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Running head: PSYCHOLOGICAL SEQUALAE AND LOW BIRTH WEIGHT

**A Cohort Study of Psychological Sequelae in Low Birth Weight Children  
from the Bishop Lavis Community Health Centre**

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**A dissertation submitted in partial fulfilment of the requirements for the award of the  
degree of Masters of Clinical Psychology**

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UNIVERSITY OF CAPE TOWN

2007

Compulsory Declaration:

This work has not been submitted in whole, in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works of other people has been attributed, and has been cited and referenced.

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## Abstract

The relationship between low birth weight, behavioural inhibition and psychopathology was investigated in 65 seven to nine year-olds and their caregivers who were attendees of a community clinic in a low-income, urban suburb in Cape Town, South Africa. Significant relationships were found between key socioeconomic variables and birth weight status, behavioural inhibition and psychopathology respectively. Low birth weight children were more behaviourally inhibited in anxiety-provoking situations and their caregivers were less engaging than controls. High levels of psychopathology were found, independent of birth weight status and included emotional, hyperactivity, conduct and peer difficulties. Despite this, children had high levels of prosocial skills. A model consisting of birth weight and a measure of socioeconomic status was an effective overall predictor of behavioural inhibition status. The findings showed that at a sub clinical level, low birth weights were distinguishable from controls by behavioural inhibition status, but that at a clinical level, the risk created by low birth weight for psychopathology was diluted by other socioeconomic variables present within low income strata. The findings emphasised preventative interventions targeting socioeconomic status and early remedial interventions targeting coping strategies so as to reduce the risk for dysfunctional coping, behaviour and psychopathology.

**Key words:** Children, low birth weight, behavioural inhibition, psychopathology

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## TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>1. INTRODUCTION</b>  | <b>9</b>  |
| 1.1 The Definition of Low Birth Weight  | 9         |
| 1.2 Increased Survival Rates of Low Birth Weight Infants                              | 9         |
| <i>1.2.1 The Implications of Increased Survival</i>                                   | 10        |
| <i>1.2.1.1 Behavioural Inhibition</i>   | 10        |
| <i>1.2.1.2 Psychopathology</i>  | 10        |
| <i>1.2.1.3 Demographics and Socioeconomics</i>  | 11        |
| 1.3 The Present Study   | 11        |
| 1.4 Aims of the Study   | 11        |
| <b>2. LITERATURE REVIEW</b>   | <b>13</b> |
| 2.1 The Prevalence of Low Birth Weight  | 13        |
| <i>2.1.1 Wealthy Nations</i>  | 13        |
| <i>2.1.2 Low to Middle Income Nations</i>   | 13        |
| 2.2 Sequelae and Low Birth Weight   | 14        |
| <i>2.2.1 Behavioural and Psychological Difficulties</i>                               | 15        |
| <i>2.2.1.1 Behavioural Inhibition</i>   | 16        |
| <i>2.2.1.1.1 Animal models.</i>   | 18        |
| <i>2.2.1.1.2 Intrauterine stress, emotion and behaviour-regulation in humans.</i>     | 19        |
| <i>2.2.1.1.3 Intrauterine stress, emotion and behaviour-regulation in animals.</i>    | 19        |
| <i>2.2.1.1.4 Intrauterine stress and social interaction in humans.</i>                | 20        |
| <i>2.2.1.1.5 Intrauterine stress and social interaction in animals.</i>               | 20        |
| <i>2.2.1.1.6 Intrauterine stress and anxiety behaviours postpartum.</i>               | 20        |
| <i>2.2.1.1.7 Attention, hyperactivity and behavioural problems in human children.</i> | 21        |

|   |    |
|---|----|
| 2.2.2 <i>Psychiatric Disorders</i>  | 22 |
| 2.2.2.1 <i>Prenatal Stress, Child, Adolescent &amp; Adult Psychopathology</i>               | 24 |
| 2.2.2.2 <i>Gender</i>   | 25 |
| 2.2.3 <i>Intelligence and low birth weight</i>  | 25 |
| 2.3 <i>Summary of Low Birth Weight, Cognitive, Behavioural and Psychological Problems</i>   | 26 |
| <b>3. METHODOLOGY</b>   |    |
| 3.1 <i>Design</i>   | 29 |
| 3.1.1 <i>Background</i>   | 29 |
| 3.2 <i>Sample</i>   | 30 |
| Table 1 <i>Consort Diagram: Sample Selection</i>  | 31 |
| 3.3 <i>Ethical Issues</i>   | 31 |
| 3.4 <i>Data Collection</i>  | 32 |
| 3.5 <i>Measures</i>   | 33 |
| 3.5.1 <i>Strengths and Difficulties Questionnaire</i>                                       | 33 |
| 3.5.2 <i>The Scary Black Box Task</i>   | 35 |
| 3.5.2.1 <i>Reliability</i>  | 36 |
| 3.5.2.2 <i>Comparisons between Groups</i>   | 37 |
| 3.6 <i>Procedure/Administration</i>   | 38 |
| 3.6.1 <i>Administration of Strengths and Difficulties Questionnaire and Scary Black Box</i> | 38 |
| 3.7 <i>Data Analysis</i>  | 39 |
| <b>4. RESULTS</b>   |    |
| Table 2 <i>Descriptive Statistics of Demographics by Birth Weight Status</i>                | 43 |
| 4.1 <i>Demographics and Birth Weight Status</i>   | 44 |
| 4.2 <i>The Scary Black Box Task and Birth Weight Status</i>                                 | 45 |

|  |    |
|--|----|
| Table 3a <i>Birth Weight Status and Scary Black Box Task Variables</i>                 | 45 |
| 4.2.1 <i>Initial Behaviour</i>   | 45 |
| 4.2.2 <i>Hole 1</i>  | 46 |
| 4.2.3 <i>Hole 2</i>  | 46 |
| 4.2.4 <i>Hole 3</i>  | 46 |
| 4.2.5 <i>Hole 4</i>  | 47 |
| Table 3b <i>Birth Weight Status and Scary Black Box Global Variables</i>               | 47 |
| 4.2.6 <i>Global Behaviours</i>   | 48 |
| 4.2.6.1 <i>Mothers' Discrete Behaviours</i>  | 48 |
| 4.2.6.2 <i>Mothers' Communications or Behaviours to her Child</i>                      | 48 |
| 4.2.6.3 <i>Mothers' Boundary Setting and Acceptance of her Child's Agenda</i>          | 49 |
| 4.2.6.4 <i>Mothers' Taking-Over and Overprotective Behaviour</i>                       | 49 |
| 4.2.6.5 <i>Global Atmosphere between Mother and Child</i>                              | 49 |
| 4.2.7 <i>Behavioural Inhibition and Demographics</i>                                   | 49 |
| Table 3c <i>Behavioural Inhibition by Demographics</i>                                 | 51 |
| 4.3 The Strengths and Difficulties Questionnaire and Birth Weight Status:              | 51 |
| Table 4 <i>Birth Weight Status and SDQ Variables</i>                                   | 52 |
| Table 5a <i>SDQ Percentage Distribution across Score Cutoff Ranges</i>                 | 52 |
| Table 5b <i>SDQ Percentage Distribution across Score Cutoff Ranges by Birth Weight</i> | 53 |
| 4.4 The Strengths and Difficulties Questionnaire and Behavioural Inhibition            | 53 |
| Table 5c <i>SDQ Variables by Behavioural Inhibition</i>                                | 53 |
| 4.5 The Strengths and Difficulties Questionnaire and Demographics                      | 54 |
| 4.5.1 <i>Total Difficulties by Demographics</i>  | 54 |
| Table 5d <i>SDQ Total Difficulties (Nominal Categories) and Demographics</i>           | 55 |
| 4.5.2 <i>Total Strengths by Demographics</i>   | 56 |

|   |           |
|---|-----------|
| Table 5e <i>SDQ Total Strengths (Nominal Categories) and Demographics</i>                     | 56        |
| 4.6 Behavioural Inhibition, Birth Weight Status, Demographics and Psychopathology             | 57        |
| Table 6a <i>Multivariate Analysis of Four Predictors of Behavioural Inhibition</i>            | 58        |
| Table 6b <i>Multivariate Analysis of Three Predictors of Behavioural Inhibition</i>           | 58        |
| Table 6c <i>Multivariate Analysis of Two Predictors of Behavioural Inhibition</i>             | 59        |
| <b>5. DISCUSSION</b>  | <b>60</b> |
| 5.1 Demographics and Socioeconomics   | 60        |
| 5.1.1 <i>Commonalities</i>  | 60        |
| 5.1.2 <i>Differences</i>  | 62        |
| 5.2 Behavioural Inhibition  | 65        |
| 5.2.1 <i>The Evolutionary Purpose of Anxiety</i>  | 65        |
| 5.2.2 <i>Low Birth Weights as Behaviourally Inhibited</i>                                     | 66        |
| 5.2.3 <i>Global Interactions between Mother and Child</i>                                     | 67        |
| 5.2.4 <i>Interactions between Mother and Child in Socioeconomically Deprived Environments</i> | 68        |
| 5.3 Psychopathology   | 69        |
| 5.4 Behavioural Inhibition, Birth Weight, Demographics and Psychopathology                    | 71        |
| <b>6. CONCLUSION</b>  | <b>73</b> |
| 6.1 Recommendations   | 73        |
| 6.2 Limitations   | 75        |
| 6.3 Future Directions   | 76        |
| <b>REFERENCES</b>   | <b>77</b> |

| <b>APPENDICES</b> |  | <b>91</b> |
|-------------------|--|-----------|
| Appendix 1        |  | 91        |
| 1.1               | <i>Demographic Questionnaires</i>  | 91        |
| Appendix 2        |  | 104       |
| 2.1               | <i>Strengths and Difficulties Questionnaire Protocol (Parent-Completed Format)</i>   | 104       |
| Appendix 3        |  | 105       |
| 3.1               | <i>Instructions for the Scary Black Box Task</i>   | 105       |
| Appendix 4:       |  | 111       |
| 4.1               | <i>Coding Scheme for the Scary Black Box</i>   | 111       |
| Appendix 5        |  | 114       |
| Table 7a          | <i>Table of Kappa values for behaviours coded during the Scary Black Box task</i>  | 114       |
| Table 7b          | <i>Table of Pearson Product-Moment Correlation coefficients for Interrater Reliability between Two Independent Raters for behaviours coded during the Scary Black Box task</i> | 115       |
| Appendix 6        |  | 116       |
| 6.1               | <i>Informed Consent Document</i>   | 116       |
| Appendix 7        |  | 118       |
| Table 8a          | <i>Birth Weight Status and Demographics</i>  | 118       |
| Table 8b          | <i>Behavioural Inhibition and Demographics</i>   | 119       |
| Table 8c          | <i>Total Difficulties Category on the SDQ and Demographics</i>   | 120       |
| Table 8d          | <i>Total Strengths Category on the SDQ and Demographics</i>  | 121       |
| Table 9           | <i>Demographics of Study Sample in Comparison to Cohort Sample</i>   | 122       |
| Table 10          | <i>SDQ Means and Standard Deviations for the Current Sample in Comparison to the British Norms for 5-10 Year Olds</i>  | 123       |
| Appendix 8        |  | 124       |
| Table 11          | <i>Hierarchical Logistic Regression Model Building Results</i>   | 124       |

## CHAPTER 1

### INTRODUCTION

Pregnancy and birth complications result in a continuum of reproductive casualty that extends from subtle impairments in both specific and generalised cognitive, intellectual, behavioural and emotional difficulties, to death, profound disability, cerebral palsy and mental retardation (Breslau, 1995). Reproductive casualty is associated with high rates of physical, neurological, cognitive and emotional sequelae, but the biological basis of moderate and mild forms of reproductive casualty is less clear.

#### 1.1 The Definition of Low Birth Weight

Low birth weight refers to a child's weight at birth falling  $\leq 2500\text{g}$ . Low birth weight is divided into the following broad categories: Low Birth Weight (LBW) (1501 - 2500g), Very Low Birth Weight (VLBW) (1001 - 1500g), and Extremely Low Birth Weight (ELBW) ( $\leq 1000\text{g}$ ) (Liu, Sun, Neiderhiser, Uchiyama & Okawa, 2001). Low birth weight is a valid and reliable marker for defining new born infants as high risk, as it correlates with various kinds of prenatal risk factors, birth complications and neonatal disease (Breslau, et al. 1996). Low birth weight often co-occurs with other risk markers, including prematurity and size-for-gestational age. Of these, birth weight is the most reliable and easier-to-identify marker of trauma. The label 'low birth weight' is nonetheless problematic, as the literature on intrauterine trauma often uses birth weight, gestational age and prematurity interchangeably, to refer to a general marker of neonatal risk (Breslau, 1995; Drillien, Thomson, & Burgoyne, 1980; Kessinich, 2003).

#### 1.2 Increased Survival Rates of Low Birth Weight Infants

There have been significant advances in medical care along with increased access to medical care, both during pregnancy and postpartum (Bregman, 1998; Rauh, Achenbach, Nurcome, Howell, & Teti, 1988).

In wealthy nations, this has resulted in increased survival rates for at-risk neonates and a decrease in severe handicap (Aylward, Pfeiffer, Wright, & Verhulst, 1989), but it is not clear

whether the prevalence of low birth weight has remained stable (Breslau, 1995) or increased (Kessinich, 2003).

In poor and middle income nations, including South Africa, the literature is sparse, but there is evidence of improved survival for low birth weights, with prevalence ranging from 6 – 23% (Cooper, Saloojee, Bolton, & Mokhachane, 1999; Khan & Louw, 1991; Liu, et al., 2001; Molteno, 2002). It is not clear whether this rate is stable or on the increase.

### *1.2.1 The Implications of Increased Survival*

In wealthy nations, with increased survival, there has been an increase in subtle manifestations of impairment. This impairment may manifest as poor visual motor integration, spatial relations deficits, reading, language, mathematics, behavioural and emotional problems (Aylward, et al., 1989; Liu, et al., 2001). Moreover, despite the decrease in the prevalence of moderate to severe handicap, significant impairment still remains a concern (Kessinich, 2003). Poor to middle income nations and South Africa in particular, show a similar pattern (Thompson, Buccimazza, Webster, Malan, & Molteno, 1993).

#### *1.2.1.1 Behavioural Inhibition*

Impairment often manifests in low birth weight children's behaviour. Limited research on low birth weight human children suggests that such children can show either inhibited or disinhibited behavioural responses to their environment (Kagan & Snidman, 1999). In particular, anxiety- or fear-provoking situations tend to evoke behavioural responses that either appear muted, indifferent or excessive, relative to controls. Research on behavioural inhibition in animal models corroborates findings in human subjects (Weinstock, 2001).

#### *1.2.1.2 Psychopathology*

There is a relationship between low birth weight and psychopathology (Zeanah, Boris, & Larrieu, 1997). However, it is not clear whether this is a linear relationship or categorical, in which certain classes of low birth weight carry increased risk for certain kinds of psychopathology (Drillien, et al., 1980; Breslau, 1995). Nonetheless, a broad range of

psychological sequelae are related to low birth weight, including mood, anxiety, attention-deficit hyperactivity, conduct and interpersonal difficulties.

A comprehensive search of the literature did not locate any research on the relationship between behavioural inhibition and low birth weight in human subjects in the developing world, or in South Africa. There is a similar dearth of information on psychological sequelae in low birth weight children in the developing world and South Africa.

### *1.2.1.3 Demographics and Socioeconomics*

The literature documents a myriad of biological and environmental factors that influence or co-occur with low birth weight (Cheung, 2002). The most noteworthy is social class, but this relationship is not necessarily linear or unifactorial and its effect can be diluted by environmental factors in children from low socioeconomic strata (Lagerstrom, Bremme, Eneroth & Magnusson, 1990).

Other relevant demographics include mother's age, maternal education, tobacco, alcohol, nutrition, early intrauterine insult and neurological status amongst others (Diamond, et al., 2001). The influence of many of these factors is small if certain key social factors like class and maternal education are controlled for (Drillien, et al., 1980; Breslau, 1995).

## 1.3 The Present Study

This study formed part of a longitudinal cohort follow-up study aiming to further elucidate possible mechanisms underlying the associations between low birth weight and psychological sequelae along with other variables including health, nutrition, muscle development and motor skills. The sample consisted of preadolescent children of a peri-urban, working class community who attended a local community clinic.

## 1.4 Aims of the Current Study

The study aimed to draw attention to an important area of child mental health, given the relative lack of research into psychological difficulties in preadolescent, low birth weight children at a community level within South Africa. It was hypothesised that low birth weights would be of lower socioeconomic status, have greater levels of BI and psychopathology (with

mood and ADHD disorders most evident) in comparison to their normal birth weight peers. Moreover, an interactional effect between the afore-mentioned variables was expected. The literature on which these hypotheses are based is explored in the following chapter.

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## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 The Prevalence of Low Birth Weight

##### 2.1.1 *Wealthy Nations*

Despite consensus within the literature from wealthy nations that there has been a reduction in infant mortality in the last few decades, it is unclear whether the prevalence of low birth weight has changed or stabilised (Aylward, et al., 1989; Kessinich, 2003). Breslau (1995) reported that in the United States, the prevalency rate had remained stable at 7%. Whitaker et al. (1997) reported the same percentage prevalence, but did not expound on whether this was stable or had changed. Conversely, Kessinich (2003) cited a 1998 March of Dimes Birth Defects Foundation report, which reported a 10% increase in prevalence in low birth weight in the United States since the 1980s. McCormick (1997) reported that rate of VLBW births in the US had remained stable for white infants but had recently increased for African-American infants. Other countries report different prevalence rates: Walther, den Ouden, & Verloove-Vanhorick (2000) noted the prevalence of VLBW infants in the Netherlands in 1983, as 0.68%, and added that it had increased since 1983 to 0.96%.

##### 2.1.2 *Low to Middle Income Nations*

The reported prevalence rates in developing countries vary considerably. Although Molteno (2002) stated that the prevalence of VLBW in poor communities in many developing countries ranges from 13 - 43%, others have reported ranges similar to those in the developed world, at 6 - 7% (Liu, et al., 2001). Cooper, et al. (1999) reported a 6% prevalence for VLBWs at Baragwanath Hospital in Johannesburg, South Africa. Tygerberg Hospital's (Western Cape, South Africa) records from 1990 showed a 22.5 % prevalence of low birth weight, whilst the Cape Province and Cape Town Metro reported 14.84% and 14.2% respectively for that same year (Khan & Louw, 1991). The prevalence of low birth weight from the Bishop Lavis Community Clinic records, Western Cape, South Africa in 1991 were 17.6%, whilst official Western Cape Regional Health Services Council records showed an average of 20.5% for that same year. A card study in Cloetesville (a township near Stellenbosch) in 1995 showed a prevalence of 7.7%.

## 2.2 Sequelae of Low Birth Weight

Early intrauterine insult may be a primary cause of later handicap in some low birth weight infants, and handicaps possibly reflect the effect of intrauterine growth disruption during vulnerable periods of brain development (Cheung, 2002; Whitaker, et al., 1997). In childhood, low birth weight is associated with developmental delays, neuro-motor and cognitive deficits, attentional problems, hyperactivity and behavioural abnormalities (Kofman, 2002; Weinstock, 2001). In adulthood, a significant association has been found between low birth weight and the incidence of psychopathology such as mood disorders or Schizophrenia.

Low birth weight is associated with higher rates of both minor and major developmental disabilities (Kessinich, 2003). Drillien, et al. (1980) found that the percentage of severe sensory, mental or neurological handicap increased from 6% to 14% to 25% with step-down increments of 250g, from 2000g to below 1000g. Although major handicap in low birth weight children has declined due to improved care, educational and behavioural difficulties are still common (Michaeli, 1978, in Drillien, et al., 1980). Walther et al. (2000) found that 10% of the children in their Dutch national sample had one or more severe disabilities at school age.

More commonly, there is an increase in more subtle problems which affect IQ, non-verbal functioning, visual-motor and visual-spatial skills, reading, language, maths, executive functioning, overall academic achievement, behaviour and social adjustment (Aylward, et al., 1989; Breslau, 1995; Drillien, et al., 1980; Kessinich, 2003). These difficulties usually manifest as a uniform effect upon the main areas of cognitive ability, but additionally, specific deficits can manifest on top of general cognitive disability (Breslau, 1995). This category of less severe impairment is viewed in the literature as often very difficult to interpret, generally consisting of “ad hoc combinations of neurological findings, sensorineural deficits, and borderline IQ scores” (McCormick, 1997, p. 870).

Although as many as 90% of low birth weight children are without severe disabilities at school age, more than half of them meet with serious difficulties in everyday life and have to cope with learning, attention, social and emotional problems (Walther, et al., 2000). In fact,

Walther et al. (2000) go as far as to state that that about half of the VLBWs in their Dutch sample would not be able to become fully independent adults.

Such research has contributed to techniques which allow the use of neurological signs in low birth weight infants as predictors of later schooling difficulties (Amiel-Tison, 2002, Walther, et al., 2000). Walther et al. (2000) reported that abnormalities found during early, standardised clinical neurological examinations are highly predictive of later problems. This is important, for as recently as the 1980s, criticism was still being levelled at researchers for their inability to use early infant markers as predictors of future outcome (Amiel-Tison, 1976, in Drillien, et al., 1980). This predictive ability is particularly important as studies have found that all categories of low birth weight have higher percentages of children in non-mainstream schooling, and that of those children in mainstream schools, low birth weights are more impaired than controls (Drillien, et al., 1980). Low birth weights also have higher levels of enrolment in special education programmes, higher rates of attention problems, are more likely to repeat a grade and are less likely to graduate from high school (Kessinich, 2003). It is thus important to note that the majority of VLBW and at least one-third to one-half of ELBW children function within normal limits from infancy through adolescence (Kessinich, 2003).

### *2.2.1 Behavioural and Psychological Difficulties*

The association between intrauterine stress and birth weight, physical and behavioural development has a long-documented history, starting in the 1940s with studies of the relationship between emotional disturbance in pregnant mothers and later feeding difficulties in infants (Jones & Tauscher, 1978; Lou, et al., 1994; Sontag, 1941; Weinstock, 2001). However, such research has been difficult to interpret given methodological flaws. These include using objective measures to quantify stress when research has shown that subjectively perceived stress is a greater determinant of the various outcome measures than are measures based on objective severity (Lobel, 1994; Kofman, 2002).

As a result, the research available on behavioural difficulties in low birth weight children is limited to a few recent studies with sound methodology. However these studies have been limited by the ethics of research with human subjects, so a greater volume of

methodologically sound research has been developed with animal models (Weinstock, 2001). Animal models have been found to mimic human developmental and behavioural alterations (Frye & Wawrzycki, 2003; Weinstock, 2001). These models provide significant insight into the functioning of genetics, neurobiology and behaviour in human beings.

### *2.2.1.1 Behavioural Inhibition*

A commonly described set of infant postpartum responses identified within the literature on intrauterine trauma includes excessive clinging, crying, fearfulness, hyperactivity and low frustration tolerance (Meijer, 1985; Mulder, Robles de Medina, Huizink, Van den Bergh, Buitelaar, & Visser, 2002). Similar patterns of response have been seen in non-human animal studies of offspring exposed to Prenatal Stress (PS)<sup>1</sup> in which it has been shown that the Hypothalamic-Pituitary-Adrenal Axis (HPA axis) is overactive and has impaired feedback regulation (Huizink, Mulder, & Buitelaar, 2001).

Gray (1982) developed a neurological model of the functioning of the stress response systems in human beings, and identified two subsystems which regulated anxiety and impulsivity respectively. The former he called the Behavioural Inhibition System (BIS) and the latter the Behavioural Activation System (BAS). Kagan and others (Garcia-Koll, Kagan, & Reznick, 1984) developed a psychological/behavioural model of infant temperament at a similar time. According to Kagan and Snidman (1999), infants born with a low amygdalic threshold show vigorous limb movement and become easily distressed by unfamiliar stimulation. As young children, they tend to be avoidant of, or fearful towards, unfamiliar events and are referred to as inhibited. Kagan and colleagues used the phrase Behavioural Inhibition (BI), to describe a stable temperamental trait “identifiable in early childhood, characterised by a stable pattern of fearful feelings & inhibited behavioural responses to social and non-social stimuli” (Morgan, 2006, p. 270).

Kagan and Snidman (1999) describe the longitudinal path of BI, which manifests within the first few months after birth and is moderately stable up to adolescence (Schwartz,

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<sup>1</sup> Prenatal Stress is the term used within animal models to refer to intrauterine trauma, and includes markers such as low birth weight.

Snidman, & Kagan, 1999). At 4 months old, 20% of a large sample of infants were labelled “high reactive” as they fretted, cried and showed increased motor activity. When reassessed at 14 and 21 months respectively, and exposed to a variety of unfamiliar social and non-social events, infants labelled “high reactive” previously, showed significantly more fears at both ages (in comparison to low reactives and controls). These children were assessed again at four and a half years, and in comparison to controls, children labelled “high reactive” as infants showed significantly fewer verbal comments and smiles with an examiner and were more likely than children classed as “low reactive” to be classified as shy/inhibited when playing with unfamiliar peers (Kagan, Snidman, & Arcus, 1998). A proportion of the original sample was re-evaluated at seven and a half years of age, using a comprehensive framework to identify anxious versus unanxious children. More children previously classified as “high reactive” infants had acquired anxiety symptoms than those classified as “low reactive” (45% versus 15%) (Kagan, Snidman, Zentner, & Peterson, 1999). High reactives also showed fewer spontaneous comments or smiles whilst interacting with an unfamiliar person.

With further research, definitions of BI now include the fact that BI children are identifiable by a moderately stable pattern of responses including, wariness, avoidance or fear in response to unfamiliar people, objects or contexts (Zeanah, et al., 1997). BIs, as children, are avoidant of the unfamiliar, and when exposed to a stressor, will stop, become watchful and potentially retreat to the safety of their caregiver (Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Morgan, 2006; Neal & Edelman, 2003; Schwartz, Wright, Shin, Kagan, & Rauch, 2003; Tillfors, 2004). According to Neal and Edelman (2003) and Morgan (2006), such children are also characterised by their socially avoidant behaviour and longer speech latencies.

Studies have revealed a prevalence of between 10 - 20% for BI (Kagan, Reznick, & Snidman, 1988; Morgan, 2006; Tillfors, 2004; Turner, Biedel, & Wolff, 1996; Zeanah, et al., 1997) and have also shown that BI has a genetic component. Although there is not one specific gene for BI (Snidman, Kagan, Riordan, & Shannon, 1995; Zeanah, et al., 1997), BI is described as a biologically mediated temperament type (Bertolino, et al., 2005; Fox, et al., 2005; Hirschfield-Becker, et al., 2004; Kalin, Shelton, Fox, Oakes & Davidson, 2005; Moehler, et al., 2006; Morgan, 2006; Schwartz, et al., 2003; Smoller, et al., 2005). This is

because genes influencing BI may be activated and deactivated by different developmental stages (Plomin, et al., 1993; Zeanah, et al., 1997), or by modes of social interaction that include peer interactions, parenting-styles, attachment relationships and socioeconomics (Marshall, et al., 2005; Morgan, 2006; Neal & Edelman, 2003). Animal models have shown that activation/deactivation of BI may also come about as a result of differences in the degree of amygdala activity to particular stimuli (Bertolino, et al., 2005; Morgan, 2006; Schwartz, et al., 2003). Together, the child's genetics, social history and temperament determine the extent to which an event activates the stress-influenced brain structures and the subsequent emotional and behavioural responses, explaining the individual variation in response to stressors (Kagan & Snidman, 1999).

No research could be identified that directly explored the link between low birth weight and BI in human subjects. However, Huizink, et al. (2001) linked the two concepts theoretically with regard to prenatal stress and risk for early or later psychopathology and a substantive amount of research has been conducted on the PS offspring (including low birth weights) of non-human animals (Buitelaar, et al., 2003; Weinstock, 2001).

#### 2.2.1.1.1 *Animal models.*

In animal research, PS refers to markers of intrauterine trauma that include decreased size for gestational age, prematurity but more specifically low birth weight (Welberg, Seckl, & Holmes, 2001). The literature treats PS in animals as comparable to markers of human intrauterine trauma such as low birth weight. PS rats have decreased social interaction, increased anxiety in intimidating or unfamiliar situations and have changes in brain morphology and functioning similar to that seen in Schizophrenic humans (Frye & Wawrzycki, 2003; Weinstock, 2001). PS rats also show behaviour consistent with depression in humans: changes in circadian rhythm, sleep abnormalities, a deficit in the ability to experience pleasure or engage in pleasurable activities and learned helplessness (Frye & Wawrzycki, 2003; Huizink, et al (2001).

