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THE ASSOCIATION BETWEEN EARLY CHILD ENVIRONMENT AND CHILDREN'S OUTCOMES: EVIDENCE FROM THE BIRTH TO TWENTY PLUS STUDY

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A dissertation submitted to the Faculty of Health Sciences, Department of Paediatrics, University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the degree of Master of Science in Medicine.

Johannesburg, 2017

Declaration

I, Refiloe Lerato Cele, declare that this dissertation is my own, unaided work. It is being submitted for the degree of Master of Science in Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any University.

_____

(Signature of candidate)

_____day of_____2017

Dedication

This dissertation is dedicated to my dearest mother Jane Thandekile Motaung. Thank you Ma, I am a product of all your prayers, teachings, financial support and personal sacrifices.

Presentations arising from this research project

Cele R, Slemming W, and Richter L (2016). The Impact of poverty and inequality in early childhood on long-term outcomes: Evidence from the Birth to Twenty Plus study. Programme to Support Pro-Poor Policy Development (PSPPD) 2nd Research Dissemination Conference, Pretoria, 12 October 2016.

Abstract

Later adult outcomes in health, economic participation and psychological well-being have been scientifically linked to early childhood development. Thus, it is paramount that children be exposed to nurturing environments that optimise their development, especially for those who are most vulnerable.

We investigated the effects of early child care quality (in-and out-of-home) as a proximal early child environmental factor at the ages of six months to two years, and again later at the ages of four to five years on children's cognitive development and schooling outcomes, using data from the South African Birth to Twenty Plus cohort. The Revised Denver Pre-screening Developmental Questionnaire (R-DPDQ) was used as a measure of cognitive development at five years of age and the number of grade repeats by Grade 7 was used to measure schooling achievement. The sample size differed by outcome, age category and environment analysed. The final analytical sample varied from 203 to 1148 children. Our measures of in-home quality of care at six months to two years was a latent variable of quality child care, which was created by combining cognitive stimulation scores and maternal responsiveness scores. At the ages of four to five years, measures of in-home quality of care included child supervision and cognitive stimulation. Measures of child care quality in the out-of-home environment included childminder education at the ages of six months to two years, number of children in the care of the childminder at the ages of six months to two years and at the ages of four to five years, and the type of daycare/crèche attended at the ages of four to five years. To assess the impact of in-and out-of-home child care quality on cognitive functioning, multivariate linear regressions were estimated. To assess the impact of in-and out-of-home child care quality on schooling achievement, multivariate logistic regression analysis was conducted.

Our findings showed that children who received high quality child care in the home, as indexed by high maternal responsiveness and high cognitive stimulation between the ages of six months and two years, scored 1.3 points higher in the R-DPDQ at the age of five years, compared to children who received low quality care ($\beta = 1.25$, $p<0.01$, 95% CI: 0.49, 2.01). High maternal responsiveness scores between the ages of six months and two years were protective against the risk of grade repetition in primary school (OR = 0.95, $p<0.05$, 95% CI: 0.90, 0.99).

The analysis of the out-of-home environment revealed that children between the ages of six months and two years who had childminders with post-school training, scored 4 points higher in the R-DPDQ ($\beta = 3.91$, $p<0.05$, 95% CI: 0.05, 7.76) compared to children with childminders who had a Grade 7 education level or lower. Children between the ages of six months and two years who had childminders with an education level of Grade 11 or Grade 12 had a 57% lower chance of repeating a grade (OR = 0.43, $p<0.05$, 95% CI: 0.17, 0.99) by Grade 7, compared to children whose childminders had a Grade 7 education level or lower. Children between the ages of six months and two years who were cared for in small group sizes (less than six children per group) had a 65% reduction in the odds ratio for repeating a grade (OR = 0.35, $p<0.05$, 95% CI: 0.13, 0.94) by Grade 7, compared to children who were cared for in groups of seven or more.

There was also evidence that the children from lower socioeconomic backgrounds who received high quality child care, both in-and out- of the home, scored higher in the R-DPDQ compared to children of the same socioeconomic status who received lower quality care. Children under the age of two years in the low socioeconomic status group receiving high quality child care in the home scored 2 points higher on the R-DPDQ at age five years compared to children receiving low quality care in the same socioeconomic status group ($\beta = 1.99$, $p<0.05$, 95% CI: 0.45, 3.51). Furthermore, low socioeconomic status children under the age of two years who were had out-of-home care either in the sole care of a childminder ($\beta = 11.55$, $p<0.01$, 95% CI: 4.82, 18.27) or in a group of fewer than six children ($\beta = 12.41$, $p<0.01$, 95% CI: 5.71, 19.11) scored 12 points higher in the R-DPDQ at the age of five years, compared to children cared for in big groups (seven to 50 children) in the same socioeconomic status category.

High quality child care environments, both in-and out-of-home, were positively associated with young children's cognitive and schooling outcomes in this study. However, the strength of this association was attenuated by household socioeconomic status and maternal education. Thus, strategies and policies aimed at improving children's socioeconomic conditions and child care quality within the home, and in out-of-home early child care as well as in education settings will have lasting positive effects, especially for young children living in poverty.

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Abbreviations and Acronyms

ANCOVA:	Analysis of covariance
Bt20+:	Birth to Twenty Plus cohort
CI:	Confidence interval
CIS:	Caregiver Interaction Scale
DSD:	National Department of Social Development
ECD:	Early childhood development
ECERS-R:	Early Childhood Environment Rating Scale Revised
HIC:	High Income Country
HOME:	Home Observation for the Measurement of the Environment
LMIC:	Low Middle Income Country
LR:	Likelihood ratio
NICHD ECCRN:	National Institute of Child Health and Human Development Early Child Care Research Network
NICHD:	National Institute of Child Health and Human Development
OR:	Odds ratio
ORCE:	Observational Record of the Caregiving Environment
R-DPDQ:	Revised Denver Pre-screening Developmental Questionnaire
SES:	Socio Economic Status
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
UNICEF:	United Nations International Children's Fund
WHO:	World Health Organisation

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CHAPTER 1: INTRODUCTION

1.1 Background

Studies have linked the early years to adult life trajectories in health, well-being, behaviour, socioeconomic status (SES), economic participation and positive or negative social participation (Power & Hertzman, 1997; Shonkoff & Phillips, 2000; Zielinski, 2009; Gertler et al., 2013; Monaghan & Haussman, 2015). Early childhood is a period of rapid growth and development and, in terms of human capital investment, is believed to yield the highest returns on investments (Yoshikawa, 1995; Nelson, 2000; Shonkoff & Phillips, 2000; Thompson &Nelson, 2001; Carneiro & Heckman, 2003; Heckman, 2008). During this period, brain development is easily influenced and neurobiological structures and functions underlying cognitive and socio-emotional development are very impressionable by early life experiences (Rutter, 1981; Shure, 1981; Mize & Ladd, 1990; Thompson & Nelson, 2001). A unique window of opportunity, particularly from conception to two years of age, exists during which interventions to improve life trajectories have the most benefit. Conversely, it is also a period of high vulnerability and exposure to early deprivation and other forms of toxic stress that can be detrimental to child development (Walker et al., 2007; Walker et al., 2011; Black et al., 2017).

1.2 Problem statement

Poverty is negatively associated with child development (Walker et al., 2007; Bradley & Corwyn, 2002; Currie & Goodman, 2008). The 2016 Lancet Series on Early Childhood Development estimated that over 250 million children in low middle income countries are at risk of not reaching their developmental potential due to poverty-related risk factors (Black et al., 2017). Development could be optimised if such children were exposed to more nurturing environments, i.e. responsive caregiving, early learning, nutrition and safety (Engle et al., 2007; Black et al., 2017). The United Nations Children's Fund (UNICEF), in the third round of the Multi-Indicator Cluster Survey (MICS3), revealed that most young children receive inadequate early childhood care and access to early learning programmes to promote their cognitive development and readiness for school. More than 50% of young children in two thirds of countries surveyed lived in homes that appeared to not support early learning, with only 10% of children in a third of these countries surveyed having

access to any centre-based educational programs (UNICEF, 2012). High quality care is a critical factor in moderating early childhood inequalities (Hart & Rinsley, 2003; World Bank, 2006; Irwin, Siddiqi & Hertzman, 2007). Child care quality has been studied across a wide range of child and contextual factors, including gender, SES, ethnicity, family structure and culture (Burchinal et al., 2000, Burchinal & Cryer, 2003; Love et al., 2003; Yeung & Conley, 2008; Lamb et al., 2014; Hartman & Manfra, 2015). However, almost all of the research has been conducted in high-income countries. Bornstein and Putnik (2012) critiqued child care theories as being limited by the fact that they are based mostly on North American and European samples, with insufficient testing whether these theories hold true in low and middle income countries (LeVine et al., 1996; Samman et al., 2016).

Similarly, there is a paucity of published research on how quality of child care moderates early childhood inequalities in South Africa. The only study been published, found that quality home environments were associated with children's mental development (Richter and Grieve, 1991). However, this study used cross-sectional data. It is critical to understand the long-term impact of quality of care environments for children facing poverty-related risks in a low middle income country like South Africa where 63% of children live in poverty (Hall & Sambu, 2016).

This study attempted to address the identified gap and used data from a South African longitudinal birth cohort to contribute to the evidence-base on early child development in low and middle income contexts.

1.3 Aim of study

The aim of this study was to examine the influence of the quality of in-home and out-of-home child care and household SES conditions during early childhood on children's developmental outcomes at later ages, utilizing data from the Birth to Twenty Plus (Bt20+) study in Johannesburg, South Africa.

1.4 Study objectives and hypothesis

To test the hypothesis: whether early or late quality of child care in the home has an influence on cognitive development and school achievement in primary school. The study achieved the following objectives:

1. Determined the associations between household SES, quality of child care in the home environment (between the ages of six months and two years) and subsequent cognitive development at age five years and grade repeats by Grade 7.
2. Determined the associations between household SES, quality of child care in the home environment (between the ages of four and five years) and subsequent cognitive development at age five years and grade repeats by Grade 7.

To test the hypothesis: whether early or late quality of child care out-of-home has an influence on cognitive development and school achievement in primary school. The study achieved the following objectives:

3. Determined associations between household SES, quality of child care in the out-of-home environment (between the ages of six months and two years) and subsequent cognitive development at age five years and grade repeats by Grade 7.
4. Determined associations between household SES, quality of child care in the out-of-home environment (between the ages of four and five years) and subsequent cognitive development at age five and grade repeats by Grade 7.

To test the hypothesis: whether quality of child care optimises outcomes of children from lower socioeconomic backgrounds. The study achieved the following objective:

5. Tested the effects of in-home and out-of-home quality child care on cognitive development and grade repeats under different socioeconomic contexts.

CHAPTER 2: LITERATURE REVIEW

This section outlines evidence from previous studies in the literature on associations between early childhood environments and subsequent child outcomes. This section also provides information on the theoretical framework used for this study.

2.1 Environment and child development

Child development refers to the process changes that occur in a child's physical growth, emotional- and cognitive functioning (Shaffer, 2002). A child's development is largely shaped by maturation and learning processes. Maturation refers to physical changes genetically driven by parental genes. Learning processes refer to changes which occur in the biological processes, behaviour, thinking and emotions as a result of experiences and environmental factors to which an individual is exposed (Papalia & Feldman, 1990). Environmental factors can be proximal or distal and include parental socialization, parental stimulation, socioeconomic status, relationships, nutrition, culture, local and global policies and/or laws (Bronfenbrenner, 1994; Shaffer, 2002; Siddiqi, Irwin & Hertzman, 2007). There is consensus among scientists that both biological- and environmental factors interact to influence a child's development (Thompson & Nelson, 2001; Sameroff & Mackenzie, 2003; Shaffer & Kipp, 2013). Nonetheless, research has shown that environmental factors are able to alter inherited genetic expressions (Meaney, 2010; Jaenisch & Bird, 2003). The importance of environmental factors in children's development was shown in a study by Weisglas-Kuperus and colleagues (1993), who found that children with very low birth weight (<1500 grams) and abnormal neurodevelopment or were at risk of neurodevelopmental deficits compared to their full-term counterparts, were able to catch up on their cognitive delay if placed in highly stimulating home environments.

2.2 Socioeconomic status and children's development

Studies have found a strong link between parental SES and children's short and long term outcomes. This SES 'gradient effect' includes family income, parental education, parent occupational status, household ownership of durable assets, house ownership, household crowding, and so on (Bradley & Corwyn, 2002; Vyas & Kumaranayake , 2006; Yeung & Conley, 2008).

Analysis of data obtained from participants in the US-based National Institute of Child Health and Development (NICHD) Study of Early Child Care showed that a $10,000 increase in permanent annual family income was associated with significant improvements in children's cognitive-language, mental development, school readiness and social behaviour, with the largest effects in school readiness and mental development (Taylor, Dearing & McCartney, 2004). Another study showed that SES indexed by parental education, occupation and income-to-needs ratio accounted for 31.4% of variance occurring in children's language and 15.3% in executive functioning, and that parental education accounted for most of the variance in both children's language and children's executive functioning (Noble, Norman & Farah, 2005). Other studies have shown associations between SES and schooling outcomes i.e. school readiness, test scores, age of school entry and academic achievement (Currie & Thomas, 1999; Battle & Lewis 2002; Feinstein, 2003; Duncan, Morris & Rodrigues, 2011). Using data from the United States' National Educational Longitudinal Study (NELS), Battle & Lewis (2002) reported that by the 12th grade, SES had a larger effect in predicting schooling achievement than race.

Children from impoverished backgrounds tend to have worse developmental and schooling outcomes than their better-off peers, ultimately resulting in the intergenerational transmission of poverty; while the opposite is true for children from advantaged backgrounds (Duncan, Brooks-Gunn & Klebanov, 1994; Brooks-Gunn & Duncan, 1997; Bradley & Corwyn, 2002; Meyer, 2002; Taylor, Dearing & McCartney, 2004; Grantham-McGregor et al., 2007; Engle et al., 2011; UNICEF, 2012). One of the reasons for poor children's lower cognitive and schooling outcomes is that their parent's low income and education make it more difficult for families to access stimulating environments, provide adequate learning experiences and high quality schools, all of which are crucial in promoting optimal development (Shonkoff & Phillips, 2000; Grantham-McGregor et al., 2007). Low parental income also means that parents are unable to afford adequate nutrition (Petrou & Kupek, 2010), and quality health care needed for the child's optimal health and physical development (Mayer, 2002). Studies have found that children from impoverished backgrounds also have higher levels of socio-emotional problems in the form of behavioural problems such as aggression, fighting, acting out, anxiety, social withdrawal and depression (Brooks-Gunn & Duncan, 1997; Mayer, 2002; Walker et al., 2007). These are thought to be due to the negative impact that financial stress has on caregivers' psychological well-being causing them to be more likely to have depressive symptoms, be less sensitive to the child, more withdrawn and

thus provide negative care giving (McLoyd, 1998). This relationship is depicted in the conceptual framework (Figure 2.1) as outlined by Grantham-McGregor et al., (2007).

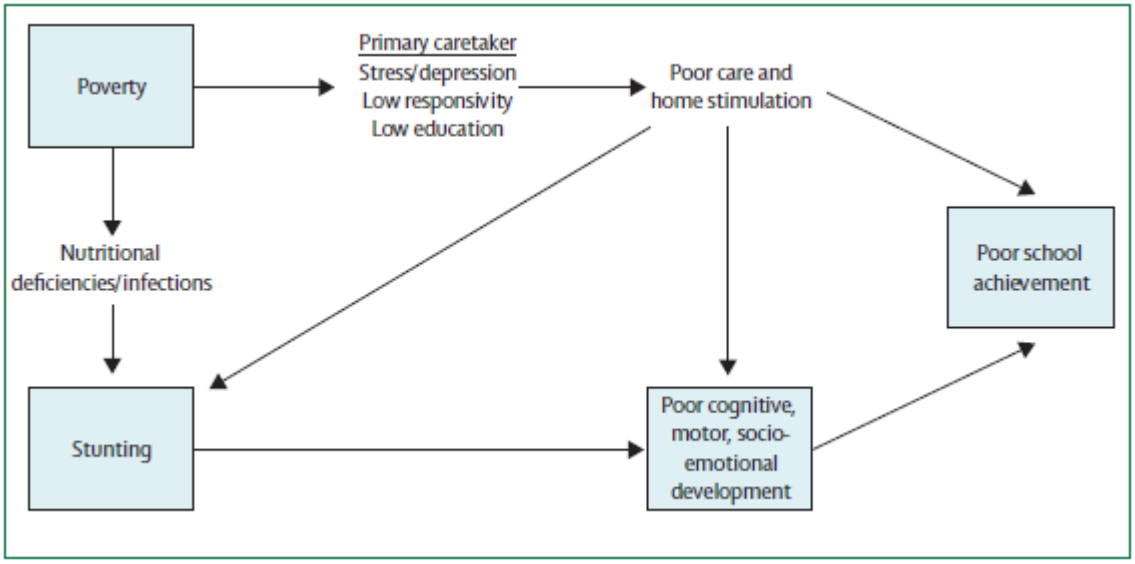


Figure 2.1 Pathways through which poverty affects child outcomes. *Source*: Grantham-McGregor et al., 2007.

Disparities between affluent and impoverished children's outcomes have been found to persist through to adolescence. Results from a British cohort revealed that differences in test scores (measuring intellectual, emotional and personal development) between high and low SES groups widened from early childhood to late childhood. Indeed, at 22 months the difference in test score rank was in the 13 percentile and at 10 years the difference was in the 28 percentile (Figure 2.2) (Feinstein, 2003). Furthermore, other studies reported that the lower performance levels observed in children in poverty worsens with age (Paxson & Schady, 2007; Hamadani et al., 2014).

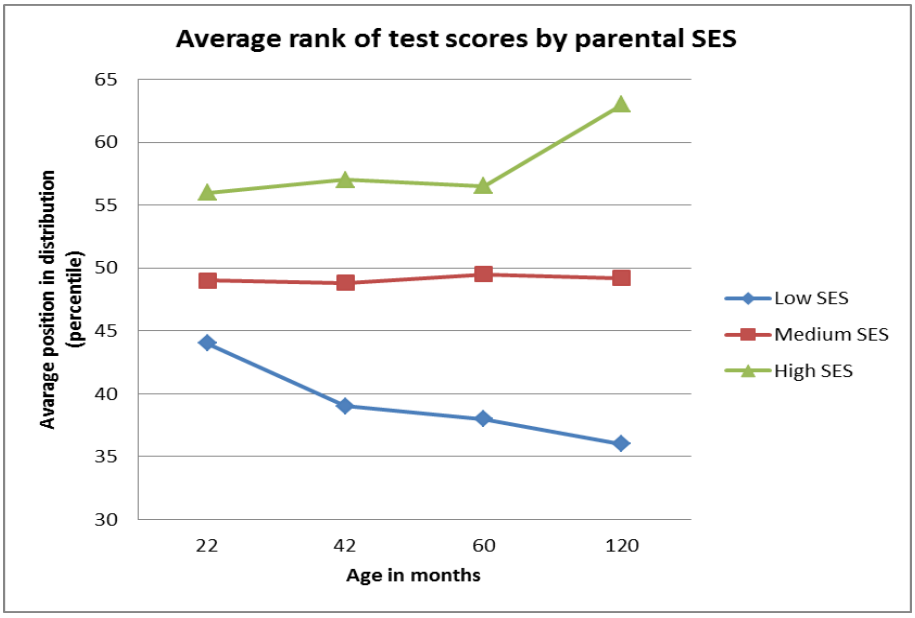


Figure 2.2 Socioeconomic status differences in test score ranks. *Adapted from*: Feinstein, 2003.

These disparities point to a need for a "levelling of the playing fields" for all children, but in particular in the support of children from impoverished backgrounds. Such support can be in the form of interventions to improve nutrition, health, security and quality of care (Brooks-Gunn & Duncan, 1997; Engle et al., 2007; Black et al., 2017, Britto et al., 2017). Such interventions have been shown to ameliorate negative outcomes for children facing risk factors (McKay et al., 1978; Grantham-McGregor et al., 1991; Pollitt et al., 1993; Kagitcibasi et al., 2001; Powell et al., 2004; Aboud & Akhter, 2011).

2.3 Quality of child care and children's outcomes

The following sections outline the history of child care research, definitions and concepts that were developed studying child care and published literature analysing associations between quality of child care and child outcomes.

2.3.1 History of child care research

Child care research in its early days was mainly sparked by the shift in male and female roles in society when women started entering the labour force as nations were becoming industrialized. By 1990, global female labour force participation was 53.6% compared to 38.6% in 1980 (Kapsos,

2007). This meant that women had to find alternative care arrangements for their children, raising questions as to the impact of non-maternal care on children's wellbeing and development (Belsky & Steinberg, 1978; Schwartz, 1983; Jacobson & Wille, 1984; Belsky, 1988). Silverstein (1991) highlighted the need for child care research to focus not only on the negative consequences of non-maternal care but also on the negative consequence of not providing high quality care for infants of women who work, thereby calling for transforming the child care research agenda. Richters and Zahn-Waxler (1988) also pointed out the need for the transformation of child care research. They emphasised the importance of a child's home environment but also the need for research that defines the characteristics of non-maternal care (and associated circumstances) that are associated with various child development outcomes. During the 1990's, the main findings from child care research pointed out that quality of child care, be it parental in the home or non-parental out-of-home, needed to be critically assessed and measured across different cultural, SES and individual differences (Belsky, 1990; NICHD ECCRN, 1993; Shpancer, 1993).

At the core of this call was the NICHD study of early child care (Peth-Pierce, 1998), which analysed quality of child care by both its process and structural features across a wide range of contextual factors. The NICHD study was initiated in 1991and was based across ten locations in the United States of America (USA) with a total sample of 1364 children and their families representing different ethnicities, socioeconomic backgrounds and family structures. The study followed children from one month to 15 years of age and collected data in four phases. The main aims of the study were to firstly profile child care arrangements in the USA, and secondly, to analyse how child care quality and quantity is associated with children's developmental domains within diverse contextual factors. Although the NICHD study on early child care ended in 2009, it is still the most influential child care study to date. In summary, the study found that:

- Children's child care experiences differed between ethnicities and socioeconomic backgrounds.
- Both child care quantity and quality were associated with children's developmental domains, however, quality of child care was more salient for children's outcomes than quantity.
- Child care quality features can be regulated and improved.
- Poor quality child care compromised child outcomes, whereas higher quality was beneficial.

- Higher quantity child care was associated with poor mother-child interaction while lower quantity improved child to mother attachment (Peth-Pierce, 1998; NICHD, 2006).

2.3.2 Child care: definitions and concepts

Child care is defined as the adult-child relationship or interaction where the role of the adult (in family and in community) is to support the growth, health and development of the child (UNESCO & UNICEF, 2012). Child care, as defined in the NICHD study referred to earlier, varies according to type, quality and quantity. Type refers to whether the care is maternal or non-maternal, individual or group care, quality refers to varying degrees of poor or good quality child care, and quantity refers to the hours spent in non-maternal care (NICHD, 2006).

