The influence of malnutrition and prenatal maternal substance misuse on externalizing behaviour in children

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ABSTRACT

There is a significant public health burden attributable to aggression and violence in South Africa. Many children in this country are raised in circumstances that have the potential to adversely affect their emotional and physical development, reduce their ability to succeed in school, and also increase the likelihood that they will become aggressive as they grow older. Aggression and violence are acknowledged as being the result of a complex interaction of risk factors beginning at the earliest developmental stages. This study aimed to assess the influence of malnutrition and prenatal maternal substance misuse as specific prenatal development factors that may influence the development and maintenance of externalizing behaviour problems in children. Grade 1 children from an English-medium school situated in an historically Coloured and working class community of greater Cape Town were recruited as the participants for this study. The parents/caregiver of each child participant were also included. 72 child assessments were completed, and 65 interviews were conducted with parents. Measures included the WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), the school-age version of the Child Behaviour Checklist/4-18, and a simplified nutritional survey including a Hunger Scale and anthropometric assessment of child participants. No significant association was found between maternal alcohol consumption during pregnancy, maternal use of "other" drugs while pregnant, and children's aggression. The association between children's current nutritional status and children's aggression was also non-significant. The association between maternal smoking during pregnancy and children's aggression approached significance. The implications of these findings are discussed below.

Keywords: aggression, externalizing behaviour, prenatal, malnutrition, alcohol, maternal smoking, illicit drugs, South Africa, children

Introduction and Literature Review

The level of interpersonal violence (which includes family, community, and youth violence) in South Africa is alarmingly high and has come to be considered not only a social issue, but a public health problem too. South Africa has among the highest burdens of interpersonal violence injury in the world, with rates of homicide seven times higher than the global average (Norman et al., 2010). Of particular concern is the fact that youth violence in South Africa is exceptionally high, at nine times the global rate (Burton, 2007). Such figures make South Africa one of the most violent countries in the world.

There is strong evidence that young people exposed to and involved in violence at a young age are at increased risk of a wide range of psychological and behavioural problems (Ward, Martin, Theron, & Distiller, 2007). These children are also more likely to become aggressive and get caught up in cycles of violence as repeat victims or as perpetrators (Norman et al., 2007). Furthermore, once a characteristic style of aggressive responding develops in a young child, it has been found to persist and continue to characterize their behaviour as they grow into adolescence and adulthood. Childhood aggression displayed in school has been found to predict antisocial aggressiveness in young adults (Huesmann, Eron, Lefkowitz, & Walder, 1984). Levels of violence in a society are modifiable and preventable and given the exceedingly high levels of interpersonal violence in South Africa, risk factors for violence and aggression need to be measured and recognized as a priority for effective interventions (Norman et al., 2010).

Although a variety of studies have documented the effects of multiple risk factors on the development of violence and aggression, few studies have focused attention on prenatal development and its association with aggression. This study aimed to assess prenatal risk factors that predispose children to externalizing behaviour problems (hyperactivity, aggression, and conduct disorder). The effects of pre- and post-natal malnutrition and maternal substance abuse during pregnancy are all considered in terms of their impact on the developing brain and their association with children's externalizing behaviour.

Externalizing Behaviour and Aggression

The terms violence and aggression can be thought of on a continuum in which violence can be seen to stem from and build on aggression. Aggression, a broader set of generally less serious behaviours that can lead to violence (i.e., more extreme and harmful acts of aggression) often manifests itself in childhood as problems of conduct, including

persistent disruptive and antagonistic behaviours (Ramirez, Martin, Rodriguez & Manuel, 2003; Ward, 2007). The high prevalence and severity of the problems arising from these externalizing behaviour problems in young children mean that they constitute a major health challenge to South African society (Hill, 2002).

Seminal studies have found childhood externalizing behaviour problems to be a major predisposing factor to antisocial and violent behaviours in adolescence and adulthood. Moffit (1993) identifies two different types of anti-social behaviour: *adolescent limited antisocial behaviour*, normative and adaptive antisocial behaviour that occurs only during adolescence, and *life course persistent antisocial behaviour,* a more serious pathway of repeated offending that continues throughout life. Persistent antisocial behaviour is found to be the result of children's neuropsychological problems interacting cumulatively with their criminogenic environments throughout their development, culminating in a pathological personality and repeated violent offending (Moffit, 1993; Ward, 2007).

Many South African children are deeply involved in violent contexts from an early age. Neuropsychological impairments that may have resulted from fetal insults during pregnancy, or immediately after birth, may interact with this violent environment, putting South African children at risk of strengthening violent behaviour repertoires rather than learning pro-social alternatives (Ward, 2007).

Research into the stability and persistence of antisocial and aggressive behaviour indicates that aggression and violence are the result of the complex interaction of a number of risk factors beginning in early childhood, and sometimes even before birth (Burton, 2007; Huesmann, Eron, Lefkowitz, & Walder, 1984; Loeber & Hay, 1997). It is the life course persistent theory of antisocial behaviour that serves as the base for this study as it becomes increasingly necessary in South Africa to understand what predisposes children to increased and prolonged aggression, in order to develop interventions to prevent and diminish adult violence.

The Developing Brain and Externalizing Behaviour

Research shows that the brain is the most vulnerable and sensitive to insults when it is growing most rapidly. Intra-uterine growth, as well as the first few years of human life, is particularly important because vital development occurs in all regions. The brain develops rapidly and specific ontogenetic events happen at different times and build on each other, such that small disruptions in these processes can have long-term effects on the brain's structural and functional capacity (Grantham-McGregor et al., 2007; Liu & Raine, 2006).

Disruption in the ontogenesis of the fetal brain has been recognised as a source of neuropsychological variation that is linked to problem behaviour in children. Evidence is strong that these early neuropsychological deficits are linked to the type of antisocial behaviour that begins in childhood and is sustained for lengthy, often life-long, periods. These deficits often produce learning disabilities in children which can manifest itself in symptoms such as inattention and impulsivity. These symptoms may indicate the presence of early antisocial and aggressive behaviour in children (Grantham-McGregor et al., 2007; Liu & Raine, 2006; Moffit, 1993).

Certain factors present before or immediately after birth have been shown to be capable of producing neuropsychological disruptions which may predispose the infant to externalizing behaviour problems. Neural development may be disrupted by maternal substance abuse during pregnancy, and poor pre- and post-natal nutrition.

Prenatal Exposure to Alcohol and Externalizing Behaviour

Fetal Alcohol Syndrome (FAS) is perhaps the most widely recognized consequence of prenatal alcohol exposure. Recent research has suggested however that the effects from prenatal exposure to alcohol lie on a continuum, or present a spectrum of disorders. The term Fetal Alcohol Spectrum Disorders (FASD) has therefore recently been adopted as an umbrella term, rather than a diagnostic term, which describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects can be physical, mental, or behavioural, with possible lifelong implications (Riley & McGee, 2005).

Heavy prenatal alcohol exposure is recognized as a significant causal factor in a range of developmental disorders associated with neuropsychological deficits across several domains. These include intelligence, social and adaptive functioning, language, memory and learning, fine and gross motor skills and attention (Guerri, Bazinet, & Riley, 2009). Previous studies that have involved parent reports have suggested that alcohol-exposed children are at high risk for problem behaviours that can interfere with their participation in home, school, and social environments. These children are more likely than non-exposed exposed children to be rated as hyperactive, disruptive, impulsive or delinquent. Furthermore, based on parent ratings of their child's behaviour, children with histories of prenatal alcohol exposure had particular difficulties in social, attention and aggressive domains (Riley & McGee, 2005; Spadoni, McGee, Fryer, & Riley, 2007).

South Africa has recorded consistently high rates of alcohol abuse and its related problems, including very high levels of FASDs. In communities in the Western Cape, the

prevalence of FAS in particular has been found to be between 65.2 and 74.2 per 1000 1st grade children (Viljoen et al., 2005). Although the rates of FAS are likely to be lower in other areas of the country, the fact that certain segments of the population are engaging in alcohol abuse that is having damaging effects on children indicates that it remains a tremendous burden on the health and welfare sectors of the country (May et al., 2007; Ward, 2007).

