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# Fetal alcohol spectrum disorder (FASD) from infancy to childhood: neuropsychological development and maternal depression

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**2012-07-16**
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# FETAL ALCOHOL SPECTRUM DISORDER (FASD) FROM INFANCY TO CHILDHOOD: NEUROPSYCHOLOGICAL DEVELOPMENT AND MATERNAL DEPRESSION

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A thesis submitted to the Faculty of Humanities, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy

Johannesburg, 2012

# DECLARATION

I declare that this dissertation is my own work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

_____

C. M. CHETTY-MAKKAN

_____ day of _____2011

# DEDICATION

I dedicate this thesis to the everlasting memories of my grandparents and to the love of my family.

# ACKNOWLEDGEMENTS

I would like to thank Prof Denis Viljoen, the staff of the Foundation for Alcohol Related Research (FARR) and the participants from the Upington Research Centre for providing me with the opportunity to conduct this study. Without their assistance, this project would not have been possible.

Prof Kate Cockcroft, Prof Peter Fridjhon, Mrs Christina Govender, Dr Michael Urban, Mr Eustacius Musenge, Prof Mary H Latka and colleagues at The Aurum Institute thank you for your technical expert guidance and editorial assistance.

My deepest gratitude goes to my loving parents, cherished sister and treasured husband who have been my pillars of strength and motivation. I will always value the immense support that you gave me so that I could spend the necessary time completing this thesis.

# ABSTRACT

Fetal Alcohol Spectrum Disorder (FASD) is a preventable cause of intellectual delay. Highly prevalent in South Africa, it has become a public health concern. Effective screening measures to identify women at risk of producing a FASD child is therefore important. This study postulated that a distinctive maternal profile may exist for mothers with FASD infants compared to a comparison group. Consequently, the study investigated the occurrence of maternal depression and its potential association with maternal risk factors and infant development respectively; differences in the profiles of mothers; as well as developmental differences in FASD and No FASD groups of children. An ex-post facto design was implemented, where the sample comprised of dyads that completed initial (infants 9-18 months) and follow-up (children 18-45 months) assessments. Severity of maternal depression (measured on the Beck Depression Inventory); maternal current mood states (measured on the Profile of Mood States) and infant developmental differences (measured with the Griffiths Mental Developmental Scales) were assessed. The results showed no distinct patterns in maternal depression in the FASD versus the No FASD groups; maternal depression was not significantly correlated with infant development; infants with FASD showed impaired overall development, with especially poor social adjustment; and all infants (FASD and No FASD) performed lower than the expected developmental norms. Maternal alcohol use was the only significant covariate associated with infant development. Identifying the predictors of high risk behaviour during pregnancy is complex, where prenatal alcohol exposure cannot be viewed in isolation from contextual factors, as limited resources, historical factors, cultural/community knowledge, a lack of stimulation and malnutrition prevail in many areas of South Africa. Profiling maternal predisposition to prenatal

alcohol use is essential in reducing the incidence of FASD in South Africa and implementing social skills intervention programs could aid the long-term adjustment of FASD infants.

**Keywords:** Prenatal alcohol exposure; maternal risk factors; maternal depression; infant development; South Africa

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# CHAPTER 1 LITERATURE REVIEW

## 1.1 Introduction

Maternal depression in women and Fetal Alcohol Spectrum Disorder (FASD) are international and South African public health concerns. While the association between depression and alcohol use in women has been investigated in isolation, little is known about the comorbid influence of maternal depression and alcohol use during pregnancy and the effect that these factors may have on infant development within low socio-economic communities (Hock & DeMeis, 1990; Homish, Cornelius, Richardson & Day, 2004; Kessler, 1997; Paschall, Freisthler & Lipton, 2005; Rubio, Kraemer, Farrell & Day, 2008 ; Van Dorn, Williams, Dell-Colle & Hawkins, 2008). Studies describing the demographic characteristics of women who consume alcohol during pregnancy are limited, and it is likely that the lack of information in this area is related to the restricted success of prevention strategies in lowering the incidence of FASD in South Africa and elsewhere (Coyne, De Costa, Heazlewood & Newman, 2008; Croxford & Viljoen, 1999; Flanigan, McLean, Hall & Prop, 1990; Kvigne et al., 2003; May et al., 2005; May et al., 2004; Nanson, 1997 ; Viljoen, Croxford, Gossage, Kodituwakku &May, 2002).

This study was prompted by the dearth of information in this area to investigate the relationship between maternal characteristics and infant development in a low socio-economic community. In such communities, environmental factors often propagate alcohol abuse and places women at high risk for producing children with FASD. Research in this area contributes to theoretical and applied knowledge that identifies factors that place women and infants in a vulnerable position to alcohol exposure. Such factors could contribute to the perpetuating cycle of poverty in low socio-economic communities, making their identification critical. Knowledge

of innate and environmental factors that place females at risk for producing an infant with FASD could assist in developing practical preventative interventions. Consequently, this thesis describes a longitudinal study that assessed variations in maternal mental health, as well as other maternal demographic characteristics, in relation to the development of infants with FASD. The focal points of the study were to investigate the occurrence of maternal depression, the association between maternal depression, infant development and socio-economic status, as well as the occurrence of FASD within the Upington (Northern Cape, South Africa) area.

Another objective of the study was to examine possible differences in symptoms of maternal depression when infants were between 9-18 months (initial assessment) and again when the same infants were between 18-45 months (follow-up assessment). Two groups were compared in this regard namely a group of FASD diagnosed infants and their mothers and a comparison group of infants without FASD symptoms (No FASD) and their mothers. On an applied level, this study attempted to identify maternal profiles which could be used to screen mothers at high risk of producing infants with FASD. In addition, the developmental functioning of infants with FASD was compared that of the No FASD group in order to further understand the developmental delays of infants from disadvantaged environments.

The majority of the studies on FASD in South Africa have been conducted in the Western Cape with children of school-going age, while minimal studies have been undertaken in the Northern Cape. Consequently, this study was part of a larger project, which was initiated in 2004 in the Northern Cape (Adnams et al., 2001; Croxford & Viljoen, 1999; May et al., 2005; May, 2008; Viljoen, Croxford, Gossage, Kodituwakku & May, 2002; Urban et al., 2008). Data

was collected by conducting structured interviews and administering psychometrically validated instruments. Mothers were given a structured interview at the outset of the study, and were screened for current symptoms of depression (measured by means of the Profile of Mood States) on one occasion. The severity of depression (measured by means of the Beck Depression Inventory) was assessed when the infants were between 9-18 months and 18-45 months. Infants were clinically diagnosed for features of FASD (using the Institute of Medicine Criteria) and assessed using a developmental scale (the Griffiths Mental Developmental Scales-Extended Revised) at two time points. Infants who did not meet the FASD diagnostic criteria formed the comparison group. As a consequence of unforeseen problems, infant mortality and demographic mobility, there was considerable attrition in the sample at different stages of data collection.

The chapter that follows set the context for an understanding of the current study and its findings. It covers the broad topic of depression in women at high risk for alcohol consumption, the role of maternal influence on infant development and the rationale for conducting this research. The main debates that emerge from local and international studies are addressed. Chapter two outlines the objectives, research design, description of the instruments used, sample selection and schedule of procedures. In chapter three, the results of the statistical analyses are discussed according to the hypotheses that were proposed. An integrated discussion of the results can be found in chapter four, which concludes with a discussion of the theoretical and practical implications of the present study, its limitations and suggestions for future research.

## 1.2 Depression in women at high risk for alcohol consumption

### 1.2.1 Introduction.

Depression becomes a public health concern when symptoms progress from the normal to the severe range, which could ultimately interfere with daily functioning. A sense of inadequacy, feelings of despondency, decreasing physical activity, pessimism, sadness and related symptoms, if experienced for a short period are considered to be normal. When these symptoms progress for a longer duration, are extreme and intense, then depression could be considered a primary psychological disorder or part of a syndrome of related symptoms secondary to another disorder (Reber, 1985). Severe depression could be experienced when negative ideas persist and there is no logical interaction between thoughts and the actual situation (Beck, Rush, Shaw & Emery 1979). Given that depression is a complex phenomenon that stems from the lack of biological, emotional, behavioural and/or social support, it is likely that women from disadvantaged backgrounds may have greater susceptibility for developing depression (Blatt, 2006; Ferster, 1973; Fiske, Wetherell, & Gatz, 2009; Jesse, Walcott-McQuigg, Mariella, Swanson, 2005; Lewinsohn, Biglan & Zeiss, 1976).

The sections that follow highlight the debates around depressive symptoms versus depressive disorder and the arguments around screening versus the diagnosis of depression. Prevalence rates of depression internationally, in sub-Saharan and South Africa will be described. In addition, the rates of depression in the general and maternal population showing gender differences are tabulated. Demographic and health risk factors associated with depression; comorbidity of depression and alcohol use; will also be highlighted. Causes of depression; treatment of depression and the relationship of depressive symptoms with child development

will be presented. There has been some controversy between the self-reported symptoms of depression and the clinical diagnosis of depression therefore, the sections that follow outline the various arguments in literature that focus on the classification of depression.

### 1.2.2 Depressive Symptoms versus Depressive Disorder.

Beck's cognitive model is used as a basis to delineate the symptoms of depression as indicated in Table 1, that is based on the activation of dysfunctional beliefs triggering negative thoughts which can be interpreted as the primary source of emotional, somatic and motivational symptoms of depression (Beck, Rush, Shaw & Emery, 1979 ; Pössel & Knopf, 2008).

Table 1

*Characteristics of Depression*

| | |
|---|---|
| 1. | Feelings of sadness or emptiness |
| 2. | Diminished interest or pleasure in activities |
| 3. | Significant changes in appetite (both increases and decreases) |
| 4. | Insomnia or Hypersomnia |
| 5. | Psychomotor agitation or retardation |
| 6. | Fatigue or loss of energy |
| 7. | Feelings of worthlessness or inappropriate guilt |
| 8. | Diminished ability to think, concentrate or make decisions |
| 9. | Recurrent thought of death or suicide |

Source: Hagen, E. H. (1999). The Functions of Postpartum Depression. *Evolution and Human Behaviour*, 20, 325-359

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) includes symptoms as outlined by Beck et al (1979), as part of the criteria for diagnosing an individual

with a mood disorder. Other DSM-IV-TR criteria include the duration of the symptoms; timing of depressive symptoms and the evidence of manic episodes. Behaviour theorists are in support of these diagnostic criteria as behavioural theory indicates that the frequency of occurrence of negative behaviours, such as crying, complaining, irritability and avoidance behaviours would be the defining characteristic of depression. Other common behavior characteristics of a depressed individual include a lack of interest in pleasurable activities, lack of concern toward others, and reduced frequency of positively reinforced behavior, which again concurs with the symptoms of depression as summarized in Table 1 (Ferster, 1973 ; Lewinsohn, 1973). In addition, a range of somatic, psychological, social and occupational symptoms, as well as low rates of pleasant daily activities or a high rate of negative situations could be reported by depressed individuals (Lewinsohn, Biglan & Zeiss, 1976). According to DSM-IV-TR there are 9 types of depression mood disorders which include major depressive episode, manic episode, mixed episode, hypomanic episode, major depressive disorder, dysthymic disorder, bipolar I disorder, bipolar II disorder and cyclothymic disorder (American Psychiatric Association, 1994; Beck, Rush, Shaw & Emery, 1979; Carr, 2004; Hagen, 1999). Self-reporting symptoms of depression, as measured by an instrument such as the Beck Depression Inventory (BDI), needs to be distinguished from a clinical diagnosis of depression, which is defined as "an emotional state with retardation of psychomotor thought processes, a depressive emotional reaction, feelings of guilt or criticism and delusions of unworthiness" (American Psychiatric Association, 1968, p36), as the process to reaching a decision on the latter condition is multi-faceted.

### 1.2.3 Screening versus Diagnosis of Depression.

Techniques that are used for the screening and diagnosis of depression within a research setting have been a consistent point of debate throughout the literature. Some studies used screening tools to assess the level of severity of depressive symptoms, while others used an in-depth clinical interview based on diagnostic criteria. Although certain individuals could display symptoms of depression, they may not meet all the diagnostic criteria of a mood disorder and therefore could be classified as false positives within a research setting. In addition, some symptoms of depression could be associated with normal signs of pregnancy and motherhood, leading to complexity in the diagnosis of depression in women (Gotlib, Lewinsohn & Seely, 1994).

Ideally, an in-depth evaluation of depression is required before an individual is diagnosed, yet this is not always practically possible. The process of diagnosing depression generally entails a clinical examination by a doctor, a possible toxicology screening examination and then referral to a psychologist for an evaluation. Diagnosis of depression is also based on the number of symptoms that are reported based on the criteria outlined in the DSM IV and the frequency of the depressive episodes (Hagen, 1999). The type of assessment battery used to identify depression can either be brief or extensive which is again dependent on time constraints and funding available for the project. Due to practical limitations of research, potentially depressed individuals could be screened for symptoms of depression as assessed by a tool such as the BDI or diagnosed with a mood disorder as detailed above, which is dependent on the availability of resources.

A study conducted in the United States with a group of 130 low income women, which tested brief depression screening measures as an initial step to identifying women at risk for depression in pregnancy, showed that short screening questions are effective in identifying depression being a potential problem (Jesse & Graham, 2005). According to the literature from international studies, the Centre for Epidemiologic Studies Depression Scales (CES-D) and the Edinburgh Postnatal Depression Scale (EPDS) are instruments that have been commonly used as shown in Table 1. Although there are limitations of only using the CES-D as a screening tool, a study conducted in Pittsburgh on 829 individuals whose average age was 23 years, and where these studies were conducted between 1982 to 1985, showed that it was possible to differentiate between those who were depressed and those who were not by just implementing screening tool (Homish, Cornelius, Richardson & Day, 2004). Screening of depression was frequently assessed by using a tool such as the Beck Depression Inventory (BDI) and this served a similar purpose as the CES-D for African research studies. The BDI was able to provide information regarding the onset, severity, duration and progression of depressive symptoms (Adewuya, Eegunranti & Lawal, 2005; Makosky, 1982 ; Ward, Flisher, Zissis, Muller & Lombard, 2003). In this current study, the Beck Depression Inventory (BDI) and the Profile of Mood States (POMS) were utilised to screen for elevated levels of maternal depression symptoms and were not used as a diagnostic tool. Due to research limitations such time constraints and limited funding, a comprehensive assessment of depression was not possible, instead focus was placed on identifying mothers that had heightened symptoms of depression. Based on the cited literature a screening tool for depression such as the BDI is an acceptable tool to be used within research settings instead of full clinical assessments.

### 1.2.4 International Prevalence of Depression.

Depression is a prevalent and common mood disorder in Western countries and in South Africa (Akhtar-Danesh & Landeen, 2007; Schlebusch, 2005; Stein et al., 2007). According to the World Health Organisation (WHO), depression is a mental mood disorder that is one of the leading causes of disability worldwide as it affects approximately 121 million people (WHO, 2011). International studies show that there is a high rate of depression in the overall community and depressive symptoms are generally prevalent in women.

The studies summarized in the tables that follow were selected based on the time period, large sample size and if the sample comprised of women. Table 2 shows the rate of depression in studies that were conducted internationally. The studies referenced in the table were selected based on the composition of the sample where depression was assessed on the general community, and where women from either a rural or urban background were the primary focus of the sample. Although one of the referenced studies is from 1990 which was selected to show that maternal depression persists in mothers who have young children (5-6 years), other studies conducted within the last 10 years are summarized in Table 2.

The study that was conducted in Canada (2007) which used the Composite International Diagnostic Interview (CIDI) as an assessment tool indicated that depression in the general community is of public concern as 11% of that sample reported lifetime depression (Akhtar-Danesh & Landeen, 2007). The remaining five of the eight studies reviewed in this literature that ranged between 1990 and 2010 where women were the primary focus of the sample showed that symptoms of depression were between 6.4% and 52% (Din & Noor, 2009; Hall, 1990; Karmaliani et al., 2009; Minkovitz et al., 2005; Wulsin, Somoza, Heck & Bauer, 2010). Three

of the eight studies were comprised of women who were in the post-partum phase where a high level of postnatal depression was also reported that ranged from 13.5% to 36%. The prior literature shows that depression is high in women generally and remains high during the post-partum period (Beeghly et al., 2003; Chaudron et al., 2005; Husain, Husain, Chaudhry, Atif & Rahman, 2006). These international studies had a large sample size and the most common assessment tool was the Centre for Epidemiologic Studies Depression Scale (CES-D). The outcome of these studies confirms that depression is an international public health concern while Table 3 further indicates that depression is highly prevalent within developing countries.

Table 2

*International Rates of Depression*

| Author | Year | Country | Sample | Assessment of Depression | Outcome |
|---|---|---|---|---|---|
| Akhtar-Danesh et al | 2007 | Canada | n = 12376 men and women | CIDI | Life time depression = 11%<br>12 month depression = 4.8% |
| Beeghly et al. | 2003 | USA | n = 163 post-partum women | CES-D administered at 2, 3, 6, 12 & 18 months post-partum | Single visits depression in women ranged between 13.5 - 14.7% |
| Chaudron et al | 2005 | California | n = 218 non pregnant Hispanic low income mothers | EPDS and telephonic interviews | Reported depressive symptoms = 23% |
| Din et al. | 2009 | Malaysia | n = 487 urban and rural women | Interviews and the CES-D | Life time major depressive symptoms = 27.5%<br>Current depressive symptoms = 34.5% |
| Hall | 1990 | USA | n = 196 mothers of 5 & 6 year old children | CES-D | Depression = 49% |
| Husain et al. | 2006 | Pakistan | n = 149 Mothers 12 weeks post-partum | EPDS | Postnatal Depression = 36% |
| Karmaliani et al. | 2009 | Pakistan | n = 1368 pregnant women | Aga Khan University Anxiety Depression Scale | 18% of the sample were anxious and/or depressed |
| Minkovitz et al. | 2005 | USA | n = 5565 mothers | CES-D administered at two time points when infants were between 2-4 months and between 30-33 months | Depression (infants 2-4 months) = 17.8%<br>Depression (infants 30-33 months) = 15.5%<br>Overall depression at both time points = 6.4% |
| Wulsin et al. | 2010 | Honduras | n = 415 urban and rural women | Spanish version of the PHQ-9 | Current major depressive syndrome = 17.6%<br>Mild depressive symptoms = 52% |

Note.
CIDI: Composite International Diagnostic Interview
CES-D: Centre for Epidemiologic Studies Depression Scale
EPDS: Edinburgh Postnatal Depression Scale
PHQ: Patient Health Questionnaire

### 1.2.5 Sub-Saharan and South African Prevalence of Depression.

Depression is not only a public health concern in Western societies but also in developing countries. Although depression within the affluent sector had been well-researched, mental disorders within the developing world have received little research attention despite this disorder being a common problem (Rudolph, Rosanowski, Eysholdt & Kummer, 2003). There has been some reluctance to conduct research within developing countries, possibly due to a lack of resources (Hadley et al., 2008). An Ethiopian study of a sample of 902 adult females and males confirmed that those who were significantly distressed, anxious, depressed and who displayed symptoms of post-traumatic stress were more likely to be within the lower socio-economic status bracket (Hadley et al., 2008). Further to this, the complexity of diagnosing depression in disadvantaged settings could be related to the social, ethical, economic or legal conditions that women encounter, as in some cases their depression could be misdiagnosed while in other situations these depressive symptoms may not be given the attention that they need. In both cases, these women may not receive the care that they require (Hare-Mustin, 1983).

Despite this limitation, studies that have been done show that women within developing countries are vulnerable to general psychiatric disorders especially depression (Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; Chibanda et al., 2010; Cooper, Smiley, Morrison, Williamson & Allan, 2007; Havenaar, Geerlings, Vivian, Collinson & Robertson, 2008; Hollifield, Katon, Spain & Pule, 1990; Ndokera & MacArthur, 2011; Pillay & Kriel, 2006; Rochat et al., 2006; Stein et al., 2007; Thom, Zwi & Reinach, 1993 ; Tomlinson, Grimsrud, Stein, Williams & Myer, 2009). A summary of literature in Table 2 shows that a high prevalence of depression is evident within Sub-Saharan Africa and South Africa. The studies

summarized in Table 3 were selected based on the following criteria: study was conducted in sub-Saharan or South Africa, depression levels in the general population were assessed, levels of depression in a women only sample and the rates of depression within those living with human immunodeficiency virus (HIV) since this latter virus is a public health concern in Africa.

For research studies in Africa where the sample included men and women, the rates of depression ranged between 9.7% and 12.4% (Hollified, Katon, Spain & Pule, 1990 ; Tomlinson, Grimsrud, Stein, Williams & Myer, 2009). Rates of depression in women had ranged between 9.7% and 21.0%, while the rate of postnatal depression was extremely high and reached an elevated level of 34.7% (Ndokera & MacArthur, 2011; Pillay & Kriel, 2006 ; Cooper, Smiley, Morrison, Williamson & Allan, 2007). Partum depression in women diagnosed with HIV also reached a high level of 54% in a study that was conducted in Zambia (Chibanda et al., 2010). When compared to international rates, depression rates in sub-Saharan Africa and South Africa are above 40.0% while post-partum depression in South Africa was reported to be three times the rate of post-partum depression in Western countries, suggesting that depression in women in developing countries is also a public health concern (Cooper, Smiley, Morrison, Williamson & Allan, 2007). However, one argument that emerged from the literature suggested that individuals from developed countries experience more severe depression when compared to a sample from a developing country, as a traditional way of life within developing countries was identified as a protective factor against depression (Colla, Buka, Harrington & Murphy, 2006).

Table 4 highlights past and recent literature that was reviewed which compared depression between the developed and developing world to assess if there were any differences in depression experienced within these populations. The studies summarized in Table 4 were

selected based on the sample composition of the study where levels of depression were compared between a country in Africa and the western world.

One study conducted on post-partum women in South Africa and another study that was conducted on both genders in Lesotho showed that depression in the developing countries is high when compared to the United States (Cooper, Smiley, Morrison, Williamson & Allan, 2007 ; Hollified, Katon, Spain & Pule, 1990). Although this is not an equal comparison based on the difference between sample composition, the same instrument was used to assess depression in the same time period which may suggest that further investigation into this association is necessary, due to depression being high in South Africa. The lower position of women in society and concomitant lack of skills tend to contribute to the limited opportunities that are available to those in developing countries. Reduced pleasant experiences with a higher rate of exposure to detrimental situations could perpetuate their negative feelings (Dill & Greywolf, 1982). Due to the limited studies and controversy in results about the rates of depression within the developed versus developing world this remains a point of debate.

Table 3

*Rates of Depression in sub-Saharan and South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bhagwanjee et al. | 1998 | South Africa | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria & SRQ (used back-translation process & validated) | Major depression = 3.7%<br>Dysthymia = 7.3%<br>Depression & Dysthymia = 8.2%<br>Generalised Anxiety = 3.7% |
| Chibanda et al. | 2010 | Zimbabwe | HIV infected women (n = 31); HIV uninfected women (n = 148); Women of unknown status (n = 31) | EPDS (Shona version); MSE; DSM Major Depression criteria used for diagnosis | HIV infected females = 54% depression. There is a high prevalence of postnatal depression |
| Coleman et al. | 2006 | West Africa | n=565 women | Reproductive Health Survey, EDS, reproductive health questionnaire and gynaecological examination | Prevalence of depression = 10.3% |
| Cooper et al. | 2007 | South Africa | n = 147 post-partum women | Interviews and Major Depression section of the DSM-IV | Depression = 34.7% |
| Havenaar et al. | 2008 | South Africa | n = 230 (Cape Town);<br>n = 333 (Limpopo); men and women | SRQ | Depression and Anxiety (Cape Town) = 34.9%;<br>Depression and Anxiety (Limpopo) = 27% |
| Hollifield et al. | 1990 | Lesotho | n = 356 men and women | Structured psychiatric interview; NIMH DIS | Major depression = 12.4%<br>Panic Disorder = 4.2%<br>Generalised Anxiety disorder = 6.2% |
| Ndokera et al. | 2011 | Zambia | n = 278 women | SRQ | High risk depression = 9.7% |

Note.
BAI: Beck Anxiety Inventory
BDI: Beck Depression Inventory
DIS: Diagnostic Interview Schedule
DSM: Diagnostic Statistical Manual
EDS: Edinburgh Depression Scale
EPDS: Edinburgh Postnatal Depression Scale
MSE: Mental Status Examination
SRQ: Self reporting Questionnaire

Table 3 (continued)

*Rates of Depression in sub-Saharan and South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Pillay et al. | 2006 | South Africa | n = 422 women | Brief Checklist clinician's assessment | Depression = 21%<br>Suicidal behaviour = 14%<br>Low self-esteem = 65% |
| Rochat et al. | 2006 | South Africa | n = 242 men and women of unknown HIV status | EPDS | Depression = 40.91% |
| Stein et al. | 2007 | South Africa | n = 4351 men and women | National representative survey | Most prevalent class of 12 month disorder: Anxiety (8.1%); Substance use (5.8%); Mood disorder (4.9%). Most prevalent individual 12 month disorder: Major depressive disorder (4.9%); Alcohol Abuse (4.5%); Agoraphobia without panic (4.8%). Mood disorders were the highest in the Western Cape and Orange Free State. |
| Thom et al. | 1993 | South Africa | n = 299 men and women | Interviews; SRQ; Present state examination | Prevalence of psychiatric disorders at primary care clinic = 14.38% |
| Tomlinson et al. | 2009 | South Africa | n = 4351 men and women | National representative survey | Major depression = 9.7%<br>Lifetime depression = 4.9% |

Note.
BAI: Beck Anxiety Inventory
BDI: Beck Depression Inventory
DIS: Diagnostic Interview Schedule
DSM: Diagnostic Statistical Manual
EDS: Edinburgh Depression Scale
EPDS: Edinburgh Postnatal Depression Scale
MSE: Mental Status Examination
SRQ: Self reporting Questionnaire

Table 4

*Depression in the Developed World versus Depression in the Developing World*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Colla et al. | 2006 | West Africa and North America | n = 657 men and women | Lifetime depression interview items from DSM-III | Depression in rural Nigerians were the lowest (10%) where highest depression reported among urban Americans (32%) |
| Cooper et al. | 2007 | South Africa | n = 147 post-partum women | Interviews and Major Depression section of the DSM-IV | Post-partum depression in a South African sample (34.7%) which was reported as being three times the rate in Western samples |
| Hollifield et al. | 1990 | Lesotho | n = 356 men and women | Structured psychiatric interview; NIMH DIS | Total depression in the Lesotho sample (12.4%) was higher when compared to the rate of depression in the United States ECA study (2.2-3.5) |

Note.

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

Another point of controversy in the literature had been centered on the rates of depression among those living in an urban setting compared to those from a rural setting. The studies summarized in Table 5 were selected based on studies that comprised of samples from urban and rural settings which compared the differences in depression between these groups. Studies referenced are from approximately five years ago.

The outcome of the one South African study and the two international studies are not consistent in their findings, implying that controversy remains regarding the current symptoms of depression experienced by individuals within urban and rural settings (Havenaar, Geerlings, Vivian, Collinson & Robertson, 2008). A drawback of the results obtained in the South African study could be that the samples were not selected from the same geographical region for the urban and rural populations, which could have included confounding by ethnicity. The results of the two international studies concur where the outcome indicated that there was no difference in major depression between the urban and rural samples (Din & Noor, 2009; Wulsin, Somoza, Heck & Bauer, 2010). However, the study in Malaysia showed that current symptoms of depression differed between the rural and urban groups. Despite these controversies, studies on the prevalence of depression as summarized in Table 2 and Table 3 show that depression is a public health concern in both developed and developing countries, even though it is unclear whether the extent of it differs by geographic setting or socio-economic status.

Table 5

*Rates of Depression among those living in an Urban Setting compared to those from a Rural Setting from Approximatey Five Years Ago*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Din et al. | 2009 | Malaysia | n = 487 urban and rural women | Interviews and CES-D | No significant difference between the groups on major depressive symptoms but current depressive symptoms were higher in the urban when compared to the rural sample |
| Havenaar et al. | 2008 | South Africa | n = 330 (Cape Town peri-urban); n = 333 (Limpopo-rural); men and women | SRQ | Depression & Anxiety = 34.9% (Peri-urban); Depression & Anxiety = 27% (Rural). Mental illness and substance abuse problems were higher within the peri-urban communitywas prevalent in both communities |
| Wulsin et al. | 2010 | Honduras | n = 415 urban and rural women | Spanish version of the PHQ-9 | No significant difference in the major depressive syndrome between rural and urban samples |

Note
CES-D: Centre for Epidemiologic Studies Depression Scale
SRQ: Self reporting Questionnaire
PHQ: Patient Health Questionnaire

### 1.2.6 Rate of Depression varying by Gender.

There are several factors that contribute to symptoms of depression being highly prevalent in women when compared to the rate of depression in men, as there are many variables that could cause or perpetuate a negative mood state in women. Pregnant women, women who had recently given birth, women with children, women from rural or urban areas, all experience some level of depression confirming that depression among women is a public health concern (Akhtar-Danesh & Landeen, 2007; Beeghly et al., 2003; Chaudron et al, 2005; Din & Noor, 2009; Hall, 1990; Husain, Husain, Chaudhry, Atif & Rahman, 2006; Karmaliani et al., 2009; Minkovitz et al., 2005 ; Wulsin, Somoza, Heck & Bauer, 2010). Depression in women may stem from various sources that would be specific to an individual's personality, emotional maturity and environmental situation. Especially, pregnant women due to biological factors with new life circumstances and new mothers are at heightened risk for depression as they could be highly vulnerable to developing mood disorders (Sohr-Preston & Scaramella, 2006; Stowe & Nemeroff, 1995). Women could encounter a variety of physiological changes and subjective feelings of stress that emerge from environmental demands. Depression could emerge as a consequence of a negative event or develop from pre-menstrual and/or postnatal hormone changes, hormone deficiencies, alcoholism, and/or drug dependency. Women may experience bodily changes during the course of their lives and this could account for the high prevalence of depression in women. Stress, challenging family conditions, financial problems such as low income or unpredictable income and/or social settings could also contribute to depression being associated with women (Hare-Mustin, 1983). Table 6 summarises the literature on the differences in depression between men and women. Studies for Table 6 were selected from international, sub-Saharan and South African countries if one of the outcomes reported on

gender differences in depression and if the sample size was large enough to suggest generalizability of the results.

According to epidemiological studies, the likelihood of depression in women is greater when compared to the prevalence in males (Ensel, 1982; Frerichs, Aneshensel, Clark & Yokopenic, 1981; Hamilton & Halbreich, 1993; Weissman & Olfson, 1995). Women rather than men tend to have an earlier onset of depressive symptoms due to their hormonal fluctuations, biological vulnerabilities and environmental stresses, and tend to show increasing levels of depression over time when these risk factors prevail (Burke, Burke, Rae & Regier, 1991; Hamilton & Halbreich, 1993; Kessler, 2003). Within relationships, women have been more prone to developing depression due to taking on socially expected passive roles, attempting to always accommodate their male partner and/or engaging in learned helplessness behaviours when depression is experienced (Hare-Mustin, 1983).

Epidemiological and metabolic evidence further indicates that the risk factors for alcohol use, like depression differs between genders (Redgrave, Swartz & Romanoski, 2003). For women, there seems to be an overlap between the risk factors for alcohol use and symptoms of depression. Understanding these risk factors is imperative in identifying effective preventative and treatment interventions within disadvantaged communities.

Table 6

*Rates of Depression in Men versus Women from International, sub-Saharan and South African Studies*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bhagwanjee et al. | 1998 | South Africa (SA) | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria; SRQ (used back-translation process & validated) | Major depression higher in females (16.85%) compared to males (6.33%). However, general anxiety disorder higher in males (21.01%) compared to females (5.82%). Dysthymia in males (26.08%) higher than dysthymia in females (13.33%). But overall no significant difference in the prevalence of mental disorders |
| Ensel | 1982 | United States | n = 1091 men & women | CES-D | Depression in females = 22.9%<br>Depression in males = 17.6% |
| Hadley et al. | 2008 | Ethiopia | n = 902 men & women | The Hopkins Symptom Checklist; Harvard Trauma Questionnaire | No significant difference between gender on prevalence of high depressive symptoms. Depression in females = 37%; Depression in males = 35% |
| Hamilton | 1993 | - | - | Review of literature | Prevalence of depression in women higher than prevalence of depression in men |

Note

CES-D: Centre for Epidemiologic Studies Depression Scale
DIS: Diagnostic Interview Schedule
DSM: Diagnostic Statistical Manual
SRQ: Self reporting Questionnaire

Table 6 (continued)

*Rates of Depression in Men versus Women from International, sub-Saharan and South African Studies*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Hollified et al. | 1990 | Lesotho | n = 356 men & women | Structured psychiatric interview; NIMH DIS | Depression in females = 14.5%<br>Depression in males = 8.8%<br>Statistical significant difference between genders were found for Generalised Anxiety Disorder and Panic Disorder where females obtained higher scores than males |
| Tomlinson et al. | 2009 | South Africa (SA) | n = 4351 men & women | National representative survey | Lifetime major depression in females = 66.1%;<br>Lifetime major depression in males = 33.9%.<br>Lifetime depression 1.75 times more likely in women than in men.<br>12 month major depression in females = 71.2%;<br>12 month major depression in males = 28.8%.<br>12 month major depression 2.17 more likely in females than in males |
| Weissman et al. | 1995 | - | - | Review of literature | Major depression twice as common in females than in males |
| Weissman et al. | 1984 | United States | n = 5038 men & women | DIS according to the DSM-III | 2:1 female to male ratio for major depressive disorder |

Note

CES-D: Centre for Epidemiologic Studies Depression Scale

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

SRQ: Self reporting Questionnaire

### 1.2.7 Demographic, Pregnancy and Health Risk Factors associated with Depression

There are potential maternal demographic factors (age, weight, marital status, educational level, employment status and income); pregnancy history (pregnancy intent, contraceptive use, total number of pregnancies, total number of live births and total number of miscarriages); and health risk factors (drug use, alcohol use, smoking and tuberculosis (TB) diagnosis) that could be associated with the level of depression that is experienced by women. These criteria were selected from the maternal questionnaire that was administered during the maternal interview of the current study. The following tables summarise the literature that highlights the association between maternal depression and age (Table 7), marital status (Table 8), educational level (Table 9), socio-economic status (Table 10), total number of miscarriages (Table 11), smoking (Table 12) and TB diagnosis (Table 13) respectively.

International and South African studies that were published less than 15 years ago, which included the general population or people from a low income area which reported on the association between depression and age were selected and summarized in Table 7.

Table 7

*Relationship between Depression and Age from studies conducted Internationally and within South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bhagwanjee et al. | 1998 | South Africa | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria; SRQ (used back-translation process & validated) | Generalised anxiety and depressive disorders were higher in the 30-49 years and greater than 50 years group when compared to the 18-29 year olds. |
| Burke et al. | 1991 | USA | n = 20745 men and women | DIS according to the DSM-III | Females age of onset for major depression = 15-19 years; Males age of onset for major depression = 25-29 years |
| Hall | 1990 | USA | n = 196 mothers with children between 5 & 6 years old | CES-D and ESI | High depression was reported in those who were under 25 years. |
| Pillay et al. | 1999 | South Africa | n=50 men and women from low socio-economic conditions | BDI; BAI; Hopelessness Scale (measure of pessimism) | Anxiety, depression and hopeless was positively associated with age with age range from 23 years to 67 years where higher levels of distress were reported with increasing age. |
| Tomlinson et al. | 2009 | South Africa | n = 4351 men and women | National representative survey | Individuals between 40-49 years were more likely than the 18-29, 30-39 or >=50 groups to be depressed. |

Note:

BAI: Beck Anxiety Inventory

BDI: Beck Depression Inventory

CES-D: Centre for Epidemiologic Studies Depression Scale

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

ESI: Everyday Stressor Index

SRQ: Self reporting Questionnaire

According to Table 7, studies that were initially conducted indicated that depression was less prevalent among older adults when compared to younger individuals (Frerichs, Aneshensel, Clark & Yokopenic, 1981; Hall, 1990). For example, an epidemiological study conducted in Los Angeles, USA, in 1979 with a sample of 1003 participants, indicated that the highest rate of depression was between those aged 18-24 years while the lowest rate of depression was evident between those 45-64 years old (Frerichs, Aneshensel, Clark & Yokopenic, 1981). However, recent South African studies show that rates of depression are positively associated with increasing age (Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; Pillay & Sargent, 1999 ; Tomlinson, Grimsrud, Stein, Williams & Myer, 2009).

Population statistics that included men and women in sample selection and studies that included women only from international, sub-Saharan or South African areas that reported on the association between depression and marital status which ranged from 1982 to 2009 were selected and summarized Table 8.

Table 8

*Relationship between Depression and Marital Status from International, African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Akhtar-Danesh et al | 2007 | Canada | n = 12376 men and women | CCHS-1.2 | Lowest rate of depression = 8.5% in those who were married; Highest rate of depression = 26.1% in those who were divorced. |
| Beeghly et al. | 2003 | USA | n = 163 post-partum women | CES-D administered at 2, 3, 6, 12 & 18 months post-partum | Single marital status, low income status and negative maternal perceptions of adequacy of income for meeting familial needs were significantly associated with depression. |
| Bhagwanjee et al. | 1998 | South Africa | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria; SRQ (used back-translation process & validated) | Generalised Anxiety and Dysthymia were significantly higher for single people than those who were married or cohabitating. Marital status on major depression was not significant. |
| Brennan et al. | 1994 | International | n = 704 men and women | Depression Research Diagnostic Criteria | Initial levels of depression were associated with subsequent depression; More initial symptoms of depression and more use of substance coping strategies independently predicted depression at follow-up; Individuals with more negative life events, more chronic health stressors and more ongoing conflicts with their spouse had more depressive symptoms at follow-up. Improved marital relationships could help prevent and increase in depressive symptoms. |

Note:

CCHS-1.2: Canadian Community Health Survey

CES-D: Centre for Epidemiologic Studies Depression Scale

DSM: Diagnostic Statistical Manual

EDS: Edinburgh Depression Scale

ESI: Everyday Stressor Index

MINI: Mini International Neuropsychiatric Interview

IRLE: Interview for Recent Life Events

SRQ: Self reporting Questionnaire

Table 8 (continued)

*Relationship between Depression and Marital Status from International, African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Coleman et al. | 2006 | West Africa | n=565 women | Reproductive Health Survey, EDS, reproductive health questionnaire and gynaecological examination | Depression was signficantly associated with widowhood or divorce, infertility and severe menstrual pain. |
| Ensel et al. | 1982 | USA | n = 1091 men and women | CES-D | Unmarried females were most depressed = 28.9% when compared to other males and females of varying marital status. |
| Hall | 1990 | USA | n = 196 mothers with children between 5 & 6 years old | CES-D and ESI | High depression was reported in those who had never married. The ESI was a high predictor of depressive symptoms controlling for demographic factors. |
| Muhwezi et al | 2008 | Uganda | n=138 (Depressed n=74); Unmatched controls n=64) | MINI and IRLE | Depressed individuals were more likely to be single when compared to the marital status of the unmatched controls. |
| Ramchandani et al. | 2009 | South Africa | n = 1035 women | Pitt Depression Questionnaire | Exposure to societal stressors (witnessing violent crime/danger of being killed) and difficulties with partner were predictors of post natal depression (16.4%). |

Note:

CCHS-1.2: Canadian Community Health Survey

CES-D: Centre for Epidemiologic Studies Depression Scale

DSM: Diagnostic Statistical Manual

EDS: Edinburgh Depression Scale

ESI: Everyday Stressor Index

MINI: Mini International Neuropsychiatric Interview

IRLE: Interview for Recent Life Events

SRQ: Self reporting Questionnaire

Research that was conducted internationally, in sub-Saharan Africa and South Africa concur in their findings in that the highest levels of depression were evident in those who were single, divorced or those that experienced marital conflict where a trend of stable social support appears to be a protective factor against symptoms of depression as summarized in Table 8 (Akhtar-Danesh & Landeen, 2007; Beeghly et al., 2003; Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; Brennan, Moos & Mertens, 1994; Coleman, Morison, Paine, Powell & Walraven, 2006; Ensel, 1982; Hall, 1990; Muhwezi, Agren, Neema, Maganda & Musisi, 2008 ; Ramchandani, Richter, Stein & Norris, 2009). According to psychological theory, depression was more likely to occur in individuals in response to perceived loss or rejection in social relationships, therefore this could be one of the reasons for depression being highly prevalent within an unmarried group when compared to those who were married or in some form of relationship (Akhtar-Danesh & Landeen, 2007; Blatt, 2006; Freud, 1894; Reis, 1988 ; Weissman & Olfson, 1995).

Studies ranging from 1990 to 2009 were the association between depression rates and levels of education were reported from the general community or from a sample of women only for studies that were conducted internationally, sub-Saharan Africa or South Africa were selected and summarized in Table 9.

Table 9

*Relationship between Depression and Educational Status from International, African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bhagwanjee et al. | 1998 | South Africa | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria; SRQ (used back-translation process & validated) | Poor educational achievements and lack of education were associated with higher rates of psychiatric morbidity. Overall psychiatric disorders, dysthymia, & general anxiety were significantly higher among those with no formal education than primary or high school education. |
| Hall | 1990 | USA | n = 196 mothers with children between 5 & 6 years old | CES-D and ESI | High depression was reported in those who had less than high school education. |
| Miech et al. | 2000 | USA | n=2031 from the Work, family, and Well Being 1990, national probability telephone survey | CES-D | Physical health problems and depression is more prevalent in those with lower education. |
| Muhwezi et al. | 2008 | Uganda | n=138 (Depressed n=74); Unmatched controls n=64) | MINI and IRLE | Depressed individuals were more likely to have less than post-primary education when compared to the unmatched controls. |
| Pillay et al. | 1999 | South Africa | n=50 men and women from low socio-economic conditions | BDI; BAI; Hopelessness Scale (measure of pessimism) | Anxiety, depression and hopeless was negatively associated with education. |
| Tomlinson et al. | 2009 | South Africa | n = 4351 men and women | National representative survey | Individuals with low education had higher prevalence of depression. |

Note:

BAI: Beck Anxiety Inventory

BDI: Beck Depression Inventory

CES-D: Centre for Epidemiologic Studies Depression Scale

DSM: Diagnostic Statistical Manual

ESI: Everyday Stressor Index

MINI: Mini International Neuropsychiatric Interview

IRLE: Interview for Recent Life Events

SRQ: Self reporting Questionnaire

Table 9 shows that studies that were conducted internationally, in sub-Saharan Africa and South Africa again concur in their findings in that the highest levels of depression were evident in those who had poor educational level (Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; Hall, 1990; Miech & Shanahan, 2000; Muhwezi, Agren, Neema, Maganda & Musisi, 2008; Pillay & Sargent, 1999 ; Tomlinson, Grimsrud, Stein, Williams & Myer, 2009). Those who have lower educational levels possibly have fewer opportunities and this could enhance their exposure to depressive symptoms due to more life stressors being experienced. A review of literature suggested that those with lower income experienced higher levels of depression (Zimmerman & Katon, 2005).

International, sub-Saharan and South African studies ranging from 1990 to 2008 that reported on the rates of depression within groups of varying socio-economic status were selected and summarized in Table 10.

Table 10

*Relationship between Depression and Socio-econmic Status from International, African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bhagwanjee et al. | 1998 | South Africa | n = 354 (first stage)<br>n = 81 (second stage) | Interviews based on DSM criteria; SRQ (used back-translation process & validated) | Rate of depression was higher among the employed than unemployed where those were employed were probably not earning enough and this could have contributed to their high levels of depression. Depressive disorders were significantly higher among those in the low income category. |
| Hadley | 2008 | Ethiopia | n = 902 men and women | The Hopkins Symptom Checklist; Harvard Trauma Questionnaire | Individuals with low SES were categorised as being distressed, anxious, depressed and reported post-traumatic stress. |
| Hall | 1990 | USA | n = 196 mothers with children between 5 & 6 years old | CES-D and ESI | High depression was reported in those who were Black and had low income. |
| Lorant et al. | 2003 | Europe & America | Review of prevalence, incidence and persistence studies | - | Individuals with low SES were more likely to be depressed, more likely to experience a new depressive episode and more likely to have persistent symptoms of depression |
| Middeldorp et al. | 2006 | Netherlands | n=4309 Dutch twins | Questionnaires; Maslach Burnout Inventory-General Survey and the YASR | Associations between employment and anxious depression are due to overlapping genetic and individual-specific environmental factors |
| Muhwezi et al. | 2008 | Uganda | n=138 (Depressed n=74); Unmatched controls n=64) | MINI and IRLE | Depressed individuals lacked formal employment and experienced more undesirable life events when compared to the unmatched controls |
| Reiss et al. | 1988 | USA | n = 654 women | CES-D | Low social support emerged as the best predictor of depression (47%) independent of age and marital status; chronological age was not an important contributor |
| Riviéres-Pigeon et al. | 2001 | Canada | n=447 women | Questionnaires; CES-D; ASSIS; Physical health measured by the Santé Québec Survey | Employment status and socio-environmental context is associated with depressive symptomatology where those seeking employment are more likely to have depressive symptoms at six months post partum. |
| Samuels-Dennis | 2007 | Canada | n=96 (Employed n=48; Social Assistance n=48) | Questionnaires that included the adapted version of the Social Readjustment Rating Scale, Coping Strategy Inventory and the BDI | Mothers on social assistance reported higher symptoms of depression on the BDI compared to employed mothers. |

Note:

ASSIS: Arizona Social Support Interview Schedule
BDI: Beck Depression Inventory
CES-D: Centre for Epidemiologic Studies Depression Scale
DSM: Diagnostic Statistical Manual
ESI: Everyday Stressor Index
MINI: Mini International Neuropsychiatric Interview
IRLE: Interview for Recent Life Events
SRQ: Self reporting Questionnaire
YASR: Young Adult Self Report

According to Table 10, individuals who were unemployed and those with a low socio-economic status were more likely to be depressed than the employed. It was suggested that those from disadvantaged backgrounds were more likely to be depressed due to the increase in environmental stressors that they are exposed to (Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; des Riviéres-Pigeon, Seguin, Goulet & Descarries, , 2001; Hadley et al., 2008; Hall, 1990; Lorant, Deliége, Eaton, Phillipot & Annseau, 2003; Middeldorp, Cath & Boomsma, 2006; Muhwezi, Agren, Neema, Maganda & Musisi, 2008; Reis, 1988 ; Samuels-Dennis, 2007). The role of lower SES in depression has also been demonstrated in the developed world. In a study conducted with African American individuals from Harvard-affiliated teaching hospitals indicated that the likelihood of depression in low socio-economic groups was greater when compared to the higher socio-economic groups even after controlling for race as this study included only African Americans. This incidence study indicated that the odds ratio or likelihood (OR = 2.06) of depression persisting in a low socio-economic group was double when compared to those from a higher socio-economic status group (Beeghly, Olson, Weinberg, Pierre, Downey &Tronick, 2003, Fortenberry, 2003; Frerichs, Aneshensel, Clark & Yokopenic, 1981; Lorant, Deliége, Eaton, Phillippot & Ansseau, 2003).The causes of depression for those in the middle to upper income group differ from those of a lower economic status, as individuals from the more affluent sector tend to place extreme focus on self-worth and self-criticism when they feel that their goals have not been reached. It is possible that these individuals strive for perfection with little satisfaction and this could lead to self-critical depression (Blatt, 2006). While some studies had indicated that higher education, engagement in valued activities, and social support could serve as protective factors against depression; others suggested that achievement-orientated individuals who were extremely afraid of the possibility of failure and

criticism experienced depression when they felt they did not have control over their environment (Blatt, 2008 ; Rubio, Kraemar, Farrell & Day, 2008). In contrast, depressive symptoms reported by those from a lower economic class could stem from difficult environmental conditions. In addition, lower education, high levels of unemployment and low socio-economic status contributes to the high levels of depression within disadvantaged groups.

Studies that were conducted less than 15 years that investigated the association between pregnancy loss and depression were selected and summarized in Table 11.

Table 11

*Relationship between Depression and Miscarriages from studies conducted Internationally and within Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Bergner et al. | 2008 | Berlin | n= 342 | Survey data that included a German Depression Scale, medical histories, socio-demographic data, patterns of coping and attribution after miscarriage and psychological attitudes and patterns of coping in a new pregnancy | Pregnant women who have suffered miscarriages were more likely to report pregnancy specific anxiety than pregnant women who did not have a history of pregnancy losses. Anxiety symptoms were most marked in the group of women who had recurrent abortions. There was no increase in depressive symptoms in pregnant women who had a history of miscarriages. However, women with depressive symptoms after pregnancy loss were at higher risk for depressive symptoms in subequent pregnancies. Induced abortions made depressive symptoms more likely in a pregnancy which followed a miscarriage |
| Lok et al | 2004 | Hong Kong | n=337 | BDI and the Structured Clinical Interview for DSM-III-R | BDI scores were higher for those diagnosed with depression. BDI is an effective tool in screening for psychiatric morbidity after miscarriage but should not be used for diagnositic purposes. |
| Lok et al | 2010 | Hong Kong | n=430 | 12 item General Health Questionnaire (GHQ-12) and BDI | At 3 months and 6 months after miscarriage, a significant percentage of women reported psychological distress. However, over the course of a year, this level of psychological distress reduced. |
| Neugebauer et al. | 1997 | USA | n= 459 | Major depression measured by the DIS | Symptoms of major depressive disorder was more likely in childless women who had a miscarriage when compared to women who had a child. |
| Obi et al | 2009 | Nigeria | n=202 | Questionnaire and the Zung self rating depression scale | Following pregnancy loss, women experienced some level of depression: Minimal depressive symptoms (50-59)= 74.3%; Moderate symptoms of depression (60-69) = 3%; Severe symptoms of depression (70-80)=13.9%. No living children and pregnancy loss after 20 weeks of gestation were the most significant risk factors. |

Note:

BDI: Beck Depression Inventory

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

GHQ-12: General Health Questionnaire

In terms of pregnancy history, a study that was conducted in the United States with 8069 participants which was part of the Early Childhood Longitudinal Study-Birth Cohort where the CES-D was used to assess the level of depression in women, indicated that the likelihood of mothers with multiple births experiencing moderate to severe symptoms of depression during post-partum, was greater when compared to mothers who had only one child (Choi, Bishai & Minkovitz, 2009). The literature summarized in Table 11 also shows that women who experienced pregnancy loss were more likely to experience some level of depression soon after the distressing event, yet these levels of psychological uneasiness decreased over time (Bergner, Beyer, Klapp & Rauchfuss, 2008; Lok et al., 2004; Lok, Yip, Lee, Sahota & Chung, 2010; Neugebauer et al., 1997 ; Obi, Onah & Okafor, 2009). This information suggests that environmental stressors are a major factor that contributes to the level of depression experienced by women.

While, demographic health surveys showed that cigarette or tobacco use in Africa is prevalent, there is limited research regarding the association between depression and smoking (Boshoff, 2008; Pampel, 2008 ; Peltzer, Phaswana & Malaka, 2001). However, other South African studies showed that a factor such as alcohol use is comorbid with smoking (Croxford & Viljoen, 1999 ; Viljoen, Croxford, Gossage, Kodituwakku & May, 2002). Studies summarized in Table 11 were selected based on the outcome of international studies that reported on the differing levels of depression in those that smoked compared to those that did not smoke. While results of published international, sub-Saharan and South African studies in the past 10 years that investigated the association between depression and TB were summarized in Table 13.

Tuberculosis (TB) is an infectious disease that is leading cause of morbidity and mortality in the world (Issa, Yussuff & Kuranga, 2009). TB is commonly evident within high risk groups that is those who are homeless, HIV positive, those with a history of alcohol or drug abuse and immigrants from a country where TB is endemic (Trenton & Currier, 2001). According to the World Health Organisation, the prevalence of TB in Africa is 450 per 100 000 and is a public health concern within disadvantaged communities where mood disorders are also evident in those diagnosed with TB (Trenton & Currier, 2001; WHO, 2011). Table 12 and Table 13 indicate that smokers and those diagnosed with TB are at higher risk of experiencing symptoms of depression respectively (Frerichs, Aneshensel, Clark & Yokopenic, 1981; Hickman, Delucchi & Prochask, 2010 ; Rubio, Kraemar, Farrell & Day, 2008). There is a high rate of depression for those diagnosed with TB and corresponding number of visits to treatment clinics, suggesting that symptoms of depression could interfere with adherence to completing the required treatment (Aydin & Ulusahin, 2000; Issa, Yussuff & Kuranga, 2009 ; Naidoo & Mwaba, 2010).

Table 12

*Relationship between Depression and Smoking from studies conducted in the United States*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Freirichs et al | 1981 | USA | n = 1003 men and women | CES-D | Smokers compared to non-smokers reported significantly higher levels of depression. Differences in smoking were not signficant for age, sex, income or employment. |
| Hickman et al | 2010 | USA | n=3411 Black men and women | Composite International Diagnostic Interview (CIDI) | Individuals with lifetime (35.6%), past year (36.0%) or past month (45.4%) mental illness had a higher smoking prevalence compared to those without mental illness (20.6%). Mental illness was also associated with heavier smoking. |
| Rubio et al. | 2008 | USA | n = 278 (MPHCD);<br>n = 209 (HOPE) | Questions on alcohol use; CES-D; EPDS | HOPE Cohort: Smoking and less education were predictors of depression. Illicit drug use was a predictor of the co-occurrence of alcohol use and depression. |

Note:

CIDI: Composite International Diagnostic Interview

CES-D: Centre for Epidemiologic Studies Depression Scale

EPDS: Edinburgh Postnatal Depression Scale

HOPE: Health Outcomes from Prenatal Education

MHPCD: Maternal Health Practices and Child Development

Table 13

*Relationship between Depression and Tuberculosis from International, African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Aydin et al. | 2000 | Turkey | n=157 men diagnosed with 3 clinical groups of pulmonary tuberculosis and chronic obstructive pulmonary disease (COPD) | GHQ-12; CIDI and Brief Disability Questionnaire | Depression and/or anxiety varied for the 3 clinically diagnosed groups of TB. The prevalence of depression and or anxiety within the Recently Diagnosed TB group (19%), Defaulted TB (21.6%) and Multi-drug resistant TB (25.6%). |
| Issa et al. | 2009 | Nigeria | n=65 men and women attending a Directly Observed Therapy Short Course (DOTS) clinic | Socio-demographic questionnaire and PHQ-9 | Prevalence of depression within a cohort attending a TB treatment clinic = 27.7%. |
| Naidoo et al. | 2010 | South Africa | n=166 men and women diagnosed with TB attending a public health clinic | BDI, Social Network Support Questionnaire | Incidence of depression within this sample = 64.3%. |

Note:

BDI: Beck Depression Inventory

CIDI: Composite International Diagnostic Interview

GHQ-12: General Health Questionnaire

PHQ: Patient Health Questionnaire

Advanced age, lack of social support, poor education, unemployment, low socio-economic status, multiple births, increase in miscarriages, smoking and tuberculosis are some factors that increase the risk of women being prone to experiencing symptoms of depression.

### 1.2.8 Comorbidity of depression and alcohol use.

While studies of depression and alcohol use in women are each well documented in isolation, there are few studies that investigate the comorbidity of depression and alcohol use among disadvantaged women who consumed alcohol during pregnancy, even though there is evidence that excessive alcohol use and depression co-exist (Homish, Cornelius, Richardson & Day, 2004; Kessler, 1997; Van Dorn, Williams, Dell-Colle & Hawkins, 2008). An Australian study conducted on a sample of males and females aged between 20 and 70 years showed that depression (as measured by the BDI-II and the depression section of the Structured and Clinical Interview (SCID) for DSM-IV-TR) and alcohol use (the average amount of alcohol consumed per week as measured by the Alcohol Use Disorders Identification Test AUDIT and the Time Line Follow Back) frequently co-occur and are highly prevalent. Participants that reported depressive symptoms as measured by the SCID with alcohol dependence (69%; n=114/165) were more than those who reported depressive symptoms without alcohol dependence (2%; n=4/165) (Hunt, Baker, Michie & Kavanagh, 2009). A summary of studies ranging from 1991 to 2009 the investigated the association between alcohol use and mental illness which were conducted internationally and in South Africa were selected and summarized in Table 14.

Table 14 shows that there are limited previous studies which have characterized the relationship between maternal alcohol use and levels of maternal depression after controlling for

demographic, health and socio-economic factors (Hock & DeMeis, 1990; Paschall, Freisthler & Lipton, 2005; Rubio, Kraemer, Farrell & Day, 2008).Those with co-occurring mental illness and substance abuse were more likely to report stressful life events than those who only reported substance abuse, thus it is implied that alcohol use by women within disadvantaged communities enhances their risk of experiencing symptoms of depression.

One international prospective study that was conducted in Sweden with 458 women investigated the impact of prenatal alcohol exposure, maternal depressive symptoms using the EPDS scale and low emotional support on infant irritability (Lemola, Stadlmayr & Grob, 2009). This study showed that fetal alcohol exposure was associated with infant irritability while there were no long term association between maternal depression and infant irritability. In addition, no association between drinking alcohol and depressive symptoms were found probably due to the emotionally supportive relationships shared with their partners (Lemola, Stadlmayr & Grob, 2009). It would be worth further investigating the comorbid relationship between maternal depression and alcohol use within the disadvantaged community of this current study, as majority of the women were single and lacked emotional support when compared to the sample of international study where over 80% of the women were married or cohabitating. Thus, women with the Northern Cape have additional stressors that could place them at high risk of using alcohol and experiencing symptoms of depression.

Table 14

*Comorbidity of Depression and Alcohol Use in Women from Studies Conducted Internationally and in South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Jacobson et al | 1991 | International | n = 361 mothers | Michigan Alcoholism Screening Test (MAST); Becks Depression Inventory (BDI) | Maternal depression was the strongest predictor for alcohol, marijuana and cocaine use |
| Rubio et al. | 2008 | USA | n = 278 (MPHCD);<br>n = 209 (HOPE) | Questions on alcohol use; CES-D; EPDS | MPHCD: Depression = 85%; Depression & alcohol use = 56%<br>HOPE: Depression = 34%; Depression & alcohol use = 10% |
| Thom et al. | 1993 | South Africa | n = 299 men and women | Interviews; SRQ; Present state examination | Alcohol Use and Mental Illnes = 4% |
| Van Dorn et al. | 2009 | USA | n = 633 young adults | Substance use response (alcohol, marijuana, cocaine, other drugs); DIS; questions on violence | Alcohol Use and Mental Illness = 10.6% |

Note.
BDI: Beck Depression Inventory
CES-D: Centre for Epidemiologic Studies Depression Scale
DIS: Diagnostic Interview Schedule
EPDS: Edinburgh Postnatal Depression Scale
HOPE: Health Outcomes from Prenatal Education
MAST: Michigan Alcoholism Screening Test
MHPCD: Maternal Health Practices and Child Development
SRQ: Self reporting Questionnaire

### 1.2.9 Causes of Depression.

Innate insecurities, perceived feelings of rejection, deprived or stressful environmental conditions and/or low socio-economic status are some of the factors that place individuals in a vulnerable position for experiencing symptoms of depression (Blatt, 2006; Fiske, Wetherell, & Gatz, 2009; Jesse, Walcott-McQuigg, Mariella, Swanson, 2005). From the biological perspective, higher than normal amounts of cortisol discharges in the adrenal glands and abnormal brain wave patterns are evident in those who are depressed (Lowry, 1984). Chemical imbalances contributing to the symptoms of depression emerged during the late 1950's and mid 1960's where fluctuating levels of melatonin had the potential of interfering with an individual's sleep cycles which contributed to symptoms of depression that emerged from physical fatigue or lack of sleep (Schwartz & Schwartz, 1993). A longitudinal, prospective and comparative study which was conducted in China, that investigated the change in maternal mood states over time in 308 pregnant women or women who had recently delivered showed that fluctuations in maternal hormone levels were associated with a variation in the levels of depression that were experienced (Fan, Zau, Ma, Yie, Mao & Ma, 2009).

Hormonal fluctuations could be an underlying cause of depression while psychoanalytic and behavioural theory explains the origins of the symptoms of depression. According to Freud's psychoanalytic theory distortions which emerged from variations and disruptions in the normal psychological development of attachment and separation could account for certain mood states such as depression (Freud, 1894; Weissman & Olfson, 1995). Self-hatred could stem from the person feeling responsible for loss and this low self-esteem could contribute to the person having negative thoughts (Comer, 1992; Lowry, 1984). Although Melanie Klein, challenged

Freud on his view of the Oedipus conflict, her view of depression resembled that of Freud's theory in that an individual could develop a predisposition for the illness where it was possible that when normal grief reactions to loss were not resolved this could develop into pathological symptoms of depression, yet Klein considered a dual perspective that integrated the social environment with the unconscious life (Durand & Barlow, 2003; Klein, 1961; Kristeva, 2001; Likierman, 2001; Segal, 1973). Although symbolic loss, which is defined as "*unconscious representation which disguises or distorts the thing represented such that what is perceived consciously is a misinterpretation of the real thing"* was identified as the primary cause of depression according to psychoanalysts, there had been no way to prove the principles of this assumption (Comer, 1992; Reber, 1985). In addition, critiques of psychotherapy indicated that sex role bias and a lack of understanding of disorders in women were not addressed by the principles underlying psychotherapy (Hare-Mustin, 1983).

Hormonal imbalances, separation anxiety and the influence of disruptive environmental conditions in combination could exacerbate the symptoms of depression experienced by individuals. Behavioural theorists acknowledge that the sudden loss of a loved one or sudden unexpected changes in an individual's environment could produce a lack of interest in carrying out activities. This could subsequently lead to symptoms of anger (one of the symptoms of depression) in response to the loss or sudden change of the individual's environment (Ferster, 1973). Beck, on the other hand, a social learning theorist, did not conceptualise depression as a low rate of physical behaviour yet associated depression with feelings of inadequacy, taking things personally and a belief that the future was hopeless. This cognitive model of depression included three concepts of the cognitive triad (negative view of self, interpretation of experiences in a negative manner and a negative view of the future), schemas and faulty

information processing (Beck, Rush, Shaw & Emery, 1979). These inferior feelings could lead to more negative experiences and in turn, more thoughts of worthlessness and inferiority could develop (Schwartz & Schwartz, 1993). According to Beck's cognitive model, a stressful environmental situation could trigger negative thoughts and this could lead to varying levels of depression being experienced (Beck, Rush, Shaw & Emery, 1979).

Thus a combination of biological, grief reactions, environmental changes or negative thoughts could contribute to symptoms of depression being experienced ranging from normal to severe levels of depression, returning to the argument of whether depression can be categorized as a normal reaction to stressful conditions or as a mood disorder.

### 1.2.10 Treatment of Depression.

The lack of neurotransmitters such as norepinephrine and serotonin evident in depressed individuals were the main contributing factors to the development of anti-depressant medications such as Prozac, as extensive medication together with psychotherapy had been shown to be an effective treatment for depression (Leo & Lacasse, 2007; Miranda et al., 2003). Psychotherapy is also an effective method for the treatment of depression when it is time-limited and the techniques are able to assist individuals with improving social functioning (Miranda et al., 2003). Psychotherapy is useful for the treatment of depressed pregnant women when compared to the use of pharmacotherapeutic drugs, as depressive medication could be harmful to the developing fetus. However, there is limited information on intervention studies that compares the effectiveness between pharmacotherapy and psychotherapy on infant development (Weissman & Olfson, 1995). There is one study that was conducted in the suburban areas of Washington, DC on women who were signed up for the food subsidy programs which showed

that psychotherapy and the use of psychotherapeutic drugs were identified as the most effective form for the treatment of depression instead of referrals to welfare and community services. Although community referrals are more likely to be available in disadvantaged communities, women rarely make use of these services and therefore may not receive the assistance that they need (Miranda et al., 2003).

Activation based treatment of depression were recent advancements in basic behaviour analysis that increases targeted healthy behavior by promoting the value of reinforcers while devaluing the negative feelings of depression by increasing physical activity. For this type of behavioural activation, emotions and destructive thoughts were not ignored, as all factors were considered for the treatment of depression and provided the opportunity to put interventions in place to reduce the recurrence of the depressive symptoms (Jesse & Graham, 2005; Lejuez, Hopko, LePage, Hopko & McNeil, 2001; Leo & Lacasse, 2007).

Although psychological therapy, use of psychotherapeutic drugs and techniques of behavioural therapy are an effective form of treatment for depression, many women with low income from disadvantaged communities do not have medical insurance and it could be challenging for them to meet the financial demands of the medical costs associated with treatment, therefore these women do not always receive the assistance that they need (Miranda et al., 2003; Weissman & Olfson, 1995). If women do not receive assistance with their symptoms of depression, this could have negative implications for their personal, interpersonal and general maternal functioning.

### 1.2.11 Relationship of Depressive Symptoms with Child Development.

Women who experience several environmental risks could find parenting to be stressful and this may lead to the possibility of their infants being subject to abuse and neglect due to the poor quality of parenting. If maternal depression persists, this negative attitude toward parenting could interfere with children reaching their developmental milestones appropriately (Nair, Schuler, Black, Kettinger & Harrington, 2003). Since early attachments are vital in creating a basis through which infants interpret and make sense of future developmental experiences, there is a need for a comprehensive understanding of how maternal symptoms of depression may impact on infants' overall adaptation (Field, 1997). In South Africa, knowledge related to infant mental health and child development had mainly stemmed from predominantly Western, middle class and white ethnic groups, while there is a lack of knowledge about the combined effects of maternal depression and care of infants in disadvantaged households (Richter, 2003).The outcome of international studies that investigated the relationship between maternal depression and child development from 1982 to 2008 were selected and summarized in Table 15.

