

**Masters of Public Health Thesis Submission**

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**MKNEMM002**

**Additional Costs of FAS and PFAS learners in the classroom: An estimate  
for public primary schools in the Western Cape**

University of Cape Town

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## Declaration

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## **Abstract**

### **Background**

The Western Cape province of South Africa has the highest recorded prevalence rates of Fetal Alcohol Spectrum Disorders (FASD) in the world. In the last decade rates of fetal alcohol syndrome (FAS) and partial fetal alcohol syndrome (PFAS) prevalence of 68.0 – 89.2 per 1000 (May et al., 2007), 67.2 per 1000 (Urban et al., 2008), and 59.3 – 91.0 per 1000 (May et al., 2013) have been published after research was conducted in towns in the Western Cape (WC). Educating learners with FASD is a challenge as a result of the large range of cognitive impairments associated with heavy prenatal alcohol exposure. Determining a burden of cost to the education system may be one way to motivate for the development of prevention and intervention strategies.

### **Methods**

I designed questionnaires that were distributed to the educator and principal of a cohort of learners including learners with FAS and PFAS. Data were collected on educational impacts of variables associated with educator time use. Additional costs as a result of the use of educator's time by learners with FAS/PFAS were scaled up using risk differences and published statistics to reflect a cost burden to the WC Education Department.

### **Results**

The additional cost burden of disruptions caused by learners with FAS and PFAS for the WC Education Department is USD 7,010,166 in educator time for one academic year. The additional burden for learners with FAS/PFAS requiring additional assistance with lesson content to the WC is USD 5,754,885 in educator time for one academic year. The additional cost burden of public primary school learners with FAS/PFAS who had repeated a year of schooling was USD 3,876,565 in educator time based on 2012 salaries.

## **Conclusions**

These findings indicate that there is a large burden of cost to the education system when educator time is viewed as an economic input in education. Efforts need to be directed towards prevention programs to reduce the prevalence of learners with FAS/PFAS in the classroom. Educator training programs must be created to ensure that educators are equipped to manage the challenges posed by learners with FAS/PFAS in the classroom.

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## Table of Contents

<b>Declaration</b> .....	<b>2</b>
<b>Abstract</b> .....	<b>3</b>
<b>Acknowledgements</b> .....	<b>5</b>
<b>Part A: Proposal</b> .....	<b>9</b>
<b>Introduction</b> .....	<b>9</b>
<b>Justification</b> .....	<b>11</b>
<b>Aim</b> .....	<b>11</b>
<b>Objectives</b> .....	<b>11</b>
<b>Methods</b> .....	<b>12</b>
<b>Study Design</b> .....	<b>12</b>
<b>Population and Sampling</b> .....	<b>12</b>
<b>Sample Size</b> .....	<b>13</b>
<b>Measurement Instrument</b> .....	<b>13</b>
<b>List and definition of variables</b> .....	<b>13</b>
<b>Analysis plan</b> .....	<b>16</b>
<b>Validity and Reliability</b> .....	<b>16</b>
<b>Ethics and Communication</b> .....	<b>17</b>
<b>Stakeholders</b> .....	<b>18</b>
<b>Logistics</b> .....	<b>18</b>
<b>References</b> .....	<b>19</b>
<b>Part B: Literature Review</b> .....	<b>21</b>
<b>The impact of prenatal alcohol exposure</b> .....	<b>21</b>
<b>Epidemiology and prevalence in the Western Cape</b> .....	<b>22</b>
<b>Neurodevelopmental and cognitive impairments</b> .....	<b>24</b>
<b>IQ</b> .....	<b>24</b>
<b>Learning and Memory</b> .....	<b>25</b>
<b>Attention Deficit Hyperactivity Disorder</b> .....	<b>25</b>

<b>Executive Functioning .....</b>	<b>26</b>
<b>Social Cognition and Behaviour .....</b>	<b>27</b>
<b>Educational Context .....</b>	<b>28</b>
<b>Learners with disabilities and special education .....</b>	<b>28</b>
<b>Additional Challenges.....</b>	<b>29</b>
<b>Cost burden of FASD .....</b>	<b>31</b>
<b>References .....</b>	<b>33</b>
<b>Part C. Journal Article.....</b>	<b>39</b>
<b>1. Introduction .....</b>	<b>39</b>
<b>2. Methods .....</b>	<b>41</b>
2.1. Study Design and Setting .....	41
2.2. Population and Sample .....	42
2.3. Data Collection .....	42
2.4. Data Analysis .....	43
2.4.1 Educator salary calculation .....	43
2.4.2 Cost Calculation .....	44
2.4.3 Risk Ratios and Risk Differences .....	45
2.4.4 Expanding cost to population of the Western Cape .....	46
2.4.5 Sensitivity Analysis .....	46
2.10 Ethics .....	46
<b>3. Results .....</b>	<b>47</b>
3.1 Sample .....	47
3.3 Educator Salaries.....	48
3.4 Cost Calculations.....	48
3.2 Risk Ratios and Risk Differences .....	48
3.5 Expansion of costs and sensitivity analysis.....	49
<b>4. Discussion .....</b>	<b>50</b>
Costing .....	51
Use and purpose of results .....	51
Limitations and Future Directions.....	52