Maternal Smoking during Pregnancy and the Developing Fetus

Studies have indicated that fetal exposure to nicotine and carbon monoxide can cause neurological problems and poor development (Ward, 2007; Williams & Ross, 2007). These studies make the link between maternal smoking and increased symptoms of externalizing problems, attention deficits, hyperactivity and aggression among children (Höök, Cederblad, & Berg, 2006).

Animal research on the effects of prenatal (through maternal blood) and postnatal (through breast milk and passive inhalation) exposure to tobacco have further indicated that fetal exposure to nicotine has effects on the uptake of serotonin, the dopaminergic systems and central and peripheral noradrenergic activity (Hill, 2002). Effects on all three of these biological processes have been associated with increased aggression and conduct problems in human children as they battle to regulate their emotions (Gollan, Lee, & Coccaro, 2005; Hill, 2002). Additionally, deregulated serotonergic function has consistently been linked with increased hostility (Bradley & Corwin, 2002).

Although a dose-response relation has been found between maternal smoking and externalizing behaviours, the long-term effects of cigarette smoking on neonatal neurological development are still under researched (Ward, 2007). Tobacco is one of the most widely used substances in South Africa, with studies showing that a third of adults (18 years and older) in South Africa smoke (Sitas, Urban, Bradshaw, Kielkowski, Bah, & Peto, 2004). Smoking is often related to a number of other risky health behaviours (e.g., poor prenatal and postnatal nutrition and excessive alcohol intake during pregnancy) which may interact with smoking to produce the neurological and behavioural deficits that present themselves in aggressive children (Hill, 2002).

Prenatal Exposure to "Other" Drugs and Externalizing Behaviour

Studies have shown that the substances most abused in South Africa are depressants (e.g., alcohol, methaquaqlone, benzodiazepines) followed by hallucinogens (cannabis, amphetamine-type stimulants and ecstasy), and the substantial abuse of over-the-counter and

prescription medicines. Of considerable concern is the increase in abuse of crack cocaine which is one of the few drugs whose link to fetal maldevelopment has been investigated (Van Heerden, Grimsrund, Seedat, Myer, Williams, & Stein, 2009). Despite the abuse of these substances, few clinical studies have been conducted to assess the impact of prenatal exposure to illicit drugs on the developing foetus, therefore making it difficult to draw accurate conclusions regarding long-term impact on fetal development.

Of the studies that have been conducted, the use of cocaine during pregnancy (particularly the second trimester period) has been shown by Thompson and Stanwood (2009) to result in a subtle, though dominant developmental phenotype that resembles ADHD. The use of cocaine during pregnancy can also have long-lasting negative effects on cognitive and attention systems.

Children exposed prenatally to methamphetamine have also been shown to have decreased arousal, increased stress, decreased school achievements, and low birth weight (a high risk factor for special needs programs at school age). Because methamphetamine and amphetamine use during pregnancy has become prolific only recently, there are few studies defining its long-term consequences (Thompson & Stanwood, 2009).

Mothers who abuse inhalants, solvents (household, industrial and different types of glue) in particular, during pregnancy have been found to produce children who have symptoms similar to the fetal alcohol syndromes (Rayburn, 2007). The abuse of such substances can lead to congenital defects as well as developmental and attention delays in children (Brouette & Anton, 2001).

Little information is available about the effect of sedatives abuse (benzodiazepines) during pregnancy on the developing fetus. Current knowledge suggests that possible effects to the fetus include malformation, intrauterine growth retardation, and functional deficits (Iqbal, Sobhan, & Ryals, 2002; McElhatton, 1994). The abuse of both sedatives and inhalants among the South African population has been found to be high enough to warrant concern (Peltzer, Ramalagan, Johnson, Phaswana-Mafuya, 2010).

Due to the prevalence of illicit drug use in South Africa, studies which assess their role in the development of childhood externalizing behaviour problems is necessary in order to develop a holistic understanding as to the factors that produce persistent anti-social and aggressive behaviour in children.

Malnutrition and Prenatal Development

Malnutrition can be divided into three different categories with each one indicating a different degree of inadequate nutrition. "Wasting" indicates acute malnutrition; "underweight" indicates both acute and chronic malnutrition; "stunting" indicates chronic malnutrition (Zere & McIntyre, 2003).

Several longitudinal studies have consistently found malnutrition, in both pre- and post-natal conditions, to be a risk factor for the development of externalizing behaviour problems in children. Research has indicated that early under-nutrition beginning prenatally results in attention failures, apathy, and poor behaviour organization and impulse control. The undernourished child is therefore at risk for developing externalizing behaviour problems such as aggression (Barret, Radke-Yarrow, & Klein, 1982; Liu & Raine, 2006; Neugebauer, Hoek, & Susser, 1999).

There is increasing recognition that malnutrition directly predisposes to externalizing behaviour by impairing brain mechanisms such as those in the prefrontal cortex that are thought to regulate emotion and inhibit impulsive and aggressive behaviour (Liu, Raine, Venables, & Mednick, 2004). Critical periods have been identified during which under-nutrition has the potential to impact on the maturity of the brain. Research has indicated that the central nervous system is developing rapidly not only prenatally and shortly after birth (i.e., during the first year) but also well into childhood. Although prenatal malnutrition is of decisive importance for the developing brain, it has been suggested that there is also a postnatal critical phase (2 through 4 years of age) that is crucial for later behavioural and cognitive development. Stresses on the brain (e.g., under-nutrition) could therefore have an impact on social development if they occurred during these particular years (Barret, Radke-Yarrow, & Klein, 1982).

Results from The South African National Food Consumption Survey of 2005 indicated that, for South African children as a whole, one in two households (52%) experienced hunger and only one in four (25%) households appeared food secure. Stunting was found to affect nearly 1 in 5 children, by far the most common nutritional disorder. Wasting and underweight were found to be less common but still affected 1 in 10 children at the national level (Labadarios et al., 2005).

From these national nutritional statistics it is clear that under-nutrition is occurring in certain segments of the South African population. Combined with the high rates of aggression and violence in children, more research needs to be conducted to assess how this inadequate

nutritional intake is affecting the children of South Africa in terms of their development of aggressive and externalizing behaviours.

Conclusion

There is a significant public health burden attributable to aggression and violence in South Africa. Many children in this country are raised in circumstances that have the potential to adversely affect their emotional and physical development, reduce their ability to succeed in school, and also increase the likelihood that they will become aggressive as they grow older. Aggression and violence are acknowledged as being the result of a complex interaction of risk factors beginning at the earliest developmental stages (Burton, 2007; Ward, 2007), and can therefore be considered dynamic phenomena whose prevalence in South Africa warrants concern.

Although studies have repeatedly demonstrated the link between neuropsychological dysfunctions and the emergence of aggression and externalizing behaviour, the focus in these studies has been on the social and environmental causes. Research into how prenatal risk factors, in terms of nutrition and exposure to toxins' impacts the development of externalizing behaviour in children has been somewhat limited. Studies which investigate the effects of prenatal toxin exposure and inadequate maternal malnutrition are especially significant in South African due to the country's high levels of substance abuse, inadequate nutrition, and high levels of interpersonal violence. As a pilot study, this study aims to provide sufficient information that will help to design a larger, representative study of Cape Town's children and the risk factors that predispose them to aggression.

Methodology

Specific Aims and Hypotheses

The primary objective of this cross-sectional study was to investigate whether prenatal development is a predictor of externalizing behaviour problems in a sample of South African first grade children. The key independent variables that are assessed are maternal smoking during pregnancy, maternal use of "other" drugs during pregnancy, maternal alcohol consumption during pregnancy, maternal nutrition during pregnancy, and current nutritional status of the child. The following hypotheses are tested:

1. Maternal smoking during pregnancy is associated with aggression in children.

2. Maternal alcohol consumption during pregnancy is associated with aggression in children.

3. Maternal use of "other" drugs during pregnancy is associated with aggression in children.

4. Current nutritional status is associated with aggression in children.

Demographic variables

Demographic variables incorporated in the study include gender and socio economic status. Gender will be included as a covariate because there is strong evidence that suggests gender differences in levels of aggression become marked in the early school years. Males have been found to show higher rates of aggression than females (Loeber & Hay, 1997).