Table 15

*Relationship between Depression and Child Development from International Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Atkinson et al | 2005 | London and Canada | n = 112 | Adult attachment interview; Maternal sensitivity infant attachment | Maternal mental representations influence responsivity which influence infant attachment security |
| Brennan et al | 2000 | Australia | n = 4953 | Self report depressive symptoms during pregnancy; mother's report of child's behaviour; receptive vocabulary test | At 5 years follow-up the severity and chronicity of maternal depressive symptoms related to more behaviour problems and lower vocbaulary scores |
| Breznitz et al | 1988 | Israel | n = 25 mother infant dyads | Measures of attention (20 min) spontaneous play in home like setting; POMS; Psychiatric Interview | Children of depressed women focussed attention on more objects for shorter durations. Depressed women initiated and terminated more instances of attention to objects than well mothers |
| Campbell et al | 1995 | USA | n = 139 | Home visits rated on a mood scale; face to face interactions; feeding interactions & mother infant play | Women whose depression lasted through 6 months were less positive with their infants across 2, 4 and 6 months. Babies were less positive during face to face interaction |
| Carter et al | 2001 | USA | n = 69 pairs of mother infant pairs | Prenatal questionnaire; laboratory visits; CES-D; Emotional availability attachment status; infant-toddler social and emotional assessment | Lower emotional availability in the comorbid (depressive illness, anxiety, substance or eating disorder) group compared with depression and no psychopathology groups; a history of depression and other disorders increased risk for infant insecure attachment; higher insecurity in infants of the comorbid group compared with problem behaviours and competencies for the whole group; quality of early mother infant interaction is more central for the development of girls; maternal depressive symptoms from pregnancy to 30 months of infant development contribute to behaviour problems experienced by boys |
| Cicchetti et al | 1998 | Rochester | n = 202 | DIS using the DSM III; BDI; Daily Hassles Scales of parenting events; Family environment scale; Bayley, Attachment Q set; CBCL; Questionnaires | Toddlers with depressed mothers had significantly more insecure attachments than did toddlers with non-disordered mothers and this difference was not accounted for by contextual risk. Contextual risk mediates the relation between maternal depression and child behaviour problems |

Note:

CBCL: Child Behaviour Checklist

CES-D: Centre for Epidemiologic Studies Depression Scale

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

POMS: Profile of Mood States

Table 15 (continued)

*Relationship between Depression and Child Development from International Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Cicchetti et al | 1997 | Rochester | n = 134 mother child dyads | DIS using the DSM III; BDI; PANAS & Attachment Q sets; mirror rouge paradigm | Children of depressed mothers who exhibited self-recognition were more likely to display non positive affect and to shift affect from positive to non positive in post rouge conditions. Toddlers who did not show evidence of self-recognition and who shifted affect were low in attachment security and had mothers with less positive affect characteristics; self recognition and affective instability were related to diferences in cognitive development level among toddlers of depressed women |
| Cogill et al. | 1986 | London | n = 94 women and their first born child | McCarthy Scale; Clinically assessed by a psychiatrist using a semi-structured interview | Significant intellectual deficits were found in children whose mothers suffered depression but only when depression occurred in the first year of the child's life |
| Edborgh et al. | 2003 | Sweden | n = 11 | EPDS; Parent child ealry relational assessment | Children of high EPDS scoring mothers showed less persistence in play with less joy in reunions after separation |
| Galler et al | 2000 | Barbados | n = 226 | General adjustment and morale scale; Zung depression and anxiety scale; GMDS and feeding practices | Infants of mothers with mild to moderate depression had lower Griffiths scores than infants of mothers without depression. Maternal depressive symptoms and lack of trust at 7 weeks predicted lower infant social and performance scores at 3 months. Maternal moods at 6 months were associated with lower scores in motor development at the same age |
| Kavanaugh et al | 2006 | USA | n = 400 mothers and female guardians and infants | Mental Health Inventory (depression) | Children of mothers with depressive symptoms were more likely not to have received routine dental care in the past year; brush their teeth less than twice a day; or to be read to less than three times a week compared to children of mothers without depressive symptoms. Depressed mothers were more likely to use inconsistent discipline practices and were less confident in their parenting |
| Kurstjens et al | 2001 | Germany | n = 1329 | Standard Interview; Griffiths Scales of Babies Abilities; Columbia Mental Maturity States; Kaufman Assessment Battery for Children (K-ABC) | Maternal depression has negligible effects on childrens cognitive development. Long term effects may be found when maternal depression is chronic |
| Lyons-Ruth | 1997 | International | n = 50 | CES-D; Home Assessment; Bayley Scales; Ainsworth Strange Situation; Child Behaviour Checklist; Teacher Report | Childrens internalising symptoms were primarily predicted by high levels of maternal depression during the first 5 years; teacher's reports found an association between avoidance and internalised symptoms; high level of maternal depression was a signficant predictor of externalising problems; externalising problems only indicated from the teacher's report |

Note:

BDI: Beck Depression Inventory

DIS: Diagnostic Interview Schedule

DSM: Diagnostic Statistical Manual

GMDS: Griffiths Mental Development Scales

EPDS: Edinburgh Postnatal Depression Scale

PANAS: Positive and Negative Affect Scale

Table 15 (continued)

*Relationship between Depression and Child Development from International Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Milgrom et al | 1995 | Australia | n = 73 | 24 hour diaries of the frequency that infants cried for a week | Infants of depressed mothers cry signficantly more in total per day than infants of non depressed mothers at 3 months but not at 6 months |
| Misri et al | 2004 | British Columbia | n = 46 | Hamilton Anxiety Rating Scale; Hamilton Depression Rating Scale; Structured Clinical Interview | All 46 women suffered from clinical depression; presence of pharmacologic therapy for maternal mental illness during pregnancy; maternal levels of anxiety and depression were related to adverse infant outcome |
| Murray | 1993 | United Kingdom | n = 59 child mother dyads | EPDS; Standard psychiatric interview, Bayley scales of infant mental development | Speech of depressed women expressed more negative affect, less focussed on infant experience; less acknowledgement of infant agency |
| Murray | 1992 | Cambridge | n = 702 | EPDS, Bayley, Reynell Scales of language development; security attachment to mothers | Infants of postnatally depressed mothers performed worse on object tasks , more insecurely attached to mothers and showed more mild behaviour difficulties. Post natal depression had no effect on general cognitive and language development but makes infants more vulnerable to adverse effects |
| Petterson et al | 2001 | USA | n = 7677 child mother dyads | NMIHS; CES-D | Maternal depression and poverty limited the development of very young girls and boys. Chronic maternal depression had severe implications for boys and girls but persistent poverty had implication for development of girls. This assessment was more for cognitive development rather than motor development |
| Politano et al. | 1992 | USA | n = 56 | BDI | Anxiety in children of depressed mothers significantly correlated with mothers depression and not anxiety. High anxiety and low self-esteem in depressed women were reported |
| Prior et al. | 2008 | Australia | n = 1760 | Vocabulary (MacArthur Bates Communicative Development Inventory); Communication and Symbolic Behaviour Scales | Children of mothers with clinical levels of depression and life difficulties reported more behaviour problems |

Note:

BDI: Beck Depression Inventory

CES-D: Centre for Epidemiologic Studies Depression Scale

EPDS: Edinburgh Postnatal Depression Scale

NMIHS: National Maternal and Infant Health Survey

Table 15 (continued)

*Relationship between Depression and Child Development from International Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Reissland et al. | 2003 | Scotland | n = 64 women and infants | EPDS | The differences in maternal speech indicate that mothers who are depressed are less attuned to infants which might force the infant into self-regulation patterns that could compromise child development |
| Righetti-Veltema et al. | 2003 | Geneva | n = 35 mothers with post-partum depression and their infants | EPDS; Bayley Scales of infant development | Mothers with post partum depression were less affectionate than mothers with no post partum depression. Mothers with post partum depression had less verbal interaction and less play interaction; infants performed less well on object concept tasks and more often insecurely attached |
| Trapolini et al. | 2007 | Australia | n = 92 mothers | Attachment Story Completion Task; WPPSI-R; CIDI; CES-D; Ainsworth Strange Situation Procedure | 23% of women were depressed over a 4 year follow-up; children of mothers who were concurrently depressed were more likely to have uncontained aggression; no significant relationship between prior chronic maternal depression and child attachment representations. |
| Wang et al. | 2005 | Taiwan | n = 50 mother-child dyads | Structured questionnaires; BDI; CCDI | Women with post-natal depression (PND) had higher perceived stress, lower social support & self-esteem. Post-partum depression had no significant effect on their infants 8 developmental areas. Post-partum depression may have an influence on psychosocial health of women but does not appear to have an influence on the overall development of infants and family planning. |
| Whiffen et al | 1989 | Canada | n = 50 mother-child dyads | BDI; Bayley Scales of Infant Development | Infants of depressed mothers were less competent cognitively and expressed more negative emotions during testing. Depressed mothers perceived their infants more difficult to take care of but was not attributed to infant temperament; PPD was associated with an identifiable pattern of infant behaviour that may be exacerbate depressed mood in women. |
| Zuckerman et al. | 1990 | USA | n = 1123 mother-child dyads | CES-D; Neurologic and Adaptive Capacity Scale | The higher the depression in mothers more likely for the infant not to be consoled and to cry excessively. Early childhood problems and maternal depressive symptoms could be a part of a sequence that starts with depression during pregnancy. |

Note:

BDI: Beck Depression Inventory

CCDI: Chinese Child Development Inventory

CES-D: Centre for Epidemiologic Studies Depression Scale

CIDI: Composite International Diagnostic Interview

EPDS: Edinburgh Postnatal Depression Scale

WPPSI-R: Weschler pre-school and primary scale of intelligence-revised

Table 15 shows that insecure maternal-infant attachments, lack of developmental stimulation, behavioral problems, physical developmental delays, poor language development, poor cognitive skills, difficulty with solving object-task problems and overall developmental delays, were the outcome of international studies that investigated the association between maternal depression and infant development. Maternal sensitivity refers to the mother's ability to detect her infant's signals promptly, interpret them correctly and respond in an appropriate manner. Paying suitable attention to a child thus promotes the child's ability to explore their environment and learn. Based on this, attachment relationships have implications for early learning, organization of behaviour, cognition and emotions (Posada & Jacobs, 2001). When positive maternal-child interactions are absent, a sequence of childhood problems could result such as behavior problems when a mother does not respond to the child's dependency needs (Edhborg, Lundh, Seimyr & Widström, 2003 & Longfellow, Zelkowitz & Saunders, 1982; Zuckerman, Bauchner, Parker & Cabral, 1990). Lifetime maternal depression could compromise optimal mother-infant interaction leading to insecure infant attachment and heightened risk for physical and mental health problems in children (Kavanaugh, Halterman, Montes & Epstein, 2006). A prospective cohort study conducted in Pakistan indicated that chronic depression in mothers was associated with decreased growth that was also evident in the postnatal period of infant development (Rahman, Iqbal, Bunn, Lovel & Harrington, 2004).

Depressed mothers are less likely to provide their children with nurturance. Although depressed mothers interact with their children, they tend to use fewer friendly and affectionate styles of behavior and instead respond in a harsh manner toward their children (Weissman & Paykel, 1974). This could lead to mothers being poor models of problem solving skills to their

growing infants (Bernard-Bonnin, 2004). Mothers' with symptoms of depression or who were at high risk for substance abuse display negative emotional reactions and have limited interactive responses with their children (Reissland, Sheperd & Herrera, 2005; Savonlahti et al., 2005). In middle income homes, family structures appear to be more positive while in lower income homes this could be absent resulting in child developmental delays (Thompson, Lamb & Estes, 1982;Waters, 1978).

Although there had been some studies conducted within South Africa and sub-Saharan Africa on the relationship between maternal depression and child development, this information is sparse when compared to the numerous international studies as summarized in Table 15. Studies conducted in Africa and South Africa that investigated the relationship between maternal depression and child development were selected and summarized in Table 16.

Table 16

*Association between Maternal Depression and Child Development within African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Cooper et al | 2002 | South Africa | n = 32 pregnant women | Community based mother infant intervention; SCID; basic anthropometric measures of infants; video recording of free play and feeding practices | No significant difference in depression between the index (19%) and the comparison (28%) groups; there were differences in the physical development of infants where the weight of infants in the intervention group was higher and their height was taller. However there were no significant differences between the groups on the weight length ratio. |
| Cooper et al | 2009 (follow-on from the 2002 study) | South Africa | n = 449 pregnant women randomly assigned to an intervention or treatment group | Intervention to improve the quality of mother infant interaction at 6 & 12 months; SCID; EPDS; Ainsworth strange situation procedure video recorded | Mothers in the intervention group were more sensitive and less intrusive in their interactions with their infants. There was also a higher rate of secure infant attachment at 18 months; Prevalence of depression in the intervention group was lower than the control group but the difference was not significant; maternal depressive disorder or maternal depressive symptoms were not correlated with any parenting variables or infant attachment; depressive symptoms in the intervention group was lower at both assessments compared to the control group but the difference was only significant at 6 months. |
| Hadley et al | 2008 | Ethiopia | n = 431 mother infant (3-24 m) dyads | Household socio-economic status; household level food insecurity measured by a 7 item scale; Hopkins Symptom Checklist(anxiety & depression); Denver II infant developmental test | Children of mothers with high symptoms of depression scored significantly lower on the personal-social, fine motor, gross motor and overall development scales; nutritional stunting was a risk factor for lower developmental scores. |

Note:

EPDS: Edinburgh Postnatal Depression Scale

SCID: Depression section of the structured clinical interview for Diagnostic Statistical Manual (DSM-IV) diagnosis

Table 16 (continued)

*Association between Maternal Depression and Child Development within African and South African Countries*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Tomlinson et al. | 2006 | South Africa | n = 147 mother infant dyads | SCID; infant growth indicators were measured | No clear effect of post-partum depression on infant growth was found. Although maternal depression at 2 months was associated with lower infant weight, this effect was no longer evident at 18 months. |
| Tomlinson et al. | 2005 | South Africa | n = 147 mother infant dyads | SCID; video recording of mother infant interaction with structured play; attachment strange situation behaviour | Post-partum depression at 2 months and indices of poor parenting at 2 and 18 months were associated with insecure infant attachment. Predictor of insecure infant attachment at 2 months were maternal intrusiveness, maternal remoteness and early maternal depression. When concurrent maternal sensitivity was considered the quality of early mother infant relationship remained but maternal depression was no longer predictive. |

Note:

EPDS: Edinburgh Postnatal Depression Scale

SCID: Depression section of the structured clinical interview for Diagnostic Statistical Manual (DSM-IV) diagnosis

Insecure mother-infant attachment and poor physical development were the common consequences of maternal depression on child development for the studies that were conducted in South Africa (Cooper et al., 2002; Cooper et al., 2009; Tomlinson, Cooper & Murray, 2005; Tomlinson, Cooper, Stein, Swartz & Molteno, 2006). The outcome of the one study that was conducted in sub-Saharan Africa showed that social interaction, fine motor, gross motor and overall developmental delays were evident in the children of mothers with high symptoms of depression (Hadley et al., 2008). These limited studies conducted within developing countries like the studies conducted in Western countries show that there is a negative association between maternal depression and child development.

It had been argued that when a mother is stressed during or after her pregnancy, her child is more likely to have physical, cognitive or emotional problems, has an increased risk of attention problems, possibility of higher levels of anxiety and language delays (Cox & Klinger, 1988; Goodman, 2007;Talge, Neal & Glover, 2007). Children of mothers with symptoms of depression were also inclined to have lower intellectual functioning, problems with attention, mathematical reasoning, cognitive linguistic functioning and perceptual delays (Cox & Klinger, 1988; O'Connor, Heron, Golding & Glover, 2003). Table 17 provides a summary of functional deficits in children that could be related to maternal depression.

Table 17

*Child Functional Deficits as a Consequence of Maternal Depression*

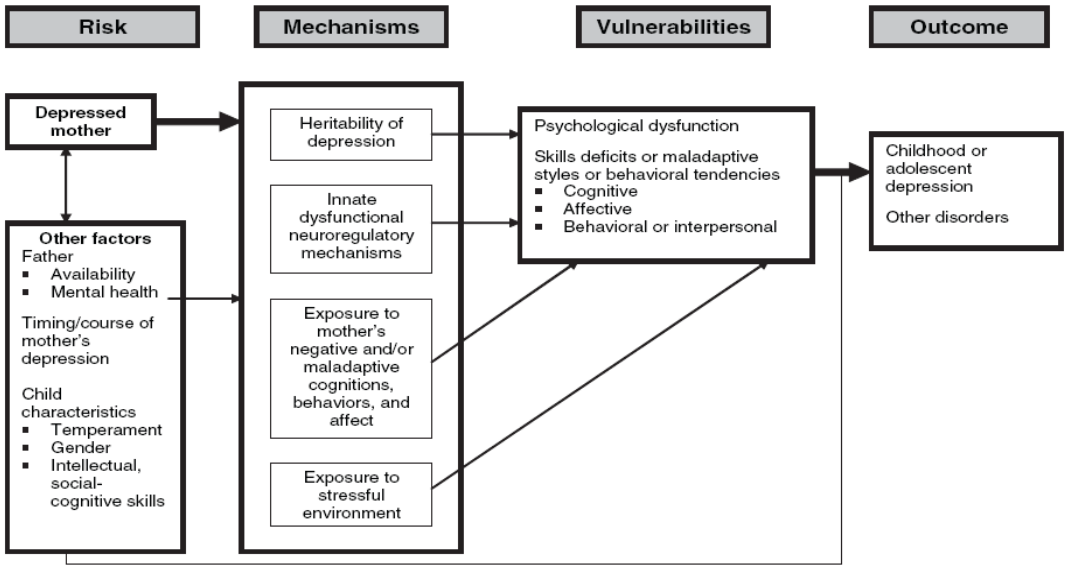
| | Developmental Stage | Consequences |
|---|---|---|
| **Prenatal** | | Inadequate prenatal care, poor nutrition, higher preterm birth, low birth weight, pre-eclampsia and spontaneous abortion |
| **Infant** | Behavioural | Anger and protective style of coping, passivity, withdrawal, self-regulatory behaviour, and dysregulated attention and arousal |
| | Cognitive | Lower cognitive performance |
| **Toddler** | Behavioural | Passive non compliance, less mature expression of autonomy, internalising and externalising problems and lower interaction |
| | Cognitive | Less creative play and lower cognitive performance |
| **School-Age** | Behavioural | Impaired adaptive functioning, internalising and externalising problems, affective disorders, anxiety disorders and conduct disorders |
| | Academic | Attention deficit/hyperactivity disorder and lower IQ scores |

Source: Bernard-Bonnin, A. C. (2004). Canadian Pediatric Society (CPS) Maternal Depression and child development. *Pediatric Child Health,* 9(8), 575-583.

Other child developmental aspects that were found to be associated with maternal depression include childhood depression, emotional, behavioural, cognitive, interpersonal, neuro-endocrine and brain function problems (Goodman, 2007). Goodman and Gotlib (1999) depicted this association within the *Integrative Model for the Transmission of Risk to Children of Depressed Mothers.* Figure 1 summarises the various areas that maternal depression that could interfere with child development.

Figure 1

*Association between Maternal Depression and Child Development*




Source: Goodman, S. H. & Gotlib, I.H. (1999). Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. *Psychological Review*, 106, 458–90

Poor physical health diminished emotional well-being and the challenges of living in a disadvantaged community, which are characteristic of a considerable proportion of the South African population, could interfere with mother-child interaction at a family and community level. Although privileged South African women, like their western counterparts, fulfill multi-dimensional roles at the individual and community levels, little attention has been given to the psychological well-being of South African women within disadvantaged communities. This provides the basis for investigating the effects in the relationship between maternal depression, maternal alcohol use and infant development outcomes.

## 1.3 Infant development and the role of maternal influence

### 1.3.1 Introduction.

Women from disadvantaged communities who consume alcohol during pregnancy are a high risk population as they are susceptible to the physical detrimental effects of teratogens and compromise the health of their developing infant. The sections that follow document the rate of substance use in South Africa; diagnosis of Fetal Alcohol Spectrum Disorder (FASD); prevalence of FASD; maternal variables associated with alcohol use and the developmental effects of exposure to alcohol prenatally.

### 1.3.2 Rate of Substance Use in South Africa.

The use of substances by the South African population is high and there has also been a general increase in the use of alcohol by women over the last decade (Croxford & Viljoen, 1999; Redgrave, Swartz & Romanoski, 2003; Stein et al., 2007). According to a study conducted on 600 rural South Africans 10.7% women were identified as hazardous drinkers while 0.3% of women met the criteria for probable alcohol dependence or harmful drinking when compared to men (Peltzer, 2006). The 1998 South African Demographic Health Survey, showed that women living in the Free State, Western Cape and Northern Cape reported the highest prevalence of alcohol use in the country (23-25%) (Global Status Report on Alcohol, 2004; van Heerden & Parry, 2001). FASD is a complex problem that stemmed from the DOP system that was implemented within the Western Cape, where labourers were paid in the form of bread, tobacco and wine for their work (McKinstry, 2005). This could account for the high

prevalence of FASD in this region of South Africa. Rates of alcohol use in South Africa from reports that were published between 1999 and 2007 were selected and summarized in Table 18.

Women are more susceptible to the negative effects of alcohol consumption when compared to men. They also tend to suffer the negative effects of alcohol use when two or more standard drinks are consumed per day and/or when one or more daily standard drinks are consumed during pregnancy (Redgrave, Swartz & Romanoski, 2003). Health problems and the probability of having an infant with Fetal Alcohol Spectrum Disorder are some of the negative consequences that women are vulnerable to when they consume alcohol (van Heerden & Parry, 2001).

Table 18

*Rate of Substance Use in South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Croxford et al. | 1999 | South Africa | n=636 pregnant women attending antenatal clinics located in poorer socio-economic areas of the Western Cape | Interview that collected demographic details, medical and obstetric history, cigarette smoking, alcohol consumption, drug use, eating practices and health data for current pregnancy | 42.8% women used alcohol to varying degrees during their current pregnancy |
| Global Status Report on Alcohol, World Health Organization | 2004 | South Africa | n=5574 males; n=7962 females; aged 15 years and above | DOH South African Demographic and Health Survey conducted in 1998 | 16.9% females & 44.7% males consume alcohol. Risky drinking for females (dinking 3 or more drinks per day) was 8.8% and 32.4% of females consumed alcohol during the weekend |
| Stein et al | 2007 | South Africa | n=4351 National Representative Survey | Survey | Alcohol abuse was 4.5%. Compared with 14 other countries, South Africa had the second highest prevalence of substance use disorders |

Note:
DOH: Department of Health

### 1.3.3 Diagnosis of Fetal Alcohol Spectrum Disorder (FASD).

The teratogenic effect of alcohol on fetal development leading to a diagnosis of Fetal Alcohol Syndrome was first published in 1973 (Jones, Smith, Ulleland & Streissguth, 1973). Fetal Alcohol Spectrum Disorder (FASD) was a consequence of maternal alcohol consumption and had been considered to be the most common cause of preventable mental retardation in the world that was evident among all race groups (Perreira & Cortes, 2006 ; Viljoen, Craig, Hymbaugh, Boyle & Blount, 2003). Due to the consequences of varying amounts of alcohol exposure on fetal development, the clinical diagnosis of FASD remains complex even though the diagnosis had evolved over time to enhance the specificity of the clinical features of FASD (Smithells & Smith, 1984).

For this study, strict criteria based on those of the Institute of Medicine (IOM) 1996 classification were used to clinically diagnose infants at risk for FASD instead of implementing a subjective assessment of facial features typical of FAS, as was previously used (Autti-Rämö, Gaily & Ganström, 1992; Institute of Medicine, 1996). According to the diagnostic criteria of the IOM, infants or children that displayed all of these clinical symptoms were diagnosed with FAS and this was considered to be the most severe case of prenatal alcohol exposure (Hoyme et al., 2005; Viljoen, 1999). Infants that displayed some, but not all the features of FAS, were clinically diagnosed on the FASD spectrum as Partial FAS (PFAS), Alcohol Related Birth Defects (ARBD) or Alcohol Related Neuropsychological Disorder (ARND), the outcome of which was dependent on the severity of prenatal alcohol exposure. Table 19 summarises the expected features of the FASD spectrum.

Table 19

*Summary of FASD classification and diagnostic features*

| FETAL ALCOHOL SPECTRUM DISORDER | | | |
|---|---|---|---|
| **Fetal Alcohol Syndrome (FAS)** | **Partial Fetal Alcohol Syndrome (PFAS)** | **Alcohol Related Birth Defects (ARBD)** | **Alcohol Related Neuropsychological Disorder (ARND)** |
| *Must have A-D | *Must have A-C | *Must have A-C | *Must have A and B |
| A- Maternal drinking | A- Maternal drinking | A- Maternal drinking | A- Maternal Drinking |
| B- Has 2 of the following: | B- Has 2 of the following: | B- Has 2 of the following: | B- Has 1 of: |
| · Palpebral Fissures | · Palpebral fissures | · Palpebral fissures | · Deficient brain growth |
| · Thin upper lip | · Thin upper lip | · Thin upper lip | · Evidence of behavioural or cognitive abnormalities |
| · Smooth philtrum | · Smooth philtrum | · Smooth philtrum | |
| C- Pre/postnatal growth retardation | C- Has 1 of the following: | C- Displays 2 minor abnormalities | |
| · Height | · Pre/postnatal growth retardation | · Cardiac | |
| · Weight | · Deficient brain growth | · Skeletal | |
| D- Deficient brain growth | · Evidence of complex behavioural or cognitive abnormalities | · Renal | |
| · Structural abnormalities | | · Eyes | |
| · Head circumference $<10^{th}$ centile | | · Ears | |
| | | · Other | |

Source: Hoyme, E.H., May, P.A., Kalberg, W. O., Kodituwakku, P., Gossage, J. P., Trujillo, P. M., Buckley, M. A., Miller, J. H., Aragon, A. S., Khaole, N, Viljoen, D. L., Jones, K. L., & Robinson, L. K. (2005). A Practical Clinical Approach to Diagnosis of Fetal Alcohol Spectrum Disorders: Clarification of the 1996 Institute of Medicine Criteria. *Pediatrics*, 115 (1), 39-47

A study that aimed at clarifying the IOM criteria for the diagnosis of FASD was conducted over a five year period and included high risk populations from the United States and South Africa. Extensive clinical evaluations, developmental assessments and maternal interviews were

conducted to gather data in order to describe the criteria more precisely. The study evaluated 1500 children and the focus was on the 164 children who were diagnosed with FASD. Since the data that was collected for the revision of the IOM criteria was obtained from a multi-racial cohort, this allowed for the criteria to be applied to a wide range of clinical and research settings (Hoyme et al., 2005). Other researchers who had used the IOM criteria for clinical diagnosis indicated that it was appropriate to use the revisions to the criteria, as they were specific and clinically applicable (Elliot, Payne, Morris, Haan & Bower, 2008). A similar method of diagnosing children with FASD was used in the current study where a clinical diagnosis, developmental assessment and maternal interview were conducted as part of data collection within this high risk sample. Conducting developmental assessments prior to a FASD diagnosis are necessary as these findings assist in identifying underlying problem areas that are a consequence of alcohol exposure, as some infants may suffer the effects of alcohol exposure prenatally but may not display all the clinically required facial features of FASD for diagnosis. By identifying the developmental delays in these individuals, this would provide an opportunity for these deficits to be addressed with early intervention programs (Kalberg et al., 2006).

### 1.3.4 Prevalence of Fetal Alcohol Spectrum Disorder.

According to the Centre for Disease Control and Prevention (CDC), studies that were conducted from 1995 to 1997 indicated that FAS prevalence rates ranged from 0.3 to 1.5 per 1000 live births in different areas of the United States that included Alaska, Arizona, Colorado and New York (Evans, 2002). Studies in other parts of the world reported that the prevalence rate in Washington was 3.1 per 1000 and selected communities in Western Canada showed a

prevalence of FAS and FASD between 1% to over 10 % (Clarren, Randels, Sanderson, 2001; Robinson, Conry & Conry, 1987; Square, 1997 ; Williams, Odaibo & McGee, 1999). Another study conducted in Italy among school age children showed that the rate of FASD was 20.3-40.5 per 1000 (May et al., 2006). Statistics cited in the Morbidity and Mortality Weekly Report (2001), confirmed that FAS is also a health problem in South Africa as the prevalence rates had been found to be 18 to 141 times greater than in the United States (Viljoen, Croxford, Gossage, Kodituwakku & May, 2002). These considerably different rates are indicative of this disorder being a public health concern particularly in disadvantaged communities (McKinstry, 2005).

An epidemiological study conducted in the rural areas of the Western Cape Province indicated that approximately 46 cases per 1000 of school entry children had FASD and a follow up study further reported that the FASD rates were 65.2-74.2 per 1000 (May et al., 2000 & Viljoen et al., 2005). In a study conducted during 2001 in four socio-economically poor communities of Gauteng, the rate of only FAS was 19 per 1000 school-entry children, while the rate of FASD was 26.5 per 1000 school entry children (Viljoen, Craig, Hymbaugh, Boyle & Blount, 2003). Refer to Table 20 for a summary of FASD epidemiology studies that were conducted in the Western Cape and Gauteng provinces, South Africa in the last 10 years. The situation was extreme in two populations in the Northern Cape Province, where the FASD prevalence rates were reported as 119.4 per 1000 and 74.5 per 1000 respectively. According to epidemiological studies conducted between 2001 and 2004, the Northern Cape Province in South Africa had the highest reported rates of Fetal Alcohol Syndrome in the world and it is 1.7 times more likely that there are FAS/PFAS children in De Aar than in Upington (Urban et al.,

2008). Yet there is limited published literature on research that was conducted in the Northern Cape, South Africa.

Table 20

*Prevalence of FASD in the Western Cape and Gauteng Provinces, South Africa*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| May et al. | 2000 | Western Cape (South Africa) | n=992 first grade pupils | Measures of growth, development, dysmorphology and maternal risk delineating characterisitics of children with FAS | Rate of FAS was 40.5 to 46.4 per 1000 children aged 5 to 9 years. |
| May et al. | 2006 | Western Cape (South Africa) | n=818 | Active case ascertainment using the IOM diagnostic criteria | Rate of FAS/PFAS was 68.0 to 89.2 per 1000 children with an average age of 7.3 years. |
| Viljoen et al. | 2005 | Western Cape (South Africa) | n=857 | Clinical dysmorphology examination, maternal interview, developmental tests (TROG; Ravens Colored Progressive Matrices, PBCL-36 providing measures of verbal and non-verabl IQ, cognitive skills and behavioural problems) | Rate of FAS was 65.2 to 74.2 per 1000 children with an average age of 6.5 years. |
| Viljoen et al. | 2003 | Gauteng (South Africa) | n=830 | Clinical dysmorphology examination and neuropsychologic assessments | Prevalence of FAS and deferred cases combined was 26.5% per 1000 children with an average age of 6.5 years. |

Note:
FAS: Fetal Alcohol Syndrome
IOM: Institute of Medicine
IQ: Intelligence Quotient
PFAS: Partial Fetal Alchol Syndrome
TROG: Tests of Reception of Grammar

### 1.3.5 Maternal variables associated with alcohol use.

There is limited information related to the characteristics of women whose children are affected by FAS (Nanson, 1997). Despite the general mention of gestational age in a study that was conducted on white British women, maternal age was not specified for the 973 participants that attended an antenatal clinic in Warwickshire. The outcome of this research indicated that individual factors such as maternal nutrition, lifestyle and maternal health could have increased or decreased fetal vulnerability to alcohol exposure (D'Avanzo & Barab, 2000 ; Davis, Partridge & Storrs, 1982). Table 21 summarises literature on the characteristics of women who were at risk of having an infant with FASD where studies from 1990 to 2008 were selected.

Table 21

*Maternal Variables Associated with Alcohol Use*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Anderson et al. | 2002 | United States | n=2672 English speaking women | Survey as part of the Project CHOICES Research Group | Having smoked more than 100 cigarettes, a history of inpatient treatment for drugs or alcohol, inpatient mental health treatment, having multiple partners and recent physical abuse was significantly associated with increased risk of an alcohol exposed pregnancy. |
| Coyne et al. | 2008 | Australia | n=110 | Review of maternal records, clinical diagnosis by a paediatrician, and information obtained from the self-report of alcohol consumtpion | Mothers with a FAS child were older, had multiple births, smoked more cigarettes, attended fewer antenatal visits and had more delivery complications when compared to mothers who did not have a child with FAS. |
| Croxford et al. | 1999 | South Africa | n=636 pregnant women attending antenatal clinics located in poorer socio-economic areas of the Western Cape | Interview that collected demographic details, medical and obstetric history, cigarette smoking, alcohol consumption, drug use, eating practices and health data for current pregnancy | Heavy drinkers follwed a pattern of binge drinking over weekends. Alcohol and tobacco use occurred in 29.6% of the sample. Only one individual reported using marijuana. |
| Flanigan et al. | 1990 | United States | n=43 | Questionnaire | 91% (n=39) reported unplanned pregnancies with their current pregnancy and 81% (n=35) had used no form of contraception. One-third (n=13) had used alcohol in conjunction with the intercourse which resulted in the current pregnancy and 5 had used other drugs |

Note:

FAS: Fetal Alcohol Syndrome

Table 21(continued)

*Maternal Variables Associated with Alcohol Use*

| Author | Year | Country | Sample | Tools | Outcome |
|---|---|---|---|---|---|
| Kvigne et al. | 2003 | United States | n=172 | Detailed examination of maternal medical records and children were diagnosed with FAS according to the International Classification of Diseases, Clinical modification (ICD-9-CM) based on documentation in their clinical notes | Mothers with children diagnosed with symptoms of FAS were older, had fewer prenatal visits, multiple pregnancies, more mental health problems, more total injuries where some were alcohol related, had more alcohol-related medical problems, drank heavily in binges and daily when compared to control mothers. |
| May et al. | 2005 | South Africa | n=168 | Dysmorphology examination, psychological and life skills tests to assess development and an interview with the use of a questionnaire | Miscarriages and stillbirths did not differ between the groups. Case mothers were more likely to reside in a rural setting, had lower education, lower income and religious practises were also low compared to the control groups. Mothers with a child with FASD had multiple births, multiple pregnancies, were more likely to cohabitate with their partner instead of being married, engaged in heavy binge drinking during weekends with no reduction in use of alcohol over the duration of the pregnancy and smoked more when compared to the control group. |
| May et al. | 2004 | Comparison of two datasets from the US and one dataset from South Africa | US merged dataset n=755; SA dataset n= 88 | Dysmorphology examination, neuropsychological assessments and interview with the mother or guardian | Maternal age (older women average 27.6 years in the SA sample), high gravidity and parity, binge drinking, heavy intergenerational drinking in the mother's extended family and immediate social network and length of drinking history were risk factors for having a child with FASD. |
| Viljoen et al. | 2002 | South Africa | n=62 | Dysmorphology examination and children were diagnosed with FAS according to the IOM criteria, interview with the use of a questionnaire. This was a retrospective study | Mothers with a FASD child reported started using alcohol at a younger age, , reported higher rates of alcohol consumption in their extended family, use of alcohol for the duration of the pregnancy, smoked cigarettes during each trimester of pregnancy, had lower education, low religious practises. Mothers with a FASD child did not have a higher number of births or higher number of live births. |

Note:

FAS: Fetal Alcohol Syndrome

FASD: Fetal Alcohol Spectrum Disorder

IOM: Institute of Medicine

According to Table 21 women that were vulnerable to drinking during pregnancy were found to be of advanced maternal age, had lower education, lower socioeconomic status, attended fewer antenatal visits, had multiple births, had more unplanned pregnancies, a history of smoking and/or substance abuse and had extended family history of alcohol abuse (Coyne, De Costa, Heazlewood & Newman, 2008; Croxford & Viljoen, 1999; Flanigan, McLean, Hall & Propp, 1990; Kvigne et al., 2003; May et al., 2005; May et al., 2004 ; Viljoen et al., 2002). Interestingly, women with a FASD infant also started using alcohol at a younger age when compared to a control group (Viljoen et al., 2002). The probability of infant malformations such as microcephaly, craniofacial deficits and behavioural problems also depend on certain maternal characteristics such as malnutrition, timing of prenatal alcohol consumption, quantity of alcohol ingested, advanced maternal age, high gravidity (total number of pregnancies), parity (total number of births), unstable marital status, cigarette use and use of other drugs (May et al., 2005; Viljoen, 1999 ; Warren & Foudin, 2001).

### 1.3.6 Developmental Effects of exposure to alcohol prenatally.

Infant development encompasses physical, cognitive and emotional components where learning is embedded within socio-cultural contexts (Sanson, Smart & Misson, 2011). The theoretical frameworks adopted showed the requirements for healthy infant adjustment and the shortcomings experienced by children who were prenatally exposed to alcohol. The sections that follow initially show the detrimental effects of prenatal alcohol exposure. Later sections provide a detailed account of overall infant development. Firstly Piaget's theory explains the cognitive development of children. Secondly, detail from the theory of Skinner and Chomsky highlighted

the developmental aspects of language and communication. Thirdly, Bowlby and Ainsworth's theory indicated the importance of the role of relationships in promoting infant development and fourthly Erikson's theory highlighted the psycho-social aspects of development. Throughout the discussion of these sections, the lack of resources within the socio-cultural context of this community was highlighted and the detrimental impact on infant development was also brought to the fore. Child development is a life-long process that is influenced by maternal behavior during pregnancy, individual and relational aspects.

Some professionals argue that small quantities of alcohol during pregnancy is safe to use, a review of published research provided contrary information in that there was no safe level of alcohol consumption during pregnancy as even moderate "social" drinking was associated with fetal abnormalities (Dhami & Pelletier, 1982 ; Redgrave, Swartz & Romanoski, 2003).Other adverse fetal outcomes related to ingesting large quantities of alcohol during pregnancy include heightened risks for spontaneous abortion, stillbirth, premature placental separation and intrauterine growth restriction (Fifer & Moon, 2003). The quantity of alcohol consumed and the timing of exposure to the teratogen, determines the severity of the defects experienced by the fetus (Tomlinson-Keasey, 1985). Binge drinking (the consumption of 5 or more standard drinks per occasion) or frequent consumption of alcohol during pregnancy was reported to have negative outcomes on a growing fetus related to the stage of development at which alcohol consumption occurred (Gladstone, Levy, Nulman & Koren, 1997 ; Nanson, 1997). The harm caused to the fetus could be apparent at birth or neurological deficits would be displayed only at a later stage of development depending on the degree of exposure to the substance (D'Avanzo & Barab, 2000).

A study conducted in Sweden on 100 children with an average age of 27 months, where 52 had experienced prenatal alcohol exposure of varying durations while the remaining 48 children were controls, confirmed that those who had been exposed to alcohol showed a higher number of physical anomalies (Autti-Rämö, Gaily & Ganström, 1992). Further to this, maternal alcohol ingestion during the first trimester appeared to cause the most harm to a fetus while moderate exposure to alcohol during the second and third trimester could lead to symptoms of FAS or more subtle developmental delays (D'Avano & Barab, 2000). During the prenatal developmental period, certain drugs such as nicotine, alcohol and general anesthetics are able to diffuse across the placental membrane, placing the fetus in a vulnerable position to sustain damage to systems and growing organs. Due to the rapid division and formation of cells during this period of development, the brain is highly vulnerable to damage (Rouleau, Levichek & Koren, 2003 ; Tomlinson-Keasey, 1985).

Growth retardation and mental retardation were the most common challenges experienced by a child who had been exposed to alcohol prenatally, and these children were unable to catch up on their growth after birth, remaining below the third percentile on measures of length and weight during the postnatal stages of development (Streissguth, Landesman-Dwyer, Martin & Smith, 1980 ; Tze, Friesen & MacLeod, 1976).

As a consequence of the toxic effect of alcohol, infants that are exposed to alcohol prenatally could be born with low birth weight, have decreased height, distinct facial characteristics, cranio-facial abnormalities, developmental abnormalities, develop congenital malformations and be cognitively disabled (Mattson, Schoenfeld & Riley, 2001; van Heerden & Parry, 2001). A review of the literature shows that the prefrontal cortex of the brain that controls "executive functioning" could be damaged in children who are prenatally exposed to alcohol. Due to this, these children could struggle to plan, carry out and solve problem specific tasks, as schemata (*abstract cognitive mental plans that serve as a guide for action, interpreting information and solving problems*) may not be well co-ordinated. Subsequently, these children could struggle to establish real relations between objects and events in the world, thus interfering with the assimilation (*the application of a general framework to a particular person, object or event and adapting to new situations*) and accommodation (*modification of internal mental plans to fit a changing understanding of reality*) of information (Piaget, 1952; Piaget, 1971; Piaget, 1973; Rasmussen, 2005; Reber, 1985 ; Streissguth, 1997). A disruption in these processes could limit the child's ability to remember information thus interfering with future development.

Jean Piaget's work is relevant as this theory had made the greatest impact on understanding infant cognitive development. The theory indicates that that intelligence, which is evident from birth, becomes progressively complex where intellectual progress took place when the external environment placed pressure on the mental structures of a child. In addition, development was perceived to be an inter-relationship between biological structures, and intelligence was conceptualised to be an assimilatory activity (Piaget, 1952). Piaget's cognitive developmental

theory was selected as one of the theoretical frameworks within which to locate the current study as this theory provides a normative frame of reference for understanding children's development from infancy to adolescence, and importantly the role of socialization influence on the child's development. Piaget indicated that development took place by the process of objectification, reflection and abstraction (Flavell, 1963 ;Piaget, 1952). One of the advantages of Piaget's theory is that a child has the ability to classify things into living and non-living entities, which assists the child in distinguishing levels of consciousness that creates wider meaning for the child (Piaget, 1973). Another benefit of Piaget's theory is the high degree of continuity in development from birth to maturity, where cognition is a constructive process of building new structures on earlier foundations. In addition, Piaget's theory views development as cyclic in nature where continuity in development is associated with functional aspects and discontinuity with structural aspects (Flavell, 1963).

Normal child development, as conceptualized by Piaget, is divided into different stages dependent on the age of the child. The sensorimotor stage (first two years of development) is that period when the child relies on seeing, touching, sucking, feeling and using their senses to learn things about themselves and the environment (Bretherton, 1992). This is the beginning of a developmental course from reflexes to active intention driven behaviours. Intelligence at this stage consisted of the direct co-ordination of initially involuntary actions without any mental representation or thought (Piaget, 1971). However, children who had been exposed to alcohol prenatally struggle with this stage of development. Children who had been exposed to alcohol during pregnancy were sometimes hospitalized due to the failure to thrive as they were reported to be unsettled, irritable, non-alert and had weak sucking ability that stemmed from structural

anomalies. It further appeared that even though malnutrition was not directly associated with FASD, it compounded the detrimental effects of prenatal exposure to alcohol (Dhami & Pelletier, 1982; Jones & Smith, 1973 ; Sparks, 1993). According to research conducted on five FASD infants to assess growth hormone response in FAS, growth failure persisted in infants post-natally if they had been diagnosed with FASD. Although these five infants received good care and nutrition, the study showed that prenatal alcohol exposure impaired physical growth drastically and these delays were noticed early in development. No recovery of growth was noticed in any of these infants post-natally (Tze, Friesen & MacLeod, 1976). These conclusions though would need to be viewed with caution as the study is representative of a small sample size.

The sensorimotor stage is characterised by six stages. Stage 1 (0-1 month) refers to the infant's reflex development. During Stage 2 (1-4 months), there should be inter-coordination of the infant's reflexes and by Stage 3 (4-8 months) the infant's actions are orientated toward objects and events outside his or her own body. Familiar behaviour patterns in new situations are used by the infant in Stage 4 (8-12 months). Stage 5 (12-18 months) is described as the period when the infant discovers new concepts and pursues novelty. Finally, at stage 6 (18 months-24 months), internal, symbolic representations of sensory motor problems, invention of solutions by implicit rather than explicit trial and error methods are implemented (Cook & Cook, 2005). Table 22 provides a summary of the expected motor skills developmental milestones that need to be reached during the sensori-motor stage. Although, these are expected norms, children with FASD struggle to reach these milestones. Individual biology and environmental influences on the development of children should not be ignored, as these factors

could also affect motor development due to a lack of stimulation that may occur within disadvantaged households.

Table 22

*The Development of Motor Skills from Infancy to Early Childhood*

| Age | Gross Motor Skills | Fine Motor Skills |
|---|---|---|
| 1-3 months | Stepping reflex, lifts head, sits with support | Grasps object if placed in hand, sucks, control of eye movements, the first smile |
| 2-4 months | When prone lifts head and uses arms for support | Grasps cube when placed near hand |
| 5-8 months | Sits without support | Reaches for and grasps object using one hand |
| 5-10 months | Stands with support and pulls self to stand | Points at object of interest, grasps with thumb and finger ("pincer grip") |
| 5-11 months | Crawls | Grasps spoon, gradually learns to direct food to mouth |
| 10-14 months | Stands alone, and walks alone | Puts objects into small containers, builds "tower" of cubes. Produces first meaningful word |
| 13-18 months | Walks backwards and sideways, runs, climbs, walks up stairs | Holds crayon with fingers, scribbles energetically |
| 18-30 months | Runs easily, jumps, skips, rides and steers tricylcle, walk on tiptoe | Vocabulary and articulation increases rapidly, picks up small objects (eg candy/sweets) |

Source: Slater, A., Hocking, I. & Loose, J. (2003) Theories and Issues in Child Development. In A. Slater and G. Bremner. *An Introduction to Developmental Psychology.* USA: Blackwell Publishing.

Children that had been exposed to alcohol prenatally and who are deprived of maternal attention are obviously placed at a disadvantage in terms of development from infancy to childhood. Since changes could be subtle or severe depending on the amount of alcohol exposure or environmental deprivation, it is important to monitor the development of these infants over time. Prenatal development in children diagnosed with FASD and those who live in deprived conditions would be expected to deviate from the typical developmental process due to damage to the brain from prenatal alcohol exposure and a lack of stimulation related to limited

resources (Kalberg et al., 2006). Stimulus deprived children are less responsive to their environment and continuous deprivation could result in learning impairments. Cortical underdevelopment, inadequate neurotransmitter activity and/or less dense connections between neurons could perpetuate the difficulties that a child with FASD may experience (Riggs, Jahromi, Razza, Dillworth-Bart & Mueller, 2006).

Prenatal alcohol exposure interferes with levels of attention where awareness of objects, responding to hearing tests, ability to follow simple instructions, dropping things intentionally, recognizing certain objects as having specific characteristics, and the imitation of activities could be impeded (Tomlinson-Keasey, 1985 ; Slater, Hocking & Loose, 2003). In addition, prematurity and/or a combination of environmental factors that contributes to the intellectual deficiencies, perceptual-motor dysfunction, immature speech, visual defects and difficulty with abstract reasoning could perpetuate the challenges that infants with prenatal alcohol exposure experience (Fitzgerald, 1977; Hyter et al., 2003; Tomlinson-Keasey, 1985). Consequently, challenges in focussing and shifting attention from one task to another, lowered executive functioning, deficits in working memory and challenges with higher order thinking could reduce the ability of children with prenatal alcohol exposure from reaching their developmental milestones (Jacobson & Jacobson, 1999; Tomlinson-Keasey, 1985). .

A South African study of 68 children with an average age of 7 years, where 34 were diagnosed with FASD and 34 were controls, confirmed that children with FASD struggle with higher order functions and manifest lowered performance on the Hearing and Speech (language), Eye Hand Co-ordination (fine motor co-ordination), Performance (pattern

construction, measure of skill in manipulation, speed of working and precision), and Practical Reasoning (arithmetical comprehension and the realisation of simple practical problems) skills of the Griffiths Mental Developmental Scales (GMDS) (Adnams et al., 2001). However, this study surprisingly found no significant difference between the two groups on the Locomotor (gross motor) scale, despite other studies having shown that locomotor development of infants or children that had been exposed to alcohol is negatively affected when compared to controls (Jones, Smith, Ulleland & Streissguth, 1973; Jones & Smith, 1973 ; Kalberg et al., 2006). Findings from a study of 21 children born between 1970 and 1976, who were selected from 103 children of 30 alcoholic women, and paired to controls matched for sex, age, birth weight and gestational age indicated that there was a significant delay in gross motor behaviour and poor co-ordination in those who had been exposed to alcohol prenatally (Kyllerman et al., 1985). According to animal studies, exposure to alcohol disrupts the functions of the hippocampus (which is implicated in working memory functioning) and/or interferes with cerebellar development (which is involved in balance and motor co-ordination). This results in ataxia and gait movements that have been identified as sensitive indicators of alcohol exposure (Hannigan & Riley, 1989). Similar findings were evident from a study that was conducted in the United States across seven sites where fine motor delays were evident in children (20-68 months) with FASD when compared to comparison groups (Kalberg et al., 2006).

The problems experienced by infants who had been prenatally exposed to alcohol could be perpetuated by the poor environmental conditions and disadvantaged backgrounds. A developmental study of 196 rural Indian children aged between one and three years confirmed the role of environmental influences on infant development. The data collected comprised

physical growth parameters, the Gesell's Developmental Schedule that provided a developmental quotient, intellectual quotients and concept formation assessment, the Binet Kulshrestha Intelligence Scale, the Block Sort test, a parental interview and home observations based on the Caldwell Inventory, where information related to socio-economic status was collated into a range. This study determined the predictive relationship between nutrition, home environment, socio-economic status and family variables on children's development and intelligence. The statistical results showed that malnourished children scored poorly in motor, adaptive, language and personal-social areas of development, and had delayed development for concept of colour shape and size. Importantly, the effect of home environment was associated with delayed development and low intelligence while maternal involvement and stimulation were strongly associated with better behaviour development and intelligence (Agarwal et al., 1992).

Another study conducted on a sample of 40 South African Black infants aged between 13 to 16 months found that maternal education was positively associated with the gross motor development of infants. This study also found that children from homes of low socio-economic status performed significantly poorer than children from more affluent homes (Cockcroft, Amod & Soellaart, 2008). Maternal education was associated with the quality of maternal interactions with the infant and ability to promote the development of a child by encouraging communication. Less educated mothers tend to have access to fewer resources and this could influence the interaction that she would initiate with her child and could contribute to the developmental difficulties that an infant experiences.

An interesting Greek study assessed 800 children aged between 37 and 72 months on the subscales of the GMDS-ER (Extended Revision) in order to investigate the relationship between residential area and maternal education on infant development. The results showed that children who lived in urban areas had significantly better fine motor co-ordination when compared with children who resided in rural areas. However, children in the rural areas performed significantly better than the urban children on the locomotor subscale. This difference was attributed to the variations between urban and rural living conditions in Greece. There is more open space in the rural communities where children have the opportunity to develop their gross motor skills while there is limited space within urban settings that could limit the gross motor development of children within these areas (Giagazoglou, Kyparos, Fotiadou & Angelopoulo, 2007).

Delays in language acquisition, receptive and expressive language deficits are also documented consequences of prenatal exposure to alcohol and cocaine. Cranio-facial abnormalities of FASD, that could include a cleft palate, may place a child in a vulnerable position of being diagnosed with otitis media with effusion and conductive hearing loss which can subsequently affect language and memory development (Cone-Wesson, 2005). Children that have been exposed to alcohol prenatally could also display unintelligible speech, delayed vocabulary comprehension, limited receptive and expressive syntactic skills (*that is difficulty with sentence construction and complexities with multiple word and sentence meaning*). In addition, poor socio-emotional development such as maltreatment could delay language and literacy development (Hyter, 2007).

Importantly, varying amounts of alcohol exposure could negatively impact on communication, speech and language development, where delays within Piaget's preoperational stage (between two and six years) could be evident as this is the sensitive period for language development (Hyter, 2007 ; Sparks, 1993). Further to this, there could be delays in advancing from sensory-motor development toward a conceptual-symbolic phase that could contribute to poor intellectual development. Since combinations of cognitive and social skills are required to develop effective and appropriate communication skills, children with FASD are at a disadvantage, as permanent birth defects could result in cognitive, linguistic and social development delays. Elsewhere it had been argued that children with FASD did not have adequate pragmatic and social cognitive skills and therefore struggled to use language appropriately for communication Coggins, Timler & Olswang, 2007 ; Hyter et al., 2003). Thus a comprehensive assessment of language development in children with FASD is recommended. (.

The reason for including the theory of Skinner and Chomsky respectively within this discussion is to show the underlying theory of language development. According to Skinner (1957), children learned language through imitating their caregivers and exploring the environment. Incorrect responses that are made by the infant are not reinforced and tend to decline, while using correct words are encouraged (Blackman, 1991; Skinner, 1957). Initially children use non-verbal cues such as pointing to initiate communication with those around them. However, as their language ability develops, their interactions advance to more verbal instead of non-verbal cues (Kuczaj & Hill, 2003). The limitation of Skinner's approach was that the theory did not explain how the child developed new and grammatically incorrect statements (Cockcroft, 2002). In order for an infant to master a language through development, it was

required that the child learned sounds, the form of words, the meaning of words and the order of words (Cockcroft, 2002 ; Tomlinson-Keasay, 1985). Children with FASD on the other hand tend to be impulsive and struggle with turn-taking that is important for the development of initiating or sustaining conversations. In order to promote language development in children, it is important for mothers to talk to their children when playing games, even when the child has not developed his/her speech as yet. This helps the child to develop speech and learn to wait for a turn during conversations. However, children with FASD are at a disadvantage as mothers with FASD infants do not provide adequate verbal stimulation to their developing infants. Due to damage to the brain and a lack of stimulation from their mothers, children with FASD could struggle to develop social relationships, further impeding their language development (Coggins, Friet & Morgan, 1998; Fitzgerald, 1977 ; Kuczaj & Hill, 2003).

The child's environment influences the quality of words used and the child's comprehension of the world would depend on his/her cognitive skill (Kuczaj & Hill, 2003 ; Tomlinson-Keasey, 1985). From 24 months to 36 months and above the child's speech would undergo dramatic changes. The extent to which children generalise the rules of the language that they learn will depend to an extent on the type of stimulation that they receive from their environment (Kuczaj & Hill, 2003). A case study of a FASD female participant aged 9 years 8 months who was recruited from the University of Washington Fetal Alcohol Syndrome Diagnostic Prevention Network Clinic showed a complex cognitive behavioural profile that was representative of children with FASD. Poor memory, deficient pragmatic skills during conversation and problems with social skills were noted. The outcome of the intervention implemented within this case study indicated that memory and attention skills impacts a child's ability to be a competent

social communicator and problem solver. However, the disadvantage was that this was a single case study where the effectiveness of the outcome could be limited in terms of the proposed intervention being generalised to the wider community (Timler, Olswang & Coggins, 2005).

Chomsky's theory showed that language development was based in biology which was similar to Skinner's approach. Chomsky's theory differed in that language development took place through maturation instead of reinforcement as was indicated by Skinner (Chomsky, 1959 ; Cockcroft, 2002). Another view of learning theory was that children learned language through their experiences. According to Piaget (1962), it was assumed that children developed language as part of general cognitive development. This viewpoint indicated that language development did not take place by reinforcement or maturation; instead it formed part of the completion of cognitive processes. According to this latter argument, a child could only develop language for abstract concepts once the cognitive capacity to understand those concepts were attained (Piaget, 1962).

Attachment theories, based on the work of Bowlby and Ainsworth confirmed the importance of child-caregiver relationships to child development. These relationships had implications for personality development, interpersonal relationships and child psychopathology. John Bowlby's dynamic theory of infant-mother relationships highlighted the importance for an infant to develop a secure base to explore and learn about the environment (Atkinson et al., 2005 ; Senior, 2002). Bowlby's theory focussed primarily on creating and breaking of attachments while Ainsworth gave attention to individual differences in attachment (Meins, 2003). Bowlby indicated that attachment behaviour was made up of instinctual responses that form a reciprocal

bond between mother and child. The basic principle of the joint work of Bowlby and Ainsworth indicated that the bond a child shares with the maternal figure could be disrupted through separation, deprivation and bereavement (Bretherton, 1992). According to this theory, children experienced separation anxiety or fear when the attachment figure such as the mother was not available. If the attachment figure acknowledged the infants need for comfort, protection and respect, the infant would develop an internal working model of self as being valuable and likeable. However, if the parent had frequently rejected the infant's desire for comfort or exploration, the infant would construct an internal model of being unworthy or incompetent and could develop negative expectations regarding relationships (Bretherton, 1992; Senior, 2002). Disruption in the early relationship between the infant and the primary care-giver could lead to behavioural, emotional and mental health problems of the infant (Bowlby, 1944; Richter, 2003). Positive relationships between a child and their primary caregiver could promote trustworthiness and dependability on others. In addition, insecure attachments could place children at risk for behavioural and social problems, low self-esteem and general adjustment difficulties.

Bowlby's emphasis on the importance of the care-giver child development and it's implication for child development was contradictory to psychoanalytic theory. Although Bowlby's theory concurred with the object-relations theory of psychoanalysis, this theory also incorporated dimensions of evolution, ethology, control theory and cognitive psychology (Senior, 2002). Securely attached infants tend to progress in several areas of cognitive development. These children are eager to explore and learn from their environment through play activities. By exploring the environment, these children would develop their visual spatial skills (Hazen & Durrett, 1982). When challenges are encountered, securely attached children will be

motivated and persistent in finding a solution to the task. Due to the positive interaction between mother and child from early development, the child would be able to develop a comprehensive vocabulary and language development progresses well (Londerville & Main, 1981). Child language acquisition is also related to the clarity with which a mother speaks to her infant during early stages of speech perception (Liu, Kuhl & Tsao, 2003). Bowlby emphasises the environmental influence of child development and had been criticized for not placing much emphasis on the child's inner world (Senior, 2002). Cultural differences between individuals suggested that parenting practices and attitudes are important in the establishment of the attachment relationship between the child and the primary care-giver (Meins, 2003). Therefore, an integrated approach that combines specific innate abilities and social interaction with the environment are vital factors for intellectual and language development (Kuczaj & Hill, 2003 ; Tomlinson-Keasey, 1985).

However, children with FASD do not advance to higher levels of language development, as despite a high verbal output, their conversations are unrelated due to their limited understanding of words (Coggins, Friet & Morgan, 1998). A study conducted on feedback received from Australian paediatricians between January 2001 and December 2004, confirmed that most children diagnosed with FASD had central nervous system dysfunctions, reported speech and language disorders, intellectual impairments, fine motor, gross motor and co-ordination problems (Elliot, Payne, Morris, Haan & Bower, 2008). It is already known the children exposed to alcohol in utero have delays in speech development. However, the association of environmental influences on child speech development has not been well documented in children with FASD. Since alcohol exposure at different developmental stages exerts a

differential impact on development, there is a need for additional information regarding the environmental influences on child development, such as mother-child interaction (Larrson, Bohlin & Tunell, 1985).

Lowered intellectual development, general developmental delays, reduced attention, hearing impairments and socio-behavioural problems are associated with infant pre-natal alcohol exposure. Erikson's theory was integrated into this study to account for the development of interpersonal relatedness of the infant, as Piaget's theory did not adequately address this (Blatt, 2006 ; D'Avanzo & Barab, 2000). Although Piaget acknowledged the influence of cultural factors, Piaget's theory lacked detail on how cultural factors could influence cognitive development in children (Flavell, 1963 ; Rogoff, 1990). In addition, the vagueness and lack of precision of Piaget's work needs to be considered as clear definitions are limited. There were also some gaps between the theory and the science, as initial writings were not documented in a scientifically acceptable manner therefore there was some uncertainty about the empirical basis for his experimental conclusions. Although the qualitative information from Piaget's observations and writing formed the basis for the conception and understanding of cognitive resources of children, his theory was nevertheless considered to be descriptive instead of providing detailed explanation of the underlying mechanisms of cognitive development (Cook & Cook, 2005 ; Kuhn, 1992). The major criticism of Piaget's theory was based in the fact that he described cognitive development as taking place in stages instead of gradually. Since cognitive development is complex, children acquire skills in different areas gradually instead of clear delineated stages therefore consistency across the stages cannot be assumed (Flavell, 1963). Another criticism of Piaget's theory was that other factors that could influence a child's

development was ignored and it could not be assumed that if a child was unable to complete a task then he or she lacked the competency without investigating other influential factors such as a lack of stimulation (Cockcroft, 2002 ; Piaget, 1972). Despite criticism that Piaget had attributed too much system and structure to the child's thought in later stages of development, it cannot be ignored that progress made in earlier stages of development could influence gradual development over time (Flavell, 1963).

Erikson's psychosocial theory on the other hand indicated that the infant's development followed a predetermined schedule that encompassed moments of progress and regression, integration and retardation (Erikson, 1963). The infant gradually progresses from one development stage to another until each social part of the child has been developed. Erikson perceived a human being as being an integration of biological, psychological and interpersonal experiences. He took an optimistic premise to the resolution of developmental crises. His theory used psychoanalytic methods as a basis yet placed focus on the individual in the context of the person's circumstances. Understanding the affective forces that motivated a person to react was the premise from which Erikson's theory was based. This theory also took into account the role that culture played in assisting the individual to progress from different periods of development. During early childhood, Erikson considered the child's play activities to be one of the major ego functions as it was considered to be the means of reasoning (Maier, 1988).

According to Erikson there are 8 stages of psycho-social conflict that need to be resolved to promote development during childhood and adulthood (Erikson, 1977; Hook, 2002 ; Tomlinson-Keasay, 1985).Yet, due to prenatal alcohol exposure children with FASD may struggle to reach these milestones, as alcohol exposure at different developmental stages exerts a differential

impact on development.. Children with FASD struggle with social communication that could lead to maladaptive and dysfunctional behaviours evident at later stages of development (Coggins, Friet & Morgan, 1998). Table 23 highlights the social developmental milestones that infants who had been exposed to alcohol between birth to 3 years could struggle to achieve.

According to Erikson's theory, healthy adjustment to various phases occurred when the child was able to solve basic conflicts in a positive manner (Erikson, 1977 ; Tomlinson-Keasey, 1985). Erikson's theory provided an adequate description of psychosocial development yet it lacked detailed reasons of why developmental changes occurred. In addition, Erikson's theory came across as being too optimistic and the stages of development were idealized. He also seemed to over value the adaptive and integrative functions of the ego. Erikson's theory had also been criticized for indicating that negative events during childhood could be alleviated or exaggerated depending on the type of support that was obtained from the child's surroundings (Hook, 2002 ; Maier, 1988).

Table 23

*Erikson's Phases from Infancy to Childhood (3 years)*

| Stage | Period of Childhood | Goal of Stage | Radius of significant persons | Favourable resolution | Unfavourable resolution |
|---|---|---|---|---|---|
| Trust versus Mistrust | Infancy | Reduction of tension, attainment of basic equilibrium, both of inner biological need and between inner and outer worlds | Maternal Person | Child begins to trust adults | Suspicion |
| Autonomy versus Shame | Toddlerhood | Attaining a basic sense of independence, free choice, and will from accomplishment of rudimentary tasks and exploratory activities | Parents | Self-control; self-esteem | Doubts about abilities, self conscious |
| Initiative versus Guilt | Childhood | Reaching out; meeting the challenges of the social environment in a directed and purposeful way; being able to take responsibility for self | Family | Ability to direct and initiate activities | Fear of punishment, denial |

Source: Table assembled from various sources (Hook, 2002; Maier, 1988 and Tomlinson-Keasey, 1985).

In general, decisions made by children with FASD are based on intuitive judgments rather than critical thinking, struggling to learn from experience, finding it complex to plan and execute a series of goal related actions, showing little desire to please socially significant people, limited social attachment and exercising of poor social judgment (Coggins, Friet & Morgan, 1998). Due to these complexities, children with FASD struggle to adjust socially as they find it difficult to remember social cues (Timler, Olswang & Coggins, 2005). Various theorists highlight the importance of stimulation and environmental influences in promoting child development. Prenatal alcohol exposure, coming from a disadvantaged environment, access to limited resources and a lack of stimulation from their maternal figure cause children with FASD to struggle to reach the developmental milestones of intellectual, motor, verbal and social adjustment.

### 1.4 Rationale

The purpose of this study was to investigate the relationship between maternal depression, maternal high risk behavior during pregnancy and delayed developmental functioning in infants that had been exposed to alcohol prenatally, and those that were not. There are reports of independent adverse effects of alcohol on child development (Adnams et al., 2001; D'Avanzo & Barab, 2000; Jacobson & Jacobson, 1999; Rasmussen, 2005; Rouleau, Levichek & Koren, 2003; Streissguth, 1997). In addition there is information on the negative association between depression and child development (Alloy et al., 2001; Bernard-Bonnin, 2004; Galler, Harrison, Ramsey, Forde & Butler, 2000; Goodman, 2007; Hay, Pawlby, Sharp, Asten, Mills & Kumar, 2001; Kavanaugh ,Halterman, Montes & Epstein, 2006; Kurstjens & Wolke, 2001; Pauli-Pott, Mertesacker & Beckmann, 2004; Politano, Stapelton & Correll, 1992; Righetti-Veltema,

Bousquet & Manzano, 2003) Yet, there is limited information regarding the combined relationship of these factors (Lemola, Stadlmayr & Grib, 2009).

The epidemiological results from the FASD Northern Cape study showed that there is a need for supplementary information to be collected and analyzed with regard to those communities that were at high risk for producing children with FASD (Urban et al., 2008). The data collected from studies conducted in the Western Cape Province showed that cognitive and motor delays were evident in FASD children and that there were maternal characteristics that distinguished mothers with a FASD infant from mothers without a FASD infant (Adnams et al., 2001). However, the pattern of maternal trends from the Northern Cape community has not been documented in detail. While some studies in the Northern Cape had identified high prevalence rates of FASD, there are limited reports of infant development and associated maternal variables. Therefore there is a need to address this lack of data. Since FASD is a problematic medical and social concern in the Northern Cape, research within this field is essential in contributing to health care and education policy changes to provide early and consistent prenatal care to all women who come from these deprived conditions (D'Avanzo & Barab, 2000; Malet, de Chazeron, Llorca & Lemery, 2006). Encouraging mother-child interaction and educating mothers on how to care for themselves and their children are essential to bring about a positive change by creating awareness about the detrimental consequences of drinking during pregnancy.