The varying degrees of quality of child care are measured by structural and process variables (NICHD ECCRN 2002a). Structural variables are those associated with centre-based or non-maternal care, which can be regulated by agencies or governments and which include education of caregiver, caregiver wages, adult to child ratio, and size of the group of children in the care of the childminder (NICHD ECCRN, 2002a). Observed high quality child care is associated with well-educated caregivers, low adult-child ratios or group sizes, and adequate remuneration (NICHD ECCRN, 2000 and 2002a; NICHD, 2006; Dowsett et al., 2008; Hestenes et al., 2015). The opposite is defined as low quality child care.

Process variables are the day-to-day personal and social interactions between child and caregiver in the home environment or the out-of-home environment (e.g. child daycare centres), which include positive caregiver attitude and responsiveness, child encouragement, positive physical contact, sensitivity to children's distress and stimulation of cognitive development (teaching, reading, telling stories, singing, outdoor excursions, etc.) (NICHD ECCRN, 2000 and 2002a; NICHD, 2006). Observed high quality child care is associated with more positive, stimulating, sensitive and responsive care giving and the opposite is associated with low quality child care (NICHD ECCRN, 2000 and 2002a; NICHD, 2006; Dowsett et al., 2008).

2.3.2.1 Measurement of observed child care quality

The following are accepted, standardized measurements used to measure observed child care quality. Their interpretation is that the higher the score on scale items, the higher the quality of care received by the child.

(1) Home Observation for the Measurement of the Environment (HOME) Scale (Bradley & Caldwell, 1977 and 1984). This is a 45-item scale evaluating quality of physical and social resources available to the child in the home setting. These items measure:

- Emotional and verbal responsivity of the mother to the child;
- Acceptance of the child;
- Organization of the child's home environment;
- Provision of appropriate play materials;
- Maternal involvement with the child, and;
- Variety in daily stimulation.

(2) Caregiver Interaction Scale (CIS) (Arnett, 1989; Colwell, 2013). This is a 26 item scale gauging caregiver response to and interaction with the child, measuring dimensions of:

- Sensitivity e.g. speaking warmly to the child, responding to the child's communication, encouraging the child to try new things and responding to the child's gestures, including distress;
- Harshness e.g. speaking with irritation to the child, being critical of the child, punishing the child unnecessarily;
- Detachment e.g. inadequate child supervision, failure to show interest in the child's activities, limited physical contact with child and;
- Permissiveness e.g. how permissive or restrictive is the caregiver to the child's exploratory behaviour.

(3) Early Childhood Environment Rating Scale Revised (ECERS-R) (Harms & Clifford, 1982; Sakai et al., 2003). This measure is mainly used to assess quality at child care centreshas and consists of 43 items, measuring the class room environment according to:

- Personal care e.g. meals, lavatories/diapering, napping;
- Space, furnishing and displays;

- Developmental activities e.g. language development, dramatic play, music, nature/science, blocks, social development;
- Staff-child interaction;
- Program structure, and;
- Staff and parents e.g. staff needs and development, staff supervision and provision for parent-staff interaction.

(4) Observational Record of the Caregiving Environment (ORCE), (NICHD ECCRN, 1996). This instrument is used to assess characteristics of child care in both the home and out-of-home environments, focusing on the caregivers' behaviours. It is a 26 item scale divided into two categories i.e. Behaviour Scale and Qualitative Ratings. The Behaviour scale is the frequency count of specific behaviours, while the qualitative section rates the quality of those counted behaviours in relation to the child's acts. The assessed behaviours relate to the caregiver's sensitivity/response to the child's distress and non-distress communication, cognitive stimulation, detachment and intrusiveness or permissiveness.

2.3.3 Association between child care quality and child outcomes

Over the last two decades, the importance of quality child care, both in- and out-of-home has been reinforced, with most studies showcasing the benefits of high quality care and the consequence of poor quality care. Table 2.1 displays a sample of comparative studies that have evaluated the effect of child care quality (both in- and out-of-home) on children's cognitive functioning, socioemotional development, schooling outcomes and stress levels using various analysis techniques. These studies were systematically selected based on the child care quality variables the respective authors used, which closely resemble quality indicators used in the current study for ease of comparison (see Chapter 3, the methodology section).

From these studies, it is evident that there are significant associations between quality of child care and child outcomes. High quality child care is positively associated with higher cognitive test scores, higher academic achievement scores and lower behavioural problems. On the other hand, low quality child care is consistently associated with negative child outcomes, while medium quality child care has not been found to produce outcomes significantly different from low quality

child care (Burchinal et al., 2000). This is evidence that only high quality child care promotes children's development.

The significance of child care quality on outcomes can be seen as early as six months and across early childhood, with effects persisting into late childhood (Belsky et al., 2007), adolescence (Vandell, Burchinal & Pierce, 2016) and even into young adulthood (Campbell et al., 2002). However, the strength of this association may attenuate with increasing age. The study by the NICHD ECCRN & Duncan (2003) found that early child care quality (between 6 and 24 months) compared to later child care quality (36-54 months) had a larger effect on cognitive development at 54 months. This is potential evidence that early rather than late intervention yields a larger impact, though this is not consistent across studies. Some studies found that this association is reduced by other control variables such as household SES, ethnicity, family structure and child health factors (Bradley et al., 1986; NICHD ECCRN, 2002b). These control variables have been found to directly influence child care quality (Bradley et al., 1986). These findings are discussed further in the next section.

Table 2.1 Comparative studies that evaluated the effect of child care quality on various child outcomes

Author/s	Exposure/s Measured	Outcome/s measured	Key findings
Bradley et al., 1986	• **HOME scores** at 6, 12, 24, 36 and 54 months.	• **Cognitive development** measured by the Bayley Mental Development Index (MDI) up to 24 months and the Staford-Binet IQ test at 36 and 54 months) • **Later schooling outcomes** measured by the Science Research Associates Achievement (SRA) scale at age 6-7 and 10-11	• HOME subscale scores at 6-months were significantly correlated with 12-month MDI score, r =0.30 • HOME subscale scores at 24-months were significantly correlated with 54-month IQ scores, r =0.63 • 36 months HOME scores were significantly positively associated with IQ scores at both 36 and 54 months, with the following HOME subscales: stimulation through toys, games and reading materials; pride, affection, and warmth; showing the strongest correlations with IQ scores. • Correlations showed marginally significant relations between 6 months HOME scores and 10-11year SRA achievement test scores. Play materials and maternal responsivity showed to be the strongest correlates (r =0.27 & r =0.28 respectively). • Differences in HOME scores were attributable to race, SES and family structure
NICHD ECCRN, 2002a	• **Non-maternal care structural features** at 54 months(staff-child ratios and caregiver education) • **Maternal care process features** between 6 months and 54 months (maternal sensitivity,	• **Cognitive competence at 54 months** (latent variable by combining items from Woodcock-Johnson Test, Preschool Language Scale and the Continuous Performance Task)	• Caregiver education was indirectly positively associated with cognitive competence (β =0.17) • Child-staff ratio was indirectly negatively associated with cognitive competence (β = -0.10). • Maternal care was significantly positively associated with cognitive competence (β = 0.46).

	cognitive stimulation resources available to the child and child rearing attitudes)		
NICHD ECCRN, 2002b	• **Quality of Non-maternal care measured by ORCE scores** at 6, 15, 24, 36 and 54 months • **Quality of parental care measured by HOME and maternal sensitivity scores** at 6, 15, 24, 36 and 54 months	• **Pre-academic skills at 4.5 years** measured by the Woodcock Johnson Achievement and Cognitive Batteries • **Language skills at 4.5 years** measured by the Preschool Language Scale (PLS-3**)**	• Children in the high quality non-maternal care group scored 2.3 points higher on pre- academic skills and 2.3 points higher on language skills than children in the low-quality group. • Children receiving high quality parenting scored 8.3 points higher on pre-academic skills and 13.7 points higher on language skills than children receiving low quality parenting.
Belsky et al., 2007	• **Child care quality measured by ORCE scores at** 6, 15, 24, 36 and 54 months. • **Parenting quality measured by mother-child interaction and maternal sensitivity at** 54 months, 3rd Grade and 5th Grade	• **Cognitive and academic achievement** from 54 months up to 5th Grade measured by the Woodcock–Johnson Psycho- Educational Battery –Revised) • **Socioemotional functioning** from 1st to 6th Grade (teacher reported check list of the Teacher Checklist of Peer Relations)	• Children who experienced higher quality care had significantly higher reading scores at 54 months ($\beta = 6.47$). • Children who had experienced higher quality care had higher vocabulary scores in 5th grade ($\beta = 3.15$). • Higher levels of parenting quality predicted higher levels of social skills, socio–emotional functioning, and work habits in 6th grade.
Peisner-feinberg & Burchinal, 1997	• **Composite quality child care index in the classroom**, made up of ECERS	• **Cognitive development** measured by the Peabody Picture Vocabulary Test-Revised (PPVT-R),	• Higher classroom quality and closer teacher-child relationships were positively associated with better PPVT-R language scores, even when controlling for child and family characteristics i.e. SES and ethnicity.

	scores, CIS teacher sensitivity, teaching style and teacher responsiveness scores. • **Quality of Teacher-child relationship** measured by teacher-child closeness	Woodcock-Johnson Test (WJ) • **Socioemotional development** measured by the Classroom Behaviour Inventory (CIB)	• Higher classroom quality was positively associated with better WJ reading skills, moderated by maternal education. Teacher-child relationships were not significantly associated with reading skills. • Closer teacher-child relationships were associated with fewer behaviour problems. Child care quality in the classroom was not a strong predictor of behaviour problems, it was however a significant predictor for certain ethnic groups.
Sims, Guilfoyle & Parry, 2006	• **Centre quality** measured by, staff-child interaction, staff-parent interaction, program structure, learning & development, personal care and facilities.	• **Cortisol levels** of children between the ages of 3-5 years who were attending a child care centre.	• Cortisol levels of children attending high quality centres demonstrated a decline across the day whereas levels in children attending lower quality centres increased across the day.
NICHD ECCRN & Duncan, 2003	• **Non-maternal child care quality measured by ORCE scores** at 6-24 months and 36-54 months	• **Cognitive development** at 54 months measured by the Bayley MDI and by the WJ achievement test	• A one standard deviation increase in either early (6-24 months) or later (36-54 months) child care quality significantly increased MDI cognitive scores by 1.4 and 1.2 points respectively • A one standard deviation increase in either early (6-24 months) or later (36-54 months) child care quality significantly increased WJ achievement scores by 0.9 and 1.1 points respectively.
Hirsh-Pasek & Burchinal, 2006	• **Maternal sensitivity and cognitive stimulation** at 6, 15, 24, 36, and 54	• **Language competence** at 54 months measured by the Preschool Language Scale (PLS-3)	• Children scored higher on language and academic tests when they experienced consistent sensitive caregiving across the analysis period (6 months to 1st Grade).

	months, and later at 1st Grade. • **Non-maternal child care quality measured by ORCE scores** at 6, 15, 24, 36, and 54 months	• **Academic achievement** in 1st Grade measured by the WJ achievement test	• ANCOVA results showed significant moderate to large differences between children whose mothers showed low and declining sensitivity across the analysis period and children whose mothers showed moderate and increasing sensitivity across the analysis period.
Burchinal et al., 2000	• **Quality of centre based child care measured by ECERS scores**	• **Language skills** measured by the PPVT-R • **Academic ability** measured by the WJ	• Children in the poor quality of care had the lowest adjusted language skills mean scores (M=80.3), followed by children in medium quality care (M = 89.0), and children in high quality care (M = 92.9). • Children in poor quality care had significantly lower WJ math scores (M = 90.4) than children in high quality care (M= 96.1). The math scores of children in medium quality care (M = 94.4) were not significantly different from the scores of children in poor quality care.
Leerkes, Blankson & O'Brien, 2009	• **Maternal sensitivity** to infant's distress and non-distress at 6 months.	• **Socioemotional development** measured by the Child Behaviour Checklist (CBCL) at 24 and 36 months.	• Maternal sensitivity accounted for 24% of variance occurring in behaviour at 24 months and 28% at 36 months. • Mothers who were more sensitive to infant distress had children with fewer behaviour problems i.e. sensitivity to distress was negatively associated with behaviour problems at both 24 and 36 months.
Bono, Sy & Kopp, 2016	• **Latent variable of Parenting behaviour scores** created from a combination of maternal sensitivity ratings and HOME scores	• **Cognition and language development** measured by a composite score created by a combination of WJ and PLS-3 scores at 54 months	• Parenting behaviours accounted for over a third of the (0.42) variance in cognitive/language abilities.

Bass et al., 2016	• **Quality of child care measured by HOME scores** for children between the ages of 2 – 5 years.	• **Cognitive development** measured by the Mullen Scales of Early Learning and Colour Object Association Test (COAT).	• A unit increase in total HOME score was associated with a 0.56 unit increase in Mullen scores. • A unit increase in HOME acceptance subscale scores was associated with a 0.57 unit increase in COAT scores.
Vandell, Burchinal & Pierce, 2016	• **Quality of early child care measured by measured by ORCE scores and caregiver sensitivity** at 6, 15, 24, 36 and 54 months.	• **Academic outcomes at the end of high school** measured by their overall grades in high school i.e. A's, B's, C's, D's • **Social outcomes at the end of high school** measured by Delinquent Behaviour and Aggressive Behaviour scales. Also self-reports on engagement in risky behaviour.	• Adolescents whose early child care was of higher quality attained higher grades in high school compared to adolescents whose early child care was of lower quality. • None of the early child care quality variables were found to be significantly associated with social outcomes.

2.3.3.1 Socioeconomic status, culture, child care quality and child outcomes

As discussed earlier, both SES and quality of child care influence child outcomes. These factors are highly correlated, though not necessarily causally related (Figure 2.1). Studies have shown that differences in child care quality are attributable to household SES (Phillips et al., 1994; Grantham-McGregor et al., 2007; Yeung & Conley, 2008; Engle et al., 2011; Bornstein & Putnik, 2012; UNICEF, 2012). Literature advocates parental education to be the most significant predictor of child care quality and outcomes amongst other SES indicators (Shonkoff & Phillips, 2000; NICHD ECCRN & Duncan, 2003; Paxson & Schady, 2007; Santos et al., 2008; Barros et al., 2010; Blums et al., 2016; Gonzalez et al., 2017). The reason for this advocacy is due to parental or maternal education proven being associated with better access to stimulating environments, sensitivity and knowledge on how to care for children's development (Richter & Grieve, 1991; Santos et al., 2008; Bornstein & Putnik, 2012; Raby et al., 2015; September et al., 2016).

However, some studies have found variations in child care and subsequent quality may not be exclusively a function of SES, but also due to cultural and ethnic factors (e.g. Bradley et al., 1986; LeVine et al., 1996; Bradley & Corwyn, 2005; Pungello et al., 2009; Mulvaney & Morrisey, 2012; Lamb et al., 2014). For example: LeVine et al. (1996), conducted a mother-infant interaction comparison between a sample of Gusii mothers (Black Kenyan tribe) and Boston mothers (White American) and found that Gusii mothers did not respond to infants vocal or visual communication with reciprocal talking, but rather with soothing and comforting holding, whereas Boston mothers responded with visual and verbal communication. The authors hypothesized that the Gusii delay verbal instructions to children until they are able to talk or understand commands and they discourage children's social visibility. In support of the LeVine et al. (1996) study, Aboud & Alemu (1995) found this same interaction pattern in a sample of Ethiopian mothers. In addition, Le Vine et al (1996) speculated that Gusii mothers expected their children to learn by watching older children or siblings as explicated by social learning theory (Bandura, 1971), whereas Boston mothers themselves were active in teaching their children. It is clear that there are stylistic differences in child care between cultures and societies. However, Richter (1995) argued that basic features of mother-infant interactions are universal but differ in approach or modality underpinned by cultural and social differences. If this were not the case, the well-accepted theoretical edifice built around the acquisition of communication, language and cognition could not hold true (Richter et al., 1995).

One of the pivotal findings from studies that explored associations between SES, quality of care and child outcomes is that high quality child care buffers children against negative outcomes, particularly children facing risk factors such as poverty and other forms of toxic stress. There is evidence of remediation of young children from low socioeconomic backgrounds, where improvements in cognitive and academic abilities are attributed to improvements in quality of care (Peisner-Feinberg & Burchinal, 1997; Loeb et al., 2004; McCartney et al., 2007; Lugo-Gil & Tamis-LeMonda, 2008; Dearing, McCartney & Taylor, 2009; Burchinal et al., 2010; Watamura et al., 2011; Burchinal et al., 2014). Unfortunately, fewer studies have assessed the effects of child care quality on developmental outcomes of children from advantaged backgrounds and results from these few studies are inconclusive. Some studies found no significant associations between quality child care variations and developmental outcomes of children from more privileged families (Deater-Deckard, Pinkerton & Scarr, 1996). This is attributed by their background circumstances (i.e. access to high quality centre based care, highly educated parents, access to stimulatiing material) buffering them from the harmful effects of poor quality care when in out-of-home or group care. Indeed, usual indicators of poor quality child care are rarely found in the homes of socioeconomically privileged children, with the exception of toxic stress associated with abuse or neglect (Gilbert et al., 2009). However, a study by Peisner-Feinberg & Burchinal (1997) challenged this conclusion, as it did not find any evidence that children from affluent family backgrounds were protected against the harmful effects of poor quality centre-based care. The study concluded that high quality group child care was important for all children's development regardless of their SES, and this was also supported in a subsequent report by Burchinal et al., 2000.

2.3.3.2 Child care research findings in low-middle income countries (LMIC)

Most child care research has been conducted in high-income countries (HIC) (Bornstein & Putnik, 2012). After examining NICHD studies that profiled associations between child care and subsequent outcomes, Love at al., (2003), found that these results could not be generalized across a wide spectrum of child care. Hence, there has been a general concern to test whether child care theories hold in low and middle income countries (LeVine et al., 1996; Bornstein & Putnik, 2012). One of the major barriers to conducting and comparing LMIC studies is the lack of culturally appropriate child care measurement tools. Sakai et al., (2003) found that both the ECERS and its revised version may have language barriers. Furthermore, almost all child care quality

measurement tools have been based on HIC samples (Vermeer et al., 2016) and may require modification and piloting to remove cultural biases and ascertain reliability and validity (Farquhar, 1990; Richter & Grieve, 1991; Bradley & Corwyn, 2005; Fernald et al., 2009; Hamadani et al., 2010; Kariger et al., 2012).

Studies conducted in LMIC settings indicated that high quality child care is beneficial to child outcomes, (Aboud & Alemu, 1995; Bradley & Corwyn, 2005; Hamadani et al., 2010; McCall et al., 2010; Nores & Barnett, 2010; Walker et al., 2011; Malmberg, Mwaura & Sylva, 2011; Gertler et al., 2013; Hamadani et al., 2014; Bass et al, 2016). However, some studies highlight that SES and physical growth play a much more significant role in predicting child outcomes than the child care quality, as reported in LMIC settings. For example, Paxson & Schady (2007) studied associations between SES, parenting quality (measured by HOME scores) and cognitive development in a sample of poor Ecuadorian children and found that SES had a stronger impact on cognitive development than parenting quality. Thus, for this sample, SES affected child development through other mechanisms beyond child care quality - a finding in contrast to study results reported on in the United States (e.g. Bono, Sy & Kopp, 2016).

2.4 South African context

In South Africa, there are about 6.3 million children under the age of six years, and 63% of these children live in poverty (Hall et al., 2016). This high poverty prevalence results in early childhood inequity. In response, the South African government has increased its efforts in providing early childhood education services through subsidised centre-based care for children from birth to six years. By 2013, 91% of children between the ages of five and six years were attending some form of centre-based out-of-home care (Hall, 2015). In contrast, it's been estimated that only 30% of children from birth to four years old are in some form of centre-based out-of-home care (Richter et al., 2012), and disturbingly, attendance is even lower for children living in poverty. Although access to centre-based out-of-home care for children has increased, the quality of some of these centres may be questionable. A 2014 national audit of ECD centres in South Africa revealed that most centres were of poor quality, i.e. unregistered, unqualified personnel, high staff-child ratios and improper infrastructure (National Department of Social Development, 2014). This raises questions as to how the quality of these centres would affect children's development, and according

to our knowledge, there has not been a study to evaluate the quality of these centres and how this quality affects child development. As the majority of children under the age of four years are cared for in the home, the evaluation and improvement of quality of care in the home is also of critical importance for children in this age group. In South Africa, only one study directly investigated the effects of quality child care in the home on children's early development outcomes. Amongst a sample of Black infants, Richter & Grieve (1991) found that quality home environments as measured by the HOME Screening Questionnaire (HSQ) were positively associated with infant's early mental development.

In 2015, the South African government released the National Integrated Early Childhood Development Policy which recognises the importance of quality child care, and plans to improve quality of child care both in- and out-of-home through strategic interventions. These interventions include: parental support in the home, improving infrastructure and improving personnel qualification levels in out-of-home care (Department of Social Development, 2016). The importance of quality child care in South Africa is gaining momentum, it is paramount that scientific evidence in the South African context be available to support evidence based decision making.

The current study aims to add to the body of literature in understanding the effects of child care quality on child outcomes using the framework depicted in Figure 2.3 which was adapted from Grantham-McGregor et al., 2007 as shown in Figure 2.1.

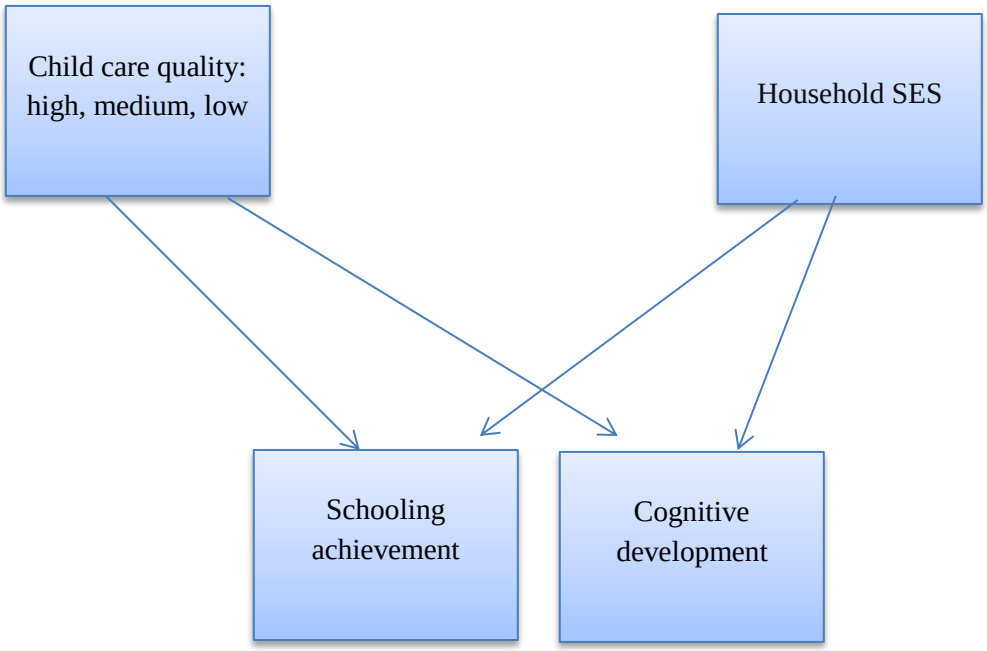


Figure 2.3 Associations between socioeconomic status, child care quality and child outcomes

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CHAPTER 3: METHODOLOGY

This chapter describes the Birth to Twenty Plus (Bt20+) cohort, which is the data source for the current study and outlines the study participants, sample selection, design, measures and statistical tests used to analyse the data.