<b>Conclusions .....</b>	<b>53</b>
<b>References .....</b>	<b>54</b>
<b>Appendix A: Parental Consent Form.....</b>	<b>59</b>
<b>Appendix B: Parental Consent for information gathering at schools .....</b>	<b>67</b>
<b>Appendix C: Educator questionnaire .....</b>	<b>70</b>
<b>Appendix D: Principal questionnaire .....</b>	<b>73</b>
<b>Appendix E: UCT Ethics approval.....</b>	<b>75</b>
<b>Appendix F: Education Department Research Registration .....</b>	<b>77</b>
<b>Appendix G: 2012 Educator Salary Scales.....</b>	<b>80</b>
<b>Appendix H: Tabulation of Cost Calculations .....</b>	<b>82</b>
<b>Appendix I.....</b>	<b>84</b>

# Part A: Proposal

## Introduction

Fetal alcohol syndrome (FAS) is one of the most common causes of preventable intellectual disability worldwide (Abel and Sokol, 1987; Astley, 2004). This disorder is the most severe of the fetal alcohol spectrum disorders (FASD), grouped together with partial fetal alcohol syndrome (PFAS), alcohol-related birth defects (ARBD) and alcohol-related neurodevelopmental disorders (ARND).

Recent publications of research conducted in South Africa put the prevalence of FAS and PFAS in communities of the Western Cape Province at 68.0 – 89.2 per 1000 (May et al., 2007), 67.2 per 1000 (Urban et al., 2008), 59.3 – 91.0 per 1000 (May et al., 2013) and 175 per 1000 (Olivier et al., 2013). These are staggeringly high rates of what is an entirely preventable condition. The historical and social factors that contribute to the high levels of FAS in the Western Cape are many and come together in a complex manner to produce the high rates measured in the area.

The many intellectual and behavioural aspects of FAS or FASD make it an important consideration in an educational context. Davis and colleagues (2013) list the areas for potential cognitive deficits as follows:

- Intellectual Ability
- Attention
- Executive Functioning
- Language
- Quantitative Reasoning
- Social Cognition
- Learning and Memory
- Adverse Secondary Disabilities

Collectively, the intellectual and behavioural difficulties that these children are faced with can make learning in a classroom environment very difficult. These difficulties place burdens on the children's educators and the educational resources available, as well as having direct and indirect impacts on the other learners. The disruptions

caused by behavioural problems related to FASD can directly impact other learners, and any extra assistance required by learners with FASD could detract from the possible time a teacher could spend instructing the class on lesson content. Given the difficulties associated with FASD and how many of them could have a direct impact on a learner's academic abilities, a cost assessment of FASD in education is important. Popova and colleagues (2011b) compared results of studies using Canadian data and found that education accounted for \$4275 (32.6%), and \$5260 (28%) of the annual total costs per individual with FASD in Canada measured in Canadian dollars. These results, however, represent the Canadian context in which many children with FASD would attend special schools or be home schooled as a result of their learning difficulties. In contrast many children with FASD in South Africa attend government schools as there is a shortage of specialised educational facilities and the South African Education Department advocates in favour of an inclusive education model. This inclusive model is clearly outlined in Special Needs Education: Education White Paper 6, a policy document from the South African Department of Education as a model in which we "acknowledge and respect differences in learners, whether due to age, gender, ethnicity, language, class, disability or HIV status".

Inclusive education requires that teachers receive training and support in order to educate learners with disabilities within normal classes, but this support and training is being implemented far too slowly in South Africa (Engelbrecht, 2006). Whatever the educational context, evaluating the cost burden of FASD in terms of education is important in any population with a high prevalence. This study will form a part of a wider investigation into the financial implications of FASD in the Western Cape, including the healthcare and welfare costs associated with the conditions. The investigation also aims to address the potential impact of FASD on an individual's likelihood to be involved in criminal activities. A 2011 systematic review of literature on the topic found that youths with FASD were 19 times more likely to be in prison in Canada than youths without FASD in 2008/2009 (Popova et al., 2011a). Statistics such as these highlight the importance of further research into the relation between FASD and the justice system in South Africa. A paper on the

cost burden of FAS on the health care system has been published (Credé et al., 2011) and with contributions from other sectors of the financial impact of FASD the research group aims to model the costs associated with the conditions as costs averted per case, and compare these costs to the cost of comprehensive FASD prevention efforts.