These behavioural abnormalities are associated with impaired regulation of the HPA axis response to stress and increased activity of certain stress hormones (Stansbury & Gunnar,

1994; Zeanah, et al., 1997). In a review of the literature, Weinstock (2001) states that the developmental and behavioural abnormalities in PS offspring could occur through sensitisation of the foetal brain by maternal stress hormones to the action of stress hormones and to neurotransmitters affected by them. This might have long-lasting consequences and could explain the precipitation of depression or Schizophrenia by psychosocial stress in later life (Frye & Wawrzycki, 2003; Huizink, et al, 2001). Thus, the nature of the behavioural abnormalities probably depends upon the point during the pregnancy that maternal stress is experienced and the point of development of the foetus at the time.

#### 2.2.1.1.2 *Intrauterine stress, emotion and behaviour-regulation in humans.*

In human beings, maternal exposure to stress, particularly if chronic in nature, has been found to result in activation of the maternal HPA axis (Frye & Wawrzycki, 2003; Petraglia, Florio, Nappi & Genazzani, 1996; Weinstock, 2001). This results in increased release of stress hormones, is associated with an increase in foetal HPA axis activity and the occurrence of pregnancy and birth difficulties such as low birth weight (Demyttenaere, Nijs, Evers-Kiebooms, & Koninckx, 1989; McClean et al., 1995; Wadhwa, Dunkel-Schetter, Chicz-DeMet, Porto & Sandman, 1996; Wadhwa, Porto, Garite, Chicz-DeMet & Sandman, 1998; Weinstock, 2001).

#### 2.2.1.1.3 *Intrauterine stress, emotion and behaviour-regulation in animals.*

Similar abnormal regulation of the HPA axis is seen in PS rats and non-human primates (Frye & Wawrzycki, 2003; Huizink, et al., 2001; Weinstock, 2001). Such animals have excessive stress responses and stay stressed for longer than controls (Gray, 1982; Weinstock, 2001). PS rats have abnormally raised stress hormone levels long after controls have stabilised, after repeated exposure to the same environment in the absence of stress (Katz, Roth, & Carroll, 1981; File, 1982; Fride, Dan, Feldon, Halevy, & Weinstock, 1986; Weinstock, 2001).

The failure of stress hormones to return to baseline increases the risk for a permanent alteration in the feedback regulation of the HPA axis (Frye & Wawrzycki, 2003; Weinstock,

2001). Such alterations can permanently sensitise the foetal brain to stress hormones released in subsequent stressful situations and possibly lead to supersensitivity (Slotkin, Lau, McCook, Lappi, & Seidler, 1994; Weinstock, 2001). This happens in certain forms of depression in humans and can be remedied by chronic treatment with antidepressants (Frye & Wawrzycki, 2003; Sulser, 1989; Weinstock, 2001).

#### 2.2.1.1.4 *Intrauterine stress and social interaction in humans.*

Studies by Meijer (1985) show that PS children are less sociable than their peers. This pattern of poor social interaction has also been found in PS children that subsequently develop Schizophrenia (Offord & Cross, 1969; Done, Crow, Johnstone & Sacker, 1994; Weinstock, 2001).

#### 2.2.1.1.5 *Intrauterine stress and social interaction in animals.*

The above pattern can be reproduced in animal models with as few as 30% of PS female rats initiating any contact with other rats compared to 90% for controls (Frye & Wawrzycki, 2003; Poltyrev & Weinstock, unpublished, cited in Weinstock, 2001). However, of PS rats which did initiate contact, many spent significantly more time following around the rat with which they had initially connected following the first contact. Similarly, juvenile male PS rats show reduced social interaction and “rough and tumble” play usually seen in young male rats (Ward & Stehm, 1991; Ohkawa, 1987, cited in Weinstock, 2001). PS Rhesus monkeys show much less play behaviour, exploration and cling more to other monkeys (Clarke & Schneider, 1993; Weinstock, 2001). The latter is a sign of greater anxiety in the face of novelty.

#### 2.2.1.1.6 *Intrauterine stress and anxiety behaviours postpartum.*

There are some core components of anxiety in animals that resemble those seen in humans and also respond to treatment with anxiolytic medication (Frye & Wawrzycki, 2003; Gray, 1982; Marks, 1987; Weinstock, 2001). These anxiety features include: increased startle response, decreased social interaction and exploration or lack of interest in new surroundings and may be followed by attempts to escape or freezing behaviour. In normal animals, the

response to fear-provoking situations shows a positive relationship between activity and fear over time. Activity levels increase with fear up to a point, then plateau before tapering off again (Inverted U-shaped function).

Infant rats show escape behaviour accompanied by vocalisation at mild or moderate levels of arousal, but once these are exceeded by fear and anxiety, behavioural suppression or freezing occurs with decreased vocalisation (Ginsburg et al., 1974, cited in Weinstock, 2001; Takahashi, Turner, & Kalin, 1992; Weinstock, 2001). In these same studies, PS infant rats appeared either less anxious or showed a greater measure of behavioural suppression. The latter was the favoured explanation as these rats had higher baselines of stress hormones and this behavioural suppression could be reproduced by injecting controls with stress hormones (Takahashi & Kalin, 1991; Peters, 1982; Takahashi & Rubin, 1993; Weinstock, 2001). The PS rats also show less signs of relaxation than controls and in adulthood, PS rats and monkeys show less exploration, more defecation and escape behaviour than controls in intimidating novel environments (Frye & Wawrzycki, 2003; Weinstock, 2001). Defensive withdrawal, as the opposite of exploratory behaviour, also manifests more overtly in PS rats, which show more and longer-lasting withdrawals than controls (Ward, Johnson, Salm, & Birkle, 2000; Weinstock, 2001).

#### 2.2.1.1.7 *Attention, hyperactivity and behavioural problems in human children.*

In studies with humans, low birth weights in early childhood have greater delays in walking, speech and toilet training and signs of emotional disturbance, including excessive clinging, crying, hyperactivity, low frustration threshold, unsociable and inconsiderate behaviour (Meijer, 1985; Ward, 1991; Papousek & von Hofacker, 1998; Weinstock, 2001). According to Kessinich (2003), there was a greater incidence of social-emotional and behavioural problems associated with prematurity and low birth weight, including internalising (e.g., depression, anxiety) and externalising (e.g., aggression) problems. Bhutta, Cleves, Casey, Craddock and Anand (2002) conducted a meta-analysis of 13 studies, and reported significantly higher incidence of externalising symptoms and internalising problems with low birth weight children.

According to Breslau (1995), there was a positive association between VLBW and hyperactivity in most of the studies she examined, which measured a range of behavioural domains, with one exception (Rickards, Kitchen, Doyle, et al., 1993), which found no significant difference between VLBWs and normals on any behavioural domain. These findings are supported by studies using cut-off measures of behaviour problems, which found higher rates of problems in VLBWs relative to normals. Of the three studies identified by Breslau (1995) that reported on attentional problems, all three reported a significant difference between VLBWs/ELBW and controls on teacher/parent ratings of hyperactivity/inattention. Furthermore, ELBW had cognitive deficits and attention problems in excess of VLBWs and normals. Breslau, Klein and Allen (1988 cited in Breslau, 1995) found that VLBW boys scored higher than girls on a wide range of externalising and internalising behaviour problems as rated by both parents and teachers.

A limited number of studies have reported on the prevalence of risk-taking behaviours (drug and alcohol use, sexual activity, teen pregnancy and truancy) in adolescents born prematurely, but these have contradictory findings (Kessinich, 2003). Hack, et al (2002) reported lower rates of teen pregnancy and substance abuse whilst Chilcoat and Breslau (1999) found a higher rate of drug use, although this was more closely associated with attention deficit disorder than birth weight. A third study by Bjerager, Steensberg and Greisen (1995) found no difference in alcohol and drug use in young adults.

### 2.2.2 *Psychiatric Disorders*

Behaviour disorders, particularly ADHD are common in school age, low birth weight children (Huizink, et al., 2001; Lagerstrom, et al., 1990; Whitaker, et al., 1997). Whitaker et al. (1997) found that 22% of their VLBW and ELBW sample had at least one psychiatric disorder, with ADHD being the most common (15.6 %). However, they found that neither birth weight nor gestational age independently increased the risk for ADHD. Others, such as Leckman et al. (1990), have reported a relationship between maternal perceived stress and high proportions of children with ADD (61%). This pattern was also evident in animal models, with an increase in attention deficits found in PS Rhesus monkeys whose mothers

were subjected to psychological stress during early or mid-gestation (Schneider, Roughton, Koehler, & Lubach, 1999; Weinstock, 2001).

Of the studies Breslau (1995) reviewed, only two measured psychiatric disorders as distinct from behaviour problems. Both studies found an association between ADHD and low birth weight. Breslau, et al. (1996) found that low birth weight was associated with ADHD but not Oppositional Defiant Disorder or anxiety disorders. The second study found no relation between low birth weight and conduct or mood disorders (Szatmari, Saigal, Rosenbaum, Campbell, & King, 1990; Breslau, 1995). The Breslau, et al. (1996) study also found that the association between low birth weight and ADHD was stronger in urban disadvantaged children than in those of suburban middle class. This confirmed findings by Lagerstrom, et al. (1990) and Levy-Shiff, Einat, Mogilner, Lerman and Krikler (1994).

These behavioural and psychiatric sequelae are not just confined to VLBW. McCormick, Brooks-Gunn, Workman-Daniels, Turner and Peckham (1992) found increased rates of non specific behaviour problems, whilst Breslau, et al. (1996) found higher rates of ADHD and hyperactivity at all low birth weight levels. The literature thus indicates that low birth weight is specifically associated with ADHD and inattention/hyperactivity symptom clusters (Breslau, 1995). This might be part of neurodevelopmental abnormalities, including minor neurological signs, developmental delays and low IQ. However, the link between low birth and non-specific behaviour problems/social maladjustment is less clear (Breslau, 1995; McCormick, 1997).

Although Breslau (1995) considers the link between ADHD and low birth weight in the absence of associations with other disorders (such as Oppositional Defiant, anxiety and Conduct Disorders), to be congruent with adult long-term follow up research, Kessinich (2003) expresses concern about the scarcity of research on the social-emotional and behavioural outcomes of adolescents and young adults. Buka, Tsuang, and Lipsitt (1993) found no evidence (with the exception of cognitive impairment) between low birth weight and adult psychiatric disorders including alcohol, drugs, antisocial personality disorder, mood, anxiety and psychotic disorders. Similarly, Hack et al. (2002) reported that VLBW adolescents are less likely to use alcohol and drugs, engage in sexual activity, become

pregnant, or engage in delinquent behaviours such as truancy. However, Kessinich (2003) cited Bjerager, et al., (1995) and Chilcoat and Breslau (1999), as having documented equivalent or even increased rates of risk-taking behaviours. Botting, Powls, Cooke, and Marlow (1997) along with Stevenson, Blackburn, and Pharoah (1999) also report higher incidences of externalising and internalising behaviours in low birth weight adolescents.

#### 2.2.2.1 *Prenatal Stress, Child, Adolescent & Adult Psychopathology*

An association is also described between maternal stress and an increased likelihood of Schizophrenia and depressive symptomatology in PS children as they grow older (Pasamanick & Kawi, 1956; Huttunen & Niskanen, 1978; Van Os & Selten, 1998; Mednick, Huttunen, & Wang, 1999; Weinstock, 2001).

Low birth weight, along with other pre- or perinatal complications, is a risk factor for Schizophrenia, particularly in males (Foerster, Lewis, Owen, & Murray, 1991; Jones, Rantakallio, Hartikainen, Isohanni, & Sipila, 1998; Hultman, Sparén, Takei, Murray, & Cnattingius, 1999; Weinstock, 2001). Significantly more PS adolescents whose mothers were war widows had diagnoses of Schizophrenia and mood disorders (Huttunen & Niskanen, 1978; Weinstock, 2001). Van Os and Selten (1998) confirmed this, finding an increased risk for Schizophrenia independent of gender if the stress occurred during the first trimester, whilst exposure in the second trimester resulted in an increased risk for men only. Taylor (1969) suggests that this gender difference (by the time of stress) in the incidence of Schizophrenia might be due to the slower rate of cortical development in males, which makes the male brain vulnerable to injury for a longer period. A relationship has also been found between adult psychosis and disturbed behaviour in childhood (including conduct disorders and poor social skills) for male Schizophrenics (Offord & Cross, 1969; Done, et al., 1994; Weinstock, 2001).

Another study found a significant association between participants whose mothers were exposed during the second and third trimester to severe famine during war and hospitalisation for bipolar and unipolar mood disorders, independent of gender (Van Os & Selten, 1998; Brown, van Os, Driessens, Hoek, & Susser, 2000; Weinstock, 2001). Men whose mothers

were exposed to a severe earthquake during the second trimester were found to be at increased risk for unipolar depression (Watson, et al., 1999; Weinstock, 2001).

#### 2.2.2.2 *Gender*

Findings covering gender differences in childhood psychiatric diagnoses for low birth weights are scarce, and of those studies available, the results are contradictory. Whitaker, et al. (1997) found that 6 year old low birth weight boys are significantly more likely than girls to have any psychiatric disorder, any disruptive disorder, oppositional defiant disorder, OCD and nocturnal enuresis. Male gender at 6 years of age independently predicted a diagnosis of any psychiatric disorder and ADHD, whilst female gender was a consistent protective factor. However, Lagerstrom, et al. (1990) found that low birth weight girls score higher on social disharmony at age 10 and have more concentration difficulties at both ages 10 and 13. Moreover, they reported that the symptoms of ADD (using DSM-III criteria covering aggressiveness, motor restlessness and concentration difficulties) are more pronounced in 10 year old girls of low socioeconomic status. At both ages 10 and 13, low birth weight girls scored significantly higher on lack of school motivation and concentration difficulties. Lagerstrom, et al. (1990) cited McGee, Williams and Silva, (1987) along with Berry, Shaywitz, and Shaywitz (1985) as corroboration that there are no significant behaviour differences between boys and girls diagnosed with ADHD and that these symptoms are not necessarily more common among boys. As described above, prenatal stress seems to have differential effects accordant on the time of the stress during pregnancy. However, generally low birth weight seems to amplify the risk for Schizophrenia in men more than it does for women (Weinstock, 2001). The pattern appears similar for mood disorders (Frye & Wawrzycki, 2003).

#### 2.2.3 *Intelligence and low birth weight*

Low birth weight children are consistently at increased risk for poorer cognitive and academic outcomes through infancy and childhood (Drillien, et al., 1980; Breslau, 1995; Kessinich, 2003). However, there is little research that extends into adolescence and adulthood.

Low birth weight infants show early cognitive and learning problems that later manifest in academic and learning problems and included impairments in literacy, numeracy and social adjustment. This can be generalised, but specific deficits can also manifest on top of general cognitive disability.

School age low birth weights exhibit higher rates of cognitive deficits, learning disabilities and lower scores on reading, writing, math, spelling, executive functioning and IQ across all low birth weight ranges (Aylward, et al., 1989; Breslau, 1995; Bhutta, et al., 2002; Kessinich, 2003).

The literature consistently shows a significant gradient relationship between low birth weight and IQ across all low birth weight levels. The entire low birth weight range is an average of 5 IQ points lower than normal birth weights (Breslau, 1995). These findings are maintained when socioeconomic and demographic factors are controlled for.

Adolescents have lower scores on IQ and achievement tests, higher rates of repeating a grade, enrolment in special education classes, and lower rates of graduation from high school (Kessinich, 2003). Young adults show poorer intellectual and educational outcomes and there is evidence of a link between low birth weight and adult cognitive impairment. Furthermore, intelligence is negatively related to the diagnosis of any psychiatric disorder (Whitaker, et al., 1997). However, while low birth weight children and young adults demonstrate significantly lower mean IQ scores, the majority (> 50%) score within normal limits on IQ tests (Kessinich, 2003).

### 2.3 Summary of Low Birth Weight, Cognitive, Behavioural and Psychological Problems

Biological explanations of low birth weight and its associated deficits include suboptimal development in utero, vulnerability to post natal disease and associated suboptimal brain development in infancy (Cheung, 2002, Whitaker, et al., 1997). Studies show a possible association between gestational stress, subsequent psychopathology and behavioural problems in the offspring of both animals and humans (Kofman, 2002;

Weinstock, 2001). The developing brain may be sensitised by stress hormones that make the individual more vulnerable to life stresses. One behavioural outcome of these neurological alterations is BI. Such children are avoidant of unfamiliar people, objects or contexts, and when confronted by these, respond with avoidance, fear, distress, withdrawal, mute watchfulness or the inhibition of behavioural response. The variation seen in behavioural responses to stress and psychological symptomology results from an interaction between prenatal, genetic and postnatal factors.

Low birth weight human children have higher rates of both major and minor developmental disabilities (Kessinich, 2003). They also obtain lower scores on tests of IQ, language skills, visual-motor and visual-spatial skills, academic achievement, and executive functioning. Low birth weight is associated with IQ deficits and increased risk for ADHD at school age, as distinct from more severe disability, including neurological handicaps and severe mental retardation (Whitaker, et al., 1997). There is a gradient effect between low birth weight and IQ, as well as between low birth weight and ADHD. Low birth weights, independent of class and race, are vulnerable to developmental problems including academic failure, learning disabilities and psychopathology.

Low birth weights have higher rates of internalising and externalising problems and higher rates of attention problems. The brain regions potentially affected by intrauterine trauma may also be linked to BI, ADHD and anxiety disorders (Whitaker, et al., 1997). The association between increased risk for ADHD and related symptoms with low birth weight may signal future onset of other psychiatric problems including mood disorders, obsessive compulsive disorders and Schizophrenia (Breslau, 1995; Whitaker, et al., 1997; Weinstock, 2001).

However, whilst low birth weights do demonstrate poorer outcomes compared with normals, at least one-third to a half of low birth weight children function within normal limits from infancy through adolescence (Kessinich, 2003).

Certain demographic factors such as class and race are associated with psychopathology and cognitive development, and are confounding variables if not controlled for, as they are

associated with biological determinants of low birth weight (Breslau, 1995; Kessinich, 2003). The influence of the demographic factors is small if mother's education and social class are controlled for.

The chapter which follows describes how the constructs identified in the literature were operationalised, the methods and procedures involved in measuring these constructs and details of the sample to which these measures were administered.

University of Cape Town

## CHAPTER 3

### METHODOLOGY

#### 3.1 Design

##### *3.1.1 Background*

This study formed part of a longitudinal follow up of a cohort nutrition and pregnancy study that took place between 1994 and 1995 by Dr Ali Dhansay and others at the Bishop Lavis Antenatal and Well-Baby Clinics along with the Antenatal Clinic at Tygerberg Hospital (Dhansay et al., 1995, unpublished). The original cohort study consisted of 789 participants and aimed to assess the effect of a clinic-based nutrition intervention and supplementation programme integrated into the existing primary health care system, on the nutrition and health status of pregnant women, infants and children up to 2 years of age living in the Bishop Lavis area of Cape Town.

Phase 1 consisted of a baseline descriptive study to determine the nutritional status of pregnant women and their infants (from newborn to two years of age), and to formulate a nutritional supplement for these women and children. Phase 2 consisted of a prospective cohort study to evaluate the effects of the intervention on mother and child health along with the intervention delivery mechanisms, using a before and after study design. The results of the prospective cohort study were compared to the baseline study and to the cross-sectional studies described below.

Cross-sectional surveys of the antenatal and well-baby clinics along with the community (via randomised cluster sampling) were done during recruitment of the cohort, at an interval of one year and lastly at the end of the study. The purpose was to monitor changes in the community so as to compare clinic attenders with clinic non attenders, and to gather information on mothers and children not exposed to the intervention.

The current research consisted of a series of sub-studies aiming to further elucidate possible mechanisms underlying the associations between low birth weight, health, nutrition, muscle development, motor skills and psychological sequelae.

### 3.2 *Sample*

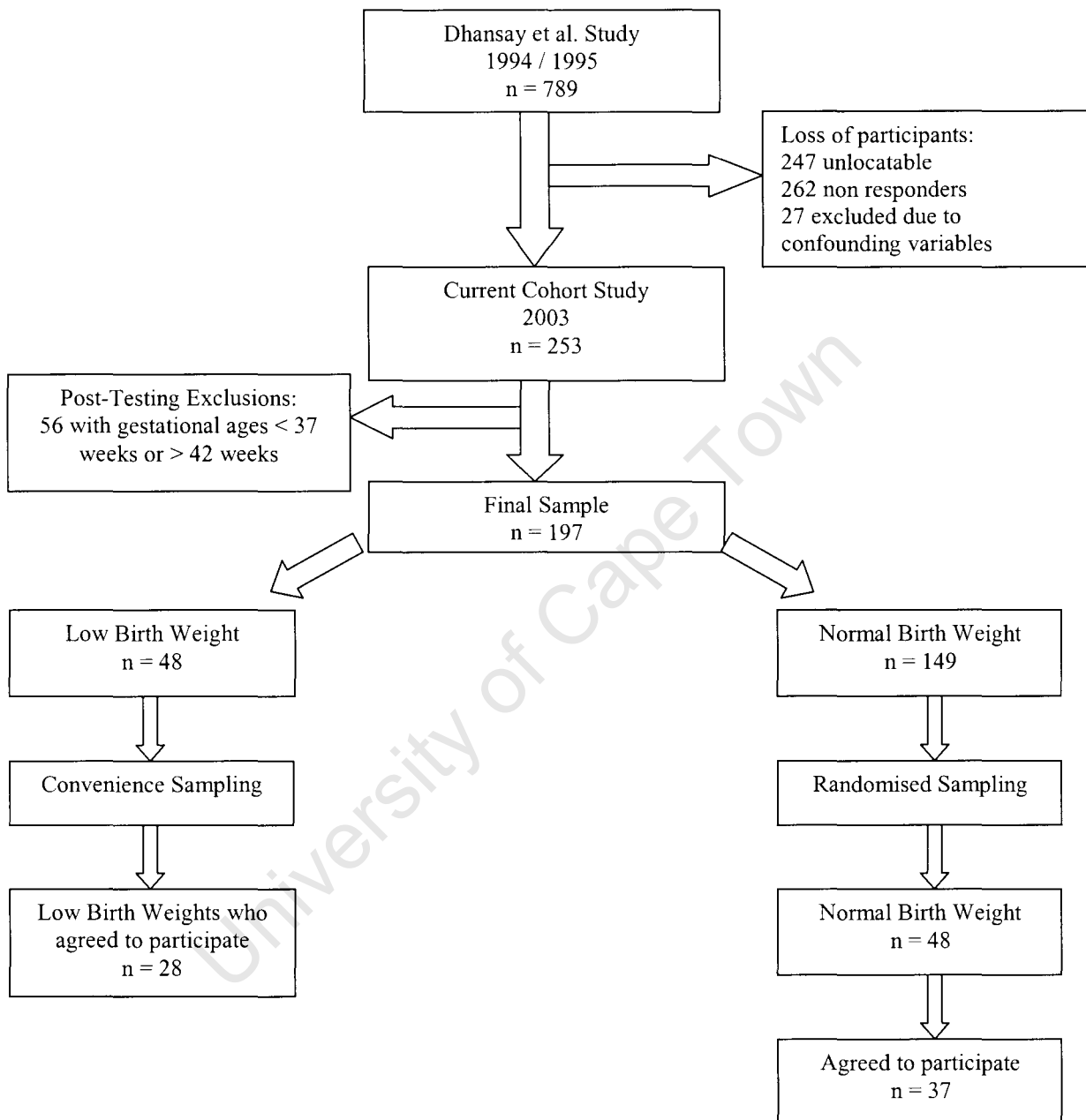
The study's primary cohort consisted of 253 mother and child pairs drawn from the original cohort on whom birth weight, maternal nutritional status and subsequent growth data were available for the first 12 months of life (see table 1). Of the remaining 535 participants, 247 could not be located, 262 did not respond, and 27 were excluded due to miscarriage, missing birth data, subsequent death of the child, twin births or child illness including cerebral palsy. A further 56 subjects were excluded after testing, due to gestational ages of less than 37 weeks or more than 42 weeks. The remaining sample of 197 participants was examined on anthropometric measures, including birth weight and salivary cortisol. The process included an initial home visit and laboratory visit, followed by a second home visit for demographic and anthropometric data, and a second laboratory visit.

The sub-sample upon which this dissertation was based, consisted of 65 English and Afrikaans-speaking children born in the Bishop Lavis Community Health Clinic drainage area and their caregivers (see Table 1). The community was urban working class, (on the outskirts of the Cape Town Metropole), predominantly of mixed ancestral origin<sup>2</sup> (Micklesfield, et al., 2006). Of this sample, 48 children were classified as low birth weight ( $\leq 2500\text{g}$ ). A total of 28 of these children were recruited via convenience sampling. A total of 48 children from the remaining sample ( $n = 149$ ) of normal birth weight children were selected via randomised selection. Of these 48, 37 agreed to participate. The remaining low and normal birth weight children were unavailable for further testing for reasons including relocation, unavailability and other commitments. All of the subjects were collected from their homes and data collection took place at the University of Cape Town Sports Science Institute laboratory, and the Child Guidance Clinic respectively.

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<sup>2</sup> Khoi, Bantu, European and East Indian, colloquially referred to as "coloured" in South Africa.

Table 1

*Consort Diagram: Sample Selection*

## 3.3 Ethical Issues

A comprehensive framework was in place during the administration of this study to minimise ethical problems that might arise. Permission for the administration of the main study was obtained from the Western Cape Department of Health, and relevant staff at the

Bishop Lavis Community Clinic. The study proposal was reviewed and approved by the Research Ethics Committees of the Department of Psychology, and Faculty of Health Sciences respectively, both situated at the University of Cape Town.

Both the participants and their caregivers were fully informed of their rights, including their right not to participate or to discontinue participation at any time. Full informed consent was obtained from the child's caregiver, as the participants were minors. Although no remuneration was offered to participants, transport costs to and from the test venues, along with meals and snacks provided during testing were paid for out of the research funds. Such provisions were deemed non-coercive as they were of limited financial value and participants benefited from these, independent of whether they completed the testing or chose to withdraw prematurely. In addition to this, participants and caregivers were informed about issues of confidentiality, which included that researchers and other relevant persons involved in the project would have no access to participants' personal information without legitimate reason. It was emphasised that this study was intended to benefit participants and caregivers directly: it would assist the community health clinic and other interested parties to develop beneficial interventions for them and their community. They were also informed that the results of the study might be used to assist other communities in the future (See Appendix 6 for Informed Consent Document).

#### 3.4 Data collection

The method of data collection involved several different formats. Demographic data was collected via questionnaires completed by the child's primary caregiver (See Appendix 1). Some responses were in a fixed response format with additional data collected via self-recorded qualitative responses to fixed questions. Some psychological and behavioural data was collected via a brief behavioural screening questionnaire with fixed response formats completed by the participant's caregiver.

### 3.5 Measures

#### 3.5.1 *Strengths and Difficulties Questionnaire*

The Strengths and Difficulties Questionnaire (SDQ) assesses psychological morbidity in children and adolescents (Haines, Mc Munn, Nazroo & Kelly; 2002; Goodman, Ford, Simmons, Gatward & Meltzer, 2000). It is a brief behavioural screening questionnaire covering 25 attributes, some positive and some negative. It explores common areas of emotional and behavioural difficulty, enquiring whether the informant thinks that the child has a problem in these areas and if so, asks about resultant distress and social impairment (Goodman, Ford, Simmons, et al., 2000). The questionnaire consists of 25 items that are divided between five scales of five items each, generating scores for conduct problems, hyperactivity-inattention, emotional symptoms, peer problems and pro-social behaviour (see Appendix 2). All but the last scale are summed to generate a total difficulties score.

The SDQ has been widely used internationally and, despite its brevity, functions as well as commonly used questionnaires (Youth in Mind, 2007). Normative data is available from Britain, Finland, Germany, Sweden and the United States of America. The pro-social behaviour scale is inline with current trends in child psychology/psychiatry, increases acceptability of instrument on behalf of informants, and makes it suitable for the general population where most children are healthy (Smedje, Broman, Hetta, & von Knorring, 1999; Youth in Mind, 2007).

The informant-rated version can be completed by either teachers or parents of 3 to 16 year olds (Goodman, 1997; Goodman, Meltzer, & Bailey, 1998; Goodman & Scott, 1997; Goodman, 1999; Goodman, 2001). Goodman, Ford, Simmons et al. (2000) reported that teachers and parents have been found to provide information of roughly equal predictive value, but that this is dependent on the type of disorder. They add that information from parents is slightly more useful for detecting emotional disorders, while information from teachers is more useful in detecting conduct and hyperactivity disorders.