As part of a FASD study that was conducted in De Aar, Northern Cape between 2003 and 2006, 365 women of predominantly Coloured ethnicity were interviewed and assessed for levels of depression. Phase one of the study took place during 2003 to 2004 while phase two was

implemented during 2005 and 2006. The majority of the women were single mothers and more than 50% of them had between one or two children. Many of these mothers reported having some level of secondary education and were unemployed at the time of interview. When assessed for the severity of maternal depression on the Beck Depression Inventory (BDI), most mothers displayed some level of depression from moderate to severe. These preliminary findings further showed that maternal age, number of children, maternal educational level and maternal depression were variables that were associated with the likelihood of a mother having an infant with symptoms of FASD (Urban et al., 2003; Urban et al., 2004 ; Urban et al., 2005). A study combining the samples of De Aar and Upington (n = 809) shows that the percentage of depression among mothers in this community who are at high risk of alcohol consumption is 65% (Chersich et al., 2011). Given the socio-economic similarities between communities of De Aar and Upington, the current study was designed to longitudinally assess the association between maternal mood states, maternal high risk behaviours during pregnancy and infant development within a sample at high risk for FASD.

A review of various epidemiological studies indicated that there is a need to improve the strategies of prevention, screening and management of alcohol use among women who are vulnerable to alcohol consumption (Malet, de Chazeron, Llorca & Lemery, 2006). Given that South Africa has one of the highest reported rates of FASD in the world, understanding some of reasons why women drink during pregnancy could contribute to the the development of an effective tool to screen females at risk for alcohol abuse during pregnancy that could help reduce the incidence of FASD. FASD, although not as intensely researched when compared to AIDS research in South Africa, is nevertheless like the AIDS epidemic a public health concern

that could have socioeconomic implications for cause, diagnosis and treatment within disadvantaged communities. Identifying women at high risk for producing a FASD infant and screening developmental problems of children prenatally exposed to alcohol at an early stage of development could assist with the prevention of another FASD child from being born and improving the academic and social adjustment of vulnerable children within these disadvantaged communities.

Depression and alcohol consumption during pregnancy has detrimental effects on the physiological and anatomical development of the infant where the effects are irreversible, while depression after pregnancy primarily interferes with mother infant interaction and depression is generally perpetuated from a lack of emotional and social support that has a negative impact on infant development (Cooper et al., 1999; Rouleau, Levichek & Koren, 2003). Delineating the variables that distinguish a mother who used alcohol during pregnancy from one who had abstained would assist in developing intervention strategies that prevent another FASD child from being born. Although several studies indicated that high levels of alcohol consumption are associated with severe depression, limited focus has been given to the relationship between poor maternal mental health and negative infant outcomes, despite literature showing that maternal stress is negatively related to child health and development (Baum-Baicker, 1985; Chick, 1999; Misri, Oberlander, Fairbrother, Carter, Ryan, Kuan & Pratibha, 2004; Peele & Brodsky, 2000).

Although the correlation between mother-infant relationship and infant development are well documented, there is limited research that describes the association between maternal depression, alcohol use and infant development within impoverished communities such as that

found in the Northern Cape (Nylen, Moran, Franklin & O'Hara, 2006). The lack of contextual information available regarding the association between depression and risk factors among women in disadvantaged communities of South Africa is one of the reasons for conducting research within this field. Since the independent effects of maternal alcohol use and lowered maternal mood state on child development are already known, the current study aims to extend the reviewed findings by investigating the combined impact that maternal alcohol use and lowered mood state may have on the long-term development of infants. Theoretical findings related to the early identification of maternal depressive symptoms within a community that is at high risk for socio-economic deprivation and alcohol use could lead to appropriate referrals, parenting interventions and may prevent the adverse outcomes associated with maternal depression

This study aims to provide further insight into the factors affecting these communities with a high FASD prevalence. In identifying which maternal variables are major or significant contributors to negative child development outcomes, intervention programs may be designed that would assist the development of FASD children and reduce maternal depressive symptoms. Despite poor nutrition not being directly assessed in this study, the poverty within the community from which the sample was drawn could not be ignored. It is likely that alcohol consumption during pregnancy and deprived conditions may exert a combined influence on child development. Understanding the role of comorbid factors that exist with maternal alcohol use could enhance screening methods for risk factors and initiate the development of preventative measures that could improve women's and their children's health. Although there are limited resources within the community from which this sample was drawn to assist mothers

in coping with depression, practical interventions emerging from this study may offer ways of mediating symptoms of depression which could reduce the vulnerability of women within this sector of the community. The results of this study would also be helpful for professionals who use a multi-dimensional integrated approach when working with women and children, as it would increase awareness regarding the negative consequences of maternal depression on infant development.

This study would aid in the development of practical intervention programs that would involve creating awareness among mothers and communities by educating them about the factors that exacerbate the FASD problem in their communities. It has become apparent that with the high prevailing FASD rates, comprehensive awareness needs to be disseminated in lowering prevalence rates. This study is one of many that formulate part of the mandate of the Foundation for Alcohol Related Research (FARR).

## 1.5 Conclusion

In South Africa, depressive symptoms are often under diagnosed and under treated despite the high prevalence of the condition due to the complexity of diagnosis and lack of resources such as access to psychiatrists and psychologists. Considering the various factors that contribute to maternal alcohol use, maternal depression, the delayed development in FASD infants, and the possible interaction of these factors; this study aimed to identify maternal profiles which could be used to screen mothers at high risk of producing infants with FASD.

# CHAPTER 2 METHODS

## 2.1 Introduction

The sections that follow detail the objectives, research design, description of the instruments used, sample selection and schedule of procedures. A detailed account of sample attrition and the reasons for selecting participants that completed all scheduled visits are presented, as this had implications for later data analysis. Table 27 and Figure 2 summarise the sample composition and the procedures that were followed for the duration of this study.

## 2.2 Aims, Research Question and Hypotheses

This was a longitudinal study that assessed variations in maternal mental health in relation to the development of infants with FASD. The focal point of the study was to investigate the occurrence of maternal depression, the association of maternal depression with infant development, socio-economic status, and occurrence of FASD within the Upington, Northern Cape area. Another objective of the study was to assess whether there was a change in the symptoms of maternal depression and infant development after certain maternal covariates such as maternal demographic factors, pregnancy history, and/or health risk factors had been statistically ruled out.

Specifically, the study aimed to examine the difference in symptoms of maternal depression when infants were between 9-18 months and again when infants were between 18-45 months, in a group of FASD infants and in a comparison group of No FASD infants. In addition to this, the study assessed whether covariates such as maternal age at time of interview, maternal weight, marital status, maternal education, employment status, income, pregnancy intent, contraceptive

use, total number of pregnancies, total number of live births, total number of miscarriages, drug use during pregnancy, alcohol use during pregnancy, smoking during pregnancy and TB diagnosis are factors that influenced symptoms of maternal depression and predicted later child developmental outcomes in children with FASD. The fundamental objective was to investigate the potential differences in development of the selected infants between 9-18 months and again between 18-45 months between FASD and No FASD groups. Primarily, steps were implemented to investigate the long-term relationship between symptoms of maternal depression and infant development within a sample that had been prenatally exposed to alcohol.

The posed research question is as follows: What is the relationship between maternal mood states, maternal variables and the development of FASD infants in a low socio-economic community and how does this compare to that of a No FASD group from the same community?

These research questions were operationalised as the following hypotheses:

1. Infants with FASD are more likely to have depressed mothers than infants without FASD.
2. There is a significant relationship between levels of maternal depression, maternal demographic factors (maternal age at time of interview, maternal weight, marital status, maternal education, employment status and income); pregnancy history (pregnancy intent, contraceptive use, total number of pregnancies, total number of live births and total number of miscarriages); and health risk factors (drug use during pregnancy, alcohol use during pregnancy, smoking during pregnancy and TB diagnosis).
3. Infants who screened positive for FASD will achieve significantly lower performance levels on developmental assessments than infants who did not screen positive for FASD from the

same community and who have been classified as having no distinct features of prenatal exposure to alcohol.

4. There is a significant relationship between infant development and maternal mood states.
5. There is a significant relationship between the severity of maternal depression, current symptoms of depression and infant developmental outcomes.

### 2.3 Research Design

This longitudinal, quantitative, non-experimental research study comprised components of an Ex-post Facto design, as it formed part of a larger FASD project within the Northern Cape. In addition, the diagnosis of FASD could not be influenced and the sample was recruited from a selected population group (Heim et al., 2004). Infants with FASD had specific physical characteristics that were essential for a clinical diagnosis and since these infants were born with these characteristics, it was not possible to manipulate the clinical features. Randomization within the domains of this study was not possible as the infants had to be clinically diagnosed with FASD to be part of the case group and was not relevant for this current study as no intervention was applied (Adnams et al., 2001 ; May et al., 2005). The selection of infants with FASD was not random and selection of the comparison group took place by matching infants with no clinical features of FASD to the clinically screened FASD group. Once a list was generated of infants with No FASD with demographic features of age and ethnicity, these infants were compared to the sample of infants clinically diagnosed with FASD. Each FASD infant was randomly paired to an infant with No FASD, by selecting a specific infant from the No FASD list that shared the same defining features (features of FASD are described in Section 1.3.3 of the Literature Review) as that of the FASD infant to be matched (Gall, Gall & Borg,

2003). This procedure allowed for comparisons to take place between the infant and mother samples based on the clinical diagnosis of the infant. However, the true qualities of a comparison group were compromised due to some infants in the No FASD group also being exposed to alcohol prenatally, as evident from the self-report of their mothers.

The classification of FASD is not only based on the clinical diagnostic outcome but is a complex process due to the under-reporting of maternal use of alcohol and lack of clinical skills in making a diagnosis. Chudley (2008) indicated that there is a need to change strategies of screening for FASD and prevention of FASD by using a multi-disciplinary approach to standardize the diagnostic criteria in order to obtain an accurate estimate of the number of affected children in a community (Chudley, 2008). A multi-step process that included an infant medical examination, infant medical history and infant developmental psychometric evaluation was used to assess the dysmorphology patterns of infants that had been exposed to alcohol prenatally, and those not exposed to the effects of teratogens. The multi-disciplinary approach similar to past studies also included a maternal interview to obtain a detailed maternal history prior to the infant being diagnosed (Autti-Rämö, Gaily & Granström, 1992 ; Larrson, Bohlin & Tunell, 1985). Standardised criteria were used in the clinical diagnosis of FASD, while psychometrically approved assessment tools were used to evaluate infant development and maternal mood states in the infant and mother samples respectively (Hoyme et al., 2005).

The advantages of using a quantitative approach to investigate this topic were that variables were clearly defined and objective conclusions could be reached. Infant development and symptoms of maternal depression could be measured by using psychometrically standardized

instruments that were numerically scored and could be compared to norm groups. Obtaining these numeric scores enabled longitudinal comparisons of infant development and severity of maternal depression to be assessed (Burns, 2005; Mateev, 2002). However, the outcomes obtained by this type of quantitative research are limited, in that the research objectives are hypotheses driven and not related to emerging themes, as in qualitative research. Another limiting factor in quantitative research and longitudinal studies is that the evolving and continuous investigation of phenomena is not encouraged (Mateev, 2002). However, one of the major advantages of using quantitative research is that results can be assessed for statistical significance and generalized to similar samples (Howell, 1999).

## 2.4 Subjects

Areas of Paballelo, Louisvale, Rosedale, Morning Glory and Progress that are within Upington, Siyanda District, South Africa were the recruitment sites for enrolling mothers or caregivers and their respective infants into this study. There were two samples, namely mothers and infants. Infants were categorised into FASD and No FASD group and classification of mothers into groups were based on the diagnosis of their respective infants. According to the demographic information collected, the ethnic classification of the infants within these areas was 90% Coloured, 5.55% Black and the remaining 4.44% were either not stated or not completed in the questionnaire, but consisted of Mixed Black (father from one tribe and mother from another) or Caucasian. Approximately 97.87% of the people in Upington speak Afrikaans while the other main languages used are Setswana, isiXhosa and English (Statistics South Africa, 2001). Consequently, Afrikaans was the selected language of communication. Within

the Northern Cape region, 5.63% of individuals were reported as having no education (Statistics South Africa, 2001). Although agricultural initiatives are the source of employment for many inhabitants in Upington, there are high levels of poverty and inequality that persist within this province among the different race groups, with the Black and Coloured groups at a distinct disadvantage when compared to the Caucasian community (Punt et al., 2005).

This study was initiated in 2004 with 413 children that ranged between the infancy (birth to 12 months) and toddler stages (12 months – 36 months), who were clinically screened for features of FASD. The inclusion criteria required that the infant was born in Upington Gordonia Hospital. Mother-infant pairs were excluded if they were from a country outside of South Africa and were unable to communicate in English or Afrikaans as this would have compromised their understanding of the informed consent. Although the broader aim of the larger protocol was to recruit 500 infants, the study was able to recruit 82.60% of the intended target. Follow-up examinations on a selected proportion of the initial sample were conducted on infants that ranged from 18 months, the toddler stage (12 months – 36 months) and advancing into the childhood stage (> 36 months). The profile of mothers in this sample that emerged from the maternal interview provided a background to the type of community that this study was conducted in. These factors obtained from the maternal interview include demographic factors, pregnancy history and health risk factors which are further described within the Results section.

Due to unforeseen problems, such as infant mortality and demographic mobility in low socio-economic groups, there was evidence of high attrition in the sample. In addition, logistical difficulties that arose during recruitment and follow-up were the reasons for examinations taking

place at varied stages of infant development. A detailed explanation of the sample composition is provided under the Procedures section.

### 2.5 Instruments

Clinicians used the clinical examination and neurodevelopment evaluation form (Appendix A) to gather demographic and pregnancy history details from the mother sample that were developed by the Foundation for Alcohol Related Research (FARR). Clinical parameters that were assessed during the examination of the infant were also recorded on these forms. The forms included the infant's name, sex, ethnicity, date of birth, date of examination, developmental milestones, illness's and breastfeeding history. In addition, the mother's name, date of birth, age, ethnicity, marital status and pregnancy history were also recorded.

Trained psychometrists assessed depression in the mother sample by administering the Beck Depression Inventory (BDI) and the Profile of Mood States (POMS), while the Griffiths Mental Developmental Scales (GMDS) and the Griffiths Mental Developmental Scales Extended Revised (GMDS-ER) was administered to evaluate the development of the infant sample. Table 24 outlines the specific areas of functioning that each instrument assessed.

Table 24

*Description of Instrument and Area of Assessment*

| Instruments | Areas | Type of Measure |
|---|---|---|
| BDI | Maternal Depression | Severity of maternal depression |
| POMS | Maternal Mood State | Present mood state |
| GMDS-ER | Infant Development | Infant developmental functioning |

Note:
BDI: Beck Depression Inventory
GMDS-ER: Griffiths Mental Developmental Scales-Extended Revised
POMS: Profile of Mood States

Structured maternal interviews (Appendix B) were also conducted with the mother sample to gather detailed information about maternal history and past behaviours to identify possible predictors of alcohol consumption during pregnancy.

### 2.5.1 Maternal Interview.

The Foundation for Alcohol Related Research (FARR) designed the maternal interview questionnaire, which was previously used to assess alcohol use by pregnant women in three under-privileged areas of the Western Cape. This instrument had been developed and tested on local populations (Croxford & Viljoen, 1999). It was produced in English, Afrikaans and isiXhosa so that participants could be interviewed in their mother tongue. The sections covered in the maternal interview included information on biographical; demographics; socio-economic status; reproductive health; smoking; drug use; the frequency and quantity of alcohol use; knowledge of problems experienced by children with FASD; and the role of nutrition. The duration of the interview ranged between 45 minutes to 60 minutes.

The advantage of using this maternal interview was that comprehensive information could be obtained regarding the potential characteristics that could distinguish women who consumed alcohol during pregnancy from those who abstained from alcohol during pregnancy within similar socio-economic backgrounds. Although caregivers were not able to provide a detailed account of the biological mother's history, in most cases they were able to confirm or deny alcohol consumption of the biological mother during pregnancy. Importantly, data that was collected from the maternal interview contributed to the multi-dimensional approach that was used for diagnosing the infant sample into either a FASD or No FASD group.

### 2.5.2 Beck Depression Inventory (BDI).

The Beck Depression Inventory (BDI) is a self-report inventory that screens for symptoms of depression (Richter, Werner, Heerlein, Kraus & Sauer, 1998). It was developed by Aaron T Beck in 1961 and has a theoretical basis in cognitive behavioral therapy (Weishaar, 1993). Initially, the BDI was viewed with suspicion by psychiatrists, as there was limited support for the area of cognitive therapy in the early 1960s (Richter, Werner, Heerlein, Kraus & Sauer, 1998; Weishaar, 1993). However, its popularity has grown and it is currently the most frequently used means of determining the presence of depressive symptoms (Richter, Werner, Heerlein, Kraus & Sauer, 1998).

The BDI was designed to assess distinct depression criteria, as specified in the Diagnostic and Statistical Manual of Mental Health Disorders, Fourth Edition (DSM IV-TR) (Beck, Steer, Ball & Ranieri, 1996; Enns, Cox, Parker & Guertin, 1998). While the BDI does not diagnose depression as a syndrome, it is widely referred to as a useful screening tool for assessing the

severity of depression (Richter, Werner, Heerlein, Kraus & Sauer, 1998). The information obtained from the BDI gives an indication of the presence of negative thought patterns, such as poor self-perception and a negative outlook on life, as well as depressive symptoms such as pessimism, a sense of failure and vegetative signs of depression. It is able to identify critical symptoms, such as a desire to commit suicide, which would require rapid intervention. Scores on the BDI provide an indication of the intensity of depression and can serve as a basis for the development of an appropriate treatment plan for the individual (Richter, Werner, Heerlein, Kraus & Sauer, 1998). In addition, the BDI is useful for monitoring change in depressive symptoms over time. Ideally, the evaluation and diagnosis of depression should be done by a professional who has training in psychological disorders and the BDI should be used together with other assessment strategies, such as a detailed clinical interview (Beck, Rush, Shaw & Emery, 1979).

The BDI is a 21-item, paper and pencil test, which takes approximately 10 minutes to complete by a literate, English speaking adult. Items one to 13 evaluate the presence of psychological characteristics associated with depression, while items 14 to 21 tap physical features associated with depression. The participant is requested to circle one option that best describes how he or she has been feeling in the last month, on a Likert type scale that is scored from zero (not at all) to three (very much). The standardized instructions make provision for the instructions to be read to the participant or for the participant to read the statements independently (Beck, Ward, Mendelson, Mock & Erbaugh, 1961). Although the mothers in the current study had been exposed to varying levels of formal schooling, many found it difficult to

complete the questionnaire independently and requested that the administrator read the options to them.

The total score obtained on the BDI indicates the severity of depression according to the following criteria: 0-9 = No Depression; 10-15 = Mild Depression; 16-23 = Moderate Depression; and 24-63 = Severe Depression (Hatzenbuehler, Parpal & Matthees, 1983). Mild depression is indicated when few symptoms of depression are reported, and those that are present lead to very minor impairment in work functioning, social activities and/or relationships with others. Moderate depression would be experienced if the reported number of symptoms falls between mild and severe depression. Severe depression is characterized by the presence of all the symptoms necessary to make a clinical diagnosis. As such, the reported symptoms would directly interfere with occupational responsibilities, social interactions and relationships with others (DSM IV-TR, 2000). The original copy of the BDI is copyright protected. The BDI was translated into Afrikaans for the purposes of this study, as the majority of the participants from this community are Afrikaans speakers. Refer to Appendix C for an example of the Afrikaans version of the BDI that was used.

The advantages of the BDI are its high content and concurrent validity (0.77), validity in differentiating between depressed and non-depressed subjects and sensitivity to changes in depressive state over time (Beck, Steer & Garbin, 1988; Beck, Rush, Shaw & Emery, 1979; Groth-Marnat, 1990 ; Richter, Werner, Heerlien, Kraus & Sauer, 1998). It is also reported as possessing high internal consistency ($\alpha = 0.81$) when administered to different samples of non-

psychiatric patients between 1961 and 1986 (Beck, Steer & Garbin, 1988). There are some disadvantages associated with this inventory; the main one being that its re-test reliability fluctuates because the variable measured is mood state (Groth-Marnat, 1990 ; Kendall, Hollon, Beck, Hammen & Ingram, 1987). Although the split half reliability of the BDI (0 .93) is high, there are variations in the re-test reliabilities of this instrument, which range from 0.48 to 0.96, depending on the interval between the initial test and the re-test (Dozois, Dobson & Ahnberg, 1988; Groth-Marnat, 1990 ; Sprinkle et al., 2002). Other criticisms of the BDI include a lack of representative norms, controversial factorial validity, instability of scores over short periods and poor discriminant validity between depression and anxiety (Ahava, Iannone, Grebstein & Schirling, 1998 ; Enns, Cox, Parker & Guertin 1998). The inventory has been normed on many populations, but not a South African one. Establishing its validity and reliability within a developing country like South Africa is likely to be complex, as different cultures within South Africa manifest anxiety and depression differently (Ward, Flisher, Zissis, Muller & Lombard, 2003). Further, there are many confounding factors such as self-esteem, duration of illness, use and duration of medication and/or therapy, that may limit the accurate measurement of depression. Despite these difficulties, the BDI has been widely used in psychological studies of African populations, such as a study that was conducted to determine the prevalence of post-partum depression in Nigerian women where the BDI was used to distinguish depressed participants from those who were not, making it appropriate for use in this context (Adewuya, Eegunranti & Lawal, 2005). In addition, the outcome of a study that was conducted on an adolescent sample from Cape Town confirmed that the BDI was an appropriate tool that could be used within developing countries even though the small sample size was a limiting factor for that study (Ward, Flisher, Zissis, Muller & Lombard, 2003).

### 2.5.3 Profile of Mood States (POMS).

The Profile of Mood States (POMS) was included in the assessment battery to assess the underlying mechanisms that may contribute to current mood alteration of the mother sample, as the BDI was used to assess potential changes in the severity of depression at the two data collection points. Since part of the study aims to outline a demographic profile that distinguishes mothers with a FASD infant from mothers without a FASD infant, the POMS provides the opportunity to screen the mother sample for a current mood profile, thus it was administered once at the follow-up assessment.

The POMS is easy to administer, as the instructions require that the participant select one option that best describes how they felt in the last week including the day of the interview, to have a time period that is sufficiently long to highlight an individual's persistent mood reactions to current life situations and adequately short to assess sensitivity to mood changes. This questionnaire consists of a five point scale from strongly agree to strongly disagree. The paper and pencil format of this assessment takes approximately 10 minutes to administer.

Nowlis and Green (1957) developed the original set of 55 scales that comprise the POMS. Following a series of factor analytic studies, the adjectives in the POMS were adjusted to those which an average individual could understand (Thorndike & Lorge, 1944). The POMS is a simple, 65 point adjective rating scale that can be used with individuals that have at least a United States Grade 7 education, as these individuals experience little or no difficulty in

understanding the terms (McNair, Lorr & Droppelman, 1971). It was appropriate to use the POMS in the current study due to lower education levels that are evident for mothers within this community. Mothers who understood the adjectives but struggled with the completion of the forms were assisted by. The POMS that was standardised on a United States sample is a classified psychological instrument that measures six current identifiable mood or affective states. The six mood states include Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, and Confusion-Bewilderment. This instrument is a sensitive measure that identifies and assesses transient, fluctuating affective states. The POMS is also a self-report inventory that measures both positive and negative aspects of mood states (McNair, Lorr & Droppleman, 1992). Vigor is considered a positive mood while anger, depression, fatigue and tension refer to negative moods. Table 25 summarises the POMS subscales.

Table 25

*Description of the Profile of Mood States (POMS) Scale*

| Subscales of POMS | Description |
|---|---|
| Tension-Anxiety | Refers to heightened musculoskeletal tension and somatic tension |
| Depression-Dejection | Refers to a sense of personal inadequacy, difficulty with adjustment, personal worthlessness, emotional isolation, sadness and guilt |
| Anger-Hostility | Includes assessment of overt anger, milder feelings of hostility and suspicious components of hostility |
| Vigor-Activity | Suggests high energy and represents a positive affect |
| Fatigue-Inertia | Represents weariness and low energy levels |
| Confusion-Bewilderment | Refers to organized-disorganized dimension of emotion, where it represents a self-report of cognitive efficiency and is possibly a by-product of anxiety |

Source: McNair, D. M.; Lorr, M. & Droppleman, L. F. (1992). *POMS Manual Profile of Mood States*, San Diego: EdITS, Pages 4 -5

The POMS instrument is available in English and in various other languages such as Dutch, Chinese, Korean, Czech, French, German, Italian, Japanese and Spanish (Bourgeois, LeUnes & Meyers, 2010 ; Yeun & Shin-Park, 2006). However, there is no Afrikaans translation of the POMS. Thus, for this study, the English version of the POMS was translated into Afrikaans by a professional research nurse and back-translated into English to check for consistency in terminology by a registered psychometrist before being administered to this sample where Afrikaans is the dominant language. Although there is no standardised Afrikaans version of the POMS, a study was conducted with a sample of male and female South African athletes with an average age of 20 years, where the POMS-Adolescent (POMS-A) version was incorporated into the Stellenbosch Mood Scale (STEMS) instrument. A forward and back-translation method was also used to translate the POMS-A into Afrikaans before it was included as part of the STEMS, which is a dual language (English and Afrikaans) assessment tool. The outcome of that initial validation statistics study indicated that the STEMS instrument was applicable to both the English and Afrikaans South African groups, implying that it has cross cultural relevance (Terry, Lane & Fogarty, 2003).

The POMS is an internally consistent, multi-dimensional tool that has stable psychometric properties (Norcross, Guadagnoli & Prochaska, 1984 ; Terry, Lane & Fogarty, 2003). The internal consistency for all items are 0.90 and above and the test re-test reliability for depression is 0.74 (Boyle, 1987 ; McNair, Lorr & Droppelman, 1971). It is effective in measuring reported depressive symptoms and confirmatory item factor analysis suggests convergent item validity and similarity of structure across patients admitted at the Epilepsy Monitoring Unit (EMU), University Hospital in Cincinnati, USA (Griffith et al., 2005 ; Reddon, Marceau & Holden,

1985). Furthermore, the POMS instrument is able to discriminate between healthy adults and patients with known mood disturbance showing strong support for concurrent validity (Gibson, 1997).

The completed questionnaires were manually scored by using the standardized scoring masks and the POMS Profile sheet for a normative sample instead of an outpatient sample. The sample of this study were non patients, 18 years and older who had some school education and met the criteria for the profile sheet of the normative sample. The raw scores were plotted onto the profile sheet and these were converted to standard T scores. The mean standard score for each subscale of the POMS in the standardization sample is 50 with a standard deviation of 10 (McNair, Lorr & Droppleman, 1992). The original copy of the POMS is copyright protected

The primary advantage of the POMS is the ease of administration, excellent user acceptance and that it is an instrument that is widely used in research. Although there are debates whether a shortened version or the original POMS should be used, it had been suggested that the abbreviated versions of the POMS be used more frequently in applied research provided that the psychometrically weak items are removed, as it takes less time to administer which could be a benefit within the research setting (Bourgeois, LeUnes & Meyers, 2010). The POMS is an instrument that can be used in conjunction with other depression scales such as the BDI-II as a strong correlation has been found between these instruments (Griffith et al., 2005). Contrary to this, another study indicated that there were discrepancies in the symptoms of depression when different self-reported measures of depression (Edinburgh Postnatal Depression Scale, depression scale of the Hospital Anxiety Depression Scale, the Zung self-rating depression scale

and POMS) were used where differences in the time period covered by these instruments and differing item content were some of the identified reasons for the discrepancies (Condon & Corkindale, 1997). This shows that POMS is able to assess constructs of depression with certain screening tools such as the BDI, while when included with other depression assessment batteries, the correlation could be limited. Although the POMS is a suitable screening instrument, its use within clinical settings should be limited to confirmation of clinical disorders by other comprehensive assessments that include classification according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) (Moore, Stanley & Burrows, 1990 ; Wilkins et al., 1995).

One administrative limitation of the POMS is that when questions arise regarding the meaning of the adjectives used, there is no standardised list of alternatives that the administrator can refer to. Since this could have implications for the validity of the instrument, there is a need for the instructions on the POMS to be extended. A multi-phase study that was conducted to obtain alternatives to item development showed that it was beneficial to have a standard list of alternative adjectives for future studies that use this tool in research and that this alternative list of adjectives could work in conjunction with the standard POMS instructions for participants who have a language and/or intellectual problem (Albrecht & Ewing, 1989). This suggestion could be useful within developing countries where the literacy rate is generally low. Having an alternative standard list of adjectives could assist in gathering more information from the participants that could enhance the power of future studies.

The POMS instrument has been used extensively in studies related to exercise and sport (Berger & Motl, 2000; Bourgeois, LeUnes & Meyers, 2010; Grove & Prapavessis, 1992; LeUnes & Burger, 2000; Martin, Andersen & Gates, 2000; Simpson & Newby, 1994 ; Snow & LeUnes, 1994). However, women have been under-represented in studies that utilised the POMS for sport and alcohol-related research (Howland et al., 2010; McMahon & Davidson, 1986; Schellekens et al., 2010 ; Snow & LeUnes, 1994). There have also been some studies on HIV, alcohol, prenatal diagnosis, breast cancer, parental attitudes during motherhood and mood states, where women were the primary sample (Birnbaum, Taylor & Parker; 1983; Di Lorenzo, Bovbjerg, Montgomery, Valdimarsdottir & Jacobsen, 1999; Grussu, Quatraro & Nasta, 2005; Kermode, Fisher & Jolley, 2000; Lex, Griffin, Mello & Mendelson, 1989; Simoni, Demas, Mason, Drossman & Davis, 2000 ; Tunis et al., 1990).

An American study conducted on 30 young women with a mean age of 26 years that investigated the relationship between alcohol and marijuana use and mood states (POMS), indicated that when marijuana and alcohol were consumed scores for friendliness and vigor increased while tension and fatigue decreased (Lex, Griffin, Mello & Mendelson, 1989). Another American study that utilised the POMS assessed the relationship of alcohol and sober mood state in 93 female social drinkers whose ages ranged between 30 and 65 years. The results from the first test session indicated that there was a significant relationship between alcohol consumption and self-reported depression and anger in the sober states. The results from the second session of that same study showed a decrease in depression, anger and mental confusion in those who were randomly selected to reduce their alcohol consumption when compared to those who maintained or increased their alcohol consumption during the same time period.

Overall the outcome of that study suggested that relatively low levels of alcohol consumption produced increases in depression and anger in the sober states of female social drinkers (Birnbaum, Taylor & Parker, 1983). These studies show that the POMS appear to be effective in the mood profiling of women that consume alcohol and other substances.

Published literature that utilised the POMS within the South African context focused on clinical and sport related research (de Klerk, du Plessis, Steyn & Botha, 2004 ; Herbert & Potgieter, 2005). Despite the limited local research using the POMS where women have been the primary sample, it has good psychometric properties, it is quick and easy to administer and was therefore deemed appropriate for the purposes of this study.

### 2.5.4 Griffiths Mental Developmental Scales Extended Revised (GMDS-ER).

Developmental tests that identified or, described current problems and predicted later developmental status in infants and children have been used since the 1930's (Barnett, et al., 2004). The Griffiths Scale of Mental Development (GMDS) that was first published in 1954 covered the first two years of life and assessed Locomotor, Personal Social, Hearing and Speech, Eye Hand Co-ordination and Performance. During the 1960's the Griffiths Extended Scales of Mental Development (GMDS-ER) was developed that included a Practical Reasoning Scale and this evaluated children aged two to eight years (Luiz et al., 2004).

The GMDS-ER measures the processes and rate of development of attributes and abilities of infants and young children from birth to 8 years. This is a developmental test that assesses

developmental abilities individually and collectively that encompassed several aspects of learning within 6 subscales. These areas of development included: Locomotor (gross motor) , Personal-Social (adaptive skills), Hearing and Speech (verbal ability), Eye-Hand Co-ordination (fine motor co-ordination), Performance (skills in manipulation and speed of performance) and Practical Reasoning (range of skills that involve practical reasoning that includes numerical and spatial concepts). An infant's developmental quotient (DQ) was the average of his/her scores on the five or six subscales depending on the relevant age.

The ***Locomotor (Subscale A)*** assesses the child's ability to balance, co-ordinate and control movements. The ***Personal-Social (Subscale B)*** evaluates the child's ability to competently complete daily activities, level of independence and ability to interact with other children. The ***Hearing and Language (Subscale C)***, determines the child's receptive and expressive language abilities. A child's fine motor ability, manual dexterity and visual perception skills are assessed within the ***Eye-Hand Co-ordination (Subscale D.)*** During the administration of ***Performance (Subscale E)*** items, the psychometrist is able to assess the child's manipulation skills, speed of working and precision when completing tasks. The ***Practical Reasoning (Subscale F)*** appraises the child's ability to solve practical problems, assesses understanding of basic mathematical concepts and poses questions related to moral and social issues. In addition, the child's knowledge of the days of the week, ability to tell time and understanding of right and wrong are also assessed.

The GMDS-ER items are based on natural activities and are placed in the order of gradually increasing difficulty. The original copy of the GMDS-ER is copyright protected. This instrument consists of 228 items with six items per year group from year one to year seven. For year eight an additional two items per subscale are included. Each subscale is administered to the child until the child obtains a basal (first of six consecutive passed items) and a ceiling (last of the six consecutive failed items) score within each subscale. A positive score on an item indicates that the infant or child is able to carry out a task and a negative score implies a lack of competency on the item. The mean score of subscales ranges between 99.79 and 100.46 while the standard deviation scored ranges from 0.58 to 17.43 (Adnams et al., 2001). Normal or average general quotient ranges between 90 and 109 (Ivens & Martin, 2002). According to past research, there were no significant discrepancies between raters with different backgrounds and experience, suggesting that the GMDS-ER has good inter-rater reliability (Smith, Bidder, Gardner & Gray, 1980). The overall reliability of the scale is very satisfactory ($\alpha = 0.95$). However, there are some controversies regarding the re-test reliability of the instrument related to discrepancies between first and second year developmental patterns, where a recommendation has been made to conduct additional studies on the re-test reliability score (ARICD, 1996). Another limitation of the GMDS-ER scale is that some test items require information from parents/caregivers and are not related directly to the assessment of the administrator. This can result in subjectivity which could interfere with the results.

The norms of each subscale were initially standardized on a British sample and since each subscale had been standardized on the same population, comparison across a range of learning domains for the same child was possible rather than the use of several different tests (Luiz et al.,

2004). These norms were later revised and could be used within certain but not all sectors of South African population groups. Despite, this limitation, the GMDS-ER had been used widely within the South African research domains (Adnams et al., 2001; Cockcroft, Amod & Soellaart, 2008 ; Reber, 1985). Although the GMDS-ER has been standardized on a group of children living within the UK and Ireland whose first language was English, international studies from countries including South Africa showed that the GMDS-ER scales were applicable to children from different cultural groups and could be used within different research settings (Amod, Cockcroft & Soellart, 2007; Cockcroft, Amod & Soellart, 2008; Luiz, Foxcroft & Stewart, 2001 ; Smith, Adnams & Eley, 2008).

According to a study that was conducted on 430 South Africans of varying race aged between 54 and 83 months, the GMDS-ER scores shared a high level of correlation between White, Mixed Race (Coloured), Indian and Black children, which suggested that this instrument measured a consistent construct across cultures. Yet the outcome of this study showed that more research was needed in this area (Luiz, Foxcroft & Stewart, 2001). Other studies that assessed the use of the GMDS-ER within a South African context confirmed that the developmental constructs being measured across groups were consistent and that the differences in performance on specific subscales were attributed to cultural biases (Amod, Cockcroft & Soellaart, 2007). The outcome of one South African study on a sample of 40 Black 13 to 16 month old infants showed that the socio-economic status and cultural practices of infants and their caregivers need to be considered when the scores of the GMDS-ER scales were interpreted, as contextual factors influenced the general functioning of infants (Cockroft, Amod & Soellaart, 2008). Although there are concerns regarding the use of psychometric assessments within a South African

context, the cultural applicability and effective deduction of comparative developmental profiles from the GMDS-ER scales indicate that it is a useful tool to collect quantitative data within research settings (Cockcroft, Amod & Soellaart, 2008).

The GMDS-ER was selected as an instrument for this study as it had been previously used in clinical practice and in research on special populations where general developmental deviations could be distinguished from delays in specific areas of functioning (Ivens & Martins, 2002). Infants identified as "at risk", consisting of those diagnosed with neonatal encephalopathy or FASD may not show obvious cognitive delays immediately but could display subtle impairments in the development of language and motor co-ordination. Since the teratogenic effects on infant development cannot be completely reversed or compensated for by stopping alcohol abuse, the impairments experienced by the infants are permanent where the consequence of this could be associated with school failure and psychosocial problems. The results of a study conducted in London on a special population of 80 infants that were diagnosed with neonatal encephalopathy indicated that a poor score on the GMDS at 12 or 24 months was a good predictor of impairment at school entry. Yet a normal score on this developmental assessment during early years could not exclude later neurological, perceptual, motor or cognitive abnormalities (Barnett et al., 2004). Another study conducted on infants from a rural area of the Bulacan province (Phillipines), indicated that there was a good correlation between hearing screening outcomes and the developmental outcomes from the GMDS-ER scales. The results of this study further showed that all sub-scales and the developmental quotient of GMDS-ER were below average in infants that had bilateral profound hearing loss (Chiong, Ostrea, Reyes, Llanes, Uy & Chan, 2007).

Importantly, the scales of the GMDS distinguished between grade one children diagnosed with FASD when compared to those with No FASD in a study that was conducted in the Western Cape Province of South Africa. The results showed that children with FASD struggled significantly with higher order cognitive motor competencies (Adnams et al., 2001). Since children with FASD require similar stimulation to encourage development as children with genetic disorders such as Down's Syndrome or Angelman Syndrome, past studies on these populations has confirmed that the GMDS-ER tool was effective in identifying developmental delays and guiding the decision on the type of interventions necessary to promote positive mental and general development of children with special needs (Andersen, Rasmussen & Strømme, 2001; Piper & Bless, 1980).

### 2.6 Procedure

This study was part of a larger protocol that obtained ethical clearance from the University of Witwatersrand Medical Ethics Committee protocol number M041127 and the additional procedure (administration of the POMS) for this current study was approved under the protocol number M070732 (Appendix D). Permission had been obtained from Professor Denis Viljoen, principal investigator of the Foundation for Alcohol Related Research (FARR) to use data that was collected from the clinical diagnoses, developmental assessments and maternal evaluations as part of the current study. The researcher had been appointed as the FARR Upington Area Co-coordinator since 2005 and had been actively involved in conducting the developmental assessments and maternal interviews in the Northern Cape with the assistance of trained psychometrics. The psychometrists that conducted evaluations had Honours degrees in

Psychology and most of them were working toward their Masters' Degree. The researcher and her colleague who administered the majority of the assessments were accredited users of the GMDS-ER. Due to the geographical and socio-economic status of this community, this study was conducted to assess the severity of drinking during pregnancy and to educate women about the dangers of drinking alcohol during pregnancy. According to the Declaration of Helsinki, the basic principles of research involving human subjects were adhered to (Code of Federal Regulations, 2008). Clinicians and psychometrists with the appropriate scientific training and qualifications conducted the study. This disadvantaged community also benefitted from the clinical and developmental assessments. Infants who required additional speech therapy following the developmental assessment were referred to the on-site speech therapist for further assistance. In addition, mothers and or children were referred for clinical care if any medical problems were identified by the clinicians. All mother's/caregivers signed an informed consent prior to enrolling in the study.

All procedures for the larger protocol and current study were implemented at the Upington FARR Community Centre during the planned FARR clinical trips. The larger longitudinal study (retrospective phase) comprised of initial and follow-up assessments. The POMS specific to the current study (prospective phase) was introduced at the follow-up assessment.For the retrospective phase of the study, birth records were obtained from Gordonia Hospital in Upington and randomly selected mothers using a table of random numbers were invited to participate in the study. After consent was obtained the infants were clinically screened for features of FASD. Refer to Appendix E for copies of the information sheets and consent forms. Depending on the outcome of the clinical examination, infants were classified as having features

of FASD or no characteristics of FASD between the ages of nine to eighteen months. The infants affected with FASD were considered to be the FASD or study group and infants that had no features of FASD were identified as the comparison group. The clinical diagnosis determined the classification of the mother-infant pair. Infant developmental evaluations, assessment of the severity of maternal depression together with maternal interviews were administered to these selected infants and their respective mothers. These initial clinical examinations, developmental profiles and maternal information formed the preliminary results against which post-test scores were compared. This provided an avenue to evaluate a potential change in mothers' mental mood states, as well as to track infant development.

The follow-up assessment of the retrospective phase took place approximately 1 year and 6 months later when the infants were between 18 to 45 months. At this point, equivalent measures of infant development and screening of the symptoms of maternal depression were administered. The Profile of Mood States (POMS) was the additional instrument that was included to measure current symptoms of depression in mothers and this contributed to new data being collected for this study, as the focus of this study was on the role of maternal mood states instead of identifying only the prevalence of FASD within this community. As a result of logistical factors and to ensure that all participants received the opportunity to participate in all procedures, the re-assessment took place approximately 1 year and 6 months after the initial assessment. For the purposes of this study, re-assessing the level of maternal depression at a specific period in time in both the case and comparison groups was essential.

Table 26 illustrates the prescribed assessments of the research design that was followed where "x" denotes the procedures that were implemented at the different stages.

Table 26

*Tabulated Assessment Periods of the Current Study*

| | | Screening for criteria of FASD on 413 infants (2006) | Initial Assessment (2006) | Follow-Up Assessment (2006-2007) |
|---|---|---|---|---|
| | | (9-18 months) | (9-18 months) | (18-45 months) |
| | **Clinical Evaluation** | X | | |
| Retrospective Study Phase | | | 100 out of the 413 clinically screened infants (50 FASD & 50 matched No FASD infant-mother pairs) entailed the sample of the subsequent assessments | |
| | **Clinical Evaluation** | | | X |
| | **GMDS-ER** | | X | X |
| | **BDI** | | X | X |
| | **Maternal Interviews** | | X | If interviews were not done at the initial assessment, the interview was completed at this time period |
| Prospective Study Phase | **POMS** | | | X |

Note:

BDI: Beck Depression Inventory

GMDS-ER: Griffiths Mental Developmental Scales-Extended Revised

POMS: Profile of Mood States

At the completion of each assessment, mothers were provided with referral letters if their infant required additional medical care. They were also reimbursed with a small monetary voucher for their time and travel. The voucher could be used at the local supermarket to buy food or consumables. However, an arrangement was made with the store not to allow these vouchers to be exchanged for alcohol. A photo of the mother and her infant was framed and given to thank mothers for their participation in the study.

Following the clinical screening of the 413 infants, the 50 (12.1%) infants who were diagnosed with FASD and the 50 infants who had no features of FASD were invited to attend the developmental assessment, while their mothers/caregivers were asked to complete a maternal evaluation of symptoms of depression and to participate in an interview. Not all mothers from the FASD and No FASD group returned to the centre for the infant development and maternal evaluations. Attrition of the sample was noticed approximately two months after the clinical screening when the initial developmental assessments took place. Due to unforeseen reasons there were some discrepancies in the sample composition of the mother-infant pairs during the entire study. For example, during the initial assessment phase there were developmental tests that were conducted on infants, yet symptoms of depression and/or the maternal interviews related to these infants could not be conducted due to mothers of these infants not being available. On the other hand, in certain situations where the developmental assessment had to be discontinued due to the infant being ill, it was still possible to collect the maternal data that was required for the study. Although some infants were clinically screened, they passed away before the developmental assessments and maternal data could be gathered. Due to a combination of these reasons, the dataset had missing information, as not all mother infant pairs proceeded with all evaluations as was expected in the research procedure detailed in Table 26.

As a consequence of unforeseen problems, infant mortality and demographic mobility, there was attrition in the sample at different stages of data collection. In addition, logistical difficulties that arose during recruitment and follow-up were the reasons for examinations taking place at varied stages of development. These exact figures of sample attrition and sample composition of the current study for the initial and follow-up assessments are discussed later in the chapter and

are highlighted by Table 27. Mother-infant pairs that attended both the initial and follow-up assessments were selected and categorised into a complete dataset.

Due to the missing information, a strategy of deducing comprehensive information for each assessment phase was carried out. Mother-infant pairs from the retrospective phase that attended the clinical, developmental and maternal evaluations of the initial assessment only, and those for which no stage of the assessment was missed, were classified into the initial dataset. The follow-up dataset comprised mother infant pairs that had all evaluations (clinical assessment, infant development and maternal evaluation) conducted for the follow-up assessment only from the retrospective and prospective phases. There were some mother-infant pairs that attended all evaluations for both the initial and follow-up assessments, while there were other mother-infant pairs that only attended certain assessments from the retrospective and prospective phases of the study. Only comprehensive data that was collected from mother-infant pairs that attended *all* scheduled visits during the retrospective and prospective phases could be included into the complete dataset. Due to the scarcity of information that examines associations between fetal alcohol syndrome, maternal depression and infant development, data from all three datasets were analysed. The purpose of including the exclusive initial and follow-up data sets was to investigate if there were any trends that emerged during a specific developmental period, of infants that had been exposed to alcohol prenatally compared to those that were not placed at teratogen harm. For the purposes of this study, the complete data set will be the focal point of discussion, as these individuals were the same at the initial and follow-up assessments. This complete data set was used for comparative purposes in terms of infant development and maternal depression over a period of time while the descriptive statistics of the initial and follow-up data sets will only be noted.

The following sub-sections describe the change in subject composition at various stages of data collection and outline the specific reasons that contributed to sample attrition.

### *Initial Data Set: Clinical Evaluation, Developmental Assessment, Beck Depression Inventory and Maternal Interviews*.

At clinical screening, 50 out of 413 (12.11%) infants were identified with features of FASD. The total initial data set (n=100) comprised 50 infants at high risk for FASD features and 50 comparison group infants without features of FASD when clinically screened. The comparison group of infants were matched according to age and ethnicity to the infants who screened high risk FASD. It was not possible to match the infants according to gender.

Sixteen mothers did not attend the clinic with their infants for the developmental assessment as they had moved without informing the research team of a forwarding address or the research team obtained no reply after several attempts at trying to contact them. In addition, one mother indicated that she no longer wanted to be part of the study and one infant passed away. Although another mother had attended the developmental assessment with her infant, the infant was ill at the time and the psychometrist had to discontinue the assessment. Consequently, a total of 19 mother-infant pairs across the FASD and No FASD groups had missing data during this initial assessment. For these stated reasons, only 81 developmental assessments were conducted within the initial data set. Since relatives of six infants had accompanied infants and one mother was illiterate, a total of 74 mothers were assessed with the depression tool, namely the Beck Depression Inventory (BDI).

At the initial developmental assessment phase, another objective was to administer maternal interviews to the mothers or caregivers of the infants. As a result of retention challenges that were experienced at the initial assessment, some maternal interviews had to be administered during the follow-up stages. Some of the challenges of conducting the maternal interviews at the initial assessment were that some mothers were working or not available and did not accompany their infants. However, when re-contacted by the research group some of these mothers attended the follow-up assessment with their infants and it was at this stage that the maternal interview was conducted.

Although several attempts were made to contact mothers to attend the clinic for the maternal interviews, 11 participants were excluded due to missing information from either the clinical assessment, developmental assessment and/or maternal interview. Therefore, only 89 mothers or caregivers were interviewed. From this dataset one infant passed away, one mother did not wish to participate in the study, four mothers could not be contacted, two mothers moved away with no forwarding address, one mother was drunk during two different attempts to interview her, one infant was adopted and the foster mother could provide no history and one infant lived with her aunt, who could provide no information about the infant or her biological mother. Reduced by 10, a total of 79 maternal interviews were conducted with either the biological mother of the infant or a caregiver of the infant. Twenty-five interviews were conducted with caregivers that had infants with FASD and 54 interviews were conducted with caregivers that had infants without FASD.

Due to attrition, the initial assessment (initial data set) and follow-up assessment (follow-up data set) referred to the selection of participants that had all required procedures completed at each assessment stage respectively as indicated on Table 27.

### *Follow-Up Data Set.*

A second objective was a follow-up clinical and developmental assessment on the 100 infants when they entered the toddler and child development stage (18 - 45 months).

### *Follow-up: Clinical Examinations and Developmental Assessments.*

Some mother-infant pairs did not attend any other scheduled follow-up visits while other mother-infant pairs attended either the clinical evaluation or the developmental assessment only. Only 78 of 100 mother-infant pairs were included in the follow-up data set as these individuals had both the clinical examinations and developmental assessments. Since the assessments took place on different days, 79 of the 100 clinical examinations were conducted and 82 of the 100 developmental assessments were administered. The reasons for excluding information from 22 of the 100 mother-infant pairs were that eight maternal and infant evaluations were not conducted due to the mothers not attending the clinic without a reason; five mothers moved away or were not at home; one mother was at work; one mother did not wish to participate in the study; three infants passed away and four mother-infant pairs had incomplete evaluations, as either only part of the maternal evaluation or only the infant evaluation was conducted. The follow-up data set thus comprised 78 data sets that included infant clinical, infant developmental and maternal depression assessments with outstanding maternal interviews completed.

### Follow-up: Maternal Depression.

Two depression scales were administered at the follow-up assessment when the infants were between 18-45 months. These included the Beck Depression Inventory (BDI) and Profile of Mood States (POMS).

#### *Follow-up: Beck Depression Inventory (BDI).*

Sixty-four BDI questionnaires were administered to mothers from the initial sample. A total of 36 mothers did not attend at follow-up for various reasons. Three mothers did not attend the clinic on the specified day and four mothers were not at home even though consent was signed to attend the clinic; ten mothers had moved with no forwarding address or moved to a distant farm; twelve infants were accompanied by caregivers who were not their mothers; three infants were deceased; two mothers were at work;, one mother did not wish to participate in the study and one mother was illiterate. However, there were only 57 out of the 64 mothers at follow-up who had BDI scores and whose respective infants were developmentally assessed.

#### *Follow-up: Profile of Mood States (POMS).*

The POMS was only administered at the follow-up assessment. From the initial data set of 100 mother-infant pairs, 36 mothers (for the same reasons as discussed in the section above) did not attend the clinic when the POMS questionnaire was to be administered. In addition, there was another mother that moved away with no forwarding address, three profiles were invalid as more than 10% of the questionnaire was not answered and there was one undocumented reason for the POMS not being administered. Only 53 out of the 100 mothers had valid POMS profiles and also had infants who were clinically diagnosed at the follow-up assessment that could be

used in the follow-up analysis. There was a difference of four between the number of BDI questionnaires and the POMS questionnaires administered, due to four POMS assessments being excluded due to invalid profiles that emerged.

***Overall summary of the maternal interviews.***

Seventy-four out of 100 and 57 out of 100 maternal interviews for the initial and follow-up data sets were respectively selected. The infants of these mothers were also developmentally assessed at each phase. Forty one maternal interviews for the complete data set were used, as the mother-infant pairs of these individuals had completed every required procedural step as indicated in Figure 2.

***Complete Data Set with Final Diagnosis***.

A final diagnosis of FASD or No FASD occurred after the follow-up visit at a clinical case conference where all of the professionals who participated in conducting the evaluations and assessments contributed their clinical opinions. A final diagnosis was made of each child using the available data that had been collected and classification was discussed using the criteria outlined by the Institute of Medicine (IOM) until consensus between the professionals was reached (Hoyme et al., 2005). On this basis, 89 final clinical diagnoses were made. Eleven diagnoses were deferred pending review. However, due to mothers and infants not returning to the clinic for their follow-up assessments, this final diagnosis was not possible. These 11 mother and infant pairs were thus excluded from the final sample.

Thus, the complete data set sample comprised 41 mother and infant pairs that had all comprehensive assessments at each stage of development, namely the initial assessment (9-18

months) and follow-up assessment (18-45 months). Six initial classifications changed from FASD to No FASD, as at a later stage of development, the integrated data showed that these infants did not meet the Institute of Medicine (IOM) classification criteria to be diagnosed within the FASD spectrum, while the remaining 35 classifications of FASD remained the same. Table 27 below provides a summary of the sample sizes of each data set. It also provides a breakdown of the total number of participants within the FASD and No FASD groups that were used for the statistical analyses. For the initial assessment, the majority of the FASD sample attended all required evaluations while at the follow-up assessment fewer mothers of infants with FASD attended the centre for their scheduled visits.

Table 27

*Summary of Sample Description*

| | **Initial Data Set (9 - 18 months)** | | | | **Follow-Up Data Set (18 - 45 months)** | | | | | **Complete Data Set (Initial and Follow-Up Complete Assessments with Final Clinical Diagnosis)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clinical | GMDS | BDI | Maternal Interviews | Clinical | GMDS | BDI | POMS | Maternal Interviews | Clinical | GMDS | BDI | Maternal Interviews |
| **Total (n)** | 100 | 81 | 74 | 74 | 78 | 78 | 57 | 53 | 57 | 41 | 41 | 41 | 41 |
| **FASD** | 50 | 43 | 39 | 39 | 14 | 14 | 10 | 9 | 10 | 13 | 13 | 13 | 13 |
| **No FASD** | 50 | 38 | 35 | 35 | 64 | 64 | 47 | 44 | 47 | 28 | 28 | 28 | 28 |

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

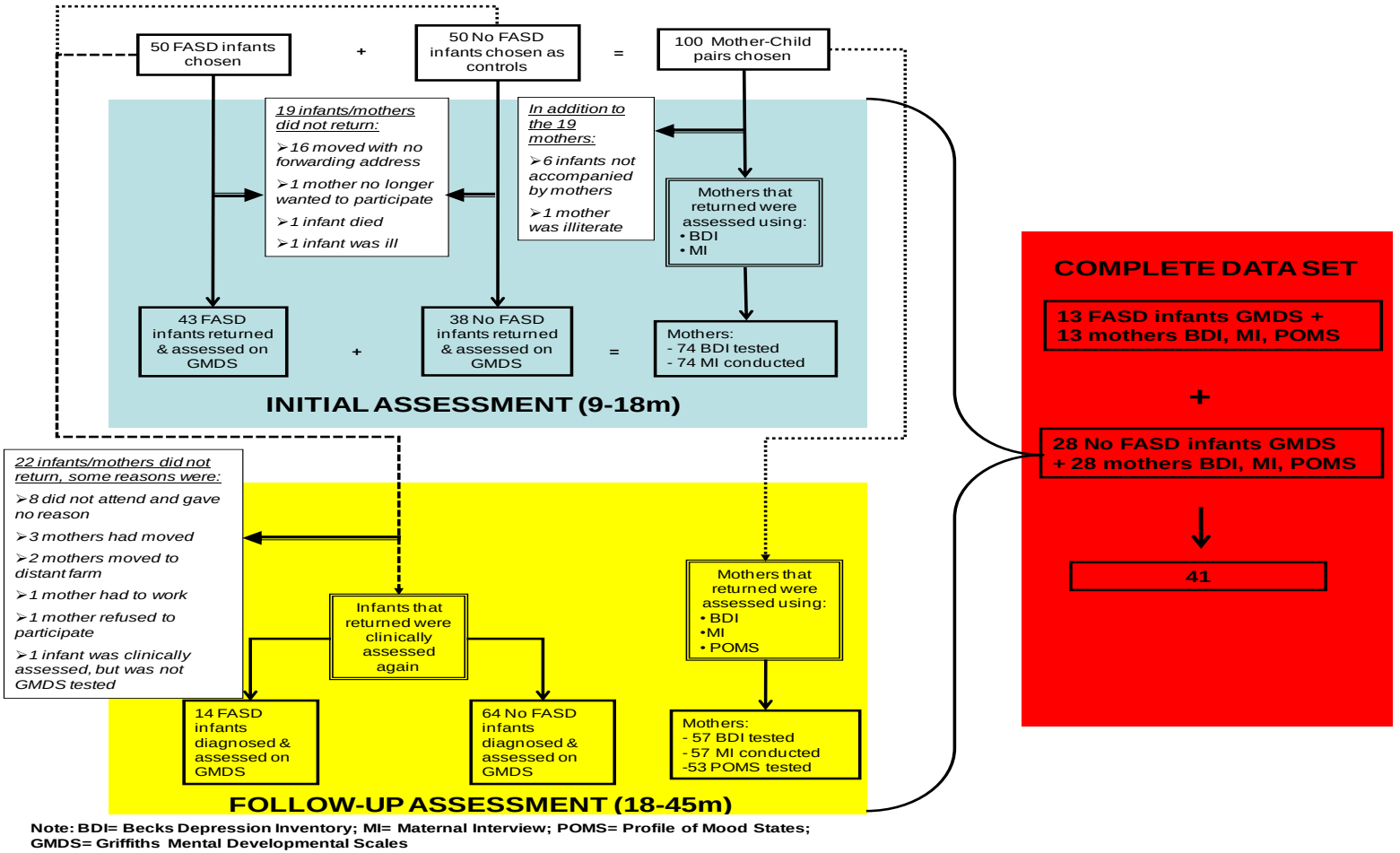



Figure 2

Flowchart of procedures to derive the dataset for the current study

## 2.7 Conclusion

The primary aim of the study was to investigate the level of maternal depression within a resource deprived community and its association with infant developmental outcomes. Compiling a maternal profile that distinguishes women with a FASD infant from those without a FASD infant, and investigating the differences between infant developmental functioning were the supplementary objectives. Due to high attrition rates, data collected from mother-infant pairs that attended all scheduled procedures were collated into a complete data set. Data obtained from the complete data set were analysed, while the results of those that attended only the initial or follow-up assessment are only noted, but no further investigations were conducted.

# CHAPTER 3 RESULTS

## 3.1 Overview to Data Analysis

Data collected on maternal depression and infant development from participants who attended the initial and follow-up assessments was used to answer the research question and address the hypotheses. Quantitative analysis using the SAS statistical package Enterprise Guide and SAS version 9.0 was implemented. An alpha level of 0.05 was set for all statistical tests where the outcomes from Type III errors were interpreted (Howell, 1999). Type III errors are defined as an error arising from a misinterpretation of the nature of the scores being compared in a significance test (Coleman, 2001). The Type III errors instead of Type I errors were taken into account in these analyses to correctly conclude the instances where the two groups are statistically different and to avoid being incorrect about the direction of the difference. Type III Sum of Squares was also used as it assumed that the data was intended to be equal and the possible lack of balance in the sample did not reflect anything meaningful. Controlling for these types of errors was achieved by selecting the appropriate parameters on the statistical analyses. Linear relationships between the variables were explored in this study.

From the outset it was important to determine the suitability of the data for parametric analyses. Normal distributions are symmetric, rise to a maximum and then reduce evenly to the sides. The assumptions of parametric tests require that data is normally distributed (Howell, 1999). This condition could not be assumed; therefore the Kolgomorov-Smirnov Goodness of Fit test was used to assess the normality of the data set. The normal distribution refers to the theoretical distribution of scores that are symmetrical. The assumptions of this statistical

parametric procedure require that the populations from which the samples are drawn are normally distributed, the cases have been selected randomly and that the variances of these populations are equal (Kaplan, 1987). In order to determine the type of statistical procedures to be used for the analysis and to determine the normality of the score distributions of the various measures, the Kolgomorov-Smirnov Tests of normality were used. The Kolgomorov-Smirnov Test is a non-parametric test that may be used to test the significance of the difference between two samples (Reber, 1985).

The assumptions for statistical parametric analyses include random, independent sampling, additive means, an interval scale for the measure of the dependent variable/s, homogeneity of variance of the groups and reasonably normal distribution of the data (Howell, 1999). The Griffiths Mental Developmental Scales (GMDS/GMDS-ER), the Profile of Mood States (POMS) and the Beck Depression Inventory (BDI) assess different development and psychological areas of functioning. These tests are categorized as ordinal scales, as these psychometric tests evaluate constructs with unknown units of measure and it is not strictly possible to determine whether such measures are normally distributed, as the intervals between two points may not necessarily have the same meaning (Minium, King, & Bear, 1993). Although the distributions of the Kolgomorov-Smirnov results showed that some data set distributions were skewed, parametric statistical tests were nevertheless selected for the following reasons.

Firstly, non-parametric tests are based on data ranks and not primarily on data distribution. All parameters in combination need to be taken into consideration before non-parametric tests are used, as these tests are considered weaker due to their poor robustness. Secondly, although

alternate methods are available if these assumptions have been violated, there are nevertheless no non-parametric procedural alternatives for certain statistical analyses, such as the analysis of covariance. Thirdly, some tests such as the Analysis of Variance (ANOVA) are relatively unaffected by the violations of these assumptions in terms of the sample not being symmetrical. A past study has shown that the ANOVA was robust to data distribution type, even to skewed distributions (Kikvidze & Moya-Larano, 2008). In addition, violation of the assumption of the sample not being normally distributed has relatively little impact on the statistical test (Kaplan, 1987). Since the dataset did not have all ranked data and parametric tests could be used even with skewed distributions, these procedures were used for the analysis of the data, as parametric tests are more powerful than non-parametric tests and the deviation from the normal is not considered a serious deviation (Kikvidze & Moya-Larano, 2008).

The FASD and No FASD groups are the independent variables while the dependent variables varied for the maternal and infant sample. Severity of maternal depression (BDI scores) and current depression that entails the subscales of the POMS (tension, depression, anger, fatigue, confusion and vigor) were the dependent variables for the maternal criteria, while the dependent variables for the infant sample entailed the GMDS-ER subscales (Locomotor, Personal Social, Hearing and Language, Eye-Hand Co-ordination, Performance, Practical Reasoning and Developmental Quotient). Analyses were grouped under the specific hypotheses to answer the research question.

Due to the high attrition rate, the outcome of the Chi Square Analysis Goodness of Fit test procedure determined whether the results from each data set could be compared. This procedure

was carried out to assess for sample bias with regards to the variability of infant gender between the initial, follow-up and complete data sets, as one important use of this method deals with the relationship to population and sample variances. Past literature shows that female infants mature biologically at a faster rate when compared to male infants (Barfield, 1976; Freedman & De Boer, 1974 & Conel, 1939; Wolff, 1981). Being exposed to alcohol prenatally and maturing at a slower rate than females would place the male infants of this study at a disadvantage. The results of the study would be questionable if there was a significant difference in the gender ratio of the sample, as there would be limitations to the interpretation of the data due to confounding factors.

Descriptive statistics (sample size, mean, standard deviation, minimum and maximum) of maternal demographic factors (maternal age at time of interview, maternal weight, marital status, maternal education, employment status and income); pregnancy history (pregnancy intent, contraceptive use, total number of pregnancies, total number of live births and total number of miscarriages); and risk factors (drug use during pregnancy, alcohol use during pregnancy, smoking during pregnancy and TB diagnosis) between the FASD and No FASD groups were presented. These descriptive statistics were also calculated for the subscales (Locomotor, Personal Social, Hearing and Language, Eye-Hand Co-ordination, Performance, Practical Reasoning and Developmental Quotient) of infant development between the FASD and No FASD groups.

Chi square tests, t-tests and Multiple Analysis of Variance (MANOVA) comparisons were calculated to assess if there were general differences that emerged between the groups for

maternal depression, maternal variables and infant development. Chi square tests were used to assess the differences between two independent groups for maternal variables that were categorized. Although the Chi Square test allows for the comparison of frequencies between the groups, the test's validity may be compromised if the expected frequencies are too small and could lack the power to detect false null hypotheses (Howell, 1999). Therefore, Fishers exact test of independence were calculated for some of the categorical variables when the sample size was very small (McDonald, 2009). This test was selected instead of Chi Square, as the outcome of the Chi Square would have been invalid since some of the expected frequencies did not reach a minimum of five (Howell, 1999). T-tests were implemented for maternal variables that comprised of continuous data (maternal age, weight and income), as shown in Table 62. The difference in means between the FASD and No FASD groups were compared, which is a commonly used test for the comparison of groups (Howell, 1999).

Since the MANOVA compares multiple dependent variables simultaneously, it was used to compare the difference in means on the depression subscales at the follow-up assessment (Table 47) and the GMDS/GMDS-ER scales between the FASD and No FASD groups at the initial and follow-up assessments (Table 66). Although the MANOVA is based on the assumptions of normality and homogeneity of variance, these assumptions could be violated in practice with relatively minor effects, as the MANOVA is a robust statistical procedure (Howell, 1999). The MANOVA uses one estimate that is obtained from variability across cell means and the second estimate is based on the variability between the groups (Kaplan, 1987). These statistical steps examine the additive and interactive effects of the dependent variable on the independent variable (Brennan, Hammen, Katz & Le Brocque, 2002). In assessing for additive effects, the

statistical package examines whether maternal depression adds to the risk for negative infant development above and beyond the effects of prenatal substance abuse of alcohol. The interactive effects investigate whether the effect of maternal alcohol use on infant development differs, depending on the presence or absence of maternal depression.

Analysis of Covariance (ANCOVA) and Multivariate analysis of covariance (MANCOVA) was calculated under the specific hypotheses to investigate if there were any covariates that were significantly associated with either the outcome of maternal depression or infant development. The ANCOVA removes the variance that can be attributed to the covariate; and this would produce a more accurate reflection of the original hypothesis by reducing the error term (Howell, 2002). It also removes any bias in the dependant variable means caused by chance group. The assumptions of the ANCOVA include the following; normal distribution, homogeneity of variance and homogeneity of regression; that is the regression coefficients are equal across all treatments. No assumption can be made about the nature of the covariate, as it can be either a fixed or a random variable. The MANCOVA applies to situations where multiple dependent variables are under analysis (Reber, 1985).