## **Justification**

Although educational costs have been estimated abroad (B et al., 2009; Lupton et al., 2004), there is no estimation of the cost of educating the high numbers of children with FASD in the Western Cape. A Western Cape study on the utilisation of health care services by children with FAS has shown that the province is faced with a significant burden as a result of the increased utilization of health care associated with FAS and an annual societal cost estimated for the province of \$70,960,053.68 (Credé et al., 2011). Calculation of the costs of FAS to the education and health sectors will provide advocacy groups the basis for greater motivation for prevention efforts to reduce the high prevalence of FASD in the Western Cape.

## **Aim**

To measure the additional burden in class as a result of disruptions caused by learners with FAS and PFAS, additional teacher time needed by children with FAS and PFAS, and repeated years of schooling completed by learners with FAS and PFAS, and to estimate the cost associated with this burden.

## **Objectives**

- To measure three educational impacts: disruptions caused, additional assistance required with lesson content, and repeated years of schooling in a research cohort
- To compare the results of the three educational impacts by learners with FASD to those of learners who do not have FASD

- To analyse the educational impacts and calculate how much teacher time is used in order to compare teacher time occupied in children with and without FASD
- To calculate a cost burden of FASD on the education system as a result of the three educational impacts

## **Methods**

### **Study Design**

This study will utilize and collect data from a large prospective longitudinal cohort study of Cape Coloured (mixed ancestry) children with varying levels of alcohol exposure *in utero* (Jacobson et al., 2008). Specifically, this study will use both cross-sectional data collected on a subset of the original cohort and obtain additional data to be used to assess the cost burden of children with FASD. The teacher and principal of each student will be asked to complete a short questionnaire designed to assess elements of the educational environment as well as the time each of the particular students draws from the teacher.

### **Population and Sampling**

Women attending the Hanover Park Maternity and Obstetrics Unit (MOU) for antenatal care between July 1999 and January 2002 were interviewed at their first antenatal visit to determine alcohol consumption both at the time of interview and at the time of conception using a timeline follow-back interview (Jacobson et al., 2008). Pregnant women with diabetes, epilepsy or cardiac conditions requiring treatment were excluded from the study, as were those below 18 years of age. Abstainers or light drinking control women of similar gestation at recruitment were recruited from the same MOU. These women were invited to participate in the longitudinal study with their children, and consent was obtained from them for every round of testing in which they and their children have participated, including testing conducted in 2011 and 2012 (Appendix A). The parental consent for these

visits included information to be provided by the educators of the individual participants for which an additional consent form was signed (Appendix B). The specific subset of the cohort used for the current study is the cohort presently undergoing active data collection and is, therefore, a convenience sampling for this particular investigation.

### Sample Size

The sample size for this study consists of 71 children who are a sub-set of the larger longitudinal FASD study cohort population described above. This is a small sample in terms of power to determine statistical significance but could still produce patterns within the data that could motivate for further research.

### Measurement Instrument

The questionnaires (Appendix C and Appendix D) used in this investigation have been designed to provide information about the amount of teaching time that is lost due to disruptive learners and enable the resulting cost to be estimated. They have been compiled with consultation from researchers in Public Health and Health Economics as well as from educators. One of the questionnaires was designed to be answered by the class educator of each learner, and one was designed to be answered by the principal of the school that the learner attends. The information gathered will be placed into a table of data for the sample.

### List and definition of variables

I will now list the variables for the educator questionnaire as they appear in the above table, and define each one in turn.

- **No. Lessons** is the number of lessons a teacher teaches in a day and would be categorised as a discrete variable.
- **Length of Lesson** is the length of each lesson and is designed as a nominal variable.