3.1 Study participants and the Birth to Twenty Plus cohort

Participants for this study were drawn from the Bt20+ cohort, the largest and longest running longitudinal birth cohort study of child and adolescent health and development in Africa. The study tracks growth, health, well-being and educational progress of South African children born in the greater Johannesburg-Soweto metropolitan area. The study was initiated with the aim of understanding the effect of urbanisation on the health and well-being of children (Richter et al., 2007).

The Bt20+ study included single children born within a seven-week enrolment period, from March to June 1990, in the larger Soweto-Johannesburg area (Figure 3.1). The study enrolled 3 273 children and their primary caregivers. At enrolment, the cohort was largely representative of the South African population, except for an under-representation of the White ethnic group and also an under-representation of higher income groups, as higher socioeconomic classes were harder to recruit and maintain (Norris et al., 2007).

The study achieved a 70% retention rate up to the children's 16th birthday and attrition has been mainly due to family or child mobility within or out of the study area in the infant years (Richter et al., 2007). The study has collected data in waves from the mothers' antenatal period to when children turned 23 years of age. During the early years, the study collected data on prenatal risk factors, household SES, mortality and morbidity, growth, cognitive and psychological development, environmental and household air pollution, family composition and child care. The Bt20+ study mainly used structured questionnaires to facilitate data collection. Researchers and data collectors were recruited from surrounding local communities and trained in ethical research conduct and on how to administer the questionnaires and conduct interviews. Parents/caregivers were requested to sign a consent form before each data collection wave (Appendix D).

The current study obtained ethical clearance from the Human Research Ethics Committee (Medical) at the University of the Witwatersrand under certificate number M150717 (Appendix A). Before the Bt20+ data collection commenced, the primary study received ethical clearance from the Human Research Ethics Committee (Medical) at the University of the Witwatersrand (certificate number M010556) (Richter et al., 2007).

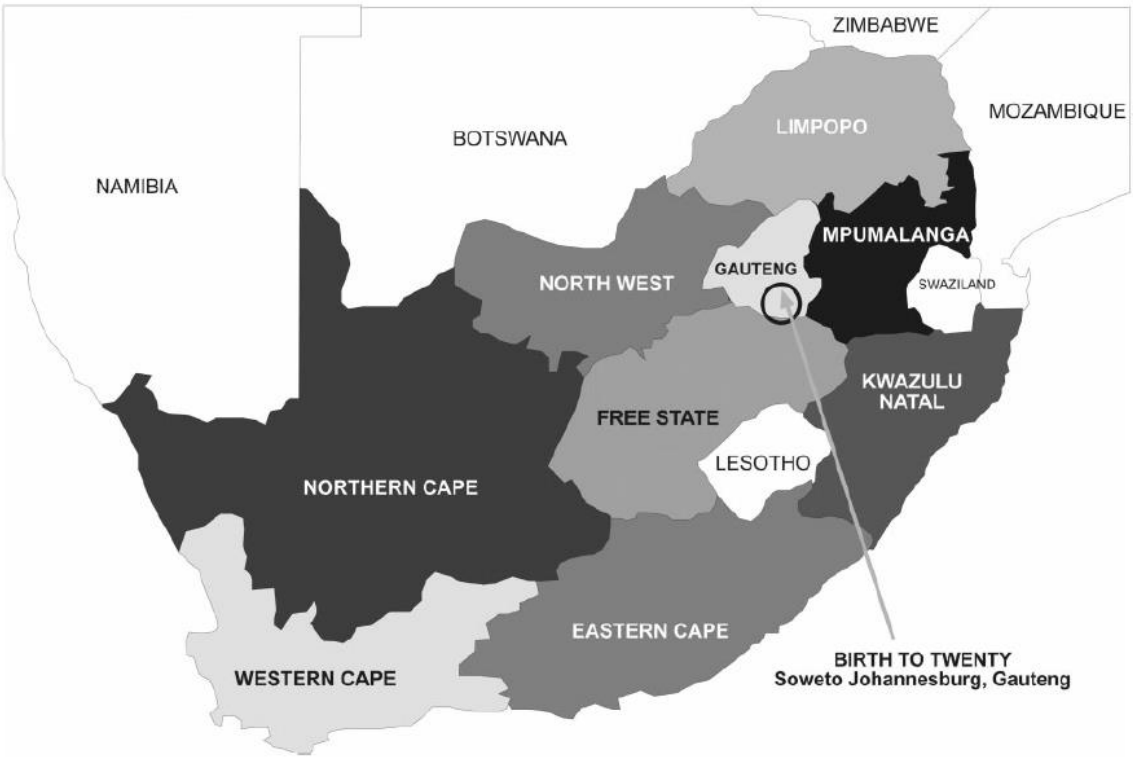


Figure 3.1 Birth to Twenty Plus study site. (Source: Richter et al., 2007)

3.1.1 Data sources and collection.

The current study utilised secondary data collected in the Bt20+ cohort. Data on variables relating to early child care such as daytime care, after school activities, monitoring and supervision, perception of parenting and household composition were collected from birth to two years, four to five years, seven to eight years and eleven to twelve years. Socioeconomic status data was collected at all 16 data collection waves.

3.2 Study design

As the current study was nested within the Bt20+ study, data was extracted from the larger primary dataset. Secondary analysis of longitudinal birth cohort data was conducted to achieve study objectives. The analysis for this study was longitudinal in nature, investigating two age periods in children's lives. The first period was when children were between the ages of six months and two years. The second period was when children were between the ages of four and five years. For both time periods, cognitive development at five years and grade repetitions in primary school were assessed as outcomes. Both outcomes were assessed for each period independently (Figure 3.2). In order to maximise the sample size, the current study used data collected at any time point during the six months to two year and the four to five year periods respectively.

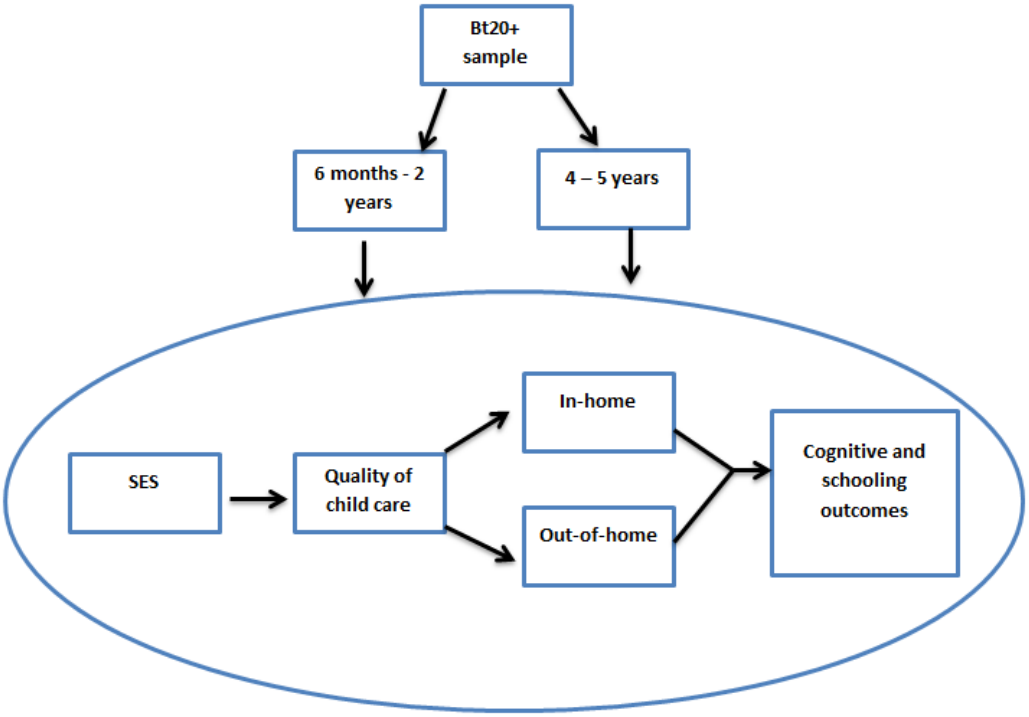


Figure 3.2 Study design.

3.3 Study sample

The study samples were derived from the Bt20+ population sample of 3 273 participants. The sample for the in-home environment analysis in both time periods consisted only of children with full data for all exposure variables, confounders and at least one of the outcome variables. The out-

of-home environment analysis consisted only of children who experienced out-of-home/non-maternal care and also had full data for all exposure variables, confounders and at least one of the outcome variables. The sample size differed for each outcome included in the study analyses and for each specified study objective. The current study consisted of 8 different sample groups (Figures 3.3 and 3.4).

Objective 1: *To assess associations between household SES, quality of child care in the home environment between the ages of six months and two years, and subsequent cognitive development at age five years and grade repeats by Grade 7.*
The sample comprised of 856 participants for assessing cognitive development at five years and 1148 participants for assessing schooling outcomes (Figure 3.3).

Objective 2: *To assess associations between household SES, quality of child care in the home environment between the ages four and five years, and subsequent cognitive development at age five years and grade repeats by Grade 7.*
The sample comprised of 991 participants for assessing cognitive development and 1143 participants for assessing schooling outcomes (Figure 3.4).

Objective 3: *To asses associations between household SES, quality of child care in the out-of-home environment between the ages of six months and two years, and subsequent cognitive development at age five years and grade repeats by Grade 7.*
The sample comprised of 203 participants for assessing cognitive functioning and 264 participants for assessing schooling outcomes (Figure 3.3).

Objective 4: *To asses associations between household SES, quality of child care in the out-of-home environment between the ages of four and five years; and subsequent cognitive development at age five years and grade repeats by Grade 7.*
The sample comprised of 693 participants for assessing cognitive functioning and 748 participants for assessing schooling outcomes (Figure 3.4)

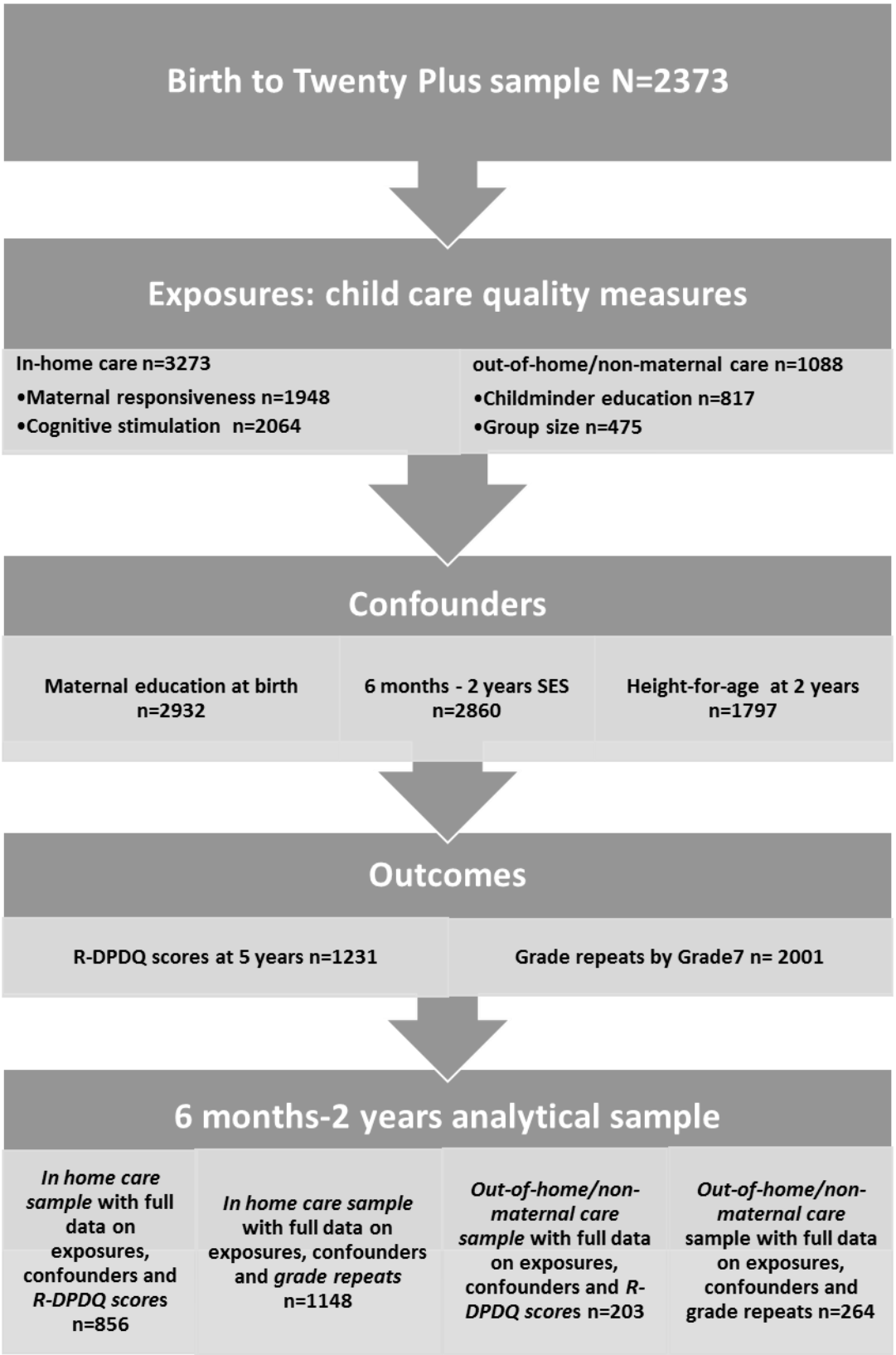


Figure 3.3 Study sample selection for the six months and two year period.

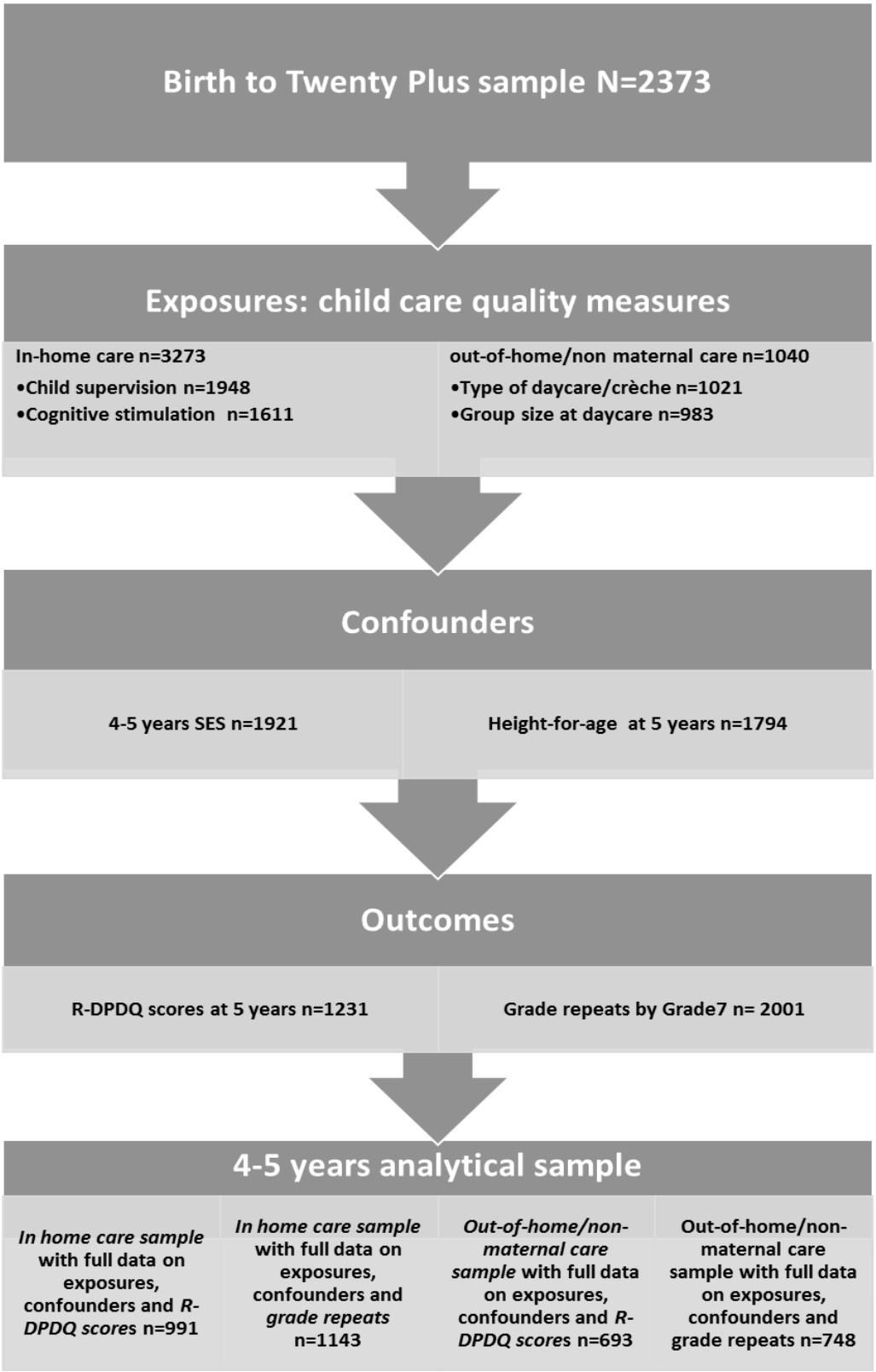


Figure 3.4 Study sample selection for the four and five year period.

3.4 Variables and measures

This section outlines the variables and measures used in the analysis, how the data was collected and data management, including the transformation of variables where applicable. The same outcome variables were used for both exposure periods, however exposure variables differed according to the period of analysis.

3.4.1 Exposure variables between six months and two years in the home

3.4.1.1 Maternal responsiveness

Data on maternal responsiveness in the Bt20+ cohort were collected when children were between the ages of six months and two years. While mothers were completing their annual interviews, their response to and interaction with the child was discreetly recorded by research assistants trained to observe mother-child interaction. The Bt20+ researchers scored the mother on a 3 point scale, i.e. 1 (negative response), 2 (mediocre response) and 3 (positive response). For the current study, a composite score was calculated from 6 items used to assess maternal responsiveness, with a range from 6 to 18:

- Mother's attitude towards the child
- Amount of mothers physical contact with the child
- Whether what mother says to child is loving and encouraging
- Whether mother responds to child's distress
- Whether mother responds to child's vocal or manual expressions
- Whether mother responds to child's physical needs

The responsiveness of most mothers was clustered in the upper band of the scores (Figure 3.5). A balanced dataset yields more accurate results (Oommen, Baise & Vogel, 2011) and in the absence of an empirical guideline, data could be de-clustered by specifying whether values fall under or exceed a certain threshold (Coles et al., 2001)as such in this case the threshold was 18. Mothers who scored between 6 and 13 were categorised as being of low responsiveness, between 14 and 17 were categorised as being of moderate responsiveness, and those who scored 18 were categorised as being highly responsive.

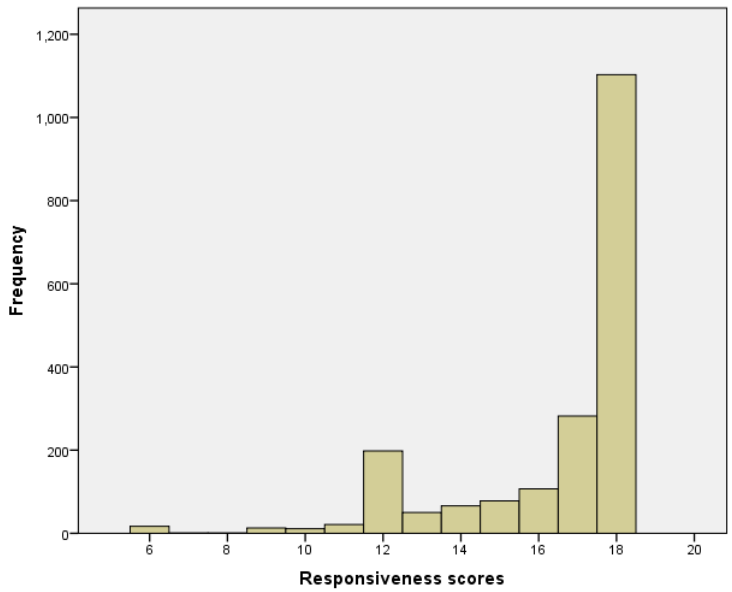


Figure 3.5 Maternal responsiveness scores between the ages of six months and two years.

3.4.1.2 Cognitive stimulation

Bt20+ data on cognitive stimulation in the home were collected when children were between the ages of six months and two years. Mothers and caregivers were asked a series of questions relating to activities deemed to stimulate cognitive development.

For the current study, a composite score of cognitive stimulation was created, ranging from 4-10 points, using the following items taken from the HOME Scale (Bradley & Caldwell, 1977):

- Does anyone in the home read newspapers or books (1 = no/2 = yes)
- Have you bought or made toys for the child (1 = no/2 = yes)
- How often do you take the child out to shops, visits, etc. (1 = never, 2 = about once a month, 3 = about once a week & 4 = most days)
- Have you tried to teach the child anything (1 = no/2 = yes)

Scores were categorised into: low cognitive stimulation (4 to 8), some cognitive stimulation (score of 9) and high cognitive stimulation (score of 10). Categories were defined with the aim of yielding a balanced sample distribution within clusters.

3.4.1.3 Quality of care in the home

For analytical purposes, a latent variable of 'quality of care in the home' was created from the maternal responsiveness and cognitive stimulation categorical variables. Maternal responsiveness had three possible outcomes, i.e. low responsiveness coded as 1; moderate responsiveness coded as 2 and high responsiveness coded as 3. Cognitive stimulation also had three possible outcomes, i.e. low cognitive stimulation coded as 1, some cognitive stimulation coded as 2 and high cognitive stimulation coded as 3. Therefore a combination of the two variables yielded 9 possible combinations according to the multiplication principle (Bona, 2012). A combination of 1-1, 2-1 and 1-2 was categorised as low quality care. A combination of 2-2, 3-1 and 1-3 were categorised as average quality care. A combination of 3-3, 3-2 and 2-3 was categorised as high quality care.

3.4.2 Exposure variables between six months and two years in out-of-home care

To establish out-of-home care or non-maternal care, caregivers were asked who in particular takes care of the child during the day.

3.4.2.1 Childminder education

Childminder education data were collected from caregivers of children between six months and two years, during caregiver interviews. For analytical purposes, childminder education levels were classified into four categories, i.e. (1) education level up to Grade 7, (2) Grade 8 to Grade 10, (3) Grade 11 to Grade 12 and (4) post-school training or tertiary education.