Repeated measures analysis of variance (ANOVA) procedure was used to assess whether there were any differences within the FASD and No FASD groups between the initial and follow-up assessments. This procedure reduces overall variability and removes subject differences from the errors resulting in independent error components (Howell, 2002). The assumptions of the Repeated Measures ANOVA include normality, homogeneity of variance, and that correlations among the categories of the repeated variable are constant. However, the

latter assumption is very stringent and is likely to be violated. The statistical procedure maintains validity if there are only minor violations of the assumptions. When subjects are measured repeatedly, subject differences can be assessed and this can be separated from error. The major disadvantage of this procedure is related to the risk of carry over effects from one assessment to another. However this is a robust procedure where the advantages outweigh the challenge (Howell, 1999).

Correlation Analysis was used to investigate the relationship of the depression scales, maternal variables and infant developmental subscales within the FASD and No FASD groups between the initial and follow-up assessments. Although this statistical procedure was designed primarily to examine linear relationships between variables, this technique could also be used to study nonlinear relationships. The correlation co-efficient describes the direction and the magnitude of the relationship. Three types of relationships could emerge from this analysis, a positive correlation, a negative correlation and no correlation (Kaplan, 1987). If the association of the variables is significant, a Fishers "z" standard score is calculated, and the outcome of the "z" score is translated to a probability to determine if there is a significant difference in the pattern of scores between the FASD and No FASD groups (Howell, 1999 ; Kaplan, 1987). Although a significant difference in the pattern of scores between groups would imply a potential significant difference between the groups when group comparison tests are implemented, this is not always the case. Small sample sizes and the presence of outliers could influence the outcome of this procedure, yet understanding the association of variables is important to obtain an overall understanding of the data.

For the sections that follow, the format would include results of between group comparisons, within group comparisons and correlations to assess the objective of each hypothesis. The modest sample size could result in low power to detect statistically significant results. Table 28 summarises the procedures that were carried out when analyzing the data in order to answer the primary research question.

Table 28

*Summary of Data Analysis*

| Comparability of Sample | Hypothesis One | Hypothesis Two | Hypothesis Three | Hypothesis Four | Hypothesis Five |
|---|---|---|---|---|---|
| CHI SQUARE | MANOVA | CHI SQUARE | MANOVA | CORRELATIONS | ANCOVA |
| -Comparability of gender | - Depression (BDI and POMS) | --Employment Status | -Infant Development (GMDS-ER) | | - Severity of Depression (BDI) |
| KOLGOMOROV GOODNESS OF FIT TEST | MANCOVA | --Marital Status | REPEATED MEASURES ANOVA | | -Infant Development (GMDS-ER) |
| - Depression (BDI and POMS) | - Depression (BDI and POMS) | --Pregnancy Intent | -Infant Development (GMDS-ER) | | CORRELATIONS |
| -Infant Development (GMDS-ER) | REPEATED MEASURES ANOVA | --Contraception Use | CORRELATIONS | | |
| DESCRIPTIVE STATISTICS | - Severity of Depression (BDI) | --Total number of pregnancies | | | |
| - Severity of Depression (BDI) | CORRELATIONS | --Total number of live births | | | |
| - Current maternal mood (POMS) | | FISHERS EXACT TEST | | | |
| - Maternal Variables | | --Educational Status | | | |
| --Age | | --Total number of miscarriages | | | |
| --Weight | | --Alcohol use during pregnancy | | | |
| --Income | | --Smoking during pregnancy | | | |
| --Educational Status | | --Diagnosis of TB | | | |
| --Employment Status | | T-TEST | | | |
| --Marital Status | | --Age | | | |
| --Pregnancy Intent | | --Weight | | | |
| --Contraception Use | | --Income | | | |
| --Total number of pregnancies | | CORRELATIONS | | | |

### 3.2 Comparability of the sample across all hypotheses, tests of normality and descriptive statistics

A Chi Square analysis was initially implemented to investigate whether there were significant differences between the number of boys and girls in the data set at each point of data collection. Results for the Chi Square Analysis are presented for all three data sets (Table 29).

Table 29

*Chi Square Analysis of Gender Across the Three Data Sets*

| | | Data Sets | | |
|---|---|---|---|---|
| | | Initial | Follow-Up | Complete |
| FASD | df | 1 | 1 | 1 |
| | n | 50 | 14 | 13 |
| | $c^2$ | 1.28 | 2.57 | 0.07 |
| | p-value | p>0.05 | p>0.05 | p>0.05 |
| No FASD | df | 1 | 1 | 1 |
| | n | 50 | 64 | 28 |
| | $c^2$ | 0.72 | 0.00 | 0.57 |
| | p-value | p>0.05 | p>0.05 | p>0.05 |

p <0 .05*

The Chi Square analysis shows that there are no significant differences between the gender distributions of the sample across the three data sets, despite the attrition that occurred over time. This outcome indicates that statistical comparisons between the FASD and No FASD

groups could be conducted within each data set. The complete data set is selected for the analyses that follow as it includes the same individuals who were assessed at the initial assessment and who returned for the follow-up assessment. This allows for a direct comparison per individual from the initial assessment to the follow-up assessment. For purposes of this study, information related to the initial (only attended initial assessment) and follow-up (only attended follow-up assessment) data sets only are noted, as no direct comparisons for individuals within these data sets were possible.

A normal distribution of the data could not be assumed for the depression (BDI and POMS) and developmental (GMDS/GMDS-ER) scales, hence the normality of these distributions had to be assessed. This was implemented by utilizing the Kolgomorov-Smirnov Tests of Normality. Tests of normality for the BDI and POMS scores are shown in Table 30, while the GMDS/GMDS-ER profiles are represented in Table 31.

Table 30 above indicates that the BDI scores for the FASD group deviates from the normal distribution for the follow-up assessment, while the initial assessment follows a normal distribution. This trend is similar within the initial assessment of the No FASD group. In contrast, BDI scores of the follow-up assessment for the No FASD group did not follow a normal distribution. The histograms of the BDI distributions are visually represented in Appendix F by figures five to 12. The POMS was only administered at the follow-up assessment. All subscales of the POMS for both groups follow a similar pattern where a significant deviation from the normal distribution is evident. An exception to this trend is the Vigor subscale that shows a normal distribution. The histograms for the POMS are represented

in Appendix G by figures 13 to 36. These skewed distributions could have implications for the statistical procedures used.

Table 30

*Kolgomorov Smirnov Goodness-of-Fit Test of Normality for the Scales of Depression*

| | | | Initial Assessment | | Follow-up Assessment | |
|---|---|---|---|---|---|---|
| | | | Statistic D | p-value | Statistic D | p-value |
| FASD | POMS | BDI | 0.18 | p>0.05 | 0.25 | p<0.05* |
| | | - Anger | - | - | 0.29 | p<0.05* |
| | | - Confusion | - | - | 0.29 | p<0.05* |
| | | - Depression | - | - | 0.26 | p<0.05* |
| | | - Fatigue | - | - | 0.34 | p<0.05* |
| | | - Tension | - | - | 0.24 | p<0.05* |
| | | - Vigor | - | - | 0.21 | p>0.05 |
| No FASD | POMS | BDI | 0.16 | p>0.05 | 0.22 | p<0.05* |
| | | - Anger | - | - | 0.27 | p<0.05* |
| | | - Confusion | - | - | 0.19 | p<0.05* |
| | | - Depression | - | - | 0.19 | p<0.05* |
| | | - Fatigue | - | - | 0.23 | p<0.05* |
| | | - Tension | - | - | 0.25 | p<0.05* |
| | | - Vigor | - | - | 0.10 | p>0.05 |

p<0.05*

Even though the initial dataset (individuals that only attended the initial assessment) and the follow-up dataset (individuals that only attended the follow-up assessment) are not the focus of the study, the overall results are noted in text. BDI scores for the FASD group deviate from the

normal distribution for the initial dataset ($d$=0.15; p<0.05*) and follow-up dataset ($d$=0.27; p<0.05*). This trend of deviation from the normal distribution is also evident within the No FASD group of the follow-up dataset ($d$=0.22; p<0.05*). In contrast, BDI scores of the initial data set ($d$=0.10; p>0.05) for the No FASD group follow a normal distribution. All subscales of the POMS for the follow-up data set again deviate from the normal distribution, except for the Vigor subscale.

Table 31

*Kolgomorov Smirnov Goodness-of-Fit Test for Infant Development*

| | | | Initial Assessment | | Follow-up Assessment | |
|---|---|---|---|---|---|---|
| | | | Statistic D | p-value | Statistic D | p-value |
| FASD | GMDS | Locomotor | 0.20 | p>0.05 | 0.14 | p>0.05 |
| | | Personal Social | 0.18 | p>0.05 | 0.14 | p>0.05 |
| | | Hearing & Language | 0.19 | p>0.05 | 0.17 | p>0.05 |
| | | Eye Hand Coordination | 0.13 | p>0.05 | 0.21 | p>0.05 |
| | | Performance | 0.18 | p>0.05 | 0.19 | p>0.05 |
| | | Practical Reasoning | - | - | 0.16 | p>0.05 |
| | | Developmental Quotient | 0.22 | p>0.05 | 0.11 | p>0.05 |
| No FASD | GMDS | Locomotor | 0.18 | p<0.05* | 0.10 | p>0.05 |
| | | Personal Social | 0.14 | p>0.05 | 0.12 | p>0.05 |
| | | Hearing & Language | 0.13 | p>0.05 | 0.08 | p>0.05 |
| | | Eye Hand Coordination | 0.11 | p>0.05 | 0.12 | p>0.05 |
| | | Performance | 0.09 | p>0.05 | 0.08 | p>0.05 |
| | | Practical Reasoning | - | - | 0.11 | p>0.05 |
| | | Developmental Quotient | 0.10 | p>0.05 | 0.12 | p>0.05 |

p<0.05*

According to the Kolgomorov-Smirnov Goodness-of-Fit Tests for the complete dataset (Table 31), only the Locomotor subscale of the No FASD group deviates from the normal distribution, while all other subscales of both groups follow a normal distribution. However, the p-values for these normal distributed scores are not exceptionally high. Hence, these normality indices were interpreted with caution. The slight skewness in the distribution of these GMDS/GMDS-ER scores are represented in Appendix H by figures 37 to 88.

For the initial dataset, only the Locomotor subscale ($d$=0.18; p>0.05) of the FASD group deviates from the normal distribution. All other subscales of the FASD group within the initial and follow-up data sets adhered to a normal distribution. For the No FASD group, all subscales of the initial and follow-up data sets do not deviate from the normal distribution, except for the Locomotor subscale ($d$=0.95; p>0.05) of the initial data set, which shows a deviation from the normal distribution.

Descriptive statistics were calculated to investigate the general trends between the FASD and No FASD groups within the complete dataset. The outcomes obtained from these analyses were used to describe the data distribution. Table 32 and Table 33 show the descriptive statistics of the depression scales.

When BDI scores fall toward the lower range, an individual is less likely to be depressed, while with escalating BDI scores, symptoms of depression increase and have the potential of interfering with an individual's general functioning. While BDI means for the two groups are similar, the FASD sample shows a greater variance when compared to the No FASD group. The

initial assessment shows the FASD group has a higher BDI score mean than the No FASD group (Table 32). The difference between these means decrease in the follow-up assessment. There are a proportion of FASD and No FASD mothers that displayed depression in the severe category both at the initial and at the follow-up assessments. The average level of depression of the No FASD group moves from moderate (16-23) at the initial assessment to mild (10-15) at the follow-up assessment. The average BDI scores of the FASD group though tend to remain constant over the two assessment periods, falling within the mild level of depression. These results imply that the severity of maternal depression between the mothers who returned for both assessments of the FASD and No FASD groups were within the similar range of mild depression.

Table 32

*Descriptive Statistics of the Severity of Depression (BDI)*

| | | FASD | No FASD |
|---|---|---|---|
| Initial Assessment | N | 13 | 28 |
| | Mean | 19.69 | 16.82 |
| | Std Dev | 15.55 | 9.38 |
| | Minimum | 0.00 | 1.00 |
| | Maximum | 51.00 | 37.00 |
| Follow-up Assessment | N | 13 | 28 |
| | Mean | 15.46 | 14.29 |
| | Std Dev | 15.42 | 11.12 |
| | Minimum | 0.00 | 0.00 |
| | Maximum | 42.00 | 45.00 |

Observing BDI scores for the initial and follow-up datasets, the follow-up data set compared to the initial dataset displays a higher mean ($\bar{x}$=18.80; SD=19.07) for the FASD group and a lower mean ($\bar{x}$=16.70; SD=12.45) for the No FASD group. The FASD group has a greater variance than the No FASD group, which could be due to the smaller FASD sample size in the follow-up data set (n=10). In both groups within the initial and follow-up data sets, a few mothers show severe (24-63) levels of depression.

In order to assess the evidence of current symptoms of depression the POMS was administered at follow up assessment only. Descriptive statistics for the subscales of the POMS within the complete dataset are highlighted in Table 33.

Table 33

*Descriptive Statistics of Maternal Current Mood States (POMS subscales)*

| | FASD (n=13) | | | | No FASD (n=28) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std Dev | Minimum | Maximum | Mean | Std Dev | Minimum | Maximum |
| Tension | 42.08 | 11.29 | 31.00 | 76.00 | 43.82 | 8.87 | 33.00 | 67.00 |
| Depression | 43.54 | 6.91 | 37.00 | 63.00 | 46.96 | 9.67 | 37.00 | 67.00 |
| Anger | 41.15 | 7.36 | 37.00 | 64.00 | 45.57 | 11.13 | 37.00 | 82.00 |
| Fatigue | 37.85 | 7.43 | 34.00 | 58.00 | 43.11 | 10.11 | 34.00 | 70.00 |
| Confusion | 40.23 | 3.37 | 37.00 | 44.00 | 44.21 | 7.43 | 30.00 | 61.00 |
| Vigor | 56.54 | 9.65 | 33.00 | 73.00 | 49.50 | 12.21 | 26.00 | 70.00 |

The mean standard score for each scale of the POMS is 50 with a standard deviation of 10 within the standardized sample (McNair, Lorr & Droppleman, 1992). The POMS scores represented in Table 33 shows that the average scores for the POMS subscales are slightly lower

than the standardized average of 50, yet within the range of acceptable scores (40-60). In the No FASD group these acceptable ranges are evident, except for the Vigor subscale that is close to the average. For the subscales of Tension, Depression, Anger and Confusion there is a similar trend of the subscale averages being below the expected norm of 50 for the FASD group. The Fatigue subscale differs for the FASD group where the scores are lower than the expected average. The spread of scores of the Vigor subscale for the FASD and No FASD groups are noticeably larger than the other subscales. The Tension subscale within the FASD group shows the second largest diversity. The diversity of the scores of the Vigor subscale is the largest within the No FASD group. As a note, the scores from the follow-up data set follow a similar pattern to the complete data set that is described.

Descriptive statistics for maternal variables in the complete dataset that include demographics (age, education, employment, total reported income and marital status); pregnancy history (contraception use, pregnancy intent, total number of pregnancies, total number of live births, total number of miscarriages); health factors (maternal weight and TB diagnosis); and risky behavior during pregnancy (drug use, alcohol use and smoking during pregnancy) are outlined from Table 34 to Table 43 respectively.

Table 34

*Descriptive Statistics of Maternal Age*

| | FASD | No FASD |
|---|---|---|
| N | 13 | 28 |
| Mean | 33.85 | 30.32 |
| Std Deviation | 6.99 | 6.05 |
| Minimum | 22.00 | 20.00 |
| Maximum | 42.00 | 44.00 |

The age range of mothers of both groups shows that they continue to have children into an advanced maternal age. T-test comparisons were run to confirm if these differences were significant. The results displayed in Table 62 show that the maternal age between the groups is not significantly different ($t(39) = -1.65$; $p>0.05$).

As a note, the average age of mothers with a FASD infant did not differ from that of mothers with a No FASD infant within the initial data set. However, there were slight differences in age between the groups within the follow-up data set. Since the follow-up data set is not a focus of the analysis, additional statistics were not implemented to determine whether these differences were significant.

The descriptive statistics of the mother sample for educational status are represented in Table 35.

Table 35

*Descriptive Statistics of Educational Status*

| | | FASD | No FASD |
|---|---|---|---|
| | N | 13 | 28 |
| School History | Standard 1 - Standard 5 | 5 (38.46%) | 4 (14.29%) |
| | Standard 6- Standard 10 | 7 (53.85%) | 24 (85.71%) |
| | Unknown | 1 (7.69%) | 0 (0%) |
| | Missing | 2 (15.38%) | - |
| Post School Studies | Yes | 2 (15.38%) | 1 (3.57%) |
| | No | 11 (84.61%) | 27 (96.43%) |

Table 35 shows that most mothers within this sample had some form of secondary schooling career. Although the majority of the women within the FASD and No FASD group did not study further, most of the mothers in both groups received some level of school education. More mothers within the No FASD group received high school education when compared to mothers within the FASD group. Less than ten percent in both groups of mothers within this specific community setting furthered their studies at a tertiary level. Due to the small sample size educational status was classified into four groups (Standard 1-5, Standard 6-10, Standard 1-5 and tertiary, Standard 6-10 and tertiary). Fishers exact test of independence were run to confirm

if these differences were significant. The results indicate that the differences in educational status between the groups are not significantly different ($p>0.05$).

Within the initial and follow-up data sets mothers from both groups had some form of schooling, where most did not study further.

The descriptive statistics of the mother sample for maternal employment are represented in Table 36.

Table 36

*Descriptive Statistics of Employment Status*

| | FASD | No FASD |
|---|---|---|
| N | 13 | 28 |
| Missing Data | 2 (15.38%) | 1 (3.57%) |
| Unemployed | 10 (76.92%) | 22 (78.57%) |
| Employed | 1 (7.69%) | 5 (17.86%) |

The majority of the mothers in the FASD and No FASD groups are unemployed. It is highly likely that the mothers who were able to return for both the initial and follow-up assessments could do so because they were unemployed, whereas those that had some form of employment attended only one of the evaluations that were required at two different time periods. Since this sample came from a disadvantaged background, the socio-economic and living conditions of mothers within this area need to be considered when analyzing and generalizing these results to

other cohorts. Chi square comparisons were run to confirm if these differences were significant. The results displayed in Table 56 show that the employment status between the groups is not significantly different ($c^2 = 0.73$; $p>0.05$).

As a note, most of the mothers within the initial and follow-up data sets were employed either on a full time, part-time or seasonal basis.

The descriptive statistics of the mother sample for total reported income are represented in Table 37.

Table 37

*Descriptive Statistics of Monthly Income*

| | FASD | No FASD |
|---|---|---|
| N | 13 | 28 |
| Mean | 514.61 | 945.89 |
| Std Deviation | 825.65 | 1134.39 |
| Minimum | 0.00 | 0.00 |
| Maximum | 3000.00 | 5000.00 |

Total reported income was based on information collected from self-report. Some women worked part-time and earned a weekly income that was not consistent, some women only received grants while others earned a monthly salary. Total reported income included the total of all income received by the participant at the time of the interview. The average total reported

income of women within the FASD group is lower when compared to the monthly income of women within the No FASD group. T-test comparisons were run to confirm if these differences were significant. The results displayed in Table 62 show that the income status between the groups is not significantly different ($t(39) = 1.22$; $p > 0.05$). As a note the income status of women for the initial and follow-up data sets show a similar trend where women in the FASD group report a lower income when compared to the No FASD group.

The descriptive statistics of the mother sample for marital status are represented in Table 38.

Table 38

*Descriptive Statistics of Marital Status*

| | FASD | No FASD |
|---|---|---|
| N | 13 | 28 |
| Unmarried | 9 (69.23%) | 19 (67.86%) |
| Married | 4 (30.77%) | 9 (32.14%) |

Mothers who returned for both the initial and follow-up assessments of the FASD and No FASD groups are single and come from an environment where they receive minimal social support. Table 38 highlights that most mothers independently managed their households. Due to the small sample size marital status was classified into two groups, married and unmarried. Chi square comparisons were run to confirm if these differences were significant. The results displayed in Table 57 show that marital status between the groups is not significantly different ($c^2 = 0.0077$; $p > 0.05$).

As a note, the majority of mothers in both groups of the initial data set were married, while most mothers within the follow-up data set were single.

Descriptive Statistics of contraception use and intention to fall pregnant are represented in Table 39.

Table 39

*Descriptive Statistics of Contraception Use and Pregnancy Intent*

| | | FASD (n=13) | No FASD (n=28) |
|---|---|---|---|
| Contraception Use | Yes | 8 (61.54%) | 19 (67.86%) |
| | No | 5 (38.46%) | 9 (32.14%) |
| Pregnancy Intent | Yes | 6 (46.15%) | 11 (39.29%) |
| | No | 7 (53.85%) | 17 (60.71%) |

The majority of mothers in both the FASD and No FASD groups report using some form of contraception. Chi square comparisons were run to confirm if these differences were significant. The results displayed in Table 58 indicate that contraception use ($c^2 = 0.16$, $p>0.05$) was not significant. More than half the mothers within the FASD and No FASD groups did not intend to fall pregnant and indicated that the number of unplanned pregnancies outweighs the number of planned pregnancies within this community. Chi square comparisons were run to confirm if

these differences were significant. The results displayed in Table 58 show that the intention to fall pregnant between the groups is not significantly different ($c^2 = 0.17$; $p>0.05$).

A similar trend was observed for the initial and follow-up data sets for contraception use and intention to fall pregnant.

The descriptive statistics of the mother sample for total number of pregnancies, total number of live births and total number of miscarriages are represented in Table 40.

Table 40

*Descriptive Statistics for the Total Number of Pregnancies, Live Births and Miscarriages*

| | | Mean | Std Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| FASD (n=13) | Total pregnancies | 3.30 | 1.97 | 1 | 6 |
| | Total live births | 2.77 | 1.48 | 1 | 5 |
| | Total miscarriages | 0.54 | 1.19 | 0 | 4 |
| No FASD (n=28) | Total pregnancies | 2.75 | 1.55 | 1 | 7 |
| | Total live births | 2.57 | 1.48 | 1 | 7 |
| | Total miscarriages | 0.18 | 0.55 | 0 | 2 |

The total number of pregnancies and the total number of live births between mothers with a FASD infant and mothers without a FASD infant were similar within this community where both groups have an average of three children. Due to the small sample size the total number of pregnancies and the total number of live births were classified into two groups (0-3

pregnancies/live births and >=4 pregnancies/live births). Chi square comparisons for total number of pregnancies and total number of live births were run to confirm if these differences were significant. The results displayed in Table 60 and Table 61 respectively show that the differences in parity ($c^2$=1.22; p>0.05) and the difference in the number of live births between the groups are not significant ($c^2$=1.31; p>0.05). As a note, mothers within the initial and follow-up data sets also have an average of three children. Women within the FASD group reported having more miscarriages when compared to the No FASD group. A Fishers exact test of independent was calculated to determine if there was a significant difference between the groups regarding the total number of miscarriages. The results show that the differences in the total number of miscarriages between the groups are not significant (p>0.05). As a note, the total reported miscarriages are higher in the FASD group when compared to the No FASD group for the initial and follow-up datasets.

The descriptive statistics of the mother sample for maternal weight are represented in Table 41. There is large variation between the scores from this analysis. Although the average maternal weight was similar between the FASD and No FASD group, the mean is lower for the FASD group when compared to the No FASD group, which suggests that many mothers with a FASD infant were within the lower weight range. T-test comparisons were run to confirm if these differences were significant. The results displayed in Table 62 show that the maternal weight between the groups is not significantly different (t (35) = 0.45; p>0.05).
As a note, mothers with a FASD infant on average weighed lower than mothers without a FASD infant within the initial data set, while there were only slight differences in weight between mothers of the follow-up data set.

Table 41

*Descriptive Statistics of Maternal Weight*

| | FASD | No FASD |
|---|---|---|
| N | 12 | 25 |
| Missing | 1 | 3 |
| Mean | 56.39 | 59.13 |
| Std Deviation | 18.87 | 16.46 |
| Minimum | 35.00 | 29.20 |
| Maximum | 89.50 | 91.10 |

The descriptive statistics of the mother sample for TB Diagnosis are represented in Table 42. Most of the mothers within these groups were not diagnosed with Tuberculosis (TB). A Fisher's exact test of independence was run to confirm if these differences were significant. The results show that the differences for TB diagnosis between the groups are not significant ($p>0.05$). As a note, TB diagnosis shows a similar trend for the initial and follow-up data sets.

Table 42

*Descriptive Statistics of TB Diagnosis*

| | | FASD (n=13) | No FASD (n=28) |
|---|---|---|---|
| TB Diagnosis | Yes | 2 (15.38%) | 5 (17.86%) |
| | No | 11 (84.62%) | 23 (82.14%) |

The descriptive statistics of the mother sample for risky behaviours (alcohol use during pregnancy, smoking during pregnancy and drug use during pregnancy) are represented in Table 43.

A higher percentage of mothers in the FASD group indicate that they smoked during pregnancy, while an elevated number of mothers in the No FASD group report that they did not smoke during their pregnancy or never smoked. Drug use during pregnancy is not commonly reported by this sample. Within the FASD and No FASD groups, most mothers report that they did not use drugs during pregnancy while a fewer number never used drugs. When comparing the FASD to the No FASD group, a higher percentage of mothers within the No FASD group never used drugs, while a higher percentage of mothers within the FASD group reported that they did not use drugs during pregnancy. It is likely that some of these women may have reported using drugs at other times but not during pregnancy.

Table 43

*Descriptive Statistics of Risky Behaviour During Pregnancy*

| | FASD (n=13) | | | | No FASD (n=28) | | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | Never | Unknown/Missing | Yes | No | Never | Unknown/Missing |
| Alcohol use | 11 (84.61%) | 0 (0%) | 1 (7.69%) | 1 (7.69%) | 6 (21.43%) | 0 (0%) | 22 (78.57%) | 0 (0%) |
| Smoking | 10 (76.92%) | 1 (7.69%) | 2 (15.38%) | 0 (0%) | 11 (39.28%) | 5 (17.86%) | 12 (42.86%) | 0 (0%) |
| Drug use | 0 (0%) | 12 (92.31%) | 1 (7.69%) | 0 (0%) | 0 (0%) | 16 (57.14%) | 11 (39.28%) | 1 (3.57%) |

As anticipated, mothers that returned for both visits within the FASD group admitted to drinking during pregnancy. It was expected that mothers within the No FASD group would deny drinking during pregnancy or would report abstinence from alcohol in general. However, a percentage of mothers in the No FASD group admit to drinking during pregnancy, despite their infants not being diagnosed with FASD. This finding highlights the complexity of FASD diagnosis and the difficulty in identifying factors that could interfere with delayed infant development within deprived communities. A Fisher's exact tests of independence were run to confirm if these differences for alcohol use and smoking were significant. According to the results group differences are only evident for alcohol use ($p<0.05$*) and smoking ($p<0.05$*). No further group comparisons were implemented for drug use, as all participants reported never using drugs, therefore any further analysis would be biased. It must be noted alcohol use during pregnancy, smoking during pregnancy and drug use during pregnancy of the initial and follow-up data sets follow a similar trend as described above.

Descriptive statistics for the GMDS/GMDS-ER profiles provide a general understanding of the spread of scores between the FASD and the No FASD groups. Refer to Table 44 for a summary of the scores.

Table 44

*Descriptive Statistics on the GMDS-ER Subscales*

| | | FASD (n=13) | | | | No FASD (n=28) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GMDS-ER subscales | Mean | Std Dev | Minimum | Maximum | Mean | Std Dev | Minimum | Maximum |
| Initial Assessment | Locomotor | 82.08 | 21.59 | 57.00 | 137.00 | 94.21 | 18.86 | 50.00 | 150.00 |
| | Personal Social | 92.85 | 17.62 | 67.00 | 125.00 | 106.93 | 14.21 | 75.00 | 127.00 |
| | Hearing & Language | 93.15 | 10.14 | 78.00 | 114.00 | 104.64 | 10.65 | 82.00 | 128.00 |
| | Eye Hand Coordination | 89.85 | 17.66 | 60.00 | 118.00 | 106.21 | 16.72 | 68.00 | 140.00 |
| | Performance | 84.00 | 16.99 | 50.00 | 119.00 | 98.46 | 14.40 | 72.00 | 127.00 |
| | Practical Reasoning | – | – | – | – | – | – | – | – |
| | Developmental Quotient | 88.15 | 15.13 | 63.00 | 118.00 | 102.07 | 11.17 | 80.00 | 126.00 |
| Follow-Up Assessment | Locomotor | 86.69 | 15.41 | 69.00 | 125.00 | 111.57 | 24.98 | 58.00 | 156.00 |
| | Personal Social | 93.23 | 23.48 | 69.00 | 155.00 | 111.32 | 19.40 | 84.00 | 166.00 |
| | Hearing & Language | 74.92 | 22.70 | 37.00 | 116.00 | 78.54 | 13.67 | 51.00 | 108.00 |
| | Eye Hand Coordination | 79.62 | 15.07 | 53.00 | 110.00 | 82.86 | 13.33 | 60.00 | 112.00 |
| | Performance | 76.00 | 15.20 | 50.00 | 97.00 | 81.86 | 16.49 | 46.00 | 112.00 |
| | Practical Reasoning | 80.00 | 13.32 | 58.00 | 103.00 | 81.07 | 12.97 | 60.00 | 107.00 |
| | Developmental Quotient | 81.62 | 13.56 | 58.00 | 111.00 | 90.89 | 10.86 | 68.00 | 110.00 |

A decrease in the scores is evident for the Hearing and Language, Eye Hand Coordination, Performance and Developmental Quotient from the initial to the follow-up assessment of the FASD group. The performance of the infants on the Locomotor and Personal Social subscales did not differ drastically when compared to the performance of the infants on the other scales of development. A similar trend of a decrease in developmental scores on the Hearing and Language, Eye Hand Coordination, Performance and Developmental Quotient was noticed within the No FASD group over time and these individuals continued to perform below the expected mean range on these subscales. T-test comparisons were run to confirm if these differences were significant.

According to the MANOVA results from Table 66 the Locomotor subscale shows no significant difference between the groups at the initial assessment (F-statistic = 3.36; p>0.05), while there is a significant difference between the FASD and the No FASD groups at the follow-up assessment (F-statistic = 10.88; p<0.05*). The FASD and the No FASD groups appear to be significantly different on the initial assessment (F-statistic = 8.22; p<0.05*) for the Eye Hand Co-ordination subscale. Yet no important difference is evident between the groups on the follow-up assessment (F-statistic = 0.48; p>0.05). For the Hearing and Language subscales, a significant difference between the FASD and the No FASD groups at the initial assessment (F-statistic = 10.64; p<0.05*) is evident. However, there is no statistical significant difference between the groups at the follow-up visit (F-statistic = 0.40; p>0.05) on this subscale. In comparing the Performance subscale across groups, a statistical significant difference is evident between the FASD and No FASD group only at the initial assessment (F-statistic = 7.99; p<0.05*) where the FASD group performs lower than the No FASD group. However, there is no significant difference between the groups at the follow-up assessment (F-statistic = 1.17; p>0.05) on the Performance subscale. No significant statistical difference is evident between the FASD and No FASD groups on the Practical Reasoning subscale at the follow-up assessment (F-statistic = 0.06; p>0.05). A significant statistical difference is evident between the groups at both initial (F-statistic = 7.48; p<0.05*) and follow-up (F-statistic = 6.75; p<0.05*) assessments of the Personal Social subscale.

As a note, for the initial data set, all the GMDS subscales of the No FASD group are within the mean range (100) for all subscales. The Locomotor ($\bar{x}$=86.74; SD=17.53) and Performance ($\bar{x}$=86.35; SD=14.80) of the FASD group fall below the expected mean range (100) for the

initial data set and these averages are lower than the Locomotor ($\bar{x}$=98.68; SD=18.92) and Performance ($\bar{x}$=96.74; SD=14.63) subscales of the No FASD group. For the sample that only attended the follow-up assessment, the scores obtained by the FASD group on all subscales are noticeably lower when compared to those of the No FASD group. The average scores of the No FASD group are also low, with the exception of the Locomotor ($\bar{x}$=106.41; SD=25.21) and Personal Social ($\bar{x}$=105.80; SD=22.60) subscales for the follow-up data set.

Inferential statistics and multivariate analysis were conducted on the complete data set for those that attended the two required evaluations to determine whether the differences found between the groups were significant, while no further analysis was conducted on the initial and follow-up data sets as individual comparisons were not possible. The sections that follow refer to the analyses carried out for the specific hypotheses.

### 3.3 Research Hypothesis One

Research hypothesis one addresses differences in maternal depression between mothers with a FASD infant and mothers whose infants did not display symptoms of FASD. Tests to assess between group differences and within group differences were used to investigate this hypothesis.

An Analysis of Variance (ANOVA) was calculated to determine whether any significant group differences would emerge for the severity of depression at the initial and follow-up assessments. Table 45 shows the outcome of this analysis.

Table 45

*ANOVA of the Severity of Depression at the Initial and Follow-up Assessments*

| Source | DF | Mean Square | Type III Error | F-Statistic | p-value |
|---|---|---|---|---|---|
| Initial Assessment | 1 | 73.17 | 73.17 | 0.54 | p>0.05 |
| Follow-up Assessment | 1 | 12.27 | 12.27 | 0.08 | p>0.05 |

p<0.05*

There are no significant differences between the groups for the severity of depression at the initial and follow-up assessments. Differences between the groups for the depression scales that were implemented only at the follow-up assessment were further assessed.

A Multivariate Analysis of Variance (MANOVA) was computed to determine whether any significant group differences would emerge for these depression scales assessed at follow-up. Table 46 outlines the variables used in this model and Table 47 displays the outcome of this procedure.

Table 46

*Variables Used in the MANOVA Model*

| Independent Variable | Dependent Variables |
|---|---|
| FASD & No FASD groups | Follow-up BDI & POMS subscales |

Note:
BDI: Beck Depression Inventory
FASD: Fetal Alcohol Spectrum Disorder
No FASD: No Fetal Alcohol Spectrum Disorder
POMS: Profile of Mood States

Table 47

*MANOVA of the Depression Scales at the Follow-up Assessment*

| Source | DF | Mean Square | Error | F-Statistic | p-value |
|---|---|---|---|---|---|
| Follow-up Depression | 1 | 12.27 | 158.69 | 0.08 | p>0.05 |
| Tension | 1 | 27.02 | 93.77 | 0.29 | p>0.05 |
| Depression | 1 | 104.19 | 79.49 | 1.31 | p>0.05 |
| Anger | 1 | 173.25 | 102.37 | 1.69 | p>0.05 |
| Vigor | 1 | 439.82 | 131.85 | 3.34 | p>0.05 |
| Fatigue | 1 | 245.73 | 87.75 | 2.8 | p>0.05 |
| Confusion | 1 | 140.88 | 41.67 | 3.38 | p>0.05 |

p<0.05*

There is no significant difference across all dependent variables (Wilks' Lambda $F(7, 41) = 1.62$, $p>0.05$), implying that the overall depression score of the FASD group is not significantly different from that of the No FASD group. No significant main effects emerged on any of the seven dependent variables between the groups, suggesting that the severity of depression and the current mood states of the mothers did not differ between the FASD and No FASD group at the follow-up assessment.

Since the MANOVA found no significant differences between the groups for depression at follow-up, and with past literature indicating that initial symptoms of depression could have an influence on the outcome of later symptoms of depression, a MANCOVA was implemented. The initial BDI score was included as a covariate in the model to remove the bias that this variable could contribute to the dependent variables being measured. Table 48 outlines the variables used in this model and Table 49 displays the outcome of this procedure.

**Table 48**

*Variables Used in the MANCOVA MODEL*

| Independent Variable | Dependent Variables | Covariate |
|---|---|---|
| FASD & No FASD groups | Follow-up BDI & POMS subscales | Initial BDI |

Note:
BDI: Beck Depression Inventory
FASD: Fetal Alcohol Spectrum Disorder
No FASD: No Fetal Alcohol Spectrum Disorder
POMS: Profile of Mood States

Table 49

*MANCOVA of the Depression Scales Between the Groups*

| | Source | DF | Mean Square | Error | F-Statistic | p-value |
|---|---|---|---|---|---|---|
| Dependent Variables | Follow-up BDI | 1 | 1223.84 | 130.66 | 9.37 | p<0.05* |
| | Tension | 1 | 259.15 | 89.42 | 2.90 | p>0.05 |
| | Depression | 1 | 368.77 | 71.88 | 5.13 | p<0.05* |
| | Anger | 1 | 236.64 | 98.84 | 2.39 | p>0.05 |
| | Vigor | 1 | 77.95 | 133.27 | 0.58 | p>0.05 |
| | Fatigue | 1 | 506.54 | 76.73 | 6.60 | p<0.05* |
| | Confusion | 1 | 267.46 | 35.72 | 7.49 | p<0.05* |

p<0.05*

Note

BDI: Beck Depression Inventory

Overall, the initial symptoms of depression are not related to depression at follow-up between the groups (Wilks' Lambda F (7, 41) = 1.85, p>0.05). However, the univariate tests indicate that when the effects of the initial BDI scores are statistically controlled, there are significant differences in means between the FASD and No FASD groups for the follow-up BDI total score, and for Depression, Fatigue and Confusion subscales. These differences relate solely to the specified dependent variables where a level of significance was found, but this does not imply an overall difference in depression between the groups.

A Repeated Measures Analysis of Variance was subsequently implemented to explore within group comparisons for the initial and follow-up assessments. By collecting data from the same participants under repeated conditions it was possible to eliminate the individual differences or reduce individual differences as a source of between group differences. In this analysis, both points of assessment were included for each group to determine if there is a significant change over time and if there was a change in the severity of depression over time. The results of this analysis are shown in Table 50.

Table 50

*Repeated Measures ANOVA of the BDI for the FASD and No FASD groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Time | 1 | 203.24 | 2.48 | p>0.05 |
| Time*Group | 1 | 12.75 | 0.16 | p>0.05 |
| Error | 39 | 81.84 | | |

p<0.05*

Note:

BDI: Beck Depression Inventory

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

The results obtained from the Repeated Measures ANOVA confirm there are no significant differences in maternal depression scores on the BDI between the initial and follow-up assessment for both the No FASD and the FASD groups, suggesting that depression scores did not change over the duration of the study.

Next, a Pearson's correlation analysis was carried out to determine if any trends would emerge within the groups at the initial and follow-up assessments for the BDI. The results of this analysis are shown in Table 51.

Table 51

*Correlation of the BDI Scores Within the FASD and No FASD groups*

| | FASD (n=13) | No FASD (n=28) |
|---|---|---|
| | Initial Assessment (BDI) | |
| Follow-up Assessment (BDI | α = 0.48<br>r = 0.32 | α = 0.73<br>r = 0.58* |

p<0.05*

Note:

BDI: Beck Depression Inventory

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

The results of the Pearson Correlation indicate that scores within the FASD group across the initial and follow-up assessments are not highly correlated and this outcome is possibly due to the small sample size and the presence of outliers. However, a moderate degree of correlation is apparent between the initial and follow-up BDI scores for the No FASD group. A Fisher's z

calculation was used to compare the two sets of correlations and the outcome shows that the relationship patterns for the FASD and No FASD group between the two time points are similar ($z = 0.88$; $p>0.05$). These results imply that the likelihood of differences in depression between the groups would be minimal.

Additional correlation tests were conducted within the FASD and No FASD groups to compare the severity of depression (BDI) at the initial and follow-up assessments to current mood states (as assessed on the POMS) at the follow-up assessment. These results are represented in Table 52 and Table 53 for the FASD and No FASD groups respectively.

Table 52

*Correlation Between the BDI and the POMS subscales Within the FASD group (n=13)*

| | POMS (Follow-up assessment only) | | | | | |
|---|---|---|---|---|---|---|
| | Tension | Depression | Anger | Vigor | Fatigue | Confusion |
| BDI initial assessment $\alpha = 0.86$ | r = 0.11 | r = 0.18 | r = 0.17 | r = 0.16 | r = 0.35 | r = 0.39 |
| BDI follow-up assessment $\alpha = 0.89$ | r = 0.60* | r = 0.74* | r = 0.57* | r = -0.18 | r = 0.76* | r = 0.57* |

p<0.05*

Note:

BDI: Beck Depression Inventory

FASD: Fetal Alcohol Spectrum Disorder

POMS: Profile of Mood States

The BDI total score at the initial visit is not significantly associated with any follow-up variables of the POMS within the FASD group. However, there are significant associations between the follow-up assessment BDI and follow-up self-reported symptoms of Tension, Depression, Anger, Fatigue and Confusion within the FASD group.

Table 53

*Correlation between the BDI and the POMS subscales within the No FASD group (n=28)*

| | POMS (Follow-up assessment only) | | | | | |
|---|---|---|---|---|---|---|
| | Tension | Depression | Anger | Vigor | Fatigue | Confusion |
| BDI initial assessment $\alpha = 0.83$ | r = 0.42* | r = 0.49* | r = 0.31 | r = -0.29 | r = 0.45* | r = 0.49* |
| BDI follow-up assessment $\alpha = 0.86$ | r = 0.59* | r = 0.64* | r = 0.49* | r = -0.03 | r = 0.61* | r = 0.68* |

p<0.05*
Note:
BDI: Beck Depression Inventory
No FASD: No Fetal Alcohol Spectrum Disorder
POMS: Profile of Mood States

Within the No FASD group, the BDI total score is significantly associated with follow-up symptoms of Tension, Depression, Fatigue and Confusion of the POMS. The BDI total score at follow-up correlates with POMS subscale scores of Tension, Depression, Anger, Fatigue and

Confusion. Since the BDI measures different constructs compared to the Vigor subscale, it is expected that there will not be any significant correlation between these scores.

These correlations were then used in the Fisher's z calculation to assess the importance of the difference between the significant associations. These z scores are represented in Table 54 and Table 55 for the initial and follow-up BDI scores respectively.

Table 54

*Fishers Z of the Initial BDI Total Correlated to the Follow-up POMS Subscales*

| Description of correlation | z-score | p-value |
|---|---|---|
| Correlation of the initial total BDI score with the follow-up Tension subscale of the POMS compared for the FASD and No FASD groups | 0.90 | p>0.05 |
| Correlation of the initial total BDI score with the follow-Up Depression subscale of the POMS for the FASD and No FASD groups | 0.95 | p>0.05 |
| Correlation of the initial total BDI score with the follow-up Fatigue subscale of the POMS for the FASD and No FASD groups | 0.32 | p>0.05 |
| Correlation of the initial total BDI score with the follow-up Confusion subscale of the POMS for the FASD and No FASD groups | 0.33 | p>0.05 |

p<0.05*

Note:

BDI: Beck Depression Inventory

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

POMS: Profile of Mood States

The outcome of the Fisher's z calculation indicates that the relationship pattern between the groups are similar for the association of the initial BDI total score with the Tension, Depression, Fatigue and Confusion subscales of the POMS.

Table 55

*Fishers Z of the Follow-up BDI Total Correlated to the Follow-up POMS Subscales*

| Description of correlation | z-score | p-value |
|---|---|---|
| Correlation of the follow-up total BDI score with the follow-up Tension subscale of the POMS for the FASD and No FASD groups | 0.60 | p>0.05 |
| Correlation of the follow-up total BDI score and the follow-up Depression subscale of the POMS for the FASD and No FASD groups | 0.74 | p>0.05 |
| Correlation of the follow-up total BDI score and the follow-up Anger subscale of the POMS for the FASD and No FASD groups | 0.57 | p>0.05 |
| Correlation of the follow-up total BDI score and the follow-up Fatigue subscale of the POMS for the FASD and No FASD groups | 0.76 | p>0.05 |
| Correlation of the follow-up total BDI score and the follow-up Confusion subscale of the POMS for the FASD and No FASD groups | 0.57 | p>0.05 |

p<0.05*

Note:
BDI: Beck Depression Inventory
FASD: Fetal Alcohol Spectrum Disorder
No FASD: No Fetal Alcohol Spectrum Disorder
POMS: Profile of Mood States

A similar pattern is evident for the association between the follow-up BDI total scores and Tension, Depression, Anger, Fatigue and Confusion subscales of the POMS as that found in Table 54.

In summary, there are no significant differences between the groups for the severity of depression. In addition, associations between BDI and the subscales of the POMS at the initial and follow-up assessments between the FASD and No FASD groups follow a similar pattern. Hence, the MANOVA confirms the expectation of no significant differences between the groups. Further confirmation of the similarity of the groups is evident from the results of the Repeated Measures ANOVA. Despite mothers in this sample displaying some level of depression, there are no trends in depression that differentiates mothers with a FASD infant from mothers without a FASD infant.

### 3.4 Research Hypothesis Two

Research hypothesis two investigated the relationship between demographic, reproductive and maternal health factors that could be associated with depression levels of the mother samples.

Chi Square analysis to determine frequency differences were carried out for the dichotomous variables of employment (Table 56), marital status (Table 57), contraception use (Table 58), pregnancy intent (Table 59), total number of pregnancies (Table 60), total number of live births (Table 61) which met the sample size requirements for this analysis. A Fishers exact test of independence was carried out for the nominal variables of education, total number of miscarriages, TB diagnosis, alcohol use during pregnancy and smoking during pregnancy as these variables did not meet the expected frequency requirement for a Chi Square Analysis. Variables such as education, total number of pregnancies, total number of live births and the total number of miscarriages were categorized into groups for the Chi Square and Fisher's exact

test of independence analysis to determine if there were significant differences between the FASD and No FASD groups. Tests of statistical significance and determining practical applicability were used as markers to select potential covariates for the Analysis of Covariance (ANCOVA).Only two variables were selected for inclusion into the ANCOVA due to the modest sample size.

The descriptive data for the frequency of drug use during pregnancy shows that none of the women in FASD and No FASD groups reported using drugs during pregnancy. Since there were no differences between the groups the level of significance could not be considered, as the relevance would be biased toward one direction therefore drug use during pregnancy was not included as a potential covariate. A significant difference between the FASD and No FASD groups from the outcome of Fishers exact test of independence on the reported use of alcohol during pregnancy ($p<0.05$*) emerged. Although this outcome was expected given that there would be differences between the groups based on the clinical classification of infants, there were also women in the No FASD group who reported using alcohol during pregnancy. The use of alcohol during pregnancy was considered a potential covariate as there was a statistical difference between the groups for this variable and has implications for the vulnerability of women within this sector of community. There was also a significant difference between the groups on smoking during pregnancy from the outcome of the Fishers exact test of independence ($p<0.05$*). Therefore this variable was also selected as a potential covariate. According to the Fishers exact test of independence there were no significant differences between the group for educational status, total number of miscarriages and TB diagnosis. Due to the lack of statistical significance these variables were not considered as potential covariates.

Descriptive statistics for the variables of employment, marital status, contraception use, pregnancy intent, total number of pregnancies, total number of live births, show a variation in the spread of scores between the FASD and No FASD groups. The results for the Chi Square analysis to compare differences between the groups for these variables are shown from Table 56 to Table 61.

Table 56

*Chi Square Analysis of Employment*

| | | Employed | Unemployed | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 1 (7.69) | 12 (92.31) | | |
| | | | | 1 | p>0.05 |
| No FASD (n=28) | n (%) | 5 (17.86) | 23 (82.14) | | |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

There was no significant difference between the FASD and No FASD groups for employment ($c^2 = 0.73$, $p>0.05$). Therefore, this variable was not selected as a potential covariate.

The results for the Chi Square analysis to compare differences between the groups for marital status are represented in Table 57.

Table 57

*Chi Square Analysis of Marital Status*

| | | Married | Unmarried | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 4 (30.77) | 9 (69.23) | 1 | p>0.05 |
| No FASD (n=28) | n (%) | 9 (32.14) | 19 (67.86) | | |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

There was no significant difference between the FASD and No FASD groups for marital status ($c^2 = 0.0077$, $p>0.05$). Therefore, this variable was not included as a potential covariate.

The results for the Chi Square analysis to compare differences between the groups for contraception use are represented in Table 58.

Table 58

*Chi Square Analysis of Contraception use*

| | | Yes | No | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 8 (61.54) | 5 (38.46) | | |
| No FASD (n=28) | n (%) | 19 (67.86) | 9 (32.14) | 1 | p>0.05 |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

There was no significant difference between the FASD and No FASD groups for contraception ($c^2 = 0.16$, $p>0.05$). Therefore this variable was not included as a potential covariate.

The results for the Chi Square analysis to compare differences between the groups for pregnancy intent are represented in Table 59.

Table 59

*Chi Square Analysis of Intention to Become Pregnant*

| | | Yes | No | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 6 (46.15) | 7 (53.85) | 1 | p>0.05 |
| No FASD (n=28) | n (%) | 11 (39.29) | 17 (60.71) | | |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

There was no significant difference between the FASD and No FASD groups for pregnancy intent ($c^2 = 0.17$, $p>0.05$). Therefore, this variable was not included as a potential covariate.

The results for the Chi Square analysis to compare differences between the groups for total number of pregnancies are represented in Table 60. There was no significant difference between the FASD and No FASD groups for total number of pregnancies ($c^2 = 1.22$, $p>0.05$). Therefore, this variable was not included as a potential covariate.

Table 60

*Chi Square Analysis of the Total Number of Pregnancies*

| | | Yes | No | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 7 (53.85) | 6 (46.15) | | |
| No FASD (n=28) | n (%) | 20 (71.43) | 8 (28.57) | 1 | p>0.05 |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

The results for the Chi Square analysis to compare differences between the groups for total number of live births are represented in Table 61. There was no significant difference between the FASD and No FASD groups for total number of live births ($c^2 = 1.31$, $p>0.05$). Therefore, this variable was not included as a potential covariate.

Table 61

*Chi Square Analysis of Total Number of Live Births*

| | | Yes | No | df | p-value |
|---|---|---|---|---|---|
| FASD (n=13) | n (%) | 22 (78.57) | 6 (21.43) | | |
| | | | | 1 | p>0.05 |
| No FASD (n=28) | n (%) | 8 (61.54) | 5 (38.46) | | |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

For continuous variables of maternal age, weight and income, the "t-test" procedure was implemented to compare differences between the FASD and the No FASD groups of mothers that attended both the initial and the follow up assessments (Table 62). Variables that were significantly different when compared between the FASD and No FASD groups were included in the ANCOVA model.

Table 62

*Group Differences between Maternal Variables of Age, Weight and Income*

| | FASD (n=13) | | No FASD (n=28) | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t statistic | p value |
| Age | 33.85 | 7.00 | 30.32 | 6.05 | -1.65 | p >0.05 |
| Mother's weight | 56.39 | 18.87 | 59.13 | 16.46 | 0.45 | p >0.05 |
| Income (per month) | 515 | 825.65 | 945.89 | 1134.39 | 1.22 | p >0.05 |

p <0 .05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

According to Table 62 there are no significant differences between the FASD and No FASD groups with regards to maternal age, weight and monthly income. None of these variables were included in the ANCOVA model. Alcohol use and smoking during pregnancy were selected as the potential covariates to include in the ANCOVA model. The ANCOVA model for the severity of depression and infant development are presented from Table 73 to Table 87 for the initial and follow-up assessments respectively.

Next, a Pearson's correlation analysis was carried out to determine if there were any significant relationships between maternal variables and BDI and POMs scores within each group at the initial and follow-up assessments as shown in Table 63 and Table 64 for the FASD and No FASD groups respectively.

Table 63

*Pearson Correlations Between Maternal Variables and the Depression Subscales of the FASD Group (n=13)*

| | MATERNAL VARIALBLES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessments | Age | Alcohol | Contraception | Drugs Pregnancy | Employment | Income | Marital Status | Mother's Weight | School | Tertiary | Smoking | TB | Total no. of live birth | Total no. of Miscarriages | Total no. of pregnancies |
| | α = 0.76 | α = 0.73 | α = 0.76 | α = 0.80 | α = 0.75 | α = 0.77 | α = 0.77 | α = 0.75 | α = 0.76 | α = 0.80 | α = 0.76 | α = 0.74 | α = 0.77 | α = 0.77 | α = 0.77 |
| **BDI Initial** | r = 0.05 | r = -0.35 | r = -0.18 | r = 0.07 | r = 0.10 | r = -0.28 | r = 0.48 | r = -0.16 | r = -0.50 | r = 0.05 | r = -0.24 | r = -0.17 | r = 0.31 | r = -0.07 | r = 0.19 |
| **BDI Follow-Up** | r = 0.20 | r = -0.24 | r = 0.33 | r = 0.18 | r = -0.62 | r = -0.26 | r = 0.44 | r = -0.24 | r = -0.16 | r = 0.40 | r = -0.24 | r = 0.11 | r = 0.03 | r = 0.008 | r = 0.03 |
| **Tension** | r = 0.007 | r = 0.14 | r = 0.26 | r = 0.13 | r = -0.05 | r = -0.11 | r = 0.16 | r = -0.28 | r = -0.18 | r = -0.13 | r = -0.06 | r = 0.36 | r = -0.05 | r = -0.22 | r = -0.17 |
| **Depression** | r = -0.01 | r = -0.05 | r = 0.19 | r = 0.28 | r = -0.25 | r = -0.28 | r = 0.33 | r = -0.40 | r = 0.004 | r = 0.16 | r = -0.11 | r = 0.23 | r = -0.11 | r = -0.06 | r = -0.12 |
| **Anger** | r = 0.03 | r = -0.19 | r = 0.21 | r = 0.17 | r = -0.04 | r = -0.23 | r = 0.16 | r = -0.43 | r = -0.22 | r = 0.13 | r = -0.04 | r = 0.19 | r = -0.02 | r = -0.16 | r = -0.11 |
| **Vigor** | r = -0.14 | r = 0.30 | r = 0.06 | r = 0.17 | r = 0.63* | r = -0.25 | r = -0.31 | r = 0.21 | r = -0.07 | r = -0.16 | r = 0.22 | r = -0.23 | r = 0.08 | r = -0.03 | r = 0.04 |
| **Fatigue** | r = 0.15 | r = -0.17 | r = 0.22 | r = 0.16 | r = -0.23 | r = -0.24 | r = 0.33 | r = -0.33 | r = -0.26 | r = 0.23 | r = -0.16 | r = 0.23 | r = 0.07 | r = 0.18 | r = 0.16 |
| **Confusion** | r = 0.06 | r = -0.33 | r = -0.15 | r = 0.29 | r = -0.46 | r = -0.29 | r = 0.44 | r = -0.45 | r = -0.21 | r = -0.03 | r = -0.19 | r = 0.29 | r = -0.10 | r = -0.18 | r = -0.19 |

p<0.05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

Table 64

*Pearson Correlations Between Maternal Variables and the Depression Subscales of the No FASD Group (n=28)*

| | MATERNAL VARIALBLES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessments | Age | Alcohol | Contraception | Drugs Pregnancy | Employment | Income | Marital Status | Mother's Weight | School | Tertiary | Smoking | TB | Total no. of live birth | Total no. of Miscarriages | Total no. of pregnancies |
| | α = 0.76 | α = 0.73 | α = 0.76 | α = 0.80 | α = 0.75 | α = 0.77 | α = 0.77 | α = 0.75 | α = 0.76 | α = 0.80 | α = 0.76 | α = 0.74 | α = 0.77 | α = 0.77 | α = 0.77 |
| **BDI Initial** | r = -0.05 | r = 0.24 | r = -0.36 | r = -0.06 | r = -0.11 | r = -0.02 | r = -0.26 | r = -0.31 | r = -0.14 | r = 0.23 | r = -0.12 | r = -0.23 | r = 0.01 | r = -0.14 | r = -0.04 |
| **BDI Follow-Up** | r = 0.06 | r = 0.18 | r = -0.22 | r = -0.07 | r = -0.09 | r = 0.13 | r = -0.21 | r = -0.05 | r = -0.19 | r = 0.04 | r = 0.06 | r = 0.20 | r = 0.29 | r = -0.03 | r = 0.26 |
| **Tension** | r = 0.23 | r = 0.04 | r = -0.15 | r = -0.18 | r = 0.08 | r = -0.16 | r = -0.19 | r = -0.26 | r = -0.33 | r = 0.15 | r = 0.15 | r = -0.02 | r = 0.19 | r = 0.44* | r = 0.34 |
| **Depression** | r = 0.04 | r = 0.08 | r = -0.10 | r = 0.18 | r = -0.15 | r = 0.02 | r = 0.05 | r = -0.37 | r = -0.11 | r = 0.20 | r = 0.26 | r = 0.14 | r = -0.01 | r = 0.15 | r = 0.04 |
| **Anger** | r = -0.04 | r = 0.22 | r = -0.19 | r = 0.16 | r = -0.08 | r = -0.03 | r = 0.08 | r = -0.47* | r = -0.12 | r = 0.15 | r = 0.31 | r = 0.08 | r = -0.13 | r = 0.33 | r = -0.009 |
| **Vigor** | r = 0.07 | r = -0.09 | r = 0.11 | r = 0.17 | r = -0.002 | r = 0.03 | r = 0.02 | r = 0.20 | r = 0.26 | r = -0.02 | r = -0.13 | r = 0.36 | r = 0.04 | r = 0.16 | r = 0.09 |
| **Fatigue** | r = -0.06 | r = 0.19 | r = -0.21 | r = 0.13 | r = -0.01 | r = 0.03 | r = -0.0009 | r = -0.43* | r = -0.17 | r = 0.06 | r = 0.14 | r = 0.15 | r = 0.006 | r = 0.25 | r = 0.09 |
| **Confusion** | r = 0.10 | r = 0.16 | r = -0.03 | r = 0.08 | r = -0.34 | r = 0.02 | r = 0.02 | r = -0.23 | r = -0.04 | r = 0.08 | r = 0.27 | r = -0.08 | r = 0.08 | r = -0.0006 | r = 0.08 |

p<0.05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

Table 63 shows that there is a significant positive relationship between Employment Status and Vigor subscale of the POMS. According to Fisher's z calculation, the relationship pattern for the FASD and No FASD groups of this association is similar ($z = 1.99$; $p>0.05$). According to Table 64, there is also a significant, positive relationship between maternal weight and maternal current symptoms of anger and fatigue, with higher weight associated with increased levels of these negative emotions. A significant positive relationship was also found between a mothers' total number of miscarriages and current levels of maternal tension. Table 65 shows the Fisher's z outcome of the comparison of significant correlations that are presented in Table 64.

Table 65

*Fishers z Calculation for Maternal Variables and Depression Scales*

| Description of correlation | z-score | p-value |
|---|---|---|
| Correlation of Maternal Weight with follow-up Anger subscale of the POMS for the FASD and No FASD groups | -0.16 | p>0.05 |
| Correlation of Maternal Weight with the follow-up Fatigue subscale of the POMS for the FASD and No FASD groups | -0.30 | p>0.05 |
| Correlation of total Miscarriages with the follow-up Tension subscale of the POMS for the FASD and No FASD groups | 1.86 | p>0.05 |

p<0.05*

Note:

FASD: Fetal Alcohol Spectrum Disorder

No FASD: No Fetal Alcohol Spectrum Disorder

POMS: Profile of Mood States

The relationship patterns for the association of maternal weight with Anger and Fatigue scales are similar for the FASD and No FASD group. In addition, the total number of miscarriages and the level of tension in mothers who experienced this adverse event do not differ between the FASD and No FASD groups.

In summary, similarities exist in relationship patterns for the associations of maternal variables with depression between the FASD and No FASD groups. The relationship pattern of scores imply that the demographics (age, education, employment, marital status and income); pregnancy history (contraception use, pregnancy intent, total number of pregnancies, total number of live births, total number of miscarriages); health factors (maternal weight and TB diagnosis); and risky behavior during pregnancy (drug use, alcohol use and smoking during pregnancy) do not differ significantly among women from this disadvantaged community. Women who are exposed to similar stressors could increase their vulnerability of having an infant with FASD.

### 3.5 Research Hypothesis Three

Research Hypothesis three investigated the potential developmental differences between the groups of infants that had been prenatally exposed to alcohol during pregnancy and those that had no clinical features of FASD. Inferential and multivariate statistics were used to investigate this hypothesis.

To assess developmental differences between the FASD and No FASD groups, a MANOVA was computed for group differences on all dependent variables in order to assess if the FASD

group performs lower than the No FASD group due to their prenatal exposure to alcohol. The developmental areas include an assessment of physical (Locomotor and Eye Hand Co-ordination), cognitive (Hearing and Language, Eye Hand co-ordination, Performance and Practical Reasoning) and social (Personal-Social) abilities (Table 66).

Table 66

*MANOVA Results for Subscales of the GMDS-ER Between the FASD and No FASD Groups*

| | Source | DF | Mean Square | Error | F-Statistic | p-value |
|---|---|---|---|---|---|---|
| *Initial Assessment* | Locomotor | 1 | 1307.87 | 389.79 | 3.36 | p>0.05 |
| | Personal Social | 1 | 1760.65 | 235.37 | 7.48 | p<0.05* |
| | Hearing and Language | 1 | 1171.88 | 110.11 | 10.64 | p<0.05* |
| | Eye Hand Co-ordination | 1 | 2378.57 | 289.49 | 8.22 | p<0.05* |
| | Performance | 1 | 1857.43 | 232.22 | 7.99 | p<0.05* |
| *Follow-up Assessment* | Locomotor | 1 | 5495.25 | 505.02 | 10.88 | p<0.05* |
| | Personal Social | 1 | 2905.54 | 430.27 | 6.75 | p<0.05* |
| | Hearing and Language | 1 | 115.87 | 287.84 | 0.40 | p>0.05 |
| | Eye Hand Co-ordination | 1 | 93.29 | 192.88 | 0.48 | p>0.05 |
| | Performance | 1 | 304.57 | 259.37 | 1.17 | p>0.05 |
| | Practical Reasoning | 1 | 10.19 | 171.07 | 0.06 | p>0.05 |

p<0.05*

Statistical significant p-values that equal 0.05 are evident at the initial ($F = 2.47$; $p = 0.05$) and follow-up ($F = 2.35$; $p = 0.05$) assessments, showing that there are overall differences in development between the FASD and the No FASD groups. Table 66 shows that with the exception of performance on the Locomotor subscale, the No FASD group performed

significantly better than the FASD group on all other subscales of the GMDS at initial assessment. Although there was no significant difference between the groups on the Locomotor scale, the FASD group still performed lower than the No FASD group on this scale of gross motor development. Over time the difference in gross motor development between the groups became clear where the FASD group performs significantly worse than the No FASD group at the follow-up assessment. Children within the No FASD group continue to perform better with their ability to read social cues while children within the FASD group struggle to respond appropriately, as indicated by the significant differences on the Personal Social subscale. The Personal Social subscale is rated by observations made by the administrator and this could have contributed to some bias in the scores.

Figure 3 and Figure 4 provide visual depictions of the average performance of the two samples on the subscales of the GMDS/GMDS-ER at the initial and follow-up assessments. The mean scores that were used to create these figures are listed in Table 44.