The socio economic status (SES) of the family is included as a covariate because low SES has consistently been linked with poor prenatal care, maternal substance abuse, poor maternal nutrition during pregnancy, and stunting. All of these have been associated with the development of behavioural problems (internalizing and externalizing) in young children (Bradley & Corwyn, 2002). SES is also used as a descriptive variable in order to provide information about the sample.

Design and Setting

This study is situated within the context of a larger study which aims to record the prevalence of a number of risk factors (of which pre-natal development is one) among Cape Town children, and to map which of these risk factors are strongly associated with aggression in childhood. A quantitative, cross-sectional research design was used. The details of the protocol of the larger study can be found in Appendix A.

Data was collected from Grade 1 learners at an English-medium school situated in a historically Coloured and working class community of greater Cape Town. The school is in the 4th quintile (the 5th quintile being the highest), according to the Western Cape Education Department from SES perspectives and parents/guardians are expected to pay fees which have been assessed by the Western Cape Education Department at R650 per year. Schools falling into the quintiles below four have no school fees (i.e., are free for parents). Researchers were made aware of the fact that some parents at the school struggle to pay the yearly school fee.

Data collection took place during the period of 4-21 June 2012 as it was identified by the researchers and school educators that minimal disruption of teaching and learning would

occur at this time. The collection of data took place on school premises with home/work visits to interview parents if needed.

Participants

The school that served as the base of our sample was conveniently selected and obtained with the assistance of the local school authorities. The school's Grade 1 class consists of approximately 220 students, of which approximately 115 are English-speaking. Due to the fact that this is a pilot study, for ease of study purposes only English-speaking Grade 1 learners were included in the study. The use and appropriateness of the measurement instruments also needed to be verified in this smaller study before they are translated into other languages for use in the future larger study. No relevant isiXhosa instruments, the other language spoken at the school, had yet been identified when the data collection took place. All English-speaking Grade 1 students attending this school were eligible for selection into the study. Grade 1 has been considered the ideal point at which to conduct an early assessment of children, as there is nearly universal enrolment in school and therefore access to children (both aggressive and non-aggressive) is easier. The parents/caregiver of each selected child were also invited to participate in the study.

A sample size calculation was conducted in order to estimate sufficient sample size needed in order to be able to conduct significant statistical tests. Using the equation for calculating sample size given in Tabachnick & Fidell (1996) the following equations were formulated:

1. $N \geq 50 + 8m$ (where *m* is the number of independent variables) - In order to estimate sufficient sample size required to test a multiple correlation with four independent variables included in the model. This equation estimated 82 as an adequate sample size.

2. $N \geq 104 + m$ – In order to estimate sufficient sample size required to test each individual predictor (IV) against the outcome measure. This equation estimated 108 as adequate sample size.

The larger sample size calculation was used for the purposes of this study and therefore it was aimed that approximately all 115 English-speaking Grade 1 learners be included in the study.

All 115 English-speaking children were invited to participate in the study. Of these, 72 parents gave written consent and their children were assessed. Only 65 parent interviews were conducted due to the fact that at the time of interview 7 parents refused to participate.

Measures

All participants were required to complete the demographic section of the questionnaire, which gathered information regarding gender and age of the child. In addition, the household inventory was used as an index of SES (see Appendix B). Further inventories were used to measure the prenatal risk factors for aggressive behaviour.

Externalizing behaviour problems. The school-age version of the Child Behaviour Checklist/6-18 was used to measure the externalizing behaviour of participants. The complete CBCL/6-18 consists of items describing eight narrow-band syndrome scales which group into two higher order factors – internalizing and externalizing behaviour problems. In this study, only the sub-scales rule-breaking behaviour and aggressive behaviour were used. These two subscales contain 36 items which assess externalizing behaviour problems in children (Höök et al., 2006).

Responses to questions were scored on a three-point Likert-type scale where the parent/teacher indicates for each item whether the item is "not true" (score 0), "somewhat or sometimes true" (score 1) or "very true or often true" (score 2) for the specific child in question. The scores 0-1-2 on the subscale problem items were summed to give a total externalizing behaviour problem score for each participant.

The CBCL/6-18 is one of the most widely used instruments for assessing child and adolescent behavioural problems in a variety of settings (Nøvik, 1999). Evidence of the instrument's stability of psychometric properties and cross-cultural comparisons has indicated that it is a well-standardized parent-report measure of emotional and behavioural problems in children aged 6-18 years. The manuals for the CBCL/6-18 present extensive data on test-retest reliability, internal consistency, inter-rater reliability, stability over periods, as well as conclusive evidence relating to content, construct and criterion-related validity (Achenbach, 1998). The CBCL/6-18 has been used before in South Africa to assess emotional/behavioural problems and competencies of children and adolescents. These studies have indicated the reliability and validity of this measure in the South African setting (Cluver, Gardner, & Operario, 2007).

Substance use. Maternal substance use during pregnancy was measured using the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). The ASSIST (version 3.1) was developed to screen for problem or risky use of tobacco, alcohol, cannabis, cocaine, amphetamine-type stimulants, sedatives, hallucinogens, inhalants, opioids and "other drugs" that do not fall into the previous categories. The ASSIST determines a risk score for

each substance which falls into a "lower/no", "moderate" or "high" risk category for each substance. Scores in the mid range on the ASSIST are likely to indicate hazardous or harmful substance use ('moderate risk') and higher scores are likely to indicate substance dependence ('high risk'). Taken together, the questions provide an indication of the level of risk associated with the subject's current or historical substance use.

The ASSIST is an 8-item scale that has been through three main phases of testing to ensure that it is a reliable and valid instrument able to be adapted and used cross-culturally in international settings. Numerous test-retest reliability studies conducted in nine different countries (including Australia, Brazil, India, Thailand, United Kingdom, United States and Zimbabwe) found that the ASSIST items were reliable (Humeniuk, Henry-Edwards, Ali, Poznyak, & Monteiro, 2010). Test-retest kappa coefficients of agreement were calculated for both question stems and drug category. The size of the overall Kappas (ranging from .58 to .90) suggests that the items were fairly reliable across different sites. The studies further demonstrated that the ASSIST had good concurrent, construct, predictive and discriminant validity, including the development of cut-off scores for 'lower', 'moderate' and 'high' risk (Humeniuk, Henry-Edwards, Ali, Poznyak, & Monteiro, 2010).

The value of the ASSIST lies in the fact that it is the only substance abuse test that assesses all classes of drugs, not just alcohol and tobacco. The test has been previously used in South Africa to detect the prevalence of substance use and misuse in a primary care clinic (Ward, 2007).

The instrument was adapted so as to focus on substances the mother used while pregnant with the child under assessment. The questions were adapted so as to read "While you were pregnant.." as opposed to "In your life...". Local names for drugs were also added for participant clarification purposes (e.g., tik).

Pre-natal and early childhood nutrition. Simultaneous collection of data for each of the sub-sections of the large study meant that a full nutritional assessment of the children and their mothers was not feasible because of burden to the subject. As a result, a simplified nutritional survey containing questions about the mothers' weight before pregnancy and the state of her household food security while pregnant was implemented.

An anthropometric assessment of each child was also done in order to determine the current nutritional status of the child. The anthropometric assessment included: height and weight measurements. Anthropometry was used to determine if the children are stunted or underweight, and is used as the actual indicator of malnutrition.

Data from the children was compared with the WHO reference population in order to determine the current nutritional status of the child. Height-for-age (stunting) and weight-for-age (underweight) are indicated if the child falls below minus two standard deviations (<-2SD) from the WHO reference median (Hendricks, & Bourne, 2010).

The nutritional status of the mother during pregnancy was assessed using a self-report questionnaire (see Appendix C). The mother's self-reported weight before pregnancy provides an indication of the mother's historic nutritional status that, in most likelihood, persisted through pregnancy. The questions pertaining to the state of the mother's food consumption during pregnancy provide an indication as to whether there was a problem with food security in the household while the mother was pregnant. This data is used descriptively, and serves to confirm that the child was malnourished.

Procedure

Permission from the Western Cape Education Department to conduct research within the school environment was obtained. Permission was also obtained from the school at which this study was based. Ethical approval for this study was applied for from the Research Ethics Committee of the University of Cape Town Department of Psychology.