- **No. Disruptions** is the number of disruptions in an average lesson and is an ordinal variable in this study
- **Time to Settle** is the amount of time it takes to settle a class after a disruption and is another ordinal variable
- **% Teaching Disr** is the percentage of the teacher's time used settling disruptions and is an ordinal variable
- **Req Add. Ass** is a variable to gauge if there are children in the class who require additional assistance with lesson content and is a binary variable
- **Able to Ass** will gauge if teachers are able to assist students who require extra assistance during class time. This is a binary variable
- **% Teaching Ass** is an ordinal variable which will determine what percentage of a teacher's time is used assisting struggling students
- **Yrs this school** is the number of years a teacher has taught at his/her present school and is a discrete variable
- **Yrs Qualified** is the number of years a teacher has been qualified and is another discrete variable.
- **Disr. Comp** will compare the disruptive behaviour of the individual learner with the behaviour of others and is measured on an ordinal scale
- **Disr How Oft** will measure the frequency of the individual learner's disruptive behaviour again on an ordinal scale
- **Disr Per Week** is the teacher's estimate of the number of times the individual learner is disruptive in a week and would produce a discrete measurement
- **Extra Ass** is a binary variable to assess if the individual learner requires additional assistance with lesson content
- **Ass Dur Class** is another binary variable which will show if the teacher is able to provide the individual learner with needed assistance during class
- **Mins** is an ordinal variable estimating the amount of time a teacher spends assisting the individual learner

- **Extra** is a binary variable which determines if the teacher does anything out of the ordinary for the individual learner in question
- **Add resources** is a binary variable which determines if the individual learner requires additional classroom resources
- **Consequences** is a binary variable to determine the presence or absence of consequences for disruptive behaviour by learners in the classroom
- **Learner Cons** is a binary variable to determine whether the individual learner receives consequences for disruptive behaviour
- **Repeat year** will determine if the individual learner has repeated a year of schooling and is a binary variable
- **How many rep** is the number of years that an individual learner has repeated (if any) and is an ordinal variable
- **Absent in Week** is the number of times the individual learner is absent from school in an average week and is an ordinal variable
- **Absent in Month** is the number of times the individual learner is absent from school in an average month and is also an ordinal variable
- **Absent Comp** compares the individual learner's rate of absenteeism to others in the class and is an ordinal variable
- **After School** will gauge the individual learner's participation in afterschool programs and is a binary variable

The following are the defined variables for the questionnaire administered to the principal.

- **No. Educators** is the number of educators in the particular school and is a discrete variable
- **No. Learners** is the number of learners in the particular school and is a discrete variable
- **Annual Fees** is the annual school fee contribution for each learner and is a continuous variable

- **After Hours** is a binary variable to determine the presence or absence of an afterschool program for learners
- **After Hours No.** is the number of days per week that an afterschool program runs (if one does exist) and is a discrete variable
- **Supervising Ed** is the number of supervising educators for an afterschool program and is a discrete variable
- **No. Hours** is the number of hours the afterschool program runs and is a discrete variable

### Analysis plan

Analysis of the data obtained will be completed using Stata/IC version 10.0, Copyright © 1985 – 2007 by Statacorp. Univariate analysis will be carried out for each variable with appropriate methods for numerical (mean, SD, etc., depending on the shape of the distribution) and categorical variables (proportions). The data on the educators' time usage along with an average educator's salary (obtained from an Education authority) will be used to calculate a cost of disruptive behaviour in terms of the educator's time.

### Validity and Reliability

The instruments used to collect data have not been used before, and validity and reliability, therefore, can not be supported, but the questions were edited after being reviewed by teachers and principals to improve clarity and data collection. As the instruments are new and designed specifically for this purpose, this study could be viewed as a pilot study of their efficacy. Should the study produce results that are supported by other data, and/or useful for the desired purpose they could be used for investigation with a larger cohort. Weaknesses in this method of data collection are due to the subjective manner of questionnaire completion, i.e., each teacher will spend as much time answering the questions as he/she feels is needed, and not all teachers will have equivalent levels of knowledge about their index learner. To

respect the privacy of the learners the principal and educators were not informed that the study is investigating FAS, and there should, therefore, be no future bias imposed on the participants by their participation.

### **Ethics and Communication**

Ethics approval has been obtained for the large cohort from which this sample was obtained under REC/REF 187/2008, and a protocol amendment was approved for the additional questionnaires (Appendix E). There is no risk of harm to participants in this study as the data capture method is a questionnaire completed by a third party.

Respect for persons: All parents and learners have signed a consent form (in terms of the children their signature serves as assent), this form is signed at the start of each phase of testing to encompass all new tests/procedures being conducted (Appendix A). The parents have signed an additional consent (Appendix B) enabling information about their children to be collected from the educators. The participants may withdraw their participation or consent at any point either for one element of the study or for the whole study. Participants' confidentiality and anonymity are protected, and all data are analysed using ID numbers as opposed to names or other identifiers.