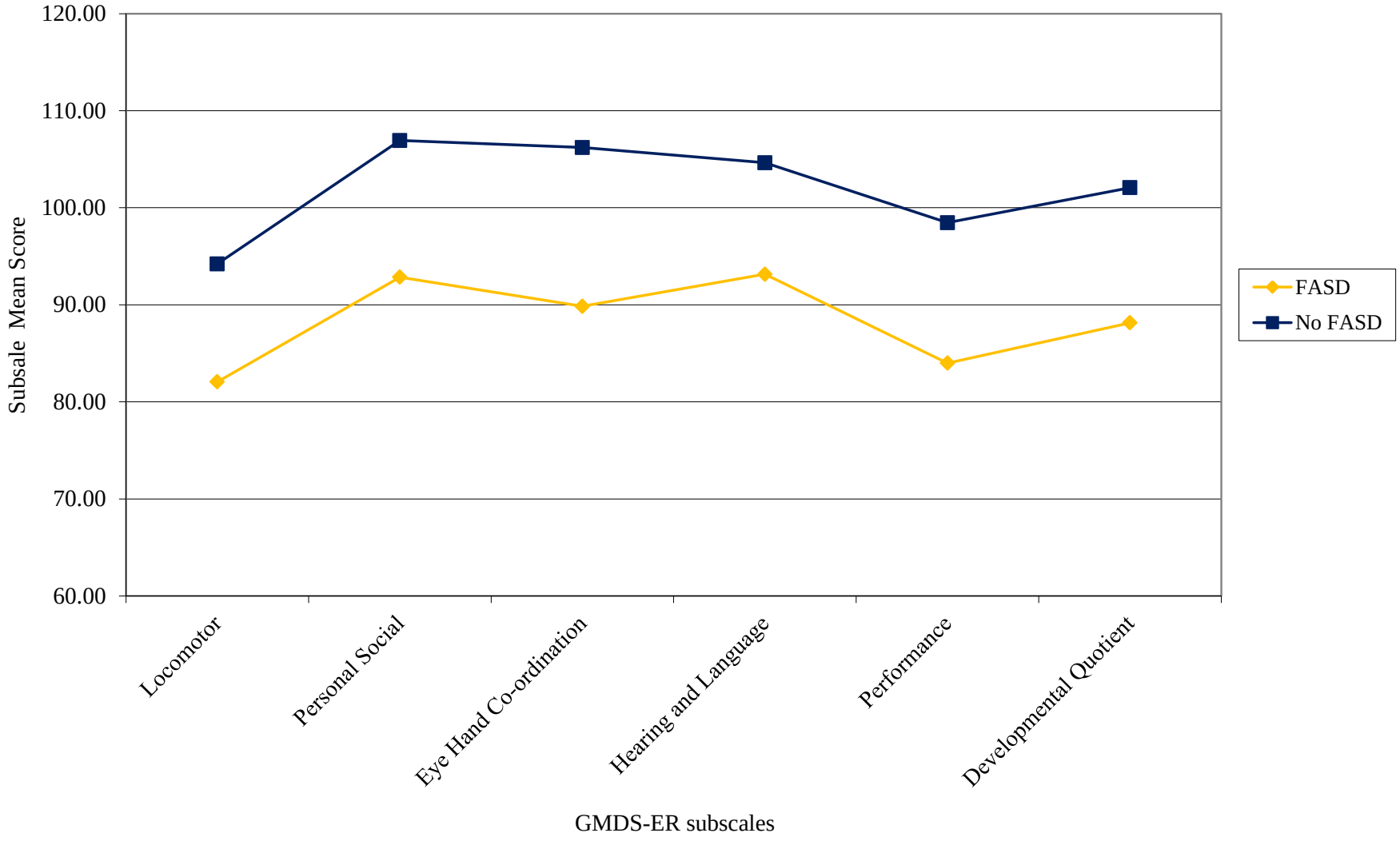



Figure 3

*Developmental differences between the FASD and No FASD Groups at the Initial Assessment*

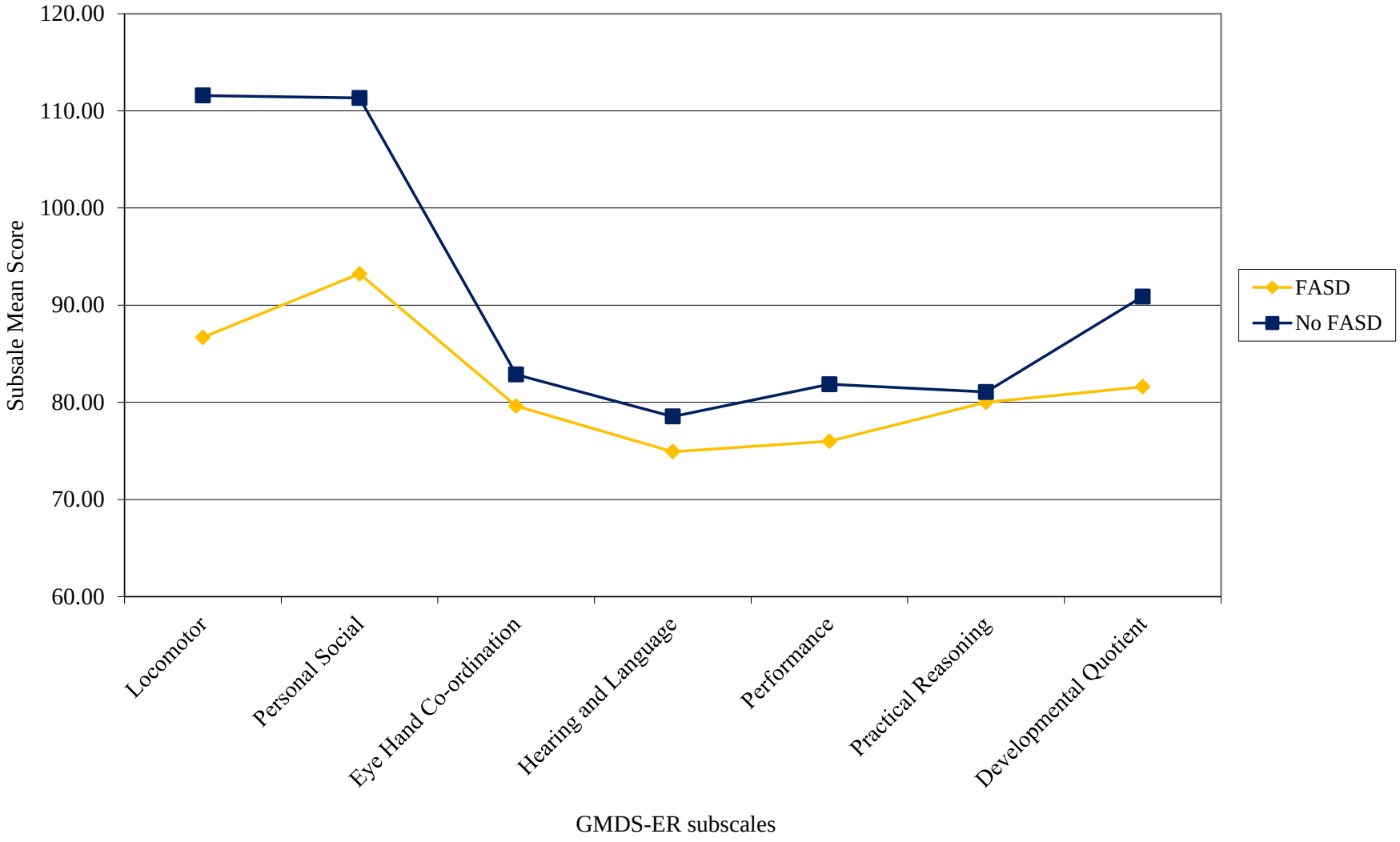



Figure 4

*Developmental Differences between the FASD and No FASD Groups at the Follow-up Assessment*

Figures 4 and 5 and Table 66 depicts the significant differences found for the Personal Social, Eye Hand Co-ordination, Hearing and Language and Performance subscales at the initial assessment. These significant differences between the FASD and No FASD groups are also noticed for the Locomotor and Personal Social subscales at the follow-up assessment. The average performance of the FASD group, as expected, is significantly lower than the No FASD group at the initial and at the follow-up assessments. Although there are no significant differences between the groups for the remaining scales (Locomotor) at the initial assessment and (Hearing & Language; Eye Hand Co-ordination; Performance & Practical Reasoning) at the follow-up assessment, the FASD group performs lower than the No FASD group on all subscales. It was interesting to note that even though the No FASD group performed better than the FASD group, some of the former group's subscale scores remain below the expected average range of 90 – 109.

A Repeated Measures Analysis of Variance was subsequently implemented to explore within group comparisons for the initial and follow-up assessments. In this analysis, both points of assessment were included for each group to determine if there was a significant change in the level of infant development over time. The results of this analysis are shown in Table 67.

Table 67

*Repeated Measures ANOVA of the GMDS-ER Within the FASD and No FASD Groups*

| GMDS-ER Subscale | Source | DF | Mean Square | F-Statistic | p value |
|---|---|---|---|---|---|
| Locomotor | Time | 1 | 2143.12 | 9.29 | p<0.05* |
| | Time*Group | 1 | 720.69 | 0.08 | p>0.05 |
| | Error | 39 | 230.76 | | |
| Eye Hand Co-ordination | Time | 1 | 5007.88 | 21.91 | p<0.05* |
| | Time*Group | 1 | 764.85 | 3.35 | p>0.05 |
| | Error | 39 | 228.52 | | |
| Hearing and Language | Time | 1 | 8726.46 | 53.47 | p<0.05* |
| | Time*Group | 1 | 275.38 | 1.69 | p>0.05 |
| | Error | 39 | 163.22 | | |
| Performance | Time | 1 | 2687.88 | 17.11 | p<0.05* |
| | Time*Group | 1 | 328.86 | 2.09 | p>0.05 |
| | Error | 39 | 157.06 | | |
| Personal Social | Time | 1 | 101.32 | 0.51 | p>0.05 |
| | Time*Group | 1 | 71.32 | 0.36 | p>0.05 |
| | Error | 39 | 197.59 | | |
| Developmental Quotient | Time | 1 | 1393.38 | 15.63 | p<0.05* |
| | Time*Group | 1 | 95.57 | 0.31 | p>0.05 |
| | Error | 39 | 89.14 | | |

p<0.05*

For the sample, there is a significant change in the Locomotor, Eye Hand co-ordination, Hearing and Language and Developmental Quotient scores over time. However, the results

show that there is no interaction effect of time and group, suggesting that the changes over time on the Locomotor subscale did not differ within the groups. Further to this, the development of fine motor co-ordination, verbal skills and overall development did not significantly change within the groups. Physical development and some aspects of cognitive development (verbal development and overall development) changed over time, while other skills in cognitive development (Performance) and social interaction skills (Personal Social) did not change significantly between the two time points. Within group performance did not change dramatically over time, suggesting that the scores obtained within the FASD and No FASD infants on the developmental scales remained fairly consistent for each group at the initial and follow-up assessments.

Based on the findings of significant between group differences but no within group differences, a correlational analysis was implemented to identify the trends between the GMDS/GMDS-ER subscales at the initial and follow-up assessment within the groups. Table 68 and Table 69 display the associations within the FASD and No FASD groups respectively. These correlations were then used in the Fisher's z calculation to assess the importance of the difference between the significant associations. Table 70 shows the results of this calculation.

Table 68

*GMDS-ER Subscale Correlations Between the Intial and Follow-up Assessments of Infants Within the FASD Group*

| | | Initial Assessment α = 0.92 | | | | |
|---|---|---|---|---|---|---|
| | | Locomotor | Personal Social | Hearing Language | Eye Hand Co-ordination | Performance |
| Follow-up Assessment | Locomotor | r = 0.44 | r = 0.19 | r = 0.02 | r = -0.07 | r = 0.39 |
| | Personal Social | r = 0.20 | r = 0.57* | r = 0.11 | r = 0.36 | r = 0.37 |
| | Hearing Language | r = 0.56* | r = 0.79* | r = 0.40 | r = 0.67* | r = 0.63* |
| | Eye Hand | r = 0.34 | r = 0.41 | r = 0.029 | r = 0.43 | r = 0.62* |
| | Performance | r = 0.52 | r = 0.34 | r = 0.51 | r = 0.37 | r = 0.70* |
| | Practical Reasoning | r = 0.69* | r = 0.61* | r = 0.56* | r = 0.54 | r = 0.82* |

p<0.05*

Table 69

*GMDS-ER Subscale Correlations Between the Initial and Follow-up Assessments of Infants Within the No FASD Group*

| | | Initial Assessment α = 0.74 | | | | |
|---|---|---|---|---|---|---|
| | | Locomotor | Personal Social | Hearing Language | Eye Hand Co-ordination | Performance |
| Follow-up Assessment | Locomotor | r = 0.53* | r = 0.18 | r = 0.24 | r = 0.38* | r = 0.05 |
| | Personal Social | r = 0.22 | r = 0.33 | r = 0.29 | r = 0.15 | r = 0.17 |
| | Hearing Language | r = 0.05 | r = 0.03 | r = 0.07 | r = -0.17 | r = -0.12 |
| | Eye Hand Co-ordination | r = 0.07 | r = -0.18 | r = 0.12 | r = -0.14 | r = 0.12 |
| | Performance | r = -0.02 | r = -0.05 | r = -0.09 | r = -0.17 | r = 0.20 |
| | Practical Reasoning | r = -0.001 | r = -0.06 | r = 0.21 | r = -0.29 | r = -0.19 |

p<0.05*

Table 70

*Fishers z Calculation of the GMDS-ER Subscales for the FASD and No FASD Groups*

| Description of correlation | z-score | p-value |
|---|---|---|
| Correlation of the initial Locomotor subscale with the follow-up Hearing and Language subscale of the FASD and No FASD groups | 1.56 | p>0.05 |
| Correlation of the initial Locomotor subscale with the follow-up Practical Reasoning subscale of the FASD and No FASD groups | 2.27 | p<0.05* |
| Correlation of the initial Personal Social subscale with the follow-up Personal Social subscale of the FASD and No FASD groups | 0.81 | p>0.05 |
| Correlation of the initial Personal Social subscale with the follow-up Hearing and Language subscale of the FASD and No FASD groups | 2.78 | p<0.05* |
| Correlation of the initial Personal Social subscale with the follow-up Practical Reasoning subscale of the FASD and No FASD groups | 2.06 | p<0.05* |
| Correlation of the initial Hearing and Language subscale with the follow-up Practical Reasoning subscale of the FASD and No FASD groups | 1.12 | p>0.05 |
| Correlation of the initial Eye Hand Co-ordination subscale with the follow-up Hearing and Language subscale of the FASD and No FASD groups | 2.63 | p<0.05* |
| Correlation of the initial Performance subscale with the follow-up Hearing and Language subscale of the FASD and No FASD groups | 2.30 | p<0.05* |
| Correlation of the initial Performance subscale with the follow-up Eye Hand Co-ordination subscale of the FASD and No FASD groups | 1.62 | p>0.05 |
| Correlation of the initial Performance subscale with the follow-up Performance subscales of the FASD and No FASD groups | 1.78 | p>0.05 |
| Correlation of the initial Performance subscale with the follow-up Practical Reasoning subscale of the FASD and No FASD groups | 3.61 | p<0.05* |
| Correlation of the initial Locomotor subscale with the follow-up Locomotor subscale of the FASD and No FASD groups | 0.32 | p>0.05 |
| Correlation of the initial Eye Hand Co-ordination subscale and the follow-up Locomotor subscale of the FASD and No FASD groups | 1.26 | p>0.05 |

p<0.05*

The outcome of the Fisher's z calculation shows that there are differences in the relationship patterns between the FASD and No FASD groups. While the No FASD group shows no significant correlations between the follow-up Practical Reasoning subscale and specific subscales from the initial assessment (Locomotor, Personal Social & Performance subscales), the FASD group shows moderate to strong positive associations between these specific subscales. Further to this, the FASD group continues to show moderate positive associations for the relationship between follow-up Hearing and Language with other subscales (Personal Social, Eye Hand & Performance subscales) from the initial assessment.

Since the Practical Reasoning subscale includes a combination of cognitive and motor abilities (e.g. Counting, comparing sizes & general knowledge) it is expected that if the child's ability to explore their environment is limited it would negatively interfere with their problem-solving skills. A lack of stimulation and interaction between mother and child may also contribute to the child being hesitant to engage within a new environment. The Personal Social subscale is dependent on stimulation provided by the infant's mother to encourage social development that includes activities such as knowing how to dress and undress, fasten a buckle, tie a knot etc. A delay in the development of language and poor comprehension also lowers cognitive development. Poor physical development (gross motor and fine motor) may limit the child's ability to explore the environment and to grasp objects, which in turn limits learning ability. Limited interaction between mother and infant could reduce the infant's interest in learning and a lack of exposure to toys or stimulating activities could limit the infant's curiosity to learn from their environment, as it is possible that infants from this community are not provided with the opportunity to learn.

In summary, the relationship between development variables indicates that infants within the FASD group struggle with their overall development and perform lower when compared to infants within the No FASD group. This implies that alcohol exposure, a lack of stimulation and living under deprived conditions could contribute to the lowered developmental scores that are evident from this sample of infants within the Northern Cape, with infants within the FASD group being at greater disadvantage when compared to the No FASD group.

## 3.6 Research Hypothesis Four

Research hypothesis four investigates the relationship between maternal depression and infant development. Correlational analyses were carried out to investigate these associations. These correlations are tabulated below in Table 71 and Table 72 for the FASD and No FASD groups, respectively.

Table 71

*Correlation Between the Initial BDI, Follow-up BDI, POMS Subscales With the Initial and Follow-up Assessment GMDS-ER Scores of the FASD Group*

| | | Beck Depression Inventory (BDI) | | Profile of Mood States (POMS) α = 0.85 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Initial Assessment | Follow-up Assessment α = 0.85 | Tension | Depression | Anger | Vigor | Fatigue | Confusion |
| *Initial Assessment* α = 0.88 | Locomotor | r = -0.08 | - | - | - | - | - | - | - |
| | Personal Social | r = 0.11 | - | - | - | - | - | - | - |
| | Hearing & Language | r = -0.36 | - | - | - | - | - | - | - |
| | Eye Hand Co-ordination | r = 0.14 | - | - | - | - | - | - | - |
| | Performance | r = -0.12 | - | - | - | - | - | - | - |
| | Developmental Quotient | r = 0.02 | - | - | - | - | - | - | - |
| *Follow-up Assessment* α = 0.86 | Locomotor | r = -0.18 | r = -0.06 | r = -0.46 | r =-0.44 | r = -0.32 | r = -0.04 | r = -0.35 | r = -0.35 |
| | Personal Social | r = 0.13 | r = -0.32 | r = -0.32 | r =-0.19 | r = -0.09 | r = 0.16 | r = -0.16 | r = -0.16 |
| | Hearing &Language | r = 0.14 | r = -0.44 | r = -0.52 | r =-0.38 | r = -0.14 | r = 0.04 | r = -0.33 | r = -0.004 |
| | Eye Hand Co-ordination | r = -0.12 | r = 0.18 | r = -0.29 | r = 0.03 | r = 0.05 | r = -0.23 | r = 0.006 | r = 0.13 |
| | Performance | r = -0.37 | r = 0.07 | r = -0.38 | r = -0.08 | r = -0.09 | r = -0.32 | r = -0.14 | r = -0.11 |
| | Practical Reasoning | r = -0.24 | r = -0.18 | r = -0.47 | r = -0.20 | r = -0.06 | r = -0.07 | r = -0.21 | r = -0.06 |
| | Developmental Quotient | r = -0.08 | r = -0.22 | r = -0.52 | r = -0.29 | r = -0.14 | r = -0.04 | r = -0.26 | r = -0.13 |

p<0.05*

Table 72

*Correlation Between the Initial BDI, Follow-up BDI, POMS Subscales With the Initial and Follow-up Assessment GMDS-ER Scores of the No FASD Group*

| | | Beck Depression Inventory (BDI) | | Profile of Mood States (POMS) α = 0.66 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Initial Assessment | Follow-up Assessment α = 0.78 | Tension | Depression | Anger | Vigor | Fatigue | Confusion |
| *Initial Assessment* α = 0.88 | Locomotor | r = -0.0006 | - | - | - | - | - | - | - |
| | Personal Social | r = -0.20 | - | - | - | - | - | - | - |
| | Hearing & Language | r = -0.31 | - | - | - | - | - | - | - |
| | Eye Hand Co-ordination | r = -0.11 | - | - | - | - | - | - | - |
| | Performance | r = -0.23 | - | - | - | - | - | - | - |
| | Developmental Quotient | r = -0.21 | - | - | - | - | - | - | - |
| *Follow-up Assessment* α = 0.86 | Locomotor | r = 0.29 | r = 0.07 | r = -0.06 | r = 0.09 | r = -0.09 | r = -0.23 | r = 0.21 | r = 0.08 |
| | Personal Social | r = 0.19 | r = -0.29 | r = -0.27 | r = -0.23 | r = -0.35 | r = 0.06 | r = -0.18 | r = -0.24 |
| | Hearing &Language | r = -0.08 | r = -0.03 | r = -0.22 | r = -0.38* | r = -0.33 | r = -0.23 | r = -0.12 | r = -0.20 |
| | Eye Hand Co-ordination | r = 0.13 | r = 0.27 | r = 0.15 | r = -0.01 | r = -0.06 | r = 0.07 | r = 0.16 | r = 0.21 |
| | Performance | r = -0.09 | r = -0.08 | r = -0.23 | r = -0.28 | r = -0.26 | r = 0.36 | r = -0.11 | r = -0.25 |
| | Practical Reasoning | r = -0.16 | r = -0.19 | r = -0.19 | r = -0.37* | r = -0.34 | r = -0.26 | r = -0.22 | r = -0.19 |
| | Developmental Quotient | r = 0.13 | r = -0.07 | r = -0.22 | r = -0.26 | r = -0.36 | r = -0.07 | r = -0.05 | r = -0.15 |

p<0.05*

According to Table 71 the FASD group displays no significant relationships between initial severity of depression and initial infant performance on the developmental subscales of the GMDS/GMDS-ER. There are also no significant associations between follow-up severity of depression and the infant's developmental performance at the follow-up assessment. In addition, there is no important relationship between the subscales of the GMDS/GMDS-ER and current maternal depression.

The results from Table 72 show that the No FASD group displays no correlation between the follow-up BDI and the follow-up subscales of the GMDS-ER within the No FASD group. Although there is an association between current Depression of the POMS scale with the follow-up Hearing and Language subscale of the GMDS-ER suggesting an inverse relationship between these variables, the Fisher's z calculation indicates that this association is not significant, implying that the relationship pattern between these variables are similar ($z = 0.00$; $p>0.05$). Although another inverse relationship between current Depression and the Practical Reasoning scale of the GMDS-ER is also evident, the Fishers z calculation again indicates that there is no difference in the relationship patterns for the FASD and No FASD groups ($z = -0.50$; $p>0.05$).

The pattern of relationship between the FASD and No FASD scores are similar for the association between the depression variables and infant development. No further analyses were carried out to investigate this hypothesis as there are no strong associations between the depression variables and infant development, implying that maternal depression is not associated with infant development within this sample. Earlier results also indicate that

maternal depression did not account for any differences between the FASD and No FASD group. The small sample size and the low level of significance between the variables could account for the limited differences between the groups with regard to this specific comparison. Past studies on infants that are diagnosed with FASD also report that the small sample size is a limiting factor that could also be related to the outcome of this study (Viljoen, 2002; Rasmussen, 2005).

### 3.7 Research Hypothesis Five

The final hypothesis investigated the relationship between severity of maternal depression, maternal variables and the association on infant developmental outcomes. Although earlier results indicate that maternal depression did not contribute to any difference between the FASD and No FASD groups, these additional statistics were carried out to assess if there were any other variables that could account for the differences between the groups of this sample. The Analysis of Covariance (ANCOVA) and correlational analyses were implemented to investigate the difference between groups and significant associations between variables respectively.

According to the Chi-Square analysis and t-test outcome from Hypothesis Two, potential covariates that contributed to the differences between the FASD and No FASD groups were alcohol use and smoking during pregnancy. These variables were included in the ANCOVA model to investigate the possible effects of maternal variables on maternal depression and infant development. The effect of these potential covariates were statistically controlled within the analysis to determine if any of the maternal variables could be associated with the severity of maternal depression or infant development. The covariates for the ANCOVA are alcohol

use and smoking during pregnancy. The dependent variable for the severity of depression is the BDI while the dependent variables for infant development are the subscales of the GMDS-ER. The independent variable is the classification of groups into FASD and No FASD. Table 73 shows the overall ANCOVA model for the initial severity of depression.

Table 73

*ANCOVA Model of the Initial Severity of Depression Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 121.54 | 0.90 | p>0.05 |
| Error | 37 | 134.74 | | |
| Group | 1 | 241.87 | 1.80 | p>0.05 |
| Alcohol | 1 | 66.51 | 0.49 | p>0.05 |
| Smoking | 1 | 218.99 | 1.63 | p>0.05 |

p<0.05*

Table 73 indicates that when all variables in the model are statistically controlled there are no differences between the groups, suggesting that the severity of maternal depression is similar between the FASD and No FASD groups. This outcome concurs with the results from Hypothesis One. Table 74 shows the overall ANCOVA model for the follow-up severity of depression.

Table 74

*ANCOVA Model of the Follow-up Severity of Depression Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 30.56 | 0.19 | p>0.05 |
| Error | 37 | 165.12 | | |
| Group | 1 | 53.30 | 0.32 | p>0.05 |
| Alcohol | 1 | 16.61 | 0.10 | p>0.05 |
| Smoking | 1 | 61.24 | 0.37 | p>0.05 |

p<0.05*

Table 74 shows that no covariates are associated with follow-up severity of depression. No significant differences are evident between the groups for the severity of depression at the initial and follow-up assessments (Table 47). Over the two time points, there are also no significant differences in depression between the groups (Table 50). At the initial and follow-up assessments none of the covariates are associated with depression (Table 73 and Table 74). These results show that depression scores follow a similar pattern, confirming that the severity of depression experienced by women within this community does not differ.

The results that follow refer to the association of covariates with infant development. Infant development has been classified into functional areas of development (Table75), to aid in the discussion of the results.

Table 75

*Functional Areas of Infant Development*

| Area of Development | GMDS-ER Scale |
|---|---|
| Physical Development | Locomotor |
| | Eye Hand Co-ordination |
| Cognitive Development | Hearing and Language |
| | Performance |
| | Practical Reasoning |
| Social Adjustment | Personal-Social |
| Overall Development | Developmental Quotient |

Table 76, Table 77, Table 78 and Table 79 summarise the outcome of the ANCOVA model for gross motor and fine motor functioning of infants at the initial and follow-up phases respectively. Alcohol and smoking were selected as potential covariates and their association to the dependent variable (functional area of infant development) was assessed.

Table 76

*ANCOVA Model of Initial Locomotor Functioning Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 976.21 | 2.66 | p>0.05 |
| Error | 37 | 367.05 | | |
| Group | 1 | 2572.20 | 7.01 | p<0.05* |
| Alcohol | 1 | 1620.76 | 4.42 | p<0.05* |
| Smoking | 1 | 1.01 | 0 | p>0.05 |

p<0.05*

Table 77

*ANCOVA Model of Follow-up Locomotor Functioning Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 1907.28 | 3.62 | p<0.05* |
| Error | 37 | 526.19 | | |
| Group | 1 | 4098.15 | 7.79 | p<0.05* |
| Alcohol | 1 | 22.84 | 0.04 | p>0.05 |
| Smoking | 1 | 200.40 | 0.38 | p>0.05 |

p<0.05*

Table 78

*ANCOVA Model of Initial Eye Hand Co-ordination Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 2050.45 | 10.09 | p<0.05* |
| Error | 37 | 203.18 | | |
| Group | 1 | 5238.38 | 25.78 | p<0.05* |
| Alcohol | 1 | 3772.69 | 18.57 | p<0.05* |
| Smoking | 1 | 3.03 | 0.01 | p>0.05 |

p<0.05*

Table 79

*ANCOVA Model of Follow-up Eye Hand Co-ordination Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 162.77 | 0.84 | p>0.05 |
| Error | 37 | 192.63 | | |
| Group | 1 | 342.41 | 1.78 | p>0.05 |
| Alcohol | 1 | 123.24 | 0.64 | p>0.05 |
| Smoking | 1 | 262.93 | 1.36 | p>0.05 |

p<0.05*

Physical development comprises of gross motor (Locomotor) and fine motor (Eye Hand Co-ordination) functioning. According to Table 66 there is no significant difference between the groups at the initial assessment while there is a significant difference between the groups at the follow-up assessment for gross motor development. Table 67 also shows that there is a difference in gross motor development between the FASD and No FASD groups from the initial to the follow-up assessment where scores on gross motor activities deteriorates between the two time points. However, within the groups there is no significant difference in gross motor development over time. At the initial assessment (Table 76) alcohol is the significant covariate that is associated with locomotor functioning. Although there is no overall group difference on initial locomotor functioning (Table 66), it is probably by chance that group differences are statistically significant when covariates are controlled. At the follow-up assessment (Table 77) none of the covariates are significantly associated with locomotor development. However, group differences remain when covariates are statistically controlled. For fine motor co-ordination, there is a significant difference between the groups at the initial assessment but not at the follow-up assessment (Table 66). Table 67 also shows that there are significant differences between the groups over time but not within the groups. At the initial assessment (Table 78) alcohol is the significant covariate that is associated with fine co-ordination. Differences between the group remains when the covariates are statistically controlled. At the follow-up assessment (Table 79) none of the covariates are associated with the fine motor co-ordination. Alcohol use during pregnancy is the common covariate that is associated with physical development at the initial assessment.

Cognitive development comprises of the Hearing and Language, Performance and Practical Reasoning scales. Table 80, Table 81, Table 82, Table 83, and Table 84 summarises the outcome of the ANCOVA model for intellectual development of infants at the initial and follow-up phases respectively.

Table 80

*ANCOVA Model of Initial Hearing and Language Subscale*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 969.91 | 14.04 | p<0.05* |
| Error | 37 | 69.09 | | |
| Group | 1 | 2572.42 | 37.23 | p<0.05* |
| Alcohol | 1 | 1731.77 | 25.07 | p<0.05* |
| Smoking | 1 | 2.16 | 0.03 | p>0.05 |

p<0.05*

Table 81

*ANCOVA Model of Follow-up Hearing and Language Subscale*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 42.34 | 0.14 | p>0.05 |
| Error | 37 | 303.10 | | |
| Group | 1 | 38.22 | 0.13 | p>0.05 |
| Alcohol | 1 | 8.24 | 0.03 | p>0.05 |
| Smoking | 1 | 2.69 | 0.01 | p>0.05 |

p<0.05*

Table 82

*ANCOVA Model of Initial Performance Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 1012.58 | 4.75 | p<0.05* |
| Error | 37 | 212.99 | | |
| Group | 1 | 2568.82 | 12.06 | p<0.05* |
| Alcohol | 1 | 1143.83 | 5.37 | p<0.05* |
| Smoking | 1 | 46.88 | 0.22 | p>0.05 |

p<0.05*

Table 83

*ANCOVA Model of Follow-up Performance Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 266.23 | 1.02 | p>0.05 |
| Error | 37 | 260.03 | | |
| Group | 1 | 373.07 | 1.43 | p>0.05 |
| Alcohol | 1 | 0.96 | 0.00 | p>0.05 |
| Smoking | 1 | 493.93 | 1.9 | p>0.05 |

p<0.05*

Table 84

*ANCOVA Model of the Follow-up Practical Reasoning Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 52.56 | 0.30 | p>0.05 |
| Error | 37 | 176.33 | | |
| Group | 1 | 27.47 | 0.16 | p>0.05 |
| Alcohol | 1 | 1.56 | 0.01 | p>0.05 |
| Smoking | 1 | 146.58 | 0.83 | p>0.05 |

p<0.05*

For hearing and language development, Table 66 shows that there are significant differences between the groups at the initial assessment while there are no significant differences between the groups at the follow-up assessment. There is also a significant difference in language development between the two time points but no significant difference within the groups over time (Table 67). Alcohol is a significant covariate that is associated with language development at the initial assessment. Group differences remain after controlling for the covariates (Table 80).At the follow-up assessment, no covariates are significantly associated with language development (Table 81). Another aspect of intellectual development was assessed by the Performance Scale. There are significant differences between the groups for performance at the initial assessment while there are no significant differences between the groups at the follow-up assessment (Table 66). The same pattern as the former scale is noticed where there is a difference in performance between the two time points while there are no significant differences within the groups over time (Table 67). Alcohol is a significant covariate that is associated with performance at the initial assessment. Group differences remain when the covariates are statistically controlled at the initial assessment (Table 82). At the follow-up assessment (Table 83), no covariates are associated with performance. The Practical Reasoning is only administered at the follow-up assessment where no covariates are associated (Table 84).

Table 85 and Table 86 shows the ANCOVA model of the Personal-Social development scale at the initial and follow-up assessments respectively.

Table 85

*ANCOVA Model of the Initial Personal Social Development Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 1087.82 | 5.24 | p<0.05* |
| Error | 37 | 207.48 | | |
| Group | 1 | 2978.19 | 14.35 | p<0.05* |
| Alcohol | 1 | 1502.2 | 7.24 | p<0.05* |
| Smoking | 1 | 0.02 | 0.00 | p>0.05 |

p<0.05*

Table 86

*ANCOVA Model of the Follow-up Personal Social Development Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 987.09 | 2.18 | p>0.05 |
| Error | 37 | 452.02 | | |
| Group | 1 | 2059.69 | 4.56 | p<0.05* |
| Alcohol | 1 | 54.09 | 0.12 | p>0.05 |
| Smoking | 1 | 2.12 | 0.00 | p>0.05 |

p<0.05*

There are significant differences between the groups at the initial and follow-up assessments for social adjustment (Table 66). According to Table 67 there are no significant differences between the groups over time and no significant differences within the groups over time. At the initial assessment (Table 85) alcohol is the significant covariate that is associated with social adjustment. Group differences remain when the covariates are statistically controlled. Although there are no covariates associated with the personal-social subscale at the follow-up assessment (Table 86), group differences remain when the covariates are statistically controlled.

The ANCOVA models for the initial and follow-up assessments are presented in Table 87 and Table 88 respectively.

Table 87

*ANCOVA Model of the Initial Developmental Quotient Between the Groups*

| **Source** | **DF** | **Mean Square** | **F-Statistic** | **p-value** |
|---|---|---|---|---|
| Model | 3 | 1232.27 | 11.01 | p<0.05* |
| Error | 37 | 111.90 | | |
| Group | 1 | 3138.8 | 28.05 | p<0.05* |
| Alcohol | 1 | 1962.87 | 17.54 | p<0.05* |
| Smoking | 1 | 23.38 | 0.21 | p>0.05 |

p<0.05*

Table 88

*ANCOVA Model of the Follow-up Developmental Quotient Between the Groups*

| Source | DF | Mean Square | F-Statistic | p-value |
|---|---|---|---|---|
| Model | 3 | 291.71 | 2.04 | p>0.05 |
| Error | 37 | 142.72 | | |
| Group | 1 | 679.57 | 4.76 | p<0.05* |
| Alcohol | 1 | 10.67 | 0.07 | p>0.05 |
| Smoking | 1 | 98.70 | 0.69 | p>0.05 |

p<0.05*

There is a difference between the groups on cognitive development between the initial and follow-up assessment while there are no significant within group differences (Table 67). Alcohol is the significant covariate that is associated with cognitive development at the initial assessment (Table 87). Group differences remain when the covariates are statistically controlled at the initial assessment. Although no covariates are associated with overall cognitive development at the follow-up assessment (Table 88), group differences remains when the covariates are statistically controlled.

Correlational analyses were conducted to determine the relationship between maternal variables and developmental outcome in infants. Table 89 and Table 90 show the associations for the FASD and No FASD groups respectively, while Table 91 indicates the outcome of the Fisher's z calculation.

Table 89

*Pearson Correlations Between Maternal Variables and Infant Developmental Outcomes for the FASD Group*

| | | MATERNAL VARIALBLES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMDS-ER | | Age | Alcohol | Contraception | Drugs Pregnancy | Employment | Income | Marital Status | Weight | School | Tertiary | Smoking | TB | Total no. of live birth | Total no. of Miscarriages | Total no. of pregnancies |
| | | α = 0.76 | α = 0.73 | α = 0.76 | α = 0.80 | α = 0.75 | α = 0.77 | α = 0.77 | α = 0.75 | α = 0.76 | α = 0.80 | α = 0.76 | α = 0.74 | α = 0.77 | α = 0.77 | α = 0.77 |
| *Initial Assessment* | Locomotor | r = -0.20 | r = -0.34 | r = -0.32 | r = -0.07 | r = -0.02 | r = -0.03 | r = -0.29 | r = -0.10 | r = 0.04 | r = 0.47 | r = -0.17 | r = -0.18 | r = -0.09 | r = 0.05 | r = -0.04 |
| | Personal Social | r = -0.14 | r = -0.35 | r = -0.37 | r = 0.20 | r = 0.19 | r = -0.27 | r = -0.01 | r = -0.16 | r = 0.19 | r = 0.07 | r = 0.11 | r = -0.42 | r = -0.008 | r = -0.11 | r = -0.07 |
| | Hearing & Language | r = -0.02 | r = -0.55 | r = -0.24 | r = -0.20 | r = -0.25 | r = 0.06 | r = -0.12 | r = -0.45 | r = 0.02 | r = 0.33 | r = -0.23 | r = 0.27 | r = -0.16 | r = 0.14 | r = -0.04 |
| | Eye Hand Co-ordination | r = -0.25 | r = -0.34 | r = -0.54 | r = 0.20 | r = -0.06 | r = -0.19 | r = 0.27 | r = -0.29 | r = 0.27 | r = 0.09 | r = 0.008 | r = -0.13 | r = -0.20 | r = 0.02 | r = -0.14 |
| | Performance | r = 0.11 | r = -0.61 | r = -0.20 | r = -0.07 | r = -0.27 | r = -0.09 | r = -0.11 | r = -0.24 | r = 0.06 | **r = 0.55*** | r = -0.16 | r = -0.17 | r = 0.05 | r = 0.21 | r = 0.17 |
| *Follow-up Assessment* | Locomotor | r = 0.34 | r = -0.19 | r = 0.29 | r = -0.08 | r = -0.14 | r = 0.02 | r = -0.54 | r = 0.55 | r = -0.03 | r = 0.39 | r = 0.06 | **r = -0.57*** | r = 0.32 | r = 0.09 | r = 0.29 |
| | Personal Social | r = 0.31 | r = -0.26 | r = -0.25 | r = 0.003 | r = 0.27 | r = -0.12 | r = -0.05 | r = 0.06 | r = 0.25 | r = 0.004 | r = 0.04 | **r = -0.70*** | **r = 0.58*** | r = 0.001 | r = 0.44 |
| | Hearing & Language | r = -0.07 | r = -0.50 | r = -0.39 | r = -0.12 | r = 0.37 | r = -0.007 | r = 0.05 | r = -0.19 | r = 0.01 | r = 0.22 | r = 0.15 | r = -0.40 | r = 0.18 | r = 0.02 | r = 0.14 |
| | Eye Hand Co-ordination | r = 0.16 | r = -0.53 | r = 0.14 | r = 0.17 | r = -0.22 | r = -0.27 | r = 0.24 | r = -0.16 | r = 0.30 | **r = 0.58*** | r = 0.29 | r = -0.44 | r = 0.05 | r = 0.25 | r = 0.19 |
| | Performance | r = -0.10 | r = -0.53 | r = 0.18 | r = 0.09 | r = -0.21 | r = -0.23 | r = 0.14 | r = -0.31 | r = 0.36 | **r = 0.74*** | r = 0.27 | r = -0.23 | r = -0.22 | r = 0.21 | r = -0.04 |
| | Practical Reasoning | r = -0.02 | r = -0.49 | r = -0.09 | r = -0.04 | r = 0.02 | r = -0.07 | r = -0.07 | r = -0.15 | r = 0.22 | r = 0.57 | r = 0.20 | r = -0.37 | r = 0.01 | r = 0.19 | r = 0.13 |

*p<0.05

Table 90

*Pearson Correlations Between Maternal Variables and Infant Developmental Outcomes of the No FASD Group*

| | | MATERNAL VARIALBLES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMDS-ER | | Age | Alcohol | Contraception | Drugs Pregnancy | Employment | Income | Marital Status | Weight | School | Tertiary | Smoking | TB | Total no. of live birth | Total no. of Miscarriages | Total no. of pregnancies |
| | | α = 0.57 | α = 0.54 | α = 0.54 | α = 0.63 | α = 0.54 | α = 0.62 | α = 0.57 | α = 0.50 | α = 0.54 | α = 0.58 | α = 0.57 | α = 0.58 | α = 0.57 | α = 0.59 | α = 0.58 |
| *Initial Assessment* | Locomotor | r = 0.22 | **r = -0.39*** | r = 0.21 | r = 0.18 | r = -0.24 | r = -0.25 | r = -0.04 | r = 0.09 | r = 0.19 | r = -0.09 | r = 0.07 | r = -0.15 | r = -0.18 | r = -0.16 | r = -0.23 |
| | Personal Social | r = 0.07 | **r = -0.51*** | r = 0.32 | r = -0.09 | r = 0.05 | r = -0.36 | r = 0.28 | r = 0.26 | r = 0.06 | r = -0.01 | r = -0.21 | r = -0.16 | r = -0.22 | r = 0.12 | r = -0.16 |
| | Hearing & Language | r = -0.02 | **r = -0.63*** | r = 0.13 | r = -0.06 | r = 0.03 | r = -0.08 | **r = 0.36*** | r = 0.38 | r = -0.0001 | r = 0.16 | r = -0.14 | r = 0.05 | r = 0.09 | r = -0.05 | r = 0.07 |
| | Eye Hand Co-ordination | r = 0.16 | **r = -0.64*** | **r = 0.48*** | r = 0.19 | r = -0.08 | **r = -0.39*** | **r = 0.52*** | r = 0.09 | r = 0.007 | r = -0.07 | r = 0.24 | r = -0.35 | r = -0.21 | r = -0.05 | r = -0.22 |
| | Performance | r = -0.07 | r = -0.29 | r = 0.30 | r = 0.19 | r = -0.06 | r = -0.16 | **r = 0.61*** | r = -0.01 | r = 0.05 | r = -0.17 | r = 0.19 | r = -0.12 | r = -0.35 | r = -0.05 | r = -0.35 |
| *Follow-up Assessment* | Locomotor | r = -0.23 | r = -0.15 | r = -0.13 | r = 0.34 | **r = -0.37*** | r = -0.02 | r = 0.16 | r = -0.15 | r = 0.15 | r = -0.21 | r = -0.01 | r = -0.09 | r = -0.22 | r = -0.19 | r = -0.28 |
| | Personal Social | r = -0.09 | r = -0.05 | r = -0.18 | r = 0.06 | r = 0.005 | r = 0.13 | r = -0.11 | r = 0.01 | r = 0.03 | r = 0.12 | r = -0.33 | r = 0.12 | r = -0.03 | r = -0.03 | r = -0.04 |
| | Hearing & Language | r = -0.08 | r = 0.29 | r = -0.36 | r = -0.06 | r = 0.07 | r = 0.19 | r = -0.21 | **r = 0.42*** | r = -0.08 | r = -0.15 | r = -0.27 | r = 0.18 | r = 0.16 | r = 0.15 | r = 0.20 |
| | Eye Hand Co-ordination | r = 0.10 | r = -0.01 | r = -0.26 | r = 0.25 | r = -0.03 | **r = 0.43*** | r = -0.18 | r = 0.04 | r = -0.28 | r = 0.10 | r = 0.02 | r = 0.15 | r = 0.34 | r = 0.05 | r = 0.34 |
| | Performance | r = -0.05 | r = 0.17 | r = -0.22 | r = 0.28 | r = 0.27 | r = 0.35 | r = -0.29 | r = 0.02 | r = -0.15 | r = -0.19 | r = -0.19 | r = 0.24 | r = 0.19 | r = 0.05 | r = 0.20 |
| | Practical Reasoning | r = -0.02 | r = 0.17 | r = -0.29 | r = 0.03 | r = 0.13 | r = 0.29 | r = -0.25 | r = 0.32 | r = -0.20 | r = 0.17 | r = -0.15 | r = 0.15 | r = 0.23 | r = 0.13 | r = 0.26 |

*p<0.05

Table 91

*Fishers z Calculation of the FASD and No FASD Groups*

| Description of Correlation | z-score | p-value |
|---|---|---|
| Correlation of alcohol use with the initial Locomotor subscale of the FASD group compared to the initial Locomotor subscale of the No FASD group | -0.15 | p>0.05 |
| Correlation of alcohol use with the initial Personal Social subscale of the FASD group compared to the initial Personal Social subscale of the No FASD group | -0.51 | p>0.05 |
| Correlation of alcohol use with the initial Eye Hand Co-ordination subscale of the FASD group compared to the initial Eye Hand Co-ordination subscale of the No FASD group | -1.04 | p>0.05 |
| Correlation of alcohol use with the initial Hearing and Language subscale of the FASD group compared to the initial Hearing and Language subscale of the No FASD group | -0.32 | p>0.05 |
| Correlation of contraception use with the initial Eye Hand Co-ordination subscale of the FASD group compared to the initial Eye Hand Co-ordination subscale of the No FASD group | 3.01 | p<0.05* |
| Correlation of Employment status with the follow-up Locomotor subscale of the FASD group compared to the follow-up Locomotor subscale of the No FASD group | -0.66 | p>0.05 |
| Correlation of Income status with the initial Eye Hand Co-ordination subscale of the FASD group compared to the initial Eye Hand Co-ordination subscale of the No FASD group | -0.56 | p>0.05 |
| Correlation of Income status with the follow-up Eye Hand Co-ordination subscale of the FASD group compared to the follow-up Eye Hand Co-ordination subscale of the No FASD group | 1.79 | p>0.05 |
| Correlation of Marital Status with the initial Hearing and Language subscale of the FASD group compared to the initial Hearing and Language subscale of the No FASD group | 1.36 | p>0.05 |
| Correlation of Marital Status with the initial Eye Hand Co-ordination subscale of the FASD group compared to the initial Eye Hand Co-ordination subscale of the No FASD group | 0.80 | p>0.05 |
| Correlation of Marital Status with the initial Performance subscale of the FASD group compared to the initial Performance subscale of the No FASD group | 2.19 | p<0.05* |
| Correlation of maternal Weight with the follow-up Hearing and Language subscale of the FASD group compared to the follow-up Hearing and Language subscale of the No FASD group | 1.64 | p>0.05 |
| Correlation of maternal Tertiary Education with the initial Performance subscale of the FASD group compared to the initial Performance subscale of the No FASD group | 2.11 | p<0.05* |
| Correlation of maternal Tertiary Education with the follow-up Eye Hand Co-ordination subscale of the FASD group compared to the follow-up Eye Hand Co-ordination subscale of the No FASD group | 1.50 | p>0.05 |
| Correlation of maternal Tertiary Education with the follow-up Performance subscale of the FASD group compared to the follow-up subscale of the No FASD group | 3.11 | p<0.05* |
| Correlation of maternal TB diagnosis with the follow-up Locomotor subscale of the FASD group compared to the follow-up Locomotor subscale of the No FASD group | -1.49 | p>0.05 |
| Correlation of maternal TB diagnosis with the follow-up Personal Social subscale of the FASD group compared to the follow-up Personal Social subscale of the No FASD group | -2.67 | p<0.05* |
| Correlation of the total number of Live Births with the follow-up Personal Social subscale of the FASD group compared to the follow-up Personal Social subscale of the No FASD group | 1.88 | p>0.05 |

p<0.05*

For the FASD group, there are significant positive associations between maternal tertiary education and infant Performance subscale at the initial assessment, Eye Hand Co-ordination subscale at the follow-up assessment, and Performance subscale at the follow-up assessment. Relationships between TB diagnosis and infant Locomotor performance at the initial assessment and Personal Social subscale at the follow-up assessment are evident. The results show another association between parity (total number of live births) and the child's Personal Social subscale at the follow-up assessment.

Table 90 shows that there are significant negative and positive relationships within the No FASD group. There are significant negative associations between alcohol use during pregnancy and the Locomotor, Personal Social, Hearing and Language and Eye Hand Co-ordination subscales of the initial assessment of infant development. This outcome shows that some women who consumed alcohol did not have their child clinically classified on the FASD spectrum yet the detrimental effects of alcohol on the infant's development is still evident. Maternal employment shares a negative relationship with the infant Locomotor development on the follow-up assessment while income status is negatively associated with eye hand co-ordination only evident at the initial assessment. At the initial assessment there is a non-significant positive association between employment and Locomotor development while this changes to a significant negative association at the follow-up assessment. The modest sample size, the presence of outliers and the significant change in the development of infants from the initial to the follow-up assessment could account for the variability in these associations. The change in significant associations between income and Eye Hand co-ordination from a negative to a positive association is also interesting, as the significant positive association at the follow-up

assessment meets the expectation of improved infant development with access to more resources.

There are also significant positive associations between Hearing and Language, Eye Hand Co-ordination and the Performance subscales of the initial assessment with marital status. This suggests that stable home environments could promote better child development. Other maternal variables that share essential relationships with assessment subscales are as follows: Contraception and the Eye Hand Co-ordination infant developmental subscale of the initial assessment and maternal weight with the Hearing and Language subscale of the follow-up assessment. However, these associations seem irrelevant when interpreted in view of child development.

According to the results from the Fisher's z calculation (Table 91), the pattern of scores are different between the FASD and No FASD groups for the relationship between tertiary education and initial and follow-up Performance scales respectively, the relationship between contraception use and eye hand co-ordination, marital status and initial performance and TB diagnosis with the personal social subscale. Even though the pattern of scores for certain variables differs, it does not necessarily imply that there will be statistical differences between groups, as shown by the outcome of the Chi Square analysis from Hypothesis Two where the results show that there are no significant differences between the groups for these individual maternal variables (Table 55 to Table 61). The pattern of scores for the remaining maternal variables follows a similar pattern for the FASD and No FASD groups.

There is no association between maternal covariates (alcohol and smoking) and the severity of maternal depression. No differences between the FASD and No FASD groups are evident for the severity of depression. This concurs with information from Hypothesis One implying that the severity of depression for women within this community is similar irrespective of the clinical diagnosis of their infant's exposure to alcohol prenatally. Alcohol is the only significant covariate that is associated with infant functional areas of development at the initial assessment. Prenatal alcohol exposure is the primary cause of developmental delays in FASD infants. However, the correlational analysis shows that infants who may have been exposed to alcohol prenatally but not clinically diagnosed as FASD also experience the negative impact of prenatal alcohol exposure, as shown by the positive associations of alcohol use and poor development in certain areas of functioning of the No FASD group (Locomotor, Personal Social, Hearing and Language and Eye Hand Co-ordination). As confirmation, the pattern of scores between the groups does not differ for these associations, implying that the children within the No FASD group experience similar challenges to the FASD. Children who are prenatally exposed to alcohol and who lack stimulation are likely to struggle reaching their developmental milestones.

## 3.8 Summary

This chapter outlined the description of the variables and the distribution of the data. The reason for selecting parametric procedures over non-parametric procedures was noted. Descriptive statistics, between group comparisons, within group comparisons, inferential and multivariate analyses were carried out to answer the research question.

Firstly, the results show that there is no difference in maternal depression between the FASD and No FASD groups. Although some level of depression is evident in both these groups, there is no trend in maternal mood that distinguishes the groups from each other. Secondly, there are no maternal variables (demographics, pregnancy history, health factors or risky behavior during pregnancy) that emerges as significantly associated with maternal depression. Thirdly, the level of depression within the groups does not change significantly between the initial and follow-up assessment. Fourthly, the level of maternal depression within the FASD and No FASD group is not associated with infant developmental outcome of this sample.

However, differences between the FASD and No FASD groups emerge with regard to infant development. Although there is some overlap with regard to delayed developmental functioning in both groups, there are also distinct areas of delayed functioning where the FASD group performs significantly lower than the No FASD group at the initial (Personal Social, Eye Hand Co-ordination, Hearing and Language, Performance) and follow-up (Locomotor and Personal Social) assessments respectively. In terms of overall development the FASD group performs lower when compared to the No FASD group. This delay in developmental functioning could be attributed to the possibility that the majority of mothers within this community consume alcohol and this impairs the infant's development from intra-uterine conception. However, there are infants that are more severely affected than others and these former infants often display both the physical and mental features that characterize an infant with FASD. Poor socio-economic conditions and a lack of resources could be other factors that negatively impact the development of the majority of children within this community.

# CHAPTER 4 DISCUSSION

## 4.1 Overview of Main Findings

This was one of the first studies to be conducted in the Northern Cape, South Africa, where alcohol use, maternal depression and their association with infant development had been an area of sparse research. Although South Africa had shown the highest reported rates of FASD in the world, maternal profiles that characterized mothers who drank during pregnancy had mainly been researched internationally and in parts of the Western Cape, South Africa, but not extensively within the Northern Cape, specifically Upington (Croxford & Viljoen, 1999; May et al., 2005; May, 2008 ; Viljoen, Croxford, Gossage, Kodituwakku &May, 2002). Thus, the South African context provides a unique opportunity to investigate these variables. In addition, the majority of FASD studies that were conducted in South Africa assessed developmental differences in children of school-going age instead of infancy (Adnams et al., 2001; Adnams et al., 2007; Kodituwakku et al., 2006; May et al., 2000; May et al., 2006; Viljoen et al., 2005 ; Viljoen, Craig, Hymbaugh, Boyle & Blount, 2003). This study adds novel information, as a sample of infants from the Northern Cape, who were exposed to alcohol prenatally, and their mothers were recruited and retained to monitor changes in maternal depression and infant development, variables not previously evaluated in this area (Urban et al., 2008).

It was hypothesized that the maternal profile (level of depression and maternal factors) of mothers with a FASD infant would be distinct from that of mothers without a FASD infant. There were four main findings that emerged during the investigation of this hypothesis. Firstly, there were no trends in depression (mood state) that differentiated mothers with a FASD infant from mothers without a FASD infant. Secondly, there were no maternal risk factors that were

associated with depressive symptoms in either the FASD or No FASD groups. Thirdly, maternal demographics (maternal age at time of interview, maternal weight, marital status, maternal education, employment status and income), pregnancy (pregnancy intent, contraceptive use, total number of pregnancies, total number of live births and total number of miscarriages), health risk factors (drug use during pregnancy, alcohol use during pregnancy, smoking during pregnancy and TB diagnosis) did not differ significantly between women in the FASD and No FASD groups from this disadvantaged community. Fourthly, maternal depression did not show a significant negative or positive correlation with any area of infant development for either the FASD or No FASD group.

Another point of investigation was to delineate a maternal profile of women who were at risk of having an infant with FASD. The main finding was that there were no trends in demographic, pregnancy and health risk factors that differentiated mothers with a FASD infant from mothers without a FASD infant in this sample. Since no significant differences emerged between the demographic characteristics of the mother samples within this disadvantaged community, the focus turned to an examination of potential developmental differences between infants clinically diagnosed as FASD compared to those without a FASD diagnosis (No FASD group). There were five primary findings that emerged from this investigation.

Firstly, infants with FASD performed significantly lower than the No FASD group on social adaptation (Personal Social subscale) and overall development (Developmental Quotient) both at the initial (9-18 months) and follow-up assessments (18-45 months). Secondly, there was a significant difference between the FASD and No FASD groups on gross motor functioning only

at the follow-up assessment. Even though the FASD and No FASD groups differed significantly on the total developmental quotient, this in all likelihood reflects only the differences between gross motor functioning and social adaptation. Thirdly, infants with FASD performed significantly lower than the No FASD group on fine motor functioning, hearing and language and non-verbal reasoning only at the initial assessment. Fourthly, maternal alcohol use during pregnancy was the only covariate that was significantly associated with functional areas of development during the early stages of infancy (9-18 months).

Finally, the FASD and No FASD groups surprisingly did not show significant differences in the developmental outcomes (Hearing and Language, Eye Hand Co-ordination, Performance and Practical Reasoning), at second assessment and they appear to be very similar groups in support of this. The FASD and No FASD children performed considerably below the average range on the GMDS-ER with a standard deviation that was greater than one difference relative to the expected norm. This suggests that infants who were born into similar deprived environments exposed to similar maternal care to the children in the FASD group, and who were possibly exposed to alcohol prenatally, but did not suffer the extreme effects of prolonged and/or repeated alcohol exposure also show developmental delays. Thus, the combined factors of possible prenatal alcohol exposure and living under deprived conditions, compounded by a lack of stimulation, could contribute to the lowered developmental scores in the children from the No FASD group - a pattern found in children from other disadvantaged and under-resourced communities (Duncan, Brooks-Gunn & Klebanov, 1994; Freedman & De Boer, 1979; Kasese-Hara, 2002 ; McLoyd, 1998).

The discussion chapter has been divided into the following sections: maternal profiles of those with a FASD infant compared to those without a FASD infant; developmental differences between infants with FASD compared to those without FASD; limitations of the study; conclusions (theoretical and practical implications of the study) and recommendations for future research.

## 4.2 Maternal profiles of those with a FASD infant compared to those without a FASD infant

The results of the statistical analyses showed that there was no distinct maternal profile that differentiated between maternal mood state and vulnerability to having an infant with FASD, as summarized in Table 92. Each main result identified in Table 92 will be discussed individually in the sections that follow.

Table 92

*Summary Results of Maternal Profiling from Current Study*

| Area of Interest using the Mother Sample | Were the results significant? | Table Reference |
|---|---|---|
| Was there a significant difference in depression between the FASD and No FASD groups? | No | 46; 47; 49; 50; 73 & 74 |
| Were there any maternal demographic, pregnancy and health risk factors significantly associated with depression between the groups? | No | 63; 64 & 65 |
| Was there distinct maternal profile that distinguished between the FASD and No FASD groups? | No | 56; 57; 58; 59; 60; 61 & 62 |

In this study, no statistically significant difference was found between the levels of maternal depression measured in mothers from the FASD and No FASD groups. Although preliminary, unpublished results from De Aar, Northern Cape indicate that women with FASD infants display a significantly higher rate of depression when compared to those with an infant without FASD, the current study did not confirm this trend (Chersich et al., 2011; Urban et al., 2003; Urban et al., 2004 ; Urban et al., 2005). The diverse methods used to measure alcohol use and depression could account for the inconsistent findings across studies as some studies have shown significant associations between alcohol consumption and depression, while others have not (Astley, Bailey, Talbot & Clarren, 2000; Graham, Massak, Demers & Rehm, 2007; Homish, Cornelius, Richardson & Day, 2004; Kessler, 1997, Rubio, Kraemar, Farrell & Day, 2008; Thom, Zwi & Reinach,1993 ; Van Dorn, Williams, Dell-Colle & Hawkins, 2008).

In addition, the timing of procedures and the type of scales (namely the BDI and POMS) used in this study to screen for depression may have been simplistic and not robust enough to identify underlying symptoms of depression that could differentiate the groups. Although the depression scales used in this study have been extensively used in research, a limitation is that they screen for depression rather than provide a comprehensive diagnosis thereof. Studies which considered the full spectrum of variables associated with depression, instead of focusing on depression in isolation, found significant differences in depression between mixed cohorts of men and women when screening, diagnostic and interview techniques were used to diagnose depression (Carter, Garrity-Rokous, Chazan-Cohen, Little & Briggs-Gowan, 2001; Rubio, Kraemar, Farrell & Day, 2008; Thom, Zwi & Reinach, 1993 ; Van Dorn, Williams, Dell-Colle & Hawkins, 2008). The

results of the current study also showed no significant correlation between maternal depression and selected maternal risk factors, which will be discussed in the section that follows.

Although several studies have indicated significant associations between depression and maternal demographic characteristics, such as age, marital status, educational level, pregnancy history, tobacco use and health problems like the presence of Tuberculosis, the current study did not confirm these outcomes (Akthar-Danesh et al., 2007; Aydin & Ulusahin., 2000; Beeghly et al., 2003; Bergner, Beyer, Klapp & Rauchfuss, 2008; Bhagwanjee, Parekh, Paruk, Petersen & Subedar, 1998; Brennan, Moos & Mertens, 1994; Coleman, Morison, Paine, Powell & Walraven, 2006; Choi et al., 2009; des Riviéres-Pigeon et al., 2001; Ensel, 1982; Hadley, 2008; Hall, 1990; Homish, Cornelius, Richardson & Day, 2004; Issa, Yussuff & Kuranga, 2009; Lok et al., 2004; Lok, Yip, Lee, Sahota & Chung, 2010; Lorant, Deliége, Eaton, Phillippot & Ansseau, 2003; Middeldorp, Cath & Boomsma, 2006; Miech & Shanahan, 2000; Muhwezi, Agren, Neema, Maganda & Musisi, 2008; Naidoo & Mwaba, 2010; Neugebauer et al., 1997; Obi, Onah & Okafor, 2009; Pillay & Sargent, 1999; Ramchandani, Richter, Stein & Norris, 2009; Reis, 1988; Samuels-Dennis, 2007 ; Tomlinson, Grimsrud, Stein, Williams & Myer, 2009). A possible reason for the lack of significant difference in depression could be attributed to the small sample size and the limited sensitivity of the depression screening tools that were used. Although there was no significant difference between the FASD and No FASD groups on the maternal variables that were assessed, there could be other variables which were not evaluated in the current study that could differentiate the maternal profiles of women with a FASD infant compared to women without a FASD infant.

Other reasons for the high rate of alcohol consumption within this area could be the drinking culture of the community where drinking alcohol was common and highly accepted; where alcohol was consumed to improve affective state, to avoid negative emotions and a lack of recreational facilities meant fewer relaxation alternatives that contributed to alcohol being an acceptable form of recreation (Bloomfield, Stockwell, Gmel & Rehm, 2003; Browning & Erickson, 2009; Cooper, Russell & George, 1988; Cox & Klinger, 1988 ; Kuntsche, Knibbe, Gmel & Engels, 2006). While the presence of depression was not significantly correlated with the likelihood of having an infant with FASD, it is possible that other, unmeasured factors not related to mood state, such as the drinking culture of the community, family influences, poverty and cultural practices or beliefs together with depression, could increase the likelihood of women consuming alcohol during pregnancy. The results showed no significant difference in the maternal profiles of women with and without FASD infants, which may suggest that their social and environmental backgrounds are very similar that will be outlined in the section that follows.

In support of this, women who had an infant clinically diagnosed with FASD and those whose infants were classified as No FASD were found to display similar characteristics. Although some women from both groups in this study self-reported alcohol use during pregnancy, not all women gave birth to infants who were clinically diagnosed as FASD. While other studies have found that older mothers (over 30 years), of low socio-economic status, with a previous child with FASD, with higher gravidity (greater than three), higher number of still births (greater than one), poor maternal nutrition and lowered metabolic activity of ADH1B2 and ADH1B3 (rapid metabolizer of alcohol) had an increased likelihood of producing an infant

with FASD, the results of the current study did not confirm these findings (Barr & Streissguth, 2001; Jacobson, Joseph, Sokol, Chiodo & Corobana, 2004; Jones, 2011, Majewski, 1981; May et al., 2008; O'Leary, 2004; Viljoen et al., 2001 ; Viljoen, Craig, Hymbaugh, Boyle & Blount, 2003).

Recollection errors or under-reporting of alcohol use could be a possible reason for the lack of a significant correlation between these variables. Despite FASD being prevalent in this community, no maternal characteristics investigated in this study formed a distinct maternal profile that differentiated women in this sample. It is possible that there could be other unmeasured factors, such as history of maternal drinking in the family which may increase the likelihood of a woman producing children with FASD. Other such factors include poor maternal nutritional status, maternal HIV status, limited access to antenatal clinic services and poor access to contraceptives (the latter which could increase the likelihood of having a child with FASD when family planning methods are not adhered to or readily available).

In this study, women were classified into the FASD and No FASD groups based on the clinical diagnosis of their infant. Although there were some women who admitted to consuming alcohol during pregnancy, their infant was not clinically diagnosed as FASD due to their infant not meeting the IOM criteria. There were some women in the No FASD group who reported consuming alcohol which concurred with other substance abuse studies (Kvigne et al., 2003; May et al., 2004; ; May et al., 2005). This situation is not uncommon in studies of alcohol and substance abuse. For example, May et al. (2005) found a trend in a sample of women (n=170) from the Western Cape, where the range in the FASD group was 13.2-11.1 drinks per week, while the range for those in the control group was 2.9-4.7 drinks per week. However, the

mothers with a FASD infant reported drinking patterns that were significantly higher than those who did not have a FASD infant (Kvigne et al., 2003; May et al., 2005 ; Viljoen, Croxford, Gossage, Kodituwakku & May, 2002).

Due to the threshold for alcohol consumption for FAS; normative patterns of consumption before, after and during pregnancy; social; cultural and demographic variables differing extensively by individuals and groups from different areas, the point of controversy remains that any amount of alcohol, especially binge drinking, for any women of child-bearing age places them at risk for having a child with FASD if they consume alcohol during pregnancy (Dhami & Pelletier, 1982; Ethen et al., 2009; May et al., 2004; May et al., 2005 ; Redgrave, Swartz & Romanoski, 2003). Since the quantity and timing of alcohol consumed by the mothers in the current sample were not taken into account, this limited the insight to their behavioural profile. This should be considered for future studies. In addition, the diagnostic tools used to assess maternal profiles need to be sensitive, as the complexity of diagnosis could lead to underlying problems being missed. The small sample size and limited sensitivity of the screening tools could be the reason for finding no significant differences in maternal depression between the groups and for no distinct maternal profile being delineated for women who consumed alcohol during pregnancy. In addition, a mixed methods research design of incorporating qualitative elements such as semi-structured interviews with a sample of mothers from the FASD and No FASD groups could have helped to understand some of these non-significant findings.

Although there was no significant association between the presence of maternal depression and infant development, some interesting significant differences emerged when the FASD and

No FASD infants were compared on their developmental functioning. These findings are discussed in the sections that follow.

## 4.3 Developmental differences between infants with FASD and those without FASD

Findings illustrated in Table 93 below, show that there were some significant developmental differences between the infants/children in the FASD and No FASD groups. The gender ratio of the sample was assessed prior to the analyses, as developmental differences between males and females had to be ruled out. There was no significant difference between the numbers of males and females in the FASD and No FASD groups, which allowed for comparisons to be made between the groups. The sections that follow address the relationships between infant development and maternal depression, cognitive functioning, co-ordination, language and communication skills and social adaptive functioning, as well as comparisons in these domains between the FASD and No FASD infants.

Table 93

*Summary Results of Infant Development from Current Study*

| | | Were the results significant? | | |
|---|---|---|---|---|
| **Functional Area** | **Area of Interest using the Infant Sample** | **9-18 months** | **18-45 months** | **Table Reference** |
| | Was maternal depression associated with infant development? | No | No | 71 & 72 |
| **Physical Development** | Was there is a difference between the FASD and No FASD groups on Gross Motor Functioning? | No | Yes | 44; 66; 67; 76 & 77 |
| | Was there is a difference between the FASD and No FASD groups on Fine Motor Functioning? | Yes | No | 44; 66; 67; 78 & 79 |
| **Cognitive Development** | Was there is a difference between the FASD and No FASD groups on the Hearing and Language subscale? | Yes | No | 44; 66; 67; 80 & 81 |
| | Was there is a difference between the FASD and No FASD groups on the Performance subscale? | Yes | No | 44; 66; 67; 82 & 83 |
| | Was there is a difference between the FASD and No FASD groups on the Practical Reasoning subscale? | - | No | 66; 84 |
| **Social Adjustment** | Was there is a difference between the FASD and No FASD groups on the Personal Social subscale? | Yes | Yes | 44; 66; 67; 85 & 86 |
| **Overall Development** | Was there is a difference between the FASD and No FASD groups on the Developmental Quotient subscale? | Yes | Yes | 44; 67; 87 & 88 |

No statistically significant correlations emerged between level of maternal depression and child development within the sample, possibly due to the small sample size that limited the power of the analyses. There is evidence that maternal depression negatively influences personal-social, cognitive and physical aspects of child development, possibly due to a significant reduction in mother-child bonding (Bowlby, 1944 ; Richter, 2003). Other studies showed inconsistent findings between maternal depression and different stages of child development (Bernstein & Hans, 1994; Cooper et al., 2009; Galler, Harrison, Ramsey, Forde & Butler, 2000; Hadley et al., 2008; Kvigne et al., 2003; Tomlinson, Cooper, Stein, Swartz & Molteno, 2006 ; Whiffen & Gotlib, 1989). Thus, while maternal depression is associated with developmental delays in infants, such a relationship could not be confirmed in the current study. There were, however, several developmental differences between the FASD and No FASD groups, which will be discussed below.