Children and their parent/caregiver were invited to participate in the study via consent letters sent home from school (see Appendix D). Children were only enrolled in the study if their parent or legal guardian gave consent. Parents were given the option to be interviewed on the school premises, at their home or at their workplace.

Child assessment. Each child was required to assent to their participation before their assessment. The researcher read the child an assent script which introduced them to the study and explained to them how the assessment process would work (see Appendix E). The researcher ticked a box to confirm the child's assent before the assessment continued. Each child was assessed for approximately 2 hours (split into two 1-hour sessions) as a number of tests pertaining to each study sub-section needed to be administered.

As part of the larger battery of tests children had their anthropometric measurements taken. The researchers followed a standardised procedure for taking the child's measurements, and were equipped with a portable electronic scale and a stadiometer. The data was recorded on each participant's assessment sheet.

Parent questionnaire. All parent questionnaires included sub-sections from each of the smaller studies that make up the larger pilot study. The "Malnutrition Measure",

"CBCL/6-18", and "Substance Abuse – ASSIST" sub-sections are the ones relevant to this particular study (see Appendix F).

Data collection for each of these sub-projects was collected at the same time in one questionnaire so as to minimise the burden to the subject. Each interview took approximately 1 hour to complete. Prior to the commencement of each parent interview, participants were given clear instructions, and informed that they may ask questions at any point for clarification. They were also informed of their ability to withdraw from the study at any point. The questionnaire was administered by one of the trained fieldworkers to the parent.

Statistical Analysis

IBM SPSS version 20.0 software package was used for data analysis. After questionnaire completion each parent questionnaire was checked and the data was then entered. Each child participant's data was captured on a spreadsheet directly from the assessment sheets by the research team. The entered data was cleaned and checked. Prior to conducting any analyses, all the data was checked for completeness and normality. Detailed descriptive statistics were conducted in order to check the data and to ensure that the sample could be adequately described. Cronbach's alpha was calculated for each of the scales used in order to check their internal reliabilities. The internal consistency coefficient for the ASSIST was .871 and .870 for the externalizing behaviour subscale of the CBCL/6-18. These coefficients indicate that both measures were reliable and therefore adequate for use in this study (Tabachnik & Fidell, 1996). The statistical significance level was set at $\alpha=0.5$ for all tests.

A univariate analysis of each of the variables was conducted in order to describe the sample. Detailed descriptive statistics were calculated for each of the independent variables and covariates in order to describe the demographic and background characteristics of the sample. The household inventory data, an index of SES, as well as the mother's nutritional status during pregnancy were used to further describe the sample.

For the analysis of the data from the shortened nutritional survey, each question had two outcomes, "yes" and "no". For each question, two groups were created: those who said "yes" and those who said "no". This data was used descriptively to assess the state of the mothers' household food security while pregnant.

Each child was assigned a malnutrition score based on their anthropometric measurements. Each child's height and weight was converted into a z-score according to the WHO reference population using WHO AnthroPlus (Blössner, Siyam, Borghi, Onyango, &

de Onis, 2009). Children were classified as stunted (height-for-age) and underweight (weight-for-age) if their scores fell below minus two standard deviations (<-2SD) from the WHO reference median.

Mothers' scores on the ASSIST were categorically coded as "low/no", "moderate" or "high" risk for each substance. This coding allowed for a description of the sample to be given. Scores for each substance were also coded as continuous variables so as to allow for later linear regression to be conducted in order to assess the association between maternal use of each class of drug during pregnancy and children's externalizing behaviour.

Regression analysis was used to determine the effects of prenatal development on child behaviour. Individual linear regression analyses were used to assess the association between each independent variable of the study
(maternal alcohol consumption during pregnancy, maternal tobacco use during pregnancy, maternal use of "other" drugs during pregnancy, current nutritional status of child) and children's continuously-scored externalizing CBCL/6-18 rating. SES and gender were inserted into each of the models as covariates in order to partial their effects out of the analysis. Independent variables that found to have a significant relation to the outcome were identified as possible co-variables for a multi-variate regression model (Cluver, Gardner, & Operario, 2007).

Ethical Considerations

Informed consent was obtained from each participant before he/she was enrolled in the study. All assessment procedures and requirements of the participants were made clear to them. In the case of the child participants who are younger than 18 years of age, informed consent was obtained from each participant's parent/guardian. The parents of the child participants were informed that they, and their child, may withdraw from the study at any time without being penalized. Participants (parents specifically) were also ensured that their responses, and their children's assessment scores, would remain confidential. This information would only be seen by people who need to do so for the purposes of research and the raw data collected from them would not be distributed to 3rd parties without their approval. The children were also required to assent to their involvement in the assessment procedure. They were permitted to take a break if they felt tired or lost concentration and were also provided with refreshments.

Parents were thanked for their participation in the study with a R50 Shoprite voucher. All Grade 1 learners, even those who were not assessed/not eligible for the study, were given a small toy once all data had been collected.

Researchers took care in the design of the study to ensure that the school learning environment was disrupted as minimally as possible. Children participating in the study missed out on two hours of class time but due to the group work nature of the Grade 1 classes, learners were easily assisted to make up what they had missed while participating in the study. The parents of any child identified as having a developmental issue that requires attention were provided with details of appropriate professional interventions.

Results

Descriptive Statistics: Demographics

A final sample size of 72 complete child assessments and 65 complete parent interviews were used in this study. Of the child participants, 41.7% (n=30) were male and 58.3% (n=42) were female. The mean age of participants was 6.15 years old (SD = 0.441). All 72 (100%) child participants were Coloured and English-speaking.

In terms of the parent questionnaires, sixty (83.3%) were completed by the biological parent of the child. Four (5.6%) parent questionnaires were completed by a grandparent and one (1.4%) was completed by a cousin of the biological parent. In most cases when the biological parent did not complete the questionnaire, the grandparent/cousin was the primary caregiver of the child concerned.

To assess socio-economic status, we asked whether participants had certain household amenities in their homes. Table 1 (see overleaf) tabulates the results from the Household Inventory Scale.

Table 1

SES (n=65)

	N	*%*
Running water	65	100
Flushing toilet	64	98.5
Car	46	70.8
Fridge	65	100
Microwave oven	64	98.5
Washing machine	60	92.3
Landline telephone	33	50.8
Cellphone	64	98.5
Electricity	65	100
Radio/hi-fi	48	73.8
Television	65	100
DVD	62	95.4
DSTV/Satellite	30	46.2
Computer	41	63.1
Internet	25	38.5

Descriptive statistics: Prenatal risk factors

Maternal nutrition during pregnancy. Maternal reports using the Hunger Scale questions of the nutritional survey showed the following: 20% (n=13) of the participants said that "while pregnant the household ran out of money to buy food"; 12.3% (n=8) reported having had to "cut the size of meals or skipped meals while pregnant because there was not enough food", and 1.5% (n=1) had "gone to bed hungry while pregnant". Maternal reports about breastfeeding indicated that 21.5% (n=14) of participants breastfed exclusively, 70.8% (n=46) partially breastfed (breastfed and used formula), and 7.7% (n=5) used formula only. In addition to this mothers were asked to report on their weight before pregnancy. Forty (61.5%) participants indicated that they were of "normal" weight before pregnancy, twenty (30.8%) indicated that they were "overweight" before pregnancy, and five (7.7%) indicated that they were "underweight" before pregnancy.

Child's current nutritional status. Anthropometric measurements of participants indicates that 69 (95.8%) of the children were not stunted. 3 (4.2%) of the children in the

sample had a height-for-age less than 2 standard deviations below the WHO reference median, indicating stunting. Additionally, 71 (98.6%) children appear not underweight, while 1 (1.4%) child had a weight-for-height less than two standard deviations below the WHO reference median, indicating underweight. The child that was stunted was also found to be underweight.

      Substance Abuse. Table 2 tabulates the minimum, maximum, mean and standard deviations for each of the substances in the ASSIST questionnaire regarding maternal substance use during pregnancy. Participants with ASSIST risk scores of "three or less" ("10 or less" for alcohol) were at a lower/no risk of health and other problems related to their use of a particular substance while pregnant. Participants scoring "between 4 and 26" ("11 and 26" for alcohol) were at moderate risk of health and other problems related to their patterns of substance use while pregnant. A score of "27 or higher" for any substance suggests that a participant was at high risk of experiencing severe problems (health, financial, legal, relationship, social) as a result of their pattern of substance use while pregnant and the participant was likely to be dependent on the substance (Humeniuk, Henry-Edwards, Ali, Poznyak, & Monteiro, 2010).