Beneficence/non-maleficence: Although the research objectives do not directly benefit the participating children they are not subjected to risk or harm through their participation, and the presence of both a nurse and paediatrician in the UCT Child Development Research Laboratory ensures that any health concerns that the children present with are referred to the appropriate clinicians. Results from this investigation could be used to increase awareness about the specific difficulties faced by teachers who have children in their class suffering from the intellectual and behavioural difficulties associated with FAS. Greater levels of information could lead to greater action and planning around the structure of inclusive education, perhaps with additional training for teachers or additional resources.

Justice: Information gathered by this study and any conclusions drawn would be made widely available to anyone within health and education and may be used to advocate for greater preventive actions on the part of key stakeholders and government. This would result in benefits to the greater community if not the individual participants involved.

### **Stakeholders**

Stakeholders in this research are UCT, Wayne State University, funders including the NIH/National Institute on Alcohol Abuse and Alcoholism (National Institutes of Health) and NRF (National Research Foundation), the South African Departments of Education and Health as well as the communities in the Western Cape in which participants live, interest groups and FAS activist groups such as the Fetal Alcohol Spectrum Disorders Centre for Excellence in the United States, and SANCA the South African National Council on Alcoholism would also be considered stake holders in the research.

### **Logistics**

This investigation, being part of a larger longitudinal cohort study will make use of the logistics within the larger study. The participants of this study will be those undergoing active testing for neurodevelopmental disorders in 2011 and 2012. A data collection pack will be compiled containing the consent form signed by the parents, instructions as to how to complete the forms and the questionnaires themselves. The questionnaires sent include those used for this study, but the primary purpose for this phase of data collection is to obtain data used by the larger study. Data collection packs will be delivered to the principal of each school that a learner in the cohort attends by the driver employed by the study and the nursing sister who acts as community liaison. Each school will be visited to ensure that the questionnaires have been completed, and to collect completed questionnaires. Any additional information or extra forms required by the school will either be faxed to them or hand delivered on request.

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## Part B: Literature Review

### The impact of prenatal alcohol exposure

The impact of in-utero alcohol exposure on a child can be entirely physical as in Alcohol Related Birth Defects (ARBD). These include malformations in an infant's heart, skeletal structure, kidneys, ears or eyes. ARBD can be present with or without accompanying neurological deficits. Alcohol related neurodevelopmental disorders (ARND) are a complex range of disorders of the central nervous system as a result of alcohol exposure in utero. These can be both structural and functional in nature, and include a range of intellectual and behavioral deficits (May et al., 2009). Partial fetal alcohol syndrome (PFAS) is a diagnosis that requires three specific elements (Hoyme et al., 2005):

1. confirmed maternal alcohol consumption
2. evidence of a characteristic pattern of minor alcohol-related facial anomalies
3. prenatal and/or postnatal growth retardation, deficient brain growth or abnormal morphogenesis, or evidence of behavioural or cognitive anomalies inconsistent with developmental level that cannot be otherwise explained

For a diagnosis of fetal alcohol syndrome (FAS) a similar four elements are required, but the requirements for diagnosis include more deficits. The required criteria are (Hoyme et al., 2005):

1. evidence of a characteristic pattern of minor alcohol-related facial anomalies
2. evidence of prenatal and/or postnatal growth retardation
3. evidence of deficient brain growth or abnormal morphogenesis or evidence of behavioural or cognitive anomalies inconsistent with developmental level that cannot otherwise be explained

The criteria listed above are summarized, and not nearly as specific as those that would be used by a medical professional to make a diagnosis of FAS or PFAS, but they clearly indicate the broad range of impacts that occur when a fetus is exposed to alcohol during development. The diagnosis is best made by a team including a geneticist, who can rule out other disorders that may mimic some of these characteristics.

The four categories of impacts detailed above fall under the overarching collection of disorders and diagnoses known as fetal alcohol spectrum disorders (FASD). FASD includes ARBD, ARND, PFAS and FAS. The most well known of these, and as a result the most often diagnosed is FAS, but the prevalence of PFAS, ARBD and ARND is not insignificant, and there are efforts being made to increase awareness of these diagnoses and assist those affected by them in accessing a diagnosis and understanding the range of impacts that can accompany each diagnosis.