3.4.2.2 Size of child group taken care of by one childminder

Child group size data were collected at the age of two years in the Bt20+. Each caregiver was asked to report on the number of children placed in their care, and in the case of a crèche, the number of children in the child's group or class.

For purposes of the current study, a group consisting of only one child was classified as a small group, a group of two to six children was classified as an average group and a group of 7 to 50 children was classified as a big group (National Department of Social Development, 2006). In the absence of data on the number of practitioners per group, group size categories were designed to balance the sample distribution.

3.4.3 Exposure variables between four and five years in the home

3.4.3.1 Cognitive stimulation

Caregivers of the Bt20+ study, taking care of children between four and five years of age, were asked a series of questions relating to activities deemed to stimulate cognitive development. For analytical purposes, a composite score of cognitive stimulation was created, ranging from 5-16 points, using the following items:

- Does someone in the household regularly bring home a newspaper (never = 1, sometimes = 2, regularly = 3)
- Does anyone in the household read to the child (never = 1, sometimes = 2, regularly = 3)
- Does anyone in the household tell the child stories (never = 1, sometimes = 2, regularly = 3)
- Does anyone in the household encourage the child to try to write or colour in (never = 1, sometimes = 2, regularly = 3)
- How many books apart from school books were in the house (non = 1, less than ten = 2, eleven to fifty = 3 & more than fifty = 4)

Scores were categorised into three: low cognitive stimulation (score of 5 to 10), some cognitive stimulation (11 to 12) and high cognitive stimulation (13 to 16). Categories were defined with the aim of yielding a balanced sample distribution within clusters.

3.4.3.2 Child supervision scores

At four years of age data on child supervision were collected asking caregivers whether someone regularly supervised the child's evening meal, bathing, brushing of teeth and dressing (no = 1, yes = 2).

For analytical purposes, a composite score was created using these items, which ranged from 4, indicating no supervision, to 8, indicating full supervision. Those who scored below 8 were categorised as partial supervision and those who scored 8 were categorised as receiving full supervision.

3.4.4 Exposure variables at four and five years out-of-home

These measures were applied for the sample of children who were attending some form of daycare between the age of four and five years.

3.4.4.1 Type of daycare

This data was collected at four and five years of age. Caregivers were asked how they would describe the kind of daycare the child was attending, i.e. formal crèche (registered daycare centre with formal facilities and structures) or non-formal e.g. backyard/garage crèche or playgroup or childminder or other.

3.4.4.2 Group size at daycare

This data were collected at the age of four and five years. Caregivers were asked to report the number of children (other than the index child) being cared for by the childminder. In the case of a crèche or playgroup, caregivers reported on the number of children in the child's class/group. Responses were classified in categories of five or fewer children, six to ten children, 11 to 20 children and more than 20 children.

The National Department of Social Development Guideline for Early Childhood Development Services stipulates that for children aged four years there should be one practitioner per 20 children or less (National Department of Social Development, 2006). Using these guidelines, this variable was categorised into two parts for the purpose of this study: more than 20 children were categorised as a big group and 20 or fewer children were considered a small group.

3.4.5 Control variables

3.4.5.1 Household socioeconomic status

Bt20+ collected household SES data at every data collection wave. An asset score consisting of ownership of seven assets, namely home ownership, electricity, television, car, fridge, washing machine and telephone was created. The score ranged from 0 to 7, where 0 indicated that the household has none of the listed assets and a score of 7 that the household had all of the listed assets.

For this study, asset scores collected between the ages of six months and two years and at four to five years were divided into three groups namely: low (0-3 assets), average (4-5 assets) and high (6-7 assets) SES.

3.4.5.1.1 Maternal education

Maternal education represents the level of education of the mother at the time of the birth of the index child. The mother's education was classified as (1) Grade 7 or less primary education, (2) Grade 8 to Grade 10, (3) Grade 11 to Grade 12 and (4) post-school training or tertiary education.

3.4.5.2 Linear growth

Child growth data was collected at all Bt20+ data collection waves. For this study, length/height data collected at age two years and at age five years were used to calculate height-for-age and gender-differentiated z-scores (WHO, 2006).

3.4.6 Child outcome variables

3.4.6.1 Cognitive development

A number of psychometric assessment instruments were used in the Bt20+ cohort to assess children's cognitive and behavioural development at different ages (Richter, Mabaso & Hsiao, 2015; Hsiao & Richter, 2014; Richter et al., 2007). At the age of five, children's cognitive functioning was assessed using the Revised Denver Pre-screening Developmental Questionnaire (R-DPDQ) (Appendix D).

The R-DPDQ is based on the Denver Developmental Screening Test (DDST), designed to screen cognitive delays and behavioural problems among pre-school children (Frankenburg, Fandal, & Thornton, 1987). The test is a 32-item scale measuring gross motor, language, fine motor-adaptive and personal-social development. For the Bt20+ cohort, some of the test items were modified to counter cultural bias. To confirm validity and cultural suitability for the South African sample, the test was piloted and found to be a suitable measure with an internal consistency of 0.72 (Cronbach alpha) (Griesel, Belciug & Richter, 1985; Luize et al., 2004; Hsiao & Richter, 2014).

With a score of 1 as a pass and 0 as a fail, the maximum score is 32. The raw scores were adjusted according to the child's chronological age i.e. (raw score ÷ child's age in months)×100. In the case of children with missing data on items, a pro-rated raw score was calculated, i.e. (raw score ÷ number of items not missing)×32. No child had more than three items missing (Hsiao & Richter, 2014).

3.4.6.2 Grade repeats

Schooling outcome data were collected annually from the age of seven years (Richter et al, 2007). Caregivers were asked to give information on the child's grade and educational performance. School report cards were also collected.

In this study, the number of recorded grade repeats by Grade 7 was used to represent schooling outcome. The numbers of grade repeats were then converted into a binary variable i.e. coded as 0 if the child has never repeated a grade and 1 if the child had repeated at least one grade.

3.5 Data cleaning and preparation

The data was checked against participants' raw files for coding errors, verification of missing data and inconsistencies. All errors were corrected, and all outliers and all inconsistencies that could not be corrected were excluded from the dataset used. Where applicable, certain data were re-coded and/or reverse coded in order to facilitate analysis. Some continuous variables were transformed into categorical variables. Where datasets needed to be merged, the IBM Statistical Package for Social Science (SPSS) version 23 and STATA version 14 (Stata Corporation, College Station, Texas, USA) were used.

3.6 Data analysis

All analyses were done using STATA version 14 (Stata Corporation, College Station, Texas, USA). To summarise the data, categorical variables were described using frequencies and proportions, and continuous variables were summarized using means and standard deviations. The Pearson's chi-square test with corresponding p-values was used to assess the current study samples' representation of the Bt20+ cohort population sample.

To determine associations between exposure and child outcome variables, bivariate and multivariate linear and logistic regressions were estimated. The p-values were reported to indicate statistical significance at 90% ($p<0.1$). The F-statistic and likelihood ratio (LR), as well as the chi-square (χ^2) p-values were reported to indicate model fit or significance of the models. Multivariate models were specified *a priori* based on the literature, and on theoretical links between the exposures and the outcomes. See Figure 3.6 below for the data analysis plan of the study.

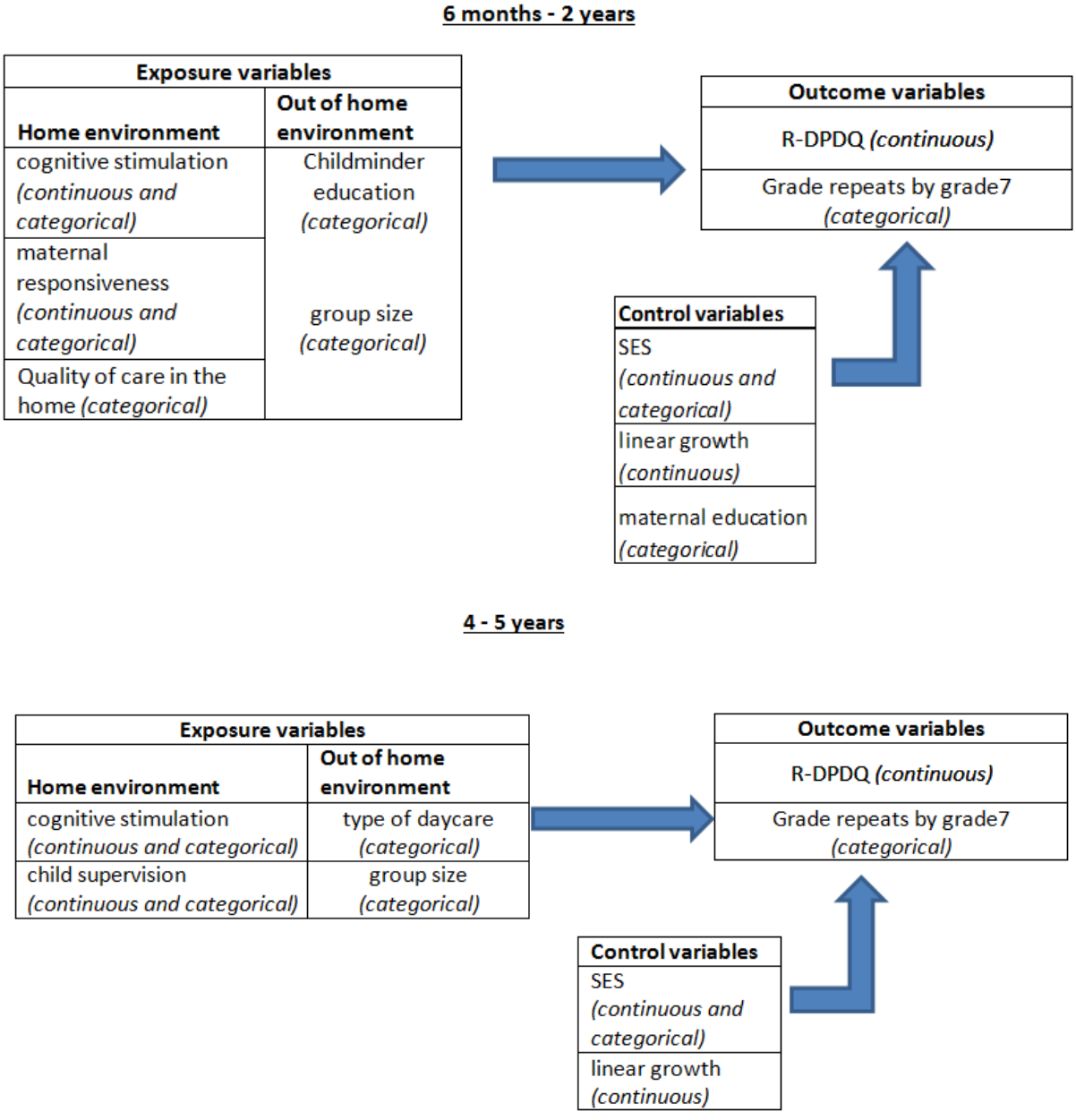


Figure 3.6 Data analysis plan for this study.

CHAPTER 4: RESULTS

This chapter summarises the study findings. Assessment of selection bias of the study sample is presented. To profile the data, categorical variables are described using frequencies and proportions and numerical data are summarised using means and standard deviations. Bivariate and multivariate logistic and linear regressions were performed to establish associations between exposures and outcomes.

4.1 Descriptive statistics of the Bt20+ population sample.

Table 4.1 provides summary statistics of the full Bt20+ population sample for key variables used in the current study. Sample sizes differed according to the number of participants who had full data for each variable.

Table 4.1 Summary statistics for full Birth to Twenty Plus sample

N = 3273	**N(%)**	**Mean (SD)**	**Range**
Demographics			
Gender			
Female	1682 (51.4)		
Male	1591 (48.6)		
Ethnicity			
White	207 (6.3)		
Black	2568 (78.5)		
Coloured	383 (11.7)		
Indian	115 (3.5)		
Maternal age at child's birth	3271	26 (6.1)	14 – 48
Childcare arrangements between the ages of 6 months to 2 years			
Caregiver during the day at 6 months	**1895 (50.0)**		
Mother	1406 (74.2)		
Grandmother	202 (10.7)		
Childminder	208 (11.0)		
Other relative or family friend	79 (4.2)		
Caregiver during the day at 1 year	**2185 (57.7)**		
Mother	1280 (58.6)		
Grandmother	117 (5.4)		
Childminder	358 (16.4)		
Other relative or family friend	430 (19.7)		
Caregiver during the day at 2 years	**1837 (48.5)**		
Mother	880 (47.9)		
Grandmother	370 (20.1)		
Childminder	237 (12.9)		

Crèche	218 (11.9)		
Other relative or family friend	132 (7.2)		
Children's day time activities between the ages of 4 to 5 years	**1886 (57.6)**		
Stayed at home with mother/childminder/relative at 4 years and at 5 years	617 (32.7)		
Stayed at home with the mother/childminder/relative at 4 years then started school at 5 years	229 (12.1)		
Attended crèche/daycare at 4 years and at 5 years	680 (36.1)		
Attended crèche/daycare at 4 years then stayed at home with the mother/childminder/relative at 5 years	30 (1.6)		
Attended crèche/daycare at 4 years then started school at 5 years	103 (5.5)		
Stayed at home with the mother/childminder/relative at 4 years then started crèche/daycare at 5 years	227 (12.0)		
Exposure variables: 6 months to 2 years			
Maternal responsiveness	**1948 (59.5)**		
Low responsiveness	312 (16.0)		
Moderate responsiveness	533 (27.4)		
High responsiveness	1103 (56.6)		
Cognitive stimulation in the home	**2064 (63.1)**		
Low to no cognitive stimulation	862 (41.8)		
Some cognitive stimulation	566 (27.4)		
High cognitive stimulation	636 (30.8)		
Quality of child care in the home	**1928(58.9)**		
Low quality	462 (24.0)		
Average quality	646 (33.5)		
High quality	820 (42.5)		
Childminder education	**817 (25.0)**		
Grade 7 or less	188 (23.01)		
Grade 8 to Grade 10	353 (43.2)		
Grade 11 to Grade 12	233 (28.5)		
Post school training	43 (5.3)		
Group size at childminder	**475 (14.5)**	3 (6.2)	1-50
Big group (7 to 50 children)	35 (7.4)		
Average group (2 to 6 children)	204 (43.0)		
Small group (1 child)	236 (49.7)		
Exposure variables: age 4 to 5years			
Cognitive stimulation in the home scores	**1611 (49.2)**		
Low to no cognitive stimulation	770 (47.8)		
Some cognitive stimulation	525 (32.6)		
High cognitive stimulation	316 (19.6)		

Child supervision in the home scores	**1598 (48.8)**		
Full supervision	1388 (86.9)		
Partial supervision	210 (13.1)		
Type of daycare/crèche	**1021 (31.2)**		
Formal daycare/crèche	507 (49.7)		
Informal daycare/crèche	514 (50.3)		
Group size at daycare/crèche	**983 (30.0)**		
Big group (more than 20 children per group)	853 (86.8)		
Small group (less than 20 children per group)	130 (13.2)		
Control variables			
Linear growth at 2 years (height-for-age z-score)	**1797 (54.9)**	-1.2 (1.1)	
Linear growth at 5 years (height-for-age z-score)	**1794 (54.8)**	-0.7 (0.9)	
Assets scores: 6months to 2 years	**2860 (87.4)**		
Low SES (6 months – 2 years)	997 (34.7)		
Average SES (6 months – 2 years)	1403 (49.1)		
High SES (6 months – 2 years)	460 (16.1)		
Assets scores:4 to 5 years	**1921 (58.7)**		
Low SES (4 – 5 years)	365 (19.0)		
Average SES (4 – 5 years)	953 (49.6)		
High SES (4 – 5 years)	603 (31.4)		
Maternal education: 6 months to 2 years	**2932 (89.6)**		
Grade 7 or less	455 (15.52)		
Grade 8 to Grade 10	1256 (42.84)		
Grade 11 to Grade 12	893 (30.46)		
Post school training	328 (11.19)		
Outcome variables			
R-DPDQ scores at 5 years	**1231 (37.6)**	43.8 (4.8)	16.8-54.5
Grade repeats by Grade 7	**2001 (61.1)**		
Never repeated a grade	1495 (74.7)		
Has repeated at least one grade	506 (25.3)		

4.1.1 Profile of child care arrangements between the ages of six months and two years and of four to five years respectively

Results from Table 4.1, suggest that a greater proportion of children under the age of two years were being taken care of by their mothers at home. These numbers declined as children grew older

totalling: 74% of children at six months, 59% of children at one year and 48% of children at two years.

At the age of four to five years, 1040 (55%) of children in the Bt20+sample attended some form of daycare/crèche. Children who were not attending daycare/crèche were either staying at home with the mother or childminder whilst a few had already started formal schooling.

4.1.2 Socio-economic status between the ages of six months and two years, and at four to five years

Age of six months to two years

The majority of the sample came from homes that averaged an asset score of around 4. Almost half (49%) of the sample was classified as coming from average SES homes (4-5 assets), 35% of the sample came from low SES homes (0-3 assets) and 16% of the sample was classified as coming from higher SES homes (6-7 assets)as can be seen in Table 4.1.

Age of four to five years

Again a large proportion (50%) of the sample came from the average SES category (4-5 assets), but in contrast to the six month to two year group, 31% of the sample was classified as coming from higher SES homes (6-7 assets) and 19% of the study sample was classified as coming from low SES homes (0-3 assets), as shown in Table 4.1.

4.1.3 Cognitive stimulation between the ages of six months and two years and four to five years

The sample exhibited low levels of cognitive stimulation in the home environment. Between the ages of six months and two years, 42% of children in the sample were receiving low to no cognitive stimulation. There was no improvement in this condition at the ages of four to five years, in which time period less than half (48%) the children were still receiving low to no cognitive stimulation in the home.

4.1.4 Group size in out-of-home/non-maternal care between the ages of six months and two years and four to five years

For children who experienced out-of-home/non-maternal care, half of the children under the age of two years (50%) were being cared for by childminders in what was called a small group (one child per group), and 43% were being cared for in medium sized groups (two to six children per group). Between the ages of four and five years, the majority of children (87%) were being cared for in large groups (more than 20 children per group).

4.2 Comparison between the analytical sample and the excluded Birth to Twenty Plus sample

Comparisons of key variables from the included and excluded samples were conducted to test for potential selection bias. To test for significant differences, a Pearson's χ^2-test was performed for categorical variables and a t-test was performed for continuous variables. Results for the six months to two year olds in-home and out-of-home care sample are shown in Tables 1 and 2, of Appendix B respectively. Results for the four to five year olds in home and out-of-home care sample are shown in Tables 3 and 4, respectively of Appendix B.

4.2.1 In-home care sample between the ages of six months and two years when analysing R-DPDQ score (n=856)

Significant differences were found in assets scores, linear growth, R-DPDQ scores, maternal education and cognitive stimulation scores. The analytical sample had a higher mean asset score of 0.4, an average of 0.1 lower z-scores, 0.8 higher mean R-DPDQ scores and 0.1 less cognitive stimulation scores when compared to the excluded Bt20+ sample, ($p<0.05$ for each variable). Significant differences were also found in maternal education levels. The analytical sample had a smaller proportion of mothers with post-school training (9.6%) compared to the excluded sample (11.9%), ($p<0.05$). No significant differences were found in terms of gender, grade repeats and maternal responsiveness scores.

4.2.2 In-home care sample between the ages of six months and two years when analysing grade repeats (n=1148)

Significant differences were found in assets scores, linear growth and maternal education. The analytical sample had a higher mean asset score of 0.3 and an average of 0.4 lower z-scores compared to the excluded Bt20+ sample, ($p<0.05$ for each variable). The analytical sample also had a smaller proportion of mothers with post-school training (9.2%) compared to the excluded sample (12.5%), ($p<0.05$). No significant differences were found in terms of gender, grade repeats, maternal responsiveness scores and cognitive stimulation scores.

4.2.3 Out-of-home care sample between the ages of six months and two years when analysing R-DPDQ score (n=203)

Significant differences were found in asset scores and childminder education. The analytical sample had a higher mean asset score of 0.4 ($p<0.05$) and a higher proportion (34%) of childminders, and the analytical sample had an education level of Grade 7 and lower, compared to the proportion of childminders in the excluded Bt20+ sample (21%), ($p<0.05$). No significant differences were found in terms of gender, linear growth, R-DPDQ scores, grade repeats and group size.

4.2.4 Out-of-home care sample between the ages of six months and two years when analysing grade repeats (n=264)

Significant differences were found in asset scores and childminder education. This analytical sample had a higher mean asset score of 0.3 ($p<0.05$) and a higher proportion (34%) of childminders, and the analytical sample had an education level of Grade 7 and lower, compared to the proportion of childminders in the excluded Bt20+ sample (21%), ($p<0.05$). No significant differences were found in terms of gender, linear growth, R-DPDQ scores, grade repeats and group size.

4.2.5 In-home care sample between the ages of four and five years when analysing R-DPDQ score (n=991)

Significant differences were observed in linear growth and R-DPDQ scores. This analytical sample had an average of 0.1 higher z-scores and 0.8 higher mean R-DPDQ scores compared to the excluded Bt20+ sample, ($p<0.05$). No significant differences were found in terms of gender, asset scores, grade repeats, cognitive stimulation and child supervision scores.

4.2.6 In-home care sample between the ages of four and five years when analysing grade repeats (n=1143)

No significant differences were observed between the analytical sample and the excluded Bt20+ sample with respect to all measured variables i.e. gender, asset scores, linear growth, R-DPDQ scores, grade repeats, cognitive stimulation and child supervision scores.

4.2.7 Out-of-home care sample between the ages of four and five years when analysing R-DPDQ score (n=693)

Differences were observed between the analytical sample and the excluded Bt20+ sample in terms of asset scores, linear growth and R-DPDQ scores. The analytical sample had a higher mean asset score of 0.6, an average of 0.3 higher z-scores and 2.4 higher mean R-DPDQ scores compared to the excluded Bt20+ sample ($p<0.05$). No significant differences were found in terms of gender, grade repeats, type of daycare/crèche and group size.

4.2.8 Out-of-home care sample between the ages of four and five years when analysing grade repeats (n=748)

Differences were observed between this analytical sample and the excluded Bt20+ sample in terms of asset scores, linear growth, R-DPDQ scores, grade repeats and group size. The analytical sample had a higher mean asset score of 0.6, an average of 0.3 higher z-scores and 2.4 higher mean R-DPDQ scores compared to the excluded Bt20+ sample ($p<0.05$). The analytical sample had a higher proportion of children who had never repeated a grade (77.3%) compared to the excluded Bt20+

sample (73.2%), ($p<0.05$). The analytical sample also recorded a higher proportion (13.9%) of children being cared for in small groups at daycare/crèche facilities compared to the excluded Bt20+ sample (9.1%), ($p<0.05$). No significant differences were found in terms of gender and type of daycare/crèche.

4.3 Bivariate associations

Tables 1 to 4 of Appendix C, display bivariate analysis or unadjusted model results for associations between outcomes and all individual exposure variables between the ages of six months and two years. Tables 5 to 8 of Appendix C, display bivariate associations between outcomes and all individual exposure variables between the ages of four and five years.

