23	-	-	15
14	8	9	22-24	-	-	7	19-26	13-17	-	-	14
13	-	10	25-26	0	-	-	15-18	11-12	15	-	13
12	9	11	27-29	1	9	6	11-14	8-10	-	5	12
11	-	-	30-31	2	8	5	9-10	6-7	-	-	11
10	10	12	32-36	3-4	7	-	8	4-5	14	-	10
9	11	-	37-39	5-6	6	4	6-7	-	9-13	-	9
8	12	13	40-48	7-8	5	3	5	3	6-8	-	8
7	13	14	49-55	9	4	2	4	2	4-5	-	7
6	14	15	56-63	10-12	3	1	2-3	0-1	3	4	6
5	15-16	16-19	64-77	13-14	2	0	1	-	-	-	5
4	-	20-21	78-79	15-17	1	-	0	-	2	3	4
3	17-18	22-25	80-86	-	0	-	-	-	0-1	1-2	3
2	-	-	-	-	-	-	-	-	-	0	2
1	19+	26+	87+	18+	-	-	-	-	-	-	1

Age 4:6 to 4:11

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	-	10	-	-	-	-	19
18	-	-	-	-	-	-	-	29-30	-	-	18
17	-	-	-	-	-	9	-	-	-	-	17
16	<6	-	-	-	10	-	-	-	-	-	16
15	7	<8	<17	-	-	-	30	27-28	-	-	15
14	8	-	18-21	-	-	8	29	20-26	-	-	14
13	-	9	22-23	0	-	7	26-28	17-19	15	-	13
12	-	10	24-25	1	9	6	22-25	15-16	-	5	12
11	9	-	26-27	-	-	-	18-21	13-14	-	-	11
10	10	11	28-32	-	8	5	14-17	9-12	14	-	10
9	11	12	33-36	2	7	-	10-13	6-8	11-13	-	9
8	-	13	37-39	-	6	4	8-9	4-5	8-10	-	8
7	12	-	40-41	3	5	3	6-7	3	7	-	7
6	-	14	42-43	4	-	1-2	4-5	2	-	4	6
5	13-15	15	44-46	-	4	-	3	-	6	-	5
4	-	16	47-62	5	-	0	0-2	-	2-5	3	4
3	16	17-22	63	6	0-3	-	-	0-1	0-1	1-2	3
2	-	-	-	-	-	-	-	-	-	-	2
1	17+	23+	64+	7+	-	-	-	-	-	0	1

Age 5:0 to 5:11

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	-	10	-	-	-	-	19
18	-	-	-	-	-	-	-	-	-	-	18
17	<9	<11	<24	-	-	-	-	-	-	-	17
16	10-12	12	25-29	-	10	-	-	-	-	-	16
15	13	13-15	30-35	-	-	-	-	27-30	-	-	15
14	14	16	36-38	-	-	9	-	25-26	-	-	14
13	15	17-18	39-40	-	-	8	30	21-24	-	-	13
12	16-17	19-20	41-43	-	9	7	-	16-20	15	5	12
11	18	21	44-47	0-1	-	6	21-29	14-15	-	-	11
10	19	22	48-49	-	8	5	15-20	10-13	14	-	10
9	20	23	50-53	2	6-7	-	11-14	7-9	-	-	9
8	21	-	54-55	-	4-5	4	8-10	5-6	13	-	8
7	22	24	56-60	-	2-3	-	6-7	4	-	-	7
6	23	25-26	-	-	-	-	5	3	11-12	4	6
5	24	27	61-66	-	0-1	3	-	2	7-10	-	5
4	25-26	28-29	67-96	3	-	2	4	-	5-6	3	4
3	-	-	97-121	4	-	1	0-3	0-1	3-4	1-2	3
2	-	30	-	-	-	-	-	-	2	-	2
1	27+	31+	122+	5+	-	0	-	-	0-1	0	1