### **Epidemiology and prevalence in the Western Cape**

The Western Cape Province of South Africa has the highest recorded prevalence rates of FAS in the world. In the last decade rates of FAS and PFAS prevalence of 68.0 – 89.2 per 1000 (May et al., 2007), 67.2 per 1000 (Urban et al., 2008), and 59.3 – 91.0 per 1000 (May et al., 2013) have been published after research was conducted in cities and towns in the Western Cape. Olivier and colleagues (2013) published a prevalence rate of 17.5% for FAS and PFAS in a rural Western Cape community, and a prevalence rate for FASD (including FAS) of 11.3% was found in two urban suburbs in South Africa (Urban et al., 2015). The alarmingly high rural prevalence rate confirms the findings of previous studies (May et al., 2007, 2011) that mothers of children with FAS and PFAS are likely drinking higher levels of alcohol than in urban settings. Rural residence is one of many maternal risk factors for FASD. As stated in a review of research into maternal risk factors the body of research has, to date, shown that the most substantial contributors to risk of a child born with FASD are the extent of alcohol exposure of the fetus and maternal drinking pattern (May and Gossage, 2011). Research has shown that 64% of current female drinkers in the Western Cape were high-risk drinkers (Ojo et al., 2010). A national population-based survey conducted in South Africa found that 2.9% of women surveyed participated in hazardous or harmful alcohol consumption, and that the Coloured population group had significantly higher rates of harmful or hazardous drinking than the other population groups (Peltzer et al., 2011). Data from the 2011 Census of the South African population show that 61.54% of the Coloured population of South Africa resides in the Western Cape (Statistics South

Africa, 2012). These data together give some indication of the extent of problem drinking in the Western Cape.

Another factor contributing to high rates of hazardous drinking in the Western Cape is the DOP system, a historical system of payment used on wine farms (vineyards) in the area. In the DOP system workers were compensated for their work in wine or alcohol as opposed to monetary remuneration. Alcohol as partial compensation for work was used in a variety of ways, and in a range of proportions of the overall compensation of workers. The practice of using alcohol as any part of a worker's payment was made illegal early in the 1960s, and the illegality of the DOP system was confirmed in the Liquor Act, Act No 59 of 2003. Even so there appears to be evidence that the DOP system persisted on farms in the Western Cape into the 1990s (London, 1999, 2000; May et al., 2005). The long term impact of such a system is hard to evaluate, but we have an understanding that alcoholism/addiction in general is a state that can pass from one generation to another as a complex genetic phenotype, and one that is influenced by many heritable and environmental factors (Cloninger et al., 1986). The perpetuation of discriminatory social norms and structures in recent South African history would provide an environment within which a dependence on alcohol in farming communities of the Western Cape could persist long after the practices of the DOP system have ceased.

Research has found many maternal risk factors over and above drinking patterns alone that contribute to pregnancies resulting in children with FASD. These include smoking during pregnancy, alcohol use as a minor, a binge drinking or alcoholic partner, maternal education, rural residence, domestic violence, and many more (May et al., 2011; Morojele et al., 2010; O'Connor et al., 2011). May and Gossage (2011) define three categories of overall risk for FASD as host, agent exposure and environmental risks. Episodic binge drinking during pregnancy has been shown to be the most damaging form of alcohol consumption on fetal development and, therefore, a significant risk factor for a child who is born with the negative impacts of alcohol exposure *in utero* and has been highlighted in studies conducted in the Western Cape (May and Gossage, 2011; VILJOEN et al., 2005). Pregnant women who participate in episodic binge drinking and have any number of the other risk factors

associated with FASD are, therefore, going to be at greater risk of bearing children who are in some way developmentally impaired by their alcohol consumption.

### **Neurodevelopmental and cognitive impairments**

It is important to appreciate the range of cognitive impairments that can be caused by in utero alcohol exposure. Jacobson and Jacobson (2002) stated that the most consistent deficits in children after PAE are in arithmetic, attention, and socioemotional function. Davis and colleagues (2013) list the areas for potential cognitive deficits as follows:

- Intellectual Ability
- Attention
- Executive Functioning
- Language
- Quantitative Reasoning
- Social Cognition
- Learning and Memory
- Adverse Secondary Disabilities

Understandably all of these can have an impact in an educational setting, and some, when they exist in the same individual can have a very large impact on that individual's experience and on their performance in the context of a learning environment. Many of the above areas of neurological deficit have been researched extensively in and out of an educational context.

### **IQ**

Prenatal alcohol exposure has an impact on IQ (Jacobson et al., 2004; Mattson et al., 1997; Streissguth et al., 1990). Mattson and colleagues (1997) found that alcohol exposed subjects performed significantly worse on overall IQ measures when compared to unexposed controls. Lower performance on age standardized tests of intelligence would impact learning and information retention in an educational context, and may be one of the primary reasons for poor school achievement in students with FASDs.