4.3.1 Outcome: R-DPDQ scores

In-home care environment between the ages of six months and two years

Maternal responsiveness and cognitive stimulation scores were significant positive predictors of R-DPDQ scores among children who were cared for at home by their mothers. Highly scored quality care was associated with higher R-DPDQ scores compared to lower scored quality care. Maternal education, asset scores and linear growth were also positively associated with R-DPDQ scores.

Out-of-home/non-maternal care environment between the ages of six months and two years

Of the out-of-home care indicators examined i.e. childminder education and size of the group of children in the care of the childminder, only higher childminder education levels (Grade 11 to Grade 12 and post-school training) were significantly positively associated with higher R-DPDQ scores and not the number of children in the group. Maternal education, asset scores and linear growth were also significantly positively associated with R-DPDQ scores.

In-home care environment between the ages of four and five years

Cognitive stimulation scores and full child supervision (supervising the child's evening meal, bathing, brushing of teeth and dressing) were significant positive predictors of R-DPDQ scores. Asset scores and linear growth were also significantly positively associated with R-DPDQ scores.

Out-of-home/non-maternal care environment between the ages of four and five years

Of the variables examined, the type of daycare was the only exposure variable that was significantly associated with R-DPDQ scores i.e. children who attended formal daycare/crèche had higher R-DPDQ scores compared to children who attended non-formal daycare/crèche. Asset scores and linear growth were also significantly positively associated with R-DPDQ scores.

4.3.2 Outcome: grade repeats by Grade 7

In-home care environment between the ages of six months and two years

Higher maternal responsiveness scores were significantly positively associated with a reduction in the odds of repeating a grade. Care rated as high quality in the home was significantly positively associated with a reduction in the odds of repeating a grade compared to lower quality care. . Importantly, the only covariates that significantly predicted grade repeats were maternal education and asset scores.

Out-of-home/non-maternal care environment between the ages of six months and two years

Of the quality of care indicators examined, only smaller group sizes (one child per group or two to six children per group) were significantly associated with reduced odds of grade repeats as measured by the time of reaching Grade 7. None of the confounders (maternal education, asset scores and linear growth) were statistically significantly associated with grade repeats.

In-home care environment between the ages of four and five years

Of the quality care indicators assed, only full child supervision was positively associated with a significant increase in the odds of grade repeats compared to partial supervision. None of the confounders (asset scores and linear growth) were found to be statistically significantly associated with grade repeats.

Out-of-home/non-maternal care environment between the ages of four and five years

In the out-of-home/non-maternal care environment, none of the exposure variables (type of daycare/crèche and group size) nor any of the confounders (asset scores and linear growth) were statistically significantly associated with grade repeats.

4.4 Multivariate associations

4.4.1 Associations between environment quality and R-DPDQ scores

In-home care environment between the ages of six months and two years

Results from Model 1 (Table 4.2) show that a point increase in maternal responsiveness scores in the home for children under the age of two years was associated with a 0.2 increase in R-DPDQ scores at age five years ($\beta = 0.16$, $p<0.05$, 95% CI: 0.05, 0.28), and a point increase in cognitive stimulation scores in the home for children under the age of two years was associated with a 0.4 point increase in R-DPDQ scores at age five years ($\beta = 0.38$, $p<0.01$, 95% CI: 0.13, 0.64). Model 2 results show that children under the age of two years who received high quality care in the home scored 1.3 points higher in the R-DPDQ at age five years, compared to children who received low quality care ($\beta = 1.25$, $p<0.01$, 95% CI: 0.46, 2.01). Average quality care was not a statistically significant predictor of R-DPDQ scores.

Model 3, indicates that asset scores became the main predictor of R-DPDQ scores even when adjusting for quality child care in the home i.e. a point increase in assets scores was associated with a 0.7 point increase in R-DPDQ scores ($\beta = 0.72$, $p<0.01$, 95% CI: 0.50, 0.95).
Models 4 and 5 results indicate that the strength of the association between quality of care in the home and R-DPDQ scores was attenuated when adjusting for covariates i.e. SES, maternal education and linear growth, and was no longer significant.

Model 5 shows that maternal education had the largest effect on R-DPDQ scores, i.e. children whose mothers had post-school training when children were between six months and two years of age, scored 2.4 points higher on the R-DPDQ ($\beta = 2.43$, $p<0.01$, 95% CI: 1.09, 3.77) at age five, while children whose mothers had an education level of Grade 11 to Grade 12 scored 2.2 points higher on the R-DPDQ ($\beta = 2.23$, $p<0.01$, 95% CI: 1.20, 3.26), and children whose mothers had an education level of Grade 8 to Grade 10 scored 1 point higher in the R-DPDQ ($\beta = 0.97$, $p<0.1$, 95% CI: -0.01, 1.93), compared to children whose mothers had a Grade 7 education level or lower.

Table 4.2 Multiple linear regression models predicting R-DPDQ scores in the home care environment between the ages of six monthsand two years

Outcome: R-DPDQ scores	**Model 1** **n = 856** **F(2, 853) = 9.32*****	**Model 2** **n = 856** **F(2, 853) = 5.35*****	**Model 3** **n = 856** **F(3, 852) = 17.18*****	**Model 4** **n = 856** **F(6, 849) =13.73*****	**Model 5** **n = 856** **F(7, 848) = 15.53*****
	β (95% CI)	**β (95% CI)**	**β (95% CI)**	**β (95% CI)**	**β (95% CI)**
Maternal responsiveness and sensitivity raw scores	0.16 (0.05-0.28)**				
Cognitive stimulation raw scores at 6months-2years	0.38 (0.13-0.64)***				
Quality of care Low quality Average quality High quality		 ref 0.55(-0.23-1.33) 1.25 (0.49-2.01)***	 ref 0.15 (-0.63-0.92) 0.62 (-0.15-1.39)	 ref -0.03 (-0.80-0.73) 0.38 (-0.39-1.14)	 ref 0.003 (-0.75-0.76) 0.22 (-0.53-0.98)
Assets scores at 6months-2 years			0.72 (0.50-0.95)***	0.54 (0.31-0.77)***	0.52 (0.30-0.75)***
Maternal education Grade 7 and less Grade 8 to Grade 10 Grade 11 to Grade 12 Post school training				 ref 1.05 (0.07-2.03)** 2.37 (1.33-3.42)*** 2.68 (1.32-4.03)***	 ref 0.97 (-0.01-1.93)* 2.23 (1.20-3.26)*** 2.43 (1.09-3.77)***
Linear growth at 2years					0.64 (0.39-0.90)***

Model 1 examines the association of responsiveness and cognitive stimulation to R-DPDQ scores.

Model 2 examines the association of the composite quality variable to R-DPDQ. *Models 3, 4 and 5* examine the stepwise addition of confounders (asset scores, maternal education and linear growth) to *Model 2*.

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

In-home care environment between the ages of four and five years

Table 4.3 Multiple linear regression models predicting R-DPDQ scores in the home care environment between the ages of four and five years

Outcome: R-DPDQ scores	**Model 1** **n = 991** **F(3, 987) =6.75*** **	**Model 2** **n = 991** **F(4, 986) =13.07*** **	**Model 3** **n = 991** **F(5, 985) = 13.67 *** **
	β (95% CI)	**β (95% CI)**	**β (95% CI)**
Cognitive stimulation at 4-5years Low-no cognitive stimulation Some cognitive stimulation High cognitive stimulation	 ref 0.88 (0.22-1.54)*** 1.55 (0.78-2.31)***	 ref 0.67 (0.02-1.33)** 1.04 (0.26-1.81)**	 ref 0.59 (-0.05-1.24)* 1.00 (0.23-1.77)**
Child supervision Partial supervision Full supervision	 ref 0.57 (-0.30-1.44)	 ref 0.43 (-0.44-1.30)	 ref 0.34 (-0.51-1.20)
Assets scores at 4-5 years		0.60 (0.39-0.81)***	0.56 (0.35-0.77)***
Linear growth at 5 years			0.59 (0.30-0.89)***

Model 1 examines the association of cognitive stimulation and child supervision to R-DPDQ scores. *Models 2 and 3* examine the stepwise addition of confounders (asset scores and linear growth).

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Results from Model 1 in Table 4.3, show that children who received high cognitive stimulation in the home between the ages of four and five years scored 2 points higher in the R-DPDQ (β = 1.55, p<0.01, 95% CI: 0.78, 2.31) at age five compared to children who had low to no cognitive stimulation, however, child supervision was not a statistically significant predictor of R-DPDQ scores. Model 2 results indicate that asset scores were a significant confounder in predicting R-DPDQ scores i.e. a point increase in asset scores was associated with a 0.6 point increase in R-DPDQ scores (β = 0.60, p<0.01, 95% CI: 0.39, 0.81). Cognitive stimulation continued to be a significant predictor even when controlling for SES and linear growth at five years. Results in Model 3 indicate that when controlling for both SES and linear growth, children who received high cognitive stimulation in the home between the ages of four and five years scored 1 point higher in the R-DPDQ (β = 1.0, p<0.05, 95% CI: 0.23, 1.77) at age five as compared to children who had low to no cognitive stimulation at this age.

Out-of-home/non-maternal care environment between the ages of six months and two years

Table 4.4 Multiple linear regression models predicting R-DPDQ scores in the out-of-home care environment between the ages of six months and two years

Outcome: R-DPDQ scores	**Model 1** **n = 203** **F(5, 197) = 1.56**	**Model 2** **n = 203** **F(6, 196) = 4.43*** **	**Model 3** **n = 203** **F(9, 193) = 3.27*** **	**Model 4** **n = 203** **F(10, 192) = 4.88 *** **
	β (95% CI)	**β (95% CI)**	**β (95% CI)**	**β (95% CI)**
Childminder education				
Grade 7 and less	ref	ref	ref	ref
Grade 8 to Grade 10	1.24 (-0.28-2.76)	0.88 (-0.59-2.35)	0.71 (-0.83-2.23)	0.55 (-0.93-2.02)
Grade 11 to Grade 12	1.90 (-0.04-3.84)*	0.96 (-0.71-3.07)	0.70 (-1.41-2.82)	0.41 (-1.63-2.44)
Post school training	3.91 (0.05-7.76)**	1.89 (-1.48-4.07)	1.70 (-2.22-5.60)	1.60 (-2.16-5.36)
Group size at 6months-2years				
Big group (7 to 50)	ref	ref	ref	ref
Average group (2 to 6)	1.19 (-1.70-4.08)	1.29 (-1.48-4.07)	1.24 (-1.54-4.02)	1.28 (-1.40-3.95)
Small group (1)	1.85 (-1.02-4.72)	1.73 (-1.02-4.49)	1.71 (-1.06-4.47)	1.51 (-1.15-4.17)
Assets scores at 6months-2years		1.06 (0.57-1.54)***	0.91 (0.39-1.43)***	0.78 (0.27-1.28)***
Maternal education				
Grade 7 and less			ref	ref
Grade 8 to Grade 10			0.79 (-1.55-3.13)	1.31 (-0.95-3.57)
Grade 11 to Grade 12			1.17 (-1.50-3.85)	1.62 (-0.97-4.20)
Post school training			2.52 (-0.60-5.64)	2.76 (-0.24-5.76)*
Linear growth at 2years				1.16 (0.60-1.71)***

Model 1 examines the association of childminder education and group size to R-DPDQ scores. *Models 2, 3 and 4* examine the stepwise addition of confounders (asset scores, maternal education and linear growth) to *Model 1*.
***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Results of Model 1 in Table 4.4, depict that for children who experienced out-of-home/non-maternal care between the ages of six months and two years, childminder education was the only significant predictor of R-DPDQ scores. Children in this age group who had childminders with post-school training scored 4 points higher in the R-DPDQ ($\beta = 3.91$, $p<0.05$, 95% CI: 0.05, 7.76) at age five compared to children with childminders who had a Grade 7 education level or lower. The size of the group of children in the care of the childminder was not found to be a significant predictor of R-DPDQ scores when adjusting for childminder education.

Model 2 results show that asset scores were a significant predictor of R-DPDQ scores, cancelling the effect of childminder education and group size, i.e. a point increase in asset scores was associated with a point increase in R-DPDQ scores ($\beta = 1.06$, $p<0.01$, 95% CI: 0.57, 1.54).

Model 4 results indicate that all covariates i.e. asset scores, maternal education and linear growth were strong significant predictors of R-DPDQ scores and cancelled out the significance of out-of-

home quality child care indicators (childminder education and size of the group of children in the care of the childminder). Only the highest level of maternal education had an effect on R-DPDQ scores for children who were in out-of-home/non-maternal care at the ages of six months and two years, indicating that children who had mothers with post-school education scored 3 points higher on the R-DPDQ (β = 2.76, p<0.10, 95% CI: -0.24, 5.76) at age five compared to children with mothers who had a Grade 7 or lower education level.

Out-of-home/non-maternal care environment between the ages of four and five years

Table 4.5 Multiple linear regression models predicting R-DPDQ scores in the out-of-home care environment between the ages of four and five years

Outcome: R-DPDQ scores	**Model 1** **n = 693** **F(2, 690) = 3.06****	**Model 2** **n = 693** **F(3, 689) = 6.42*****	**Model 3** **n = 693** **F(5, 985) = 13.67 *****
	β (95% CI)	**β (95% CI)**	**β (95% CI)**
Type of daycare/crèche Informal crèche Formal crèche	 ref 0.72 (0.10-1.34)**	 ref 0.57 (-0.05-1.19)*	 ref 0.55 (-0.07-1.16)*
Group size at 4-5years Big group (>20 children) Small group (<20 children)	 ref -0.31 (-1.23-0.61)	 ref -0.26 (-1.17-0.65)	 ref -0.34 (-1.26-0.57)
Assets scores at 4-5years		0.43 (0.20-0.66)**	0.41 (0.18-0.65)***
Linear growth at 5years			0.40 (0.06-0.73)**

Model 1 examines the association of type of daycare/crèche attended and group size to R-DPDQ scores. *Models 2 and 3* examine the stepwise addition of confounders (asset scores and linear growth) to *Model 1*.
***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category

Results of Model 1 in Table 4.5, indicate that the type of daycare/crèche that children attended at the ages of four to five years was the only out-of-home care quality indicator that influenced R-DPDQ scores at age five i.e. children who attended formal daycare/crèche (registered daycare centre with proper formal facilities and structures) scored 0.7 higher (β = 0.72, p<0.05, 95% CI: 0.10, 1.34) than children who attended an informal daycare/crèche. Model 3 results show that asset scores and linear growth were significant confounders, i.e. a point increase in both asset scores and linear growth led to a 0.4 increase in R-DPDQ scores respectively. Even when controlling for SES and linear growth, the type of daycare/crèche that a child attended was still a significant predictor of R-DPDQ scores (Model 3, Table 4.5). When controlling for SES and linear growth, children who attended formal daycare/crèche at the ages of four to five years scored a point higher on the R-DPDQ than children who were attending an informal daycare/crèche (β = 0.55, p<0.10, 95% CI: -0.07, 1.16).

4.4.2 Associations between environment quality and grade repeats

In-home care environment between the ages of six months and two years

Table 4.6 Multiple logistic regression models predicting grade repeats in the home care environment between the ages of six months and two years.

Outcome: Grade repeats by Grade 7	**Model 1 n = 1148 LR chi2(2) = 6.22****	**Model 2 n = 1148 LR chi2(2) = 4.22**	**Model 3 n = 1148 LR chi2(3) = 8.38****	**Model 4 n = 1148 LRchi2(6) = 33.44*****	**Model 5 n = 1148 LR chi2(7) = 33.51 *****
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Maternal responsiveness and sensitivity raw scores	0.95 (0.90-0.99)**				
Cognitive stimulation raw scores at 6months-2years	0.93 (0.83-1.05)				
Quality of care Low quality Average quality High quality		 1.00 0.93 (0.67-1.31) 0.72 (0.52-1.01)*	 1.00 0.99 (0.70-1.39) 0.79 (0.56-1.12)	 1.00 1.08 (0.76-1.53) 0.87 (0.61-1.24)	 1.00 1.08 (0.76-1.53) 0.87 (0.61-1.25)
Assets scores at 6months-2years			0.90 (0.82-0.99)**	0.96 (0.87-1.06)	0.96 (0.87-1.06)
Maternal education Grade 7 and less Grade 8 to Grade 10 Grade 11 to Grade 12 Post school training				 1.00 0.99 (0.66-1.49) 0.46 (0.29-0.73)*** 0.50 (0.26-0.95)**	 1.00 0.99 (0.66-1.48) 0.46 (0.29-0.73)*** 0.50 (0.26-0.95)**
Linear growth at 2years					0.98 (0.31-0.90)

Model 1 examines the association of responsiveness and cognitive stimulation to grade repeats. *Model 2* examines the association of the composite quality variable to grade repeats. *Models 3, 4 and 5* examine the stepwise addition of confounders (asset scores, maternal education and linear growth) to *Model 2*.
***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.
Note. Number of grade repeats by Grade 7 codes: 1 = has repeated at least one grade & 0 = never repeated a grade

Results from Model 1 in Table 4.6, show that maternal responsiveness was the main predictor of grade repeats by Grade 7. A point increase in maternal responsiveness scores in the home for children under the age of two years was associated with a 5% reduction in the odds of repeating a grade (OR = 0.95, $p<0.05$, 95% CI: 0.90, 0.99).

Results in Model 2 show that children under the age of two years who received high quality care in the home had a 28% decrease in the odds of repeating a grade by Grade 7, compared to children receiving low quality care (OR = 0.72, $p< 0.10$, 95% CI: 0.52, 1.01).

Model 3 indicates that asset scores were a statistically significant predictor of grade repeats, even when controlling for quality child care in the home. A point increase in asset scores was associated with a 10% decrease in the odds of repeating a grade. Furthermore, the results indicate that maternal education had the largest effect size in predicting grade repeats amongst all other covariates (asset scores, maternal education and linear growth) and child care quality in the home (see Models 4 and 5, Table 4.6). Thus, children younger than two years who had mothers with post-school training had a 50% decrease in the odds of repeating a grade (OR = 0.50, $p<0.05$, 95% CI: 0.26, 0.95) and children whose mothers had an education level of Grade 11 to Grade 12 had a 54% decreased odds of repeating a grade (OR = 0.46, $p<0.01$, 95% CI: 0.29, 0.73), compared to children whose mothers had a Grade 7 education level or lower.

In-home care environment between the ages of four and five years

Table 4.7 Multiple logistic regression models predicting grade repeats in the home care environment between the ages of four and five years.

Outcome: Grade repeats by Grade 7	**Model 1** **n = 1143** **LR chi2(3) = 8.90 ****	**Model 2** **n = 1143** **LR chi2(4) =10.55****	**Model 3** **n = 1143** **LR chi2(5) = 11.35 ****
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Cognitive stimulation at 4-5years Low-no cognitive stimulation Some cognitive stimulation High cognitive stimulation	1.00 0.96 (0.71-1.30) 0.77 (0.53-1.11)	1.00 0.99 (0.73-1.34) 0.82 (0.56-1.19)	1.00 0.99 (0.72-1.35) 0.82 (0.56-1.19)
Child supervision Partial supervision Full supervision	1.00 1.85 (1.16-2.96)**	1.00 1.88 (1.17-3.01)***	1.00 1.89 (1.18-3.04)**
Assets scores at 4-5years		0.94 (0.85-1.03)	0.94 (0.86-1.04)
Linear growth at 5years			0.94 (0.81-1.08)

Model 1 examines the association of cognitive stimulation and child supervision to grade repeats. *Models 2 and 3* examine the stepwise addition of confounders (asset scores and linear growth) to *Model 1*.

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Note. Number of grade repeats by Grade 7 codes: 1 = has repeated at least one grade & 0 = never repeated a grade.

Model 1 results shown in Table 4.7 indicate that child supervision in the home was the only statistically significant quality child care indicator that was associated with grade repeats, even when controlling for asset scores and linear growth (see Models 2 and 3).

Model 3 results show that, when controlling for SES and linear growth, children who were fully supervised in the home at the ages of four to five years had an 11% increase in the odds of repeating a grade by Grade 7, compared to children who were partially supervised (OR = 1.89, p<0.05, 95% CI: 1.18, 3.04). Cognitive stimulation in the home at the ages of four to five years was not found to be a significant predictor of grade repeats. Both asset scores and linear growth at this age were not found to be significant predictors of grade repeats.

Out-of-home/non-maternal care environment between the ages of six months and two years

Table 4.8 Multiple logistic regression models predicting grade repeats in the out-of-home care environment between the ages of six months and two years.

Outcome: Grade repeats by Grade 7	**Model 1** **n = 264** **LR chi2(5) = 8.98**	**Model 2** **n = 264** **LR chi2(6) = 9.27**	**Model 3** **n = 262** **LR chi2(9) = 12.35**	**Model 4** **n = 262** **LR chi2(10) = 12.82**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Childminder education				
Grade 7 and less	1.00	1.00	1.00	1.00
Grade 8 to Grade 10	0.71 (0.38-1.32)	0.72 (0.38-1.35)	0.73 (0.38-1.42)	0.73 (0.38-1.43)
Grade 11 to Grade 12	0.43 (0.17-0.99)**	0.44 (0.19-1.01)*	0.56 (0.22-1.39)	0.57 (0.23-1.42)
Post school training	0.25 (0.02-2.12)	0.26 (0.02-2.24)	0.37 (0.04-3.43)	0.38 (0.04-3.61)
Group size at 6months-2years				
Big group (7 to 50)	1.00	1.00	1.00	1.00
Average group (2 to 6)	0.31 (0.11-0.87)**	0.30 (0.11-0.85)**	0.31 (0.11-0.90)**	0.32 (0.11-0.91)**
Small group (1)	0.35 (0.13-0.94)**	0.34 (0.12-0.92)**	0.36 (0.13-1.01)*	0.36 (0.13-1.00)*
Assets scores at 6months-2years		0.94 (0.76-1.17)	0.99 (0.79-1.25)	0.99 (0.78-1.25)
Maternal education				
Grade 7 and less			1.00	1.00
Grade 8 to Grade 10			1.15 (0.46-2.85)	1.17 (0.47-2.91)
Grade 11 to Grade 12			0.65 (0.21-1.96)	0.64 (0.21-1.95)
Post school training			0.59 (0.15-2.31)	0.58 (0.14-2.29)
Linear growth at 2years				1.10 (0.84-1.43)

Model 1 examines the association of childminder education and group size to grade repeats. *Models 2, 3 and 4* examine the stepwise addition of confounders (asset scores, maternal education and linear growth) to *Model 1*.

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Note. Number of grade repeats by Grade 7 codes: 1 = has repeated at least one grade & 0 = never repeated a grade

Model 1 results indicate that childminder group size and childminder education were statistically significant influencers of grade repeats for children who experienced out-of-home/non-maternal care between the ages of six months and two years. Children under the age of two years who had childminders with an education level of Grade 11 or Grade 12 had a 57% decrease in the odds of repeating a grade (OR = 0.43, p<0.05, 95% CI: 0.17, 0.99) by Grade 7, compared to children whose childminders had a Grade 7 education level or lower. Children under the age of two years who were the only child in the care of the childminder had a 65% reduction in the odds of repeating a grade (OR = 0.35, p<0.05, 95% CI: 0.13, 0.94) by Grade 7, and children under the age of two years who were cared for in groups of fewer than six children had a 69% reduction in the odds of repeating a grade (OR = 0.31, p<0.05, 95% CI: 0.11, 0.87) by Grade 7, compared to children who were cared for in big groups (7 to 50 children).