Most studies have used two or more different report sources (i.e. Parent, Teacher or Self) in combination, whilst others had used only one information source, either in the short or

extended versions (Smedje et al., 1999). The Self Report version could not be used in this study, as it was only valid for 11 years of age and older (Youth in Mind, 2007). The Parent version was chosen, based on accessibility of informants, time and financial limitations. Furthermore, as the SDQ has only one question on fears and separation anxiety respectively, it was felt that the Scary Black Box measure described below, would supplement the SDQ. Further information on the SDQ questionnaires can be obtained from <http://www.sdqinfo.com>.

Goodman and Scott's (1999) comparison of the SDQ with Achenbach's Child Behaviour Checklist (CBCL) found the two to be highly correlated and to have equal diagnostic discriminative ability. The SDQ was found to be better than the CBCL at detecting inattention and hyperactivity, and at least as good at detecting internalising and externalising problems. These authors also reported high surface validity. Such results were reproduced in a study by Klasen et al. (2000) with the German SDQ and German CBCL. These were found to be highly correlated and equally able to distinguish between community and clinic samples.

Goodman (1999) found that all the SDQ scales were associated with the relevant DSM-IV diagnoses (significant at  $p < 0.002$ ) and Goodman, Ford, Simmons et al. (2000) found that the screening efficiency of the SDQ in comparison with the child's ICD-10 psychiatric diagnosis was good ( $\chi^2$  for trend = 2059,  $df=1$ ,  $p < 0.001$ ). They also found a 94.6 % specificity (at 95% confidence interval, 94.1 - 95.1%) in identifying individuals with a psychiatric diagnosis, a sensitivity of 63.3% (59.7 - 66.9%), a positive predictive value of 52.7% (49.3 - 56.1%) and a negative value 96.4% (96.0 - 96.8%) in the British Child Mental Health Survey. Goodman, Renfrew, and Mullick (2000), with a sample of British and Bangladeshi child mental health clinic patients, found that the level of chance-corrected agreement between SDQ predictions and independent clinical diagnoses was substantial and highly significant (Kendall's tau  $b$  between 0.49 and 0.73;  $p < 0.001$ ). Furthermore, SDQ prediction correctly identified 81-91% of children with definite clinical diagnoses, and norms for community-based samples predict that approximately 10% of the sample will score within the Abnormal Range, with a further 10% in the Borderline Range.

Goodman (1999) found the internal consistency of the SDQ to be good, with a mean of 0.73 and a range from 0.41 to beyond 0.80 (alpha reliability coefficients) and Smedje, et al.,

(1999) concurred (0.76). Smedje, et al. (1999) found split half reliability to be 0.78 (alpha coefficients: 0.51-0.70), and test-retest reliability to be very good at 0.96. Goodman (1999) reported test-retest reliability at 0.62 after 4 to 6 months.

### 3.5.2 *The Scary Black Box Task*

The Black Box Task was adapted by Eke (1998) from the work of Kagan and colleagues (eg. Kagan, Reznick, & Gibbons, 1989), as a measure of anxiety and BI. This included a measure of the influence of the parent-child relationship on such factors. In the task, the child is invited to explore the contents of a large black box (see Appendix 3 for full instructions). The box has four compartments, each accessed by a hole in the side of the box. The view into each of the small holes is blocked by small black curtains over each of the holes. The child is instructed to put his/her hand into the first marked hole and to feel around. Without removing the contents from the box, and without looking inside, the child is asked to describe the feel of the object inside to his/her caregiver, and to guess its identity. The caregiver is asked to help the child to describe the item, by asking questions. The child is asked to try each hole in turn, moving clockwise from the first hole, but to leave all the objects inside the box until all four compartments have been attempted. At the end, the objects are removed from the box for the participants to see what the objects are.

In addition to helping the child to describe the feel of the contents of the box, the caregiver is asked to help the child to explore each compartment in the correct order, and to encourage the child to leave the items inside the box (by making the hole smaller with his/her own hands if necessary, so that the child cannot remove items) until they have felt inside all four holes. At the end of the instructions, both caregiver and child are told that all of the objects inside the box are perfectly safe, but that some of them may be a little scary. After giving the instructions, the researcher withdraws to film the activity. If the child is reluctant to engage in the task and the caregiver is having difficulty encouraging the child to take part, the researcher suggests that the caregiver could put her hand inside to demonstrate to the child. If the child readily engages in the activity and does not appear afraid, the researcher will attempt to enhance the atmosphere of apprehension by saying “well that one wasn’t scary, but the next

one might be a bit more scary” after each hole that the child has felt inside<sup>3</sup>. If, however, the child shows signs of fear, these words are not said. Otherwise, the researcher does not intrude on the activity.

Various dimensions of mother-child engagement were coded from the video tapes of this activity, including withdrawal/approach, displays of fearfulness, hesitation and uneasiness in caregiver and child, caregiver positivity and negativity, degree of caregiver control (verbal and physical), caregiver over-protectiveness, caregiver intrusiveness or interference, caregiver facilitation of successful task completion and overall harmony and discord. The coding scheme developed is provided in Appendix 4.

### 3.5.2.1 *Reliability*

As with Eke’s (1998) study, for the purpose of establishing reliability of the coding system (given in Appendix 4) for caregiver-child interactions during the black box task, video tapes of 8 subjects were rated independently by two raters, before the remaining subjects were rated. The one rater had been trained on the Black Box task by researchers at the Winnicott Research Unit, University of Reading. Periodic checks on interrater reliability were made. In addition to caregiver behaviour rated under “global ratings” on the last page of the coding sheet (Appendix 4), caregivers’ initial behaviour when introduced to the task was rated, along with child behaviour immediately (in the 5 seconds) before and after. All instances of caregiver anxiety behaviour during the task were rated, together with child behaviour immediately (in the 5 seconds) preceding and following; and child anxious behaviour was rated, accompanied by preceding caregiver behaviour (in the previous 5 seconds).

For categorical and ordinal items (the caregiver’s initial reference to task; initial caregiver-child contingent behaviour on the introduction of the activity, and strategies used by the mother to encourage child to engage in the task), reliability was calculated using the kappa statistic (Howell, 2002) (See Appendix 5, table 7a). For interval or ratio items (all other items,

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<sup>3</sup> This exact phrasing was used throughout the study with all children that appeared unafraid during administration.

including global behaviours), reliability was calculated using Pearson Product-Moment Correlation (See Appendix 5, table 7b).

Of the 59 items coded, eight referred to the overall atmosphere and nine to strategies used by caregivers to encourage children to engage in the task (eight individual strategies along with an indication if no strategies were used). A further 12 referred to: behaviours exhibited by mothers towards children and the task; child's initial reference to task; mother's initial reference to task; child's reaction following the mother's initial reaction; whether the child put his/her hand in the hole for each of the four holes; the child's reaction to each of the four holes; the mother's reaction in the 5 seconds prior to the child's reaction for each of the four holes; and maternal 'as if afraid' behaviours. Reliability was satisfactory for 58 items. One item was dropped from the coding scheme due to unsatisfactory reliability and 15 further items (caregiver 'as if afraid' behaviours, the child's response to these behaviours and strategies to encourage the child) were omitted from analyses because they were not coded as present for the entire sample, or because analyses of these items were beyond the limits of this dissertation (Appendix 5, Tables 7a and 7b).

Of the 42 items retained in the coding scheme, all had either Kappa values ranging from 0.60 to 1 or correlation coefficients ranging from 0.56 to 1. All items were significant at  $p < 0.05$ . Eke (1998) had found satisfactory Kappa values (0.59 to 1) or correlation coefficients (0.65 to 1) for 44 items.

#### 3.5.2.2 *Comparisons between Groups*

Video footage of the caregiver and child engaging in the black box task was available for 63 subjects (two subjects were excluded. See "Data Analysis" for further details). Analyses were carried out, blind to group status, on the child's initial reference to the task, the caregiver's initial reference to the task, the child's behaviour contingent to the caregiver's reference to task, four reliable variables referring to the child placing his/her hand in each of the four holes, and eight reliable variables concerning caregiver-child contingent behaviour during the task, the twelve reliable variables concerning maternal discrete behaviours towards the child and the eight reliable variables referring to overall atmosphere.

### 3.6 Procedure/Administration

#### 3.6.1 Administration of Strengths and Difficulties Questionnaire and Scary Black

##### *Box*

During the first phase of the study at the community health clinic, participants were informed that they might be contacted at a later time for additional tests. When contact was made with the participants, caregivers were informed telephonically of the procedure, and their verbal consent for their participation obtained. Appointment dates were made for the caregiver and child to come in to the University of Cape Town Sports Science Institute and Child Guidance Clinic for testing. Each child and caregiver were collected from their home by a driver and brought to the Sports Science Institute, where they were informed of the administration procedure and their right not to participate (with no repercussions should they decline participation) and their written consent obtained (Appendix 6). Certain physiological measures were taken for the parent study, and upon completion, the caregiver and child were brought by driver to the Child Guidance Clinic. The caregiver and child were informed of the procedures, and their continued consent confirmed, before administration was started. The demographic questionnaire and the SDQ were administered simultaneously, and upon completion of these, some physiological measures were again taken, before the Scary Black Box task was administered. Upon completion of the Scary Black Box task, physiological measures were again taken, before the child and caregiver were transported home. The assessment took place over one year (July 2002 to July 2003). The division of administration times came about as a result of practical limitations including the limited number of staff trained to administer the Scary Black Box task, and a limited number of appropriate venues to administer test protocols. On all administration days, a researcher was present during the entire administration so as to assist caregivers or participants with any questions or concerns. The participants did not experience significant problems in answering questionnaires or in participating in the Scary Black Box task. All caregivers and participants received thorough debriefings immediately after administration and were reminded that should they require any further assistance at a later stage, they should make contact with the research team or their community health clinic.

### 3.7 Data Analysis

STATISTICA, Version 7 (2004) was used to conduct statistical analyses, including Chi-Square tests of Contingency, Mann Whitney U tests, and Generalised Linear Logistic Analyses. Chi-Square tests of Contingency were chosen for the purpose of examining the relationships between birth weight status and various items from the demographic data, the Scary Black Box test and the Strengths and Difficulties questionnaire for categorical data. Due to the small sample size and non-parametrics of the data, the results were adjusted for with the Fisher Exact p on 2x2 models. Mann Whitney U tests were used for ratio data to adjust for non-parametrics. These analyses were informed by those used by Eke (1998), by other literature in the field (e.g. Smedje et al., 1999), and after consultation with the literature on statistics within the field of psychology (Howell, 2002). Generalised Linear Logistic Analyses were conducted to analyse the relationship between BI and predictor variables including birth weight status and measures of socioeconomic and sociodemographic status, in order to develop an appropriate model of the interactions between these variables.

As the sample consisted of normal birth weights (> 2500g; NBW) and only those low birth weights that fell within the Low Birth Weight range (1501-2500g; LBW) (i.e., no VLBWs or ELBW), the variable, "birth weight", which was captured in ratio format, was converted into a binary variable, consisting of the integers "Low Birth Weight" and "Normal Birth Weight". Missing data was dealt with by case-wise deletion. Missing data consisted of: variables that could not be coded for the Scary Black Box Task, because the camera angle did not capture the relevant behaviour; some demographic information that had been omitted by participants or answered erroneously. Two male participants were removed from the data set prior to the analyses as more than 25% of the variables for these 2 participants were incomplete. There were no statistically significant differences between these participants and the remainder of the sample in terms of demographic data.

The following sets of comparisons were made, using Chi Square (Fisher) analysis and Mann-Whitney U tests and all low birth weights (n = 26) and controls (n = 37):

3.7.1 The demographic variables examined included age, gender, birth order and others listed in Table 2, Results Section and Appendix 7, Table 8a. The total number of

people living in the house was divided by the number of bedrooms in the home, to create an indicator of socioeconomic status: housing density. The presence or absence of 14 different assets (telephone, motor vehicle, television and others) were summed to create another indicator of socioeconomic status: asset register. Several categorical variables were condensed into binaries to allow Fishers Exact to be calculated to compensate for the small sample size. These included: maternal marital status, (married versus single, divorced/separated or widowed); and change in mother's marital status (condensed from "never", "yes, but no detail provided", "yes, in the last 2 years" or "yes, in the last 2 to 5 years", to "yes" versus "no"). The child's current health was condensed from "good", "fair" and "poor" to "good" versus "poor"; as was maternal alcohol use in pregnancy, to "never" versus "social occasions, weekends or everyday".

3.7.2 The Scary Black Box Task variables are listed in Tables 3a and 3b in the Results Section, and the coding and scoring sheets. Eke's (1998) measure of anxiety and BI explored a number of measures relevant to her research that were not part of the hypotheses in this study. These included measures of maternal mental state. All of the variables in the coding sheets for the Scary Black Box Task were coded, but items not related to the child's BI were not included in the analyses. Furthermore, a number of categorical variables were regrouped in order to allow Fishers to be calculated. These regroupings were done on the basis of sound theoretical principles identified in the literature, from descriptive analysis of the data and in consultation with a team of specialists and a statistician specialising in the psychological sciences.

The mother's initial reaction to the task was originally coded trichotomously, so further analyses were conducted with the neutral response merged with the positive response, negative response, or omitted completely. The same procedure was conducted with the child's initial reaction to the task prior to the mother's reactions, and after the mother's reactions, which were both originally scored trichotomously.

For each of the four holes, the child's reaction to the hole was coded from 13 different categories. These 13 categories were merged into either positive or negative responses.

Similarly, the mother's reaction in the five seconds preceding the child's reaction for each of the four holes were condensed into positive, negative, withdrawal and anxiety responses. They were also regrouped into positive versus negative reactions.

Counts of the number of times a mother exhibited the behaviours listed in the "Global Ratings" category of the coding sheet, including the number of prompts towards the child, mixed messages to the child, and negative comments towards the child were initially coded as ordinal. After descriptive examination of the distribution curves for these variables, the data was cut and entered dichotomously, based on the point at which the data had levelled off on the distribution curve (see Table 3b) (F. Bokhorst, personal communication, 5 September 2006).

The mother's global behaviours were originally captured trichotomously, indicating the absence of, a moderate level of, or high levels of the specific behaviour. These were regrouped into binaries so that the absence of the specific behaviour was distinct from any level of a specific behaviour and/or absence of and moderate levels of the respective behaviour were distinct from high levels of the behaviour.

Similarly, the global atmosphere between mother and child was originally coded from five rank-ordered categories. Harmony was regrouped as follows: "seldom" and "some", contrasted with "often" and "always"; then "seldom" was grouped as distinct from "some" and "often" as distinct from "always"; and finally "seldom", "some" and "often" as distinct from "always". Discord was grouped as "none" versus "seldom", and "some" versus "always"; and furthermore, as "none", "seldom" and "some" versus "often".

A binary variable was created for BI by summing the number of anxiety responses over the four holes of the Scary Black Box task, and analysing the distribution of this count. The data was cut such that the lowest quartile was labelled BI versus the remainder, which was labelled Normal to Disinhibited. This variable was used to simplify analyses which compared BI to demographic variables and psychopathology.

- 3.7.3 For the Strengths and Difficulties questionnaire listed in Table 4, Results Section , the emotional, conduct, hyperactivity, peer and total difficulties scales as well as the prosocial abilities scale were originally coded as trichotomies. For each of the scales, the categories were regrouped so that the “normal” and “borderline” categories were merged as distinct from the “abnormal” category. These results were then compared to birth weight status, BI status and demographic variables.
- 3.7.4 Logistic Regression Analyses were conducted to explore the relationship between BI and predictor variables including birth weight status, asset register (as a measure of socioeconomic status) along with demographic and SDQ variables that were found to be significantly related to BI (see table 3c and Appendix 7, table 8b). BI was entered as the dependent variable, whilst birth weight status and asset register were entered as predictor variables along with one SDQ variable (prosocial behaviour categorised) and two sociodemographic ones (birth order and number of pregnancies) that were subsequently found to be significant in comparison to BI.

In the chapter that follows, the results of the above-described measures are statistically analysed in accordance with the methodological structure described above.

## CHAPTER 4

## RESULTS

There were 34 males and 29 females, with ages ranging from 7 to 9 years, with a mean age of 8.2 years (SD = 0.7). The study sub-sample was representative of the main cohort sample, with two exceptions (see Appendix 7, Table 9): significantly more mothers were unemployed and there were significantly more LBWs in the sub-sample than in the cohort. The latter was expected given that the study format required as even a number of LBWs and NBWs as possible.

Table 2

*Descriptive Statistics of Demographics by Birth Weight Status*

| Variable  | Normal Birth Weights |             | Low Birth Weights |             | n     | p <sup>b</sup>      |
|---|----------------------|-------------|-------------------|-------------|-------|---------------------|
|   | n                    | M (SD)      | n                 | M (SD)      |       |                     |
| Age (years)   | 37                   | 8.02 (0.73) | 26                | 8.17 (0.66) | 63    | 0.20 <sup>a</sup>   |
| Males/Females (%)   | 22/15                | (59.5/40.5) | 12/14             | (46.2/53.8) | 34/29 | 0.22                |
| Child breastfed - yes/no (%)  | 36/1                 | (97.3/2.7)  | 20/6              | (76.9/23.1) | 56/7  | 0.02 <sup>*</sup>   |
| Total number of siblings  | 37                   | 3.30 (1.43) | 26                | 2.65 (0.89) | 63    | 0.03 <sup>*</sup>   |
| Child's number of living siblings   | 37                   | 3.14 (1.13) | 26                | 2.69 (0.93) | 63    | 0.05 <sup>a**</sup> |
| Birth order   | 37                   | 2.59 (1.17) | 26                | 1.96 (1.11) | 63    | 0.02 <sup>*</sup>   |
| Child current health: good/poor (%)   | 34/3                 | (91.9/8.1)  | 25/1              | (96.2/3.8)  | 59/4  | 0.45                |
| Housing Density (persons/ no of bedrooms)   | 37                   | 3.8 (1.83)  | 26                | 3.5 (1.80)  | 63    | 0.29                |
| Asset Register ( out of 14 items)   | 37                   | 7.24 (2.74) | 26                | 6.19 (2.71) | 63    | 0.06 <sup>**</sup>  |
| Mother's level of education (in years)  | 37                   | 4.62 (1.21) | 26                | 4.96 (2.16) | 63    | 0.49 <sup>a</sup>   |
| Mother employed vs unemployed (%)   | 9/27                 | (25/75)     | 6/19              | (24/75)     | 15/46 | 0.59                |
| Mother's alcohol use pregnancy: social occasions, weekends or everyday vs never (%) | 2/35                 | (5.4/94.6)  | 18/8              | (69.2/30.8) | 20/43 | 0.01 <sup>*</sup>   |
| Mother's smoking pregnancy – yes/no (%)   | 19/18                | (51.4/48.6) | 14/12             | (53.8/46.2) | 33/30 | 0.52                |
| Mother's number of pregnancies  | 37                   | 3.3 (1.22)  | 26                | 3.08 (0.98) | 63    | 0.22 <sup>a</sup>   |
| Marital status of mother (single, divorced/separated, widowed vs married) (%)       | 15/22                | (40.5/59.5) | 12/14             | (46.2/53.8) | 27/36 | 0.43                |
| Ever a change in mother's marital status (yes/no) (%)                               | 34/3                 | (91.9/8.1)  | 19/7              | (73.1/26.9) | 53/10 | 0.05 <sup>**</sup>  |
| Biological father living/not living with mother (%)                                 | 20/17                | (54.1/45.9) | 15/11             | (57.7/42.3) | 35/28 | 0.49                |
| Father employed vs unemployed (%)   | 23/5                 | (82.1/17.9) | 14/1              | (93.3/6.7)  | 37/6  | 0.30                |
| Biological father gives/doesn't give financial support (%)                          | 29/8                 | (78.4/21.6) | 16/10             | (61.5/38.5) | 45/18 | 0.12                |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed;  
\* = p < 0.05; \*\* = p < 0.1;

#### 4.1 Demographics and Birth Weight Status

Statistical analyses supported the hypothesis that LBWs and NBWs would not differ significantly in terms of demographic variables, and that if there were significant differences, they would be such that low birth weights would be more sociodemographically deprived than normals.

LBWs did not differ significantly from NBWs in respect of age, gender, grade, and a host of other demographic variables listed in Table 2 and Appendix 7, Table 8a. Both NBWs and LBWs lived in crowded living circumstances, with 3.7 (0.8) people per bedroom. Their mothers had 4.8 (1.7) years of education ( $\approx$ Grade 5). The majority of mothers smoked during pregnancy (52.4%) and had high levels of unemployment (75.4%). A total of 57.1% of mothers were married whilst 42.9% were single. Mothers had an average of 3.2 (1.1) pregnancies. Most biological fathers lived with the child's mother (55.6%), were employed (86%), and provided financial support for their child (71.4%). Most families' incomes were generated through formal employment (62.9%). All families had access to basic amenities including water (mainly through indoor plumbing (61.9%)), sanitation (96.1% had flushing toilets) and refuse collection. Most children (93.7%) and their siblings (95.2%) were of good health. However, many children were one year older than expected for their school grade (22.2%).

Nonetheless, there were a number of variables on which LBWs differed significantly from NBWs (See Table 2). LBWs had significantly less siblings and living siblings, were lower in birth order and less likely to have been breastfed as infants. Significantly more mothers of LBWs had consumed alcohol during pregnancy, despite no physiological evidence of Foetal Alcohol Syndrome during physical and medical examinations. The assets register indicated that LBWs were of lower socioeconomic status than those of NBWs. This approach to significance was related to ownership of motor vehicles, microwaves and fridges. Furthermore, significantly more mothers of NBWs had had a change in marital status during their lifetime than those of LBWs, but as all the participants omitted to provide qualitative details of changes, this result is difficult to interpret.

## 4.2 The Scary Black Box Task and Birth Weight Status

The results that follow support the hypothesis that LBW children display more inhibited behaviour in comparison to NBWs, who tend display appropriate levels of anxiety. The analyses are described below (See Tables 3a and 3b).

Table 3a

*Birth Weight Status and Scary Black Box Task Variables*

|                                | Variable   | Normal Birth Weights |                  | Low Birth Weights |                  | n       | p <sup>b</sup>      |
|--------------------------------|--|----------------------|------------------|-------------------|------------------|---------|---------------------|
|                                |  | n                    | M (SD)           | n                 | M (SD)           |         |                     |
| Initial Reaction               | Child (positive vs negative vs neutral) (%)                                    | 14/13/0              | (51.9/48.1/0)    | 8/6/3             | (47.1/35.3/17.6) | 22/19/3 | 0.07 <sup>c**</sup> |
|                                | Mother (positive vs negative) (%)  | 13/7                 | (65/35)          | 6/8               | (42.9/57.1)      | 19/15   | 0.18                |
|                                | Child's reaction after mother's reaction (positive vs negative or neutral) (%) | 13/14                | (48.2/51.8)      | 5/12              | (29.4/70.6)      | 18/26   | 0.22                |
| Hole 1                         | Child places hand in hole (yes/no) (%)   | 36/1                 | (97.3/2.7)       | 26/0              | (100/0)          | 62/1    | 0.59                |
|                                | Child's reaction to hole (relaxed/anxious) (%)                                 | 12/24                | (33.3/66.6)      | 12/12             | (50/50)          | 24/36   | 0.15                |
|                                | Mother's reaction in the 5 seconds preceding the child's reaction to hole      | 24/4                 | (85.7/14.3)      | 16/3              | (84.2/15.8)      | 40/7    | 0.60                |
| Hole 2                         | Child places hand in hole (yes/no) (%)   | 36/1                 | (97.3/2.7)       | 25/1              | (96.2/3.8)       | 61/2    | 0.66                |
|                                | Child's reaction to hole (relaxed/anxious) (%)                                 | 2/33                 | (5.7/94.3)       | 8/16              | (66.7/33.3)      | 10/49   | 0.01 <sup>*</sup>   |
|                                | Mother's reaction in the 5 seconds preceding the child's reaction to hole      | 3/12/12              | (11.1/44.4/44.4) | 0/14/5            | (0/73.7/26.3)    | 3/26/17 | 0.09 <sup>c**</sup> |
| Hole 3                         | Child places hand in hole (yes/no)   | 36/1                 | (97.3/2.7)       | 25/1              | (96.2/3.8)       | 61/2    | 0.66                |
|                                | Child's reaction to hole (relaxed vs anxious) (%)                              | 5/30                 | (14.3/85.7)      | 11/13             | (45.8/54.2)      | 16/43   | 0.01 <sup>*</sup>   |
|                                | Mother's reaction in the 5 seconds preceding the child's reaction to hole      | 19/8                 | (70.4/29.6)      | 18/0              | (100/0)          | 37/8    | 0.01 <sup>*</sup>   |
| Hole 4                         | Child places hand in hole (yes/no)   | 36/1                 | (97.3/2.7)       | 25/1              | (96.2/3.8)       | 61/2    | 0.66                |
|                                | Child's reaction to hole (relaxed vs anxious) (%)                              | 4/31                 | (11.4/88.6)      | 8/16              | (33.3/66.7)      | 12/47   | 0.04 <sup>*</sup>   |
|                                | Mother's reaction in the 5 seconds preceding the child's reaction to hole      | 20/7                 | (74.1/25.9)      | 16/2              | (88.9/11.1)      | 36/9    | 0.20                |
| No of holes completed by child |  | 37                   | 3.89 (0.52)      | 26                | 3.89 (0.59)      | 63      | 0.41 <sup>a</sup>   |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;  
\* =  $p < 0.05$ ; \*\* =  $p < 0.1$ ;

## 4.2.1 Initial Behaviour

When initially informed of and exposed to the task box, the childrens' responses approached significance ( $p < 0.1$ ), with more NBWs showing anxious responses in contrast to LBWs, who showed more neutral responses. Although non-significant, the mother's response to being informed of and initially exposed to the task revealed that mothers of NBWs showed

more positive responses, whereas those of LBWs showed more negative responses. Mothers' responses did not appear contingent upon their child's initial response by birth weight status.

Although non-significant, the child's response following his/her mother's response, showed that NBWs' responses were almost equally distributed between positivity, negativity and neutrality, whilst LBWs showed more negative and neutral responses. NBWs' responses seemed unaffected by the kind of maternal reaction in the preceding 5 seconds, whilst some LBWs showed a change from neutrality to anxiety.

#### 4.2.2 *Hole 1*

For Hole 1, the majority of mothers displayed positive behaviour in the 5 seconds prior to the child's response to the hole, but this was non significant by the birth weight status. Although non-significant, the majority of NBW children showed anxious reactions to the hole, whilst LBWs were equally distributed between anxious and relaxed responses. Nevertheless, all of the participants placed their hand in the hole.

#### 4.2.3 *Hole 2*

Although only approaching significance ( $p = 0.09$ ), mothers of LBWs in the 5 seconds preceding the child's reaction to Hole 2, showed no anxiety behaviour. However, fewer LBW mothers showed positive behaviours than those of normals, who tended to show responses that were either relaxed or positive. The child's reaction to Hole 2 was significant, with many more controls exhibiting anxiety responses (withdrawal or anxiety in combination with withdrawal) than LBWs, who showed more relaxed behaviour. Again, all the children placed their hand in the hole.

#### 4.2.4 *Hole 3*

The mothers' reaction in the 5 seconds prior to the child's reaction to Hole 3 was significant, with almost a third of NBW mothers showing anxiety behaviours whilst LBW mothers displayed only positive behaviours and no anxiety behaviours at all. The child's reaction to Hole 3 was significant, with the majority of NBWs showing anxiety responses (usually hesitation) than LBWs who were almost evenly distributed between relaxed and

anxious behaviour. Again, all the children put their hands in the third hole, completing the task.

#### 4.2.5 Hole 4

The mother's reaction in the 5 seconds preceding the child's reaction to Hole 4 was not related to birth weight, although the majority of both LBWs and NBWs participants responded positively. The child's response to Hole 4 was significant, with more LBWs showing a relaxed reaction, whilst more NBWs showed an anxious reaction. Again, all participants placed their hands in Hole 4.

The total number of holes (all four holes in the task) completed by the child did not reach significance, as 61 out of 65 children placed their hand in all four holes.