## Learning and Memory

The impact of PAE on learning as a process is an important aspect to consider for learners with alcohol exposure. Children with FASD have been shown to have significantly lower performance than the age normative expectations on verbal and visual learning tasks when compared to controls (Kaemingk et al., 2003; Lewis et al., 2015; Mattson and Roebuck, 2002). The results of Kaemingk et al., (2003) did, however, follow the same pattern as the control group subjects suggesting that their relative retention capacity is not different. Controlling for IQ in the results did not fully account for the deficits in learning among FASD subjects, although separating learning and IQ is a difficult proposition (Kaemingk et al., 2003). The same study found no significant difference between performance on visual and verbal learning tasks, suggesting that both learning modalities are impacted by PAE. Verbal learning would also realistically be affected by language skills, and many students with FASD have measurable language impairments. Wyper and Rasmussen (2011) found that subjects with FASD performed significantly worse on both receptive and expressive language tasks, on matching pictures to spoken words, and on accurately describing the meaning of words. On the Test of Language Development, younger children (ages 5 – 8yr) had additional difficulties understanding and expressing the relation between spoken words and imitating sentences that are read to them. Older children (those between 9 and 13 yrs of age) found it challenging to recognize and correct incorrect grammar, to identify and correct spoken malapropisms and to consider the structure of a sentence rather than just its meaning. In a didactic classroom setting these deficits in learning and language could have a very big impact on a student with PAE and would decrease any one student's capacity for performance during testing.

## Attention Deficit Hyperactivity Disorder

There has been much written on the association of attention disorders and alcohol exposure. As many as 41% of those with FASD have been given diagnoses of Attention Deficit Hyperactivity Disorder (ADHD) (Bhatara et al., 2006), and Jacobson et al., (2011) found that heavily alcohol exposed learners were four times

more likely to meet the diagnostic criteria for ADHD than learners whose mothers did not drink alcohol during pregnancy. This high rate of comorbidity has resulted in numerous studies which use measures of attention and/or ADHD to classify children with heavy alcohol exposure in utero (e.g., Burden et al., 2005; Jacobson et al., 2011; Lee et al., 2004). There are many different measures of attention and Lee et al., (2004) found two that could accurately discriminate between individuals with ADHD who were and were not alcohol exposed *in utero*. This indicates that the specific profile of attention deficits in alcohol exposed individuals is different from those who have attention deficits without the comorbid exposure to alcohol during embryological development, and that the alcohol exposure during brain development creates a specific attention deficit profile. Further evidence of this can be found in the results of Jacobson et al., (2011) in which adolescents with prenatal alcohol exposure and adolescents with diagnosed ADHD completed 7 different subtests of a number processing test. The two groups of adolescents performed distinctly in different dimensions of number processing, prenatal alcohol exposure being related to magnitude comparison and ADHD related to calculation, confirming that prenatal alcohol exposure creates a distinct profile of attention deficits separate from those created by ADHD, and that this profile has specific impacts on learning.

### **Executive Functioning**

Executive function describes the capabilities that enable an individual to successfully pursue *independent, purposive, self-serving behavior* (Lezak, 2004). Schonfeld et al., (2006) found that subjects with prenatal alcohol exposure (PAE) had clinically significant impairments in executive functioning and social functioning and that the impairments were present in the full range of FASD diagnoses. It was also determined that parent ratings of a subjects' executive functioning levels on the Behavior Rating Inventory of Executive Functioning were predictive of both parent and teacher ratings of social skills on the Social Skills Rating System (SSRS). The SSRS evaluates elements like cooperation, initiation of conversations, a learner's ability to make friends, and whether a learner responds

appropriately to conflict situations. Some of the potential impacts of poor executive functioning in the classroom include a greater tendency to be irritable or excitable, and difficulty making shifts in attention (Lezak, 2004).

### **Social Cognition and Behaviour**

The deficits in social cognition that are associated with PAE have been shown to increase over time with older children or adolescents being more impaired than very young children (Thomas et al., 1998). The study proposed that the deficiencies in social skills may become more apparent over time as individuals are held to a higher standard of social interactions. Researchers found that the subjects with PAE had the social abilities age-appropriate of a 4 – 6-year-old, even at much older ages. This suggests that those who have been diagnosed with FAS reach a plateau of social development. Greenbaum et al., (2009) investigated theory of mind and emotion processing in subject children with FASD compared to those with ADHD. Ratings by teachers on tools that measure behavior problems in this study scored students with FASD as having more behavior problems than students with ADHD, who were in turn more problematic than normal control subjects. The social cognition and emotion processing deficits in FASD students in this study correlated to both parent and teacher ratings of behavior problems on a number of instruments, and performance on emotion processing tasks were associated with the subjects' levels of social skill functioning. These associations between behavior and social skills/social functioning could have a great impact in a classroom environment. Another recent study investigating theory of mind and FASD found that theory of mind functions may play a "significant role in the socio-cognitive behavioural impairment of FASD," (Lindinger et al., 2016). A study conducted in the Western Cape found that behavioural and/or developmental disorders (BDD) among children were positively associated with maternal drinking (Katwan et al., 2011). Students who have difficulty conforming to the expectations of behavior in a classroom could not only impact their own learning, but pose a challenge to the whole class of students if they are disruptive or take away from teaching time for all of the students.