Table 2

Substance Abuse

	Min	*Max*	*Mean*	*SD*
Tobacco	0	29	7.06	9.71
Alcohol Beverages	0	12	.34	1.92
Cannabis	0	10	0	0
Cocaine	0	27	1.27	5.76
Amphetamine type stimulants	0	0	0	0
Inhalants	0	9	.27	1.33
Sedatives or sleeping pills	0	27	.52	3.45
Hallucinogens	0	0	0	0
Opioids	0	0	0	0
Methaqualone	0	0	0	0

Results show that, in this sample, tobacco seems to be the most commonly used substance during pregnancy with an average participant score (M = 7.06) that indicates moderate risk. The maximum scores for tobacco, cocaine and sedatives indicate that there are participants in this sample who fell into the high risk category for substance abuse while pregnant.

Table 3 reflects the results from the ASSIST questionnaire indicating the number and percentages of participants who are at low, moderate or high risk in each drug category. Tobacco, cocaine, inhalants, sedatives, and then alcohol seemed to be the substances used while pregnant that warrants the most concern, in order of highest to least abused. Three participants (4.2%) were at high risk for tobacco use while pregnant. One participant (1.4%) was at high risk for use of sedatives while pregnant.

Table 3

Substance Abuse

	Low/No Risk	Moderate Risk	High Risk
Tobacco	40 (54.2%)	22 (30.6%)	3 (4.2%)
Alcohol Beverages	63 (87.5%)	1 (1.4%)	0
Cannabis	64 (88.9%)	0	0
Cocaine	61 (84.7%)	3 (4.2%)	0
Amphetamine type stimulants	64 (88.9%)	0	0
Inhalants	62 (86.1%)	2 (2.8%)	0
Sedatives or sleeping pills	64 (88.9%)	1 (1.4%)	1 (1.4%)
Hallucinogens	64 (88.9%)	0	0
Opioids	62 (86.1%)	0	0
Methaqualone	64 (88.9%)	0	0

Descriptive Statistics: The Dependent Variable

The Child Behaviour Checklist. The table below tabulates the child externalizing behaviour raw scores as well as the T-scores. Scores for the CBCL/6-18 externalizing

behaviour subscales were normally distributed. The rule breaking and aggressive subscales are summed to give a total externalizing behaviour problem score. The problem score helps to determine whether children have significant problems with their externalizing behaviour. High scores on the externalizing behaviour scale indicate potentially significant conduct disordered behaviour in children. Cut-off points have been suggested by to evaluate potentially significant problems. T-scores up to 59 are classified as "normal", scores between 60 and 63 are classified as "borderline", and scores that fall above 63 are classified as "clinical".

Table 4

Child Externalizing Behaviour Scores

	Raw Scores		T Scores	
	M	*SD*	*M*	*SD*
Externalizing problem score	12.8	7.85	75.57	24.84

The parent ratings on the CBCL/4-18 indicate that 30 (46.2%) of the children fall within the normal range, 13 (20%) fall within the borderline range, and 22 (33.8%) of the children fall within the clinical range on externalizing behaviour problems.

Bivariate relations among study variables. Pearson's correlations were conducted to investigate the relationship between the CBCL/6-18 externalizing behaviour score and the predictor variables. Inspection of the correlation matrix shows that a significant positive correlation exists between the CBCL/6-18 externalizing behaviour score and tobacco use while pregnant ($r = 0.249$, $p = .047$). No other significant correlations between the CBCL/6-18 externalizing behaviour score and the other variables were noted.

A significant positive correlation was also found between the current weight and height of child ($r = 0.777$, $p = .000$).

Hypotheses Results

In order to assess whether each independent variable predicts externalizing behaviour problems, simple regressions were run on each of the variables and externalizing behaviour.

In order to control for the effects of gender and SES they were entered into each of the
regressions as covariates. All variables were checked to make sure that the assumptions for
regression were met.

- **H1:** Maternal alcohol consumption during pregnancy is associated with aggression in
  children.

The results showed that, contrary to the established literature, the influence of maternal
alcohol consumption during pregnancy in this sample was not significant in predicting child
externalizing behaviour problems in this sample.

- **H2:** Maternal smoking during pregnancy is associated with aggression in children.

To test H2 we included the tobacco risk variable along with the gender and SES covariates
into a simple regression model. The overall regression analysis is non-significant (R^2= .081,
F [3, 60] = 1.763, p = .164). Upon inspection of the beta values however it appears that the
influence of maternal smoking during pregnancy on child externalizing behaviour problems
is nearing significance. See results table 5 below:

Table 5
Regression analysis for H2

	B	$SE \beta$	t	p	95% Confidence Interval	
Constant		8.232	2.114	0.39	.938	33.87
Tobacco	0.244	0.101	1.97	.053	-0.003	0.401
Gender	0.029	2.028	0.224	.823	-3.603	4.512
SES	-0.128	0.545	-0.998	.322	-1.635	0.543

- **H3:** Maternal use of "other" drugs while pregnant is associated with aggression in
  children.

To test H3, we included the "other" drugs variable into a simple regression model. This variable included all drugs other than alcohol and tobacco and included: cannabis, amphetamine type stimulants, inhalants, sedatives, cocaine, hallucinogens, opioids and methaqualone. The overall regression analysis is not significant. The influence of maternal use of "other" drugs in the context of child externalizing behaviour problems in this sample is not significant.

- **H4:** Current nutritional status is associated with aggression in children.

To test H4 we included the child height and child weight variables, along with gender and SES. The influence of children's current weight and height is not significant in predicting externalizing behaviour problems in this sample.

Discussion

This study aimed to examine risk factors for the development of externalizing behaviour problems in children, focusing on the influence of prenatal development. Maternal consumption of alcohol during pregnancy, maternal smoking during pregnancy, maternal use of "other" drugs during pregnancy, and current nutritional status of children were all examined in terms of their influence on aggression in first graders. In this sample, consumption of alcohol and use of "other" drugs while pregnant, as well as current nutritional status if child, were not found to be significantly associated with children's aggression. However, one variable approached significance, namely maternal tobacco use during pregnancy. The results from these prenatal risk factors are discussed below.

Child externalizing behaviour

The results from the Child Behaviour Checklist/6-18 show that over half the children in the sample scored very highly on the externalizing behaviour subscales. Twenty-two (33.8%) children were classified as clinical, while thirteen (20%) children were approaching the clinical range. These high scores indicate that fifty-four percent of parent participants found their child's externalizing behaviour to be problematic.

The substantial number of children falling into the borderline and clinical classifications suggests that over half of the children in this sample are behaving inappropriately. Their high scores on the externalizing subscales further suggest that their

behaviour may put them at risk for the development of later conduct disorder, aggression and crime. The theory of *life course persistent antisocial behaviour* argues that childhood externalizing behaviour problems are a predisposing factor to persistent antisocial and violent behaviours in adolescence and adulthood (Moffitt, 1993). This theory reinforces the need for a preventative strategy starting at the earliest developmental stages and continuing throughout childhood and adolescence. The ability to screen and assess children at risk of future aggression at an early developmental stage has crucial implications for both prevention and intervention. By addresses and intervening on early developmental risk factors predisposing children to aggressive behaviour (e.g., pre/perinatal) later adolescent aggression and adult antisocial behaviour may be reduced.

Maternal tobacco abuse. Findings from maternal substance abuse showed that a third of all participants were at moderate risk for tobacco related problems such as health and financial problems (having money for cigarettes) and four percent of participants were at high risk for tobacco abuse. Tobacco was reported to be the most widely used substance in this sample. This may be that tobacco is readily accessible and is cheaper than other substances. Research conducted by Peltzer and Ramlagan (2007) confirms that tobacco use is the most prevalent in the Western Cape, compared to other South African provinces. Research conducted by Walbeek (2002), and by Groenewald and colleagues (2007), further indicates that Coloured people have the highest smoking prevalence (at about 49%) in comparison to other ethnic groups in South Africa.