Table 3b

#### *Birth Weight Status and Scary Black Box Global Variables*

| Global Variables  | Normal Birth Weights |             | Low Birth Weights |             | n     | p <sup>b</sup>      |
|---|----------------------|-------------|-------------------|-------------|-------|---------------------|
|   | n                    | M (SD)      | n                 | M (SD)      |       |                     |
| Mother's number of mild prompts (count)   | 28                   | 3.82 (4.75) | 19                | 2.16 (3.22) | 47    | 0.08 <sup>a**</sup> |
| Mother's number of strong prompts cut at 0-4 vs 5 or more (%)                           | 25/3                 | (89.3/10.7) | 19/0              | (100/0)     | 44/3  | 0.35                |
| Mother's number of global mild directives cut at 0-3 vs 4 or more (%)                   | 26/2                 | (92.9/7.1)  | 14/5              | (73.7/26.3) | 40/7  | 0.08 <sup>**</sup>  |
| Mother's number of global strong directives (count)                                     | 28                   | 0 (0)       | 19                | 0.05 (0.23) | 47    | 0.11 <sup>a</sup>   |
| Mother's number of global mild physical control or guidance cut at 0-4 vs 5 or more (%) | 26/2                 | (92.9/7.1)  | 19/0              | (100/0)     | 45/2  | 0.23                |
| Mother's number of global strong physical control (count)                               | 28                   | 0.07 (0.26) | 19                | 0.05 (0.23) | 47    | 0.45 <sup>a</sup>   |
| Mother's number of mixed messages (0 vs 1 or more) (%)                                  | 24/4                 | (85.7/14.3) | 19/0              | (100/0)     | 43/4  | 0.11                |
| Mother's number of positive verbal comments to child (count)                            | 28                   | 0.11 (0.42) | 19                | 0.05 (0.23) | 47    | 0.45 <sup>a</sup>   |
| Mother's number of positive behaviours to child (count)                                 | 28                   | 3.54 (2.50) | 19                | 2.58 (2.27) | 47    | 0.13 <sup>a</sup>   |
| Mother's number of positive verbal comments about the task (0-1 vs 2 or more) (%)       | 27/1                 | (96.4/3.6)  | 17/2              | (89.5/10.5) | 44/3  | 0.36                |
| Mother's number of negative verbal comments to child (0-2 vs 3 or more) (%)             | 24/4                 | (85.7/14.3) | 18/1              | (94.7/5.3)  | 42/5  | 0.32                |
| Mother's number of negative verbal comments about task (count)                          | 28                   | 0.3 (0.97)  | 19                | 0.11 (0.32) | 47    | 0.49 <sup>a</sup>   |
| Mother sets clear boundaries (not at all/some of time vs always where appropriate) (%)  | 17/10                | (63.0/37.0) | 10/9              | (56.2/47.4) | 27/19 | 0.35                |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed;

\* = p < 0.05; \*\* = p < 0.1;

Table 3b continued...

*Birth Weight Status and Scary Black Box Global Variables*

| Global Variables  | Normal Birth Weights |                 | Low Birth Weights |               |         |                |
|---|----------------------|-----------------|-------------------|---------------|---------|----------------|
|   | n                    | M (SD)          | n                 | M (SD)        | n       | p <sup>b</sup> |
| Mother confuses boundaries (not at all vs some of time/nearly always) (%)           | 19/8                 | (70.4/29.6)     | 19/0              | (100/0)       | 38/8    | 0.01*          |
| Mother accepts child's agenda (not at all vs some or all of the time) (%)           | 8/19                 | (29.6/70.4)     | 2/17              | (10.5/89.5)   | 10/36   | 0.12           |
| Mother rejects the child's agenda (not at all vs some of time vs nearly always) (%) | 12/14/1              | (44.4/51.9/3.7) | 17/2/0            | (89.5/10.5/0) | 29/16/1 | 0.01*          |
| Mother's taking-over behaviour (a little vs often) (%)                              | 18/10                | (64.3/35.7)     | 16/3              | (84.2/15.8)   | 34/13   | 0.12           |
| Mother's overprotective behaviour (a little vs often) (%)                           | 28                   | 59.6            | 19                | 40.4          | 47      | 0.16           |
| Atmosphere of harmony between mo & child (seldom & some vs often & always) (%)      | 19/9                 | (67.9/32.1)     | 9/10              | (47.4/52.6)   | 28/19   | 0.14           |
| Global atmosphere of discord between mo & child (none vs seldom, some & often) (%)  | 12/16                | (42.9/57.1)     | 15/4              | (78.9/21.1)   | 27/20   | 0.02*          |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed;  
\* = p < 0.05; \*\* = p < 0.1;

#### 4.2.6 Global Behaviours

##### 4.2.6.1 Mothers' Discrete Behaviours

Few analyses of the mothers' discrete behaviours during the task were significant. The mother's global number of mild prompts approached significance, with NBW mothers giving more mild prompts than those of LBWs. The mother's number of strong prompts was non-significant: LBW mothers and NBWs gave a similar number of prompts. Mothers' global number of mild directives approached significance, with NBW mothers performing a greater number of between zero and three directives, whilst slightly more LBWs made four or more directives. Strong directives were non-significant. The mother's use of mild (guidance) or strong physical control were also non-significant: both sets of mothers made four or less counts of mild guidance, and almost no examples of strong physical control were evident.

##### 4.2.6.2 Mothers' Communications or Behaviours to her Child

The global number of mixed messages and mother's positive verbal comments towards her child were non-significant; nearly all mothers showed no mixed messages or positive behaviour towards their children. Positive behaviours towards the child were also non-significant, despite NBW mothers displaying slightly more instances of positive behaviour towards their children than those of LBWs. Maternal positive references to the task, negative

behaviours towards the child and negative comments about the task were also non-significant, with almost all mothers showing no instances of these behaviours.

#### 4.2.6.3 *Mothers' Boundary Setting and Acceptance of her Child's Agenda*

There was no significant difference between NBW and LBW mothers in setting boundaries, despite more LBW mothers always setting boundaries when appropriate. However, significantly more NBW mothers confused boundaries than LBWs, who showed no instances of such behaviour. Maternal acceptance of the child's agenda was non-significant whilst maternal rejection of the child's agenda was significant, with more NBW mothers rejecting their child's agenda some or all of the time, compared to LBW mothers.

#### 4.2.6.4 *Mothers' Taking-Over and Overprotective Behaviour*

Maternal taking over and overprotective behaviour were not significant. The majority of the sample displayed both to a limited degree, independent of birth weight.

#### 4.2.6.5 *Global Atmosphere between Mother and Child*

There was no significant difference in the global atmosphere of harmony between mother and child, whilst the global atmosphere of discord between mother and child was significant, with the majority of LBW mother child dyads showing no discord, whilst NBWs showed more even distribution across levels of discord.

### 4.2.7 *Behavioural Inhibition and Demographics*

The binary variable BI (the lowest quartile of sum of the number of anxiety responses over the four holes of the Scary Black Box task) described under "Methodology" was used to analyse demographics by BI status. There were n=9 children classified as "BI", with n=50 classified as "Normal". Few demographic variables presented as significant in comparison to BI status (see Table 3c and Appendix 7, Table 8b).

The 90% of BI and Normals were breastfed as infants and had an average of 3 (1.3) siblings. Most children (93.2%) and their siblings (94.9%) were in good health. A number of children (22%) were one year older than the expected age for their grade.

Both BIs and normals had high housing densities ( $M = 3.7$  (1.8)) and mothers with low levels of education ( $M = 4.8$  (1.7)), 75% of whom were unemployed. A total of 84.8% of mothers had never used alcohol in pregnancy, whilst 52.5% smoked during pregnancy. More than half of mothers (59.3%) were married and 85% had had a change in marital status in their lifetime. Of the children's biological fathers, 57.6% lived with the child's mother, 86% were employed, and 75% contributed financially to their child's care. Most families sourced their income through employment (62.9%).

All families had access to water (91% via indoor taps), sanitation (64% had indoor flushing toilets) and refuse collection. Only one family did not have electricity.

A significantly ( $p < 0.01$ ) greater percentage of BIs were LBW (88.9%) than children who exhibited fear responses within the normal range. BI children were significantly lower in birth order, and their families had a significantly lower asset register score, which was contributed to by significantly lower proportions of radios, fridges and telephones. They also had lower proportions of cars, washing machines and microwaves, but these only approached significance.

Mothers of BIs had had significantly fewer pregnancies than mothers of children with normal fear responses. BI children also had fewer living siblings and had a higher housing density but these only approached significance ( $p < 0.1$  and  $p = 0.1$  respectively).

Table 3c

*Behavioural Inhibition by Demographics*

| Variable  | Normal |             | Behaviourally Inhibited |             | p <sup>b</sup> |                     |
|---|--------|-------------|-------------------------|-------------|----------------|---------------------|
|   | n      | M (SD)      | n                       | M (SD)      | n              | p                   |
| Birth Weight (Normal vs Low) (%)  | 34/16  | (68.0/32.0) | 1/8                     | (11.1/88.9) | 35/24          | 0.002*              |
| Age (years)   | 50     | 8.10 (0.71) | 9                       | 8.03 (0.74) | 59             | 0.42 <sup>a</sup>   |
| Males/Females (%)   | 30/20  | (60.0/40.0) | 4/5                     | (44.4/55.5) | 34/25          | 0.31                |
| Child breastfed – no/yes (%)  | 5/45   | (10.0/90.0) | 1/8                     | (11.1/88.9) | 6/53           | 0.65                |
| Total number of siblings  | 50     | 3.14 (1.31) | 9                       | 2.65 (0.73) | 59             | 0.14 <sup>a</sup>   |
| Child's number of living siblings   | 50     | 3.04 (1.09) | 9                       | 2.44 (0.73) | 59             | 0.08 <sup>a**</sup> |
| Birth order   | 50     | 2.50 (1.16) | 9                       | 1.67 (0.71) | 59             | 0.02 <sup>a*</sup>  |
| Child current health: good/poor (%)   | 46/4   | (92.0/8.0)  | 9/0                     | (100/0.0)   | 55/4           | 0.51                |
| Housing Density (persons/ no of bedrooms)   | 50     | 3.57/(1.76) | 9                       | 4.52 (2.12) | 59             | 0.10 <sup>a</sup>   |
| Asset Register ( out of 14 items)   | 50     | 6.24 (2.50) | 9                       | 3.56 (2.51) | 59             | 0.004 <sup>a*</sup> |
| Mother's level of education (in years)  | 50     | 4.80 (1.68) | 9                       | 4.22 (1.20) | 59             | 0.19 <sup>a</sup>   |
| Mother employed vs unemployed (%)   | 12/36  | (25.0/75.0) | 2/7                     | (22.2/77.8) | 14/43          | 0.61                |
| Mother's alcohol use pregnancy: social occasions, weekends or everyday vs never (%) | 7/43   | (14.0/86.0) | 2/7                     | (22.2/77.8) | 9/50           | 0.21                |
| Mother's smoking pregnancy – yes/no (%)   | 25/25  | (50.0/50.0) | 6/3                     | (66.7/33.3) | 31/28          | 0.29                |
| Mother's number of pregnancies  | 50     | 3.32 (1.15) | 9                       | 2.67 (0.71) | 59             | 0.04 <sup>a*</sup>  |
| Marital status of mother (single, divorced/separated, widowed vs married) (%)       | 22/28  | (44.0/56.0) | 2/7                     | (22.2/77.8) | 24/35          | 0.20                |
| Ever a change in mother's marital status (yes/no) (%)                               | 42/8   | (84.0/16.0) | 7/2                     | (77.8/22.8) | 49/10          | 0.48                |
| Biological father living/not living with mother (%)                                 | 27/23  | (54.0/46.0) | 7/2                     | (77.8/22.2) | 34/25          | 0.17                |
| Father employed vs unemployed (%)   | 31/5   | (86.1/13.9) | 5/1                     | (83.3/16.7) | 36/6           | 0.63                |
| Biological father gives/doesn't give financial support (%)                          | 37/13  | (74.0/26.0) | 7/2                     | (77.8/22.2) | 44/15          | 0.59                |

a = Mann-Whitney Z Adj.usted. One tailed; b = Fishers Exact, One tailed:  
 \* = p < 0.05; \*\* = p < 0.1;

#### 4.3 The Strengths and Difficulties Questionnaire and Birth Weight Status

The five scales of the SDQ, entered both as categoricals or binaries, did not approach significance (See Table 4), with the exception of the Prosocial Abilities Scale.

This scale approached significance ( $p < 0.1$ ), when condensed to a 2 x 2 model. However when the significance level was corrected with the Fisher Exact, the significance level for the one-tailed test dropped to  $p = 0.17$ . The Total Strengths score was not significant.

Table 4

*Birth Weight Status and SDQ Variables*

| variable  | Normal Birth Weights |                  | Low Birth Weights |                  | n        | p <sup>b</sup>    |
|---|----------------------|------------------|-------------------|------------------|----------|-------------------|
|   | n                    | M (SD)           | n                 | M (SD)           |          |                   |
| Emotional Difficulties (normal vs borderline vs abnormal) (%)     | 14/2/20              | (38.8/5.6/55.6)  | 10/1/15           | (38.5/3.8/57.7)  | 24/3/35  | 0.95 <sup>c</sup> |
| Emotional Difficulties (normal vs abnormal) (%)                   | 16/20                | (44.4/55.6)      | 11/15             | (42.3/57.7)      | 27/35    | 0.54              |
| Conduct Difficulties (normal vs borderline vs abnormal) (%)       | 9/10/17              | (25.0/27.8/47.2) | 9/4/13            | (34.6/15.4/50.0) | 18/14/30 | 0.47 <sup>c</sup> |
| Conduct Difficulties (normal vs abnormal) (%)                     | 19/17                | (52.8/47.2)      | 13/13             | (50.0/50.0)      | 32/30    | 0.52              |
| Hyperactivity Difficulties (normal vs borderline vs abnormal) (%) | 27/9/0               | (45.0/25.0/0.0)  | 19/7/0            | (73.1/26.9/0)    | 46/16/0  | 0.55              |
| Hyperactivity Difficulties (normal vs abnormal) (%)               | 25/11                | (69.4/30.6)      | 17/9              | (63.4/34.6)      | 42/20    | 0.47              |
| Peer Difficulties (normal vs borderline vs abnormal) (%)          | 13/7/16              | (36.2/19.4/44.4) | 11/2/13           | (42.3/7.7/50.0)  | 24/9/29  | 0.43 <sup>c</sup> |
| Peer Difficulties (normal vs abnormal) (%)                        | 20/16                | (55.6/44.4)      | 13/13             | (50/50)          | 33/29    | 0.43              |
| Prosocial abilities (normal vs borderline vs abnormal) (%)        | 34/2/0               | (94.4/5.6)       | 23/1/2            | (88.5/3.8/7.7)   | 57/3/2   | 0.23 <sup>c</sup> |
| Prosocial abilities (normal vs abnormal) (%)                      | 36/0                 | (100/0)          | 24/2              | (92.3/7.7)       | 60/2     | 0.17              |
| Total Difficulties Score (normal vs borderline vs abnormal) (%)   | 8/9/19               | (22.2/25/52.8)   | 7/4/15            | (26.9/15.4/57.7) | 15/13/34 | 0.65 <sup>c</sup> |
| Total Difficulties (normal vs abnormal) (%)                       | 17/19                | (47.2/52.8)      | 11/15             | (42.3/57.7)      | 28/34    | 0.45              |

a = Mann-Whitney Z Adj.usted. One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;

\* = p < 0.05; \*\* = p < 0.1;

Table 5a

*SDQ Percentage Distribution across Score Cutoff Ranges*

| Variable                  | Total Sample |                   |            |                   |        |      | Total n |
|---------------------------|--------------|-------------------|------------|-------------------|--------|------|---------|
|                           | Abnormal     |                   | Borderline |                   | Normal |      |         |
|                           | n            | %                 | n          | %                 | n      | %    |         |
| Emotional                 | 35           | 56.5 <sup>a</sup> | 3          | 4.8               | 24     | 38.7 | 62      |
| Conduct                   | 30           | 48.4 <sup>a</sup> | 14         | 22.6 <sup>a</sup> | 18     | 29.0 | 62      |
| Hyperactivity Inattention | 0            | 0.0               | 16         | 25.8 <sup>a</sup> | 46     | 74.2 | 62      |
| Peer                      | 29           | 46.8 <sup>a</sup> | 9          | 14.5 <sup>a</sup> | 24     | 38.7 | 62      |
| Pro-social                | 2            | 3.2               | 3          | 4.8               | 57     | 91.9 | 62      |
| Total Difficulties        | 34           | 54.8              | 13         | 21.0 <sup>a</sup> | 15     | 24.2 | 62      |

a = > than expected % for category (>10%)

However, the Emotional, Conduct, Hyperactivity-Inattention, Peer and Total Difficulties Scales (see Table 5a & 5b, and Appendix 7, Table 10) had greater than expected percentage distributions in the Abnormal and/or Borderline score categories. According to Haines, et al. (2002), Borderline cases should be treated as high risk cases because ideally

caregivers should seek consultation to determine the extent of the mental health problems detected by the SDQ. This is particularly concerning, as according to the SDQ norms, approximately 10% of community samples are expected to fall in the Abnormal range, whilst a further 10% will fall in the Borderline range for each scale (Youth in Mind, 2007).

Table 5b

*SDQ Percentage Distribution across Score Cutoff Ranges by Birth Weight*

| Variable                  | Normal Birth Weight |                   |            |                   |        |      | Low Birth Weight |                   |            |                   |        |      |
|---------------------------|---------------------|-------------------|------------|-------------------|--------|------|------------------|-------------------|------------|-------------------|--------|------|
|                           | Abnormal            |                   | Borderline |                   | Normal |      | Abnormal         |                   | Borderline |                   | Normal |      |
|                           | n                   | %                 | n          | %                 | n      | %    | n                | %                 | n          | %                 | n      | %    |
| Emotional                 | 20                  | 32.3 <sup>1</sup> | 2          | 3.2               | 14     | 22.6 | 15               | 24.2 <sup>1</sup> | 1          | 1.6               | 10     | 16.1 |
| Conduct                   | 17                  | 27.4 <sup>1</sup> | 10         | 16.1 <sup>1</sup> | 9      | 14.5 | 13               | 21.0 <sup>1</sup> | 4          | 6.5               | 9      | 14.5 |
| Hyperactivity Inattention | 0                   | 0.0               | 9          | 14.5 <sup>1</sup> | 27     | 43.5 | 0                | 0.0               | 7          | 11.3 <sup>1</sup> | 19     | 30.6 |
| Peer                      | 16                  | 25.8 <sup>1</sup> | 7          | 11.3 <sup>1</sup> | 13     | 21.0 | 13               | 21.0 <sup>1</sup> | 2          | 3.2               | 11     | 17.7 |
| Pro-social                | 0                   | 0.0               | 2          | 3.2               | 34     | 54.8 | 2                | 3.2               | 1          | 1.6               | 23     | 37.1 |
| Total Difficulties        | 15                  | 24.2 <sup>1</sup> | 4          | 6.5               | 7      | 11.3 | 19               | 30.6 <sup>1</sup> | 9          | 14.5 <sup>1</sup> | 8      | 12.9 |

1 = > expected % for category (>10%)

## 4.4 The Strengths and Difficulties Questionnaire and Behavioural Inhibition

There were no significant differences in psychopathology by BI status, with the exception of the Prosocial Abilities Scale, where both as a categorical and nominal variable, prosocial abilities were strongly significant (see Table 5c). Nearly all normals fell into the “normal” range, whilst just over 20 % of BIs fell within the abnormal range of prosocial abilities.

Table 5c

*SDQ Variables by Behavioural Inhibition*

| Variable  | Normal   |                  | Behaviourally Inhibited |                 | N        | P <sup>b</sup>      |
|---|----------|------------------|-------------------------|-----------------|----------|---------------------|
|   | n        | M (SD)           | n                       | M (SD)          |          |                     |
| Total Difficulties Scale Score Categorised (normal/ borderline/ abnormal)     | 13/11/25 | (26.5/22.5/51.0) | 1/1/7                   | (11.1/11.1/7.8) | 14/12/32 | 0.16 <sup>c</sup>   |
| Total Difficulties Scale Score Nominal (normal/abnormal)                      | 24/25    | (49.0/51.0)      | 2/7                     | (22.2/7.8)      | 26/32    | 0.13                |
| Prosocial Abilities Scale Score Categorised (normal/ borderline/ abnormal)    | 47/2/0   | (95.9/4.1/0.0)   | 7/0/2                   | (77.8/0.0/22.2) | 56/2     | 0.002 <sup>c*</sup> |
| Prosocial Abilities Scale Score Nominal (normal/abnormal)                     | 49/0     | (100.0/0.0)      | 7/2                     | (77.8/22.2)     | 56/2     | 0.02 <sup>*</sup>   |
| Emotional Difficulties Scale Score Categorised (normal/ borderline/ abnormal) | 21/3/25  | (42.9/6.1/51.0)  | 3/0/6                   | (33.3/0.0/66.7) | 24/3/31  | 0.29 <sup>c</sup>   |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ , One tailed;

\* = p < 0.05; \*\* = p < 0.1;

Table 5c continued...

*SDQ Variables by Behavioural Inhibition*

| Variable  | Normal   |                  | Behaviourally Inhibited |                  | n        | p <sup>b</sup>    |
|---|----------|------------------|-------------------------|------------------|----------|-------------------|
|   | n        | M (SD)           | n                       | M (SD)           |          |                   |
| Emotional Difficulties Scale Score Nominal (normal/abnormal)  | 24/25    | (49.0/51.0)      | 3/6                     | (33.3/66.7)      | 27/31    | 0.31              |
| Conduct Difficulties Scale Score Categorised (normal/ borderline/ abnormal)                         | 14/13/22 | (28.6/26.5/44.9) | 3/0/6                   | (33.3/0.0/66.7)  | 17/13/28 | 0.10 <sup>c</sup> |
| Conduct Difficulties Scale Score Nominal (normal/abnormal)  | 27/22    | (55.1/44.9)      | 3/6                     | (33.3/66.7)      | 30/28    | 0.20              |
| Attention Deficit Hyperactivity Difficulties Scale Score Categorised (normal/ borderline/ abnormal) | 35/14/0  | (71.4/28.6/0.0)  | 7/2/0                   | (77.8/22.2/0.0)  | 42/16/0  | 0.26 <sup>c</sup> |
| Attention Deficit Hyperactivity Difficulties Scale Score Nominal (normal/abnormal)                  | 33/16    | (67.4/32.6)      | 5/4                     | (55.6/44.4)      | 38/20    | 0.37              |
| Peer Difficulties Difficulties Scale Score Categorised (normal/ borderline/ abnormal)               | 19/7/23  | (38.8/14.3/46.9) | 4/2/3                   | (44.4/22.2/33.3) | 23/9/26  | 0.36 <sup>c</sup> |
| Peer Difficulties Difficulties Scale Score Nominal (normal/abnormal)                                | 26/23    | (53.1/46.9)      | 6/3                     | (66.7/33.3)      | 32/26    | 0.35              |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ , One tailed; \* = p < 0.05; \*\* = p < 0.1;

#### 4.5 The Strengths and Difficulties Questionnaire and Demographics

##### 4.5.1 Total Difficulties by Demographics

There were no statistically significant differences when the Total Difficulties categories “Normal” versus “Abnormal” were compared to sociodemographic variables (see Table 5d and Appendix 7, Table 8c).

Independent of SDQ status, 88.7% of children were breastfed, they had an average of three siblings (SD = 1.3) and three living siblings (SD = 1.1). Ninety four percent of children were of good health as were 95% of their siblings. Twenty three percent of children were one year older than expected for their grade. The children and their families had a high housing density (M = 3.7 (1.8)) and a slightly low asset register (M = 5.9 (2.7)). All had access to basic amenities such as water (90% had indoor tap water), sanitation (61% had indoor flushing toilets). All but one family had access to electricity.

The children’s mothers had an average of 4.8 years of education (SD = 1.7), only 25% of mothers were employed, 84% had never used alcohol during pregnancy whilst 53.2% had smoked during pregnancy. The mothers had an average of three pregnancies (SD = 1.1), 56.5% were married and 83% had had a change in marital status during their lifetime. Of the children’s biological fathers, 54.8% lived with the child’s mother, 88% were employed and

71% provided financial support for their child. Most families sourced their income through employment (62.9%).

Two variables approached significance: Abnormals were slightly lower in birth order than Normals, and a greater percentage of families of Normals had fridges than Abnormals. However, the overall Asset Register score was non-significant by psychopathology.

Table 5d

*SDQ Total Difficulties (Nominal Categories) and Demographics*

| Variable  | Total Difficulties Nominally |             |          |             | n     | p <sup>b</sup>       |
|---|------------------------------|-------------|----------|-------------|-------|----------------------|
|   | Normal                       |             | Abnormal |             |       |                      |
|   | n                            | M (SD)      | n        | M (SD)      |       |                      |
| Age (years)   | 28                           | 8.05 (0.73) | 34       | 8.10 (0.69) | 62    | 0.44 <sup>a</sup>    |
| Males/Females (%)   | 18/10                        | (64.3/35.7) | 16/18    | (47.1/52.9) | 34/28 | 0.14                 |
| child breastfed - yes/no (%)  | 26/2                         | (92.9/7.1)  | 29/5     | (85.3/14.7) | 55/7  | 0.30                 |
| Total number of siblings  | 28                           | 2.96 (0.96) | 34       | 3.06 (1.50) | 62    | 0.50 <sup>a</sup>    |
| Child's number of living siblings   | 28                           | 2.93 (1.02) | 34       | 2.94 (1.13) | 62    | 0.48 <sup>a</sup>    |
| Birth order   | 28                           | 2.46 (1.00) | 34       | 2.18 (1.29) | 62    | 0.09 <sup>a***</sup> |
| Child current health: good/poor (%)   | 27/1                         | (96.4/3.6)  | 31/3     | (91.2/8.8)  | 58/4  | 0.38                 |
| Housing Density (persons/ no of bedrooms)   | 28                           | 3.58 (1.65) | 34       | 3.76 (1.96) | 62    | 0.47 <sup>a</sup>    |
| Asset Register ( out of 14 items)   | 28                           | 6.21 (2.69) | 34       | 5.56 (2.78) | 62    | 0.19 <sup>a</sup>    |
| Mother's level of education (in years)  | 28                           | 5.14 (1.78) | 34       | 4.47 (1.54) | 59    | 0.19 <sup>a</sup>    |
| Mother employed vs unemployed (%)   | 6/21                         | (22.2/77.8) | 9/24     | (27.3/72.7) | 15/45 | 0.44                 |
| Mother's alcohol use pregnancy: social occasions, weekends or everyday vs never (%) | 5/23                         | (17.9/82.1) | 5/29     | (14.7/85.3) | 10/52 | 0.50                 |
| Mother's smoking pregnancy – yes/no (%)   | 15/13                        | (53.6/46.4) | 18/16    | (52.9/47.1) | 33/29 | 0.58                 |
| Mother's number of pregnancies  | 28                           | 3.25 (1.08) | 34       | 3.15 (1.18) | 62    | 0.28 <sup>a</sup>    |
| Marital status of mother (single, divorced/separated, widowed vs married) (%)       | 14/14                        | (50.0/50.0) | 13/21    | (38.2/61.8) | 27/35 | 0.25 <sup>a</sup>    |
| Ever a change in mother's marital status (yes/no) (%)                               | 42/8                         | (84.0/16.0) | 7/2      | (77.8/22.8) | 49/10 | 0.50                 |
| Biological father living/not living with mother (%)                                 | 16/12                        | (57.1/42.9) | 18/16    | (52.9/47.1) | 34/28 | 0.47                 |
| Father employed vs unemployed (%)   | 14/2                         | (87.5/12.5) | 23/3     | (88.5/11.5) | 37/5  | 0.64                 |
| Biological father gives/doesn't give financial support (%)                          | 19/9                         | (67.9/32.1) | 25/9     | (73.5/26.5) | 44/18 | 0.42                 |

a = Mann-Whitney Z Adjusted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ , One tailed;  
\* = p < 0.05; \*\* = p < 0.1;

#### 4.5.2 Total Strengths by Demographics

The Total Strengths (Prosocial Abilities) nominal categories “Normal” and “Abnormal” were compared to demographic variables. The following were non-significant by Total Strengths (see Table 5e and Appendix 7, Table 8d). Children had an average of three siblings (SD = 1.3), three living siblings (SD = 1.1), and were on average the second-born child (SD = 1.2). Nearly all children (94%) were of good health, as were their siblings (93.7%). A number of children were one year older than their expected age for grade (23%).

The children’s mothers had an average of 4.8 (SD = 1.7) years of education, 75% were unemployed, 84% had never drunk alcohol during pregnancy whilst 53.2% had smoked during pregnancy. Each mother had an average of three pregnancies (SD=1.1) and 56.5% were married. Of the children’s biological fathers, 54.8% were living with the child’s mother, 88% were employed and 71% contributed to the cost of their child’s care. Most families sourced their income through employment (64%). All families had access to basic amenities that included sanitation (61% of families had indoor flushing toilets) and refuse collection. All but one family had access to electricity.

Six variables were significant, whilst one approached significance. Normals were a year older than Abnormals; they also had a substantially lower housing density and higher asset register score. This difference in Asset Register score was contributed to by a greater proportion of families of Normals owning radios and fridges. A higher proportion of families of Normals also had access to indoor tap water, and the mothers of Normals had a significantly higher frequency of having had a change in marital status during their lives.