As can be seen in Table 93, which summarises the results of the current study, developmental delays in infants exposed to alcohol prenatally were confirmed for subtests of the GMDS and GMDS-ER at specific assessment time points. The FASD group performed significantly lower when compared to the No FASD group on social adaptive behaviours (Personal Social subscale) and overall development (Developmental Quotient subscale) at both assessment points. Varied differences were found with regard to the other developmental areas: Fine motor co-ordination, Hearing and Language, Eye Hand Co-ordination and Performance (nonverbal reasoning) that differed between the groups at the initial assessment, while Gross Motor functioning differed at the follow-up assessment. In all instances, the FASD group performed significantly lower than the FASD group. These findings are summarized in Table 93. The descriptive/summary

statistics for the groups on the GMDS and GMDS-ER are illustrated in Table 44. It is well known that delays in executive functioning (higher order cognitive abilities involving reasoning, planning, behavioural flexibility, self- awareness and goal-directed behaviours) are one of the challenges experienced by infants who have been exposed to alcohol prenatally (Chiodo, Janisse, Delaney-Black, Sokol & Hannigan, 2009; Mattson et al., 2010; Mattson, Crocker & Nguyen, 2011; Oscar-Berman & Marinković, 2007; Rasmussen, 2005 ; Wacha & Obrzut, 2007). In addition, lowered vigilance, reduced reaction time and challenges with information processing have been shown to further impede the learning ability of a child who had been exposed to alcohol prenatally (Hausknecht et al., 2005; Jacobson & Jacobson, 1994; Jacobson et al., 1993 ; Streissguth, 1997). Although executive functioning was not directly assessed in this study, the results support the findings that children diagnosed with FASD show significant delays in higher order cognitive-motor functioning when compared to those with No FASD (Adnams et al., 2001 ; Mattson, Crocker & Nguyen, 2011).

In this study, higher order cognitive-motor functioning was assessed by the Hearing and Language, Performance, Practical Reasoning and Developmental Quotient subscales of the GMDS-ER. The infants with FASD performed significantly lower than the No FASD infants on the Developmental Quotient at the initial and follow-up assessments, while differences in language and nonverbal reasoning (performance) between the groups were only evident at the initial assessment. This suggests that the infants with FASD are considerably poorer than their No FASD counterparts in terms of higher order cognitive functions in the very early years, but that this difference dissipates as they develop. It may also point to discrepancies between the infant and child GMDS scales (discussed later). The section that follows discusses the language

developmental differences between the groups and the impact these may have on their overall cognitive development.

Receptive and expressive communication and social development delays are often experienced by children who are exposed to alcohol prenatally, where such deficits depend on the severity of structural brain damage (Adnams et al., 2001; Church & Kaltenbach, 1997; Coggins, Timler & Olswang, 2007 ; O'Leary, 2004). Although the current study found significant differences between the FASD and No FASD groups in terms of the Hearing and Language subscale, these differences were only evident at the early stages of development (9-18 months) and not at the later assessment (18-45 months). A possible reason for this variation was that both groups performed poorly (i.e. below the expected norm 90-109) with a greater than one difference in standard deviation on this subscale (Hearing and Language) at the later stage of development, where subtle deficits between the groups may have been complex to differentiate with the developmental instrument (GMDS-ER). This outcome suggested that specialized instruments for assessing language development should have been used to delineate these subtle delays.

Although this study did not assess the language domain in a very in depth manner, Kodituwakku et al. (2006) found that South African children who were exposed to alcohol prenatally had greater difficulty with letter fluency when compared to category fluency and that children with FASD were able to generate fewer words in a spontaneous generation task than children not exposed to alcohol prenatally. In addition, Adnams et al. (2007) found that Grade three children with FASD (n=40) performed significantly poorer on tests of literacy that

included reading, spelling, addition, subtraction and phonological awareness when compared to children who were not exposed to alcohol prenatally (n=25). Due to the variation in significant results regarding Hearing and Language performance where language delays were only prominent at early stages of development, it is suggested that language specific assessment tools be used in future studies to allow for subtle differences in development to be detected. It is probable that children with FASD may experience language delays, yet the GMDS-ER may not be sensitive enough to detect subtle differences. The differing psychometric properties between the GMDS and the GMDS-ER could also contribute to the lack of significant differences between the FASD and No FASD groups.

Poor/delayed language development could contribute to broader social difficulties in children with FASD. Children with FASD are superficially talkative, that is they talk too much and too fast often with little substance, have a tendency to interrupt people during a conversation, display poor timing, use inappropriate conversation topics, obsess over one topic, have difficulty in remembering social rules and picking up social cues, have minimal sense of personal space, are very touchy and excessively curious, all which could contribute to poor social adjustment (Sparks, 1993). These difficulties are likely to be linked to poor executive and language skills, demonstrating the inter-relationship between cognitive functions where impairments in one area of development would influence many other areas of functioning. The outcome of social adjustment in the infant groups will be discussed in the section that follows.

Poor social adjustment of children prenatally exposed to alcohol was found in the current study where the FASD group performed significantly lower than the No FASD group on the

Personal Social subscale of the GMDS/GMDS-ER during early and later stages of development. At the initial assessment alcohol is the significant covariate that is associated with social adjustment. Deficits in social skills occur when a skill has not been learned or if there are competing deficits such as anxiety or lowered attention that inhibit the manifestation of appropriate social skills (Kavale & Mostert, 2004). Both these possibilities could be true for the FASD children, who also live in deprived conditions. These findings represent a difference from those of Adnams et al. (2001), who found no significant differences between their FASD and No FASD groups on social adaptation (Personal-Social subscale) for children who were at an average age of 7 years. The smaller sample size in the current study may have contributed to these inconsistent findings. Therefore these results need to be further assessed with a larger infant sample before any information can be generalized to the wider community.

Supportive evidence for poor social skills in school age South African children (Grade 3) with FASD comes from Adnams et al. (2007) who found that these children showed poor adaptive behaviours when rated by their teachers on standards of self-sufficiency and social responsibility expected for their age and cultural group when compared to children who were not prenatally exposed to alcohol. Since the FASD and the No FASD groups performed significantly low on the Personal Social subscale, the current study supported the findings of Kavale and Mostert's (2004) study that social instability contributed to poor language and social development, as it is possible that the environmental conditions for samples selected for FASD studies were similar. Unstable home environments could be characteristic of the type of household that FASD infants are exposed to. Larrson, Bohlin and Tunell (1985) indicated that mothers who were classified as excessive drinkers (> 125g of pure alcohol per day during the

month before first visit to clinic) tended to have children who were delayed in their speech development and also tended to have more unstable family backgrounds when compared to controls (less than 30 g of pure alcohol per day during the month before their first visit to the health clinic), as a lack of stimulation within the home environments could have contributed to the developmental delays experienced by children from disadvantaged backgrounds.

Many studies have found that poverty and low socio-economic status contribute to unstable home environments and perpetuate the delay in language development in children in general (Arriaga, Fenson, Cronan & Pethick, 1998; Bee et al., 1982; Church & Kaltenbach, 1997; Feldman et al., 2000; Larrson, Bohlin & Tunell, 1985 ; Walker, Greenwood, Hart & Carter, 1994). However, there is limited research into the association between social instability and language development in children exposed to alcohol prenatally. While language and communication deficits have been demonstrated in children with FASD, some researchers argue that cognitive and behavioural deficits are more prominent than specific speech and language disorders in these children, which suggests that there is still a need for a comprehensive neurodevelopmental profile of such infants (Adnams, 2001; Cone-Wesson, 2005; Mattson, Crocker & Nguyen, 2011 ; Wacha & Obrzut, 2007). Differences in the physical development of the current sample will be explored in the section that follows.

When motor skills are not well developed, attention and self-esteem may be affected, and anxiety may develop, which could lead to challenges in adjusting to environmental demands which could in turn impact cognitive ability (Burd, Klug, Martsolf & Kerbeshian, 2003). Visual-spatial deficits, fine- and gross motor deficits have been reported in children exposed to alcohol

prenatally (Bay & Kesmodel, 2010; Hannigan & Riley, 1989; Kyllerman et al., 1985; Mattson et al., 2010; Mattson, Crocker & Nguyen, 2011; O'Leary, 2004; Thakur, Sharma & Rani, 2004 ; Wacha & Obrzut, 2007). Children with FASD are generally able to perform simple gross motor-related tasks, but often struggle with more complex motor tasks, as alcohol-related damage to the cerebellum and basal ganglia reduces motor co-ordination skills (Humphriss, Hall & MacLeod, 2010; Kodituwakku, 2007 ; Mattson, Crocker & Nguyen, 2011). In the current study, the children with FASD performed significantly lower than children with No FASD in terms of their gross motor functioning at later stages (18-45 months) of development and with their fine motor development at the initial assessment (9-18 months). This suggests that the children with FASD struggled with complex gross motor movements and in this respect were distinctly different from the comparison group at later stages of development (18-45 months). A possible reason for this is that although the children in the No FASD group come from the same disadvantaged community as the FASD children, prenatal exposure to alcohol may have compounded the difficulty of the FASD group from gaining weight which negatively interfered with their gross movements. Analyzing the birth weights of infants was not the focus of the current study yet could be an important aspect to further investigate within this sample. Yet, these findings concur with the outcomes of Kalberg et al.'s (2006) study, where infants (between 20 to 68 months) who were prenatally exposed to alcohol, showed significant delays in motor development on the Vineyard Adaptive Behaviour Scale (VABS).

While studies have consistently shown that children with FASD experience difficulty with spatial activities, findings regarding motor development are inconsistent. For example, a South African study found no significant group effect on gross motor skill development but a

significant difference on fine motor co-ordination in FASD and Non FASD children (Adnams et al., 2001 ; Kalberg et al., 2006). Despite there being no statistically significant difference between the groups in terms of fine motor co-ordination at later stages of development (18-45 months) in the current study, the scores of the FASD group and No FASD groups were below average when compared to expected normative ranges (90-109) where the difference exceeded one standard deviation. This suggests that prenatal alcohol exposure and deprived environmental conditions could contribute to developmental delays. Although levels of potential malnutrition were not assessed in this study, the prevalence of FASD is higher in impoverished areas where there are limited resources and space to explore the environment, possibly explaining why these children performed so poorly in all areas of development (Agarwal et al., 1992, Giagazoglou, Kyparos, Fotiadou & Angelopoulo, 2007; Jones, 2011 ; Viljoen, Croxford, Gossage, Kodituwakku & May, 2002). It is possible that while the GMDS-ER may be a sensitive test for identifying general motor delays in typically developing children, it may not be sensitive enough to detect subtle differences in special populations such as those with FASD. In addition, the psychometric properties between the GMDS and the GMDS-ER differ which could contribute to the lack of significant results.

Although there were no significant differences between the FASD and No FASD groups on Hearing and Language, Eye Hand Co-ordination, Performance and Practical Reasoning developmental subscales at the follow-up assessment (18-45 months), the children without FASD struggled to reach their developmental milestones as they obtained average scores that were below the expected normative levels (90-109) where the difference was greater than one standard deviation for performance of the groups on these specific subscales. This suggests that

children from this impoverished community may be under-stimulated and not have enough resources to explore their environment and learn. This creates a vicious cyclical situation, as these environmental deprivations may be compounded by dysfunctional families where the mother is unable to take proper care of her infant/s (Toutain & Lejeune, 2008). Inconsistent parenting, poverty, lack of resources and poor stimulation may be some of the reasons why the cognitive functioning of the FASD and No FASD infants were delayed, as was evident from their low intellectual quotient scores and poor school achievement (McLoyd, 1998). Additional reasons for the infants in this sample performing below the expected norm (90-109) are described below.

Children within the No FASD group may have been exposed to small quantities of alcohol in utero and thus may also suffer the consequent neuro-cognitive deficits associated with alcohol exposure, despite the fact that they did not meet the clinical diagnostic criteria for FASD. However, the role of alcohol exposure is not exclusive as there are many other factors such as environmental influences other than alcohol that have been shown to be associated with child development (Chasnoff et al., 2005 ; O'Connor & Whaley, 2003). A multi-site study (conducted in the United States and Finland) with individuals ranging from 7 to 21 years showed that a neurobehavioural profile of poor executive functioning and poor spatial processing distinguished participants with dysmorphic and no dysmorphic features related to alcohol exposure from controls. The researchers used a comprehensive neuropsychological test battery (D-KEFS Verbal Fluency Test, D-KEFS Trail Making Test, Progressive Planning Test, Visual Discrimination Reversal Learning, NES-3, Morris Virtual Water Maze, CANTAB Spatial Recognition Memory, CANTAB Spatial Working Memory, CANTAB Spatial Span, Grooved

Pegboard, Visual Motor Integration) (Mattson et al., 2010). However, this differs from the current study differs, as the neuropsychological test battery that was used for the Mattson et al. (2010) study was more comprehensive than the assessment tools used for the current study. The assessment battery selected in the Mattson et al. (2010) study allowed for more detail to be obtained from individuals who were exposed to alcohol yet did who not all show the prominent (dysmorphic) deficits. Since the participants in the Mattson et al. (2010) study ranged from school age to young adulthood,the need remains for similar studies (with detailed assessment batteries) to be conducted with infants and young children who were exposed to varying levels of alcohol.

Among the biggest challenges in understanding the neurobehavioural outcomes of prenatal alcohol exposure are the dose, timing of alcohol exposure and pattern of alcohol consumption (Mattson, Crocker & Nguyen, 2011). Therefore, additional research, which includes more comprehensive assessment batteries, is needed to refine and extend the available information regarding the neurobehavioural profiles of infants exposed to alcohol prenatally in order to distinguish them from infants who were not exposed to alcohol prenatally but who lack stimulation due to deprived conditions. The results of the current study showed that children from deprived backgrounds who were under stimulated displayed lowered cognitive functioning and showed very few developmental differences to children with FASD. Lowered cognitive functioning, poor health, inadequate nutrition and limited parental interaction appear to be characteristic of infants who are under stimulated (Guo & Harris, 2000; Patel, Rahman, Jacob & Hughes, 2004). The outcome of a local study where 31 infants ranging from newborn to two years were assessed on the GMDS also found that infants from low socio-economic

backgrounds had lower developmental profiles when compared to the expected norms (Laughton et al., 2010). Although the results of the current study showed that there were no significant differences between the FASD and No FASD groups on the Hearing and Language scale at the follow-up assessment (18-45 months), the children in the No FASD group still performed below the expected norm (90-109) with a greater than one standard deviation difference. This concurs with the main finding from Laughton et al.'s (2010) study which found that infants from low socio-economic backgrounds who were approximately two years old performed significantly below the expected norms on the Hearing and Language subscale. Since the sample sizes for the Laughton et al. (2010) study and the current study were small, additional studies with a larger sample need to be implemented before the results can be generalized to the wider community.

The delays evident in infant development that have been associated with poverty are similar to the challenges experienced by children who were prenatally exposed to alcohol. The difficulty is that, in the current study, both samples came from deprived environmental backgrounds. Many studies show that high levels of poverty are common among mothers of children with FAS (Chasnoff et al., 2005 ; O'Connor & Whaley, 2003). This makes it difficult, if not impossible, to identify developmental delays resulting from FASD and those resulting from environmental deprivation. Since intellectual functioning alone does not determine the challenges experienced by children with FASD, a comprehensive neuropsychological test battery may be better equipped to differentiate the effects of prenatal alcohol exposure and those resulting from poor developmental stimulation.

### 4.4 Limitations of the Study and Suggestions for Future Research

A major limitation of this study was the reduced sample size, which was a result of the high attrition rate. Geographic mobility, poor health of infants, poor maternal health and generally deprived socio-economic conditions were among the primary reasons for participants either re-locating or not returning to the study. This is similar to the high rates of loss to follow-up found in other substance use literature particularly in low income, high risk communities (El-Khorazaty, et al., 2007; Larrson, Bohlin & Tunnel, 1985 ; Zand, et al., 2006). Thus, when working with groups at high-risk, the probability of retaining these individuals in a prospective study is difficult.

Another potential limitation of the current study was the statistical analyses used despite a small sample size and slight skewness in the distribution of scores. Although the skewed distributions raised concerns about the use of parametric tests, there is evidence that such tests remain robust and useful although some of the assumptions were not adhered to. Even when parametric assumptions are violated, parametric tests are able to maintain adequate Type I error rates and power (MacDonald, 1999). Thus, parametric procedures were the statistical tests of choice to investigate the differences between the FASD and No FASD groups in terms of maternal depression, environmental factors and infant development over time.

A third limitation of the current study is that the true qualities of a comparison group were compromised due to some infants in the No FASD group also being exposed to alcohol

prenatally, as evident from the self-report of their mothers. However, based on the finding that the majority of these mothers denied alcohol use during pregnancy, comparisons between these groups were valid, as the analytic sample comprised the same individuals that attended both the initial and follow-up assessments.

Related to the point above, a further fourth limitation of the current study was that maternal behavioural data relied on self-report, and since no assessments were done to determine the alcohol levels in these women prior to giving birth, there was no way to validate their reports against an external criterion. Therefore, multiple indices to assess risky drinking patterns in women are recommended such as quantity, frequency and timing of alcohol use during pregnancy (Chiodo, Janisse, Delaney-Black, Sokol & Hannigan, 2009). Alcohol history is often difficult to obtain and the likelihood of this self-reported information being unreliable is high (Chudley, 2008; Lemola, Stadlmayr & Grob, 2009). Factors such as social desirability responding (e.g. underestimating the quantity of the alcohol consumed), failure to disclose, failure to recall, under-reporting and memory loss possibly related to the quantity of alcohol could have contributed to inaccurate information being provided during the interviews (Viljoen, Croxford, Gossage, Kodituwakku & May, 2002).

Despite contradictory responses from some mothers in this sample, the multi-assessment technique that was used to classify infants as FASD, based on the IOM criteria, allowed for a diagnosis to be made with or without a maternal history of alcohol use being confirmed (Elliot, Payne, Morris, Haan & Bower, 2008 ; Hoyme et al., 2005). A research design where mothers are interviewed about their alcohol consumption and drug use at each prenatal clinic visit prior

to their evaluation could counter the limitation identified in this study in terms of reliable information being obtained from mothers. In such a design, reported by Chiodo, Janisse, Delaney-Black, Sokol and Hannigan (2009) frequent contact with mothers enabled more accurate and up-to-date self-report information to be provided.

The lack of significant developmental differences between the FASD and No FASD groups could be attributed to the low reliability between the scales of the infant GMDS (birth to two years) and the child GMDS-ER (two to eight years). Although the GMDS-ER (2-8 years) has been extensively used in research studies, direct comparisons between the GMDS-ER subscales and the GMDS-ER developmental ranges are prone to misinterpretation due to the differing means and standard deviations of the instrument (Ivens & Martin, 2002). Using descriptive terms (e.g. average, below average, borderline) for the performance of the infants and children on these subscales and/or percentiles could overcome some of the potential interpretation errors. A study conducted in the United Kingdom with 30 children ranging from two months to seven years showed that even though the administration of most items on the GMDS and GMDS-ER are reliable, there remain administration challenges with a large number of items within these scales (Hanson, 1982). The reasons for items being considered as unreliable in the Hanson study were largely a result of administration problems – some items were not administered correctly and were scored on the basis of observation; in other cases scorers reserved judgment due to the poor presentation of items that were thought to produce invalid results and yet other items were omitted as they were too complex to administer (Hanson, 1982). Despite limitations in the reliability of certain GMDS items, Laughton et al. (2010) indicated that it remains an effective

tool for identifying developmental functioning and progress in infants from disadvantaged backgrounds.

### 4.5 Conclusion

Maternal depression was not significantly associated with a maternal profile of women who were vulnerable to using alcohol prenatally. However, there could be several unmeasured factors, such as patterns of risky drinking, partner support, situational factors, a lack of community support and awareness of family planning options that influence future pregnancies, which could be characteristic of women at risk of having an infant with FASD (Fabbri, Farrell, Penberthy, Ceperich & Ingersoll, 2009). Identifying the predictors of high risk behaviour during pregnancy is complex as the Northern Cape, South Africa is characterized by high levels of poverty, a lack of resources, malnutrition and high levels alcohol consumption, which remain a public health concern.

Prenatal exposure to alcohol has detrimental effects on infant development and the outcomes from this study could be used as a motivation to conduct larger studies in order to define a FASD neurobehavioural phenotype. The participating infants came from a disadvantaged community which did not provide much environmental stimulation. This situation could perpetuate their developmental delays and therefore more definitive evaluations of the environmental influence on infant development are needed (Brown & Pollitt, 1996 ; Larrson, Bohlin & Tunnel, 1985). Prenatal alcohol exposure cannot be viewed in isolation within these communities as a lack of stimulation, poverty, limited resources, historical factors, cultural/community knowledge and malnutrition remains a reality and needs to be further

investigated (Maggi, Irwin, Siddiqi & Hertzman, 2010 ; McLoyd, 1998). Differences between the findings of the current study and other research could be attributed to varied sample sizes, alcohol exposure levels and discrepancies in methodologies used (Mattson, Crocker & Nguyen, 2011). Alternatively or in addition, the modest sample size could have resulted in low power to detect statistically significant results.

### 4.6 Recommendations

The following points are practical implications arising from the results of the current study. Enhancing knowledge of risky behaviours during pregnancy could assist health professionals in understanding depressed individuals, help with identifying women at risk for depression and for alcohol abuse during pregnancy. Such knowledge could also assist in the planning of preventative programs, the provision of measures to decrease prenatal alcohol exposure such as contraceptive use, encouraging antenatal visits and interventions to decrease alcohol use if tested positive for pregnancy (Chiodo, Janisse, Delaney-Black, Sokol & Hannigan, 2009; Jones, 2011; Levine, Toro & Perkins, 1993; May et al., 2008; Patten, 1991 ; Wedding et al., 2007). Training of health care workers to screen, diagnose, prevent and treat an alcohol exposed pregnancy in low income countries should take the form of capacity building in order not to overburden the health care workers. Health communication, social marketing, community mobilization and community wide events to create awareness about risky drinking (frequent or binge drinking) and sexual activities where safer practices are reinforced, could contribute to effective FASD prevention strategies (Hankin, 2002; Krulewitch, 2005; Rosenthal, Christianson & Cordero 2005 ; Strandberg-Larsen, Nielsen, Andersen, Olsen & Grønbaek, 2008).

More frequent follow-up visits with mother and infant could be an advantage in detecting subtle changes in infant development (Agarwal et al., 1992). Since the development of infants is affected by innate and environmental factors, damage incurred from any of these influential factors would contribute to challenges being experienced by a growing infant. Developmental pattern changes from infancy to childhood could be subtle or drastic depending on the exposure to teratogenic and environmental conditions. Although the current study monitored the development of individuals exposed to alcohol from infancy to childhood, it would be ideal to develop a research design where the extent of alcohol exposure is monitored prior to birth and then from neonatal development to school entry to identify the specific associations between prenatal alcohol exposure to development. This type of long-term follow-up would compensate for the missing information between the neonatal period and childhood, as additional measures could show other cognitive effects that were not noted in this study (Galler, Harrison, Ramsey, Forde & Butler, 2000). Children with FASD already have an unfair start to life as the neurocognitive damage that they experience begins at the intra-uterine developmental stage. In order to identify subtle changes in infant development, longitudinal research designs with close attention to retention are recommended (Graham, Massak, Demers & Rehm, 2007 ; Laude, 1999). Another advantage of conducting longitudinal studies with this vulnerable population is to identify women at high risk of consuming alcohol during pregnancy and to assist them in avoiding pregnancy or to provide them with guidance on abstaining from alcohol use during pregnancy (Nanson, 1997). Improved access to affordable contraceptives and improving women's attitudes toward contraceptive use together with integrated counseling may enhance contraceptive adherence and limit the number of infants born with deficits related to prenatal exposure to alcohol (Astley, Bailey, Talbot & Clarren, 2000 ; Hankin, 2002).

Precise measurement of alcohol use, assessing the frequency and quantity of alcohol by conducting antenatal interviews, a multi-dimensional approach to the diagnosis of depression, a comprehensive maternal questionnaire that includes questions related to patterns of sexual behaviours, screening for pregnancy intentions and assessment of maternal nutrition could be used to distinguish a group that is at high risk for prenatal alcohol exposure from an alcohol abstinent group (Anoop, Saravanan, Joseph, Cherian & Jacob, 2004; Barnett et al., 2004; Graham, Massak, Demers & Rehm, 2007; Laude, 1999; Project CHOICES Research Group, 2002 ; Tomlinson-Keasey, 1985). While a multitude of factors may influence depression, they are likely to be onerous, time-consuming and difficult to measure well within the context of prevention research. Yet, early and accurate identification of depression could assist in timely interventions being implemented to assist the well-being of women and child health. Infant attachment, anxiety or emotional development was not directly assessed in this study but it would be worth further investigation as these unmeasured factors have also been found to be associated with maternal depression (Atkinson et al., 2005; Carter, Garrity-Rokous, Chazan-Cohen, Little & Briggs-Gowan, 2001, Cooper et al., 2009; Tomlinson, Cooper & Murray, 2005 ; Zuckerman, Bauchner, Parker & Cabral, 1990).

Delineating a FASD neurocognitive phenotype using a multidisciplinary approach to assessment that includes developmental aspects which are sensitive to prenatal alcohol exposure such as executive functioning and spatial processing should be further investigated within low-income communities, as the data has been elusive thus far (Burd, Klug, Martsolf & Kerbeshian, 2003; Jones, 2011 ; Mattson et al., 2010). Although damage caused by alcohol prenatally is

permanent, children within these disadvantaged backgrounds could benefit from developmental stimulation programs which have been associated with cognitive development (Albers, Riksen-Walraven & de Weerth, 2010). Targeted cognitive interventions have been shown to be helpful in improving language and literacy skills of children with FASD, as well as children who were not exposed to alcohol prenatally. However the language and literacy performance of the children with FASD remained lower than that of those who were not exposed to alcohol prenatally (Adnams et al., 2007).

Structured training sessions that include individualized assessment of functional deficits, guidance on how to perform functional routines and development of the child's competence in a specific skills, together with reinforcement of culturally acceptable social skills, should be included in future intervention studies. These should aim to improve the social skills of children who were prenatally exposed to alcohol (Eldevik, Johr, Eikeseth, Hastings & Hughes, 2010; Kalberg & Buckley, 2007 ; Kavale & Mostert, 2004). According to the outcome of five intervention studies conducted in the United States as part of a consortium that scientifically assessed FASD samples, improving parenting attitudes, enhancing parent child interaction and educating parents and children assisted in enhancing specific functional areas, such as social skills (Bertrand, 2009). However, the limitation of these studies is that they were conducted in very controlled settings, which may not always be possible for children and parents from disadvantaged communities. Social skills training for children who had been exposed to alcohol prenatally should include areas of social problem-solving, friendships, conversations, planning and dealing with feelings, where instructions are explicit instead of abstract (Kavale & Mostert, 2004). Improved social competence and problem solving could lead to an improved ability to

interpret social cues and to provide appropriate answers which could assist in avoiding or limiting future delinquent behavior of children who were prenatally exposed to alcohol.

With the early, accurate identification of maternal vulnerability to alcohol use, it could be possible to implement effective, brief interventions within deprived communities which could provide greater social and health support to reduce the incidence of FASD births. Additionally, implementing a culturally acceptable social skill intervention program to improve social competency in children that had been exposed to alcohol prenatally could promote positive long-term cognitive, behavioural and vocational adjustment in these individuals.

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# APPENDICES

APPENDIX A: Clinical examination and neurodevelopment forms

# FASD PREVENTION STUDY SUMMARY

*FIRST FASD ASSESSMENT (9 Month - 21 Month)*

| DIAGNOSIS: | |
|---|---|

| DEMOGRAPHIC INFORMATION | | | |
|---|---|---|---|
| STUDY ID | | | |
| CHILD'S NAME | | D.O.B | |
| MOTHER'S NAME | | | |

| CLINICAL EXAMINATION | Clinician Intial | Date | Yes | No | Data Entry |
|---|---|---|---|---|---|
| CLINICIAN (SENIOR) | | | | | |
| 2nd CLINICIAN | | | | | |

| NEURO-DEVELOPMENT | Psychom Initial | Date | Yes | No | BDI Score | Comm Supp | Data Entry |
|---|---|---|---|---|---|---|---|
| 9 MONTH | | | | | | | |

| GENERAL | Initial | Date | Yes | No | Reason if ***NO*** |
|---|---|---|---|---|---|
| PHOTO | | | | | |
| FOOD VOUCHER | | | | | |
| GENETIC STUDY | | | | | |

| COMEBACK DATES |
|---|
| CLINICAL EXAMINATION |
| NEURO-DEVELOPMENT |

| Date | Yes | No | Reason for ***Comeback*** |
|---|---|---|---|
| | | | |
| | | | |

# PHYSICAL EXAMINATION – INFANTS/TODDLERS (9-18 mths)

| First Name, Surname: | | | | | | | | | | | Study No:(office use only) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date Of Examination: (dd/mm/yyy) | | | | Clinician (initials): | | | | | | | |
| DOB: (dd/mm/yyyy) | | | | Age (mths) | | | | | | | |
| Sex: | M | F | | Ethnicity: | AS | BL | CA | MA | MB | OT | |
| Mother's Name: | | | | Mother's DOB: (dd/mm/yyyy) | | | | | Mother's Age: (years) | | |
| Address: | | | | | | | | | | | |
| Contact No's (cell and home) | | | | | | | | | | | |

**PREMATURE** LBW ☐ VLBW ☐ **BIRTH HISTORY**

**PERCENTILES**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lth cm | <5 | 5 | 5-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-95 | 95 | >95 | U |
| Wt kg | <5 | 5 | 5-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-95 | 95 | >95 | U |
| OFC cm | <5 | 5 | 5-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-95 | 95 | >95 | U |

**AT TERM**

**PERCENTILES**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lth cm | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | |
| Wt kg | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | |
| Ofc cm | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | |

| | | |
|---|---|---|
| Breastfeeding | N | Y |
| Bottle Feeding | N | Y |
| Serious Illness & Hospital Admission (baby) | N | Y |

**CURRENT MEASUREMENTS** **PERCENTILES**

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lth cm | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | U | |
| Wt kg | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | U | |
| Ofc cm | <3 | 3-5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-97 | 97 | >97 | U | |
| Ipd mm | <3 | | 3 | 3-25 | | 25 | 25-50 | 50 | 50-75 | 75 | 75-97 | 97 | >97 | U | | | | |
| Ied mm | <3 | | 3 | 3-25 | | 25 | 25-50 | 50 | 50-75 | 75 | 75-97 | 97 | >97 | U | | | | |
| Pfl mm | <5 | 5 | 5-10 | 10 | 10-25 | 25 | 25-50 | 50 | 50-75 | 75 | 75-90 | 90 | 90-95 | 95 | >95 | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phil mm | Upper Lip: Clarren | 1 | 2 | 3 | 4 | 5 | | Vermillion: Clarren | 1 | 2 | 3 | 4 | 5 | | | |

**CHANGED SCORES IF APPLICABLE**

| | Lth cm) | Wt (kg) | Ofc (cm) | Ipd(mm) | Ied(mm) | Pfl(mm) | Phil(mm) |
|---|---|---|---|---|---|---|---|
| Clinician Initial | | | | | | | |
| Changed Score | | | | | | | |
| Changed Percentile | | | | | | | |

| | | Normal | Abnormal |
|---|---|---|---|
| Neurological | | | |
| Gross Motor | Sitting (unsupported) | | |
| | Weight-bearing | | |
| | Walking | | |
| | | | |
| Fine-Motor: | Pincer Grip | | |
| | Stacks blocks | | |
| | | | |
| Vision: | Light/Dark | | |
| | Red Reflex | | |
| | Overall | | |
| Hearing: | Overall | | |
| Cranium: | | | |
| Fontanelle: | | | |
| Face: | General | | |
| | Ears | | |
| | Eyes | | |
| | Nose | | |
| | Mouth | | |
| Neck: | | | |
| Thorax: | | | |
| Heart: | | | |
| Limbs: | | | |
| Hands: | General | | |
| | Creases | | |
| | Dermal patterns | | |
| Feet: | | | |
| Skin: | | | |
| Hair: | | | |
| Other: | | | |
| Comments: | | | |

| Y | N | SCORE | |
|---|---|---|---|
| | | 1 | HEIGHT (10th or below) |
| | | 2 | WEIGHT (10th or below) |
| | | 3 | HEAD CIRCUMFERENCE (10th or below) |
| | | 1 | GROSS MOTOR |
| | | 1 | FINE MOTOR |
| | | | ABNORMAL BEHAVIOUR |
| | | 2 | MIDFACIAL HYPOLASIA |
| | | 1 | RAILROAD TRACK EARS |
| | | 3 | PALPEBRAL FISSURE LENGTH |
| | | 0 | STRABISMUS |
| | | 2 | PTOSIS |
| | | 1 | EPICANTHAL FOLDS |
| | | 1 | FLAT NASAL BRIDGE |
| | | 2 | ANTEVERTED NARES |
| | | 2 | LONG PHILTRUM |
| | | 3 | SMOOTH PHILTRUM |
| | | 3 | THIN VERMILION BORDER UPPER LIP |
| | | 0 | PROGNATHISM CARDIAC MURMUR |
| | | 1 | CARDIAC MALFORMATION |
| | | 2 | SUPINATION OF ELBOW |
| | | 1 | CLINODACTYLY OF 5th FINGERS |
| | | 1 | CAMPTODACTYLY |
| | | 1 | HOCKEY STICK PALMAR CREASES |
| | | 0 | HYPERTRICHOSIS |
| | | 1 | HIRSUTISM |
| | | 0 | HYPOPLASTIC NAILS |
| | | 35 | |

## DIAGNOSIS

**normalities compatible with FASD (mark box that apply)**

1. ☐ Growth deficiency
2. ☐ Structural abnormality
3. ☐ Cognitive/behavioral abnormalities
4. ☐ No abnormalities compatible with FASD observed

**Does the child have FASD?**

☐ NO

**If Yes (Please Specify)**

☐ FAS
☐ PARTIAL FAS
☐ ARND
☐ ARBD

**Does the child have another Diagnosis?**

☐ No
☐ Yes (please specify)

_____
_____
_____

**Is special follow-up or testing recommended?**

☐ No
☐ Yes (please specify)

_____
_____
_____

**Notes:** _____
_____

## MATERNAL INFORMATION:

| | | | | | | |
|---|---|---|---|---|---|---|
| Height (in cm, to one decimal place) | | | | , | | |
| Weight (in kg, to nearest half kg) | | | | , | | |
| OFC (in cm, to one decimal place) | | | | , | | |
| MUAC (in cm, to one decimal place) | | | | , | | |

| CLINICIAN INITIAL | |
|---|---|

# PHYSICAL EXAMINATION – INFANTS/TODDLERS (21 months)

| | | |

| | | Normal | Abnormal |
|---|---|---|---|
| Neurological | | | |
| Gross Motor | Sitting (unsupported) | | |
| | Weight-bearing | | |
| | Walking | | |
| | | | |
| Fine-Motor: | Pincer Grip | | |
| | Stacks blocks | | |
| | | | |
| Vision: | Light/Dark | | |
| | Red Reflex | | |
| | Overall | | |
| Hearing: | Overall | | |
| Cranium: | | | |
| Fontanelle: | | | |
| Face: | General | | |
| | Ears | | |
| | Eyes | | |
| | Nose | | |
| | Mouth | | |
| Neck: | | | |
| Thorax: | | | |
| Heart: | | | |
| Limbs: | | | |
| Hands: | General | | |
| | Creases | | |
| | Dermal patterns | | |
| Feet: | | | |
| Skin: | | | |
| Hair: | | | |
| Other: | | | |
| Comments: | | | |

| Y | N | SCORE | |
|---|---|---|---|
| | | 1 | HEIGHT (10th or below) |
| | | 2 | WEIGHT (10th or below) |
| | | 3 | HEAD CIRCUMFERENCE (10th or below) |
| | | 1 | GROSS MOTOR |
| | | 1 | FINE MOTOR |
| | | | ABNORMAL BEHAVIOUR |
| | | 2 | MIDFACIAL HYPOLASIA |
| | | 1 | RAILROAD TRACK EARS |
| | | 3 | PALPEBRAL FISSURE LENGTH |
| | | 0 | STRABISMUS |
| | | 2 | PTOSIS |
| | | 1 | EPICANTHAL FOLDS |
| | | 1 | FLAT NASAL BRIDGE |
| | | 2 | ANTEVERTED NARES |
| | | 2 | LONG PHILTRUM |
| | | 3 | SMOOTH PHILTRUM |
| | | 3 | THIN VERMILION BORDER UPPER LIP |
| | | 0 | PROGNATHISM CARDIAC MURMUR |
| | | 1 | CARDIAC MALFORMATION |
| | | 2 | SUPINATION OF ELBOW |
| | | 1 | CLINODACTYLY OF 5th FINGERS |
| | | 1 | CAMPTODACTYLY |
| | | 1 | HOCKEY STICK PALMAR CREASES |
| | | 0 | HYPERTRICHOSIS |
| | | 1 | HIRSUTISM |
| | | 0 | HYPOPLASTIC NAILS |
| | | 35 | |

## DIAGNOSIS

**Abnormalities compatible with FASD (mark box that apply)**

1. ☐ Growth deficiency
2. ☐ Structural abnormality
3. ☐ Cognitive/behavioral abnormalities
4. ☐ No abnormalities compatible with FASD observed

**Does the child have FASD?**

☐ NO

**If Yes (Please Specify)**

☐ FAS
☐ PARTIAL FAS
☐ ARND
☐ ARBD

**Does the child have another Diagnosis?**

☐ No
☐ Yes (please specify)

_____
_____
_____

**Is special follow-up or testing recommended?**

☐ No
☐ Yes (please specify)

_____
_____
_____

**Notes:** _____
_____

## MATERNAL INFORMATION:

| | | | | | | |
|---|---|---|---|---|---|---|
| Height (in cm, to one decimal place) | | | | , | | |
| Weight (in kg, to nearest half kg) | | | | , | | |
| OFC (in cm, to one decimal place) | | | | , | | |
| MUAC (in cm, to one decimal place) | | | | , | | |

| CLINICIAN INITIAL | |
|---|---|

# APPENDIX B: Maternal Interview

# MATERNAL RISK FACTORS INTERVIEW
# MOEDERLIKE RISIKO ONDERHOUD

## OBJECTIVES

- To collect data on alcohol use during pregnancy to assist in diagnosing children with FASD
- To describe the socio-economic circumstances of the case and control groups
- To describe the reproductive health of the case and control groups
- To describe the role of alcohol, smoking and other drugs in the women's lives
- To identify factors that increase the risk of having a child with FASD
- To assess the level of knowledge of the effects of alcohol use during pregnancy
- To identify women who are currently exposed to alcohol, tobacco and other drugs, and offer them appropriate intervention

## INSTRUCTIONS FOR INTERVIEWER

1. If study participant is unable to read, ensure a third person (preferably an impartial witness) is present while the informed consent is being completed. Read the consent form to the study participant. Participants giving consent should indicate this with either a signature or an X. The witness should also sign the consent form.

2. Where possible, study participants should personally enter the date on the informed consent

3. For some questions more than one answer may apply, select the option which **best** describes the participant's response; unless the questions indicates that more than one option may apply.

4. Complete the questionnaire in black ink. If errors occur while completing the questionnaire, make a single line through the error, and date and initial next to the correction. Do not obscure the original entry.

5. Calculations of the total drinks and money from employment can be made after the interview has been completed.

6. Place an X within the box or a number as appropriate

## SECTION 1: INTERVIEW DETAILS

1. Child's study no: ☐☐☐☐☐☐☐☐

2. Child's name: _____ _____ _____
First name Middle name Last name

3. Child's DOB: ☐☐☐☐/☐☐/☐☐
yyyy mm dd (1911/11/11 Unknown/onbekend)

4. Mother's name: _____ _____ _____
First name Middle name Last name

5. Mother's DOB: ☐☐☐☐/☐☐/☐☐
yyyy mm dd (1911/11/11 Unknown/onbekend)

6. Interviewee's relationship with the child? ..... ☐☐

1 = Child's Mother / Moeder
2 = Child's Father / Vader
3 = Sister / Suster
4 = Brother / Broer
5 = Mother's former husband or partner/vorige man/vriend
6 = Mother's friend / Vriend
7 = Aunt / Tannie
8 = Uncle / Oom
9 = Grandmother / Ouma
10 = Grandfather / Oupa
11 = Other / Ander (specify-spesifiseer)_____
88 = Unknown / Onbekend

7. Name of respondent (if interviewee is not the child's mother):

_____ _____ _____
First name Middle name Last name

8. Name and signature of interviewer:

_____ _____
Name Signature

9. Date of interview: ☐☐☐☐/☐☐/☐☐
yyyy mm dd (1911/11/11 Unknown / onbekend)

10. Time at start of interview: ☐☐:☐☐
(use 24 hour clock, unknown = 23:11) hr min

## SECTION 2: DEMOGRAPHICS

1. What is your **current** marital status?

   Wat is jou huwelikstatus? ..... ☐☐

   1 = Married / getroud
   2 = Widowed / weduwee
   3 = Divorced / geskei
   4 = Separated / vervreemd
   5 = Single / enkel
   6 = Unmarried, living with partner / ongetroud, woon saam met die pa van die kind
   88 = Unknown / onbekend

2. To which ethnic group do you belong? (circle all that apply)
   Aan watter etniese group behoort jy? (merk alles van toepassing)

   1 = Coloured / kleurling
   2 = San
   3 = Zulu
   4 = Tswana
   5 = Xhosa
   6 = Venda
   7 = Tsonga
   8 = Sesotho
   9 = Pedi
   10 = Ndebele
   11 = Swati
   12 = Indian / Indies
   13 = Afrikaaner White/Blanke
   14 = Engels White/Blanke
   15 = Other, specify / Ander, spesifiseer_____

3. If you belong to a religious group, to which group do you belong?
   Indien jy aan 'n geloof behoort, aan watse geloof behoort jy?

   _____

4. What was the highest grade or standard you passed? ☐☐ Grade

   Watter graad of standerd het jy op skool voltooi? ☐☐ Standard
   (enter 99 if school was never attended)

5. Did you attend Technikon, College or University?

   Het jy 'n Technikon, Kollege of Universiteit bewoon? ..... ☐☐
   1 = Yes / Ya
   2 = No / Nee
   88 = Unknown / Onbekend

## SECTION 3: SOCIO-ECONOMIC CIRCUMSTANCES

1. How many adults and children live in your house **now:**
Hoeveel volwassenes en kinders woon **tans** in jou huis?

Adults / volwassenes (16 years and over, including yourself): ..... ☐☐

Children / kinders (15 years and under): ..... ☐☐

2. What is your current employment status? ..... ☐☐
Wat is jou huidige werkstatus?
1 = Full time / voltyds (25 + hrs / week)
2 = Part time / deeltyds (<25 hrs / week)
3 = Seasonal, full time / seisoenwerker, voltyds
4 = Seasonal, part time / seisoenwerker, deeltyds
5 = Casual worker, part time / deeltydse werker
6 = Unemployed / werkloos
7 = Unemployed because of disability / werkloos agv ongeskiktheid
8 = Homemaker (at own home) / huisvrou
88 = Unknown/Don't know / onbekend/geen inligting

3. What kind of work do you do (if currently unemployed, what work did you do in the past)?
Watter tipe werk doen jy? ..... ☐☐
1 = Factory worker / fabriekswerk
2 = Farm worker / plaaswerk
3 = Office worker / kantoorwerk
4 = Domestic worker (cleaning or childcare) / huishulp(skoonmaak/kinders oppas)
5 = Homemaker (at own home) / huisvrou
6 = Informal Trader / straatverkoper
7 = Crafts person or artist / kunstenaar
8 = Professional (i.e. nurse, teacher) / professioneel (verpleegster, onderwyser)
9 = Commercial Sex Worker / sekswerker
10 = Other (specify) / ander (spesifiseer) _____
88 = Unknown/Don't know / onbekend/geen inligting
99 = Never worked / werkloos

4. How much money do you receive from your **current employment** during **a week** when you are working?
Indien jy werk, hoeveel geld verdien jy gedurende 'n week?
R _____ per week
Or R _____ per month
9999 = NA, does not work / NVT, werkloos

5. How much money do **you** receive from **other sources** during the **month** (such as welfare, or from your children's father)?
Hoeveel geld ontvang jy in 'n maand, van ander bronne soos welsynspensioen, kinderonderhoud, pleegsorgtoelaag ens?
Children's father / kinder se pa R _____
Child care grant / kindersorg R _____
Foster care grant / pleegsorg R _____

Unemployment / werkloosheidspensioen R_____
Disability grant / ongeskiktheidspensioen R_____
Other, specify source / ander _____ R_____

**Total from other sources** R_____

9999 = Unknown / onbekend

## SECTION 4: REPRODUCTIVE HEALTH

1. Are you **currently** using contraception (family planning)?

   Gebruik jy nou enige voorbehoedmiddels (gesinsbeplanning)?..... ☐☐

   1 = Yes / Ja  2 = No / Nee  88 = Unknown / Onbekend

2. **If no**, why are you not currently using contraception?

   Indien jy nie huidiglik voorbehoeding gebruik nie, hoekom nie? ..... ☐☐

   1 = Not currently sexually active / nie huidiglik seksueel aktief nie
   2 = Trying to become pregnant / wil graag 'n kind hê
   3 = No longer fertile / vrou onvrugbaar
   4 = Partner had a vasectomy / man/kêrel het vasektomie gehad
   5 = Currently pregnant / huidiglik swanger
   6 = Do not have the money for contraception / nie geld vir voorbehoedmiddels nie
   7 = The family planning clinic does not provide a good service / gesinsbeplanning klinieke gee nie goeie diens nie
   8 = Going to the family planning clinic makes me feel uncomfortable / ek voel ongemaklik om gesinsgeplannings kliniek toe te gaan
   9 = Don't have transport to the clinic / geen vervoer om by kliniek te kom nie
   10 = Problems with side effects from contraception / newe-effekte van voorbehoedmiddels
   11 = My partner does not want me to use contraception / man/kêrel wil nie hê ek moet voorbehoedmiddels gebruik nie
   12 = Trading partner pays more if don't condomize / kry meer geld as ek nie 'n kondoom gebruik nie
   13 = Religious prohibition / deur geloof verbied
   14 = Other (specify) / ander _____
   88 = Unknown / onbekend

3. What contraception are you currently using (if not currently using contraception, what was the last method you used)?
   Wat se voorbehoedmiddel gebruik jy (indien nie huidig gebruik - die laaste keer wat 'n voorbehoedmiddel gebruik is, wat was gebruik?) ..... ☐☐

   1 = Depo injection / inspuiting
   2 = Pill / die pil
   3 = Condoms / kondome
   4 = IUD / IUD
   5 = Other, specify / ander, spesifiseer _____
   88 = Unknown / onbekend
   99 = NA, never used birth control / NVT, nog nooit voorbehoeding gebruik

4. Record the date of all births, stillbirths, miscarriages or abortions, also the current health status of each live birth **(also enter this child's details)**
   Voltooi die table. Skryf die geboortedatum, stillgeboortes, miskrame, aborsies en gesondheid van all die lewende geboortes neer.

| Order of pregnancy Swanger-skappe | How did pregnancy end? Hoe het swangerskap geëindig? 1 = Live birth / lewende baba 2 = Stillbirth / still bebore 3 = Miscarriage / miskraam 4 = Induced Abortion / aborsie 88 = Unknown / onbekend | Date pregnancy ended/ Einde van swangerskap Datum (yyyy/mm) 1911/11 =Unknown/onbekend | Health status of live births Gesondheid v lewende baba 1 = alive / lewend 2 = dead / dood 88 = Unknown / onbekend |
|---|---|---|---|
| 1. | | / | |
| 2. | | / | |
| 3. | | / | |
| 4. | | / | |

| | | | |
|---|---|---|---|
| 5. | | / | |
| 6. | | / | |
| 7. | | / | |

5. Was your pregnancy with (child's name) planned?

Was jou swangerskap met (naam van kind) 'n beplande een?..... ☐☐

1 = Yes / Ja
2 = No / Nee
3 = Unsure / Onseker
88 = Unknown / Onbekend

6. To which ethnic group does/did the father of (child's name) belong (circle all that apply)?
Aan watter etniese group behoort die pa van (naam van kind)?

1 = Coloured / kleurling
2 = San
3 = Zulu
4 = Tswana
5 = Xhosa
6 = Venda
7 = Tsonga
8 = Sesotho
9 = Pedi
10 = Ndebele
11 = Swati
12 = Indian / Indies
13 = Afrikaaner Whiite/Blanke
14 = Engels White/Blanke
15 = Other, specify / Ander, spesifiseer_____

88 = Unknown / onbekend

7. How many months were you pregnant with (child's name) when you found out you were pregnant?
Hoeveel maande was jy swanger met (naam van kind) toe jy uitgevind het jy is swanger?

..... ☐.☐ months

88 = Unknown / onbekend

8. How many months were you pregnant with (child's name) when you first visited antenatal clinic?
Hoeveel maande was jy swanger toe jy vir die eerste keer voorgeboortesorg ontvang het?

..... ☐.☐ months

99 = NA, did not attend antenatal clinic / nie voorgeboortesorg ontvand nie
88 = Unknown / onbekend

9. How many times did you attend antenatal clinic during your pregnancy with (child's name)?
Hoeveel keer het jy die voorgeboorte kliniek gedurende jou swangerskap met (naam van kind) bygewoon?

..... ☐☐

99 = NA, did not attend antenatal clinic / nie voorgeboortesorg ontvand nie
88 = Unknown / onbekend

10. Did you have any health problems during your pregnancy that required hospitalisation or othe treatment? (circle all that apply and specify as appropriate)
Het jy enige gesondheids probleme gedurende you swangerskap gehad waarvoor jy in die hospitaal was of waarvoor jy behandeling ontvang het?

1 = Hypertension/hoë bloeddruk
2 = Gestational diabetes/Suikersiete in swangerskap
3 = IDDM diabetes/Insulien afhanklike suikersiekte
4 = Excessive nausea, vomiting/Erge naarheid, braking

5 = Vaginal bleeding/Vaginale bloeding

6 = Virus infections (chicken pox, measles, rubella)/Virus infeksies (waterpokkies, masels, duitse masels)

7 = High fever/Hoë koors

8 = Sexually transmitted diseases/Seksueel oordraagbare siektes

specify/spesifiseer _____

9 = Other acute infectious disease/Ander infeksies

specify/spesifiseer _____

10 = Other chronic health problems/Ander kroniese gesondheids probleme

specify/spesifiseer _____

11 = Preterm labour/Vroeë kraam

88 = Unknown/Onbekend

99 = NA, no health problems/NVT, geen gesondheids probleme

11. Did you take any medication prescribed by a doctor, nurse, or traditional healer during your pregnancy with (child's name)?
Het jy medisyne wat deur 'n dokter, verpleegster of tradisionele dokter voorgeskryf was gebruik gedurende jou swangerskap met (naam van kind)? ..... ☐☐

1 = Yes / Ja 2 = No / Nee 88 = Unknown/cannot remember / Weet nie/kan nie onthou nie

**If yes, specify what medication the mother took?**
**Indien jy Ja geantwoord het, wat het jy gebruik en waarvoor was dit?**

_____

_____

12. After (child's name) was born, did you breastfeed? ..... ☐☐
Na die geboorte van hierdie kind, het jy die baba geborsvoed?

1 = Yes / Ja 2 = No / Nee 88 = Unknown / weet nie/ kan nie onthou nie

13. If yes, for about how long did you do so?

Indien jy hierdie kind geborsvoed het, vir hoe lank het jy dit gedoen? ..... ☐☐ months

88 = Unknown / onbekend

## SECTION 5 – SMOKING AND OTHER DRUGS

1. When did you last smoke or use tobacco, including snuff or chewing tobacco?

   Wanneer het jy laas gerook, gesnuif of tabak gekou? ..... ☐☐

   1 = Currently smoke or use tobacco / rook or gebruik tabak huidig
   2 = Within the last 30 days / in die afgelope 30 dae
   3 = Within the last 12 months / in die afgelope 12 maande
   4 = More than a year ago / meer as 'n jaar gelede
   5 = Never / nooit
   8 = Cannot remember/don't know / kan nie onthou nie, weet nie

2. How old were you when you started smoking or using tobacco regularly?

   How oud was jy toe jy gereeld begin rook of tabak gebruik het? ..... ☐☐

   88 = Unknown/cannot remember/don't know / kan nie onthou nie, weet nie  99 = NA , never smoked / NVT

3. How many cigarettes per day do you currently use (or did you use when you smoked regularly)?

   Toe jy gerook en/of tabak en snuif gebruik het, hoeveel het jy gebruik? ..... ☐☐

   88 = Cannot remember/don't know / kan nie onthou nie, weet nie  99 = NA , never smoked– NVT

4. Did you smoke cigarettes or use tobacco, including snuff or chewing tobacco during your pregnancy with (child's name)?

   Het jy sigarette of tabak gerook gedurende jou swangerskap met hierdie kind? .. ☐☐

   1 = Yes / Ja  2 = No / Nee
   88 = unknown/cannot remember/don't know / kan nie onthou nie, weet nie  99 = NA, never smoked / NVT

   **If 'Yes', how many cigarettes per day did you use during your pregnancy with (child's name)?**
   **Indien 'JA', hoeveel sigarette het jy per dag gerook gedurende jou swangerskap met (kind se naam)?**

   ..... ☐☐

   88 = Unknown/Cannot remember / kan nie onthou nie, weet nie  99 = NA / NVT

5. Have you ever used drugs such as marijuana, cocaine or heroin?

   Het jy ooit dwelms soos dagga, kokaïene of heroïene gebruik? ..... ☐☐

   1 = Yes / Ja  2 = No/ Nee  88 = Unknown/Don't know / onbekend/weet nie  99 = NA / NVT

   **If 'No' skip to Section 6, if 'Yes' complete questions below**

6. Which drugs have you used?
   Watter dwelms het jy gebruik?

   _____

7. Did you use drugs such as marijuana, cocaine or heroin during your pregnancy with (child's name)?
   Het jy dwelms soos dagga, kokaïene of heroïene gedurende jou swangerskap gebruik?

   ..... ☐☐

   1 = Yes / Ja  2 = No / Nee  88 = Unknown/Don't know / onbekend/weet nie  99 = NA / NVT

8. Which drugs did you use during the pregnancy?
   Wat se dwelms het jy gedurende jou swangerskap gebruik?

   _____

## SECTION 6: ROLE OF ALCOHOL IN WOMEN'S LIFE

1. When was the last time you had an alcoholic drink?

Wanneer laas het jy 'n drankie gedrink? ..... ☐☐

1 = Within the last week / in die afgelope week
2 = Within the last 30 days / in die afgelope 30 dae
3 = Within the last 12 months / in die afgelope 12 maande
4 = More than a year ago / meer as 'n jaar gelede
88 = Unknown / onbekend
99 = NA, never drank / NVT, nog nooit gedrink nie

2. How often do you drink?

Hoe gereeld drink jy? ..... ☐☐

1 = Every day / elke dag
2 = Almost every day / amper elke dag
3 = Usually, one or two days a week / gewoonlik een of twee keer 'n week
4 = Usually, two or three times a month / gewoonlik twee of drie keer 'n maand
5 = About once a month / een keer 'n maand
6 = Several times a year / verskeie kere in 'n jaar
7 = At most, once a year / op die meeste, een keer 'n jaar
8 = Never / nooit
88 = Unknown, or not sure / onbekend/onseker

3. Now complete the following table: the drinking behaviour among:

- the woman's mother and father **during the period when she was growing up**
- the father of (child's name) **during her pregnancy with (child's name)**

Voltooi nou die volgende tabel: die drinkgewoontes van:

- die vrou se ma en pa **toe sy grootgeword het**
- (naam van kind) se pa **gedurende haar swangerskap met (naam van kind)**

| | Is s/he alive?<br>1=Yes<br>2=No<br>88=Unknown | Does/did s/he drink alcohol?<br>1=Yes<br>2=No<br>88=Unknown | How frequently does/did s/he usually drink<br>1=Every day<br>2=Almost every day<br>3=Usually, one or two days a week<br>4=Usually, two or three times a month<br>5=About once a month<br>6=Several times a year<br>7=At most, once a year<br>8=Never<br>88 = Unknown, or not sure | Do you feel that s/he drank:<br>1=Heavy<br>2 =Moderate<br>3 =Light<br>88=Unknown<br>99=NA, does not drink | Ever had a drinking problem that led to job loss, loss of home, arrest, physical fights, or health problem?<br>1=No<br>2=Lost job<br>3=Lost home<br>4=Arrested<br>5=Physical fights<br>6=Health problem<br>88=Unknown<br>99=NA, does not drink | Cause of death<br>88=Unknown<br>99= NA, still alive | Was death related to alcohol?<br>1=Yes<br>2=No<br>88=Unknown<br>99= NA, still alive |
|---|---|---|---|---|---|---|---|
| Woman's mother | | | | | | | |
| Woman's father | | | | | | | |
| Child's father | | | | | | | |

4. How old were you when you first drank alcohol?

   Hoe oud was jy toe jy die eerste keer alkohol gebruik het? ..... ☐☐

   88 = Unknown/Cannot remember, don't know – kan nie onthou nie, weet nie  99 = NA, never drank – NVT

5. How old were you when you started drinking regularly?

   Hoe oud was jy toe jy die eerste keer alkohol gebruik het? ..... ☐☐

   88 = Unknown/Cannot remember, don't know – kan nie onthou nie, weet nie  99 = NA , never drank– NVT

6. When do you usually drink? (cross all the boxes that apply)
   Wanneer drink jy gewoonlik?

| | Friday | Saturday | Sunday | Monday | Tuesday | Wednesday | Thursd |
|---|---|---|---|---|---|---|---|
| 1. In the morning (before 12 noon) only/ slegs in die oggend (voor 12 uur) | | | | | | | |
| 2. In the afternoon (12-6pm) only slegs in die middag (12-6pm) | | | | | | | |
| 3. In the evening (6pm till late) only slegs in die aand (6pm | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| tot laat) | | | | | | | |
| 4. Mornings and afternoon oggend en middag | | | | | | | |
| 5. Afternoon and evening middag en aand | | | | | | | |
| 6. Throughout the day die hele dag | | | | | | | |

7. For each day of the week, please tell me your usual beverage and how much alcohol you drink
Vir elke dag van die week, vertel asb vir my wat jy gewoonlik drink, hoeveel, en hoeveel tyd spandeer jy om te drink

**Interviewer: specify amount in ml. A bottle usually contains 750 ml. A 2-liter plastic sack contains 2000 ml. A 'standard drink' is 1 can of beer (340 ml), 1 glass of wine (150 ml), 1 mixed drink ("cocktail"), or 1 shot of liquor.**

| | Beer Bier | | Wine Wyn | | Sweet Wine (sjerrie, port, muscadel) | | Spirits Spiritus (likeur, mengeldrankies) | | Homebrew (Napshushu) | | Other Ander, specify _____ | | Ingredients (homebrew or other) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | |
| Friday | | | | | | | | | | | | | |
| Saturday/ Saterdag | | | | | | | | | | | | | |
| Sunday/ Sondag | | | | | | | | | | | | | |
| Monday/ Maandag | | | | | | | | | | | | | |
| Tuesday/ Dinsdag | | | | | | | | | | | | | |
| Wednesday/ Woensdag | | | | | | | | | | | | | |
| Thursday/ Donderdag | | | | | | | | | | | | | |
| **Total Drinks (ml)** | | | | | | | | | | | | | |

88 = Not sure / doesn't know – nie seker nie/weet nie 99 = NA, doesn't drink – NVT, drink nie

8. How many weeks out of the month do you usually drink like this?

Hoeveel weke in die maand het jy geld om so te drink? ..... ☐☐

1 = One / een
2 = Two / twee
3 = Three / drie
4 = Every week / elke week
88 = Unknown/doesn't know / weet nie
99 = NA, doesn't drink / NVT, drink nie

**Now I would like to ask you some questions about drinking when you were pregnant with (child's name).**
**Nou wil ek jou vra oor jou drinkgewoontes toe jy swanger was met (naam van kind).**

9. For each day of the week, please tell me your usual beverage and how much alcohol you took during pregnancy.
Vir elke dag van die week, vertel asb vir my wat jy gewoonlik gedrink het, hoeveel, en hoeveel tyd jy spandeer het om te drink

**Interviewer: specify amount in ml. A bottle usually contains 750 ml. A 2-liter plastic sack contains 2000 ml. A 'standard drink' is 1 can of beer (340 ml), 1 glass of wine (150 ml), 1 mixed drink ("cocktail"), or 1 shot of liquor.**

| | Beer Bier | | Wine Wyn | | Sweet Wine (sjerrie, port, muscadel) | | Spirits Spiritus (likeur, mengeldrankies) | | Homebrew (Napshushu) | | Other Ander, specify _____ | | Ingredients (homebrew or other) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | No. of drinks | ml. per drink | |
| Friday/ Vrydag | | | | | | | | | | | | | |
| Saturday/ Saterdag | | | | | | | | | | | | | |
| Sunday/ Sondag | | | | | | | | | | | | | |
| Monday/ Maandag | | | | | | | | | | | | | |
| Tuesday/ Dinsdag | | | | | | | | | | | | | |
| Wednesday/ Woensdag | | | | | | | | | | | | | |
| Thursday/ Donderdag | | | | | | | | | | | | | |
| **Total drink (ml)** | | | | | | | | | | | | | |

88 = Not sure / doesn't know – nie seker nie/weet nie 99 = NA, did not drink during pregnancy – NVT, drink nie

10. How many weeks out of the month did you drink like this during your pregnancy with (child's name)?
Hoeveel weke in die maand het jy so gedrink tydens jou swangerskap met (naam van kind)?

..... ☐☐

1 = One – een
2 = Two - twee
3 = Three - drie
4 = Every week – elke week
88 = Unknown/Doesn't know – weet nie
99 = NA, never drank during pregnancy – / NVF, het nie in swangerskap gedrink

11. During your pregnancy, did the amount you drank change between the time you became pregnant and when you had the baby?
Het die hoeveelheid alkohol wat jy gedrink het verander vandat jy swanger geraak todat die baba gebore is? ..... ☐☐

1 = Yes / Ja
2 = No / Nee gedrink
88 = Unknown/cannot remember / onbekend of kan nie onthou
99 = NA, never drank during pregnancy / NVF, het nie in swangerskap

12. How did the amount you drank change during pregnancy?
Hoe het die hoeveelheid drank tydens swangerskap verander?
99 = NA, never drank during pregnancy / NVF nie in swangerskap gedrink/ onbekend
88 = cannot remember or unknown / kan nie onthou/onbekend

_____

13. During your pregnancy do you feel you drank a normal amount of alcohol? ..... ☐☐
Voel jy asof jy 'n normale hoeveelheid alkohol gedrink het tydens jou swangerskap?
1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kan nie onthou
99 = NA, never drank during pregnancy / NVT, nie in swangerskap gedrink

14. During your pregnancy, do you think that you drank the same amount as other pregnant women where you live? ..... ☐☐
Dink jy, jy het dieselfde hoeveelheid alkohol gedrink as ander vroue tydens jou swangerskap?
1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kan nie onthou
99 = NA, never drank during pregnancy / NVT, nie in swangerskap gedrink

15. Why did you drink during your pregnancy? (circle all that apply)
Waarom het jy gedurende you swangerskap alkohol gebruik?
1 = To celebrate a special occasion / om 'n spesiale geleentheid te vier
2 = To be sociable / om sosiaal te wees
3 = To be polite / om hoflik te wees
4 = To relax / om my te help om te ontspan
5 = Boredom / verveeldheid
6 = To overcome shyness / om my skaamheid te oorkom
7 = Because the people I know drink / omdat die mense wat ek ken drink
8 = To feel less anxious or depressed / om minder angstig of depressief te voel
9 = To feel less tense or nervous, to help relax / om minder gespanne of senuweeagtig te voel
10 =To help forget my worries / om my probleme te help vergeet
11 = To be part of a group / om deel van 'n groep te wees
12 = Grief / droefheid, verdrietigheid
13 = Cope with poverty / om armoede te hanteer
14 = Because I just feel like drinking / omdat ek net so voel
15 = Because I enjoy drinking / omdat ek daarvan hou om te drink
16 = Addiction / verslawing
17 = Forced by partner / gedwing deur vriend/kêrel
18 = Other / ander _____
88 = Unknown/Don't know / weet nie.
99 = NA, never drank / NVT, nog nooit gedrink nie

16. Did your family or partner ever worry or complain about your drinking during pregnancy?
Het jou family of jou man/kerel ooit gekla of was hulle ooit bekommered oor jou alkohol gebruik tydends jou swangerskap.?..... ☐☐
1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kan nie onthou
99 = NA, never drank during pregnancy / NVT, nie in swangerskap gedrink

17. Did you try to stop drinking during pregnancy? ..... ☐☐

Het probeer ophou drink gedurende you swangerskap? ..... ☐☐

1 = Yes / Ja
2 = No / Nee

88 = Unknown/cannot remember / onbekend/kan nie onthou
99 = NA, never drank during pregnancy / NVT, nie in swangerskap gedrink

**Now I want to ask you about your current drinking**
**Nou wil ek jou uitvrae oor jou huidige alkohol gebruik.**

18. With whom do you usually drink? (circle all that apply)
Saam met wie drink jy gewoonlik?
(**Interviewer:** If stopped drinking, with whom **did** you usually drink?)
(**Onderhoudvoerder**: Indien opgehou drink, saam met wie **het** jy gewoonlik gedrink?)