Bivariate correlational analyses conducted showed a significant positive relationship between maternal use of tobacco while pregnant and externalizing behaviour problems. The independent effects of maternal smoking during pregnancy did not, however, show significant results for child externalizing behaviour problems when assessed in a regression model with gender and SES entered as covariates. This may have been due to the relatively small sample size. The sample included 65 complete parent reports as opposed to the 108 that was calculated as the lowest number of participants required to detect an effect when testing individual variables against the outcome. The association did however approach significance.

This significance corresponds with the findings of earlier investigations that examined the link between maternal smoking during pregnancy and externalizing behaviour problems in childhood. Williams and Ross (2007) and Brook, Brook and Whiteman (2000) found that children whose mothers smoked during pregnancy have increased symptoms of externalizing behaviour problems (oppositional, aggressive, overactive). This externalizing behaviour has been found to be stable during the early childhood period of development and is associated

with later childhood aggression and problem behaviour such as conduct disorder and drug use.

In order to detect more of a significant effect, future studies should explore the association between maternal smoking during pregnancy and child externalizing behaviour problems with a larger sample. The lack of a more significant association may also have been influenced by the bias inherent in self-report measures. A study conducted by Steyn, de Wet, Saloojee, Nel and Yach (2006) found that women consciously misreported their use of tobacco while pregnant due to their desire to appear socially responsible based on their stated awareness that cigarette smoking is detrimental to the health of their unborn child.

Future studies should go beyond self-report and make use of methods such as urine testing of mother and infant, testing of infant hair and meconium (first stool of the new born). Studies have indicated that the primary metabolite of nicotine, cotinine, can be reliably measured in urine (maternal and infant), meconium, and infant hair. Hair analysis and meconium have the added advantage of being able to reflect more than just "recent" use of tobacco suggesting that a more detailed analysis of maternal tobacco use during pregnancy could be obtained (Lester, Andreozzi, & Appiah, 2004).

Maternal alcohol abuse. In terms of alcohol abuse, previous findings have indicated that the Western Cape has among the highest levels of hazardous or harmful drinking (13.8%) compared with other provinces (May et al., 2008; Peltzer & Ramlagan, 2007). In addition to this, research has indicated that hazardous or harmful drinking in pregnant women is higher in urban areas. Among pregnant women the highest level of hazardous or harmful drinking was found among Coloured women (Peltzer & Ramlagan, 2009). It was therefore expected that an association between maternal alcohol consumption during pregnancy and externalizing behaviour would be likely in this sample.

Findings from maternal substance abuse showed however that only one participant was at moderate risk for alcohol related problems. No participants were at high risk for alcohol abuse. This finding may reflect the fact that the particular school which served as our sample drew largely from a Muslim community in which drinking alcohol goes against their religious beliefs. Factors identified as protective from alcohol abuse include strong normative/cultural support for abstinence or light drinking, and religiosity (May et al, 2008). In addition, May and colleagues (2008) also report that collecting information on prenatal drinking is a highly sensitive issue which affects accuracy in a population, especially those that have higher levels of general health knowledge and some specific information on the

dangers of prenatal drinking. Stigma about reporting maternal drinking may have influenced the willingness of participants to accurately report alcohol consumption during pregnancy.

Furthermore, the use of a self-report measure in this study suggests that a social desirability bias may have influenced maternal disclosure of alcohol use during pregnancy. Previous research has found that women may underreport their alcohol use during pregnancy and that retrospective reports of maternal drinking are significantly lower than that reported during the prenatal period (May et al., 2007). Coupled with this, data for this study was collected 6-8 years retrospectively meaning that, for the mothers interviewed, accuracy of recall may have been a problem.

Future studies could perhaps consider utilizing drinking questions in a locally adapted Timeline Followback methodology, designed to elicit more accurate retrospective self-report estimates of daily drinking. Some studies have indicated that questions on current drinking could be used as benchmarks and for refreshing recall before timeline follow-back questions relating to drinking during pregnancy are asked. This framework may provide more accurate retrospective reporting and assessment of prenatal alcohol consumption (May et al., 2008; Sobell et al., 2001). Perhaps a longitudinal study starting at birth or earlier would also be more conducive to accurate maternal self-reports.

Maternal use of "other" drugs. Consideration of the prevalence of drugs other than alcohol and tobacco in this sample indicates the following: four percent of participants were at moderate risk for cocaine use, and two participants were at moderate risk for inhalants use. Sedatives and sleeping pills seemed to be a problem for only one participant, who was at moderate risk, and one participant (1.4%) who was at high risk for sedatives and sleeping pills abuse. Contrary to the high methamphetamine (tik) abuse statistics in the Western Cape (Plüddemann, Myers, & Parry, 2008), maternal reports did not indicate a problem with tik usage.

Results from this sample indicating moderate risk for cocaine, inhalants and sedatives abuse among a small number of participants is supported by previous research based on three national surveys conducted in South Africa (Peltzer, Ramalagan, Johnson, Phaswana-Mafuya, 2010). These surveys indicated that prevalence of illicit drug use in South Africa was among the highest for inhalants (between 0.2 to 11.1%), cocaine (0.1 to 6.4%) and sedatives (0.1 to 6.4%). Despite the fact that previous research has indicated that the level of drug use, as well as the range of drugs used, is higher in the Western Cape compared with other provinces, relatively few participants from this sample however were engaged in problematic drug use (Parry, 2001; Peltzer et al., 2011).

Results indicate that maternal use of "other" drugs while pregnant was not significantly associated with child externalizing behaviour problems. It may be that the rates of substance abuse in this study were not high enough to capture the relationship between the use of "other" drugs while pregnant and child externalizing behaviour problems. The number of children exposed to prenatal drug abuse in this study may have been too small to detect significant effects. The reliance on self-report for categorization levels of prenatal exposure to "other" drugs may therefore represent an underestimation of drug exposure effects.

The prevalence of prenatal exposure to illicit drugs is very difficult to estimate because of flaws in the methods of identification. Future studies should perhaps make use of both drug toxicology and maternal self-report in order to identify mothers who deny use but did use as evidence by positive toxicology confirmation. As mentioned for tobacco, urine, meconium and hair analysis are all reliable methods of illicit drug detection. A reliance on meconium only however should be guarded against as this test can only detect the presence of drugs in the second half of pregnancy (Lester, Andreozzi, & Appiah, 2004).

Current nutritional status of child. Findings from the anthropometric assessment of child participants indicate that current nutritional status of child is not significantly associated with externalizing behaviour problems.

In terms of the current nutritional status of children in this sample, three participants (4.2%) were found to be stunted and only one participant was found to be underweight. Stunting, an indicator of long-term under-nutrition, reflects the health and nutritional status of children over a long period, and of the mother during pregnancy. Underweight, in comparison, is an indicator of acute malnutrition (Hendricks & Bourne, 2006).

The historical nutritional status of the mother during pregnancy can provide useful information regarding intra-uterine growth of the fetus, which may influence the current nutritional status of the child. Results gathered through the food security questions suggests that very few participants in this sample came from households that were food insecure. With only twenty percent of the sample reporting that their household ran out of money to buy food while pregnant, and twelve percent reporting that they cut the size of their meals while pregnant because of a shortage of food, malnutrition does not seem to be a problem in this sample. Similarly, only five participants (7.7%) reported being underweight before pregnancy.

The low rate of stunting found in this sample corresponds with previous research which has found that, in comparison to other provinces, the Western Cape has among the

lowest rates of stunting (Rose & Charlton, 2001). Further research indicates that children least affected by stunting were those living in urban areas (Labadarios et al., 2005).

Risk factors for underweight and stunting in children ages 1 to 9 years have been examined in a study by Steyn and colleagues (2005). The most influential determinants were economically related indicators such as having an informal housing structure and few rooms in the house, poor or inadequate water and sanitation, and no stove or fridge in the dwelling. As has been indicated by the analysis of SES in this sample, participants had a generally high level of SES when taking into account those aspects which are directly linked to stunting and underweight. One hundred percent of participants had access to running water and a fridge, and ninety-eight percent of participants had access to a flushing toilet and a microwave in their home. As a result, perhaps the lack of a significant association between current nutritional status and externalizing behaviour problems in this sample can be accounted for by the fact that poverty and lack of resources, basic factors that contribute to malnutrition (Hendricks & Bourne, 2006), do not seem to be prevalent in this middle class sample.