Age 6:0 to 6:11

Standard Score	Posting Coins Pref hand	Posting Coins Non-pref hand	Threading Beads	Drawing Trail 1	Catching Beanbag	Throwing Beanbag onto Mat	One-Leg Balance Best leg	One-Leg Balance Other leg	Walking Heels Raised	Jumping on Mats	Standard Score
19	-	-	-	-	-	-	-	-	-	-	19
18	-	-	-	-	-	-	-	-	-	-	18
17	-	<11	<24	-	-	-	-	-	-	-	17
16	-	12	25-28	-	-	10	-	-	-	-	16
15	<13	13-15	29-31	-	-	-	-	-	-	-	15
14	14	16	32-33	-	10	9	-	29-30	-	-	14
13	15	17	34-35	-	-	8	30	-	-	-	13
12	16	18	36-37	-	-	-	-	-	-	-	12
11	17	19	38-42	0	-	7	-	24-28	15	5	11
10	18	-	43-45	-	-	-	28-29	18-23	14	-	10
9	19	20	46-47	-	9	6	24-27	14-17	-	-	9
8	-	-	48-49	-	8	5	15-23	7-13	13	-	8
7	20	21	50-54	1	6-7	4	11-14	4-6	-	-	7
6	21-22	22-23	55-58	-	5	-	7-10	3	11-12	4	6
5	23	24-26	59-63	-	4	3	6	2	9-10	-	5
4	24-25	27	64	-	3	2	4-5	-	6-8	-	4
3	-	-	65-73	2	0-2	1	0-3	0-1	-	-	3
2	-	-	-	-	-	-	-	-	-	3	2
1	26+	28+	74+	3+	-	0	-	-	0-5	0-2	1

APPENDIX E

- **LETTER PROVIDING PERMISSION FROM CARITAS COMMUNITY FOCUS**

CARITAS
Gemeenskapsfokus • Community Focus

Hoofkantoor / Head Office

TO WHOM IT MAY CONCERN

The !Xun and Khwe Early Childhood Development Centers are the responsibility of Caritas Community Focus NPC. We do the management of the ECD's and see that they comply with the Norms and Standards of the Children's Act, Act 38 of 2005.

This letter serves to state that we approve and hereby give permission to Ms M Steinberg to conduct the research with the title of: Motor Development of the Children Attending the Crèches (ECD's) in Platfontein.

We request that you issue us with a copy of the final report including the finding of your research.

Kind regards.

FD Hugo
Executive Director
Caritas Community Focus

APPENDIX F

- **LETTER PROVIDING PERMISSION FROM THE NORTHERN CAPE DEPARTMENT OF EDUCATION**

IK Nkoane Education House

156 Barkly Road
Homestead
Kimberley 8301

Private Bag X5929
Kimberley 8300
Republic of South Africa

Tel: 053 839 6500
Fax: 053 839 6580/1
Web:ncdoe.ncpg.gov.za

DEPARTMENT OF EDUCATION

Enquiries: - Ms HC Burrows
Contact No: - 056 839 6701
Reference: -
Date: - 12 August 2015

To: Miriam Steinberg
Physiotherapist (Researcher)
Kimberley Hospital Complex
Department of Health
083-403 5207

Subject: Permission Granted: Motor Development profile of the children attending the crèches in the Platfontein community.

You are herewith granted permission to do research as per your request dated 20 July 2015.

The Northern Cape Department of Education however requests that the findings and recommendations be shared with the Curriculum Chief Directorate at the Provincial Office.

Yours Faithfully

DR MI ISHMAIL
DEPUTY DIRECTOR GENERAL: CURRICULUM, EXAMINATIONS AND ASSESSMENT

APPENDIX G

- **INFORMATION DOCUMENT AND CONSENT FORM**

INFORMATION DOCUMENT
MOTOR DEVELOPMENT OF CHILDREN ATTENDING THE CRECHES IN THE PLATFONTEIN COMMUNITY

Hello, my name is Miriam Steinberg and I am doing research on the development of children in Platfontein. Research is the process to learn the answer to a question. In this study I want to learn about movement development of children in Platfontein.

I am asking for your permission to include your child in the research study. The study will include children at the crèches from the !Xun and the Khwe tribes in Platfontein. The study will take place during school hours and will take about half an hour per child. Your child will be asked to perform eight tasks which include catching and throwing of a ball, jumping and handling of beads.

This knowledge will give us a better understanding of the development of movement of the children in Platfontein.

I, the researcher, will watch your child perform these tasks and score the tasks. This will give me an understanding of your child's development of movement. If your child experiences difficulty in doing these tasks, you, as well as the teacher will be informed and we will make an appointment with the local therapist to assist to help your child to improve his or her development in these areas. If it is necessary we will refer your child to a paediatrician at Kimberley hospital. This is a governmental health service and will be free of charge. If you and your child need transport to the hospital this will be covered by the health services transport system. There will be no costs involved.

There are no risks involved when participating in the study.

You will not be paid for participating in the study.

The participation of your child in this research is voluntary. Your child or you as a parent may pull out of the study at any time. This will not lead to a penalty.

I will do my best to keep the personal information confidential. Your child's name will not appear anywhere on the sheet. It may happen that organisations would want to have a look at these records for quality control purposes, but they will not be able to identify your child from these records. Even if these findings are published in a medical or professional health journal the crèche as a whole will be identified but not so the individual children.