1 = Usually drinks alone / drink gewoonlik alleen
2 = Usually drinks with family members / drink gewoonlik saam met familielede
3 = Usually drinks with her friends / drink gewoonlik saam met vriende
4 = Usually drinks with her partner / drink gewoonlik saam met my man/my vriend (kêrel)
88 = Unkown / onbekend
99 = NA, never drank / NVT, nog nooit gedrink nie

19. Where do you usually drink? (circle all that apply)
Waar drink jy gewoonlik?
(**Interviewer:** If stopped drinking, where **did** you usually drink?)
(**Onderhoudvoerder**: Indien opgehou drink, waar **het** jy gewoonlik gedrink?)

1 = At home - tuis
2 = At a family members house / by 'n familielid se huis
3 = At a friends' house / by 'n vriend se huis
4 = At a shebeen / by 'n shebeen (smokkelhuis)
5 = Outdoors somewhere / êrens buite die huis
6 = On the street in town / op straat in die dorp
7 = Other place / ander plek (spesifiseer)_____
88 = Unknown / onbekend
99 = NA, doesn't drink / NVT, drink nie

20. Have you ever felt the need to cut down on your drinking?

Het jy al ooit gevoel jy moet minder drink? ..... ☐☐

1 = Yes / Ja
2 = No / Nee

88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

21. Do your family or friends ever worry or complain about your drinking?
Het jou familie of friende al ooit gekla, was hulle bekommerd oor jou alkohol gebruik?

..... ☐☐

1 = Yes / Ja
2 = No / Nee

88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

22. If yes, does this annoy you?

Indien Ja, het dit jou frustreer? ..... ☐☐

1 = Yes / Ja
2 = No / Nee

88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

23. Have you ever felt bad or guilty about drinking?

Het jy al ooit slegs of skuldig gevoel oor jou alkohol gebruik? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

24. Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover?
Het jy al ooit 'n drankie geneem die eerste ding in the oggend om jou te kalmeer of om van 'n babalas ontslae te raak? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

25. Has your drinking ever created problems between you and your husband or partner, family members or friends?
Het jou drank gebruik al ooit probleme veroorsaak tussen jou en jou man, kerel, familie of friende? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

26. Have you ever been arrested, lost a job, lost your home, gotten into physical fights, or had a health problem because of drinking?
Is jy al gearresteer, of het jy al jou werk of jou huis verloor, of gesondheidsprobleme gehad as gevolg van drank? ..... ☐☐

1 = No / Nee
2 = Arrested / gearresteer
3 = Lost job / werk verloor
4 = Lost home / huis verloor
5 = Gotten into physical fights/ bakleiery
6 = Health problem / gesondheidsprobleme
88 = Unknown / onbekend
99 = NA does not drink / NVF drink nie

27. Why do you drink, or why did you drink in the past? (circle all that apply)
Waarom drink jy alkohol, of waarom het jy in die verlede alkohol gebruik?

1 = To celebrate a special occasion / om 'n spesiale geleentheid te vier
2 = To be sociable / om sosiaal te wees
3 = To be polite / om hoflik te wees
4 = To relax / om my te help om te ontspan
5 = Boredom / verveeldheid
6 = To overcome shyness / om my skaamheid te oorkom
7 = Because the people I know drink / omdat die mense wat ek ken drink
8 = To feel less anxious or depressed / om minder angstig of depressief te voel
9 = To feel less tense or nervous, to help relax / om minder gespanne of senuweeagtig te voel
10 = To help forget my worries / om my probleme te help vergeet
11 = To be part of a group / om deel van 'n groep te wees
12 = Grief / droefheid, verdrietigheid
13 = Cope with poverty / om armoede te hanteer
14 = Because I just feel like drinking / omdat ek net so voel
15 = Because I enjoy drinking / omdat ek daarvan hou om te drink
16 = Addiction / verslawing
17 = Forced by partner / gedwing deur vriend/kêrel
18 = Other/ ander _____
88 = Unknown/Don't know / weet nie.
99 = NA, never drank / NVT, nog nooit gedrink nie

28. Would you like help with your drinking? Sou jy graag hulp wou hê met jou drankprobleem? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA, does not drink / NVF drink nie

## SECTION 7: FASD KNOWLEDGE

1. Do you think that:
Dink jy dat...

1 = Yes / Ja
2 = No / Nee
88 = Unknown / Onbekend
99 = Don't know / Weet nie

One drink can harm a baby during pregnancy?
Een drankie gedurende swangerskap is sleg vir die baba? ☐☐
One or two drinks a week can harm a baby during pregnancy?
Een of twee drankies 'n week gedurende swangerskap is sleg vir die baba? ☐☐
Five drinks on one occasion can harm a baby during pregnancy?
Vyf drankies een keer gedurende swangerskap is sleg vir die baba? ☐☐
One drink every day can harm a baby during pregnancy?
Een drankie elke dag gedurende swangerskap is sleg vir die baba? ☐☐
Five drinks every day can harm a baby during pregnancy?
Vyf drankies elke dag gedurende swangerskap is sleg vir die baba? ☐☐

2. Are there ways that you believe drinking alcohol during pregnancy can benefit an unborn child? (circle all that apply)
**[Interviewer: do not prompt with examples]**
Glo jy dat die gebruik van alkohol gedurende swangerskap op enige manier goed kan wees vir die ongebore baba? (omkring alles wat van toepassing is)
**[Onderhoudvoerder: Moenie voorbeelde gee nie]**
1 = Yes/Ja
2 = No/Nee
3 = Make the delivery easier/Dit maak die geboorte makliker
4 = Feed the child/Is voeding vir die kind
5 = Increase the mother's milk for the baby/maak meer moedersmelk vir die baba
6 = Refused/Weier
7 = Other, specify/ Ander, spesifiseer _____
88 = Unknown, doesn't know/Onbekend, weet nie

3. Do/did you (or others) ever give your baby or small child alcohol to drink?
Gee jy/het jy of ander mense al ooit vir jou baba of klein kindjie alkohol gegee om te drink?
..... ☐☐

1 = Yes/Ja
2 = No/ Nee
88 = Unknown, cannot remember/ Onbekend, kan nie onthou nie
99 = NA/NVT

4. Do you believe that your baby or child drinking alcohol can be of any benefit to him or her? (circle all that apply)
Glo jy dat alkohol gebruik enige voordeel kan inhou vir jou baba of kind? (omkring alles wat van toepassing is)

1 =Yes/Ja
2 = No/Nee
3 = Feed the child/Voeding vir die kind
4 = Kills worms/Maak wurms dood
5 = Keeps the child warm/Hou die kind warm

6 = Other, specify/ Ander, spesifiseer _____
88 = Unknown, unsure/Onbekend, onseker?

5. Did you ever get information that alcohol can harm a child during pregnancy:
Het jy al ooit inligting gekry dat alkohol tydends swangerskap 'n kind kan benadeel?

1 = Yes / Ja
2 = No / Nee
88 = Unknown/cannot remember / onbekend/kannie onthou
99 = NA / NVT

From nurses at antenatal clinic / verpleegsters by voorgeboorte kliniek..... ☐☐

On the TV or radio / oor die radio of op TV ..... ☐☐

On a poster / op 'n plakaat ..... ☐☐

**If yes, where were the posters and which TV/radio station did they get information from?**
**Indien ja, waar was die plakaat en op watter TV/radio stasie het jy die inligting gekry?**

_____

6. If you had seen such a notice when you were pregnant with (child's name), do you think you would have used less alcohol during your pregnancy?
Indien jy so 'n kennisgewing gesien het terwyl jy swanger was met (kind se naam), dink jy jy sou minder alkohol gebruik het?..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/Not sure; doesn't know / nie seker, weet nie
99 = NA, did not drink during pregnancy / NVT

7. What can alcohol use during pregnancy do to a baby?
Wat kan alkohol gebruik gedurende swangerskap aan die baba doen?

_____

88 = unknown/unanswered / onbekend/nie geantwoord

## SECTION 8: NUTRITION

1. Is your current weight similar to just before you became pregnant with (child's name)?
Is jou huidige gewig dieselfde as wat dit was net voor jy swanger geraak het met (naam van kind?)

..... ☐☐

1 = Much less / baie minder
2 = About the same / omtrent dieselfde
3 = Much more / baie meer
88 = Unknown/cannot remember / onbekend/kan nie onthou

2. If the weight is not similar, by how many kilograms has the weight changed?

As die gewig nie dieselfde is nie, met hoeveel kg het dit verander? ..... ☐☐

3. Were there times during the pregnancy when you didn't have enough food, if so how long did it usually last?
Was daar tye gedurende die swangerskap wat jy nie genoeg kos gehad nie, indien daar was hoe lank het die aangehou? ..... ☐☐

1 = For a day / vir n dag
2 = For a week / vir a week
3 = For a month or more / vir n maaand of meer
4 = All the time / heeltyd
88 = Unknown/doesn't know / weet nie of kannie onthou
99 = NA, never hungry / NVT, nooit honger

4. Since (child's name) was born, have you had any health problems which required hospitalisation or other treatment?
Het jy enige gesondheids probleme gehad, vanaf (naam van die kind) se geboorte, waarvoor jy in die hospitaal opgeneem is of waarvoor jy ander behandeling ontvang het? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown/Don't know / weet nie
99 = NA / NVT

5. If yes, specify the problem:
Indien ja, spesifiseer die probleem:

_____ _____

6. Have you ever had TB treatment?

Het jy al ooit TB gehad? ..... ☐☐

1 = Yes / Ja
2 = No / Nee
88 = Unknown / onbekend

7. If yes, when was TB detected?

Indien Ja, het jy TB gehad? ..... ☐☐☐☐/☐☐
(1911/11 Unknown/onbekend) yyyy mm

**Complete the woman's measurements if not previously done**

8. What is woman's height? ..... ☐☐☐.☐ cm
Wat is vrou se lengte?

9. What is woman's weight? ..... ☐☐☐.☐ kg
Wat is vrou se gewig?

10. What is woman's head circumference?..... ☐☐.☐cm
Wat is vrou se kopomtrek?

11. Does the woman have braids or very thick hair? ..... ☐☐
Het die vrou gevlegde of baie dik hare?
1 = Yes-Ja
2 = No-Nee
88 = Unknown/Don't know- weet nie
99 = NA – NVT

12. Time at completion of interview: ☐☐:☐☐
(use 24 hour clock, unknown = 23:11) hr min

**INTERNAL AUDIT QUESTIONS** (Confidence rating)
**Is the above information significantly distorted by:**

1. This woman's misrepresentation? ..... ☐☐
   1 = Yes 2 = No 88 = Unknown
   The following factors considered in choosing how to answer this question:
   a. Contradictory information in child's chart (e.g. documentation of intoxication at birth)
   b. Contradictory information from reliable source
   c. Contradictory response to questions within the interview
   d. Subjective assessment of the interviewer based on interaction with and observation of the woman during the interview (body language, etc.)

2. This woman's inability to understand? ..... ☐☐
   1 = Yes 2 = No 88 = Unknown
   The following factors are considered in choosing how to answer this question:
   a. Language c. Psychaitric disorders
   b. Intellectual ability d. Contradictory response to questions within the interview

3. What was the primary source of "risk" in this woman's life (at the time of the pregnancy of interest)?
   **(circle ALL that apply)**
   1 = Woman used alcohol
   2 = Excessive family involvement in alcohol
   3 = Partner used alcohol
   4 = Friends used alcohol
   5 = Woman used other drugs
   6 = Other psychiatric diagnosis
   7 = Other (specify) _____

4. Risk category of this woman TODAY for producing future affected child? ..... ☐☐
   1 = High risk 3 = Low risk
   2 = Medium risk 4 = Lowest risk
   88 = Unknown
   The following factors are considered in choosing how to answer this question:
   a. High risk
      1) The woman is currently drinking and pregnant
      2) The woman is currently drinking and is not using any form of birth control
      3) The woman is currently using other drugs
   b. Medium risk
      1) The woman has been abstinent < 1 year, and is not using any form of birth control
      2) The woman has been abstinent < 1 year; however, her partner is still drinking and/or the woman has not made any positive changes in her social situation.
      3) The woman drank only before her pregnancy was diagnosed; was abstinent for remainder of pregnancy
      4) The woman has been abstinent < 1 year, and the woman's partner has had a vasectomy.
   c. Low risk
      1) The woman has been abstinent > 1 year; currently she does not have a partner who is drinking or has no partner
      2) The woman has been abstinent > 1 year, and she has made positive changes in her social situation.
      3) The woman is using semi-permanent method of birth control (depo-provera, norplant)
      4) The woman has been abstinent > 1 year, and the woman 's partner has had a vasectomy
      5) The woman is currently pregnant, and there is no information to suggest any use so far in pregnancy.
   d. Lowest risk
      1) The woman has had surgical sterilization (i.e., tubal ligation, or hysterectomy)

5. Does the woman require referral to the community worker ..... ☐☐
   1 = Yes 2 = No 88 = Unknown

# APPENDIX C: Afrikaans version of the Beck Depression Inventory

ID : .....
ONDERHOUDSVOERDER :../.. .
DATUM :.../.../...
BESOEKNO : .....

## BECK OPNAME

Ek gaan vir jou groepe stellings lees. Ek wil hê jy moet een stelling kies uit elke groep wat die beste beskryf hoe jy gevoel het die **LAASTE WEEK, INSLUITENDE VANDAG.** (Omring die getal langs die stelling wat jy kies)

1.
0 Ek voel nie treurig nie.
1 Ek voel treurig.
2 Ek voel altyd treurig en kan nie daaruit kom nie.
3 Ek is so treurig of ongelukkig dat ek dit nie kan hou nie.

2.
0 Ek is nie eintlik mismoedig oor die toekoms nie.
1 Ek voel mismoedig oor die toekoms.
2 Ek voel ek het niks om na uit te sien nie.
3 Ek voel dat die toekoms nie kan verbeter nie en dinge nie kan verbeter nie.

3.
0 Ek voel nie soos 'n mislukking nie.
1 Ek voel dat ek meer misluk het as die gemiddelde persoon.
2 As ek terugkyk oor my lewe sien ek net 'n klomp mislukkings.
3 Ek voel ek is 'n totale mislukking as mens.

4.
0 Ek kry net soveel bevrediging uit dinge soos altyd.
1 Ek geniet nie dinge soos altyd nie.
2 Ek kry nie ware bevrediging uit enigiets meer nie.
3 Ek is ontevrede en vervelig met alles.

5.
0 Ek voel nie eintlik skuldig nie.
1 Ek voel skuldig vir 'n goeie deel van die tyd.
2 Ek voel redelik skuldig meeste van die tyd.
3 Ek voel altyd skuldig.

6.
0 Ek voel nie dat ek gestraf word nie.
1 Ek voel ek mag moontlik gestraf word.
2 Ek verwag om gestraf te word.
3 Ek voel ek word gestraf.

7.
0 Ek voel nie teleurgesteld in myself nie.
1 Ek is teleurgesteld in myself.
2 Ek is geskok met myself.
3 Ek haat myself.

ID :.....

| | | |
|---|---|---|
| 8. | 0 | Ek voel nie ek is erger as iemand anders nie. |
| | 1 | Ek is krities op myself vir my swakhede en foute. |
| | 2 | Ek blameer myself die hele tyd vir al my foute. |
| | 3 | Ek blameer myself vir wat gebeur wat sleg is. |
| 9. | 0 | Ek dink nie daaraan om myself dood te maak nie. |
| | 1 | Ek dink daaraan om myself dood te maak, maar sal dit nooit doen nie. |
| | 2 | Ek sal graag myself wil doodmaak. |
| | 3 | Ek sal myself doodmaak as ek die kans kry. |
| 10. | 0 | Ek huil nie meer as gewoonlik nie. |
| | 1 | Ek huil meer nou as voorheen. |
| | 2 | Ek huil nou altyd. |
| | 3 | Ek kon altyd gehuil het, maar kan nie meer nie al wil ek ook. |
| 11. | 0 | Ek is nie nou meer geirriteerd as voorheen nie. |
| | 1 | Ek word makliker kwaad of geirriteerd as voorheen. |
| | 2 | Ek voel nou altyd geirriteerd. |
| | 3 | Ek word nie meer geirrriteerd deur goed wat my voorheen geirriteer het nie. |
| 12. | 0 | Ek het nie belangstelling in ander mense verloor nie. |
| | 1 | Ek is minder geinteresseer in mense as voorheen. |
| | 2 | Ek het meeste van my belangstelling in ander mense verloor. |
| | 3 | Ek het al my belangstelling in ander mense verloor. |
| 13. | 0 | Ek neem besluite omtrent net so goed soos ek altyd kon. |
| | 1 | Ek stel meer uit om besluite te neem as voorheen. |
| | 2 | Ek neem moeiliker besluite as voorheen. |
| | 3 | Ek kan glad nie meer besluite neem nie. |
| 14. | 0 | Ek voel nie dat ek slegter lyk as voorheen nie. |
| | 1 | Ek is bekommerd dat ek oud of onaantreklik lyk. |
| | 2 | Ek voel daar is permanente veranderinge in my voorkoms wat my onaantreklik laat lyk. |
| | 3 | Ek glo ek lyk lelik. |
| 15. | 0 | Ek kan omtrent net so goed werk as voorheen. |
| | 1 | Dit neem meer van my om sover te kom om te begin om iets te doen. |
| | 2 | Ek moet myself hard druk om iets te doen. |
| | 3 | Ek kan nie meer enige werk doen nie. |

ID :.....

16. 0 Ek kan net so goed slaap as voorheen.
1 Ek slaap nie so goed soos altyd nie.
2 Ek word 1-2 uur vroeër wakker en sukkel om weer aan die slaap te raak.
3 Ek word heelwat vroeër wakker en kan nie daarna weer slaap nie.

17. 0 Ek word nie gouer moeg as voorheen nie.
1 Ek word gouer moeg as voorheen.
2 Ek word moeg van omtrent niks doen nie.
3 Ek is te moeg om enigiets te doen.

18. 0 My eetlus is nie erger as voorheen nie.
1 My eetlus is nie so goed soos voorheen nie.
2 My eetlus is baie erger nou.
3 Ek het geen eetlus meer nie.

19. 0 Ek het nie veel gewig, indien enige, onlangs verloor nie
1 Ek het meer as 5kg verloor. Ek probeer gewig
2 Ek het meer as 10kg verloor. verloor deur minder te
3 Ek het meer as 15kg verloor. eet. Ja... Nee...

20. 0 Ek is nie meer as gewoonlik bekommerd oor my gesondheid nie.
1 Ek is bekommerd oor my fisiese probleme soos pyne en skete, onstelde maag of hardlywigheid.
2 Ek is baie bekommerd oor my fisiese probleme en dit is baie moeilik om aan iets anders te dink.
3 Ek is so bekommerd oor my fisiese probleme dat ek nie aan iets anders kan dink nie.

21. 0 Ek het nie enige verandering in my belangstelling in seks opgemerk nie.
1 Ek is minder geinteresseerd in seks as voorheen.
2 Ek is baie minder geinteresseerd in seks nou.
3 Ek het heeltemal belangstelling in seks verloor.

INDIEN RESPONDENT ERG DEPRESSIEF VOORKOM

Dit lyk my jy het 'n moeilike tyd nou. Ontvang jy enige professionele hulp of berading? Ja.....Nee.....

INDIEN NIE: Wil jy verwys word vir professionele hulp?
(aanbod aanvaar? Ja.....Nee.....)

# APPENDIX D: Ethics Approval Letter

**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG**

Division of the Deputy Registrar (Research)

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)**
R14/49 Viljoen

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER M041127** |
| **PROJECT** | Fetal Alcohol Spectrum Disorder (FASD) Prevention and Intervention in Upington, Northern Cape Province of South Africa |
| **INVESTIGATORS** | Prof DL Viljoen |
| **DEPARTMENT** | Human Genetics |
| **DATE CONSIDERED** | 04.11.26 |
| **DECISION OF THE COMMITTEE*** | Approved unconditionally |

**Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.**

**DATE** 04.11.29 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof DL Viljoen

---

**DECLARATION OF INVESTIGATOR(S)**

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG**

Division of the Deputy Registrar (Research)

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)**
R14/49 Chetty

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER M070732** |
| **PROJECT** | FASD from infancy to childhood: neuro-psychological functioning and maternal depression within a SA community |
| **INVESTIGATORS** | Miss CM Chetty |
| **DEPARTMENT** | Psychology |
| **DATE CONSIDERED** | 07.07.27 |
| **DECISION OF THE COMMITTEE*** | APPROVED UNCONDITIONALLY |

**Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.**

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
PROF AJ WOODIWISS
Co - Chair
2007 -10- 05
HREC (Medical)

**DATE** 07.09.27 **CHAIRPERSON** .....
(Professors RE Cleaton-Jones, A Dhai, M Vorster, C Feldman, A Woodiwiss)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr K Greenop

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**DECLARATION OF INVESTIGATOR(S)**

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

# APPENDIX E: Information Sheets and Consent Forms

1. 9-18 months Clinical Evaluation and Infant Development Information Sheet
2. 18-36 months Clinical Evaluation and Infant Development Information Sheet
3. Information Sheet for infant development and maternal interview
4. Consent form for clinical evaluation and infant developmental tests
5. Consent Form for infant developmental tests and maternal interview
6. Afrikaans version of consent form for developmental tests and maternal interview
7. Maternal Interview Consent Form (English and Afrikaans)

Dear Mrs_____ January 2004

Professor Denis Viljoen and his team have conducted research studies to determine the incidence of Fetal Alcohol Syndrome (FAS) in the Western Cape, Gauteng and the Northern Cape. The second part of the project in the Northern Cape started in 2002 where a medical survey of all babies born in 2001-2002 will be carried out.

FAS is the most common preventable cause of mental retardation worldwide. It can cause mental retardation, behavioural difficulties (such as hyperactivity and poor concentration span) and problems with the child's growth.

This survey is part of a research programme to determine previously undetected (hidden) medical problems suggestive of disorders such as fetal alcohol syndrome. These may include minor heart defects, physical abnormalities, ear and eye defects and others.

Each baby will be measured for height, weight and head circumference and will be examined by doctors during clinics to be held from 2002-2005. Babies identified to undergo clinical examinations will be required to partially undress to enable doctors to listen to their hearts. No specimens or samples will be taken during the initial screening. A photograph will be taken of each baby during the assessment. The baby's name will not be recorded on the photo, which will be stored in a secure place. Examinations will take place at a specific clinic, and there is no charge for this.

A number of babies may be required to have developmental tests, which consist of watching your baby play and his/her responses to toys and other harmless items, administered by a psychologist/psychometrist ( a person specially trained to tests the baby) and these too will be at no cost.

Participation of this examination is entirely voluntary. Should you wish for your baby to take part, we ask you to sign the attached consent form. This form should be returned to Mrs. Jenny Josephs, the FAS Community Coordinator. Consent may be withdrawn at any time, and further information can be obtained by contacting Ms Leigh-Anne Fourie on (011) 489-9509 or faspr@nhls.ac.za. Please note that we undertake to refer babies to the relevant medical authorities if any problems are found. If the developmental tests reveal difficulties that may affect your baby's progress, we will inform you, so that these issues can be addressed.

We realize that this programme will take up some of your time, so all mothers who participate will be given a food voucher and a color family photograph.

Thank you for your co-operation.
Yours Sincerely

Ms Leigh-Anne Fourie
Project Co-ordinator

# CONSENT FORM

Yes, I ..... the mother/guardian
**(mother's/ guardian's name)**
of

..... give permission for my
**(baby's name)**

baby to be measured by the team, and examined by the doctors if necessary. I also give permission for my child to undergo a developmental test, and for a photograph to be taken.

Mother's address (place where the baby lives)

.....

.....

Baby's date of birth (day/month/year)

.....

Name of baby's mother

.....

Signature of mother/guardian.....

Date .....

Contact telephone
number.....

Dear Mother

January 2005

As you know, you gave consent for your baby to be measured for height, weight and head circumference, and to be examined by a doctor during the initial screening programme for the Fetal Alcohol Syndrome (FAS) project. Your baby was found to be below the normal range for these measurements, and small for her/his age. We would like your baby to have some neurodevelopmental tests, which consist of watching your baby play and his/her responses to toys and harmless items, administered by a psychologist/psychometrist (a person specially trained to test the baby). There will be no charge for these tests. Some of the mothers of these babies will need to be interviewed by one of our team members for approximately 45 minutes to talk about the pregnancy of the baby in the study.

Participation in the developmental testing and the interview is entirely voluntary. Should you wish for your baby to take part, we ask you to sign the attached consent form. This form should be returned to Mrs. Jenny Josephs, the FAS Community Coordinator. Consent may be withdrawn at any time, and further information can be obtained by contacting Ms Candice Chetty on (011) 489-9509 or chettyc@telkomsa.net. Please note that we undertake to refer babies to the relevant medical authorities if any problems are found. If the developmental tests reveal difficulties that may affect your baby's progress, we will inform you, so that these issues can be addressed.

1. We realize that this programme will take up some of your time, so all mothers who participate will be given a food voucher and a color family photograph.
2. All mothers of babies who are thought to have FAS will be invited to attend a FAS advocacy/support group and will be:
    a) Helped to look after the health of their babies by referral to community clinics for vaccinations, and treatment of illnesses.
    b) Referred to therapists for stimulation for developmental delay in their babies.
    c) Referred to nutritional programmes.
    d) Referred to family planning clinics for contraceptive needs.
    e) Assisted in obtaining assistance from Welfare Departments.
    f) Referred to appropriate NGO's in the area (e.g. alcohol rehabilitation programmes & counseling).

Thank you for your co-operation.
Yours sincerely

Ms Candice Chetty(Project Co-ordinator)

## CONSENT FORM

Yes, I..... the mother/guardian
(mother's/guardian's name)
of ..... give permission for
(baby's name)
my baby to undergo a developmental test. I agree to being interviewed by a member of the team if necessary.

Mothers address (place where the baby lives)
.....
.....
Baby's date of birth (day/month/year)
.....
Name of baby's mother
.....
Signature of mother/guardian
.....
Date .....

Contact telephone number.....

January 2005

Dear Mother

As you know, you gave consent for your baby to be measured for height, weight and head circumference and to be examined by a doctor during the initial screening programmed for the Fetal Alcohol Spectrum Disorder (FASD) project. Your baby was found to be within the NORMAL range for these measurements. A number of other babies were found to be below the normal range, and are called screen positive. For this study we need a baby with NORMAL growth to be a control for a screen positive baby and we would like your baby to be a CONTROL in the study.

Your baby may also be required to be a NORMAL control for the developmental tests that will be administered by a psychologist/ psychometrist. There will be no charge for these tests. Some of the mothers of these babies will need to be interviewed by one of our team members to talk about the pregnancy of the baby in the study.

Participation of this examination and the interview is entirely voluntary. Should you wish for your baby to take part, we ask you to sign the attached consent form. This form should be returned to Mrs Cecilia Van Tonder, The FASD Projects Manager. Consent can be withdrawn at any time, and further information can be obtained by contacting Ms Candice Chetty on (011) 489-9509. Please note that we undertake to refer babies to the relevant medical authorities if any problems are found. If the developmental tests reveal difficulties that may affect your baby's progress, we will inform you, so that these issues can be addressed.

We realise that this programme will take up some of your time, so all mothers who participate will be given a food voucher and a colour family photograph.

Thank you for you co-operation.

Yours sincerely

Ms Candice Chetty
Area Co-ordinator

## CONSENT FORM

Yes, I ..... the mother / guardian of
**(mother's/guardian's name)**

..... give permission for my baby to
**(baby's name)**

undergo a developmental test. I agree to being interviewed by a member of the team if necessary.

Mother's address (place where baby lives)
.....

.....

Baby's date of birth (day/month/year) .....

Name of baby's mother .....

Signature of mother/guardian .....

Date .....

Contact telephone number.....

## TOESTEMMINGSVORM

Ja, hiermee gee ek _____. die moeder/ voog van
**(moeuer/voog se naam)**

_____ my toestemming dat my baba
**(baba se naam)**

ontwikkelingstoetse mag ondergaan. Ek gee my teostemming dat een van die span 'n onderhoud met my mag voer.

Moeder se adres (Plek waar baba bly)

_____

_____

Baba se geboortedatum (Dag/maand/jaar) _____
Naam van baba se moeder _____
Handtekening van moeder/voog _____
Datum _____
Kontak telefoon nommer _____

## 3. MATERNAL RISK FACTORS INTERVIEW
## MOEDERLIKE RISIKO ONDERHOUD

### Informed consent

We are doing research on fetal alcohol syndrome. We are trying to learn about factors that are important in having a healthy baby. I would like to ask you some questions about your pregnancies, your family, and also about habits such as drinking and smoking. It may be difficult for you to remember or talk about some of these things. Some of this information may be sensitive, or confidential. Whatever information you provide will be kept strictly confidential and will not be shown to other persons. Your name will never be mentioned to anyone outside the study without your consent. Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions.

Is there anything you want to ask me about this research before we begin?

Do you understand what I have said? Yes ☐ No ☐

Do I have your permission to begin with the questionnaire? Yes ☐ No ☐

Full name _____ Date _____

Signature _____

### Onderhoud toestemming

Ons doen navorsing oor fetale alkohol sindroom. Ons probeer vasstel watter faktore belangrik is vi 'n vrou om 'n gesonde baba te hê. Ek gaan vir jou vrae vra oor jou swangerskappe, jou familie, en vrae omtrent jou rook-en drinkgewoontes. Dit mag vir jou moeilik wees om van hierdie dinge te onthou of om daaroor te praat. Van die inligting mag van `n sensitiewe aard wees en ook moeilik wees om oor te praat. Ek wil jou egter verseker dat alles wat jy ons vertel baie vertroulik hanteer sa word. Jou naam sal nooit aan enige ander persoon bekend gemaak word sonder jou toestemming nie. Deelname aan die navorsing is vrywillig en as daar vrae is wat jy nie wil beantwoord nie is die jou keuse om dit nie te doen nie.

Is daar enige iets wat jy wil vra voordat ons begin?

Verstaan jy dit wat ek aan jou verduidelik het? Ja ☐ Nee ☐

Het ek jou toestemming om met die vraelys te begin? Ja ☐ Nee ☐

Volle naam _____

Handtekening _____

# APPENDIX F: Histogram Distributions of the Beck Depression Inventory

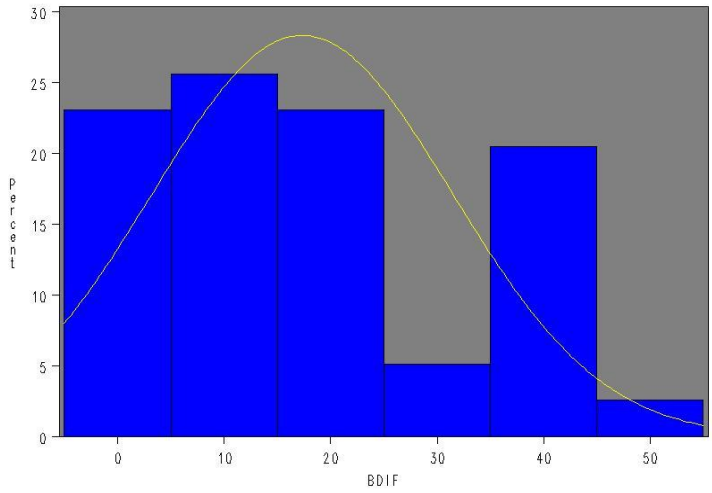



Figure 5 Histogram of BDI scores of the initial dataset for mothers of children with FASD

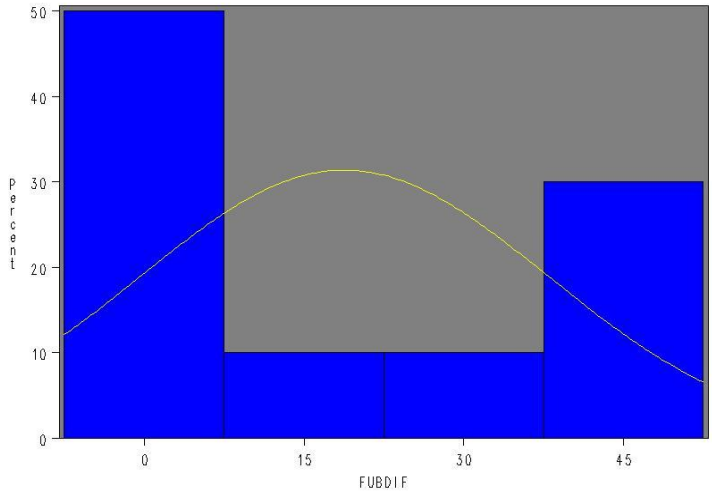



Figure 6 Histogram of BDI scores of the follow-up dataset for mothers of children with FASD

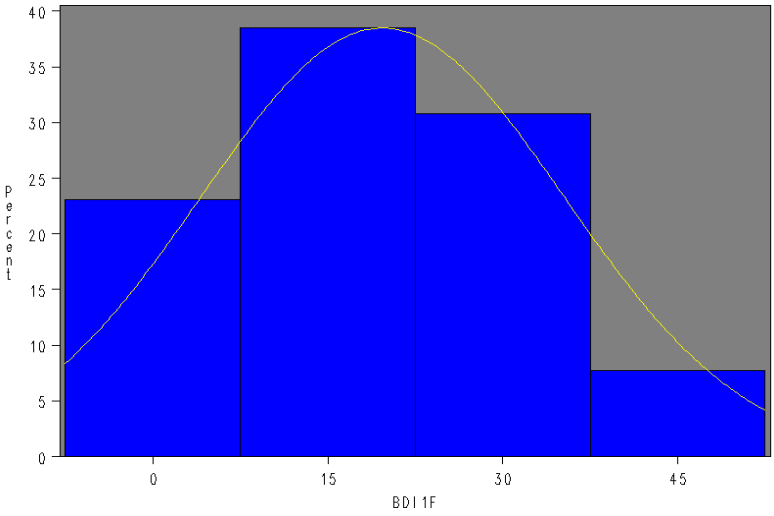



Figure 7 Histogram of the initial assessment BDI scores of the complete data set for mothers of children with FASD

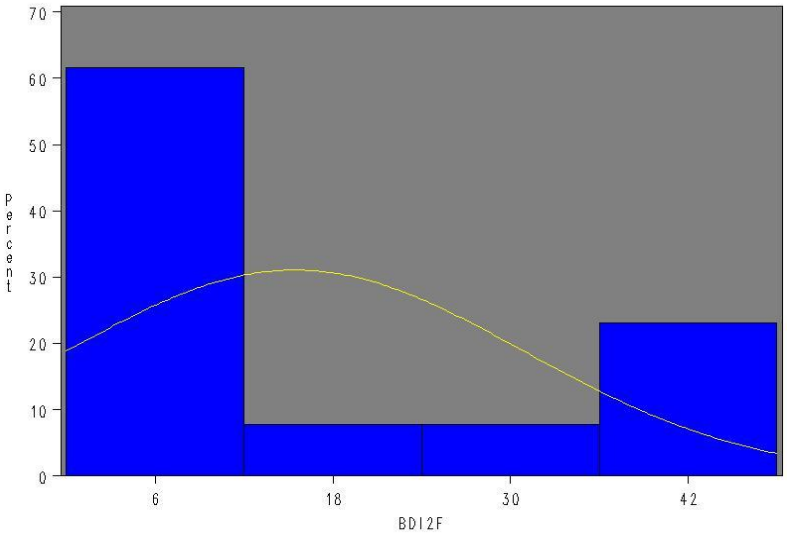



Figure 8 Histogram of the follow-up assessment BDI scores of the complete data set for mothers of children with FASD

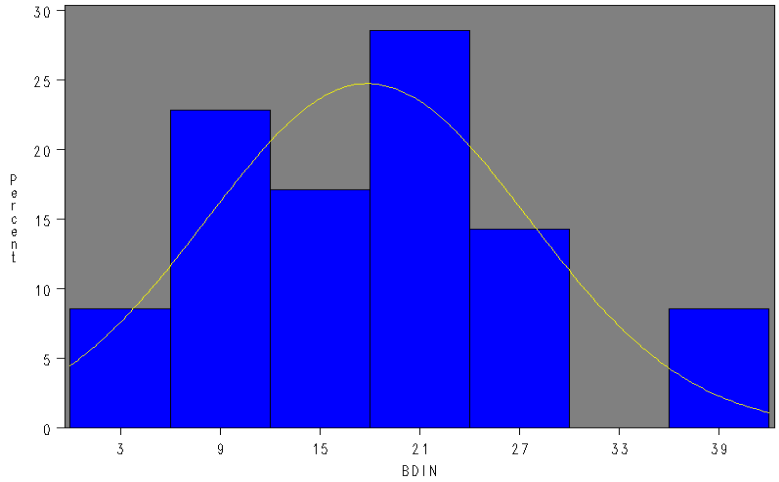



Figure 9 Histogram of BDI scores of the initial dataset for mothers of children with No FASD

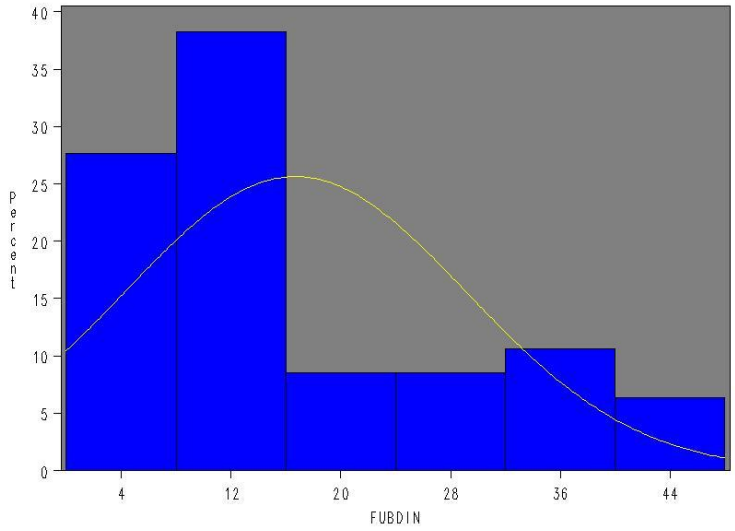



Figure 10 Histogram of BDI scores of the follow-up dataset for mothers of children with No FASD

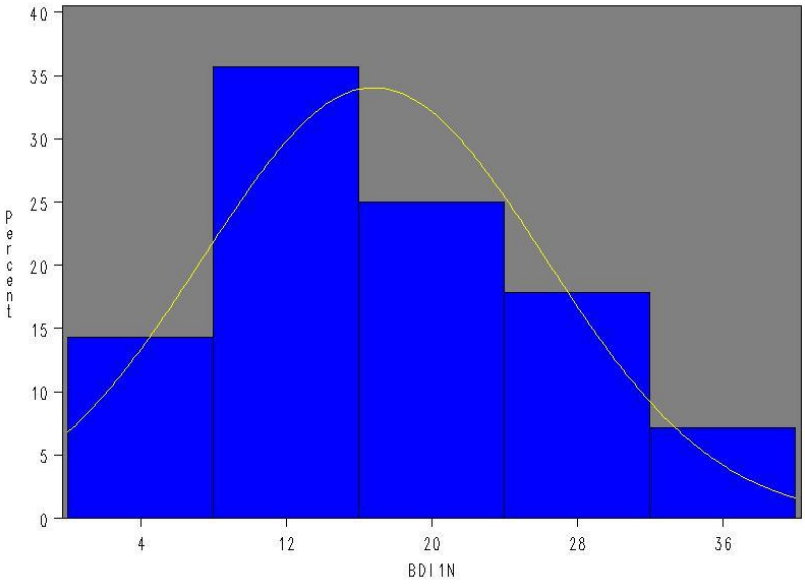



Figure 11 Histogram of the initial assessment BDI scores of the complete data set for mothers of children with No FASD

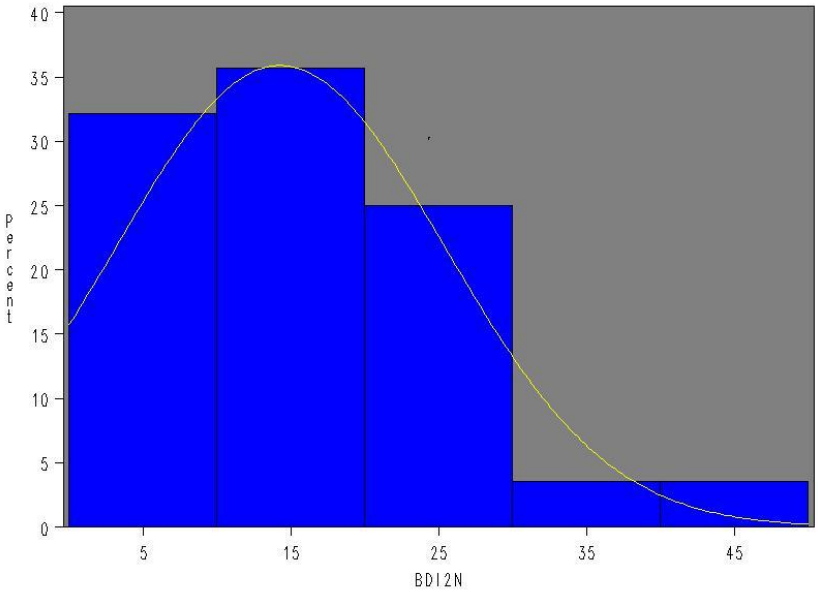



Figure 12 Histogram of the follow-up assessment BDI scores of the complete data set for mothers of children with No FASD

# APPENDIX G: Histogram Distributions of the Profile of Mood States

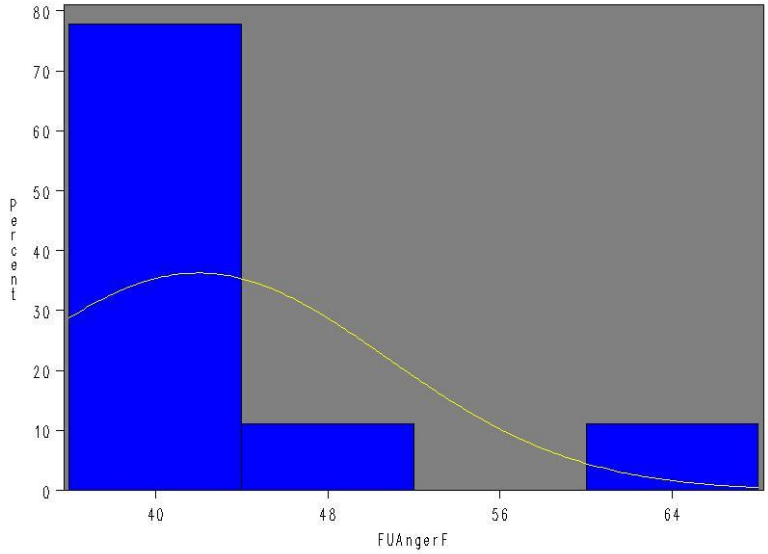



Figure 13 Histogram of Anger subscale of the follow-up dataset for mothers of children with FASD

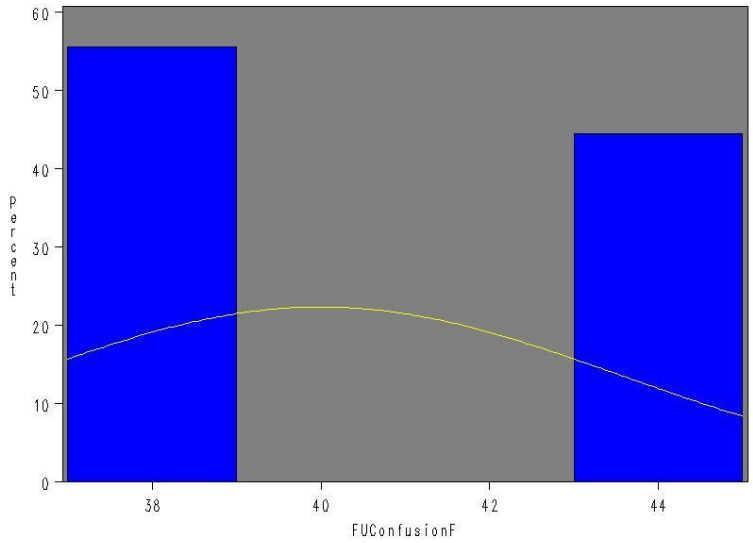



Figure 14 Histogram of Confusion subscale of the follow-up dataset for mothers of children with FASD

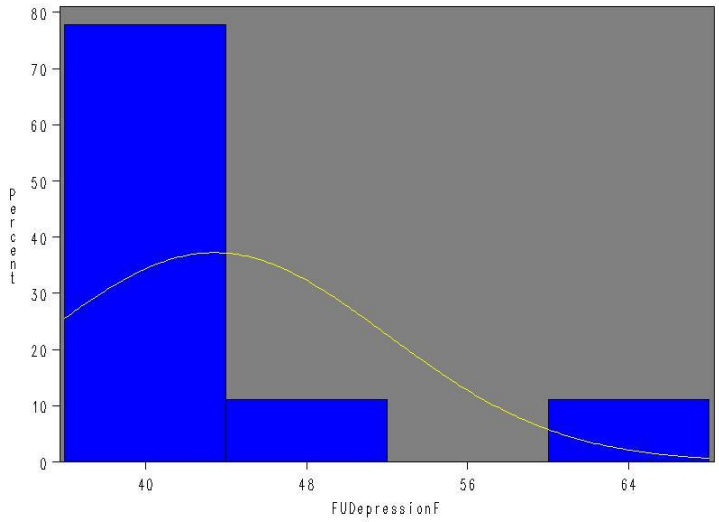



Figure 15 Histogram of Depression subscale of the follow-up dataset for mothers of children with FASD

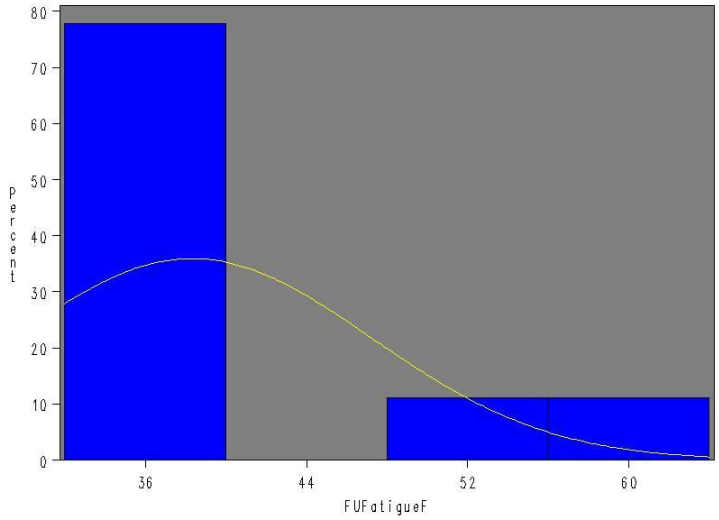



Figure 16 Histogram of Fatigue subscale of the follow-up dataset for mothers of children with FASD

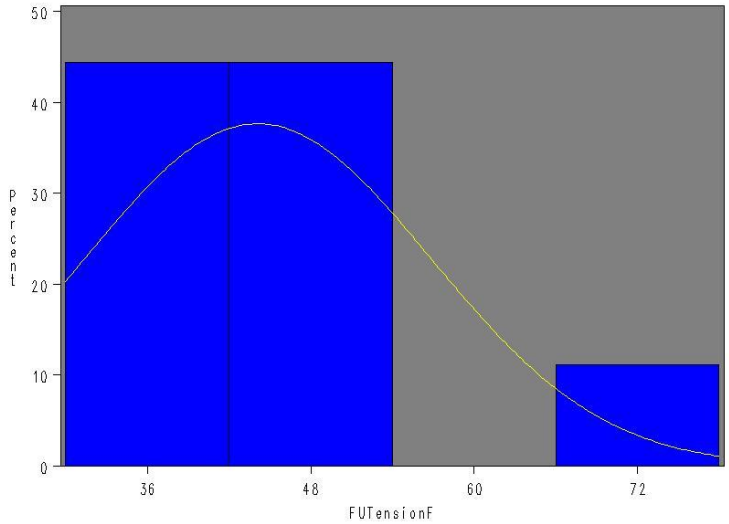



Figure 17 Histogram of Tension subscale of the follow-up dataset for mothers of children with FASD

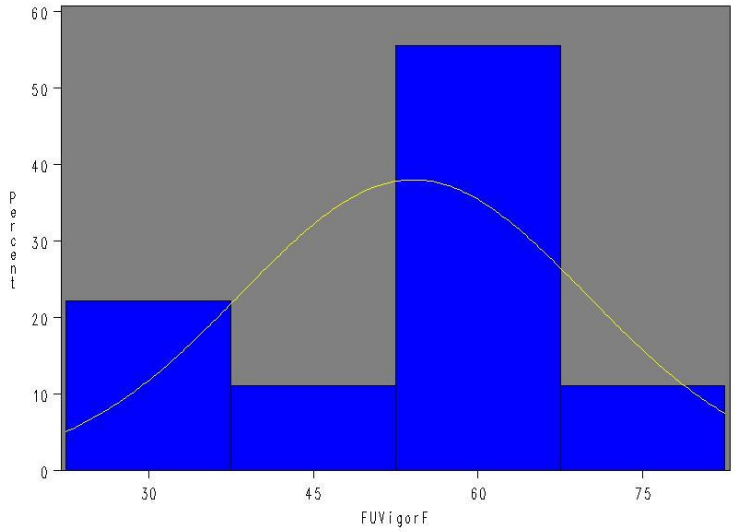



Figure 18 Histogram of Vigor subscale of the follow-up dataset for mothers of children with FASD

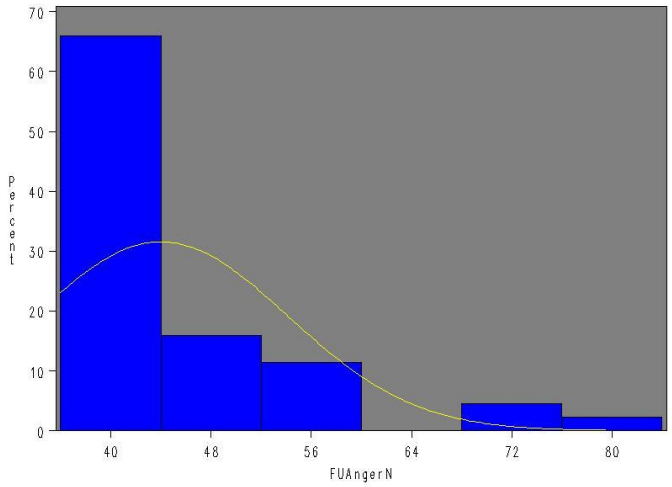



Figure 19 Histogram of Anger subscale of the follow-up dataset for mothers of children with No FASD

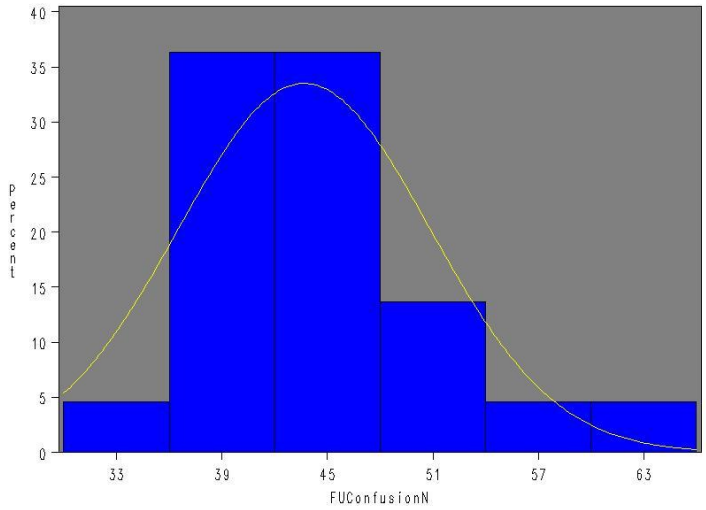



Figure 20 Histogram of Confusion subscale of the follow-up dataset for mothers of children with No FASD

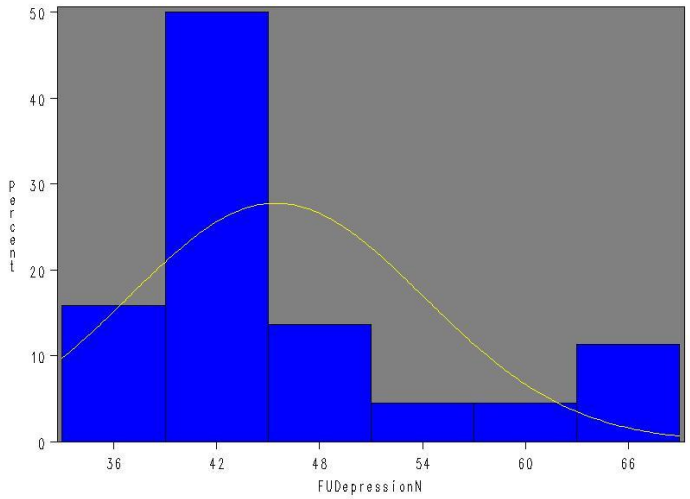



Figure 21 Histogram of Depression subscale of the follow-up dataset for mothers of children with No FASD

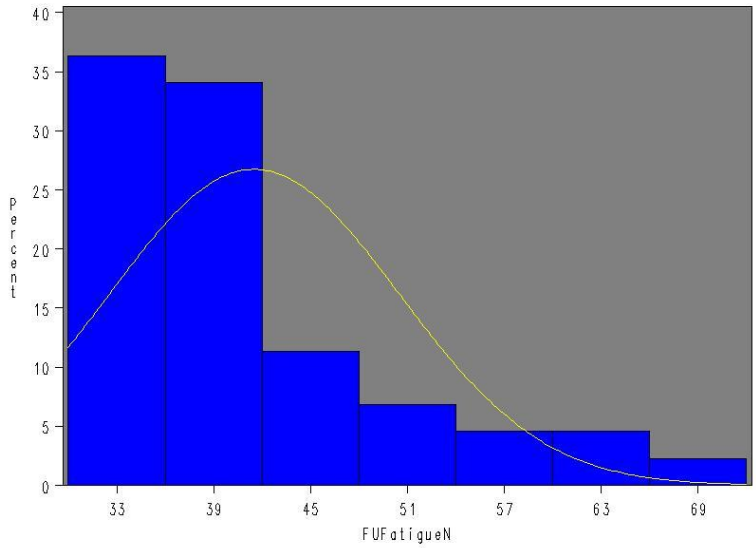



Figure 22 Histogram of Fatigue subscale of the follow-up dataset for mothers of children with No FASD

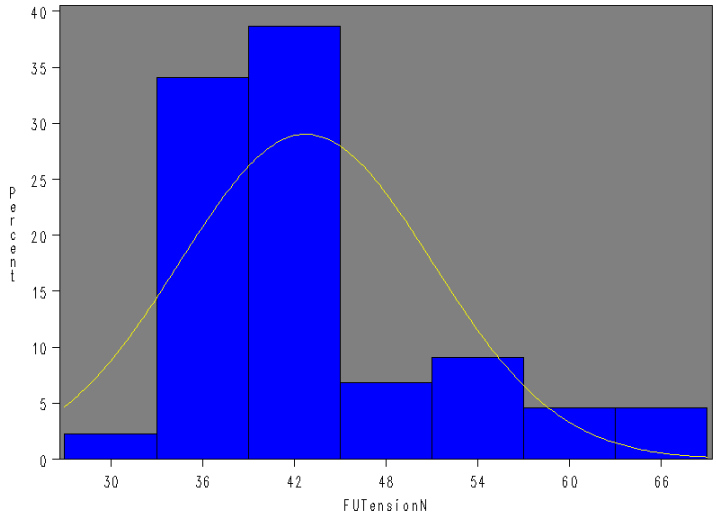



Figure 23 Histogram of Tension subscale of the follow-up dataset for mothers of children with No FASD

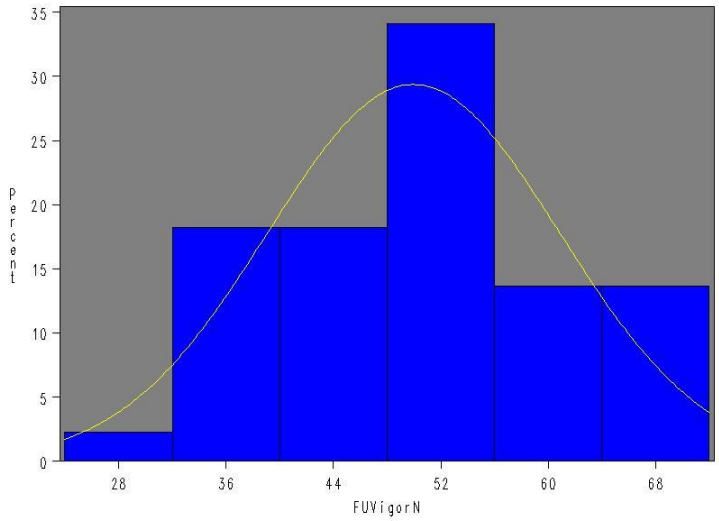



Figure 24 Histogram of Vigor subscale of the follow-up dataset for mothers of children with No FASD

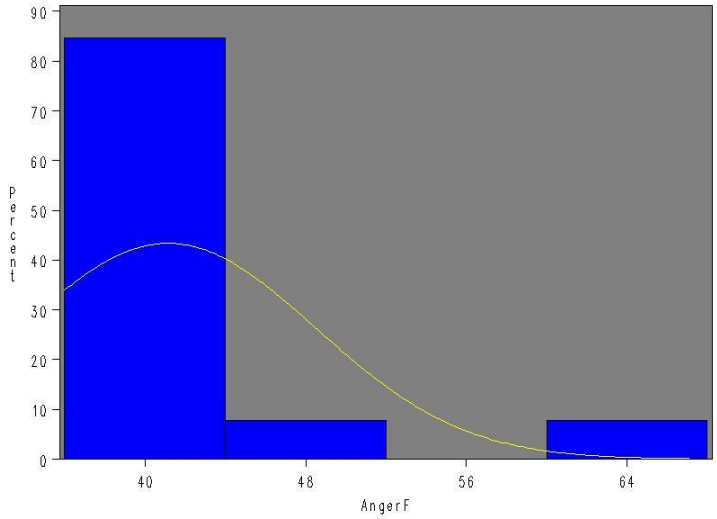



Figure 25 Histogram of Anger subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

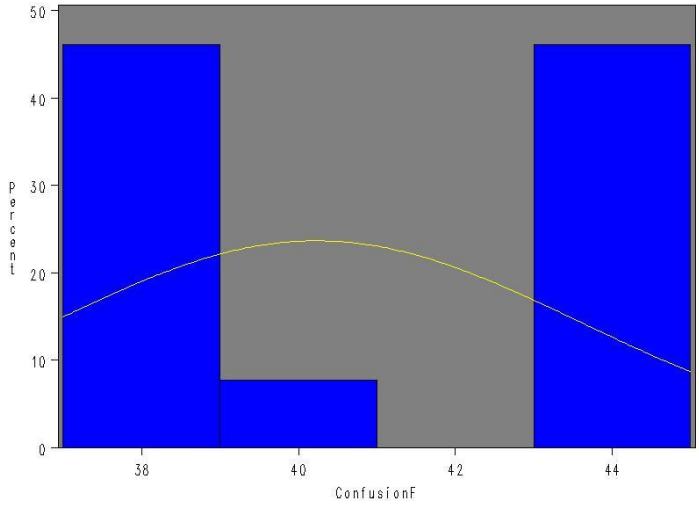



Figure 26 Histogram of Confusion subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

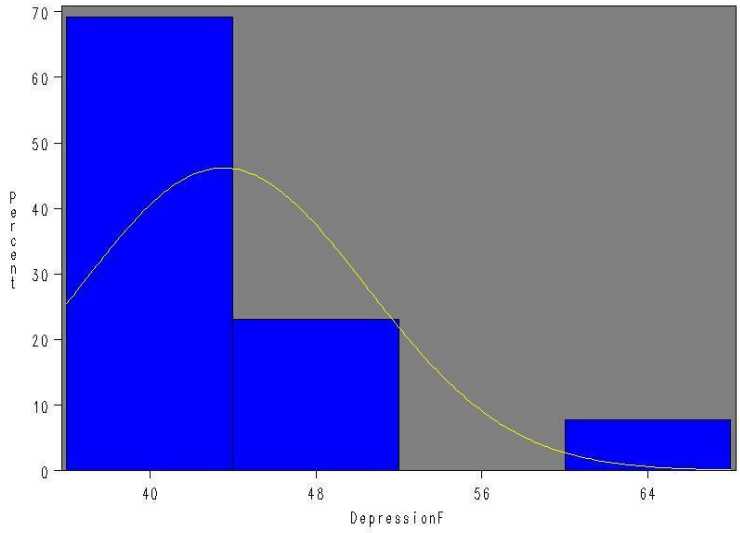



Figure 27 Histogram of Depression subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

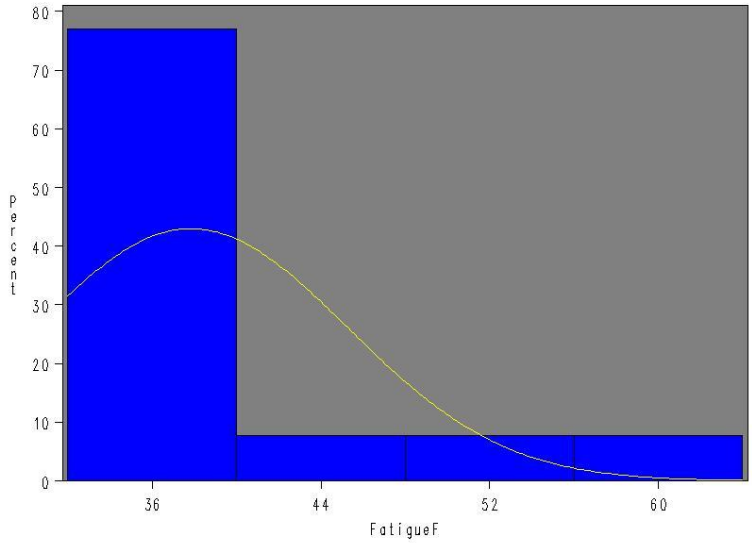



Figure 28 Histogram of Fatigue subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

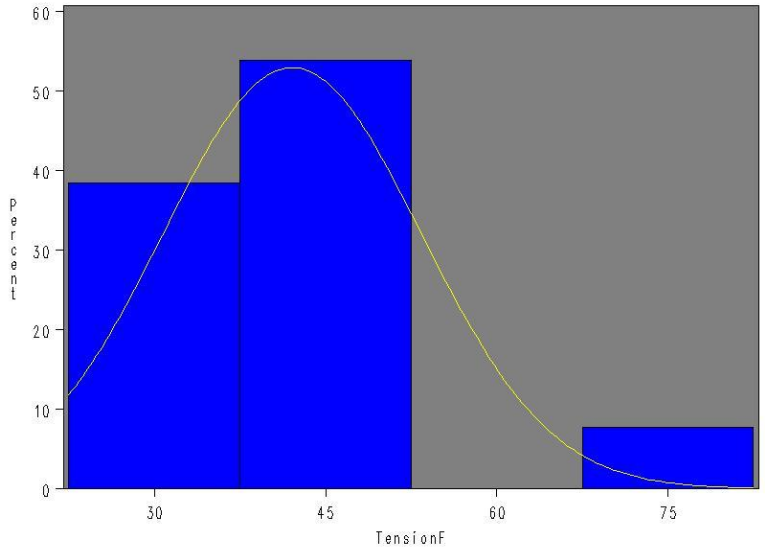



Figure 29 Histogram of Tension subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

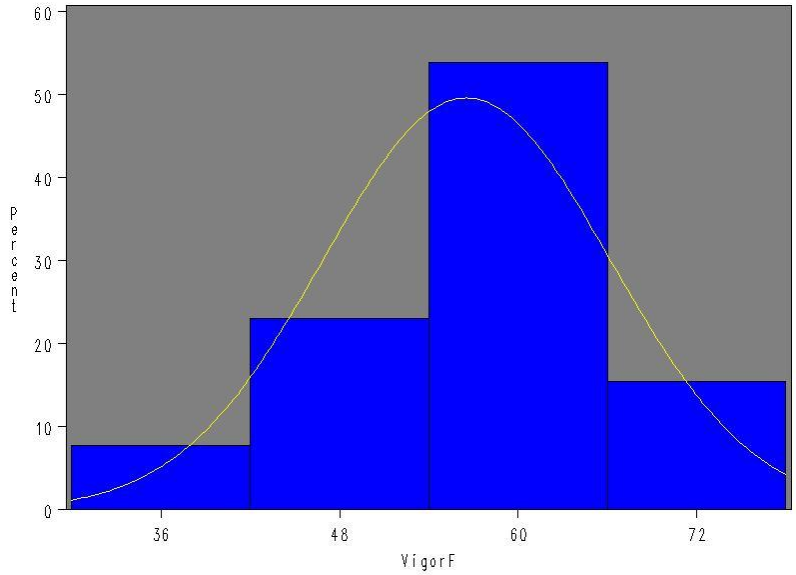



Figure 30 Histogram of Vigor subscale of the follow-up assessment for the complete dataset for mothers of children with FASD

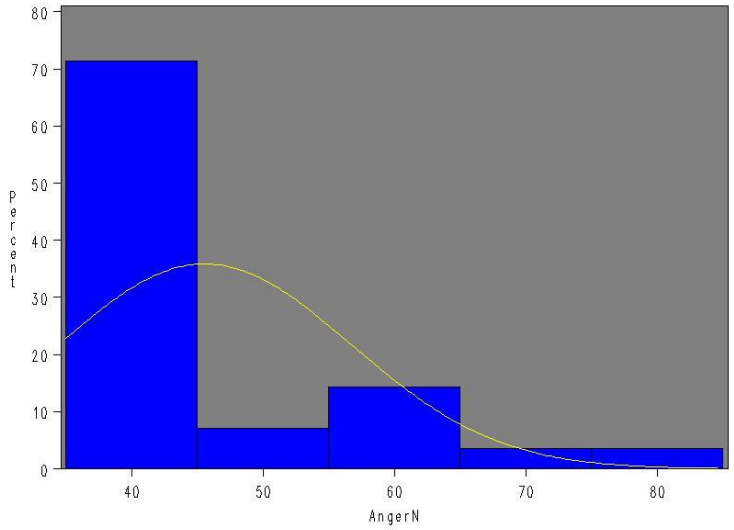



Figure 31 Histogram of Anger subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