Stunting was not identified as associated with aggression in this sample; this may be because malnutrition was not severe enough in this group of children. This is made evident by the fact that only one mother reported going to be hungry while pregnant. Since malnutrition's association with aggression is a robust finding in the literature (Liu, Raine, Venables, & Mednick, 2004; Liu & Raine, 2006; Neugebauer, Hoek, & Susser, 1999) it is entirely possible that this sample was too small to detect an effect, and/or that there was insufficient malnutrition in this middle class sample. Future studies should include larger samples and a broader spread of social class to see if this relationship does hold in South Africa.

General limitations and proposed solutions

This research was based on a cross-sectional design therefore variables were assessed at only one point in time. Although this type of study makes it possible to gather preliminary data to support future research, future studies could benefit from using a longitudinal design beginning before or shortly after birth. This could perhaps enhance the accuracy of maternal recall relating to substance use and nutritional status during pregnancy.

Participants included children and mothers/caregivers from only one school and area of the larger Cape Town region. As a result, it is unlikely that the results are representative of South Africa as a whole, limiting their generalizability. However, it is hoped that the results and discussions in this study will be useful in designing a larger and more representative

study that may be able to detect an effect between these prenatal factors and externalizing behaviour problems in children.

Another limitation was that the study only used maternal reports of child behaviour. Children's behaviour varies between contexts (i.e., home and school) and between different interaction patterns (i.e., mother, father, teacher, peers). A comprehensive assessment of children requires data from multiple sources. As a result, it is suggested that future studies make use of the CBCL/6-18 teacher rating questionnaire to assess the extent of the child's externalizing problems in the school environment. The additional child behaviour ratings from teachers would have proved useful in corroborating the results of the maternal child behaviour reports. Reports from an alternative source would also have allowed children's behaviour in different settings to be assessed and compared. A multi-method approach could also prove beneficial. For instance, observed child behaviour could be considered in addition to reports from parents/caregivers and teachers.

All prenatal risk factors were also assessed through maternal reports. Caution should therefore be taken in the interpretation of the results as maternal characteristics and social desirability bias may have influenced the results.

The lack of association between prenatal risk factors and aggression in children in our sample may also reflect the fact that there are stronger influences on aggression in this environment. Although the role of prenatal development in the development of aggression in children has been well documented (Grantham-McGregor et al., 2007; Liu & Raine, 2006; Loeber & Hay, 1997), the importance of environmental and learning factors in this sample may have outweighed prenatal risk factors. Examples of aggressive behaviour are abundantly available in the media and may well be present in the children's home, school and neighbourhood environments. The learning and reinforcing of aggressive dispositions may therefore account for the problematic behaviour seen in some children in this sample.

Conclusion

Aggression and violence are complex problems whose prevalence in South Africa warrants significant concern. Particularly alarming is the fact that young people constitute a considerable percentage of perpetrators of crime, and in particular violent crime, in the country (Burton, 2007). Early childhood aggression has been shown to be a strong predictor of later aggression, antisocial behaviour and violence in adolescence and adulthood (Loeber & Hay, 1997; Moffit, 1993). Among the earliest manifestations of violent antecedents are childhood aggression and poor emotional regulation.

Contrary to research previous research literature on the association between prenatal risk factors and children's aggression, findings from this study suggest that maternal consumption of alcohol during pregnancy, maternal use of "other" drugs during pregnancy, and current nutritional status of child are not associated with externalizing behaviour problems in children. Maternal use of tobacco during pregnancy neared significance, which is supported by research literature that has previously found this association. Despite the lack of significant findings in this study, the high prevalence of childhood aggression and adolescent and adult violence in South Africa, coupled with high rates of substance abuse and inadequate nutrition in certain segments of the population has been well documented. This reiterates the urgent need to address violence in our society and to improve the availability of reliable data.

It is hoped that the findings of this study are able to direct future research by indicating the need to assess prenatal risk factors in a longitudinal study with a larger and more varied sample. Further research into the effects of prenatal development on childhood externalizing behaviour would help to develop a more holistic understanding regarding the risk factors that cause neuropsychological dysfunctions in children which may predispose them to externalizing behaviour and aggression. Through research and the building of a knowledge base concerning the risk factors which predispose children to aggression, practical solutions may be developed and put in place with the hopes of reducing the likelihood that children raised in difficult circumstances will persistently resort to violence in adolescence and adulthood.

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Appendix A

Study Protocol

Examining risk factors to children's development

Many children in South Africa are raised in difficult circumstances, and these conditions can affect children's emotional and physical development so as to hamper their chances of succeeding at school. Many of the same conditions that reduce a child's ability to succeed educationally also increase the likelihood that they will become aggressive as they grow older; aggression is a problem in its own right, but of course can also affect children's abilities to learn and schools' abilities to teach.

Among those factors that place children at risk for poor development are:

- Poor brain development, which is in turn influenced by:
    - Maternal substance misuse
    - Poor pre-natal nutrition
    - And evidenced by disorders such as ADHD (attention-deficit/hyperactivity disorder)
- Poor parenting
- Poor capacity for empathy

This study will map the prevalence of these factors in a group of English-speaking Grade 1 learners at Portavue Primary School, Athlone.

Children and a parent or caregiver will be invited to participate in the study via letters sent home from school; children will only be enrolled in the study if their parent or legal guardian gives consent. Educators will also be invited to participate. Assessments will be as follows:

- Children will be assessed at school. Assessments of children will include:
    - Height and weight (as measures of malnutrition)
    - A brief intelligence test, the WASI
    - Brief tests of empathy – two subtests of the NEPSY, Happe's Strange stories, and a first and second order false belief task;
    - Children will also be observed in class and during breaks.
- Parents will be interviewed at a venue of their choice. Assessments will include:
    - Nutrition during pregnancy and at present
    - Substance misuse (current and during pregnancy)
    - An assessment of parenting (the Alabama Parenting Questionnaire)
    - Their child's capacity for empathy (Griffiths Empathy Measure, and another of callous, unemotional traits).
    - Their child's behaviour (the Child Behaviour Checklist)
- Educators will be asked to provide information on:
    - Children's behaviour (the Child Behaviour Checklist)
    - Children's capacity for empathy (the Griffiths Empathy Measure)

Benefits and risks

The primary benefit to the school (and to the individual children and their parents) is that if there are behavioural or learning problems that are likely to affect the child's capacity to learn, these will be identified early. The team will inform parents and provide links to appropriate service providers. This benefit is not to be under-estimate: many serious learning problems are only identified in high school, when interventions have limited power to help. In addition, the educators at Portavue Primary have indicated that their local school psychologist faces a heavy workload, and that such assessments would be of enormous benefit to them in their work.

Each child's assessment is likely to be under two hours in length. With the assistance of Mr Jonkers, the principal of Portavue Primary School, we have identified the period of 4-21 June 2012 as appropriate for our work. During this period, the first-graders will be undergoing academic assessment, but educators have given assurance that, since many of their assessments are delivered individually, our research work (which is also done via individual assessment) will incur little or no disruption to their work. In addition, educators have been uniformly enthusiastic about the possibilities that the study offers them for identifying problems in learners early in their educational career, and concomitantly identifying referral resources.

As a gesture of gratitude to Portavue Primary School for hosting this research, Dr Ward (the principal investigator) has offered to lead a workshop for the Portavue educators on problem-solving as an approach to managing learners' disruptive behaviour. In addition, the research team would like to donate some books to the Portavue school library; the choice of books will be discussed with the Grade 1 educators and the principal. Educators and parents will receive gift vouchers as a token of appreciation. Children will receive refreshments and a small toy.

Appendix B

Household Inventory

HOUSEHOLD INVENTORY			
How many of the following do you have in your household at this time? (please tick the box if you have at least one in your home)			
Running water inside the house	☐	Electricity inside the house	☐
Flushing toilet inside the house	☐	Radio/Hi-fi	☐
Car	☐	Television	☐
Fridge	☐	Video machine/DVD	☐
Microwave Oven	☐	DSTV/ Satellite	☐
Washing machine	☐	Computer	☐
Landline telephone	☐	Internet	☐
Cellphone	☐		
Apart from your immediate family, how many other people live in your household? _____			

Of the additional members of your household, how are they related to your 1st Grade child?