Model 4 shows that, of the out-of-home quality child care measures observed, childminder group size was the only predictor of grade repeats when controlling for asset scores, maternal education and linear growth. Children in both sole care (OR = 0.36, p<0.1, 95% CI: 0.11, 1.00) and in groups of fewer than six children (OR = 0.32, p<0.05, 95% CI: 0.11, 0.91) had a 64% and 68% reduction respectively, in the odds of repeating a grade, compared to children in large groups sizes.

Out-of-home/non-maternal care environment between the ages of four and five years

Table 4.9 Multiple logistic regression models predicting grade repeats in the out-of-home care environment between the ages of four and five years

Outcome: Grade repeats by Grade 7	**Model 1** **n = 748** **LR chi2(2) = 1.86**	**Model 2** **n = 748** **LR chi2(3) = 3.09**	**Model 3** **n = 748** **LR chi2(4) = 3.71**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Type of daycare/crèche Informal crèche Formal crèche	 1.00 0.94 (0.67-1.33)	 1.00 0.97 (0.68-1.36)	 1.00 0.97 (0.69-1.37)
Group size at 4-5years Big group (>20 children) Small group (<20 children)	 1.00 1.37 (0.85-2.19)	 1.00 1.37 (0.86-2.19)	 1.00 1.39 (0.87-2.23)
Assets scores at 4-5years		0.93 (0.81-1.06)	0.93 (0.82-1.06)
Linear growth at 5years			0.92 (0.19-1.11)

Model 1 examines the association of type of daycare/crèche attended and group size to grade repeats. *Models 2 and 3* examine the stepwise addition of confounders (asset scores and linear growth) to *Model 1*.

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Note. Number of grade repeats by Grade 7 codes: 1 = has repeated at least one grade & 0 = never repeated a grade

No quality of child care measures reached statistical significance in predicting grade repeats.

4.5 Sensitivity analysis of quality child care on R-DPDQ scores and grade repeats

Further exploratory regression analysis was conducted for all SES tertiles separately, to determine the effect of quality of child care indicators in both the home and out-of-home environment on R-DPDQ scores and grade repeats. This analysis is based on the period between six months and two years, since the child care measures during this period were the most comprehensive.

4.5.1 Outcome: R-DPDQ scores

In-home care environment between the ages of six months and two years

Table 4.10 results indicate that only high quality child care in the home was a significant predictor of R-DPDQ scores for children in low SES group. Children younger than two years of age in the low SES group who received high quality child care in the home scored 2 points higher on the R-DPDQ at age five compared to children receiving low quality care in the same SES group (β = 1.99, $p<0.05$, 95% CI: 0.45, 3.51).

Table 4.10 Sensitivity of quality child care on R-DPDQ scores in the home environment between the ages of six months and two years

Outcome: R-DPDQ scores	**Low SES** **n = 241** **F(2, 238) = 3.61 ****	**Average SES** **n = 468** **F(2, 465) = 0.10**	**High SES** **n = 147** **F(2, 144) = 1.36**
	β (95% CI)	**β (95% CI)**	**β (95% CI)**
Quality of care Low quality Average quality High quality	 ref 0.25 (-1.30-1.80) 1.99 (0.45-3.51)**	 ref 0.16 (-0.84-1.17) -0.02 (-1.03-0.99)	 ref -0.66 (-2.77-1.44) 0.57 (-1.34-2.48)

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

Out-of-home/non-maternal care environment between the ages of six months and two years

The size of the group of children in the care of the childminder was a statistically significant predictor of R-DPDQ scores for children in the low SES category only (see Table 4.11). Children aged between six months and two years in the low SES category who were in out-of-home care, who were cared for alone by a childminder (β = 11.55, $p<0.01$, 95% CI: 4.82, 18.27) or in a group of fewer than six children (β = 12.41, $p<0.01$, 95% CI: 5.71, 19.11) scored 12 points higher on the R-DPDQ at age five compared to children cared for in big groups (7 to 50 children) in the same SES category.

Table 4.11 Sensitivity analysis of quality child care on R-DPDQ scores in the out-of-home environment between the ages of six months and two years

Outcome: R-DPDQ scores	**Low SES** **n = 52** **F(5, 46) = 3.74*****	**Average SES** **n = 114** **F(5, 108) = 1.18**	**High SES** **n = 37** **F(5, 31) = 0.75**
	β (95% CI)	**β (95% CI)**	**β (95% CI)**
Childminder education Grade 7 and less Grade 8 to Grade 10 Grade 11 to Grade 12 Post school training	 ref -0.51 (-3.15-2.12) 2.86 (-2.59-8.31) 5.62 (-3.55-14.78)	 ref 1.94 (-0.11-3.98) 1.51 (-0.92-3.94) 1.31 (-4.35-6.97)	 ref 2.76 (-0.63-6.51) 0.97 (-2.97-4.92) 3.40 (-2.45-9.26)
Group size at 6months-2years Big group (7 to 50) Average group (2 to 6) Small group (1)	 ref 12.41 (5.71-19.11)*** 11.55 (4.82-18.27)***	 ref -1.91 (-5.36-1.54) 1.73 (-4.33-2.53)	 ref -0.69 (-7.46-6.06) 0.29 (-6.67-7.25)

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category.

4.5.2 Outcome: Grade Repeats

In-home care environment between the ages of six months and two years

The quality child care composite variable was not found to be a statistically significant predictor of grade repeats for any of the SES categories, (Table 4.12).

Table 4.12 Sensitivity of quality child care on grade repeats in the home environment between the ages of six months and two years

Outcome: Grade repeats by Grade 7	**Low SES** ***n* = 360** **LR chi2(2) = 1.72**	**Average SES** ***n* = 613** **LR chi2(2) = 3.33**	**High SES** ***n* = 175** **LR chi2(2) = 0.31**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Quality of care Low quality Average quality High quality	 1.00 0.70 (0.40-1.23) 0.77 (0.45-1.35)	 1.00 1.22 (0.75-1.98) 0.83 (0.51-1.37)	 1.00 0.97 (0.29-3.18) 0.79 (0.26-2.40)

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category

Out-of-home/non-maternal care environment between the ages of six months and two years

Results from Table 4.13 show that childminder education and the size of the group of children in the care of the childminder were protective against grade repeats for children in the average SES group. Children under the age of two years in the average SES group who were being cared for by childminders with a Grade 11 or Grade 12 education level had a 68% decrease in the odds of repeating a grade (OR = 0.32, 95% CI: 0.10, 0.97) by Grade 7, compared to children whose

childminders had a Grade 7 education level or lower in the same SES group. Children in sole care had a 79% reduction in the odds of repeating a grade (OR = 0.21, 95% CI: 0.05, 0.81) and children in average group sizes (two to six children) had a 68% reduction in the odds of repeating a grade (OR = 0.32, 95% CI: 0.09, 1.23), compared to children who were cared for in big groups of 7 to 50 children.

Table 4.13 Sensitivity of quality child care on grade repeats in the out-of-home environment between the ages of six months and two years.

Outcome: Grade repeats by Grade 7	**Low SES** ***n*** **= 76** **LR chi2(4) = 5.38**	**Average SES** ***n*** **= 149** **LR chi2(5) = 9.19**	**High SES** ***n*** **= 35** **LR chi2(4) = 1.71**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Childminder education			
Grade 7 and less	1.00	1.00	1.00
Grade 8 to Grade 10	1.03 (0.30-3.52)	0.58 (0.25-1.35)	0.95 (0.14-6.05)
Grade 11 to Grade 12	1.06 (0.23-4.85)	0.32 (0.10-0.97)**	0.24 (0.02-3.09)
Post school training	1 (omitted)	0.30 (0.03-3.20)	1 (omitted)
Group size at 6months-2years			
Big group (7 to 50)	1.00	1.00	1.00
Average group (2 to 6)	0.15 (0.01-1.44)	0.32 (0.09-1.23)*	0.63 (0.03-10.08)
Small group (1)	0.49 (0.06-4.27)	0.21 (0.05-0.81)**	0.92 (0.06-12.67)

***P<0.01; **P<0.05; *P< 0.10. (ref) is the reference category. Omitted, indicates a near singular matrix i.e. insufficient observations to determine association.

CHAPTER 5: DISCUSSION AND CONCLUDING REMARKS

A summary of the main findings of this study are provided and discussed according to the study objectives. Study findings are compared to the existing literature and unexpected or ambiguous results are also discussed. The chapter concludes by outlining study limitations and strengths, and recommendations for future research and policy implications.

5.1 Overview of main findings

Children's development is largely shaped by their environments, and thus, children thrive in nurturing environments. This study investigated the effects of child care quality, in-and out of the home, as a proximal environmental factor on children's cognitive and schooling outcomes. Our results suggest that high quality child care in the home environment, indicated by high maternal responsiveness and cognitive stimulation between the ages of six months and two years and at four to five years, promoted children's cognitive development at age five years. High maternal responsiveness between the ages of six months and two years was also protective against grade repetition in primary school. Unexpectedly, cognitive stimulation in the home at all age categories was not associated with grade repeats in primary school, while full child supervision at the ages of four to five years increased the odds of a grade repeat by Grade 7.

In the out-of-home care environment, high childminder education between the ages of six months and two years and sending a child to a formal daycare/crèche rather than an informal daycare/crèche between the ages of four and five years was associated with higher R-DPDQ scores. Furthermore, children who had highly qualified childminders and were exposed to smaller class/group sizes between the ages of six months and two years were less likely to repeat a grade in primary school.

Our study evidence further suggests that SES and maternal education were both strong predictors of cognitive and schooling outcomes, even when adjusting for child care quality and linear growth at two years of age. However, the strength of this association varied with the type of child care quality indicator adjusted for in the analysis. There was also evidence that children from lower socioeconomic backgrounds who received high quality child care both in- and out- of the home

scored higher in the R-DPDQ, compared to children in the same SES who received lower quality child care.

5.2 Study sample description

The study sample consisted mainly of Black South African children from low to average SES who had mothers with low education levels. This is largely due to the fact that the BT20+ cohort was based in Soweto and that data collection for the study period took place in the early 1990's. This was the dawn of the post-apartheid era in South Africa, therefore a majority of the previously disadvantaged groups would have been experiencing a time lag between the newfound democracy and improved socioeconomic conditions (Richter et al., 1995). Most children under the age of two years were being cared for in their home by their mothers and a majority of the children who were in out-of-home care between the ages of four and five years were with a relative/non-relative childminder or in a crèche.

In the current study sample, most mothers had high responsiveness scores but scored lower on the cognitive stimulation items. This observation is consistent with other studies that have found that Black African mothers, irrespective of SES or social adversity, tend to be responsive, warm and nurturing towards their children (LeVine et al., 1996, p. 196-197; Tomlinson, Cooper & Murray, 2005; Lamb et al., 2014). Similarly, several studies have reported that mothers from lower resource settings tend to provide less cognitively stimulating environments or caregiving that is promotive of cognitive development (Grantham-McGregor et al., 2007; Bornstein & Putnick, 2012: UNICEF 2012). In South Africa, cultural norms and SES are suggested to both influence cognitive stimulation activities (Botha & Cleaver, 1992). Botha and Cleaver (1992) assessed mother-child activities in a sample of White and Black South African mothers, and found that there were certain child activities that White mothers would permit and Black mothers would not permit because of cultural beliefs e.g. swimming and differences in book ownership between the two samples were attributable to SES. Similarly, Lindland et al. (2016), found that the general South African public emphasises child nurturance but tend to overlook early cognitive stimulation in their understanding of factors that promote early childhood development.

Low levels of cognitive stimulation in the home may also be dependent on maternal education levels (Richter & Grieve, 1991). Observed low levels of maternal education in this sample may manifest in the lack of knowledge of early childhood development, since early learning begins from birth (Lindland et al., 2016). As an example, a study conducted among Ethiopian mothers by Aboud & Alemu (1995), found that a significant percentage of mothers in the sample did not believe that their children could understand spoken words before 18 months of age, and that these mothers did not believe that they could influence their children to learn new words until the age of 48 months.

In the out-of-home care sample, children between the age of six months and two years were generally cared for in small groups with lower educated childminders. This is because children at this age mostly had in-home non-maternal care and the childminder in most cases would be an older relative e.g. the grandmother (Botha & Cleaver, 1992). Between the ages of four and five years, children mostly experienced low quality out-of-home care, i.e. in informal daycare centres with larger group sizes. This is an expected observation, since access to high quality care centres is associated with affordability (Deater-Dackard, Pinkerton & Scarr, 1996; Mayer, 2002).

5.3 Associations between household socioeconomic status, quality of child care in the home environment (between the ages of six months and two years and four and five years) and child outcomes

Consistent with other studies, our latent variable of child care quality in the home at six months to two years was a significant predictor of both children's cognitive development in the short term and their schooling outcomes in the longer term (Bradley et al., 1986; NICHD ECCRN, 2002a and 2002b; Duncan & NICHD ECCRN, 2003; Hirsh-pasek & Burchinal, 2006). Children who received high quality child care had higher cognitive functioning and better chances of succeeding in school, compared to children who received poor quality child care. Children who received average quality child care were not statistically different from children who received poor quality child care. Our results provide confirmatory evidence that high quality child care is of primary importance. As expected, we found that cognitive stimulation was the most salient home environment factor for children's cognitive development. Cognitive stimulation at six months to two years and at four to five years in the home was associated with increased cognitive functioning at the age of five years.

This is consistent with previous studies that have found that early stimulation through toys, games, reading materials, teaching, and taking the child out on excursions had positive effects on cognitive development and IQ (NICHD ECCRN, 2000; Bradley et al., 1986).

This study shows that high maternal responsiveness at six months to two years is associated with better schooling outcomes, and is marginally linked to cognitive functioning. Although studies reported that maternal responsiveness is important for both outcomes (Bradley et al., 1986; NICHD CCRN, 2002b; Belsky et al., 2007; Lugo-Gil & Tamis-LeMonda, 2008;), maternal responsiveness and sensitivity best predict socio-emotional outcomes (Bradley et al., 2001; Landry, Smith & Swank, 2006), which in turn have been linked to children's academic performance (Hinshaw, 1992; Chen, Rubin & Li, 1997). The current study did not assess socio-emotional outcomes, which may be a possible mediator between maternal responsiveness and grade repeats.

Our study did not find any associations between cognitive stimulation in the home at both the 6 months to two years and at the four to five year ages, and subsequent grade repetition, which is contrary to the findings of Blums et al., 2016 and others (for example Bradley et al., 1986; Gottfried & Gottfried, 1986; Melhuish et al., 2008). These studies found that cognitive stimulation in the home environment, i.e. access to reading materials, being taught letters/numbers and/or songs/poems/rhymes, resulted in better schooling achievements. This implies that, for our study sample, this translation may be inhibited by other out-of-home quality features, which were not accounted for, such as school and teacher quality (Spaull, 2013). Furthermore our results reveals that high levels of parental supervision over the child's day-to-day activities between the ages of four to five years did not reduce the likelihood of grade repetition i.e. full-time child supervision was not necessarily protective against adverse schooling outcomes. Our supervision construct was created from parents answering whether they supervised the child while bathing, dressing, brushing teeth and eating. All these activities are involved in early independence training. Hoffman, (1972 and 1979) argues that high levels of child supervision with no allowance for independence may not always benefit a child. He reported that girl children who had insufficient independence training engaged less in exploratory activities and thereby developed lower self-esteem and had inadequate skills to cope independently later on in life (Hoffman, 1972). On the other hand, high levels of supervision may indicate that parents closely supervise children who are already showing signs of slow mental maturity or who are struggling to become independent or if they perceive that the child

is facing a certain degree of environmental hazard (Peterson, Ewigman and Kivlahan, 1993; Glascoe and Dworkin, 1995). Therefore, parents need to determine the appropriate level of supervision needed, whilst lending extra support to children who may be struggling.

5.4 Associations between household SES, quality of child care in the out-of-home environment (between the ages of six months and two years and four to five years) and child outcomes

The study by NICHD ECCRN & Duncan (2003) found that high childminder education and small staff ratios had a positive effect on cognitive development and academic achievement. Consistent with this finding, we found that children who were cared for by childminders with high education levels (Grade 11-12 and tertiary education levels) between the ages of six months and two years scored higher on the cognitive measure, and children who were cared for in smaller groups (groups of fewer than six children) were less likely to repeat a grade in primary school. High quality structural features of care promote children's development while child care centres that exhibit poor quality structural features hamper development (Loeb et al; 2004; Barnett, 2008; Dowsett et al., 2008; Dearing, McCartney & Taylor, 2009; Burchinal et al., 2010 and 2014;).

While sending a child to centre-based care (pre-school/crèche) is beneficial (Dowsett et al., 2008; Aboud & Hossain, 2011; Malmberg, Mwaura & Sylva, 2011), the type of centre is of importance. Our results indicate that children who were attending a formal rather than informal daycare/crèche between the ages of four and five years scored higher on the R-DPDQ. Bernal & Keane (2011) found a negative association between cognitive development and attending daycare. They speculated that the underlying cause of this negative association was that a great number of children in their sample were attending informal daycare centres. Unexpectedly, we could not find any association between type of daycare and grade repetition by Grade 7. We speculate that the underlying reason could be other unmeasured quality factors that influence schooling outcomes, such as school and teacher quality. As we found in the current study, schooling outcomes may not follow a linear process and requires the measurement of other confounders outside the scope of this study.

5.5 The significance of household socioeconomic status

In the current study, the significance of SES varied with outcome and environment assessed, as well as with age. From our results, SES had the largest effect on cognitive development for children under the age of two years, overshadowing the effect of quality child care both in-and out-of-home. This finding echoes the results of Paxson & Schady (2007), where SES was the strongest predictor of cognitive development even when controlling for child care quality measures, indicating a direct causal link. The socioeconomic gradient that was most salient for cognitive development was maternal education, as already established by previous studies (for example, Shonkoff & Phillips, 2000; NICHD ECCRN & Duncan, 2003; Paxson & Schady, 2007; Santos et al., 2008; Barros et al., 2010; Walker et al., 2011; Hsiao & Richter, 2014; Blums et al., 2016; Gonzalez et al., 2017). Children with mothers who had higher education levels, scored higher on the R-DPDQ. Gonzalez et al. (2017) found that this association is mediated by the mother's positive literacy beliefs, the child frequently seeing the mother read and also frequency of shared reading between the mother and the child. In predicting grade repeats in the out-of-home care environment analysis, the significance of both SES and maternal education were attenuated by group size. Children who were cared for in smaller groups between the ages of six months and two years were less likely to repeat a grade in primary school even when controlling for SES and maternal education. This suggests that high quality out-of-home care environments offer benefits that can outweigh family socioeconomic circumstances (Barnett, 1995, 2008; Watamura et al., 2011).

In older children (four to five years), the effect of SES on cognitive and schooling outcomes was overshadowed by quality child care indicators in both home (i.e. cognitive stimulation and child supervision) and out-of-home (i.e. type of daycare/crèche) environment. This is contrary to the finding by Paxson & Schady (2007), where the association between SES and cognitive development grew stronger with the children's age. We speculate that the difference in findings may be attributable to sample characteristics. In our sample, more children were in out-of-home care at this age (four to five years) which may have dampened the effect of household SES. Pre-school attendance in the study sample of Paxson & Schady (2007) was not confirmed.

Overall, our results indicate that household SES and maternal education show the strongest association with child outcomes in the first two years of life even when controlling for child care

quality. However, we found that the strength of this association declined with age and with the introduction of out-of-home care. Studies such as Brooks-Gunn & Duncan (1997) and Yeung & Conley (2008) have noted that SES gradients have the largest effect on child outcomes in early childhood rather than later in childhood or in adolescence.

5.6 Sensitivity of child care quality

Previous studies have noted that high child care quality can ameliorate negative outcomes for children from low socioeconomic backgrounds (McCartney et al., 2007; Dearing, McCartney & Taylor, 2009; Burchinal et al., 2010, 2014; Gertler et al., 2014). We tested this hypothesis by assessing the effect of child care quality on different SES groups. Our focus was on children between the ages of six months and two years, since this age category showed the strongest association between SES and outcomes. Moreover, child care measures during this period were the most comprehensive.

In assessing the sensitivity of the child care quality latent variable, we found that children from low socioeconomic backgrounds who received high quality child care scored higher in the R-DPDQ, compared to children from the same socioeconomic background who received low quality child care. This suggests that high quality child care in the home, indexed by maternal responsiveness and cognitive stimulation, buffers poor children from adverse cognitive outcomes (McCartney et al., 2007). We did not find any significant associations when testing the sensitivity of the child care quality latent variable in predicting grade repetition in primary school.

In the out-of-home environment, our results indicate that children from lower socioeconomic backgrounds scored higher on the R-DPDQ and were less likely to repeat a grade in primary school if they were cared for in smaller groups (groups of less than six children) at an early age.

Small staff-child ratios as a structural feature of quality care, may be regarded as a protective feature for children from impoverished backgrounds against negative cognitive and schooling outcomes, i.e. children from impoverished backgrounds benefit more from individual attention (NICHD ECCRN, 1999; Finn et al., 2001; Barnett, Schulman & Shore, 2004). Thus, our findings

dispute the notion that small child-staff child ratios have little to no effect on child outcomes as suggested by Perlman et al., (2017).

We did not find any conclusive results for children from higher socioeconomic backgrounds. This concurs with existing evidence as few studies have found a significant association between child care quality measures and developmental outcomes for low risk study samples (Peisner-Feinberg & Burchinal, 1997; Burchinal et al., 2000).

5.7 Study limitations and strengths

The first limitation is that the study findings may not be generalised to the South African population because of the under representation of the White and Indian ethnic groups. Secondly, selection biases were observed in the following analytical samples:

- **In-home care sample between the ages of six months and two years when analysing R-DPDQ score (n=856)**: This analytical sample had a slightly higher mean asset score, lower height-for-age z-scores, higher mean R-DPDQ score, lower cognitive stimulation scores and a smaller proportion of mothers with post-school training compared to the Bt20+ sample. However, the observed unit differences (in assets scores, linear growth z-scores, R-DPDQ scores and cognitive stimulation scores) were not greater than 1, and the proportion difference of mothers with post-school training between the analytical sample and the Bt20+ sample was only 2.3%.
- **In-home care sample between the ages of six months and two years when analysing Grade repeats (n=1148)**: This analytical sample had slightly higher mean asset scores and lower height-for-age z-scores, as well as a smaller proportion of mothers with post-school training compared to the Bt20+ sample. However, the observed unit differences (in assets scores and linear height-for-age z-scores) were not greater than 1 and the proportion difference of mothers with post-school training between the analytical sample and the Bt20+ sample was only 3.3%.
- **Out-of-home care sample between the ages of six months and two years when analysing R-DPDQ score (n=203)**: This analytical sample had higher mean asset scores and a higher proportion of childminders with an education level of Grade 7 or lower. The observed unit difference in asset scores was not greater than 1 and the proportion difference

of childminders with an education level of Grade 7 or lower between the analytical sample and the Bt20+ sample was 13%.