Table 5e

*SDQ Total Strengths (Nominal Categories) and Demographics*

| Variable                     | Total Strengths Nominally |             |          |             |       |                     |
|------------------------------|---------------------------|-------------|----------|-------------|-------|---------------------|
|                              | Normal                    |             | Abnormal |             |       |                     |
|                              | n                         | M (SD)      | n        | M (SD)      | n     | p <sup>b</sup>      |
| Age (years)                  | 60                        | 8.11 (0.69) | 2        | 7.08 (0.59) | 62    | 0.03 <sup>a**</sup> |
| Males/Females (%)            | 33/27                     | (55.0/45.0) | 1/1      | (50.0/50.0) | 34/28 | 0.35                |
| Child breastfed – no/yes (%) | 7/53                      | (11.7/88.3) | 0/2      | (0.0/100.0) | 7/55  | 0.39                |

Table 5e continued...

*SDQ Total Strengths (Nominal Categories) and Demographics*

|   |       |             |     |             |       |                     |
|---|-------|-------------|-----|-------------|-------|---------------------|
| Total number of siblings  | 60    | 3.02 (1.30) | 2   | 3.00 (0)    | 62    | 0.36 <sup>a</sup>   |
| Child's number of living siblings   | 60    | 2.93 (1.09) | 2   | 3.00 (0)    | 62    | 0.36 <sup>a</sup>   |
| Birth order   | 60    | 2.33 (1.17) | 2   | 1.50 (0.71) | 62    | 0.14 <sup>a</sup>   |
| Child current health: good/poor (%)   | 56/4  | (93.3/6.7)  | 2/0 | (100/0.0)   | 58/4  | 0.87                |
| Housing Density (persons/ no of bedrooms)   | 60    | 3.57 (1.73) | 2   | 7.00 (1.41) | 62    | 0.02 <sup>a**</sup> |
| Asset Register ( out of 14 items)   | 60    | 5.97 (2.71) | 2   | 2.50 (0.71) | 62    | 0.03 <sup>a**</sup> |
| Mother's level of education (in years)  | 60    | 4.77( 1.69) | 2   | 5.00 (1.41) | 60    | 0.36 <sup>a</sup>   |
| Mother employed vs unemployed (%)   | 15/43 | (25.9/74.1) | 0/2 | (0.0/100.0) | 15/45 | 0.56                |
| Mother's alcohol use pregnancy: social occasions, weekends or everyday vs never (%) | 9/51  | (15.0/85.0) | 1/1 | (50.0/50.0) | 10/52 | 0.30                |
| Mother's smoking pregnancy – yes/no (%)   | 32/28 | (53.3/46.7) | 1/1 | (50.0/50.0) | 33/29 | 0.72                |
| Mother's number of pregnancies  | 60    | 3.20 (1.15) | 2   | 3.00 (0)    | 62    | 0.47 <sup>a</sup>   |
| Marital status of mother (single, divorced/separated, widowed vs married) (%)       | 27/33 | (45.0/55.0) | 0/2 | (0.0/100.0) | 27/35 | 0.31                |
| Ever a change in mother's marital status (yes/no) (%)                               | 52/8  | (86.7/13.3) | 0/2 | (0.0/100.0) | 52/10 | 0.02 <sup>*</sup>   |
| Biological father living/not living with mother (%)                                 | 32/28 | (53.3/46.7) | 2/0 | (100.0/0.0) | 34/28 | 0.30                |
| Father employed vs unemployed (%)   | 35/5  | (87.5/12.5) | 2/0 | (100.0/0.0) | 37/5  | 0.77                |
| Biological father gives/doesn't give financial support (%)                          | 42/18 | (70.0/30.0) | 2/0 | (100.0/0.0) | 44/18 | 0.50                |

a = Mann-Whitney Z Adj.usted. One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ , One tailed;  
 \* = p < 0.05; \*\* = p < 0.1;

#### 4.6 Behavioural Inhibition, Birth Weight Status, Demographics and Psychopathology

A logistic regression analysis was run in order to investigate the extent to which birth weight status, demographic factors, and psychopathological status were predictors of BI. The significant variables from the bivariate analyses between BI and birth weight, SDQ scores and demographic variables, were entered into a hierarchical logistic regression analysis. These were birth weight status, birth order, asset register, number of pregnancies and prosocial behaviour categorised. A custom binomial logit design was initially used in a best subsets model. Using the model building function, a number of significant models were identified (see Appendix 8, table 11). The following model was selected as the best significant model, as it had the highest likelihood score, for the lowest degrees of freedom and best significance level: BI = asset register + birth order + birth weight status + prosocial behaviour categorised. (LR = 23.09,  $df = 5$ ,  $p = 0.0003$ ).

This model was rerun through a standard logistic regression, which confirmed that the overall model was indeed significant ( $\chi^2 = 19.85$ ,  $df = 4$ ,  $p = 0.0005$ ), and that this model was sound, given that the original Maximum Likelihood improved considerably from 30.21 to 15.11 by adding the four predictor variables. However, all four predictors were non-significant, suggesting that a better model might be found, especially since two predictors, asset register and birth weight status, approached significance.

Table 6a

*Multivariate Analysis of Four Predictors of Behavioural Inhibition*

| Predictors             | Estimate | SE Estimate | Wald's $\chi^2$ | p    | Odds Ratio (unit change) | t (53) |
|------------------------|----------|-------------|-----------------|------|--------------------------|--------|
| <b>Birth Weight</b>    | 2.04     | 1.19        | 2.97            | 0.09 | 7.73                     | 1.72   |
| <b>Asset Register</b>  | -0.36    | 0.19        | 3.80            | 0.06 | 0.70                     | -1.95  |
| <b>Birth Order</b>     | -0.77    | 0.57        | 1.81            | 0.18 | 0.46                     | -1.35  |
| <b>Prosocial Behav</b> | 0.81     | 0.94        | 0.74            | 0.39 | 2.25                     | 0.86   |

\* =  $p < 0.05$ ; \*\* =  $p < 0.1$ ;

Prosocial behaviour categorised was the first variable removed, as it had the poorest significance level, and the model was rerun.

Table 6b

*Multivariate Analysis of Three Predictors of Behavioural Inhibition*

| Predictors            | Estimate | SE Estimate | Wald's $\chi^2$ | p    | Odds Ratio (unit change) | t (54) |
|-----------------------|----------|-------------|-----------------|------|--------------------------|--------|
| <b>Birth Weight</b>   | 2.16     | 1.17        | 3.40            | 0.07 | 8.65                     | 1.84   |
| <b>Asset Register</b> | -0.39    | 0.19        | 4.45            | 0.04 | 0.68                     | -2.11* |
| <b>Birth Order</b>    | -0.83    | 0.58        | 2.09            | 0.15 | 0.43                     | -1.45  |

\* =  $p < 0.05$ ; \*\* =  $p < 0.1$ ;

The significance of the overall model improved slightly ( $\chi^2 = 18.97$ ,  $df = 3$ ,  $p = 0.0003$ ), and asset register was significant at  $p < 0.05$ . Both the significance levels for birth weight status and birth order improved in this model, whilst birth weight status's approach to significance improved. It was thus decided to remove birth order and rerun the model, as birth order now had the poorest significance level.

Table 6c

*Multivariate Analysis of Two Predictors of Behavioural Inhibition*

| Predictors            | Estimate | SE Estimate | Wald's $\chi^2$ | p    | Odds ratio (unit change) | t (55) |
|-----------------------|----------|-------------|-----------------|------|--------------------------|--------|
| <b>Birth Weight</b>   | 2.57     | 1.15        | 5.04            | 0.03 | 13.12                    | 2.25*  |
| <b>Asset Register</b> | -0.40    | 0.19        | 4.63            | 0.03 | 0.67                     | -2.15* |

\* =  $p < 0.05$ ; \*\* =  $p < 0.1$ ;

The overall level of significance for the model remained stable ( $\chi^2 = 16.25$ ,  $df = 2$ ,  $p = 0.0003$ ). However, both birth weight status and asset register were significant. Examination of the odds ratio for the overall model showed that although nearly 88% of the sample was accurately identified with this model, it was far superior at predicting normal anxiety response (95.9%) than BI response (44.4%).

The chapter that follows draws upon the relevant literature to interpret the results of the statistical analyses.

## CHAPTER 5

### DISCUSSION

Statistical analyses largely confirmed the hypotheses regarding low birth weight, sociodemographics and BI respectively. However, the hypothesis regarding low birth weight and psychopathology was shown to be non-significant. The paragraphs that follow explore these findings by drawing upon the literature.

#### 5.1 Demographics and Socioeconomics

Birth weight, BI and psychological status showed concurrence on the majority of sociodemographic variables: most sociodemographic variables were non-significant when compared to each of the above variables respectively. This indicated that the community in which these children were raised provided a fairly uniform experience of a working class living environment and furthermore, it pointed towards the relative robustness of birth weight, BI and psychopathology against some demographic influences. However, LBWs, BIs and children with abnormal levels of psychopathology, differed from NBWs, normals and children falling within the normal range of psychopathology, in certain key areas. The commonalities and differences are discussed below.

##### *5.1.1 Commonalities*

Children were raised in an environment which is socioeconomically deprived, but this environment was not as impoverished as expected. Most children and their siblings were of good health. However, as is common in such communities, possibly due to difficulty accessing education and poor quality of education, many children were one year older than expected for their school grade.

Children lived in crowded circumstances, had mothers with low levels of education, with limited knowledge of self-care and care of the foetus during pregnancy, and high levels of unemployment. However, most mothers were married, had a relatively low pregnancy

average and high child-survival rate. Most biological fathers lived with the child's mother, were employed, and provided financial support for their child.

Family income was mainly obtained through formal employment, an unexpected finding as welfare grants or financial support from other family members tend to be an important source of income for most working class families. Furthermore, most families had access to basic amenities including water (mainly through indoor plumbing), sanitation (mainly via flushing toilets) and all had refuse collection.

Despite clear evidence of socioeconomic deprivation in the community, reasons that suggested that such deprivation was not as severe as expected, included the fact that families appeared largely intact, had access to formal employment, were serviced with basic amenities and children were of good health. This is likely to be as a result of national and local government efforts to challenge economic disparities through Black Economic Empowerment initiatives, strong national and provincial economic growth and the provision of basic services to previously disadvantaged communities (Cameron & Tapscott, 2000; Nel, 2001).

The cultural and religious value systems of the community, namely patriarchal and Christian, may explain the high levels of maternal unemployment, high number of married parents, and the high number of biological fathers or mother's partners providing financially for the child (Sherkat, 2000).

The legacy of educational deprivation during the Apartheid era shows in the low levels of maternal education, and its longer term effects can be seen in the high number of children who are older than the expected age for their grade. Children with parents who are poorly educated tend to perform more poorly at school, and this is no doubt compounded by the poor quality of education and deprived educational conditions in schools within poor communities currently (Jensen & Nielsen, 1997).

### 5.1.2 Differences

The common demographic factors that differentiated LBWs, BIs and children with abnormal levels of psychopathology from their respective controls included that all were significantly lower in birth order and had lower asset register scores compared to controls. LBWs and BIs both had fewer siblings and living siblings, whilst BIs and children with abnormally low prosocial skills had a higher housing density. Fewer LBWs were breastfed as infants and more of their mothers had used alcohol in pregnancy, compared to controls, whilst BIs differed from children with normal anxiety ranges, in that BIs' mothers had had fewer pregnancies. Children with normal levels of prosocial skills were older and had greater access to indoor tap water than those with abnormally low levels of prosocial skills.

Lower birth order relates to the quality of the intrauterine environment and suggests that there is an organic component to BI, LBW and psychopathology (Diamond, et al., 2001; Ejrnaes & Pörtner, 2004; Marston & Cleland, 2003). For instance, uterine blood supply is not as efficacious in early pregnancies but improves with multiparity, and the quality of blood supply affects foetal growth and development (Diamond, et al., 2001; Juntunen, Laara & Kauppila, 1997a; Juntunen, Laara, & Kauppila, 1997b; Maymon, et al., 1998; Seidman, Dollberg, Stevenson, & Gale, 1991). This finding also emphasises the influence of the environment, as new mothers often lack the knowledge and experience of effective self care during pregnancy, potentially depriving a foetus of essential nutrients or exposing it to unnecessary toxins. Continuing with this point, the lower number of pregnancies in mothers of BIs and the relationship between lower numbers of siblings and living siblings for both BIs and LBWs further emphasises the importance of maternal health and its effects on reproductive health (Parke et al., 2004; Appleyard, Egeland, van Dulmen & Sroufe, 2005). Moreover, BI and LBW may be outcomes shaped by genetic factors that in turn influence reproductive health, the quality of the intrauterine environment and the health of the child in utero or post partum. These factors can similarly be influenced by the external environment in terms of maternal nutritional status and exposure to stress and toxins (Lundberg, 1993). They can also have an influence on the health of infants post partum.

Further evidence of the importance of the intrauterine environment is provided by the relationship between LBW status and maternal alcohol consumption during pregnancy.

Despite no evidence of Foetal Alcohol Syndrome in the sample, alcohol exposure might still nonetheless retard physical development (Moser, 1999). Maternal alcohol consumption is also an indicator of a stressful social environment (Costa, Jessor & Turbin, 1999; Jennison & Johnson, 2001). Moreover, the fact that fewer LBWs were breastfed, despite breastfeeding being a common practice in socioeconomically disadvantaged communities, suggests that intrauterine deprivation or trauma can have influences upon the development of a child from its earliest moments post partum (Cole & Cole, 2001; Kalanda, Verhoeff, & Brabin, 2006; Mostert, Steyn, Temple, & Olwage, 2005; Whitaker, et al., 1997). Many infants that have suffered intrauterine complications show impaired or delayed reflex responses. These include difficulty latching and nursing, and often it is easier for caregivers to assist infants having difficulty feeding by bottle nursing them.

The importance of good health for both mother and infant during pregnancy and post partum is further emphasised by the fact that children with normal levels of prosocial skills as preadolescents were found to have greater access to indoor tap water. Although apparently arbitrary, this relationship emphasises the importance of good health both in the mother and her child. Indoor tap water reduces exposure to germs and pollutants in both the individual and the people they have everyday contact with. Moreover, as children with normal levels of prosocial ability were significantly older than children lacking such skills, this finding emphasises the importance of child development (Cole & Cole, 2001). As children move towards adolescence and adulthood, their social skills improve developmentally. This finding iterates the importance of normal development from the womb to adulthood. If children experience developmental delays at any point in their lifetime, which are significant enough to set them behind others of their age, the consequences can be significant and long lasting (Cole & Cole, 2001; Nolen-Hoeksema, 2004; Seiffge-Krenke, 1995). Thus, a child disadvantaged developmentally from birth that does not receive interventions that allow her to keep up with children of her age, put her at risk for problems not only in the short-term but longitudinally. Despite its non-significance in this sample, the literature suggests that both BIs and LBWs are not only at risk during childhood but also for adult psychopathology.

Finally, given that BIs, LBWs and children with abnormal levels of psychopathology all had significantly lower asset register scores than controls highlights what the afore-mentioned

findings have been hinting at: low socioeconomic status is linked with developmental, behavioural and psychiatric sequelae both in early childhood and in later development (Parke et al., 2004; Appleyard, Egeland, van Dulmen, & Sroufe, 2005). Environmental deprivation acts directly upon the child's prenatal environment and postnatally through factors such as nutrition but it can also be insidious, such as stress upon caregivers resulting from socioeconomic deprivation, which in turn affects their ability to care for a child in utero and post partum (Lundberg, 1993). Poverty and unemployment can result in chronic stress and poor maternal nutrition, which in turn expose the foetus to excess and chronic levels of stress hormones and deprive the foetus nutritionally. Post partum, the child's physical and emotional needs can add to caregiver stress and further impinge on effective caregiving behaviour. Thus, the finding that BI and impaired social skills are linked with high housing density not only emphasises the effects of poverty on the emotional and social development of the child, but also points to the fact that human beings are adaptive, and that many behaviours or responses labelled as pathological by westernised, middle-class standards, might in fact be adaptive within the context in which they appear (Swartz, 1998; Painter, Terre Blanche & Henderson, 2006). Firstly, living in crowded circumstances (where every other person who shares that space with the child is potential competition in accessing limited resources) is likely to promote asocial responses. For example, theft of others' food may be quite adaptive in environments where resources are extremely limited. Furthermore, the fact that BI is linked with high housing density may also be adaptive. In crowded conditions where caregivers have little capacity to tolerate a child's needs, strong emotional or behavioural expressions may result in deprivation or punishment. Thus, an "easy" child, who places little demand on his/her caregivers may at best endear him/herself towards reward or at worst, spare him/herself from punishment (see for example, Marks, 1987).

This is confirmatory of the hypothesis that where the three respective sets of variables differed from their normal categories, the difference would favour the normals. It also emphasises the interactive effect between socioeconomic status, intrauterine trauma, later behaviour and psychopathology. Moreover, it suggests that LBW, BI and childhood psychopathology can be treated as markers for severe socioeconomic deprivation relative to the community as a whole. Paths of causality cannot be provided but it is proposed that an interactive model explains the compounding effect of severe socioeconomic deprivation.

## 5.2 Behavioural Inhibition

The scary Black Box Task revealed that from the outset, NBWs were anxious, and although initially responsive to their mother's positive reactions, they generally exhibited consistent anxiety responses throughout the task. However, there were variations in these anxiety responses, that appeared mediated both by their experience of previous holes and by their mother's reactions at the time. These expressions of anxiety included anxious facial and body signs, withdrawal behaviour and hesitation.

Conversely, LBWs showed neutral or relaxed behaviour from the outset. Although their mothers' initial negative responses to the task appeared to unsettle some LBWs initially, LBW children's behaviour over the four holes was almost consistently relaxed, with a non significant few displaying anxiety. It was not clear how their experience over the four holes and their mother's reactions at the time mediated their responses, as the children's responses were stable and their mothers were positive throughout the task (aside from the initial negative response).

The paragraphs that follow explain these two sets of responses by drawing upon a neuro-evolutionary model of anxiety, and are followed by an examination of mother-child interactions.

### 5.2.1 *The Evolutionary Purpose of Anxiety*

Anxiety responses to fearful situations are evolutionarily adaptive and are a means of protection in physically and socially dangerous situations (Hofer, 1995, cited in Stein & Bouwer, 1997). A lack of anxiety may in fact be maladaptive as optimal levels of anxiety allow the individual to detect and discriminate a threat and respond to this threat in an appropriate way (Mealey, 1995; Nesse & Williams, 1995; Stein & Bouwer, 1997). This is what is exhibited in the sample of NBWs' response to fear-evoking stimuli (the Scary Black Box task). The variation seen in the children's anxiety responses was shaped by the kind of stressor to which they were exposed, which in turn affected their response (Kagan & Snidman, 1999; Marks & Nesse, 1994). Furthermore, neurobiology along with variation

within the environmental context, effect conditioning and sensitisation that further personalise the response (Kagan & Snidman, 1999; Stein & Bouwer, 1997). Moreover, human beings develop different kinds of anxiety at different developmental stages (Bowlby 1973; Marks, 1987; Plomin, et al., 1993; Zeanah, et al., 1997; Stein & Bouwer, 1997). These different kinds of anxiety responses are adaptive and prepare infants and children for new risks that they will be exposed to with each developmental milestone. These anxieties are non-random and include, for example, the fear of heights developing just prior to infants beginning to crawl. According to Marks and Nessel (1994), although subtypes of anxiety response are adaptive to particular stressors (such as freezing when exposed to heights), these responses are not necessarily discrete entities evoked by specific stressors. Rather, given the significant variation between stressors and their complex interaction, stress responses are similarly complex and interactive. The variation seen in anxiety responses is shaped by neurobiology and the environmental context in which they develop and are activated (conditioning and sensitisation) (Kagan & Snidman, 1999; Stein & Bouwer, 1997). The variation seen in individual responses are also shaped by the activation threshold for that individual, the personal triggers of anxiety, which in turn, are both shaped by genetics and experience (Bertolino, et al., 2005; Kagan & Snidman, 1999; Marks, 1987, Morgan, 2006; Schwartz, et al., 2003; Stein & Bouwer, 1997). Low activation thresholds may result in BI and include increased sensitivity to social and environmental stimuli, whilst high thresholds may be associated with decreased inhibition and increased risk-taking behaviour (Bertolino, et al., 2005; Kagan & Snidman, 1999; Marks, 1987; Morgan, 2006; Schwartz, et al., 2003; Stein & Bouwer, 1997). It is this low anxiety activation threshold shaped by intrauterine trauma, environmental and genetic factors which manifests in the form of BI seen in the current sample of LBW children as “relaxed” behaviour.

### 5.2.2 *Low Birth Weights as Behaviourally Inhibited*

The “relaxed” behaviour exhibited by LBWs in this sample when exposed to a fearful situation, fit the descriptions in the literature of BI (Weinstock, 2001). This response is, in part, programmed in utero by foetal exposure to the maternal physiological responses to stressors (Meijer, 1985; Mulder, et al., 2002). BI is a potentially adaptive evolutionarily response, and involves stress hormones programming the foetal HPA axis in order to prepare

the foetus for a suboptimal perinatal environment (Gray, 1992; Maccaria, et al., 2003; Marks, 1987; Weinstock, 2001; Welberg, et al., 2001). Especially when intrauterine exposure stress is pervasive, the neurobiological response to anxiety (and consequently the child's behaviour) can be permanently reset (Weinstock, 2001). Various stressors (including poor maternal nutrition, high perceived stress, exposure to substances and alcohol) can interact and compound this effect (Faraone & Biederman, 1998; Milberger, Biederman, Faraone, Guite, & Tsuang, 1997; Sprich-Buckminster, Biederman, Milberger, Faraone, & Krifcher Lehman, 1993;). Anxiety responses can however outlive their initial adaptiveness: fetuses exposed to intrauterine stress continue to show the effects of this post partum, both in the short and longer term (Faraone & Biederman, 1998; Maccaria, et al., 2003). For example, fetuses nutritionally deprived (as a result of various complex biological processes) in the womb exhibit behavioural and emotional consequences that include behavioural and emotional inhibition, retardation of locomotion and cognition, increased mortality, increased anxiety and sleep disturbances (Maccaria, et al., 2003). This intrauterine trauma may also result in the longer term outcomes described in the literature including cognitive deficits, psychopathology and physical impairment (Breslau, 1995; Kessinich, 2003).

### 5.2.3 *Global Interactions between Mother and Child*

Both sets of mothers were far less actively engaged with their children during the task than what might have been expected. There was some positive behaviour towards the child from mothers of NBWs, but no other forms of positive verbal engagement about the task or child, and no negative verbal comments or actions towards child or task were observed from either set of mothers.

This general lack of engagement between mother and child independent of birth weight status, might in part, be explained by early infant-mother attachment relationships. Furthermore, it could be reflective of environmentally mediated rules of mother-child engagement which limit interaction. Lastly, it might be that within the experimental situation, mothers thought they were not supposed to engage verbally or behaviourally. However, this last possibility is unlikely as the instructions at the beginning of the Black Box task facilitated mother-child engagement, even if these instructions did not actively indicate that interaction

was acceptable. Furthermore, some mothers did engage with their children, suggesting that if there was an experimental effect, that it was not pervasive.

#### *5.2.4 Interactions between Mother and Child in Socioeconomically Deprived Environments*

Environments where caregivers' capacities to accommodate infants are limited by social stresses, infants that attempt to engage with caregivers are not met with rewards and often can be met with punishment (Lieberman & Zeanah, 1995). They may even learn that the less engaging they are with caregivers, the more likely they are to have their needs met. Such circumstances create the so-called "easy baby". This response is reinforced as the child grows, given the stressful social environment of a working-class community, where adults do not have the emotional resources to accommodate the needs of their children (McLoyd, 1990).

The effects of this are amplified for LBW mother-infant dyads. The minor levels of boundary confusion and global discord between NBW mothers and children is reflective of the normal complexities of social interaction: the more the mother and child interact with each other, the higher the chance of misunderstanding and conflict. Thus, the near absence of boundary confusion and global discord between LBW dyads is probably reflective of disengagement between mother and child.

In environments where the caregivers' capacity to accommodate the infant is already limited by social stresses, infants programmed prenatally to be inhibited are more vulnerable targets for the "easy baby" syndrome (Lieberman & Zeanah, 1995). Furthermore, caregivers who are engaging and attuned to their children may themselves learn that their attempts at engagement are met with a lack of responsiveness from their infant. Such caregivers may become less engaging with their children over time as their attempts to engage are not reinforced by their infant.

Although behavioural and emotional inhibition may be adaptive in the stressful environments with limited socioeconomic and emotional resources, it remains to be seen whether such responses remain adaptive in other settings. As the children grow older, they may be exposed to environments that demand different behavioural and emotional responses

from them, such as high-school and later on, the workplace (Seiffge-Krenke, 1995). Environments that demand proactive engagement and regular social reciprocity may prove challenging for inhibited individuals. Responses that contrast with the expected range of emotional response within a setting may be misinterpreted as laziness, arrogance and indifference. This could significantly impact upon the individual's ability to function effectively within different environments.

### 5.3 Psychopathology

Given the Scary Black Box findings, it is noteworthy that there was no significant difference in the level of psychopathology detected between LBWs and NBWs or BIs versus normals on the Strengths and Difficulties Questionnaire. Although a level of pathology was anticipated (given the community's socioeconomic circumstances), one would have expected the percentage of SDQ scores in the abnormal and borderline ranges to be significantly higher for LBWs and BIs, especially on the Mood and Hyperactivity Scales, given previous findings in the literature (Breslau, 1995; Goodman, Renfrew & Mullick, 2000; Kessinich, 2003; Weinstock, 2001). However, a number of factors may have influenced this outcome from the SDQ. Firstly, the SDQ relies on accurate observation of behavioural and emotional manifestations. Drawing upon the hypothesis described above concerning BI in LBW children, it may be that many parents miss these markers of psychopathology because such children inhibit their responses. This might explain why the Hyperactivity Scale detected no children with difficulties in the abnormal range, as two key aspects of ADHD are observed distractibility and/or over-activity. Distractibility is more subtle and often more easily overlooked as it does not tend to manifest as overtly as over-activity. In behaviourally inhibited individuals, symptomology might thus manifest differently given the inhibition of behavioural response. Secondly, it is possible that the self-report format SDQ would have been more accurate in detecting psychopathology in low birth weight participants. It is thus unfortunate that the self-report SDQ was limited to children of 11 years of age and older.

The high levels of emotional difficulties and the relatively low levels of attention deficit/hyperactivity might relate to the fact that the parent-completed SDQ format was used, as this has been previously reported to be accurate in detecting emotional difficulties but less

effective in detecting attention-deficit/hyperactivity difficulties (Youth in Mind, 2007). Another explanation for the lower levels of abnormality on the Hyperactivity Scale may relate to the low birth weight range used in this study. Low birth weights in the 1501-2500g range (LBW) tend to have more diffuse, non-specific difficulties, whereas VLBWs and ELBW can have more overt diagnoses of ADHD (Kessinich, 2003). However, there is no consensus in the literature on this, and ADHD diagnoses have been found to be more prevalent in even the mild low birth weight range (relative to NBWs). Thus, the most likely explanation is that the effects of BI and LBW are diluted by low socioeconomic status.

Birth weight and BI status aside, the level of psychopathology in this sample is alarming. Youth in Mind, (2007) suggests a coarse estimate of 10% of community samples falling in the Abnormal range, with a further 10% falling in the Borderline range. With the exception of the Hyperactivity Scale and Prosocial scales, all the scales including the Total Difficulties Scale had levels of abnormality at around the 50% mark.

The consequences of such levels of pathology both in the short-term and longitudinally are of concern. Aside from interfering with children's ability to benefit from education, it places additional burden upon already overburdened caregivers, and may impact upon medium term and longer term outcomes for these children (Carr, 1999; Nolen-Hoeksema, 2004). There is an increased risk for substance abuse and dependence starting in the teenage years, and given the Western Cape's runaway methamphetamine ("tik"<sup>4</sup>) problem, these children are at serious risk (Myers, Parry, Karassellos & Jardine, 2006). Substance abuse is associated with increased risk for adult psychopathology (particularly psychotic disorders, Schizophrenia and Bipolar Mood Disorder), criminality and unemployment, which would simply be compounded by childhood psychopathology (Nolen-Hoeksema, 2004). LBWs and BIs already are at increased risk for such outcomes, so that when biology is combined with environment, such children are a "time-bomb" (Breslau, 1995). However, it is potentially comforting to note the low levels of pathology on the Prosocial Abilities Scale- nearly 92-97% of children fell in the Normal range. Although one should be cautious in interpreting this result, especially in the light of the results from the Scary Black Box Task, this may indicate

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<sup>4</sup> A colloquial term for a more potent, highly addictive version of methamphetamine, usually in crystalline form, which is heated over a flame and the vapours inhaled. The name derives from the "cracking" sound the "tik" makes when heated.

that prosocial skills may be a very effective moderating factor for the psychopathology detected by the other scales (Carr, 1999). It also provides a potential foundation for interventions with children, for if such children already have good social skills, minor adjustment of these skills might provide positive outcomes.