_____

_____

_____

_____

_____

_____

Appendix C

Maternal Nutrition during Pregnancy Measure

Malnutrition Measure

1. Weight before pregnancy

   Underweight ☐

   Normal   ☐

   Overweight   ☐

2. While you were pregnant did your household ever run out of money to buy food?

   Yes   ☐

   No   ☐

3. While you were pregnant did you ever cut the size of meals or skip any meals because

   there was not enough food in the house?

   Yes   ☐

   No   ☐

4. While you were pregnant did you ever go to bed hungry because there was not enough

money to buy food?

Yes ☐

No ☐

---

5. Did you breast feed once your baby was born?

breast fed exclusively ☐

breast fed partially (breast fed and formula) ☐

formula only ☐

Appendix D

Parent's Informed Consent Form

Consent Form

University of Cape Town

Consent to participate in a research study:

Risk Factors for Poor Development in First-graders

Dear Parent,

Study purpose

You and your first-grade child are being invited to participate in a research study being conducted by researchers from the Department of Psychology at the University of Cape Town. The purpose of this study is to map the prevalence of certain factors that place children at risk for poor development.

Study procedures

If you decide to participate in this study, you will be interviewed for approximately 60 minutes, either at home or at the school – this is your choice. The interview will include questions about your parenting history as well as your child's behaviour. Your child will be assessed at school. The assessment will include tests of ability to do academic work and to get along with others. Their height and weight will also be measured. They will be assessed over two 60 minute sessions and breaks can be taken whenever they need them. In addition, we will also be asking your child's teacher to provide us with information about his/her academic performance and behaviour at school.

Possible risks and benefits

There are no real risks involved in this study. Your child may become tired during the assessments, but he/she will be encouraged to take breaks whenever needed. Your child will be provided with refreshments during the assessment as well as a small toy upon completion. You will be offered a R50 cell phone or supermarket voucher to thank you for your time.

One very real benefit is that this study will provide your child with a developmental assessment which he/she would not likely get otherwise. You can be assured that, in the event that we should find your child to be at risk for any problems, we will notify you and refer you to the appropriate resources.

Alternatives

You may choose not to participate in this study. Your decision will not affect your or your child's relationship with the school in any way.

Voluntary participation

Participation in this study is completely voluntary. You are free to refuse to answer any question. You are free to change your mind and discontinue participation at any time without any effect on your relationship with the school.

Confidentiality

Information about you and your child for this study will be kept confidential. You and your child's consent form and other identifying information will be kept in locked filing cabinets. The information obtained will not be disclosed to anybody else but the researchers involved. Any reports or publications about this study will not identify you or any other study participant. The computers used to type up the data will be password protected.

Questions

Any study-related questions or problems should be directed to the following researchers:

Dr. Catherine Ward 021 650 3422

Dr. Susan Malcolm-Smith 021 650 3421

Questions about your rights as a study participant, comments or complaints about the study may also be presented to Ms. Rosalind Adams (021 650 3417).

Please fill out the last page and send it back to Portavue primary school by **MAY 31st**. You are welcome to keep the first two pages.

Appendix E

Children's Assent Form

UNIVERSITY OF CAPE TOWN
DEPARTMENT OF PSYCHOLOGY

Assent Form

(To be read to the child participant before testing begins)

Hello! We want to tell you about a research study we are doing. A research study is a way to learn more about something.

If you agree to join this study, you will be asked to do some tasks like drawing pictures, telling me about the meaning of some words, and building puzzles with blocks. We will also measure your height, arm and head with a measuring tape. Then we will measure your weight on a scale.

There will be two sessions, both about an hour long. If you get tired, we can take a break at any time. When you are finished with the tasks, you will get a small toy and something to eat and drink.

You do not have to join this study. It is up to you. No one will be mad at you if you don't want to be in the study or if you join the study and change your mind later and stop.

Any questions?

If you sign your name below, it means that you agree to take part in this research study.

----------------------   -------------------------------

  Date (MM/DD/YEAR)   Signature of Child Participant

Signature of Test Administrator

Appendix F

Parent Questionnaire

Child Behavior Checklist For Ages 6-18			
Child's Full name:	Child's Gender: Boy ☐ Girl ☐	Child's Age:	Child's Ethnic Origin:
Grade in School:	Child's Birthdate (year/month/date):		

Please fill out this form to reflect your view of the child's behaviour even if other people might not agree. Feel free to print additional comments beside each item and in the spaces provided.
Be sure to answer all items.

PARENTS' USUAL TYPE OF WORK, even if not working now.
(Please be specific — for example, auto mechanic, high school teacher, homemaker, laborer, lathe operator, shoe salesman, army sergeant.)

FATHER"S TYPE OF WORK:_____

MOTHER"S TYPE OF WORK:_____

PARENT/ CAREGIVER'S AGE: _____

YOUR RELATION TO THE CHILD:

Biological Parent ☐   Step Parent ☐

 Adoptive Parent ☐   Foster Parent ☐

Grandparent ☐   Other (specify):   ☐   _____

THIS FORM FILLED OUT BY (Full name): _____

YOUR GENDER: MALE ☐   FEMALE ☐

About how many close friends does your child have? (Do *not* include brothers & sisters)

        ☐ None   ☐ 1   ☐ 2 or 3   ☐ 4 or more

About how many times a week does your child do things with any friends outside of regular school
        Hours?
        (Do *not* include brothers & sisters)

        ☐ Less than 1   ☐ 1 or 2   ☐ 3 or more

Does your child receive special education or remedial services or attend a special class or special school?

        ☐ No   ☐ Yes - **kind of services, class, or school:**

Has your child ever had a serious head injury?

☐ No   ☐ Yes – please describe:

Below is a list of items that describe pupils. For each item that describes the pupil **now or within the past 2 months,** please circle the **2** if the item is **very true or often true** for the pupil. Circle the **1** if the item is **somewhat or sometimes true** of the pupil. If the item is **not true** of the pupil, circle the **0**. Please answer all the items as well as you can, even if some do not seem to apply to this pupil.

0 = Not True (as far as you know)   1 = Somewhat or Sometimes true   2 = Very True or Often True

This child/my child:	0 = not true	1 = somewhat or sometimes true	2 = very true or often true
1. Drinks alcohol without parent's approval	☐	☐	☐
2. Argues a lot	☐	☐	☐
3. Cruelty, bullying or meanness to others	☐	☐	☐
4. Demands a lot of attention	☐	☐	☐
5. Destroys his/her own things	☐	☐	☐
6. Destroys things belonging to his/her family or others	☐	☐	☐
7. Disobedient at home	☐	☐	☐
8. Disobedient at school	☐	☐	☐
9. Doesn't seem to feel guilty after misbehaving	☐	☐	☐

10. Breaks school rules	☐	☐	☐
11. Gets in many fights	☐	☐	☐
12. Hangs around with others who get in trouble	☐	☐	☐
13. Impulsive or acts without thinking	☐	☐	☐
14. Lying or cheating	☐	☐	☐
15. Physically attacks people	☐	☐	☐
16. Poor school work	☐	☐	☐
17. Prefers being with older children or youths	☐	☐	☐
18. Disrupts class discipline	☐	☐	☐
19. Screams a lot	☐	☐	☐
20. Inattentive or easily distracted	☐	☐	☐
21. Stares blankly	☐	☐	☐

22. Stubborn, sullen or irritable	☐	☐	☐
23. Sudden changes in mood or feelings	☐	☐	☐
24. Sulks a lot			

	☐	☐	☐
25. Suspicious	☐	☐	☐
26. Swearing or obscene language	☐	☐	☐
27. Teases a lot	☐	☐	☐
28. Temper tantrums or hot temper	☐	☐	☐
29. Seems preoccupied with sex	☐	☐	☐
30. Threatens people	☐	☐	☐
31. Smokes, chews, or sniffs tobacco	☐	☐	☐
32. Truancy or unexplained absence	☐	☐	☐
33. Unusually loud	☐	☐	☐
34. Uses alcohol or drugs for nonmedical purposes (don't include tobacco)	☐	☐	☐
35. Overly anxious to please	☐	☐	☐