- **Out-of-home care sample between the ages of six months and two years when analysing Grade repeats (n=264)**: This analytical sample had higher mean asset scores and a higher proportion of childminders with an education level of Grade 7 or lower. The observed unit difference in asset scores was not greater than 1 and the proportion difference of childminders with an education level of Grade 7 or lower between the analytical sample and the Bt20+ sample was 13%.
- **In-home care sample between the ages of four and five years when analysing R-DPDQ score (n=991)**: When comparing the analytical sample measure of height-for-age z-scores and higher mean R-DPDQ scores, to the excluded Bt20+ sample, the observed unit differences were not greater than 1.
- **Out-of-home care sample between the ages of four and five years when analysing R-DPDQ score (n=693)**: This analytical sample had a higher mean asset score, higher height-for-age z-scores and a higher mean R-DPDQ score compared to the excluded Bt20+ sample. These observed unit differences were not greater than 1.
- **Out-of-home care sample between the ages of four and five years when analysing grade repeats (n=748)**: This analytical sample had a higher mean asset score, higher height-for-age z-scores, higher mean R-DPDQ scores, and a higher proportion of children who had never repeated a grade as well as a higher proportion of children being cared for in small groups at daycare/crèche compared to the Bt20+ sample. However, the observed unit differences (in assets scores, higher height-for-age z-scores, R-DPDQ scores and cognitive stimulation scores) were not greater than 2.

It is worth noting that the study sample did not dramatically differ with the Bt20+ population sample when assessing unit size differences. These differences can be attributed to random sampling errors rather than systematic errors.

Thirdly, there is a lack of a standardised and validated child care quality measurement tools for South Africa which would've improved estimation and comparability in the current study. For this reason, maternal responsiveness and cognitive stimulation were classified according to sample distribution which makes the results applicable only to this study cohort. Cognitive stimulation

activities and supervision were self-reported, therefore, reporting biases may exist. The data used in the current study were collected more than twenty years ago and some child care dynamics may have changed since then; also this meant that probing participants on inaccuracies or for further information could not be done. In some models, the sample size may have compromised model soundness.

Lastly, the study did not accounted for all possible confounders, but only for the most common confounders found in the literature. Therefore, there may be other unmeasured confounders not accounted for in our study. Furthermore, the scope of the study objectives may have limited the evaluation of some other associations.

Despite these limitations, this study is the first to provide evidence of the significance of child care quality using longitudinal data from a South African sample. Thus, it adds significantly to the evidence base (local and international) that seeks to profile early child care in LMICs. Despite the skewed distribution of the study sample, the study had sufficient power to significantly detect meaningful associations.

5.8 Implications and policy considerations

Results from the current study gave rise to a number of policy considerations and implications for early child care in South Africa.

The study findings highlight the importance of quality child care in the home environment, especially for the poorest children. Our results, combined with research from studies such as Potterton et al., (2010) and Richter & Grieve (1991), show that access to cognitive stimulation materials and activities in the home is most salient for early cognitive development. However, recent findings suggest that the South African public is still unaware of the importance of early brain development and the necessity for appropriate cognitive stimulation (Lindland et al., 2016). For this reason, interventions that empower parents to engage in early cognitive stimulation activities with their children are necessary. The 2016 Lancet series on Early Childhood Development (Black et al., 2017), recommends alternative low-cost home-based cognitive stimulation activities such as storytelling, singing, playing with and naming household objects as

opposed to costly materials such as books, puzzles and commercial toys which may be unaffordable for parents in LMIC's. Furthermore, the World Health Organisation (WHO) in partnership with UNICEF, have developed a guideline of activities, Care for Child Development, which aims to promote healthy child development for children from birth to two years (WHO & UNICEF, 2012). These guidelines include supporting parents and caregivers on how to communicate and play with a young child and also emphasises the importance of showing affection to children. Such interventions require an efficient and effective mechanism to reach young children. Home visits and routine child health visits at health care facilities may be such mechanisms. Accordingly, the South African government in the recently adopted the National Integrated Early Childhood Development Policy (Department of Social Development, 2016), has committed funds towards parental support in the form of trained home visitors to high-risk families, aimed at capacitating parents with information and skills that will promote optimal early childhood development. Furthermore, the policy also proposes to increase early childhood development knowledge and awareness of the general public through media platforms. Secondly, our measured child care structural features e.g. higher childminder education, low group size and formal daycare structures improved cognitive and schooling outcomes. The recent National Integrated Early Childhood Development policy has made education and training provisions for childminders and argued for committed funding for infrastructure and educational resource expansion in daycare centres. While the policy is specific about qualification standards for childminders and ECD practitioners, it is not specific on group size or staff-child ratio thresholds and government commitment strategies to reduce group sizes or staff-child ratios (Department of Social Development, 2016).

Lastly, the current study also highlights the importance of socioeconomic factors as having a critical influence on child development, especially for the youngest children (six months to two years). Therefore government strategies aimed at poverty alleviation such as social grants would not only benefit households but child development as well (Grinspun, 2016). However, the Child Gauge 2016 (Delany & Jehoma, 2016) reported that there was a low uptake of child grants for children under the age of one year. The unavailability of birth certificates for these children was cited as the main reason for this low uptake. The National Department of Home Affairs should improve service delivery in this regard for the sake of early childhood development. The National Integrated Early Childhood Development policy has also proposed that high-risk families/mothers should register for the social grants as early as pregnancy (Department of Social Development,

2016). Such social assistance will also afford young mothers quality alternative care while they complete their schooling.

5.9 Future Research

The current study focused on cognitive and schooling outcomes. Future research should also consider how the early environment influences other child developmental domains such as socio-emotional development and expand the period of outcomes analysis to adolescence and adulthood.

This study did not find much evidence in predicting schooling outcomes. In order to understand what factors are necessary for schooling success in South Africa, a multi-disciplinary approach should be employed. The current study was mainly based on a high-risk sample and did not find any conclusive results for children at low-risk. It will provide valuable insight to know whether poor or high quality child care affects low-risks samples. It will also be important to know whether high-risk samples receiving high quality child care are developmentally on par with their low-risk counterparts.

The development and/or adoption of a measurement tool for quality of care which is appropriate in the South African context, will improve estimations and thereby improve study results, which will render the South African studies to be a better comparison to other international studies.

5.10 Conclusion

Early childhood is a period in life when the developing brain is highly malleable. Therefore, environments that consist of responsive caregiving and early cognitive stimulation which foster optimal child health and development are necessary. Using data from a South African cohort, this study shows that child care quality as a proximal environmental factor influences children's cognitive and schooling outcomes. Findings from this research add to the growing body of evidence which seeks to understand the effects of child care on child development outcomes in a LMIC context.

High quality child care both in-and out-of-home between the ages of six months and two years and between four and five years, promotes cognitive functioning at five years of age and reduced the odds of grade repeats during the course of primary school. Household SES and maternal education were both found to be critical confounders in this association. This implies that, to ensure optimal child outcomes in the LMIC context, quality of child care must be improved concurrently with socioeconomic conditions. Improving one condition without the other might not yield the desired results.

In addition, the study showed that high quality care ameliorated the negative effects of poverty on cognitive development. The provision of high quality child care in- and out-of-home in early childhood can be used as a policy instrument in reducing early childhood inequality. This is particularly applicable in a country like South Africa which is facing severe inequality. Therefore, research of cost-effective scalable interventions in this regard is required. Governments, parents and the society at large should play a role in ensuring the provision of high quality environments, especially for children at risk.

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Appendix A: Ethics clearance certificate

R14/49 Ms Refilce Lerato Cele

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150717

NAME: (Principal Investigator)	Ms Refilce Lerato Cele
DEPARTMENT:	Paediatrics
PROJECT TITLE:	The association between early Child Environment and Childrens Outcomes: Evidence from the Birth to Twenty Plus Study
DATE CONSIDERED:	31 July 2015
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Wiedaad Slemming
APPROVED BY:	Professor Angela Woodiwiss, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	31/07/2015

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 B: Difference between the analytical sample and the Bt20+ sample

Table 1 Differences between the study sample and the Bt20+sample at 6 months -2 years in the home.

In home						
	Outcome: R-DPDQ			Outcome: Number of grade repeats by Grade 7		
Variable	***Study sample included*** ***n=856*** ***n (%)***	**Bt20+ sample excluded** **N=2934** **n (%)**	**P-value**	***Study sample included*** ***n=1148*** ***n (%)***	**Bt20+ sample excluded** **N=2642** **n (%)**	**P-value**
Gender[2]			0.479			0.418
Male	425(49.7)	1166(48.2)		547(47.6)	1044(49.1)	
Female	431(50.4)	1251(51.8)		601(52.4)	1081(50.9)	
Assets scores at 6m-2yrs[1], mean(SD)	4.2(1.4)	3.8(1.7)	**0.000***	4.1(1.4)	3.8(1.7)	**0.000***
Linear growth at 2yrs[1], mean(SD)	-1.2(1.1)	-1.1(1.1)	**0.018***	-1.3(1.1)	-0.9(1.0)	**0.000***
R-DPDQ scores[1], mean(SD)	44.0(4.5)	43.2(5.2)	**0.010***	43.9(4.6)	43.5(5.0)	0.089
Grade repeats[2]			0.779			0.811
never repeated a grade	557(75.1)	938(74.5)		860(74.9)	635(74.4)	
has repeated at least one grade	185(24.9)	321(25.5)		288(25.1)	218(25.6)	
Maternal education[2]			**0.000***			**0.000***
Grade 7 or less	97(11.3)	358(17.2)		141(12.3)	314(17.6)	
Grade 8 to Grade 10	394(46.0)	862(41.5)		531(46.3)	725(40.6)	
Grade 11 to Grade 12	283(33.1)	610(29.1)		371(32.3)	522(29.3)	
post school training	82(9.6)	246(11.9)		105(9.2)	223(12.5)	
Maternal responsiveness scores[1], mean(SD)	16.3(2.6)	16.5(2.3)	0.057	16.4(2.6)	16.5(2.3)	0.05
Cognitive stimulation scores[1], mean(SD)	8.6(1.2)	8.7(1.2)	**0.021***	8.6(1.2)	8.7(1.2)	0.112

Table 2 Differences between the study sample and the Bt20+sample at 6 months -2 years out-of-home.

Out of home/non-maternal care						
	Outcome: R-DPDQ			**Outcome: Number of grade repeats by Grade 7**		
Variable	***Study sample included*** ***n=203*** **n (%)**	**Bt20+ sample excluded** **N=3587** **n (%)**	**P-value**	***Study sample included*** ***n=264*** **n (%)**	**Bt20+ sample excluded** **N=3526** **n (%)**	**P-value**
Gender[2]			0.44			0.669
Male	104(51.2)	1487(48.4)		125(47.4)	1466(48.7)	
Female	99(48.8)	1583(51.6)		139(52.7)	1543(51.3)	
Asset scores at 6m-2yrs[1], mean(SD)	4.3(1.4)	3.9(1.7)	**0.000***	4.2(1.4)	3.9(1.7)	**0.000***
Linear growth at 2yrs[1], mean(SD)	-1.2(1.1)	-1.2(1.1)	0.851	-1.3(1.1)	-1.1(1.1)	0.156
R-DPDQ scores[1], mean(SD)	44.2(4.9)	43.7(4.7)	0.149	43.8(5.0)	43.7(4.7)	0.865
Grade repeats[2]			0.959			0.971
never repeated a grade	123(74.6)	1372(74.7)		197(74.6)	1298(74.7)	
has repeated at least one grade	42(25.5)	464(25.3)		67(25.4)	439(25.3)	
Childminder education[2]			**0.000***			**0.000***
Grade 7 or less	69(34.0)	382(20.7)		89(33.7)	362(20.3)	
Grade 8 to Grade 10	89(43.8)	809(43.9)		109(41.3)	789(44.3)	
Grade 11 to Grade 12	38(18.7)	560(30.4)		57(21.6)	541(30.3)	
post school training	7(3.6)	93(5.0)		9 (3.4)	91(5.1)	
Group Size[2]			0.912			0.583
big group (7 to 50 children)	13(6.4)	24(7.3)		21(8.0)	16(6.0)	
average group (2 to 6 children)	84(41.4)	138(41.8)		106(40.2)	116(43.1)	
small group (1 child)	106(52.2)	168(50.9)		137(51.9)	137(50.9)	

Table 3 Differences between the study sample and the Bt20+sample at 4-5 years in the home.

In home						
	Outcome: R-DPDQ			Outcome: Number of grade repeats by Grade 7		
Variable	***Study sample included*** ***N=991*** ***n (%)***	**Bt20+ sample excluded N=2799 n (%)**	**P-value**	***Study sample included*** ***N=1143*** ***n (%)***	**Bt20+ sample excluded N=2647 n (%)**	**P-value**
Gender[2]			0.688			0.284
Male	487 (49.1)	1104 (48.4)		541(47.3)	1050 (49.3)	
Female	504 (50.9)	1178 (51.6)		602(52.7)	1080 (50.7)	
Assets scores at 4-5yrs[1], mean(SD)	4.8 (1.4)	4.7 (1.6)	0.079	4.7(1.4)	4.7(1.6)	0.995
Linear growth at 5yrs[1], mean(SD)	-0.6(1.0)	-0.7(0.9)	**0.007***	-0.7(0.9)	-0.7(0.9)	0.507
R-DPDQ scores[1], mean(SD)	43.9(4.7)	43.1(5.1)	**0.020***	43.9(4.6)	43.4(5.0)	0.053
Grade repeats[2]			0.338			0.404
never repeated a grade	651(75.8)	844(74.0)		862(75.4)	633(73.8)	
has repeated at least one grade	208(24.2)	298(26.1)		281(24.6)	225(26.2)	
Cognitive stimulation at 4-5yrs [2]			0.671			0.116
low to no cognitive stimulation	472(47.6)	298(48.1)		530(46.4)	240(51.3)	
some cognitive stimulation	318(32.1)	207(33.4)		376(32.9)	149(31.8)	
high cognitive stimulation	201(20.3)	115(18.6)		237(20.7)	79(16.9)	
Child supervision scores in the home[1], mean(SD)	7.8(0.5)	7.8(0.5)	0.559	7.8(0.5)	7.8(0.5)	0.185

Table 4 Differences between the study sample and the Bt20+sample at 4-5 years out-of-home.

Out of home/non-maternal care						
	Outcome: R-DPDQ			Outcome: Number of grade repeats by Grade 7		
Variable	***Study sample included*** ***n=693*** **n (%)**	**Bt20+ sample excluded N=3097 n (%)**	**P-value**	***Study sample included*** ***n=748*** **n (%)**	**Bt20+ sample excluded N=3042 n (%)**	**P-value**
Gender[2]			0.677			0.143
Male	332(47.9)	1259(48.8)		346(46.3)	1245(49.3)	
Female	361(52.1)	1321(51.2)		402(53.7)	1280(50.7)	
Asset scores at 4-5yrs[1], mean(SD)	5.1(1.3)	4.5(1.6)	**0.000***	5.1(1.3)	4.5(1.6)	**0.00***
Linear growth at 5yrs[1], mean(SD)	-0.5(0.9)	-0.8(0.9)	**0.000***	-0.5(0.9)	-0.8(0.9)	**0.000***
R-DPDQ scores[1], mean(SD)	44.8(4.1)	42.4(5.1)	**0.000***	44.8(4.1)	42.8(5.1)	**0.000***
Grade repeats[2]			0.146			**0.042***
never repeated a grade	465(76.9)	1030(73.8)		578(77.3)	917(73.2)	
has repeated at least one grade	140(23.1)	366(26.2)		170(22.7)	336(26.8)	
Type of daycare/crèche[2]			0.210			0.852
informal crèche	360(52.0)	163(47.8)		377(50.4)	146(51.1)	
formal crèche	333(48.1)	178(52.2)		371(49.6)	140(49.0)	
Group size at daycare/crèche[2]			0.328			**0.018***
big group (more than 20 children per group)	603(87.0)	410(88.9)		644(86.1)	369(90.9)	
small group (less than 20 children per group)	90(13.0)	51(11.1)		104(13.9)	37(9.1)	

Appendix C: Bivariate associations

Table 1 Linear regressions to assess predictors of R-DPDQ scores between the ages of 6 months to 2 years in the home care environment (N = 856).

	β	**SE**	**R^2**	**F**
Maternal responsiveness raw scores	0.19***	0.05	0.012	F(1, 854) = 9.94***
Maternal responsiveness categories			0.007	F(2, 853) = 3.08**
low responsiveness	ref			
moderate responsiveness	0.59	0.48		
high responsiveness	1.02**	0.42		
Cognitive stimulation raw scores at 6m-2yrs	0.43***	0.13	0.013	F(1, 854) = 11.08***
Cognitive stimulation categories			0.005	F(2, 853) = 2.29
low-no cognitive stimulation	ref			
some cognitive stimulation	0.50	0.38		
high cognitive stimulation	0.76**	0.37		
Quality of child care			0.012	F(2, 853) = 5.35***
low quality	ref			
average quality	0.55	0.40		
high quality	1.25***	0.39		
Assets scores at 6m-2yrs	0.77***	0.11	0.054	F(1, 854) = 48.52***
Linear growth at 2yrs	0.77***	0.13	0.037	F(1, 854) = 33.21***
Maternal education			0.062	F(3, 852) = 18.61***
Grade 7 and less	ref			
Grade 8 to Grade 10	1.45***	0.49		
Grade 11 to Grade 12	3.05***	0.52		
post school training	3.79***	0.66		

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Table 2 Linear regressions to assess predictors of R-DPDQ scores between the ages of 6 months to 2 years in the out of home care environment (N = 203).

	β	**SE**	**R^2**	**F**
Childminder education			0.028	F(3, 199) = 1.92
Grade 7 and less	ref			
Grade 8 to Grade 10	1.23	0.77		
Grade 11 to Grade 12	1.75*	0.97		
post school training	3.34*	1.91		
Group size at 6m-2yrs			0.005	F(2, 200) = 0.51
big group (7 to 50 children)	ref			
average group (2 to 6 children)	0.51	1.45		
small group (1 child)	1.09	1.43		
Assets scores at 6m-2yrs	1.15***	0.24	0.101	F(1, 201) = 22.63***
Linear growth at 2yrs	1.35***	0.28	0.100	F(1, 201) = 22.35***
Maternal education			0.064	F(3, 199) = 4.51***
Grade 7 and less	ref			
Grade 8 to Grade 10	1.48	1.16		
Grade 11 to Grade 12	2.63**	1.22		
post school training	4.68***	1.43		

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Table 3 Logistic regressions to assess predictors of grade repeats between the ages of 6 months to 2 years in the home care environment (N = 1148).

	OR	**95% CI**	**Pseudo R^2**	**LR chi2**
Maternal responsiveness raw scores	0.95**	0.89-0.99	0.004	LR chi2(1) = 4.81**
Maternal responsiveness categories			0.003	LR chi2(2) = 4.26
low responsiveness	1.00			
moderate responsiveness	0.86	0.58-1.28		
high responsiveness	0.70*	0.49-1.00		
Cognitive stimulation raw scores at 6m-2yrs	0.92	0.82-1.03	0.002	LR chi2(1) = 2.07
Cognitive stimulation categories			0.003	LR chi2(2) = 3.86
low-no cognitive stimulation	1.00			
some cognitive stimulation	1.10	0.80-1.51		
high cognitive stimulation	0.77	0.56-1.08		
Quality of child care			0.003	LR chi2(2) = 4.22
low quality	1.00			
average quality	0.93	0.66-1.31		
high quality	0.72*	0.52-1.01		
Assets scores at 6m-2yrs	0.89**	0.81-0.98	0.005	LR chi2(1) = 5.85**
Linear growth at 2yrs	0.94	0.84-1.06	0.001	LR chi2(1) = 0.95
Maternal education			0.024	LR chi2(3) = 30.77***
Grade 7 and less	1.00			
Grade 8 to Grade 10	0.95	0.64-1.41		
Grade 11 to Grade 12	0.42***	0.27-0.67		
post school training	0.44**	0.24-0.82		

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category

Table 4 Logistic regressions to assess predictors of grade repeats between the ages of 6 months to 2 years in the out of home care environment (N = 264).

	OR	**95% CI**	**Pseudo R^2**	**LR chi2**
Childminder education			0.013	LR chi2(3) = 4.01
Grade 7 and less	1.00			
Grade 8 to Grade 10	0.71	0.38-1.33		
Grade 11 to Grade 12	0.52	0.24-1.15		
post school training	0.27	0.03-2.28		
Group size at 6m-2yrs			0.012	LR chi2(2) = 3.48
big group (7 to 50 children)	1.00			
average group (2 to 6 children)	0.39*	0.15-1.04		
small group (1 child)	0.44*	0.17-1.13		
Assets scores at 6m-2yrs	0.94	0.76-1.15	0.001	LR chi2(1) = 0.35
Linear growth at 2yrs	1.08	0.84-1.40	0.001	LR chi2(1) = 0.36
Maternal education			0.021	LR chi2(3) = 6.23
Grade 7 and less	1.00			
Grade 8 to Grade 10	1.11	0.47-2.62		
Grade 11 to Grade 12	0.55	0.21-1.46		
post school training	0.45	0.13-1.54		

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Table 5 Linear regressions to assess predictors of R-DPDQ scores between the ages of 4 to 5 years in the home care environment (N = 991).

	β	**SE**	**R^2**	**F**
Cognitive stimulation raw scores at 4-5yrs	0.31***	0.07	0.021	F(1, 989) = 21.43***
Cognitive stimulation categories			0.018	F(2, 988) = 9.11***
low-no cognitive stimulation	ref			
some cognitive stimulation	0.91***	0.34		
high cognitive stimulation	1.57***	0.39		
Child supervision			0.003	F(1, 989) = 2.76*
partial supervision	ref			
full supervision	0.74*	0.45		
Assets scores at 4-5yrs	0.68***	0.10	0.041	F(1, 989) = 42.60***
Linear growth at 5yrs	0.72***	0.15	0.022	F(1, 989) = 21.92***

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category

Table 6 Linear regressions to assess predictors of R-DPDQ scores between the ages of 4 to 5 years in the out of home care environment (N = 693).

	β	**SE**	**R^2**	**F**
Type of daycare/crèche			0.008	F(1, 691) = 5.68**
informal crèche	ref			
formal crèche	0.75*	0.31		
Group size at 4-5yrs			0.001	F(1, 691) = 0.79
big group (>20 children)	ref			
small group (<20 children)	-0.42	0.47		
Assets scores at 4-5yrs	0.47***	0.12	0.022	F(1, 691) = 15.46***
Linear growth at 5yrs	0.44**	0.17	0.009	F(1, 691) = 6.74***

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Table 7 Logistic regressions to assess predictors of grade repeats between the ages of 4 to 5 years in the home care environment (N = 1143).