#### 5.4 Behavioural Inhibition, Birth Weight, Demographics and Psychopathology

The results of the logistic regression suggest that BI is a complex construct. Certain demographic factors do not usefully contribute to the predicted risk for BI in an additive model. Birth order and number of pregnancies tend to orientate maternal reproductive health and the quality of the intrauterine environment (Diamond, et al., 2001; Juntunen, Laara & Kauppila, 1997a; Juntunen, Laara, & Kauppila, 1997b; Maymon, et al., 1998; Seidman, Dollberg, Stevenson & Gale, 1991). They also potentially reference parental knowledge of selfcare and of foetal and post partum infant care. The literature documents that the quality of the intrauterine environment and the mother's knowledge about her health and that of her infant prenatally and post partum improve with the number of pregnancies. Moreover, a child's prosocial skills are indicative of a variety of factors including innate temperament and quality of social experience, primary within the home environment (Cole & Cole, 2001). However, their predictive ability is eclipsed by what appear to be far more accurate predictors of the quality of the intrauterine environment, and the quality of the social environment post partum, namely birth weight status and asset register.

The particularly high accuracy of the birth weight status and asset register model when used to predict anxiety responses within the normal range emphasises the importance of the intrauterine environment and socioeconomic status. This fits with findings in the literature that indicates that birth weight status and socioeconomic status are significantly related to behavioural and anxiety outcomes (Kagan & Snidman, 1999; Zeanah, et al., 1997). Normal birth weight serves as a marker for the absence of intrauterine trauma and the consequent lack of exposure to stress hormones in utero that are known to negatively effect the neurobehavioural responses to stress (Weinstock, 2001). Socioeconomic status is a useful indicator of environmental stress, and higher socioeconomic status is considered a protective factor (Breslau 1995). Thus, children with normal expressions of anxiety in stressful

situations probably have healthy neurochemical stress response systems, and are at the same time possibly exposed to a lesser degree to chronic environmental stress, allowing their biological stress response mechanisms to function appropriately.

However, the birth weight status and asset register model is less accurate in predicting BI. This is probably because BI is an outcome of the interaction between genetics, the quality of intrauterine experience, and the social environment postpartum (Breslau 1995; Weinstock, 2001). It is likely that a genetic predisposition to BI can be activated either in utero or post partum by exposure to physiological or psychosocial stress (Kagan, Reznick, & Snidman, 1988; Morgan, 2006; Tillfors, 2004; Turner, Biedel, & Wolff, 1996; Zeanah, et al., 1997). Possibly due to their families' lower socioeconomic status, BI children appear exposed to a greater variety of stressors more frequently, for longer periods and with greater intensity (both in utero and post partum). Thus, a limited number of key markers of intrauterine and psychosocial stress are not effective reflecting this complexity, because their individual effects are diluted.

The chapter that follows links the discussion of the results of this research back to the literature on low birth weight, BI and psychological sequelae together with hypotheses proposed, and makes recommendations for the use of the findings to assist the community in which this study took place. It also identifies the limitations of this study and concludes with suggestions for future research.

## CHAPTER 6

### CONCLUSION

The literature on low birth weight, BI and psychopathology broadly indicated that low birth weights are at greater risk for behavioural difficulties, psychological difficulties and psychiatric diagnoses. The effect of socioeconomic status was emphasised as accentuating this risk. This study confirmed the relationship between LBW and BI: LBWs are more behaviourally inhibited than their peers, and have less engaging reciprocal relationships with their caregivers than NBWs. Furthermore, mothers of these LBW children appear less engaging with their children. These findings are likely to manifest as a result of the interaction between intrauterine neuro-chemical changes in the brains of LBW infants, the social interactions between infant and caregivers post partum, and the stressful systemic context. Such interactions reinforce the inhibited behaviour and these responses are likely to be adaptive within the child's environment within the medium term. However, in the longer term, as the child is exposed to environments that require behavioural and emotional adaptability, such responses may become more problematic.

However, the results of this research highlighted that for South African children living in socioeconomically deprived circumstances, the influence of low birth weight on risk for psychopathology is significantly diluted by other variables, most likely of an environmental nature. The study found that the children in this sample, independent of their birth weight or BI status, had significantly high levels of clinical psychopathology, and that a substantial number of children are at risk for developing clinical diagnoses. In spite of this, children in the sample had relatively sound social skills that may operate as a mediating factor for psychopathology. Nonetheless, this research shows that the children of this working class community may be at significant risk in a multitude of ways, and that further research is imperative, especially to explore meaningful interventions.

#### 6.1 Recommendations

Continued efforts to assist communities to uplift and empower themselves and to redress the legacy of Apartheid deprivation are critical. It is extremely well documented that

poor socioeconomic circumstances place individuals and communities at risk for a host of physical, psychological and social problems, and that socioeconomic status interacts with genetics, physiology and psychosocial risk factors to compound the effects of these.

A component of such efforts would include interventions to prevent, or at least reduce, LBW. Women need to be educated about self-care and care of the foetus during pregnancy, preferably prior to conception. This education needs to be done by professionals with knowledge of reproductive and prenatal health who are easily accessible (i.e. staff at community clinics). This education should not only be limited to women but should include their partners, families and the greater community. Social networks have a powerful influence over the individual, and can either support or undermine efforts to assist women in self-care and foetal care. Although reproductive and prenatal healthcare education is already provided at many community clinics, limited numbers of professional staff and poor resources impair the efficacy of such interventions. Moreover, the daily reality for women in socioeconomically deprived circumstances is such that even those who are knowledgeable are often prevented from putting this knowledge into practice because of their practical circumstances. A woman with limited financial resources, who is physically abused by her partner and has little social support, is more likely to suffer from poor nutrition, chronic stress and be at greater risk for substance or alcohol abuse. Thus, efforts to reduce the prevalence of LBW should be part of efforts to further the empowerment of women and to uplift the community.

For LBW children, ideally a specialist team who could assess a range of psychological, psychomotor and behavioural abilities and institute the necessary occupational therapy, speech therapy, physiotherapy and psychological interventions would be most beneficial. More particularly, an intervention promoting diversification and adaptability of coping styles instituted as early as possible might assist children in coping more effectively with a range of different social environments. Such an intervention is described by Sieffge-Krenke (1995) in her book on coping strategies and mental health in childhood and adolescence. However, realistically, within the South African context, such an intervention is beyond the resources of the community, State and NGOs that service the community.

Perhaps a more modest school-based programme in which children are educated on mental health, effective and ineffective coping strategies and stress management techniques, similar to the health education programmes offered at some primary schools might be of benefit. Thus, construction and assessment of such an intervention might be a point of continuation for future research.

In the interim, the findings of the study will be fed back to the participants, their caregivers, and where appropriate, the community clinic staff. Caregivers will be assisted in accessing referral sources for children that require intervention.

## 6.2 Limitations

Despite this study's findings falling in accordance with those found in literature, it is recommended that they be interpreted cautiously in light of several factors.

In comparison to the cohort sample, the sample for this study was over-representative of LBWs due to convenience sampling necessitated by the difficulty in locating the original participants and the high levels of non-response from this group. This was, in part, because the original Dhansay et al. study was not planned as a longitudinal study, so structures were not in place to easily re-establish contact with participants. Furthermore, many people no longer stayed in the community due to high levels of migration. Moreover, a percentage of the caregivers could not get time off work to attend the testing sessions. Lastly, the study sample also differed significantly from the cohort in that there were more unemployed mothers than the number seen in the cohort.

The power of the results was likely to have been affected, given the relatively small sample, especially when divided according to birth weight and BI status. Although it was not possible within the financial and temporal limits of the study to obtain a larger sample, future research would benefit from samples statistically determined by the planned analyses. Furthermore, given the small sample size, it was unfeasible to analyse the sample by gender, age and other relevant demographics. Although the analyses found these variables non-significant, it would nevertheless be worth investigating these within a larger sample.

Moreover, the small sample size, along with convenience sampling limits the generalisability of the results.

Additionally, it was beyond the limits of this research to explore intelligence in comparison to low birth weight, despite strong evidence from the international literature that there is a relationship between the two. This is because intelligence testing is expensive, time-consuming and most importantly, internationally accepted measures of intelligence have not been standardised for low income, “mixed race” populations in South Africa. Similarly the influence of genetics on BI was not examined due to financial and temporal constraints, despite evidence within the literature that BI is a genetically mediated phenomenon.

There was some concern regarding the instruments used in the study. Instruments developed within western contexts may not always be appropriate for samples from a poor urban community within the developing world, as the premises on which they are based and the interpretations they make may be unsound outside of their original context. Although every effort was made to select instruments that were culturally sensitive, it is important that further research within a South African context explore the relevance of culturally grounded models and instruments. This would need to include reviews by experts on the cultural and economic practices of the population concerned. Lastly, the limitations of self-report questionnaires are well-described in the literature (Louw & Edwards, 1998; Terre Blanche & Durrheim, 1999).

Finally, perhaps the most significant limitation with respect to this study was the fact that the design did not allow any conclusions regarding causality to be drawn.

### 6.3 Future Directions

All of the above points emphasise the need for more extensive research into low birth weight, BI and clinical psychopathology, especially in South Africa, where there is a gap within the literature. Further research should include both cross-sectional and longitudinal research so as to cover all aspects of low birth weight, BI and psychopathology.

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## APPENDICES

## Appendix 1

## 1.1 Demographic Questionnaires:

BISHOP LAVIS GROWTH AND NUTRITION STUDY  
QUESTIONNAIRE

Date: \_\_\_\_\_ Cohort number: \_\_\_\_\_  
 Interviewer name: \_\_\_\_\_ Reference number: \_\_\_\_\_

Are you the child's mother? YES/NO

If YES, Details of mother: Surname: \_\_\_\_\_ Name: \_\_\_\_\_  
 Original surname (if changed): \_\_\_\_\_

If NO, Details of primary caretaker (if different from above):  
 Surname: \_\_\_\_\_ Name: \_\_\_\_\_ N/A  
 Relationship to child: \_\_\_\_\_  
 Reason for mother not attending interview:  
 Unavailable for interview because of work  
 Unavailable because of another commitment  
 Ill at home or in hospital  
 Living in another area but in contact with child and caregiver  
 Living in another area but not in contact with child and caregiver  
 Deceased

Details of child: Surname: \_\_\_\_\_ Name: \_\_\_\_\_  
 Date of birth: \_\_\_\_/\_\_\_\_/19\_\_\_\_  
 Sex: Male/Female  
 Name of school: \_\_\_\_\_  
 Grade: \_\_\_\_\_  
 Hospital in which the child was born: \_\_\_\_\_

**DEMOGRAPHIC AND SOCIOECONOMIC DETAILS**

1. Who is the household head? \_\_\_\_\_  
 2. Relationship to child: \_\_\_\_\_

3. Please list all the members of the household, with respect to the child, in which the child lives (people generally sharing the same roof/meal). If a sibling, please note date of birth and details of father.

Please complete from the oldest to the youngest person (including the child):

| Name | Sex | Age | Date of birth<br>(for siblings only) | Relationship to<br>child | Details of father<br>siblings only |
|------|-----|-----|--------------------------------------|--------------------------|------------------------------------|
|      |     |     |                                      |                          |                                    |
|      |     |     |                                      |                          |                                    |
|      |     |     |                                      |                          |                                    |
|      |     |     |                                      |                          |                                    |
|      |     |     |                                      |                          |                                    |

4. How many rooms do you have in your house (including kitchen, lounge, dining room, bedrooms)?  rooms

5. In your home, how many rooms are there just for sleeping?  rooms

6. How would you describe your home (tick the one that best describes it)?

|  |       |              |                          |
|--|-------|--------------|--------------------------|
| Room/verandah attached/not attached to house | House | Shared house | <input type="checkbox"/> |
| Flat   | Hotel | Other:       | <input type="checkbox"/> |

7. Household water: do you have access to?

|              |                        |                    |                          |
|--------------|------------------------|--------------------|--------------------------|
| Indoor water | Only outside tap water | Other water source | <input type="checkbox"/> |
|--------------|------------------------|--------------------|--------------------------|

8. What type of toilet do you have?

|                |                    |
|----------------|--------------------|
| Flush inside   | Only flush outside |
| Outside toilet | Other:             |

9. How do you dispose of your refuse?

|   |  |
|---|--|
| Dump garbage away from home                   |  |
| Burn garbage                                  |  |
| Burn garbage in yard                          |  |
| Garbage get collected                         |  |
| Take garbage to central place to be collected |  |

10. Which of the following do you have in your household at the present time?

|                    | YES | NO |
|--------------------|-----|----|
| Electricity        |     |    |
| Television         |     |    |
| Radio              |     |    |
| Motor vehicle      |     |    |
| Fridge             |     |    |
| Stove              |     |    |
| Washing machine    |     |    |
| Telephone          |     |    |
| Video machine      |     |    |
| Microwave          |     |    |
| Computer           |     |    |
| Cellular telephone |     |    |
| MNet               |     |    |
| DSTV               |     |    |

11. Marital status of mother/primary caretaker:

|                                  |                    |
|----------------------------------|--------------------|
| Single                           | Divorced/separated |
| Married                          | Widowed            |
| Living with partner, not married |                    |

12. Is the child's biological father living with you?

YES/NO

13. Does the child's biological father give you any financial assistance?

YES/NO

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14. Does your current partner (if he is not the biological father) ever give financial assistance for the child? YES/NO/N.A.

15. Is the child currently covered by medical aid? YES/NO

16. Education (last standard passed):

|                       | Mother | Father/ Current partner | Father (if not current partner) |
|-----------------------|--------|-------------------------|---------------------------------|
| No formal education   |        |                         |                                 |
| Sub A/B (Grade 1-2)   |        |                         |                                 |
| Std 1-3 (Grade 3-5)   |        |                         |                                 |
| Std 4-5 (Grade 6-7)   |        |                         |                                 |
| Std 6-7 (Grade 8-9)   |        |                         |                                 |
| Std 8 (Grade 10)      |        |                         |                                 |
| Std 9 (Grade 11)      |        |                         |                                 |
| Matric (Grade 12)     |        |                         |                                 |
| College or University |        |                         |                                 |

17. Mother/primary caretaker's job: \_\_\_\_\_

18. Father/current partner's job: \_\_\_\_\_

19. Sources of income:

|                  |       |                      |  |
|------------------|-------|----------------------|--|
| Employment       |       | Informal income      |  |
| Disability grant |       | Support from parents |  |
| Other            | _____ |                      |  |

**RETROSPECTIVE HISTORY**

20. Have any of the following changed since the birth of your child? If YES, please give details as to the age of the child at the time of the change and details of the change.

|                          | YES | NO | 0-2 yr | 2-5 yr | 5-7 yr | Details  |
|--------------------------|-----|----|--------|--------|--------|--|
| Marital status of mother |     |    |        |        |        |  |
| Moved house              |     |    |        |        |        |  |
| Mother's job             |     |    |        |        |        |  |
| Father's job             |     |    |        |        |        |  |
| Primary caretaker        |     |    |        |        |        |  |
| Household density        |     |    |        |        |        | <input type="checkbox"/> Increased <input type="checkbox"/> Decreased<br><input type="checkbox"/> Family <input type="checkbox"/> Non-family |

**MEDICAL HISTORY OF CHILD**

21. Would you say your child's health is:

|      |     |      |
|------|-----|------|
| Good | Far | Poor |
|------|-----|------|

If POOR please explain:

---



---

22. Does the child have, or has the child had, any serious medical or developmental problems (physical or mental) or any injuries during the **past year**? YES/NO

Details:

---



---

23. Is the child on any chronic medication? YES/NO

If yes, what is the name and what has it been prescribed for?

---



---

24. Has the child ever broken any bones? YES/NO

If yes, which bone and how?

---



---

25. How would you describe the child's health in their **first year of life** compared to other children of their age and/or their siblings at that age, in relation to the following:

|                        | Less | Equal | More | N/A |
|------------------------|------|-------|------|-----|
| Visits to the doctor   |      |       |      |     |
| Medication/antibiotics |      |       |      |     |
| Hospitalisations       |      |       |      |     |

26. Has there been any body hair growth on the child? YES/NO

If yes:

|  |   |
|--|---|
| <p>Girls:</p> <p><input type="checkbox"/> Underarms</p> <p><input type="checkbox"/> Genital area</p> | <p>Boys:</p> <p><input type="checkbox"/> Underarms</p> <p><input type="checkbox"/> Genital area</p> <p><input type="checkbox"/> Face/legs</p> |
|--|---|

27. GIRLS ONLY. Has the child started menstruating?

YES/NO/NA

28. Do you have any growth data for your child taking part in the study?

YES/NO

**MEDICAL HISTORY OF BIOLOGICAL MOTHER**

29. Has a doctor or nurse told you that you have/had:

|  | YES | NO | DONT<br>KNOW | * Please specify |
|--|-----|----|--------------|------------------|
| High blood pressure                          |     |    |              |                  |
| Diabetes or "sugar"                          |     |    |              |                  |
| Heart attack/angina                          |     |    |              |                  |
| Stroke                                       |     |    |              |                  |
| High blood cholesterol or "fat in the blood" |     |    |              |                  |
| Osteoporosis                                 |     |    |              |                  |
| Other*                                       |     |    |              |                  |

30. Has medication for all of the following been prescribed to you by a doctor:

|  | YES | NO | DONT<br>KNOW | * Please specify |
|--|-----|----|--------------|------------------|
| High blood pressure                          |     |    |              |                  |
| Diabetes or "sugar"                          |     |    |              |                  |
| Heart attack/angina                          |     |    |              |                  |
| High blood cholesterol or "fat in the blood" |     |    |              |                  |
| Osteoporosis/bone fractures                  |     |    |              |                  |
| Other*                                       |     |    |              |                  |

31. Has a doctor or nurse told the father of your child that he has/had:

|  | YES | NO | DONT<br>KNOW | * Please specify |
|--|-----|----|--------------|------------------|
| High blood pressure                          |     |    |              |                  |
| Diabetes or "sugar"                          |     |    |              |                  |
| Heart attack/angina                          |     |    |              |                  |
| Stroke                                       |     |    |              |                  |
| High blood cholesterol or "fat in the blood" |     |    |              |                  |
| Osteoporosis                                 |     |    |              |                  |
| Other*                                       |     |    |              |                  |

32. Does the child have any grandparent/s who has any of the following:

|  | YES | NO | DON'T KNOW | RELATIONSHIP TO THE CHILD | Please specify |
|--|-----|----|------------|---------------------------|----------------|
| High blood pressure                          |     |    |            |                           |                |
| Diabetes or "sugar"                          |     |    |            |                           |                |
| Heart attack/angina                          |     |    |            |                           |                |
| Stroke                                       |     |    |            |                           |                |
| High blood cholesterol or "fat in the blood" |     |    |            |                           |                |
| Osteoporosis/bone fractures                  |     |    |            |                           |                |
| Other?                                       |     |    |            |                           |                |

33. Do you currently drink alcohol?

- (i) Everyday
- (ii) Only on the weekend
- (iii) Once or twice a week
- (iv) Only on social occasions
- (v) Never

34. Did you drink alcohol during your pregnancy?

- (i) Everyday
- (ii) Only on the weekend
- (iii) Once or twice a week
- (iv) Only on social occasions
- (v) Never

35. Do you currently smoke?

YES/NO

36. Did you smoke during your pregnancy?

YES/NO

37. How many times have you been pregnant?

38. Have you ever miscarried or had an abortion?

YES/NO

39. How many children have you given birth to?

40. Are they all healthy now?

YES/NO

If no, please give more details:

41. Did you breastfeed your child?

YES/NO

42. How old was your baby when you stopped breastfeeding?

years

months

43. When did your infant start to take cup feeds?

years

months

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44. What type of milk did you feed your child?

|                        | YES | NO | DON'T KNOW |
|------------------------|-----|----|------------|
| Powder infant formula* |     |    |            |
| Soya formula           |     |    |            |
| Powder milk            |     |    |            |
| Full cream cow's milk  |     |    |            |
| Skimmed cow's milk     |     |    |            |
| Combination*           |     |    |            |
| Other*                 |     |    |            |
| General comments       |     |    |            |

45. When did you introduce the child to solid foods?

months

46. What foods did you initially introduce?

|                      | YES | NO | DON'T KNOW | *Please specify |
|----------------------|-----|----|------------|-----------------|
| Baby porridge/cereal |     |    |            |                 |
| Processed baby food  |     |    |            |                 |
| Fruit/fruit juice    |     |    |            |                 |
| Vegetables           |     |    |            |                 |
| Micelle pop          |     |    |            |                 |
| Eggs                 |     |    |            |                 |
| Tea (normal)         |     |    |            |                 |
| Tea (rooibos)        |     |    |            |                 |
| Other*               |     |    |            |                 |

**PHYSICAL ACTIVITY OF THE CHILD**

**47. ACTIVITIES AT SCHOOL**

47.1 Do you attend physical education (PE/PT/GYM/games) classes at school? YES/NO

47.2 If YES, how many classes do you have a week?  classes

47.3 Using this cue card of school sports, over the last 12 months which 3 do you participate in the most?

| Activities | Monthly/yr | Times/week | Hours/time |
|------------|------------|------------|------------|
|            |            |            |            |
|            |            |            |            |
|            |            |            |            |

**48. INFORMAL ACTIVITIES**

48.1 Using this cue card, what activities do you participate in the most outside school but not in a sports club or as part of your school sports, from MON-THURS. Only name a maximum of 3 activities that you engage in and how often and how long?

| Activities | Times/week | Hours/time |
|------------|------------|------------|
|            |            |            |
|            |            |            |
|            |            |            |

48.2 Using this cue card, what activities do you participate in the most outside school but not in a sports club or as part of your school sports, on a WTKKNO. Only name a maximum of 3 activities that you engage in and how often and how long?

| Activities | Times/week | Hours/time |
|------------|------------|------------|
|            |            |            |
|            |            |            |
|            |            |            |

**49. SEDENTARY ACTIVITIES**

49.1 During a normal weekday, how many TV shows do you watch OR how many hours do you spend watching TV each day?

shows  
 hours      minutes

49.2 During a normal weekend, how many TV shows do you watch OR how many hours do you spend watching TV each day?

shows  
 hours      minutes

**50. ACTIVITY FOR TRANSPORT**

50.1 How do you usually get to school? Choose one of the following:

|                |  |          |  |
|----------------|--|----------|--|
| Walk to school |  | Bus/taxi |  |
| Car            |  | Other    |  |

50.2 If you do walk to school, to the bus stop, or to the taxi rank, how many minutes does it take to walk there?

|                      |                  |     |
|----------------------|------------------|-----|
| Less than 15 minutes | 15-30 minutes    | N/A |
| 30-60 minutes        | More than 1 hour |     |

50.3 If you do walk to school, to the bus stop, or to the taxi rank, how fast do you walk?

|   |  |
|---|--|
| I walk slowly and there is no change in my breathing                              | I walk quickly which makes me breathe harder than normal |
| I walk very quickly and sweat a lot, and makes me breathe much harder than normal | N/A  |

**DEMOGRAPHIC AND SOCIOECONOMIC DETAILS**

1. How many people live in your house?  people
2. How many rooms do you have in your house (including kitchen, lounge, dining room, bedrooms)?  rooms
3. In your home, how many rooms are there just for sleeping?  rooms
4. Which of the following do you have in your household at the present time?

|                    | YES | NO |
|--------------------|-----|----|
| Electricity        |     |    |
| Television         |     |    |
| Radio              |     |    |
| Motor vehicle      |     |    |
| Fridge             |     |    |
| Stove              |     |    |
| Washing machine    |     |    |
| Telephone          |     |    |
| Video machine      |     |    |
| Microwave          |     |    |
| Computer           |     |    |
| Cellular telephone |     |    |
| Internet           |     |    |
| DSTV               |     |    |

5. Mother/primary caretaker's job: \_\_\_\_\_
6. Father/current partner's job: \_\_\_\_\_
7. Sources of income:

|                  |                      |
|------------------|----------------------|
| Employment       | Informal income      |
| Disability grant | Support from parents |
| Other            |                      |

**MEDICAL HISTORY OF CHILD**

8. Would you say your child's health is:

|      |      |      |
|------|------|------|
| Good | Fair | Poor |
|------|------|------|

If FAIR, please explain:

.....

.....

9. Has there been any body hair growth on your child?

YES/NO

If YES:

|   |   |
|---|---|
| Girls<br><input type="checkbox"/> Underarm<br><input type="checkbox"/> Genital area | Boys<br><input type="checkbox"/> Underarm<br><input type="checkbox"/> Genital area<br><input type="checkbox"/> Pubic area |
|---|---|

10. GIRLS ONLY: Has your child started menstruating?

YES/NO/NA

11. Do you have any growth data for your child taking part in the study?

YES/NO

**PHYSICAL ACTIVITY OF THE CHILD**

**12. ACTIVITIES AT SCHOOL**

12.1 Do you enter physical education (PE/PT/GYM/games) classes at school?

YES/NO

12.2 If YES, how many classes do you have a week?

classes

12.3 Using the content of school works over the last 12 months which 3 do you participate in the most?

| Activities | Months/y | Times/week | Hours/time |
|------------|----------|------------|------------|
|            |          |            |            |
|            |          |            |            |
|            |          |            |            |

**13. INFORMAL ACTIVITIES**

13.1 Using the content of your work activities do you participate in the most outside school but not in a sports club or as part of your school sports, from MON-THURS. Only name a maximum of 3 activities that are enjoyable and how often and how long?

| Activities | Times/week | Hours/time |
|------------|------------|------------|
|            |            |            |
|            |            |            |
|            |            |            |

13.7 During this day, date, what activities do you participate in the most outside school but not in a sports club or as part of your school sports, or a WEEKEND. Only name a maximum of 3 activities that you engage in and how often and how long?

| Activities | Freqs/week | Hours/time |
|------------|------------|------------|
|            |            |            |
|            |            |            |
|            |            |            |

14. SEDENTARY ACTIVITIES

14.1 During a normal weekday, how many TV shows do you watch OR how many hours do you spend watching TV each day?

shows  
 hours  minutes

14.2 During a normal weekend, how many TV shows do you watch OR how many hours do you spend watching TV each day?

shows  
 hours  minutes

15. ACTIVITY FOR TRANSPORT

15.1 How do you usually get to school? Choose one of the following.

|                |          |
|----------------|----------|
| Walk to school | Bus/taxi |
|                | Other    |

15.2 If you do walk to school, to the bus stop, or to the taxi rank, how many minutes does it take to walk there?

|                      |                  |     |  |
|----------------------|------------------|-----|--|
| Less than 15 minutes | 15-30 minutes    | N/A |  |
| 30-60 minutes        | More than 1 hour |     |  |

15.3 If you do walk to school, to the bus stop, or to the taxi rank, how fast do you walk?

|  |  |
|--|--|
| I walk slowly and there is no change in my breathing                             | I walk quickly which makes me breathe harder than normal |
| I walk very quickly and sweat a lot and makes me breathe much harder than normal | N/A  |

CUE CARD

| ACTIVITIES AT SCHOOL | ACTIVITIES OUT OF SCHOOL |
|----------------------|--------------------------|
| Athletics            | Aerobics                 |
| Ballet               | Ballet                   |
| Dancing              | Basket ball              |
| Basket ball          | Bicycling                |
| Gymnastics           | Dancing                  |
| Hockey               | Gymnastics               |
| Cricket              | Nippers                  |
| Karate               | Lifesaving               |
| Judo                 | Roller skating           |
| Netball              | Skate boarding           |
| Running              | Surfing                  |
| Soccer               | Swimming                 |
| Swimming             | Volleyball               |
| Teams                | "On-on", Kurnet Pedags,  |
| Other:               | One stokkies             |
|                      | Other                    |

## Appendix 2

2.1 *Strengths and Difficulties Questionnaire Protocol (Parent-Completed Format)*

## The Strengths and Difficulties Questionnaire

I am now going to ask you questions regarding your child's behaviour, his/her relationships at school, and how they have been managing at school or with friends over the last 6 months. It would help me if you answered all items as best as you can even if you are not absolutely certain or the item seems silly. In response to the following, please tell me if this statement is not ever true of your child, somewhat or sometimes true of your child, or certainly or almost always true of your child. There are no right or wrong answers and your responses will always be confidential.