Please feel free to contact me if you have any questions regarding the research. You can contact me on 083 403 5207.

These are the contact details if you would like to contact the Ethics committee at the University of the Witwatersrand or if you would like to report any problems.

Proferssor Peter Cleaton-jones
Tel: 011 707 2301;
Email: peter.cleaton-jones1wits@ac.za
OR
Ms Zanele Ndlovu: Secretarait
Tel: 011 707 1252/1234/2700
Email: Zanele.ndlovu@wits.ac.za

Thank you,
Miriam Steinberg

CONSENT FORM TO PARTICIPATE IN THE RESEARCH PROJECT
MOTOR DEVELOPMENT OF CHILDREN ATTENDING THE CRECHES IN THE PLATFONTEIN COMMUNITY

I, _____ the parent/ guardian of_____ (child's name and surname) give permission for him / her to participate in the research study to assess his/her motor function.

The researcher will take precautions to keep the participant's information confidential.

_____ _____
Parent/ guardian Date

_____ _____
Researcher Date

TOESTEMMING OM DEEL TE NEEM AAN DIE STUDIE

Ek_____die ouer / voog van _____(kind se naamen van) gee toestemmingdathy/sydeelneemaan die studie om sy/ haar motorise funksietebepaal.

Die navorsersal die nodigevoorsorgmaatreëls neem om die informasievertrouliktehou

_____ _____
Ouer/ voog Date

_____ _____
Navorser Date

APPENDIX H

- **ETHICAL CLEARANCE FORM**

R14/49 Miss Miriam Steinberg et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150718

NAME: (Principal Investigator)	Miss Miriam Steinberg et al
DEPARTMENT:	Physiotherapy Platfontein Community, Northern Cape
PROJECT TITLE:	Motor Development of Children Attending Créches in the Platfontein Community
DATE CONSIDERED:	31/07/2015
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Natalie Benjamin
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	18/09/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX I

- **INSTRUCTIONS FOR ANTHROPOMETRIC MEASURES**

INSTRUCTIONS FOR ANTHROPOMETRIC MEASURES

Instructions given to the study participant for weight measurement.

Please take off your shoes.

Step onto the scale with both your feet. Stand and wait.

Once the measurement had been visualized:You can now climb off, thank you!

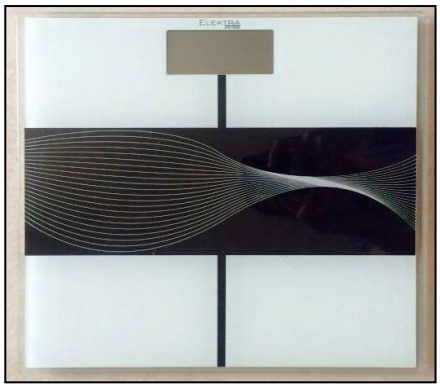


Figure 1.1: The ELEKTRA CARE Slimline electronic Scale

Instructions given to the study participant for the height measurement

Please take off your shoes.

Stand up straight against the wall with your heels touching the wall

I am now going to see how tall you are. Stand still and wait.

Once the measurement had been taken: You can now step away, thank you!

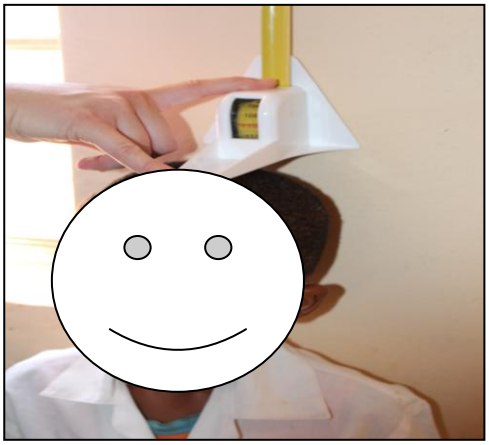


Figure 1.2: Positioning of the Body Meter Measuring Tape

Figure I.3: Shoes Removed and Heels Against the Wall

Instructions given to the child for the head and upperarm circumference measurement.

I am now going to measure your head circumference and your arm circumference. Please stand still.

Thank you!

Figure 1.4: The Tape Measure used to Measure the Head and Upper Arm Circumference

APPENDIX J

- **TURNITIN ORIGINALITY REPORT**

Turnitin Originality Report

Miriam Steinberg Research report 13 September by Miriam Steinberg

From Research Reports/Dissertations Part 1 (Moodle TT) (2016 Physiotherapy Postgraduate Research Information (Moodle TT))

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