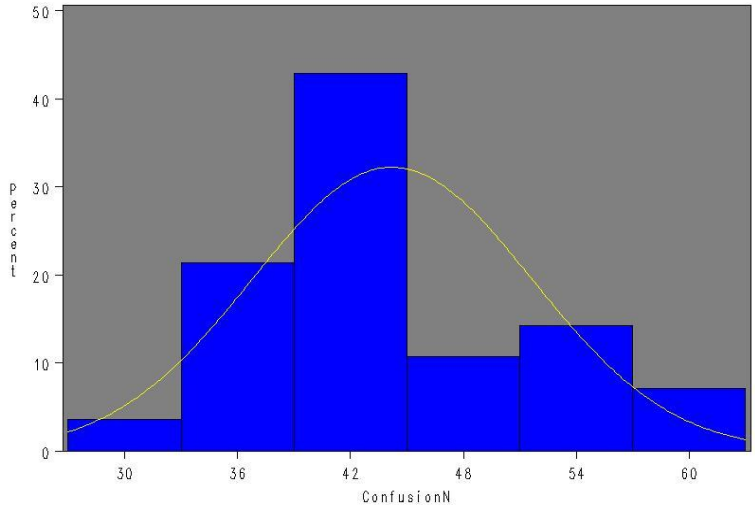



Figure 32 Histogram of Confusion subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

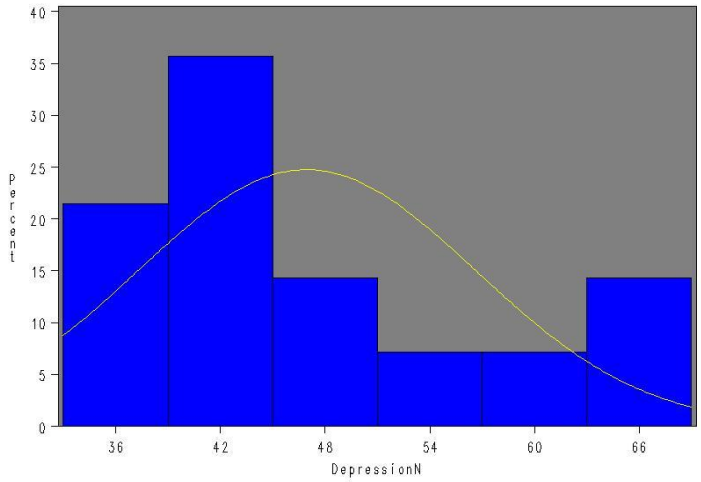



Figure 33 Histogram of Depression subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

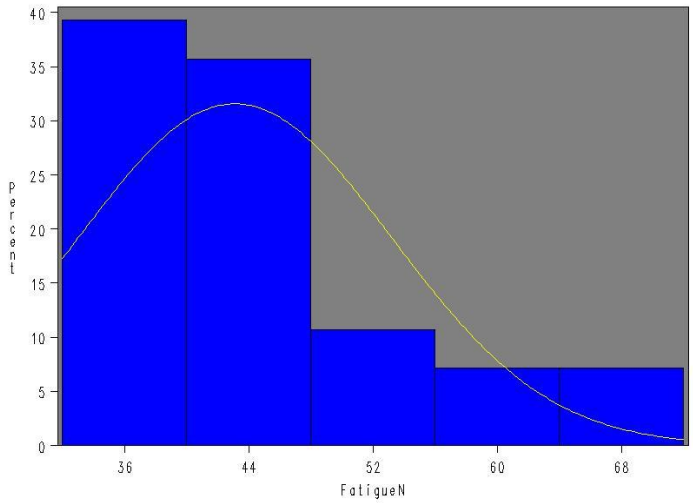



Figure 34 Histogram of Fatigue subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

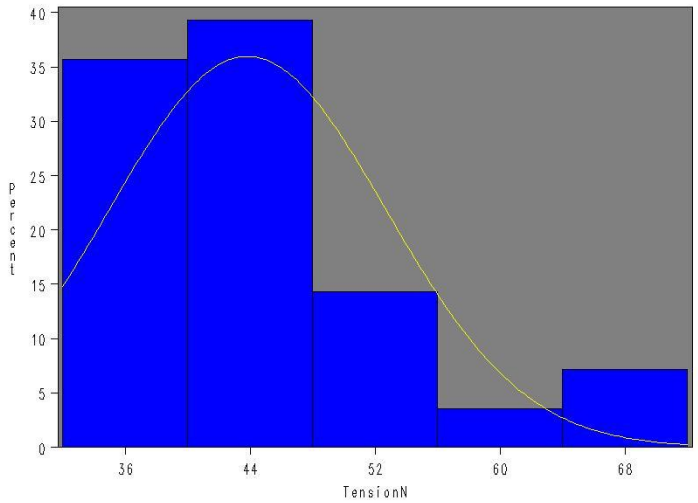



Figure 35 Histogram of Tension subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

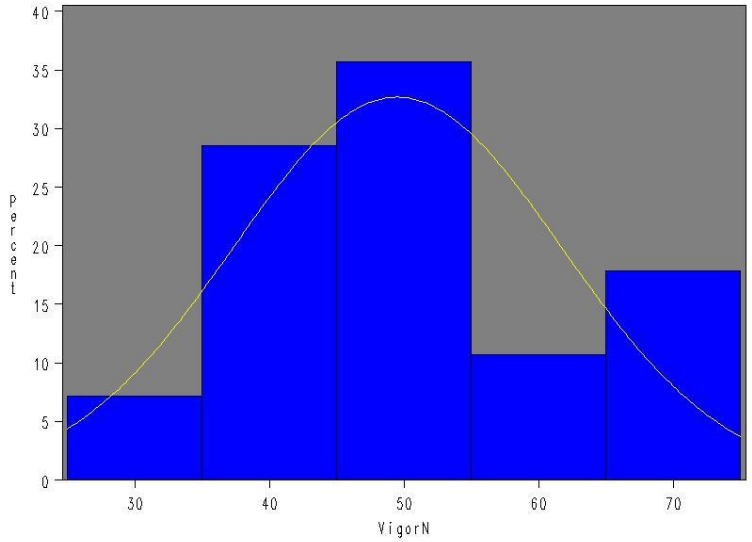



Figure 36 Histogram of Vigor subscale of the follow-up assessment for the complete dataset for mothers of children with No FASD

# APPENDIX H: Histogram Distributions of the Griffiths Mental Developmental Scales

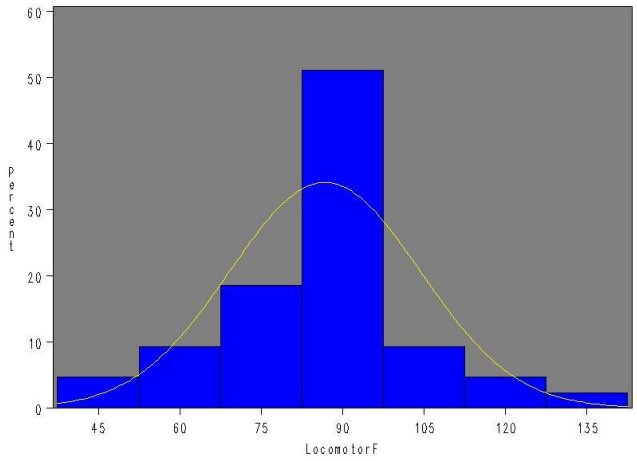



Figure 37 Histogram of Locomotor scores of the initial dataset for FASD infants

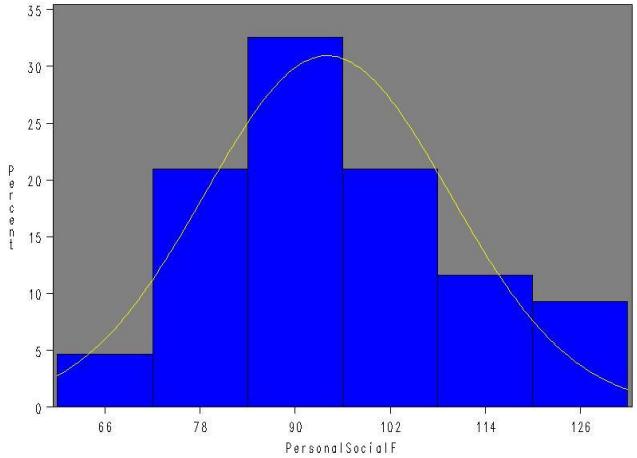



Figure 38 Histogram of Personal Social scores of the initial dataset for FASD infants

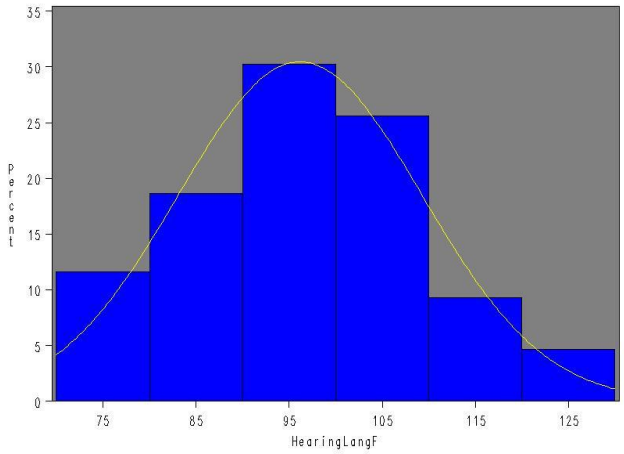



Figure 39 Histogram of Hearing and Language scores of the initial dataset for FASD infants

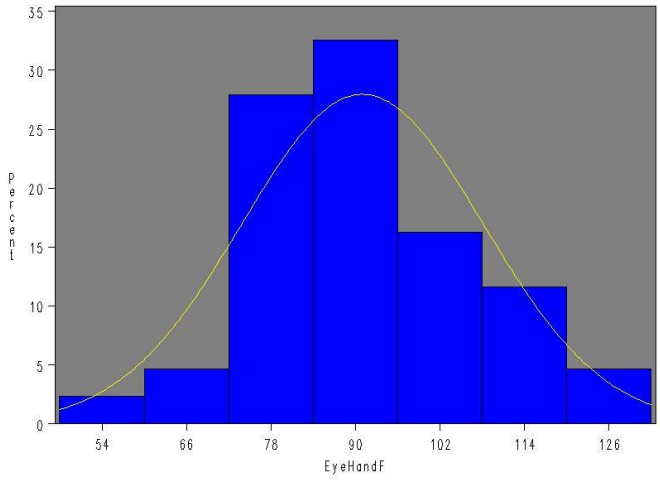



Figure 40 Histogram of Eye Hand Co-ordination scores of the initial dataset for FASD infants

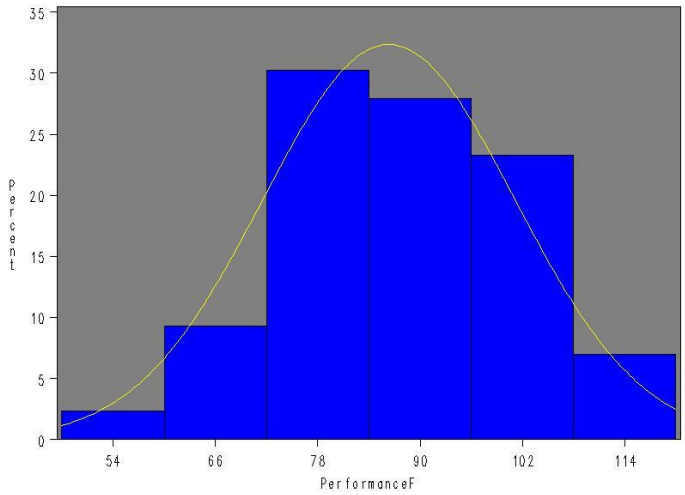


Figure 41 Histogram of Performance scores of the initial dataset for FASD infants

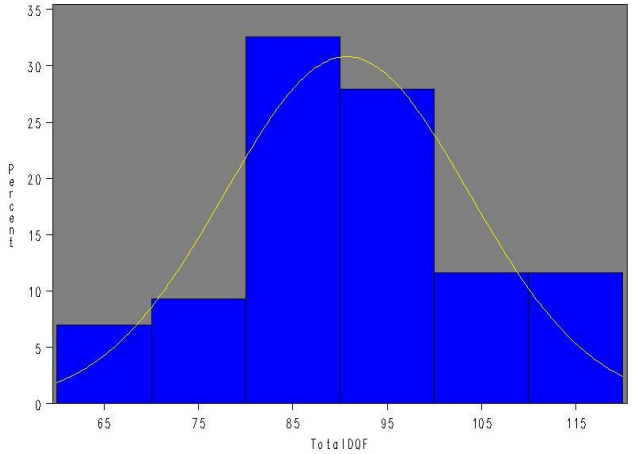



Figure 42 Histogram of Developmental Quotient scores of the initial dataset for FASD infants

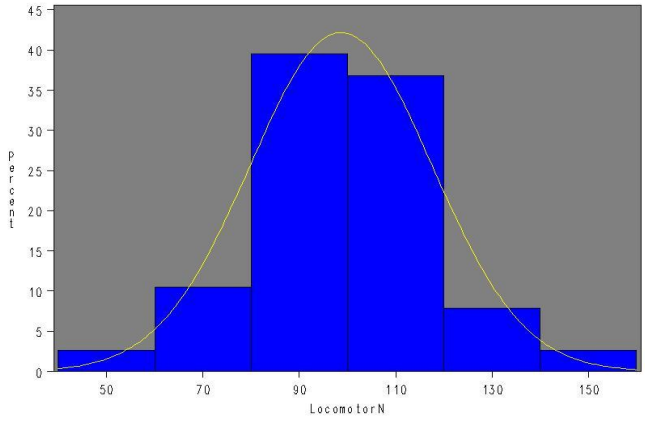



Figure 43 Histogram of Locomotor scores of the initial dataset for No FASD infants

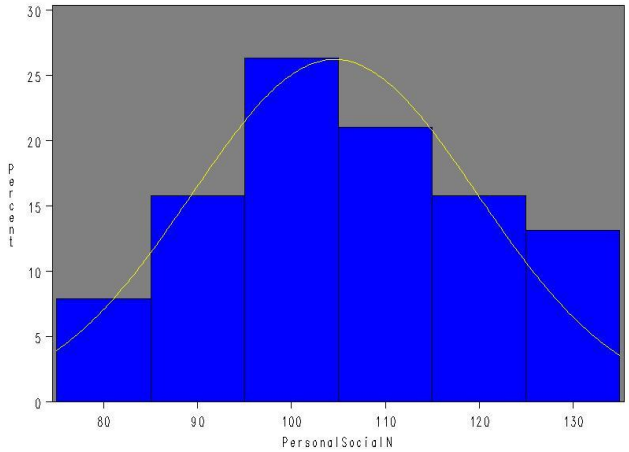



Figure 44 Histogram of Personal Social scores of the initial dataset for No FASD infants

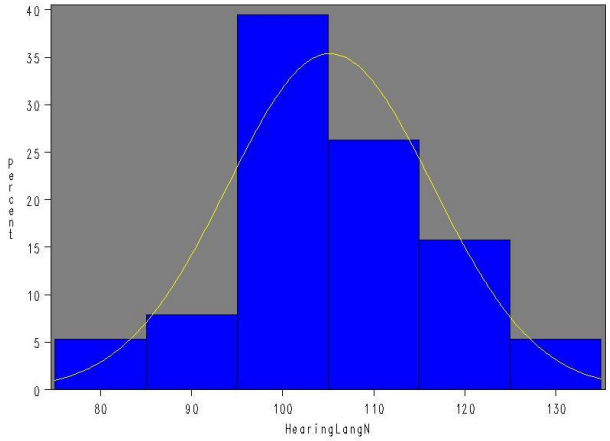



Figure 45 Histogram of Hearing and Language scores of the initial dataset for No FASD infants

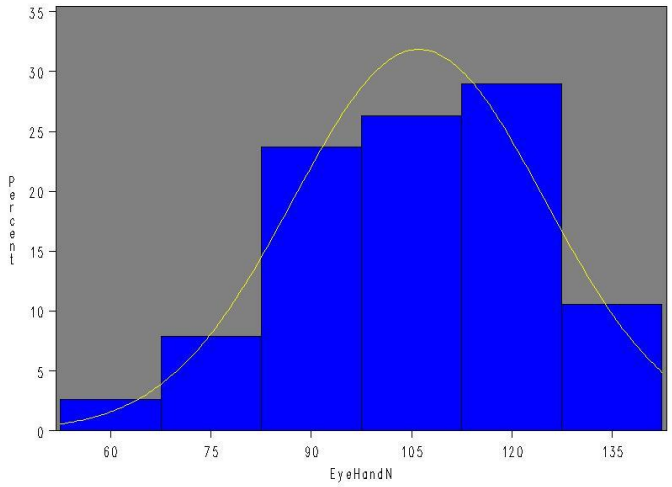


Figure 46 Histogram of Eye Hand Co-ordination scores of the initial dataset for No FASD infants

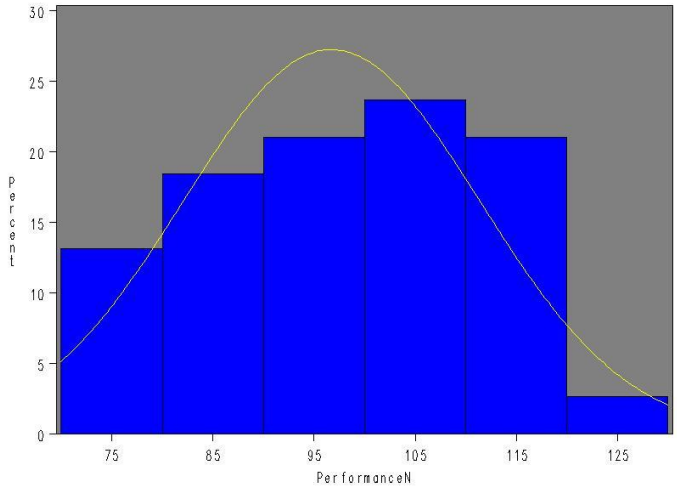



Figure 47 Histogram of Performance scores of the initial dataset for No FASD infants

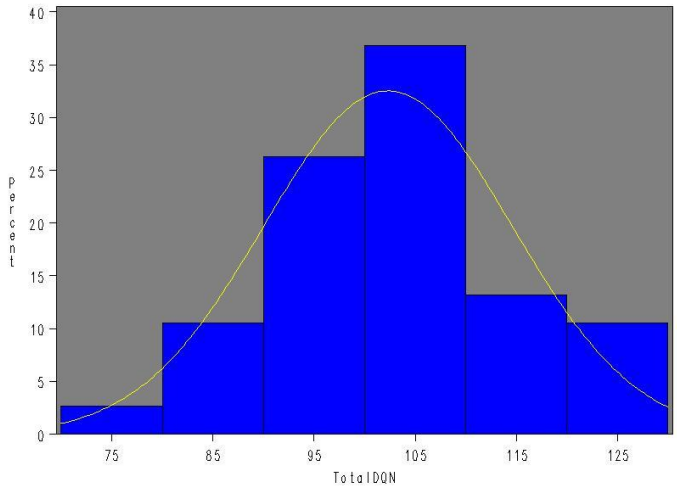



Figure 48 Histogram of Developmental Quotient scores of the initial dataset for No FASD infants

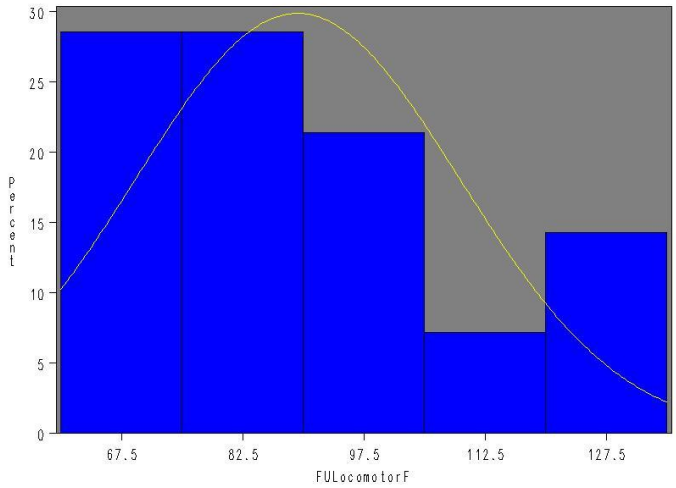



Figure 49 Histogram of Locomotor scores of the follow-up dataset for FASD infants

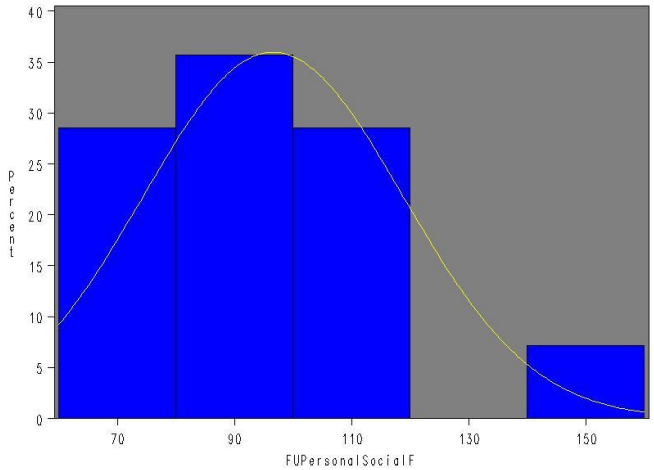



Figure 50 Histogram of Personal Social scores of the follow-up dataset for FASD infants

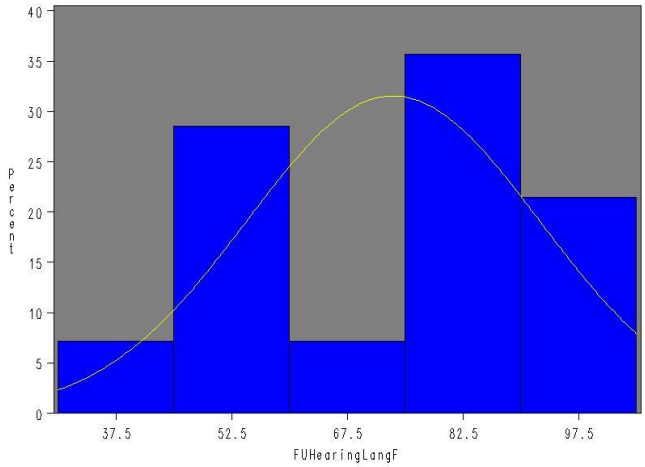



Figure 51 Histogram of Hearing and Language scores of the follow-up dataset for FASD infants

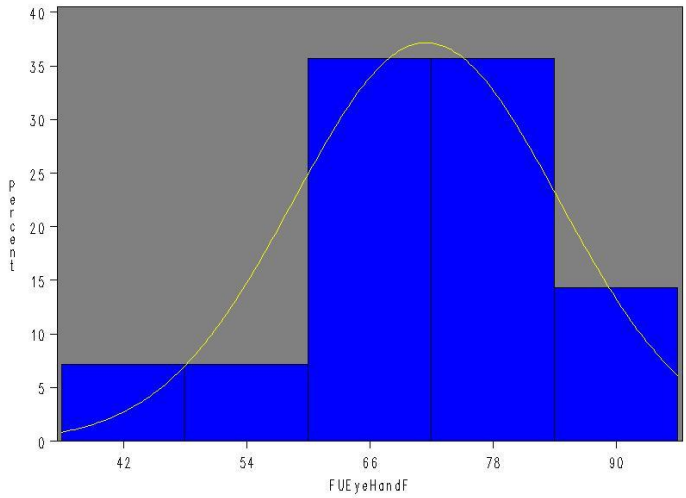



Figure 52 Histogram of Eye Hand Co-ordination scores of the follow-up dataset for FASD infants

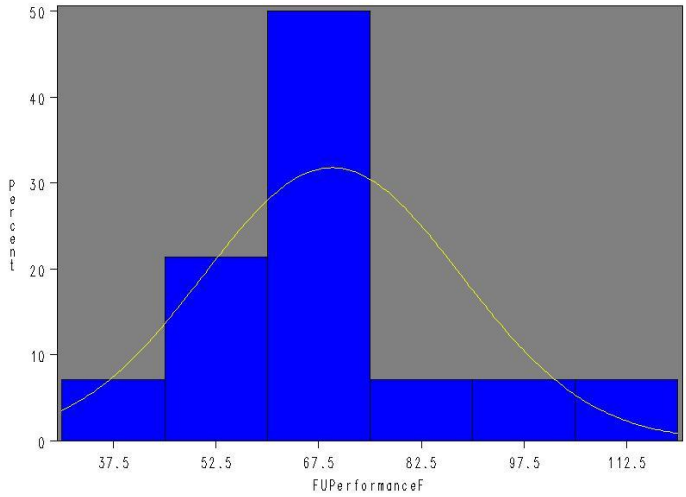



Figure 53 Histogram of Performance scores of the follow-up dataset for FASD infants

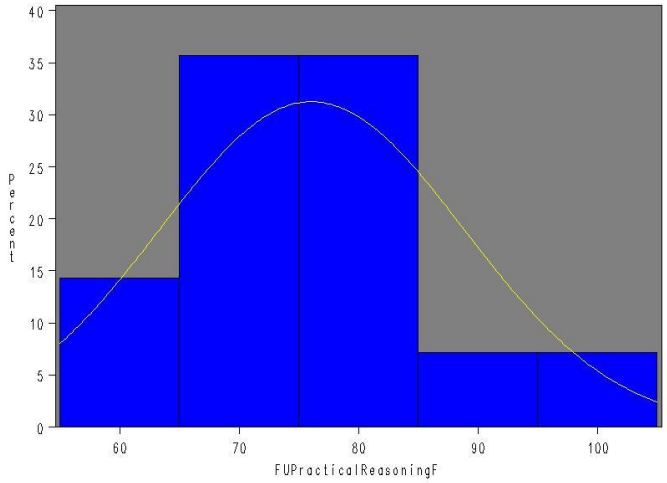



Figure 54 Histogram of Practical Reasoning scores of the follow-up dataset for FASD infants

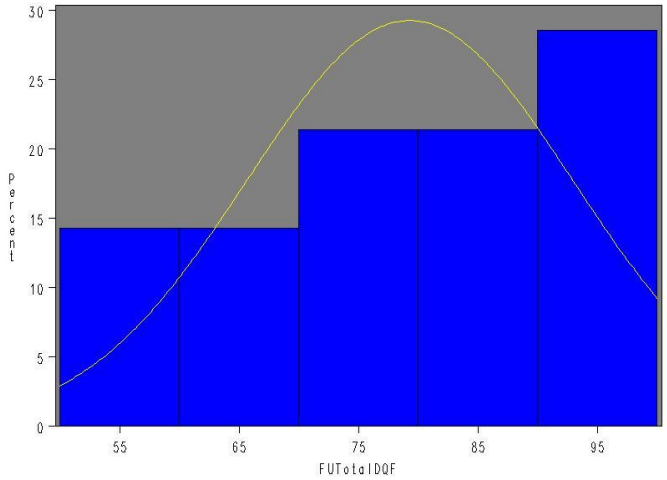


Figure 55 Histogram of Developmental Quotient scores of the follow-up dataset for FASD infants

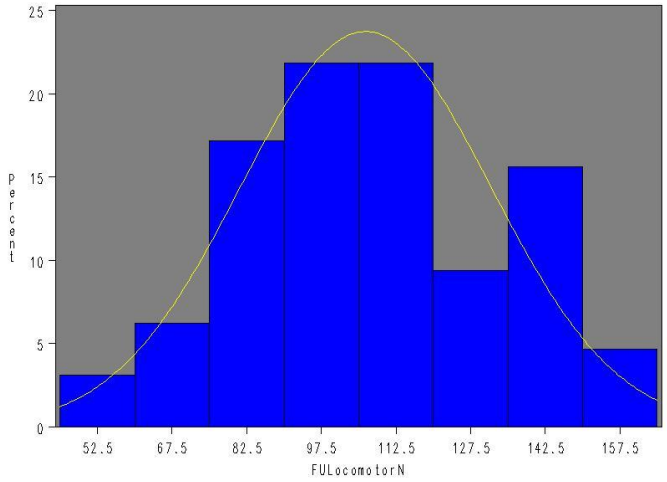



Figure 56 Histogram of Locomotor scores of the follow-up dataset for No FASD infants

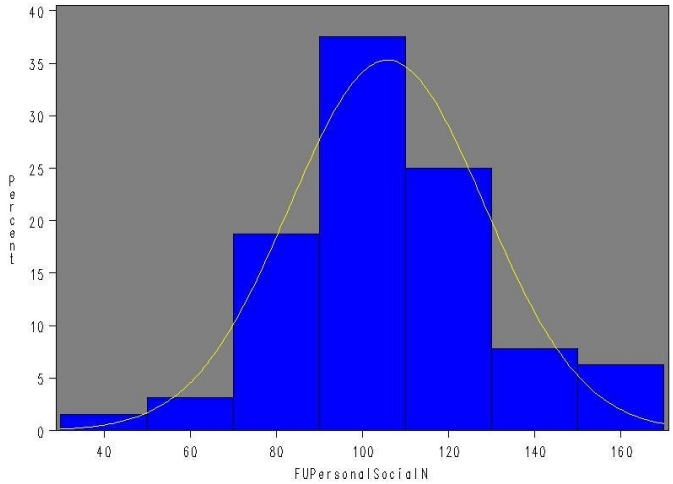



Figure 57 Histogram of Personal Social scores of the follow-up dataset for No FASD infants

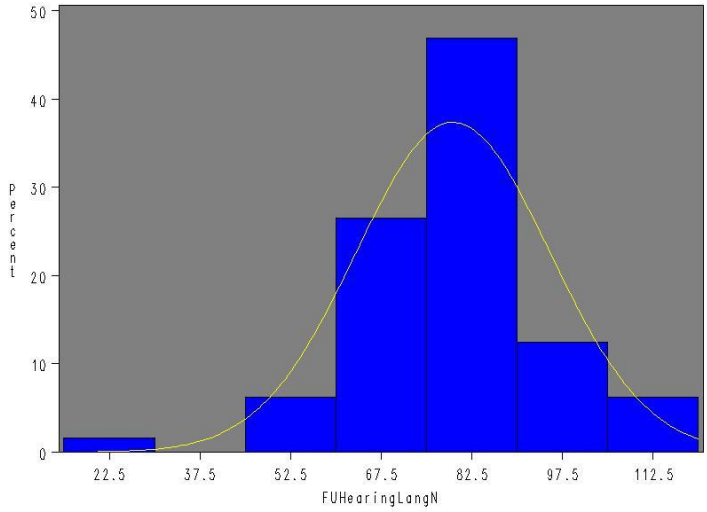



Figure 58 Histogram of Hearing and Language scores of the follow-up dataset for No FASD infants

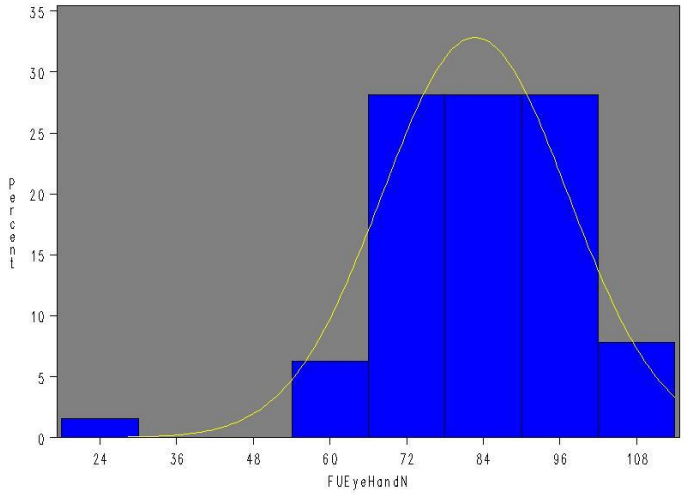



Figure 59 Histogram of Eye Hand Co-ordination scores of the follow-up dataset for No FASD infants

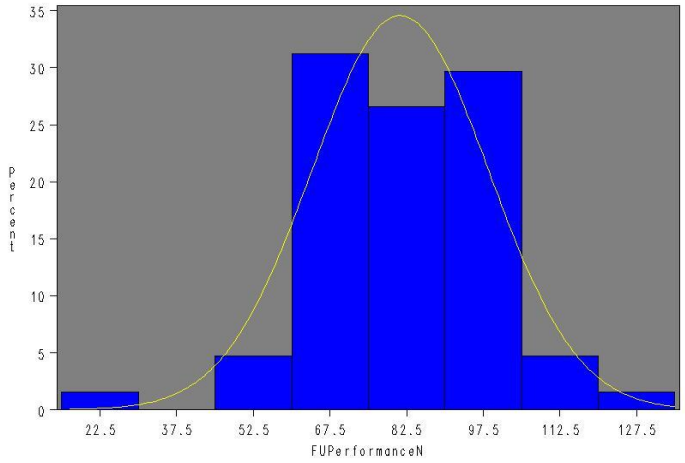



Figure 60 Histogram of Performance scores of the follow-up dataset for No FASD infants

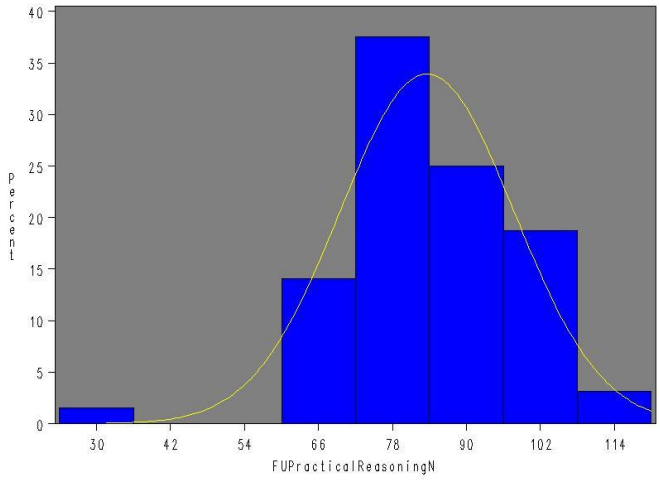



Figure 61 Histogram of Practical Reasoning scores of the follow-up dataset for No FASD infants

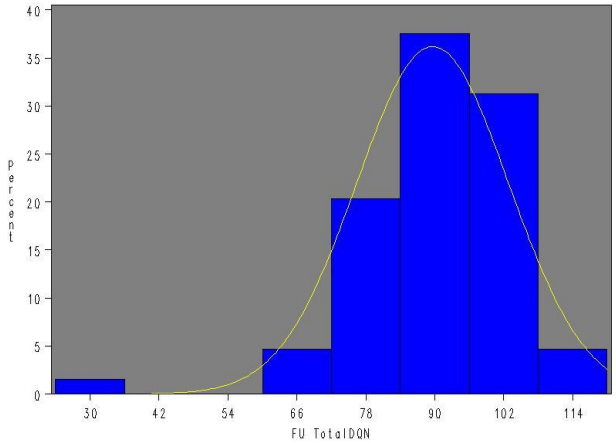



Figure 62 Histogram of Developmental Quotient scores of the follow-up dataset for No FASD infants

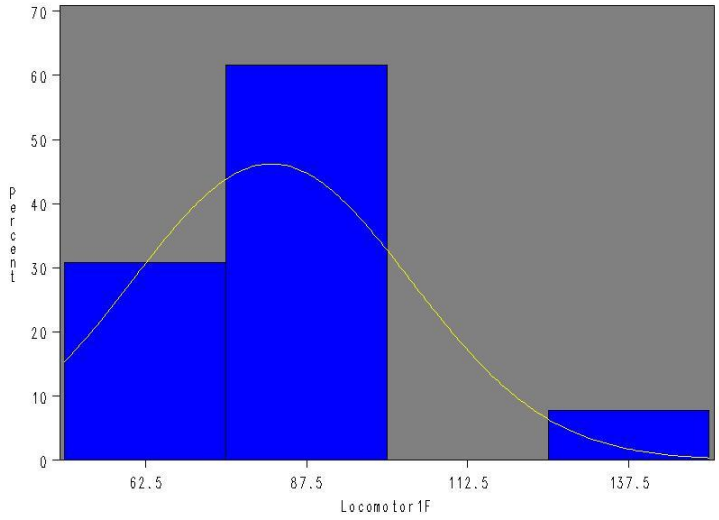



Figure 63 Histogram of Locomotor scores of the initial assessment of the complete dataset for FASD infants

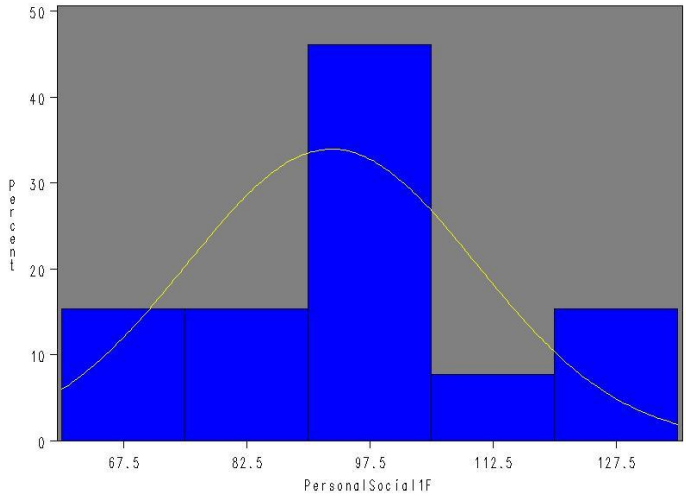



Figure 64 Histogram of Personal Social scores of the initial assessment of the complete dataset for FASD infants

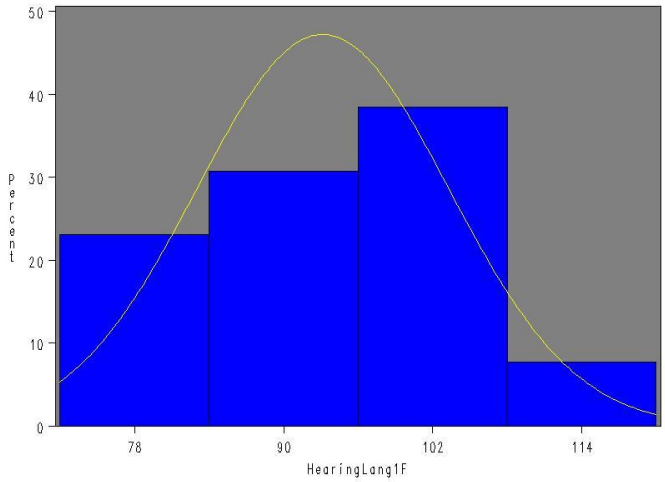



Figure 65 Histogram of Hearing and Language scores of the initial assessment of the complete dataset for FASD infants

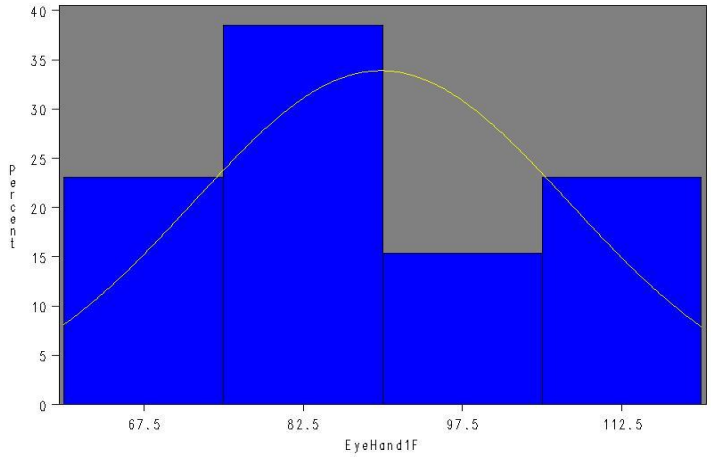



Figure 66 Histogram of Eye Hand Co-ordination scores of the initial assessment of the complete dataset for FASD infants

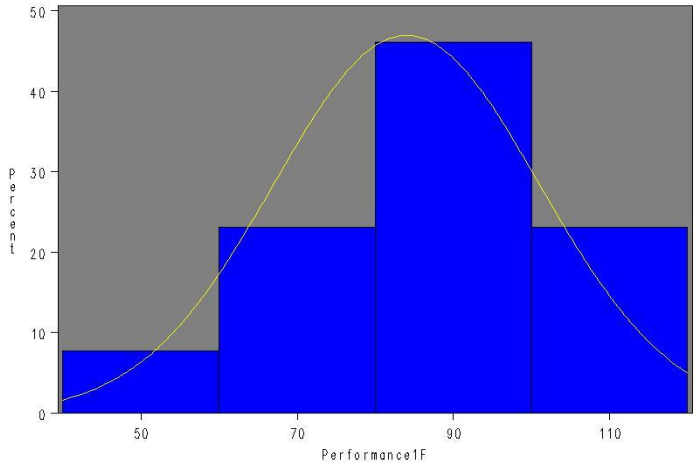



Figure 67 Histogram of Performance scores of the initial assessment of the complete dataset for FASD infants

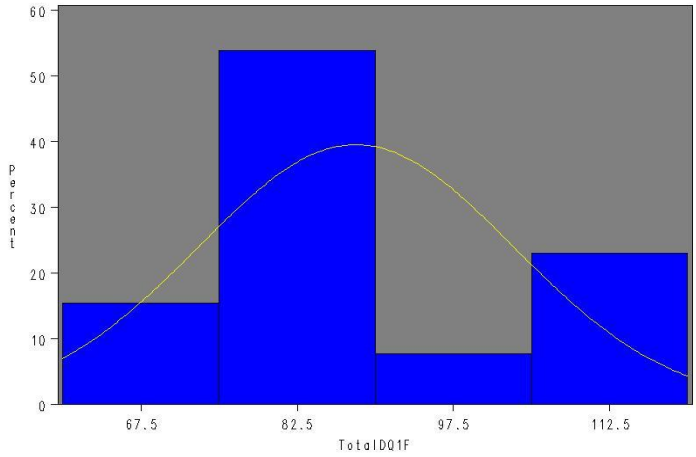



Figure 68 Histogram of Developmental Quotient scores of the initial assessment of the complete dataset for FASD infants

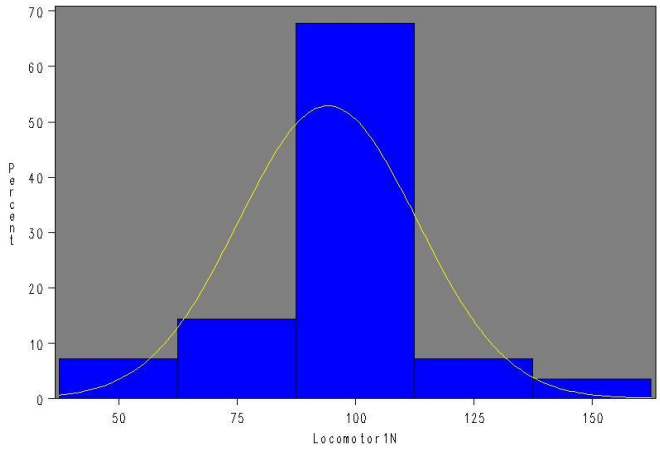



Figure 69 Histogram of Locomotor scores of the initial assessment of the complete dataset for No FASD infants

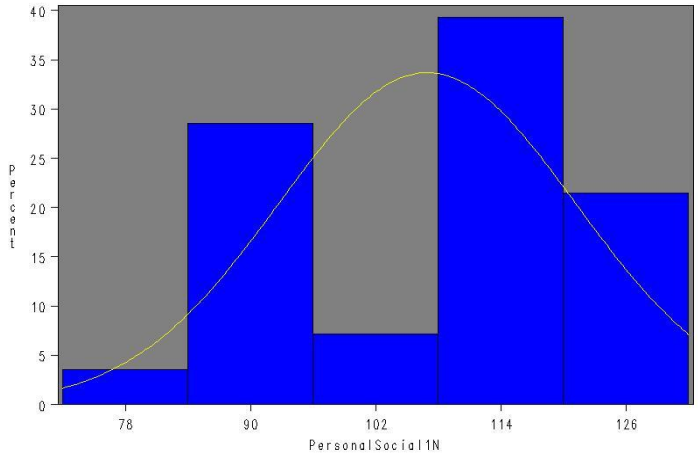



Figure 70 Histogram of Personal Social scores of the initial assessment of the complete dataset for No FASD infants

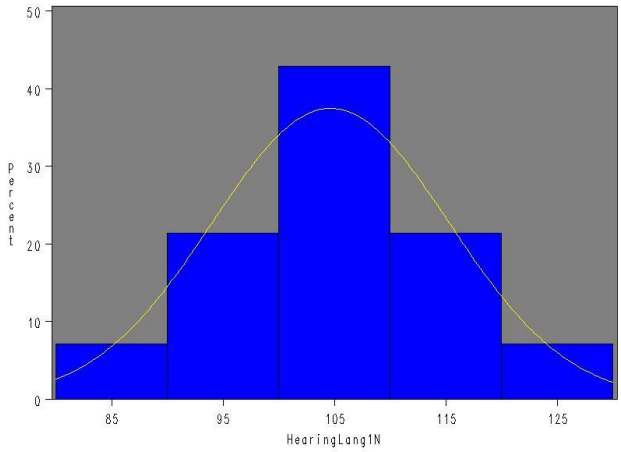



Figure 71 Histogram of Hearing and Language scores of the initial assessment of the complete dataset for No FASD infants

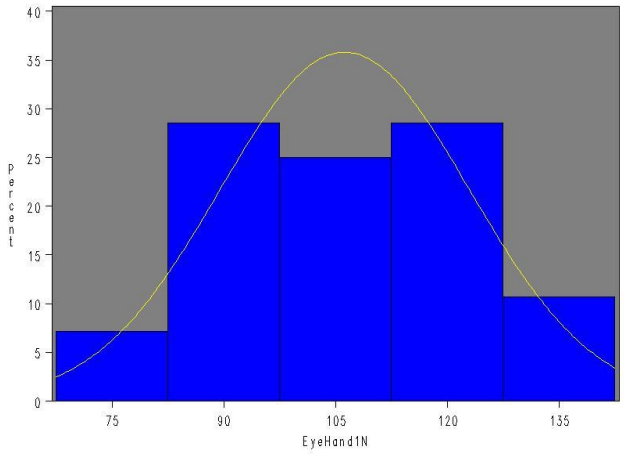



Figure 72 Histogram of Eye Hand Co-ordination scores of the initial assessment of the complete dataset for No FASD infants

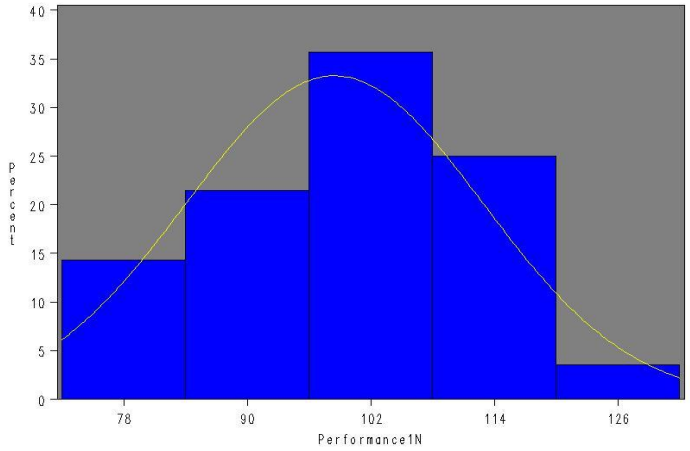



Figure 73 Histogram of Performance scores of the initial assessment of the complete dataset for No FASD infants

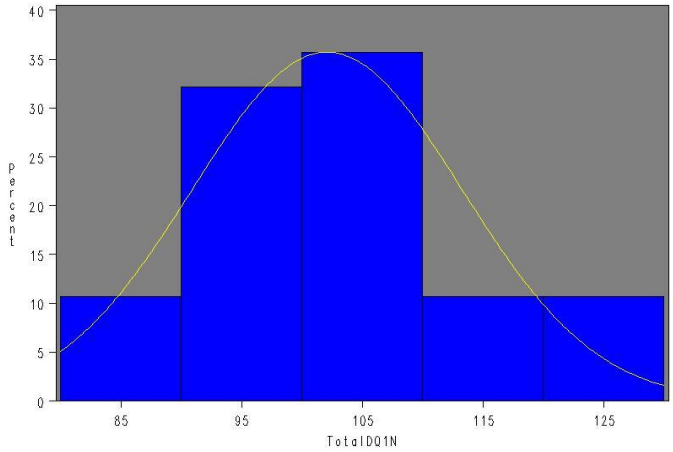



Figure 74 Histogram of Developmental Quotient scores of the initial assessment of the complete dataset for No FASD infants

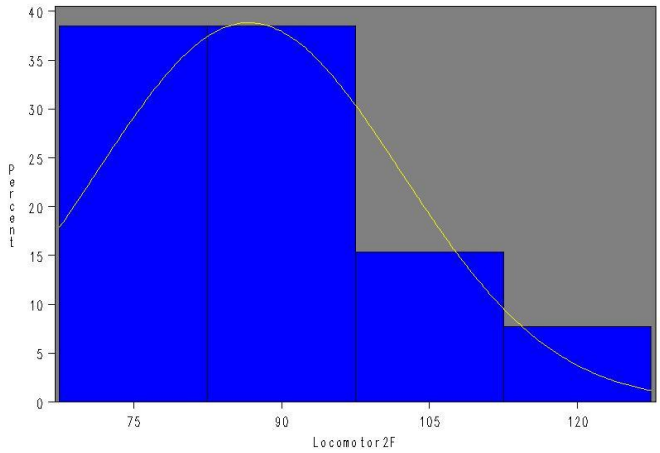



Figure 75 Histogram of Locomotor scores of the follow-up assessment of the complete dataset for FASD infants

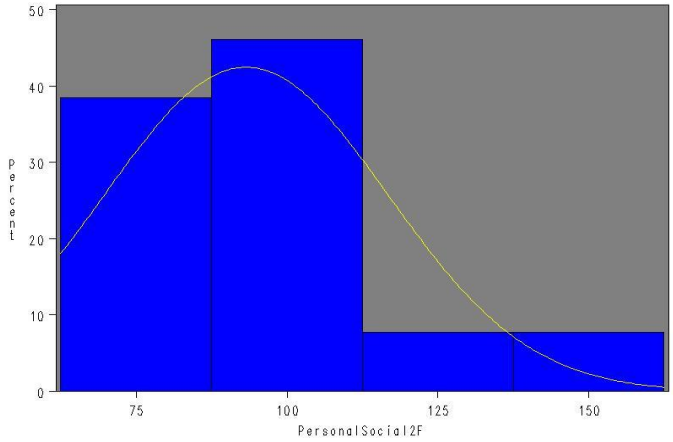



Figure 76 Histogram of Personal Social scores of the follow-up assessment of the complete dataset for FASD infants

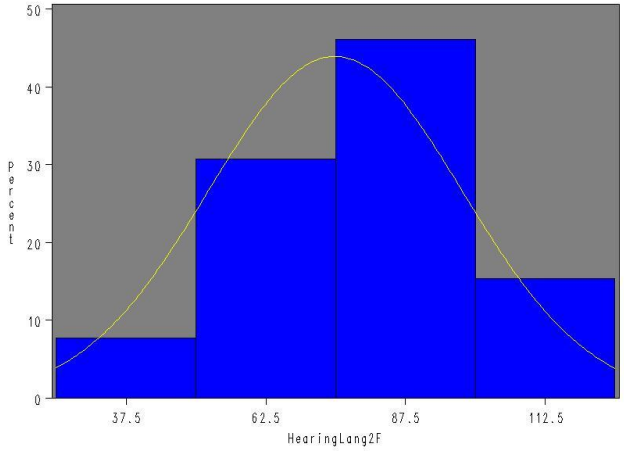



Figure 77 Histogram of Hearing and Language scores of the follow-up assessment of the complete dataset for FASD infants

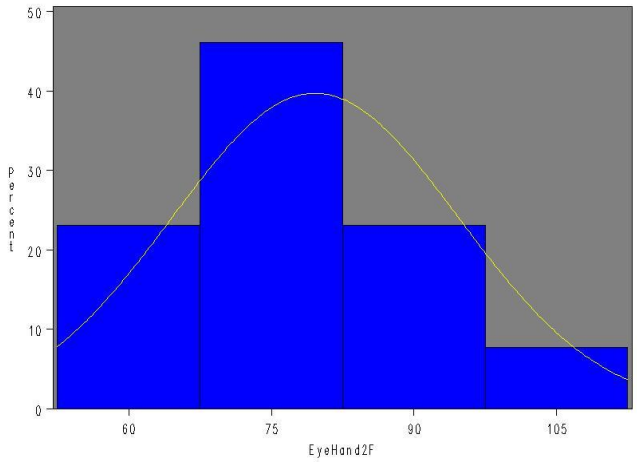



Figure 78 Histogram of Eye Hand Co-ordination scores of the follow-up assessment of the complete dataset for FASD infants

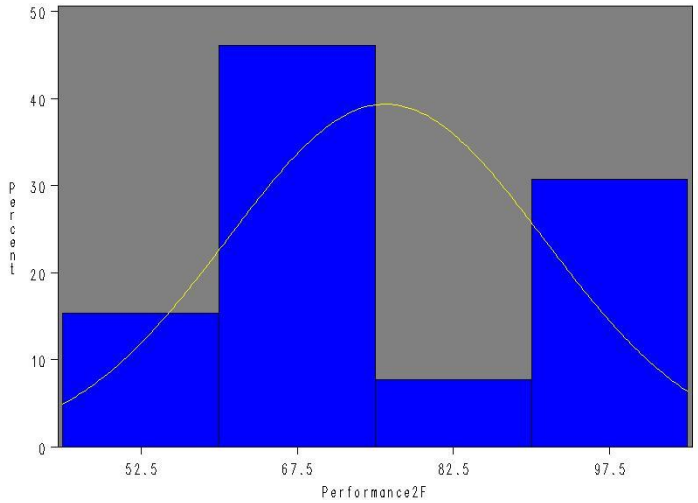



Figure 79 Histogram of Performance scores of the follow-up assessment of the complete dataset for FASD infants

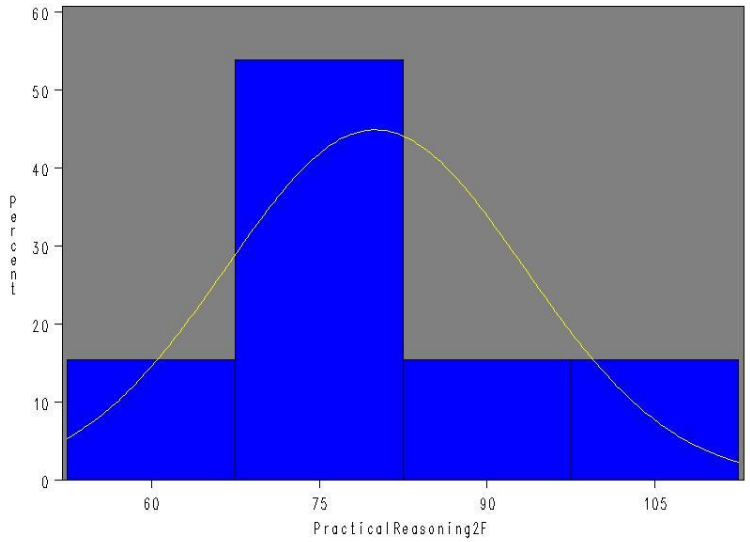



Figure 80 Histogram of Practical Reasoning scores of the follow-up assessment of the complete dataset for FASD infants

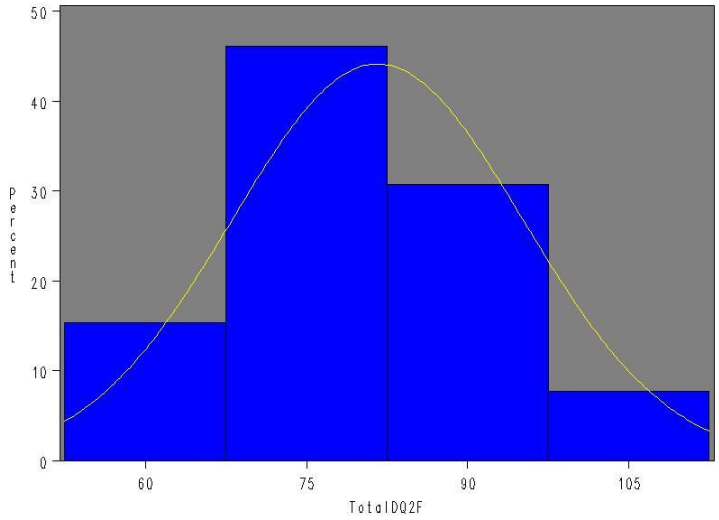



Figure 81 Histogram of Developmental Quotient scores of the follow-up assessment of the complete dataset for FASD infants

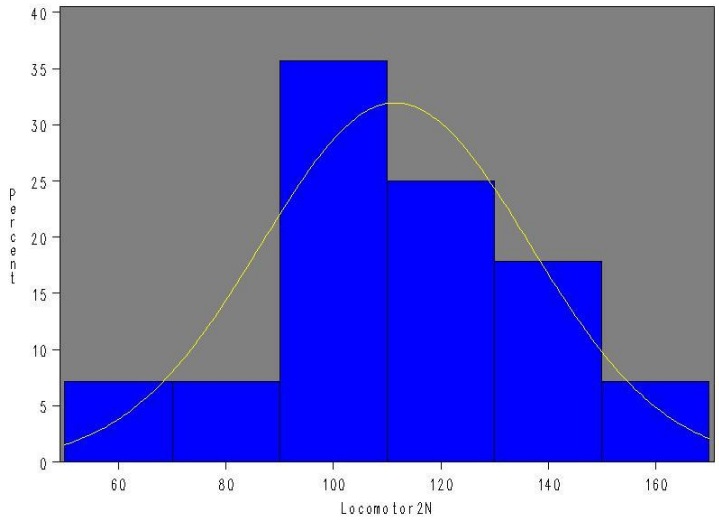



Figure 82 Histogram of Locomotor scores of the follow-up assessment of the complete dataset for No FASD infants

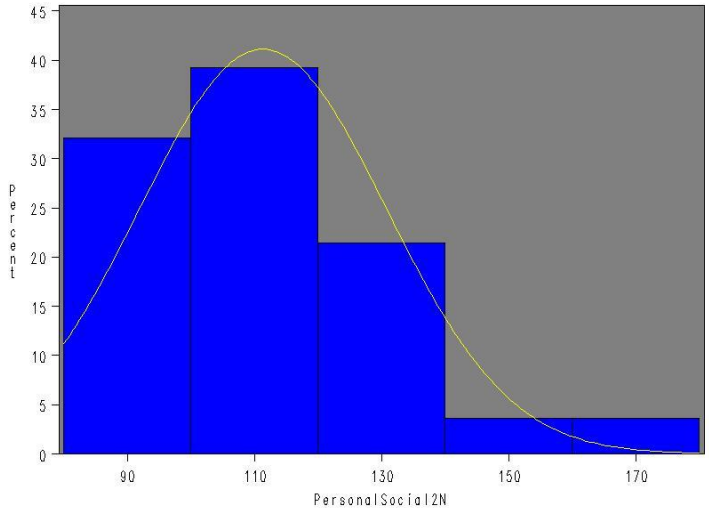



Figure 83 Histogram of Personal Social scores of the follow-up assessment of the complete dataset for No FASD infants

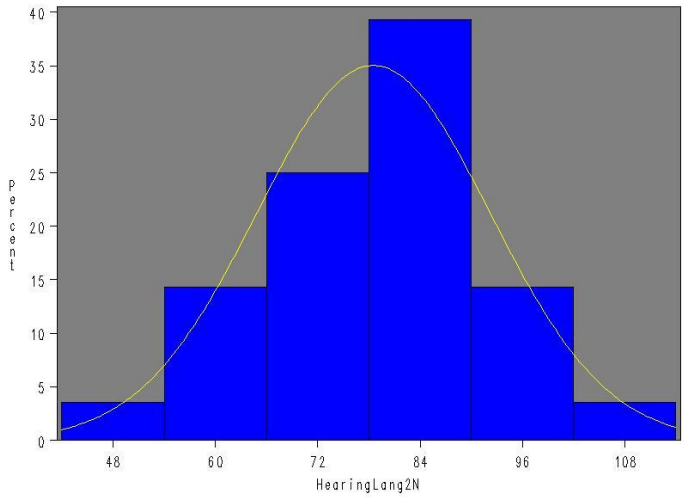



Figure 84 Histogram of Hearing and Language scores of the follow-up assessment of the complete dataset for No FASD infants

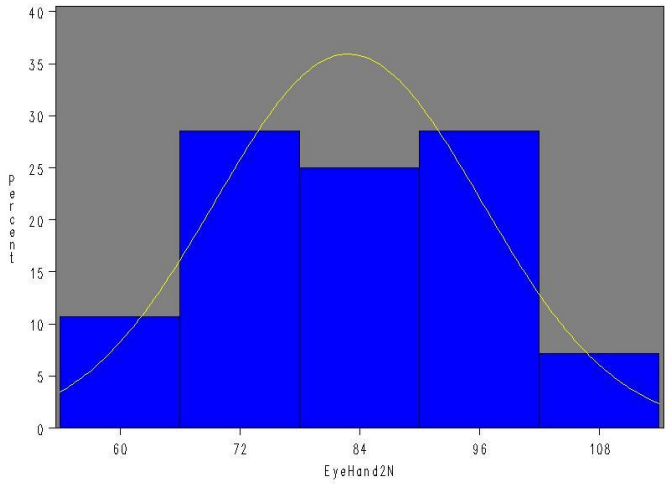



Figure 85 Histogram of Eye Hand Co-ordination scores of the follow-up assessment of the complete dataset for No FASD infants

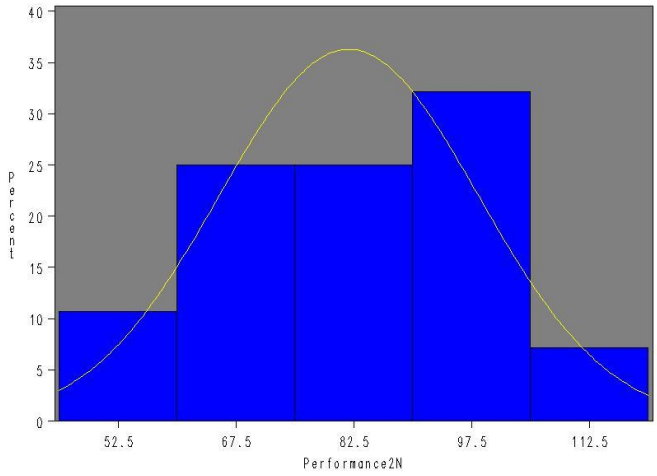



Figure 86 Histogram of Performance scores of the follow-up assessment of the complete dataset for No FASD infants

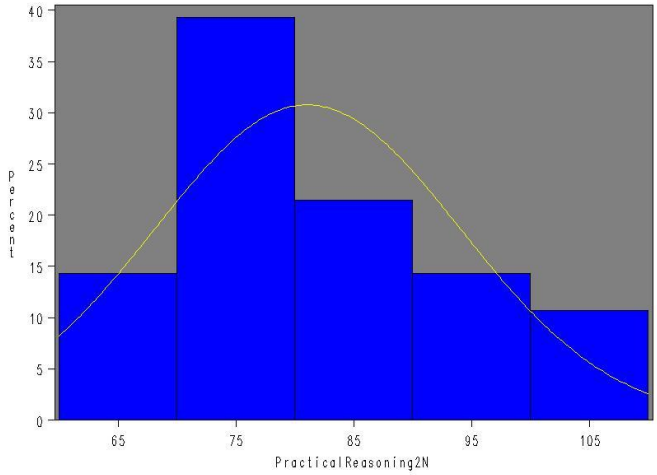



Figure 87 Histogram of Practical Reasoning scores of the follow-up assessment of the complete dataset for No FASD infants

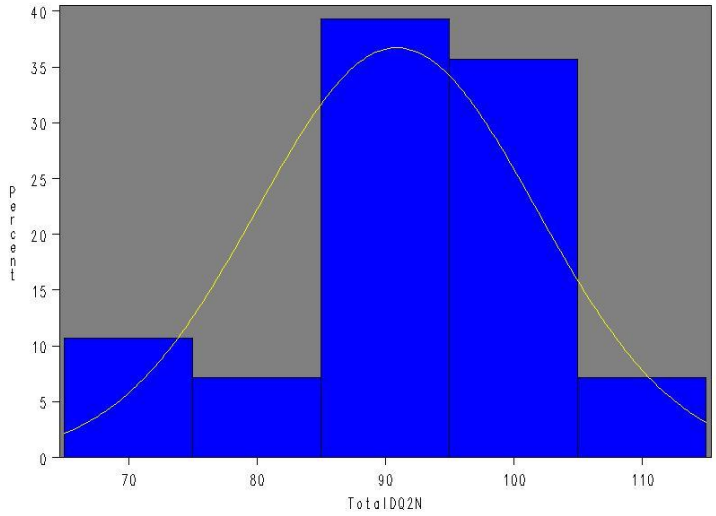



Figure 88 Histogram of Developmental Quotient scores of the follow-up assessment of the complete dataset for No FASD infants