(Interviewer: *Begin each item with "Is/are/isn't/aren't" followed by child's name*) \_\_\_\_\_ ?)

Child's name: \_\_\_\_\_ Date of birth: \_\_\_\_\_

|  | Not True                 | Somewhat True            | Certainly True           |
|--|--------------------------|--------------------------|--------------------------|
| Considerate of other people's feelings                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Restless, overactive, cannot stay still for long                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often complains of headaches, stomach-aches or sickness              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Shares readily with other children (treats, toys, pencils, etc.)     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often has temper tantrums or hot tempers                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Rather solitary, tends to play by him/herself                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Generally obedient, usually does what adults say                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Many worries, often seems worried*                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Helpful if someone is hurt, upset or feeling ill                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Constantly fidgeting or squirming                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Has at least one good friend   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often fights with other children or bullies them                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often unhappy, down-hearted or tearful                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Generally liked by other children                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Distracted easily, loses concentration easily                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Nervous or shy in new situations, easily loses confidence            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Kind to younger children   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often lies or cheats, for example makes up stories, not playing fair | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Picked on or bullied by other children                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Often volunteers to help others (parents, teachers other children)   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Thinks before he or she acts   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Steals from home, school or elsewhere or takes things without asking | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Gets on better with adults than with other children                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Many fears, easily scared or frightened                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Spees tasks through to the end, good attention span                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

\* If mother asks: "About what?", interviewer can give examples such as school, friends etc.

## Appendix 3

## 3.1 Instructions for the Scary Black Box Task

Extra Notes regarding black box ratingSuggested order:

- 1a) Rate initial behaviour of mother; *from time instructions start, you start coding the video*  
 b) then child behaviour during the 5 sec preceding and 5 sec following mother behaviour
- 2a) For hole 1: rate first instance only of each of the 6 child anxious behaviours listed, and  
 b) mother behaviour for previous 5 sec.
- 3a) For hole 1, rate other separate instances of mother 'as-if-afraid' behaviour, *that have not already been rated in 2b (i.e., under child behaviour per hole)*  
 b) and child behaviour during the 5 sec preceding and 5 sec following mother behaviour

*NOTE: make a note of any child behaviour in a 5 sec period here (3b, i.e., before or after mother 'as-if-afraid' behaviour) that was already rated under 2a (child behaviour per hole).*

## THEN REPEAT 2 AND 3 FOR EACH OF THE REMAINING HOLES

- 4) Then go back to start of activity and rate global codes, from start to finish:

Rate mother behaviours that occur from start of researcher's explanation (i.e., from start of timing) until end of child's feeling and guessing, but **DO NOT** include mother behaviours already rated under 'initial behaviour' (e.g., a positive initial comment about the task)

**NOTE:**

'Confusing the boundaries' and 'mixed messages': if mother seems scared but is reassuring child, this should be counted as 'mixed messages' (which is a special instance of 'confusing the boundaries') and not as 'confusing the boundaries'. This latter category should be reserved for instances where mother is confusing child as to what the task demands are, e.g., saying there's nothing at all in the box.

Black box; guidelines for coding1. INITIAL BEHAVIOUR in response to researcher's instructions:Mother

Code mother's behaviour during the giving of instructions and/or at hand-over

Reference to task: does mother rephrase task for child, or speak to child about the task (other than just saying 'yeah?' or 'ok?'): Yes/ no

If yes:

through her tone of voice, speech content, facial expression, body language, does mother make it seem:

- a) interesting/ exciting/ positive
- b) scary/ something for which reassurance is needed
- c) neither ? (e.g. in a flat tone of voice: 'it won't hurt you', or 'you won't look will you?')

If no:

does her facial expression/ body language display:

- a) interest/ enjoyment/ positive anticipation
- b) apprehension/ anxiety/ wariness/ (showing child reassurance)
- c) neither ?

NOTE: If mother displays more than one reaction, just code the most scared one.

Child

Code child behaviour for 5 seconds before AND 5 seconds after the above mother behaviour:

- a) at ease/ happy/ positive anticipation/ interested
- b) uncertain/ anxious/ fearful/ tense/ wary
- c) neither

2. BEHAVIOUR FOR EACH OF THE FOUR HOLES:

rate child behaviour, mothers' behaviour in the previous 5 sec, and separate instances of mother "as-if-afraid" behaviour.

Child behaviour: Rate first instance only of each child behaviour per hole.

1. Withdraw. Child withdraws hand sharply from box, or moves away from box.
2. Hesitate. Child pauses, shows some reluctance to do box task.
3. Refusal. Child says 'no' or that they are not going to or don't want to do the task, whether or not they end up doing it in the end.
4. Anxious/ fearful: through facial expression, speech, or actions, child appears fearful, anxious, tense (this can be coded in addition to withdraw, if withdrawal is accompanied by evidence of child fearfulness)

5. Displacement: ('displace') child engages in activities to diffuse anxiety, such as self-stimulation (clothes fingering, hair twiddling, raising hand to mouth whilst laughing, chewing finger, scratching, other hand movements, twisting feet together, twiddling toes, rocking) or other inappropriate activity (e.g., odd facial grimacing, possibly yawning).

6. Seek comfort ('comf'): child goes to mother for cuddles/ comfort/ reassurance

7. Relaxed/ at ease

8. Puts hand in: child puts hand in hole: yes/ no

Mother behaviour in 5 seconds previous to child behaviour

*For child behaviours 1 to 6, code mothers' behaviour in the previous 5 seconds:*

1. Withdraw: mother moves away from box, shows reluctance to engage in task

2. Anxious/ fearful: through facial expression, speech, or actions, appears fearful, anxious, tense

3. Relaxed/ at ease (normally use this if can't rate anything else)

4. Positive:

a) comments about child: praising child whether or not she has a go, acknowledging child's efforts, saying 'you're a good girl', 'you've done all those holes' etc.

b) actions toward child: giving child kisses, hugs, pat on shoulder, holding hands, as sign of encouragement, support, reassurance (can be in response to child seeking comfort, or initiated by mother).

c) comments about task: encouraging statements re task, positive framing of task, e.g., 'it's fun', 'it might be something nice', 'does it feel nice?'

d) verbal reassurance re task: 'it's not that scary', 'I did it' etc.

5. Negative:

a) criticisms of child: disapproving of child, e.g., for not having a go. Saying 'that's cheating', 'don't cheat', 'you're not being a good girl', 'don't be silly'

Note: if mother is raising her voice and being clearly hostile, code this as verbal aggression, not criticism.

b) negative comments re task: expressing doubt, negative framing of activity, e.g., 'it's not very nice', or assuming child does not like task, e.g., 'don't you like it?'

c) verbal aggression: harsh/ shouted criticisms, threats, insults, arguing, shouting at child

d) physical control (/guidance): mother tries to physically control child during task (whether or not she succeeds). Count no. of times

e.g., taking hold of child's arm and moving it toward hole, holding child's arm in hole, preventing child from pulling toy out of hole, turning child's body to face box

- mild: gently taking hold of arm or moving child in encouraging way, perhaps with reassurance, gently putting hand over child's eyes

- strong: acting in a harsh way, with minimal respect for child's feelings, or using physical control when unnecessary/ intrusive, e.g., forcing child's arm toward hole, holding child's arm in box when child obviously distressed, clapping hand over child's eyes unnecessarily firmly (intrusive/ over-controlling)

e) physical aggression: smacking, using physical force, other than to get child to put hand in hole

ALSO code separate instances of mother 'as-if-afraid' behaviour, and child behaviour (1 - 6 above) during the previous AND following 5 seconds.

Mother 'as-if-afraid' behaviour: any signs of anxiety in mother, or shows of reassurance to child before the child has shown any fear, indicating that child should be afraid (e.g., hugging child, rubbing child's stomach, holding child's hand, verbal reassurance)

### 3. GLOBAL RATINGS: MOTHER BEHAVIOUR

1. Prompting: to do the task, i.e., put hand into hole. Count no. of prompts  
 - mild: suggest, guide, encourage, gently, not in harsh tone or negative or patronising manner, without anger or frustration, e.g., 'why don't you give it a try?'  
 - strong: command, expressing anger or frustration, e.g., 'go on, do it!' (intrusive, over-controlling)

If physical or verbal aggression is used, code as such.

2. Directives: when child has hand in box (i.e., not prompts to put hand in box) Count no.  
 e.g., 'have a feel around!', 'don't take the thing out of the box'.  
 - mild: encouraging, suggesting, but not in harsh, patronising or negative way  
 - strong: command, in harsh tone of voice, expressing anger or frustration, e.g., 'no, don't do that!' (intrusive/ over-controlling)

If physical or verbal aggression is used, code as such.

3. Physical control (/guidance): see p.3.

If physical or verbal aggression is used, code as such.

Count total no. of occurrences of mild and strong physical guidance, whether or not these are also coded in the 'behaviour per hole' section.

4. Mixed messages: mother gives mixed messages from different channels, i.e., verbal and non-verbal, e.g., verbally encouraging child whilst looking hesitant/ withdrawing  
 Count number of times  
 (see note on p1 re distinction between 'mixed messages' and 'confusing the boundaries')

5) Positivity: Count number of occurrences, including instances already counted in 'behaviour per hole' section

- a) comments about child: see p 3.
- b) actions toward child: see p 3.
- c) comments about task: see p 3.

6) Negativity

- a) about child: see p 3.
- b) about task: see p 3.

Count number of occurrences, including instances already counted in 'behaviour per hole' section

7) Mother's use of different strategies to engage child

- i) Stimulating child's curiosity e.g., 'I wonder what it could be? Do you think it might be...?', 'don't you want to know what it is?', 'I know what it is'
- ii) Putting her hand in first, or putting hand in with child (only count if mother does this of her own initiative, not if researcher suggests it)
- iii) Focusing on the object rather than the process of putting the hand in, e.g., 'tell me if it's soft' rather than 'go on, put your hand in then'
- iv) Minimising: breaking the task down into manageable steps, e.g., 'we'll just do one hole', 'just one quick feel', 'last one'
- v) Verbal facilitation/reassurance: praising, telling child that they can do it, it won't be scary, might be something nice
- vi) Offering reward: physical, e.g., sweet, toy, or 'we can tell Daddy you've been clever', etc.
- vii) Humour: using humour to make it more fun and enticing e.g., 'maybe it's a banana!'

Count no. of different strategies each Mum uses

For 8 and 9 use: *Not at all/some of the time; once or twice/nearly always when appropriate; three or more times*

8a. Setting clear boundaries: mother gives appropriate reassurance if child is scared/reluctant, e.g., saying 'it won't hurt', 'it's not that scary really'. Does mother do this?  
(If child is anxious and mum sets clear boundaries only some of the time, this indicates that child has been left un-reassured on one or more occasion when seeming to want reassurance)

8b. Confusing the boundaries: mother blurs the boundaries of the activity, leaving child unsure of the safety/scariness, e.g., telling child there's nothing in the box really. Does mother do this? (see note on p1 re distinction between 'confusing the boundaries' and 'mixed messages')

9. Empathy (mothers' sensitivity/insensitivity):

- a) Acceptance of sympathy for sensitivity to the child's point of view/agenda, e.g., accepting that the child does not want to go on with that hole, so moving on to the next hole. Does mother do this?  
(If mother does not let child pull out the toys, but is otherwise sensitive to child's agenda, code as sensitive.)

b) *Rejection or insensitivity toward child's point of view* (e.g., forcing child to try again when child is obviously distressed. Does mother do this?

10. **Taking over (over-intrusive):** not allowing child time/space to explore by herself. Scale: none/ a little/ often.

11. **Over-protective:** mother envelops child with her body, moltycoddling. Scale: none/ a little/ often.

12) **Overall harmony:** Scale of 0 to 4

atmosphere of mutual enjoyment, mother and child sharing common purpose, mutual positive affect, smiling, positive friendly atmosphere. No tension, conflict, or negative feelings expressed by either.

0 = no harmony (or almost none); 1 = seldom; 2 = some; 3 = often; 4 = (nearly) always

*(If not much sharing of positive affect [e.g., mother is smiling but child not] but no tension/conflict, code some or often for harmony; but if not much positive affect from either, no tension, and mother is in tune with child's emotion, code always)*

13) **Overall discord:** Scale of 0 to 4

atmosphere of conflict, discord, tension, with negative feelings expressed by mother, child or both. No expression of positive emotions, or any positive emotions expressed are met with hostility or rejection.

0 = no discord (or almost none); 1 = seldom; 2 = some; 3 = often; 4 = (nearly) always

Appendix 4

4.1 Coding Scheme for the Scary Black Box

Black box rating

Initial behaviour

| Mother reference to task | Times:           | Mother              | child: previous 5 sec | child: following 5 sec |
|--------------------------|------------------|---------------------|-----------------------|------------------------|
|                          |                  | Interest/excitement |                       |                        |
| Yes                      | Anxiety/wariness |                     |                       |                        |
| No                       | Neither          |                     |                       |                        |

Note 1

| Time | Child        | Mother: previous 5 sec |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|------|--------------|------------------------|-----|-------|----------------|------------------|------------------|------------|----------|------------------|-------------------|----------------|-----------------|------------------|
|      |              | with- draw             | see | relax | +ve comm child | +ve action child | +ve comm re task | stop occur | child id | +ve comm re task | verbal aggression | phys guide n/d | phys guide stim | phys figure stim |
|      | withdraw     |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | hesitate     |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | refuse       |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | anxious      |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | displeas     |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | seek comfort |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |
|      | relaxed      |                        |     |       |                |                  |                  |            |          |                  |                   |                |                 |                  |

|                         |     |    |
|-------------------------|-----|----|
| Child puts hand in hole | Yes | No |
|-------------------------|-----|----|

Other instances of mother 'as-if-afraid' behaviour

| Event | Child: pre- 5 sec |     |       |     |                |                  |                  |            | Child: 5 sec: after |     |       |     |        |      |       |  |
|-------|-------------------|-----|-------|-----|----------------|------------------|------------------|------------|---------------------|-----|-------|-----|--------|------|-------|--|
|       | with- draw        | see | relax | see | +ve comm child | +ve action child | +ve comm re task | stop occur | with- draw          | see | relax | see | quiesc | comf | relax |  |
| Time  |                   |     |       |     |                |                  |                  |            |                     |     |       |     |        |      |       |  |
| Time  |                   |     |       |     |                |                  |                  |            |                     |     |       |     |        |      |       |  |
| Time  |                   |     |       |     |                |                  |                  |            |                     |     |       |     |        |      |       |  |
| Time  |                   |     |       |     |                |                  |                  |            |                     |     |       |     |        |      |       |  |
| Time  |                   |     |       |     |                |                  |                  |            |                     |     |       |     |        |      |       |  |

Notes: events of instances of mother 'as-if-afraid' behaviour specific behaviour displayed.

Hole 2!

| Time | Child           | Mum: previous 5 sec |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|------|-----------------|---------------------|-----|-------|-----------------------|------------------------|--------------------------|-----------------------|---------------------|--------------------------|---------------------------|-----------------------|-------------------------|-------------------------|--|
|      |                 | with-<br>draw       | cry | relax | eye<br>comm.<br>solid | eye<br>action<br>child | eye<br>commen-<br>tation | verb<br>reass<br>sure | verb<br>phr-<br>ase | eye<br>commen-<br>tation | verbal<br>aggres-<br>sion | phys<br>guide<br>mild | phys<br>guide<br>strong | phys<br>aggres-<br>sion |  |
|      | withdraw        |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | hesitate        |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | refuse          |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | anxious         |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | displace        |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | seek<br>comfort |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |
|      | relaxed         |                     |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |

|                         |     |    |
|-------------------------|-----|----|
| Child puts hand in hole | Yes | No |
|-------------------------|-----|----|

Other instances of mother 'as-if-afraid' behaviours:

| Event | Child: 5 sec  |     |       |                       |                        |                          |                       |                     | Child: 5 sec after       |                           |                       |                         |                         |  |  |
|-------|---------------|-----|-------|-----------------------|------------------------|--------------------------|-----------------------|---------------------|--------------------------|---------------------------|-----------------------|-------------------------|-------------------------|--|--|
|       | with-<br>draw | cry | relax | eye<br>comm.<br>solid | eye<br>action<br>child | eye<br>commen-<br>tation | verb<br>reass<br>sure | verb<br>phr-<br>ase | eye<br>commen-<br>tation | verbal<br>aggres-<br>sion | phys<br>guide<br>mild | phys<br>guide<br>strong | phys<br>aggres-<br>sion |  |  |
| Time: |               |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |  |
| Time: |               |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |  |
| Time: |               |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |  |
| Time: |               |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |  |
| Time: |               |     |       |                       |                        |                          |                       |                     |                          |                           |                       |                         |                         |  |  |

Notes re events: instances of mother 'as-if-afraid' behaviour (i.e. behaviour displaced)

This same coding template was used for Holes 3 and 4

Global ratings

| Mother behaviour          | Counts |        |
|---------------------------|--------|--------|
|                           | Mid    | Strong |
| Prompting                 |        |        |
| Directives                |        |        |
| Physical control/guidance |        |        |

| Mother behaviour              | Counts |
|-------------------------------|--------|
| Mixed messages                |        |
| Positive comments about child |        |
| Positive actions toward child |        |
| Positive comments about task  |        |
| Negativity about child        |        |
| Negativity about task         |        |

| Strategies used                                    | Yes |
|--|-----|
| stimulating child's curiosity                      |     |
| mom puts hand in first, or with child (unprompted) |     |
| focusing on object, not on putting hand in         |     |
| minimising 'just one hole'                         |     |
| verbal facilitation/reassurance                    |     |
| reward   |     |
| humour   |     |
| other  |     |

| Mother behaviour             | not at all | some of the time | (nearly) always when appropriate |
|------------------------------|------------|------------------|----------------------------------|
| Setting clear boundaries     |            |                  |                                  |
| Confusing the boundaries     |            |                  |                                  |
| Acceptance of child's agenda |            |                  |                                  |
| Rejection of child's agenda  |            |                  |                                  |

| Mother behaviour | none | a little | often |
|------------------|------|----------|-------|
| Taking over      |      |          |       |
| Over-protective  |      |          |       |

| Atmosphere | none | seldom | some | often | always |
|------------|------|--------|------|-------|--------|
|            | 0    | 1      | 2    | 3     | 4      |
| Harmony    |      |        |      |       |        |
| Discord    |      |        |      |       |        |

Total time from start of researcher's explanation until end of guessing: \_\_\_\_\_ (minutes)  
 (stop timing just before hands are taken out of box)

## Appendix 5

Table 7a

*Table of Kappa Values for Interrater Reliability between Two Independent Raters for Behaviours Coded during the Scary Black Box Task*

| Behaviour   | Kappa value (% agreement)<br>(all significant at $p < 0.05$ )          |
|---|--|
| <b>Initial Behaviour:</b>   |  |
| Mother: reference to task   | 0.60 (75)  |
| Child's reaction prior to mother's reference to task                            | 0.80 (88)  |
| Child's reaction after mother's reference to task                               | 0.80 (88)  |
| Child places hand in hole 1   | N/A (all children put their hand in) (100)                             |
| Child places hand in hole 2   | N/A (all children put their hand in) (100)                             |
| Child places hand in hole 3   | N/A (all children put their hand in) (100)                             |
| Child places hand in hole 4   | N/A (all children put their hand in) (100)                             |
| Child's reaction to hole 1  | 0.77 (88)  |
| Mother's reaction in the 5 seconds prior to the child's reaction for hole 1     | 0.69 (88)  |
| Child's reaction to hole 2  | 0.64 (75)  |
| Mother's reaction in the 5 seconds prior to the child's reaction for hole 2     | 0.77 (88)  |
| Child's reaction to hole 3  | 0.65 (75)  |
| Mother's reaction in the 5 seconds prior to the child's reaction for hole 3     | 0.81 (88)  |
| Child's reaction to hole 4  | 0.82 (88)  |
| Mother's reaction in the 5 seconds prior to the child's reaction for hole 4     | 1 (100)  |
| Child's behaviour prior to mother's "as if afraid" behaviour for hole 4 Event 1 | 0.47 (88) <sup>b</sup>   |
| Child's behaviour after mother's "as if afraid" behaviour for hole 4 Event 1    | 1 (100) <sup>b</sup>   |
| Child's behaviour prior to mother's "as if afraid" behaviour for hole 4 Event 2 | 1 (100) <sup>b</sup>   |
| Child's behaviour after mother's "as if afraid" behaviour for hole 4 Event 2    | 1 (100) <sup>b</sup>   |
| Child's behaviour prior to mother's "as if afraid" behaviour for hole 4 Event 3 | 1 (100) <sup>b</sup>   |
| Child's behaviour after mother's "as if afraid" behaviour for hole 4 Event 3    | 1 (100) <sup>b</sup>   |
| <b>Global behaviours:</b>   |  |
| Mother set clear boundaries   | 0.71 (88)  |
| Mother confused boundaries  | 0.62 (88)  |
| Mother accepted child's agenda  | 0.74 (88)  |
| Mother rejected child's agenda  | 0.71 (88)  |
| Mother exhibited "taking over" behaviour  | 0.62 (88)  |
| Mother exhibited overprotective behaviour                                       | N/A (all mothers exhibited a small degree of overprotectiveness) (100) |
| Atmosphere of harmony between mother and child                                  | 0.60 (75)  |
| Atmosphere of discord between mother and child                                  | 0.78 (88)  |
| <b>Strategies used by mother to encourage child:</b>                            |  |
| Stimulated child's curiosity  | 1 (100) <sup>b</sup>   |
| Mother put her hand in hole first   | N/A (no mms used this strategy) (100) <sup>a,b</sup>                   |
| Mother focused on the object, not on putting hand in hole                       | 1 (100) <sup>b</sup>   |
| Minimising  | 1 (100) <sup>b</sup>   |
| Verbal Reassurance  | N/A (no mms used this strategy) (100) <sup>a,b</sup>                   |
| Offered a reward  | N/A (no mms used this strategy) (100) <sup>a,b</sup>                   |
| Used humour   | 1 (100) <sup>b</sup>   |
| Other methods of encouragement  | N/A (no mms used this strategy) (100) <sup>a,b</sup>                   |
| No strategy used  | 1 (100) <sup>b</sup>   |

<sup>a</sup> = items not rated as present by either rater

<sup>b</sup> = items subsequently dropped from the analysis

Table 7b

*Table of Pearson Product-Moment Correlation coefficients for Interrater Reliability between Two Independent Raters for behaviours coded during the Scary Black Box task*

| Behaviour                              | Spearman<br>Product-Moment<br>Correlation<br>(all significant at $p < 0.05$ ) |
|--|---|
| <b>Discrete behaviours of mothers:</b> |   |
| Mild prompts                           | 0.99  |
| Strong prompts                         | 0.98  |
| Mild directives                        | 0.91  |
| Strong directives                      | 0 <sup>a</sup>  |
| Mild physical control                  | 0.98  |
| Strong physical control                | 0 <sup>a</sup>  |
| Mother gives mixed messages            | 0 <sup>a</sup>  |
| Positive comments toward child         | 0.78  |
| Positive actions toward child          | 0.97  |
| Positive comments about task           | 0 <sup>a</sup>  |
| Negative comments toward child         | 0.94  |
| Negative comments about task           | 0 <sup>a</sup>  |

<sup>a</sup> items not rated as present by either rater

University of Cape Town

## Appendix 6

## 6.1 Informed Consent Document

BISHOP LAVIS GROWTH AND NUTRITION STUDY: PHASE 2  
(Informed Consent)

## Introduction:

Thank you for participating in the first phase of our study, which took place at the Bishop Lavis Day Hospital in 2002/2003. As you will remember we did body fat, height and weight measurements on you and your child, and your child also participated in the physical fitness test and read an essay of their hand. At the time we mentioned that we may contact you regarding additional tests at a later time. This is why we would like to invite you to participate in the second phase of the study. This study that we would like to conduct is still part of the study by Dr. An Ghahway of the Medical Research Council in 1994/1995 which he collected information regarding your health and nutritional status, as well as the birth weight and health status of your child was recorded.

We would now like to do additional tests on your child so we would like to obtain more information about their health now and how it may be related to certain factors since birth and also future diseases like hypertension and type 2 diabetes. The difference between these tests and the ones that we did at the Day Hospital is that we are now looking more at the reason why low birth weight is related to certain diseases later in life. Although these tests do require some time of your time and do involve taking a blood sample, we have done everything possible to minimize the inconvenience to you and your family. You will benefit from this series of tests by gaining more knowledge about your child's health, as well as helping us to learn more about risk of diseases in later life and possible ways of preventing them.

## Procedures:

In order for you and your child to participate, we will need to make an arrangement for you to attend the University of Cape Town's Department of Human Biology to undergo some tests on two separate visits. We will be able to arrange a driver to collect you and your child from your home, and to drop you back there when the testing is completed.

During your first visit to our laboratory, you and your child will undergo the following:

1. We will put some local anaesthetic cream on your child's arm. This is for when we take a blood sample later so that it is as pain free as possible.
2. We will measure your height, weight and blood pressure, as well as that of your child. We will also take measurements of body fatness using a skinfold caliper on you and your child like we did at the last meeting.
3. We will ask you to get more questions about your child's diet and what foods they eat most frequently.
4. We will also ask you some questions about some common problems that your child may have with regard to their behaviour over the last month.
5. We will then do a "black box" test to assess your child's response to putting their hand in a black box after being told that there is something heavy inside. There will not be anything dangerous in the box and you will be in the room with your child the whole time. This test will be videotaped but we will ensure

- near site during the study by using special mirrors that stick on like a plaster and can be removed easily after the test.
3. We will then take a blood sample from your child on the vein of the skin that has been attached to the special mirror.
  4. We will then re-attach the special mirror on a suitable site during which they will cycle for 15 minutes.
  5. At the end of the cycle, if we will take another blood sample from the small elastic line that we used to attach the first blood sample. This means that only one needle stick is required.

During the hours of test, we will provide breakfast for your child and some refreshments for you.

We may also invite your child to some additional tests which will include:

1. A measurement to measure the ability of the arm blood vessels to change diameter. This does not involve giving a blood sample. Instead, we simply either heat the arm, or use a gel on the skin, that may change blood flow in the arm. We measure the change in diameter of the vessel using ultrasound. This technique is not unpleasant or painful. This test is important as it may identify if there is an association between birth weight and the ability of the blood vessel to constrict. This may provide some information about high blood pressure and low birth weight.
2. You and your child will have a body composition scan to assess how much of your baby is muscle, bone and fat. This test is painless and involves minimal radiation.

You will receive all of the results of these tests for your information, and appropriate referral for any abnormal results.

#### Consent:

I, \_\_\_\_\_ have read or have had explained to me the procedures described above. I have had an opportunity to ask questions and these questions have been answered satisfactorily. I understand that I am free to withdraw from this study without prejudice at any time. I give my consent for my child to take part in this study.

Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Witness: \_\_\_\_\_ Signature: \_\_\_\_\_

## Appendix 7

Table 8a

*Birth Weight Status and Demographics*

| Variable   | Normal Birth Weights |                       | Low Birth Weights |                     | n         | p <sup>b</sup>     |
|--|----------------------|-----------------------|-------------------|---------------------|-----------|--------------------|
|  | n                    | M (SD)                | n                 | M (SD)              |           |                    |
| Difference between age and expected age for grade (1 yr younger/ expected age for grade/ 1 yr older) (%) | 1/30/6               | (2.7/81.1/16.2)       | 2/16/8            | (7.7/61.5/30.8)     | 3/46/14   | 0.22 <sup>c</sup>  |
| Means of access of water (indoor tap/outdoor tap/other) (%)  | 34/2/1               | (91.9/5.4/2.7)        | 23/3/0            | (88.5/11.5/0)       | 57/5/1    | 0.25               |
| Form of toilet facilities (inside flush/outside non-flush/outside flush) (%)                             | 23/3/11              | (62.2/8.1/29.7)       | 16/1/9            | (61.5/3.9/34.6)     | 39/4/20   | 0.38 <sup>a</sup>  |
| Manner of refuse disposal (collected from home) (%)  | 37                   | (100)                 | 26                | (100)               | 63        | -                  |
| Electricity (yes/no) (%)   | 37/0                 | (100)                 | 25/1              | (96.2/3.8)          | 62/1      | 0.41               |
| Own a TV (yes/no) (%)  | 34/3                 | (91.9/8.1)            | 22/4              | (84.6/15.4)         | 56/7      | 0.31               |
| Own a Radio (yes/no) (%)   | 28/9                 | (75.7/24.3)           | 20/6              | (76.9/23.1)         | 48/15     | 0.58               |
| Own a car (yes/no) (%)   | 13/24                | (35.1/64.9)           | 3/22              | (12.0/88.0)         | 16/46     | 0.06 <sup>**</sup> |
| Own a fridge (yes/no) (%)  | 34/3                 | (91.9/8.1)            | 19/7              | (73.1/26.9)         | 53/10     | 0.05 <sup>**</sup> |
| Own a Stove (yes/no) (%)   | 34/3                 | (91.9/8.1)            | 25/1              | (96.2/3.8)          | 59/4      | 0.45               |
| Own a Washing machine (yes/no) (%)   | 25/12                | (67.6/32.4)           | 14/12             | (53.8/46.2)         | 39/24     | 0.20               |
| Own a Telephone (yes/no) (%)   | 21/16                | (36.8/43.2)           | 13/13             | (50/50)             | 34/29     | 0.39               |
| Own a video machine (yes/no) (%)   | 14/23                | (37.8/62.2)           | 5/21              | (19.2/80.8)         | 19/44     | 0.10               |
| Own a Microwave (yes/no) (%)   | 16/21                | (43.2/36.8)           | 6/20              | (23.1/76.9)         | 22/41     | 0.08 <sup>**</sup> |
| Own a PC (yes/no) (%)  | 2/35                 | (5.4/94.6)            | 0/26              | (0.0/100)           | 2/61      | 0.34               |
| Own a Cellular phone (yes/no) (%)  | 9/28                 | (24.3/75.7)           | 5/21              | (19.2/80.8)         | 14/49     | 0.44               |
| MNET (yes/no) (%)  | 1/36                 | (2.7/97.3)            | 0/26              | (0.0/100)           | 1/62      | 0.59               |
| DSTV (yes/no) (%)  | 0/37                 | (0.0/100)             | 1/25              | (3.8/96.2)          | 1/62      | 0.41               |
| Source of caregiver income (employment/disability grant/informal income/support from family) (%)         | 22/4/4/4             | (64.6/11.8/11.8/11.8) | 17/2/1/6          | (65.4/7.7/3.8/23.1) | 39/6/5/10 | 0.21 <sup>c</sup>  |
| Are all the children healthy (yes/no) (%)  | 34/3                 | (91.9/8.1)            | 26/0              | (100/0.0)           | 60/3      | 0.20 <sup>c</sup>  |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;  
 \* = p < 0.05; \*\* = p < 0.1;

Table 8b

*Behavioural Inhibition Status and Demographics*

| variable   | Normal     |                          | Behaviourally Inhibited |                         | n           | p <sup>b</sup>     |
|--|------------|--------------------------|-------------------------|-------------------------|-------------|--------------------|
|  | n          | M (SD)                   | n                       | M (SD)                  |             |                    |
| Difference between age and expected age for grade (1 yr younger/ expected age for grade/ 1 yr older) (%) | 2/38/10    | (4.00/76.0/20.0)         | 1/5/3                   | (11.1/55.6/33.3)        | 3/43/13     | 0.21 <sup>a</sup>  |
| Means of access of water (indoor tap/outdoor tap/other)  | 45/4/1     | (90.0/8.0/2.0)           | 8/1/0                   | (88.9/1.1/0.0)          | 53/5/1      | 0.44 <sup>a</sup>  |
| Form of toilet facilities (inside flush/outside non-flush/outside flush)                                 | 31/4/15    | (62.0/8.0/30.0)          | 6/0/3                   | (66.7/0.0/33.3)         | 37/4/18     | 0.34 <sup>a</sup>  |
| Manner of refuse disposal (collected from home)  | 50         | (100)                    | 9                       | (100)                   | 59          | -                  |
| Electricity (no/yes) (%)   | 0/50       | (0.0/100.0)              | 1/8                     | (11.1/88.9)             | 1/58        | 0.15               |
| Own a TV (no/yes) (%)  | 5/45       | (10.0/90.0)              | 1/8                     | (11.1/88.9)             | 6/53        | 0.65               |
| Own a Radio (no/yes) (%)   | 8/42       | (16.0/84.0)              | 6/3                     | (66.7/33.3)             | 14/45       | 0.004 <sup>*</sup> |
| Own a car (no/yes) (%)   | 34/15      | (69.4/30.6)              | 9/0                     | (100.0/0.0)             | 43/15       | 0.05 <sup>**</sup> |
| Own a fridge (no/yes) (%)  | 5/45       | (10.0/90.0)              | 4/5                     | (44.4/55.6)             | 9/50        | 0.02 <sup>*</sup>  |
| Own a Stove (no/yes) (%)   | 2/48       | (4.0/96.0)               | 1/8                     | (11.1/88.9)             | 3/56        | 0.40               |
| Own a Washing machine (no/yes) (%)   | 17/33      | (34.0/66.0)              | 6/3                     | (66.7/33.3)             | 23/36       | 0.07 <sup>**</sup> |
| Own a Telephone (no/yes) (%)   | 19/31      | (38.0/62.0)              | 8/1                     | (88.9/11.1)             | 27/32       | 0.007 <sup>*</sup> |
| Own a video machine (no/yes) (%)   | 34/16      | (68.0/32.0)              | 8/1                     | (88.9/1)                | 42/17       | 0.20               |
| Own a Microwave (no/yes) (%)   | 29/21      | (58.0/42.0)              | 8/1                     | (88.9/11.1)             | 37/22       | 0.08 <sup>**</sup> |
| Own a PC (no/yes) (%)  | 48/2       | (96.0/4.0)               | 9/0                     | (100.0/0.0)             | 57/2        | 0.72               |
| Own a Cellular phone (no/yes) (%)  | 40/10      | (80.0/20.0)              | 7/2                     | (77.8/22.2)             | 47/12       | 0.59               |
| MNET (no/yes) (%)  | 49/1       | (98.0/2.0)               | 9/0                     | (100.0/0.0)             | 58/1        | 0.85               |
| DSTV (no/yes) (%)  | 50/0       | (100.0/0.0)              | 9/0                     | (100./0.0)              | 59/0        | 1.00               |
| Source of caregiver income (not applicable/employment/disability grant/informal income/support from      | 2/33/4/5/5 | (4.1/67.3/8.2/10.2/10.2) | 0/5/1/0/3               | (0.0/65.4/7.7/3.8/23.1) | 2/39/6/5/10 | 0.35 <sup>a</sup>  |
| Are all the children healthy (yes/no) (%)  | 47/3       | (94.0/6.0)               | 9/0                     | (100/0.0)               | 56/3        | 0.60               |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed;  
 \* = p < 0.05; \*\* = p < 0.1;

Table 8c

*Total Difficulties Category on the SDQ and Demographics*

| Variable   | Total Difficulties nominally |                          |            |                         | n           | p <sup>b</sup>     |
|--|------------------------------|--------------------------|------------|-------------------------|-------------|--------------------|
|  | Normal                       |                          | Abnormal   |                         |             |                    |
|  | n                            | M (SD)                   | n          | M (SD)                  |             |                    |
| Difference between age and expected age for grade (1 yr younger/ expected age for grade/ 1 yr older) (%) | 0/22/6                       | (0.0/78.6/21.4)          | 2/24/8     | (5.9/70.6/23.5)         | 2/46/14     | 0.21 <sup>c</sup>  |
| Means of access of water (indoor tap/outdoor tap/other)  | 25/2/1                       | (89.3/7.1/3.6)           | 31/3/0     | (91.2/8.8/0.0)          | 56/5/1      | 0.27 <sup>c</sup>  |
| Form of toilet facilities (inside flush/outside non-flush/outside flush)                                 | 17/1/10                      | (60.7/3.6/35.7)          | 21/3/10    | (61.8/8.8/29.4)         | 38/4/20     | 0.33 <sup>c</sup>  |
| Manner of refuse disposal (collected from home)  | 28                           | (100)                    | 34         | (100)                   | 62          | -                  |
| Electricity (yes/no) (%)   | 28/0                         | (100/0.0)                | 33/1       | (97.1/2.9)              | 61/1        | 0.55               |
| Own a TV (no/yes) (%)  | 2/26                         | (7.1/92.9)               | 4/30       | (11.8/88.2)             | 6/56        | 0.43               |
| Own a Radio (no/yes) (%)   | 5/23                         | (17.9/82.1)              | 10/24      | (29.4/70.6)             | 15/47       | 0.23               |
| Own a car (no/yes) (%)   | 19/8                         | (70.4/29.6)              | 27/7       | (79.4/20.6)             | 46/15       | 0.30               |
| Own a fridge (no/yes) (%)  | 2/26                         | (7.1/92.9)               | 8/26       | (23.5/76.5)             | 10/52       | 0.08 <sup>**</sup> |
| Own a Stove (no/yes) (%)   | 1/27                         | (3.6/96.4)               | 3/31       | (8.8/91.2)              | 4/58        | 0.38               |
| Own a Washing machine (no/yes) (%)   | 10/18                        | (35.7/64.3)              | 13/21      | (38.2/61.8)             | 23/39       | 0.52               |
| Own a Telephone (no/yes) (%)   | 10/18                        | (35.7/64.3)              | 18/16      | (52.9/47.1)             | 28/34       | 0.14               |
| Own a video machine (no/yes) (%)   | 19/9                         | (67.9/32.1)              | 24/10      | (70.6/29.4)             | 43/19       | 0.52               |
| Own a Microwave (no/yes) (%)   | 18/10                        | (64.3/35.7)              | 22/12      | (64.7/35.3)             | 40/22       | 0.59               |
| Own a PC (no/yes) (%)  | 27/1                         | (96.4/3.6)               | 33/1       | (97.1/2.9)              | 60/2        | 0.70               |
| Own a Cellular phone (no/yes) (%)  | 24/4                         | (85.7/14.3)              | 24/10      | (70.6/29.4)             | 48/14       | 0.13               |
| MNET (no/yes) (%)  | 27/1                         | (96.4/3.6)               | 34/0       | (100.0/0.0)             | 61/1        | 0.45               |
| DSTV (no/yes) (%)  | 28/0                         | (100/0.0)                | 33/1       | (97.1/2.9)              | 61/1        | 0.55               |
| Source of caregiver income (not applicable/employment/disability grant/informal income/support from      | 0/17/5/1/4                   | (0.0/63.0/18.5/3.7/14.8) | 2/22/1/3/6 | (5.9/64.7/2.9/8.8/17.6) | 2/39/6/4/10 | 0.10 <sup>c</sup>  |
| Are all the children healthy (yes/no) (%)  | 27/1                         | (96.4/3.6)               | 32/2       | (94.1/5.9)              | 59/3        | 0.29 <sup>c</sup>  |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;  
 \* = p < 0.05; \*\* = p < 0.1;

Table 8d

*Total Strengths Category on the SDQ and Demographics*

| Variable   | Total Strengths Nominally |                          |           |                       | n           | p <sup>b</sup>     |
|--|---------------------------|--------------------------|-----------|-----------------------|-------------|--------------------|
|  | Normal                    |                          | Abnormal  |                       |             |                    |
|  | n                         | M (SD)                   | n         | M (SD)                |             |                    |
| Difference between age and expected age for grade (1 yr younger/ expected age for grade/ 1 yr older) (%) | 2/44/14                   | (3.3/73.3/23.3)          | 0/2/0     | (0.0/ 100.0/0.0)      | 2/46/14     | 0.35 <sup>c</sup>  |
| Means of access of water (indoor tap/outdoor tap/other)  | 55/4/1                    | (91.7/6.7/1.7)           | 1/1/0     | (50.0/50.0/0.0)       | 56/5/1      | 0.05 <sup>c*</sup> |
| Form of toilet facilities (inside flush/outside non-flush/outside flush)                                 | 37/4/19                   | (61.7/6.7/31.7)          | 1/0/1     | (50.0/0.0/50.0)       | 38/4/20     | 0.42 <sup>c</sup>  |
| Manner of refuse disposal (collected from home)  | 60                        | (100)                    | 2         | (100)                 | 62          | -                  |
| Electricity (yes/no) (%)   | 59/1                      | (98.3/1.7)               | 2/0       | (100.0/0.0)           | 61/1        | 0.97               |
| Own a TV (no/yes) (%)  | 6/54                      | (10.0/90.0)              | 0/2       | (0.0/100.0)           | 6/56        | 0.81               |
| Own a Radio (no/yes) (%)   | 13/47                     | (21.7/78.3)              | 2/0       | (100.0/0.0)           | 15/47       | 0.06 <sup>**</sup> |
| Own a car (no/yes) (%)   | 44/15                     | (74.6/25.4)              | 2/0       | (100/0.0)             | 46/15       | 0.57               |
| Own a fridge (no/yes) (%)  | 8/52                      | (13.3/86.7)              | 2/0       | (100.0/0.0)           | 10/52       | 0.02 <sup>*</sup>  |
| Own a Stove (no/yes) (%)   | 4/56                      | (6.7/93.3)               | 0/2       | (0.0/100.0)           | 4/58        | 0.87               |
| Own a Washing machine (no/yes) (%)   | 22/38                     | (36.7/63.3)              | 1/1       | (50.0/50.0)           | 23/39       | 0.61               |
| Own a Telephone (no/yes) (%)   | 26/34                     | (43.3/56.7)              | 2/0       | (100.0/0.0)           | 28/34       | 0.20               |
| Own a video machine (no/yes) (%)   | 41/19                     | (68.3/31.7)              | 2/0       | (100.0/0.0)           | 43/19       | 0.48               |
| Own a Microwave (no/yes) (%)   | 38/22                     | (63.3/36.7)              | 2/0       | (100.0/0.0)           | 40/22       | 0.41               |
| Own a PC (no/yes) (%)  | 58/2                      | (96.7/3.3)               | 2/0       | (100.0/0.0)           | 60/2        | 0.94               |
| Own a Cellular phone (no/yes) (%)  | 46/14                     | (76.7/23.3)              | 2/0       | (100.0/0.0)           | 48/14       | 0.60               |
| MNET (no/yes) (%)  | 59/1                      | (98.3/1.7)               | 2/0       | (100.0/0.0)           | 61/1        | 0.97               |
| DSTV (no/yes) (%)  | 59/1                      | (98.3/1.7)               | 2/0       | (100.0/0.0)           | 61/1        | 0.97               |
| Source of caregiver income (not applicable/employment/disability grant/informal income/support from      | 2/37/6/4/10               | (3.4/62.7/10.2/6.8/16.9) | 0/2/0/0/0 | (0/100.0/0.0/0.0/0.0) | 2/39/6/4/10 | 0.44 <sup>c</sup>  |
| Are all the children healthy (yes/no) (%)  | 57/3                      | (95.0/5.0)               | 2/0       | (100.0/0.0)           | 59/3        | 0.90               |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;  
 \* = p < 0.05; \*\* = p < 0.1;

Table 9

*Demographics of Study Sample in Comparison to Cohort Sample*

| Variable   | Cohort    |                 | Sample  |                 | n         | p <sup>b</sup>     |
|--|-----------|-----------------|---------|-----------------|-----------|--------------------|
|  | n         | M(SD)           | n       | M(SD)           |           |                    |
| Age (years)  | 197       | 8.04 (0.72)     | 63      | 8.08 (0.70)     | 260       | 0.71 <sup>a</sup>  |
| Males/Females (%)  | 104/93    | (52.8/47.2)     | 34/29   | (54.0/46.0)     | 260       | 0.81               |
| Birth weight category – normal vs low (%)  | 153/42    | (78.5/21.5)     | 37/26   | (58.7/41.3)     | 258       | 0.00 <sup>*</sup>  |
| child breastfed - yes/no   | 173/23    | (88.3/11.7)     | 56/7    | (88.9/11.1)     | 260       | 0.85               |
| Total number of siblings   | 197       | 2.97 (1.42)     | 63      | 3.03 (1.27)     | 260       | 0.76 <sup>a</sup>  |
| Child's number of living siblings  | 196       | 2.93 (1.23)     | 63      | 2.95 (1.07)     | 260       | 0.91 <sup>a</sup>  |
| Birth order  | 197       | 2.19 (1.16)     | 63      | 2.33 (1.18)     | 260       | 0.40 <sup>a</sup>  |
| Difference between age and expected age for grade (1 yr younger/ expected age for grade/ 1 yr older) (%) | 10/143/42 | (5.1/73.3/21.5) | 3/46/14 | (4.8/73.0/22.2) | 13/189/56 | 0.98               |
| Child's current health: good/poor (%)  | 186/11    | (94.4/5.6)      | 59/4    | (93.7/6.3)      | 260       | 0.74               |
| Are all the children healthy (yes/no) (%)  | 184/12    | (93.9/6.1)      | 60/3    | (95.2/4.8)      | 244/15    | 0.57               |
| Means of access of water (indoor tap/outdoor tap/other) (%)  | 127/16/54 | (64.5/8.1/27.4) | 39/4/20 | (61.9/6.3/31.7) | 166/20/74 | 0.56               |
| Form of toilet facilities (inside flush/outside non-flush/outside flush) (%)                             | 23/3/11   | (62.2/8.1/29.7) | 16/1/9  | (61.5/3.9/34.6) | 39/4/20   | 0.38 <sup>a</sup>  |
| Manner of refuse disposal (collected from home)  | 197       | (100)           | 63      | (100)           | 260       | -                  |
| Housing Density (persons/ no of bedrooms)  | 197       | 3.51 (1.69)     | 63      | 3.67 (0.81)     | 260       | 0.53 <sup>a</sup>  |
| Asset Register ( out of 14 items)  | 197       | 7.32 (2.99)     | 63      | 6.81 (2.77)     | 260       | 0.23 <sup>a</sup>  |
| Mother's level of education (in years)   | 197       | 5.17 (1.86)     | 63      | 4.76 (1.66)     | 260       | 0.12 <sup>a</sup>  |
| Mother employed vs unemployed (%)  | 73/119    | (38.0/62.0)     | 15/46   | (24.6/75.4)     | 253       | 0.01 <sup>2*</sup> |
| Mother's alcohol use pregnancy (social occasions, weekends or everyday vs never) (%)                     | 10/53     | 15.9/84.1       | 27/168  | 13.8/86.2       | 258       | 0.34               |
| Mother's smoking during pregnancy. yes/no (%)  | 92/103    | (47.2/52.8)     | 33/30   | (52.4/47.6)     | 260       | 0.30               |
| Mother's number of pregnancies   | 196       | 3.26 (1.41)     | 63      | 3.21 (1.12)     | 260       | 0.80 <sup>a</sup>  |
| Marital status of mother (single, divorced/separated, widowed vs married) (%)                            | 27/36     | (42.9/57.1)     | 74/123  | (37.6/62.4)     | 260       | 0.27               |
| Ever a change in mother's marital status (yes/no) (%)  | 133       | 67.5            | 42      | 66.7            | 175       | 0.67               |
| Biological father living/not living with mother (%)  | 120/77    | (60.9/39.1)     | 35/28   | (55.6/44.4)     | 260       | 0.27               |
| Father employed vs unemployed (%)  | 122/23    | (84.1/15.9)     | 37/6    | (86.0/14.0)     | 188       | 0.60               |
| Biological father gives/doesn't give financial support (%)   | 146/51    | (74.1/25.9)     | 45/18   | (71.4/28.6)     | 260       | 0.54               |
| Mother's partner gives financial support for child (yes vs N/A) (%)                                      | 7/189     | (3.696.4)       | 4/59    | (6.3/93.7)      | 259       | 0.13               |

a = Mann-Whitney Z Adj.usted, One tailed; b = Fishers Exact, One tailed; c = Pearson  $\chi^2$ ;  
 \* = p < 0.05; \*\* = p < 0.1;

Table 10

*SDQ Means and Standard Deviations for the Current Sample in Comparison to the British Norms for 5-10 Year Olds*

|                      | Current Sample |     |     | Parent SDQ<br>British Means and<br>Standard Deviations for<br>5-10 year olds<br>(N=5855) |     |
|----------------------|----------------|-----|-----|--|-----|
|                      | n              | M   | SD  | M  | SD  |
| <b>Total</b>         | 62             | 2.3 | 0.8 | 8.6  | 5.7 |
| <b>Emotional</b>     | 62             | 2.2 | 1.0 | 1.9  | 2.0 |
| <b>Conduct</b>       | 62             | 0.5 | 0.5 | 1.6  | 1.7 |
| <b>Hyperactivity</b> | 62             | 1.3 | 0.4 | 3.6  | 2.7 |
| <b>Peer</b>          | 62             | 2.1 | 0.9 | 1.4  | 1.7 |
| <b>Prosocial</b>     | 62             | 1.1 | 0.4 | 8.6  | 1.6 |

## Appendix 8

Table 11

*Hierarchical Logistic Regression Model Building Results*

|    | Var 1          | Var 2               | Var 3               | Var 4               | Var 5               | Var 6 | df | LR      | p       |
|----|----------------|---------------------|---------------------|---------------------|---------------------|-------|----|---------|---------|
| 1  | No. of pregs   | Asset register      | Birth Order         | Prosoc. Behav. Cat. | 1*2                 |       | 7  | 23.9021 | 0.00119 |
| 2  | No. of pregs   | Asset register      | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. | 1*2   | 7  | 23.9021 | 0.00119 |
| 3  | No. of pregs   | Asset register      | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. |       | 6  | 23.8565 | 0.00055 |
| 4  | No. of pregs   | Asset register      | Prosoc. Behav. Cat. | 1*2                 |                     |       | 6  | 23.5470 | 0.00063 |
| 5  | No. of pregs   | Asset register      | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |       | 6  | 23.5470 | 0.00063 |
| 6  | No. of pregs   | Asset register      | Birth Weight        | Prosoc. Behav. Cat. |                     |       | 5  | 23.5271 | 0.00027 |
| 7  | No. of pregs   | Asset register      | Birth Order         | Birth Weight        | 1*2                 |       | 6  | 23.3202 | 0.00070 |
| 8  | Asset register | Birth Order         | Prosoc. Behav. Cat. | 1*2                 |                     |       | 6  | 23.1295 | 0.00075 |
| 9  | Asset register | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |       | 6  | 23.1295 | 0.00075 |
| 10 | Asset register | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. |                     |       | 5  | 23.0929 | 0.00032 |
| 11 | No. of pregs   | Asset register      | Birth Weight        | 1*2                 |                     |       | 5  | 23.0398 | 0.00033 |
| 12 | Asset register | Birth Order         | Birth Weight        | 1*2                 |                     |       | 5  | 22.3142 | 0.00046 |
| 13 | Asset register | Prosoc. Behav. Cat. | 1*2                 |                     |                     |       | 5  | 20.9581 | 0.00082 |
| 14 | Asset register | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |                     |       | 5  | 20.9581 | 0.00082 |
| 15 | Asset register | Birth Weight        | Prosoc. Behav. Cat. |                     |                     |       | 4  | 20.9529 | 0.00032 |
| 16 | No. of pregs   | Asset register      | Birth Order         | Prosoc. Behav. Cat. |                     |       | 5  | 20.8011 | 0.00088 |
| 17 | Asset register | Birth Order         | Prosoc. Behav. Cat. |                     |                     |       | 4  | 20.3035 | 0.00044 |
| 18 | No. of pregs   | Birth Order         | Prosoc. Behav. Cat. | 1*2                 |                     |       | 6  | 20.1750 | 0.00258 |
| 19 | No. of pregs   | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |       | 6  | 20.1750 | 0.00258 |
| 20 | Asset register | Birth Weight        | 1*2                 |                     |                     |       | 4  | 20.1323 | 0.00047 |
| 21 | No. of pregs   | Prosoc. Behav. Cat. | 1*2                 |                     |                     |       | 5  | 20.0046 | 0.00125 |
| 22 | No. of pregs   | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |                     |       | 5  | 20.0046 | 0.00125 |
| 23 | No. of pregs   | Birth Order         | Birth Weight        | 1*2                 |                     |       | 5  | 19.9871 | 0.00126 |
| 24 | No. of pregs   | Birth Weight        | 1*2                 |                     |                     |       | 4  | 19.8416 | 0.00054 |
| 25 | No. of pregs   | Asset register      | Prosoc. Behav. Cat. |                     |                     |       | 4  | 19.8204 | 0.00054 |
| 26 | No. of pregs   | Birth Order         | Birth Weight        | Prosoc. Behav. Cat. |                     |       | 5  | 19.5681 | 0.00151 |
| 27 | No. of pregs   | Birth Weight        | Prosoc. Behav. Cat. |                     |                     |       | 4  | 19.4814 | 0.00063 |
| 28 | Birth Order    | Prosoc. Behav. Cat. | 1*2                 |                     |                     |       | 5  | 19.4326 | 0.00160 |
| 29 | Birth Order    | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |                     |       | 5  | 19.4326 | 0.00160 |
| 30 | Birth Order    | Birth Weight        | 1*2                 |                     |                     |       | 4  | 19.1065 | 0.00075 |
| 31 | No. of pregs   | Asset register      | Birth Order         | 1*2                 |                     |       | 5  | 18.8960 | 0.00201 |
| 32 | Birth Order    | Birth Weight        | Prosoc. Behav. Cat. |                     |                     |       | 4  | 18.8633 | 0.00084 |
| 33 | No. of pregs   | Asset register      | Birth Order         | Birth Weight        |                     |       | 4  | 18.5496 | 0.00096 |
| 34 | Asset register | Birth Order         | 1*2                 |                     |                     |       | 4  | 18.1087 | 0.00118 |
| 35 | No. of pregs   | Asset register      | Birth Weight        |                     |                     |       | 3  | 17.9194 | 0.00046 |

Table 11 continued...

*Hierarchical Logistic Regression Model Building Results*

|    |                     |                     |                     |  |  |   |         |         |
|----|---------------------|---------------------|---------------------|--|--|---|---------|---------|
| 36 | Prosoc. Behav. Cat. | 1*2                 |                     |  |  | 4 | 17.9111 | 0.00128 |
| 37 | Birth Weight        | Prosoc. Behav. Cat. | 1*2                 |  |  | 4 | 17.9111 | 0.00128 |
| 38 | Asset register      | Birth Order         | Birth Weight        |  |  | 3 | 17.7104 | 0.00050 |
| 39 | Birth Weight        | Prosoc. Behav. Cat. |                     |  |  | 3 | 17.6716 | 0.00051 |
| 40 | No. of pregs        | Asset register      | 1*2                 |  |  | 4 | 17.6265 | 0.00146 |
| 41 | Birth Weight        | 1*2                 |                     |  |  | 3 | 17.5445 | 0.00055 |
| 42 | Asset register      | Prosoc. Behav. Cat. |                     |  |  | 3 | 16.8629 | 0.00075 |
| 43 | No. of pregs        | Birth Order         | 1*2                 |  |  | 4 | 15.0224 | 0.00466 |
| 44 | Asset register      | Birth Weight        |                     |  |  | 2 | 14.5719 | 0.00069 |
| 45 | Birth Order         | 1*2                 |                     |  |  | 3 | 14.3660 | 0.00245 |
| 46 | No. of pregs        | Asset register      | Birth Order         |  |  | 3 | 14.2687 | 0.00256 |
| 47 | No. of pregs        | Birth Order         | Prosoc. Behav. Cat. |  |  | 4 | 14.1278 | 0.00690 |
| 48 | No. of pregs        | 1*2                 |                     |  |  | 3 | 14.0278 | 0.00287 |
| 49 | Birth Order         | Prosoc. Behav. Cat. |                     |  |  | 3 | 13.7723 | 0.00323 |
| 50 | Asset register      | Birth Order         |                     |  |  | 2 | 13.7711 | 0.00102 |
| 51 | No. of pregs        | Prosoc. Behav. Cat. |                     |  |  | 3 | 13.5322 | 0.00362 |
| 52 | Asset register      | 1*2                 |                     |  |  | 3 | 13.3626 | 0.00391 |
| 53 | No. of pregs        | Asset register      |                     |  |  | 2 | 12.4638 | 0.00197 |
| 54 | No. of pregs        | Birth Order         | Birth Weight        |  |  | 3 | 12.4483 | 0.00600 |
| 55 | No. of pregs        | Birth Weight        |                     |  |  | 2 | 12.1413 | 0.00231 |
| 56 | Birth Order         | Birth Weight        |                     |  |  | 2 | 11.8233 | 0.00271 |
| 57 | Prosoc. Behav. Cat. |                     |                     |  |  | 2 | 11.5250 | 0.00314 |
| 58 | 1*2                 |                     |                     |  |  | 2 | 10.5133 | 0.00521 |
| 59 | Birth Weight        |                     |                     |  |  | 1 | 9.9129  | 0.00164 |
| 60 | Asset register      |                     |                     |  |  | 1 | 8.4845  | 0.00358 |
| 61 | No. of pregs        | Birth Order         |                     |  |  | 2 | 4.0776  | 0.13019 |
| 62 | Birth Order         |                     |                     |  |  | 1 | 3.8871  | 0.04866 |
| 63 | No. of pregs        |                     |                     |  |  | 1 | 2.5214  | 0.11231 |