	OR	**95% CI**	**Pseudo R^2**	**LR chi2**
Cognitive stimulation raw scores at 4-5yrs	0.97	0.03	0.001	LR chi2(1) = 1.23
Cognitive stimulation categories			0.001	LR chi2(2) = 1.55
low-no cognitive stimulation	1.00			
some cognitive stimulation	0.98	0.73-1.34		
high cognitive stimulation	0.80	0.56-1.16		
Child supervision			0.005	LR chi2(1) = 6.90***
partial supervision	1.00			
full supervision	1.81*	1.14-2.90		
Assets scores at 4-5yrs	0.94	0.85-1.03	0.001	LR chi2(1) = 1.85
Linear growth at 5yrs	0.31	0.26-0.37	0.0007	LR chi2(1) = 0.87

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Table 8 Logistic regressions to assess predictors of grade repeats between the ages of 4 to 5 years in the out of home care environment (N = 748).

	OR	**95% CI**	**Pseudo R^2**	**LR chi2**
Type of daycare/crèche			0.0002	LR chi2(1) = 0.16
informal crèche	1.00			
formal crèche	0.93	0.66-1.31		
Group size			0.002	LR chi2(1) = 1.76
big group (>20 children)	1.00			
small group (<20 children)	1.38	0.86-2.20		
Assets scores at 4-5yrs	0.93	0.81-1.05	0.002	LR chi2(1) = 1.34
Linear growth at 5yrs	0.92	0.77-1.12	0.001	LR chi2(1) = 0.68

***P<0.01; **P<0.05; *P< 0.10. (ref). is the reference category.

Appendix D: Birth to Twenty Plus questionnaires



University of the Witwatersrand

Department of Paediatrics and Child Health

Example of BT20 Consent Form

BIRTH TO TEN: FIVE YEAR QUESTIONNAIRE 1995

STATEMENT BY RESEARCHER

I have fully explained the procedures, identifying those which are investigational, and have explained their purpose. I have answered any questions that have arisen regarding these procedures to the best of my ability.

Signed by:
Investigator/Researcher: _____

Date: _____ _____ 1995

STATEMENT BY THE PARENT/GUARDIAN OF THE BTT CHILD

I have been fully informed as to the procedures to be followed, including a blood sample and blood pressure measurement.

In signing this consent form I agree to this investigation on my child and understand that I am free to refuse or withdraw this consent regarding my child's participation in the study at any time. I understand that any questions I may have at any time will also be answered.

BTT ID NUMBER: | | | | | | | |

Full Name and Surname

_____

Signed by Parent/Guardian: _____

Date: _____ _____ 1995

Witness: _____

Growth data collection form

BTT ID NUMBER: ----------

Surname: ----------

Name of child: ----------

Name of Mother: ----------

Sex: male=1/female=2: ----------

Health visitor: ----------

Date: ----------

Measurements

Length (mm) | | | | |

BIRTH TO TWENTY QUESTIONNAIRES

Questions relating to socioeconomic status

DATE: Day ☐☐ **Month** ☐☐ **Year** ☐☐

BTT ID NUMBER: ☐☐☐☐☐☐☐☐☐☐

BTT CHILD'S NAME(S): _____

SURNAME: _____

MOTHER'S NAME: _____

MOTHER'S SURNAME:

_____

INTERVIEWER'S NAME:

Year one-core Questionnaire

29. What is the occupation of mother and father?

30. What is the highest standard mother has passed at school?

1 = No formal schooling	6 = Grade 8
2 = Grade 1 / grade 2	7 = Grade 9
3 = Grade 3 - 5	8 = Grade 10
4 = Grade 6	9 = Grade 1
5 = Grade 7	10 = Matric

Year two-core Questionnaire

25. What is the occupation of - BTT child's father / mother's partner?, BTT child's mother?

28. What is the BTT mother's highest educational qualification?

96. Is there a radio in the house?

97. Does anyone in the household own a motor vehicle?

98. Is there a refrigerator in the house?

99. Is there a washing machine in the house?

100. Is there a telephone in the house?

101. Is there a television in the house?

Year four-core Questionnaire

To mother/caretaker:

76(a) Would you describe yourself as:

Unemployed	1	Earning money	2

(b) If you describe yourself as **UNEMPLOYED:**

Are you a

Student	1	Pensioner	2

(c) If you describe yourself as **EARNING MONEY:**

What is your occupation (type of work)? _____

79. Which of the following do you have in your home at the present time?

Electricity	Yes	1	No	0
Television	Yes	1	No	0
Radio	Yes	1	No	0
Motor vehicle	Yes	1	No	0
Fridge	Yes	1	No	0
Washing machine	Yes	1	No	0
Telephone	Yes	1	No	0

Children's toys	Yes	1	No	0

Year five-core Questionnaire

32. Which of the following do you have in your home at the present time?

Electricity	Yes	1	No	0	
Television	Yes	1	No	0	
Radio	Yes	1	No	0	
Motor vehicle	Yes	1	No	0	
Fridge	Yes	1	No	0	
Washing machine	Yes	1	No	0	
Telephone	Yes	1	No	0	
Children's toys	Yes	1	No	0	

BIRTH TO TWENTY QUESTIONNAIRES

Questions relating to in-home care

DATE: Day ☐☐ **Month** ☐☐ **Year** ☐☐

BTT ID NUMBER: ☐☐☐☐☐☐☐☐☐☐

BTT CHILD'S NAME(S): _____

SURNAME: _____

MOTHER'S NAME: _____

MOTHER'S SURNAME:

_____

INTERVIEWER'S NAME:

Six month core and psychological questionnaire

3. Who is the primary caregiver of the child?

5. Who usually takes care of this child during the day? (e.g. childminder, relative etc), If not the mother, for what reason?

6. What is the highest school standard the caregiver has passed?

9. What languages is this baby exposed to?

33. Does anyone in your home read the newspaper or books? Yes/No

34. Have you bought or made any toys for your child? Yes/No

36. How often do you take the baby out with you to the shops, visiting,etc.?

1. Most days
2. About once a week
3. About once a month
4. Almost never

37. What sorts of things have you tried to teach your baby up to now?

1. Sitting
2. Take objects
3. Clappa handies
3. Respond to their name
5. Other

<u>Rating of mother sensitivity and responsiveness as observed by the interviewer:</u>

64. Mother's tone of voice toward baby

1. Very warm/ Loving
2. Warm/ Kind
3. Unemotional/ Neutral
4. Distant/ Cold
5. Angry/ Hostile

65. Mother's attitude towards child

1. Accepting
2. Neutral
3. Unaccepting

66. Mother's skill in caretaking

1. Very skillful
2. Neutral
3. Unskillful/ Clumsy

67. Amount of physical contact mother makes with child

1. Often
2. Frequent
3. "Part-of-the-job"/"Matter-of-fact"
4. Seldom
5. Never

68. Amount mother speaks to child

1. Often
2. Frequent
3. "Part-of-the-job"/"Matter-of-fact"
4. Seldom
5. Never

69. What mother says to her child, is

1. Loving/ Encouraging
2. Neutral
3. Critical/ Angry

70. Amount mother and child make eye contact during the assessment

1. Often 2. Frequent

3. “Part-time-of-the-job 4. Seldom

5. Never

71. How responsive did you think the mother was to child’s distress:

1. Responsive 2. Neutral

3. Unresponsive

72. How responsive was the mother to the child’s social expressions:

1. Responsive 2. Neutral

3. Unresponsive

73. How responsive was mother to the child’s physical needs:

1. Responsive 2. Neutral

3. Unresponsive

74. How restrictive do you think the mother was to the child’s exploratory behaviour?

1. Unrestrictive 2. Neutral

3. Resctrictive

<u>One year psychological questionnaire</u>

1. Does someone other than yourself take care of your baby on a regular basis? Yes/No

2. [If Yes] Who?

1=Older female family member 2=Sib or other youngster

3=Paid childminder in your home 4=Paid outside childminder

5=Crèche 6=Other

26. Does anyone in your home read the newspaper or books? Yes/No

27. Have you brought or made any toys for your child? Yes/No

29. How often do you take the baby out with you to the shops, Visiting, etc.?

1. Most days 2. About once a week

3. About once a month 4. Almost never

30. What sorts of things have you tried to teach your baby up to now?

Year two core questionnaire

11. Where is BTT child cared for?

Child's home	Childminder's home	Creche or similar facility	Other
1	2	3	4

12. If CHILDMINDER**,** is she / he being paid?

14. What is the highest educational qualification of the childminder?

15. How many children are in childminder's care?

91. About how much time each day do you manage to spend 'just playing' with your child?

No time = 0	Less than 1 hour = 1	More than 1 hour = 2

92.How often does his / her father (or other men important to the child) spend time playing with him / her?

Almost never = 1	At least once a week = 2	2 – 4 times a week = 3	Every day = 4

93. About how often do you take your child out of the house with you, to go to the shops, visiting etc.?

Almost never = 1	At least once a week = 2	2 – 4 times a week = 3	Every day = 4

94. Is there anything you are trying to teach your child at the moment? Yes/No

95. Does your child have any playthings, bought toys or things you have made or given him / her to play with? Yes/No

103. Does anyone in the household bring home a newspaper most days?

Rating of mother sensitivity and responsiveness as observed by the interviewer:

107. Does the child look clean and well looked after?

Very clean	1
A bit grubby, but normal	2
Dirty and neglected looking	3

108. Does the child appear happy, confident and secure in the mother's presence?

Completely happy	1
A little insecure, but normal	2
Not happy, confident or secure	3

109. Does the mother seem unhappy and worn down by worries and troubles?

Not at all	1
A little care-worn, but normal	2
Unhappy and worn down	3

110. Does the mother demonstrate any negative feelings towards the child?

Not at all	1
A little, but normal	2
Demonstrates negative feelings	3

111. Does the mother appear to be confident and assured in her care and management of the child?

Very much so	1
A little hesitant, but normal	2
Unsure & lacking in confidence	3

112. Does the mother show affection towards the child?

A lot	1
A little, but normal	2
None, absence is marked	3

Year four core questionnaire

7. Does someone regularly supervise (help, check on) the child's **evening meal**? Yes/No

8. Does someone regularly supervise the child's **washing** (bathing, face washing etc)? Yes/No

If **YES:** Who in general supervises?

Mother = 1	Other adult = 2	Other child = 3
Mother and other adults = 4		

9. Does someone regularly supervise the child cleaning her / his **teeth**? Yes/No

If **YES**: Who in general supervises?

Mother = 1	Other adult = 2	Other child = 3
Mother and other adults = 4		

10. Does someone regularly supervise the child's **dressing**, what to wear etc? Yes/No. If **YES:** Who in general supervises?

Mother = 1	Other adult = 2	Other child = 3
Mother and other adults = 4		

15. How do you punish your child **most often**?

Physical punishment or smacking	1
Scold or shout	2
Deprive them of something	3
Remove them from the situation	4
Other _____	5

22. Does anyone in the household regularly bring home a **newspaper**?

Regularly	1	Sometimes	2	Almost never	3

23. How many **books** apart from school books do you have at home?

None	1	Less than 10	2	11 to 50	3	More than 50	4

24. Does anyone in the house **read to the child**?

Regularly	1	Sometimes	2	Almost never	3

b. If so, What sort of books?

25. Does anyone in the house ever tell the child stories?

Regularly	1	Sometimes	2	Almost never	3

b. If so, What kind of stories?

26. Does anyone in the house encourage the child to try and **write or colour in**?

Regularly	1	Sometimes	2	Almost never	3

27. How far will you try and send your child in **education**?

Tertiary	1	Secondary	2	Primary	3	Can't say	4

BIRTH TO TWENTY QUESTIONNAIRES

Questions relating to out-of-home care

DATE: Day ☐☐ **Month** ☐☐ **Year** ☐☐

BTT ID NUMBER: ☐☐☐☐☐☐☐☐☐☐

BTT CHILD'S NAME(S): _____

SURNAME: _____

MOTHER'S NAME: _____

MOTHER'S SURNAME:

_____

INTERVIEWER'S NAME:

Six month core and psychological questionnaire

5. Who usually takes care of this child during the day? (eg childminder, relative etc), If not the mother, for what reason?

6. What is the highest school standard the caregiver has passed?

One year psychological questionnaire

1. Does someone other than yourself take care of your baby on a regular basis? Yes/No

2. [If Yes] Who?

1=Older female family member
2=Sib or other youngster
3=Paid childminder in your home
4=Paid outside childminder
5=Crèche
6=Other

Year two core questionnaire

11. Where is BTT child cared for?

Child's home	Childminder's home	Creche or similar facility	Other
1	2	3	4

12. If CHILDMINDER**,** is she / he being paid?

14. What is the highest educational qualification of the childminder?

15. How many children are in childminder's care?

Year four-core Questionnaire

3. Where does the child spend most of the day during the week?

Home	1	Childminder	3
Relatives	2	Crèche	4
Neighbour or friend			5

6(a) If the BTT child is in **daycare** what kind?

Creche: formal	1	playground	2
Backyard crèche/garage	3	Child minder	4
Other			5

(b) What made you decide to choose this kind of care for your child?

_____

(c) How much do you **pay per month** (in Rand) for this care? R _____

(f) About how many other children are at the childminder or crèche?

5 or less	1	6 to 10	2
11 to 20	3	More than 20	4

(g) How many staff members are taking care of the children? _____

(h) Does the child have **breakfast** there?

Yes = 1	No = 0

If **YES:**

Is the **breakfast** supplied by the crèche?

Yes = 1	No = 0

(i) Does the child have **lunch** there?

Yes = 1	No = 0

If **YES:**

Is the **lunch** supplied by the crèche?

Yes = 1	No = 0

(j) What are the biggest **advantages** of having your child in this daycare setting?

_____

(k) What are the biggest **disadvantages** of having your child in this daycare setting?

_____

(d) How many **hours per day** is the child in their care?

5 hours or less	1	8 hours or less	2	More than 8 hours	3

Year five-core Questionnaire

3. Where does the child spend most of the day during the week?

Home	1	Childminder	3
Relatives	2	Crèche	4
Neighbour or friend			5

9.(a) If the BTT child is in **daycare** what kind?

Creche: formal	1	Playgroup	2
Backyard crèche/garage	3	Child minder	4
Other			

(b) What made you decide to choose this kind of care for your child?

_____

_____

(c) How much do you **pay per month** (in Rands) for this care? R _____

(d) How many hours per day is the child in their care?

5 Hours or less	1	8 Hours or less	2	More than 8 hours

(f) About how many other children are at the child minder or crèche?

5 or less	1	6 to 10	2
11 to 20	3	More than 20	4

5 YEAR DEVELOPMENTAL QUESTIONNAIRE: REVISED DENVER PRESCREENING DEVELOPMENTAL QUESTIONNAIRE (R-DPDQ)

BTT ID: _____

CHILD'S NAME: _____

SURNAME: _____

INTERVIEWER: _____

WHO PROVIDED THE INFORMATION:

_____

WHAT IS THE RELATIONSHIP OF THE INFORMANT TO THE CHILD?

_____

MOTHER'S NAME_____CHILD'S DATE OF BIRTH_____

Interviewer: Please note on questionnaire if the child refuses to do any item (write Refused)

Instructions: I want to ask you about how **X** (Child's name) is developing, and also want to look at how he/she is learning to do new things.

ASK THE CAREGIVERTHE FOLLOWING QUESTIONS:

Score the responses **YES (1), NO (2**) or **NO OPPORTUNITY (3). NO**

OPPORTUNITY means that the child has not had a chance to demonstrate whether or not they can do the item, either because the caregiver does not allow the child to try alone or the child does not have the means, equipment or resources to do the item.

1. **Can X dress him-herself without help?**

That is, choose clothes, button or zip clothes (except when fasteners are at the back), put on shoes (except for tying shoelaces)

2. **Can X play any simple board or card games?**

Like Drafts or Morabaraba, the game may be home-made or bought, the child must be able to really understand and play the game

3. **Can X brush his or her teeth without help or supervision sometimes?**

Including putting toothpaste on. (In case the caregiver concludes that small children should be able to brush their teeth without help-once the caregiver has answered the question, advise them that they should brush the child's teeth occasionally to ensure proper cleaning)

4. **Can X get him-or herself a bowl, spoon, dishing it out without making too much mess, and pouring milk (or other liquid) on it**

INTERVIEWER TO SIT NEXT TO THE CHILD AT A LOW TABLE, WITH CHILD COMFORTABLE, NEXT TO MOTHER IF NECESSARY

5. **Build a tower of blocks**

Put the eight blocks in front of the child, and ask the child (with demonstrations if necessary, but not help) to stack them, or build a tower, or tall building. Record the highest number of blocks the child can stack before the tower topples down.

Give the child three chances

6 & 7 Count blocks (1)

Put the 8 blocks in front of the child. Ask him or her to put one block on your piece of paper. Record how many blocks the child puts on the paper.

NO OF BLOCKS_____

7. **Say number of blocks (1)**

When child has finished, correct the number of blocks on the paper if necessary and ask the child "How many blocks are on the paper". Record the child's answer.

NO OF BLOCKS_____

8 & 9. Count blocks (5)

Ask the child to put five blocks on your piece of paper. Record the no of blocks.

NO OF BLOCKS_____

8. Say number of blocks (5)

When the child has finished, correct the number of blocks on the paper if necessary and ask the child “How many blocks are on the paper”. Record the child’s answer.

NO OF BLOCKS_____

9. Imitate vertical line

Interviewer draws a vertical line in the space below. Give the child a pencil and ask him/her to draw a line just like yours.

Repeat three times.

---

11. Copy a circle

Show the child the first circle drawn on the questionnaire. Without naming the figure or moving your fingers or pencil to show how to draw it, ask the child to draw a picture like the one shown here.

Repeat three times.

---

12. Copy a +

Show the child the first cross drawn on the questionnaire. Without naming the figure or moving your fingers or pencil to show how to draw it, ask the child to draw a picture like the one shown here

Repeat three times.





13. Copy a square

Show the child the first square drawn on the questionnaire. Without naming the figure or moving your fingers or pencil to show how to draw it , ask the child to draw a picture like the one shown here**.**

Repeat three times.

---

14. Copy a square- demonstrated

If the child is unable to copy the square from the picture, show the child how to draw a square by drawing two opposite sides (rather than drawing the square with a continuous motion).

Repeat three times.

15-17. Pick a longer line

Show the child the two lines below, and ask the child which line is “longer” (don’t say “bigger”- we need to know if the child understands the concepts “longer”).

CHILD RECOGNISES-YES_____NO_____

16. Repeat second time

Turn the page upside down and repeat the question about which line is “longer”

CHILD RECOGNISES-YES_____NO_____

17. Repeat third time

Turn the page the right way up again and repeat the question about which line is “longer”

CHILD RECOGNISES-YES_____NO_____

IF CHILD DOES NOT RECOGNISE THE LONGER LINE, REPEAT 3 MORE TIMES, TURNING PAGE EACH TIME

Repeat a fourth time CHILD RECOGNISES- YES_____NO_____

Repeat a fifth time CHILD RECOGNISES-YES_____NO_____

Repeat a sixth time CHILD RECOGNISES-YES_____NO_____

18. Draw a person

Put the blank sheet of paper in front of the child, and ask the child to draw a picture of a person. Make sure the child has finished the drawing before moving on to the next time

19. Use of objects

Ask the child the following questions, and record the child’s answer:

(a). “What do you do with a cup?”.

(b). "What is a chair used for?"

(c). "What is a pencil used for?"

---

20. Knows actions

Show the child the following 5 pictures and ask the child (tick RIGHT or WRONG):

(a) "Which one flies?" RIGHT_____ WRONG_____
(b) "Which one says MEOW?" RIGHT_____ WRONG_____
(c) "Which one talks?" RIGHT _____ WRONG_____
(d) "Which one barks?"RIGHT_____WRONG_____
(e) "Which one gallops?"RIGHT_____WRONG_____

21. Understands prepositions

Give the child a block and give the following instructions (Tick RIGHT or WRONG).

(a). "Put the block on the table" RIGHT_____WRONG_____

(b). "Put the block under the table"RIGHT_____WRONG_____

(c). "Put the block in front of me"RIGHT_____WRONG_____

(d). "Put the black behind me" RIGHT_____WRONG_____

22. Names colours

Put a red, blue, yellow and a green block on the table in front of the child. Point to each block one at a time and ask “What colour is this?”. Scramble blocks before each question.

(a). Red RIGHT_____WRONG_____

(b). Blue RIGHT_____WRONG_____

(c). Yellow RIGHT_____WRONG_____

(d). Green RIGHT_____ WRONG_____

23. Defines words

Make sure the child is listening to you and then say “I am going to say a word and I want you to tell me what it is. Say “What is a ……..”Ask the child to tell you something about it (But do not ask the child what to do with it). Record the child’s response.

Repeat the question 3 times if necessary to get a response from the child.

(a). Ball_____

(b). Lake _____

(c). Desk _____

(d). House _____

(e). Banana_____

(f). Curtain_____

(g).Fence_____

(h). Ceiling_____

24. Knows adjectives

Ask the child the following questions. Record the child's answers

(a)." What do you do when you are cold?"_____

_____

(b). "What do you do when you are tired?"_____

_____

(c). "What do you do when you are hungry?"_____

_____

25. Opposites

Say each of the following sentences slowly and distinctly, and wait for the child to fill in the blank.

Repeat each sentence three times if necessary.

(a). "If a horse is big, a mouse is_____"

(b). "If fire is hot, ice is _____"

(c). "If the sun shine during the day, the moon shines during the_____"

26. Thumb wiggle

Demonstrate with one or both hands by making a fist with thumb pointing upward. Wiggle only your thumb. Ask the child to wiggle his/her thumb (or thumbs) the same way. Do not help the child, apart from demonstrating. Record whether PASS or FAIL

PASS_____or **FAIL**_____ if child can move the thumb of either hand without moving any other fingers

27. Balance each foot

Have the child stand away from all support. Show the child how to balance on one foot.

Tell the child to do this, and **give the child 3 chances**. Record the number of seconds the child is able to stand on **RIGHT FOOT ALONE** and then **LEFT FOOT ALONE.**

Right Foot- Trial 1_____seconds

Trial 2_____seconds

Trial 3_____seconds

Left Foot- Trial 1_____seconds

Trial 2_____seconds

Trial 3_____seconds

28. Hopping

With the child away from all support, ask him/her to hop on one foot (foot of child's choice- left or right). Demonstrate. Score PASS or FAIL. Pass if the child hops on one foot 2 or more times in a row, either on the same place or while moving, without holding onto anything

PASS_____FAIL_____

29. Heel-to-toe walk

Demonstrate how to walk in a straight line, placing the heel of one foot in front of and touching the toe of the other. Walk about 8 steps like this and then ask the child to do it. If necessary demonstrate again. Give the child three chances. Score PASS or FAIL. Score pass if the child can walk in a straight line at least 4 steps, placing the heel no more than about 2-3cm in front of the toe, and without losing his/her balance.

PASS_____FAIL_____

INTERVIEWER RATE THE CHILD'S SPEECH

30. Speech all understandable

Rate the child's speech as heard during the assessment. Place a tick against ALL or HALF UNDERSTABLE.

HALF UNDERSTANDABLE_____ALL UNDERSTANDABLE_____