## **Educational Context**

The context of learning and schooling is very important when considering children with FASD. What is the state of education in South Africa? Are students with learning challenges enrolled in mainstream schools or schools for children with difficulties? Do teachers have adequate training to manage and assist students who have deficits in learning? Do teachers have the resources, either physical or in time, to offer additional assistance when necessary? In South Africa the answers to these questions are heavily impacted by the historical context of the education system as a whole and the political history of a country that is full of inequalities.

Large education differentials that still exist between students are the legacy of apartheid policies that segregated schooling by race, and provided a distinct lack of resources to schools for non-white students (van der Berg, 2007). There are additional challenges that can be linked to the legacy of apartheid, such as the size of classes at schools in South Africa (due in parts to a lack of qualified educators and insufficient facilities), and the proportion of students who complete high school. According to data released by the South African Department of Basic Education there were 876 public primary schools with 487 394 learners and 15 531 educators in the Western Cape in 2012. These numbers result in an estimated class size of 31.38 learners per educator. This learner educator ratio (LER) was higher than both the overall LER of the Western Cape in 2012 at 28.5, and the LER of the country as a whole at 29.2 learners per educator. The same publication states that only 53.4% of all possible learners in South Africa who were of age to be in Grade 12 in 2012 were actually enrolled in school. This is in contrast to 119.3% of the age appropriate learners enrolled in Grade 1, and 81.6% of age appropriate learners enrolled in Grade 11 in 2012. This certainly demonstrates that many more learners are starting school than finishing producing low matric graduation rates (Department of Basic Education, 2014).

## **Learners with disabilities and special education**

The South African Education system has, since the foundation of the new government in 1994, moved towards the model of inclusive education. Inclusive

education is a model of education in which learners with all types of special needs are included in the mainstream education system wherever possible. Scholarly writing in inclusive education uses language based in human rights and civil rights. It aims to provide access to education to all learners, and in doing so produce competent citizens able to make a valuable contribution to society (Engelbrecht, 2006; Department of Education, 2001). In practice incorporating learners with a wide range of special education needs into mainstream classrooms is complicated and difficult to execute. Weeks (2000) lists a classification of special needs as:

- **Disabilities** (permanent shortcomings), which may be sensory, physical or intellectual in nature. Learners may also have disabilities in more than one category.
- **Developmental Problems**, which are identified when a learner does not develop or reach developmental milestones at the same rate as his or her peers.
- **Learning Problems**, or when a learner finds it “difficult to master those learning tasks which most other children in the class can manage.”

All of the above categories could be applicable to learners with FASD. Weeks (2000) also notes that a growing proportion of learners in schools are considered “learners-at-risk”. These are students who have any of a number of contextual, situational, health or societal barriers to education. Some examples of learner-at-risk categories that could apply to learners who also have the specific problem of alcohol exposure *in utero* are:

- those who are the children of alcoholic or substance users
- learners experiencing health problems
- learners who reside in rural or remote areas
- those learners who are members of dysfunctional families

### **Additional Challenges**

The education of all learners; those with special needs, those who would classify as learners-at-risk, and those who would not fall into the above categories in one classroom would be challenging in any education system. In the South African

system, with the addition of historical burdens of education inequalities and discrimination against learners of color and those with disabilities, the challenges are greater. The ability to accommodate learners with a diagnosis of FAS or PFAS in mainstream schools, and ensure that the needs of these students are met is even more of a challenge when considering the large and varying impacts that their alcohol exposure can have on their abilities in an educational context. The fact that many of these learners have additional comorbid life stressors that would have a detrimental effect on their ability to achieve academically only adds to the complexity of an already difficult learning environment. Learners with PAE could have disrupted school experiences, participate in inappropriate sexual behaviors or have alcohol and drug problems themselves. Many of the risk factors for these additional difficulties are factors with a big impact on all areas of a child's development. For example, the absence of a stable and/or nurturing home environment, or experiencing physical/sexual abuse or domestic violence would have broad psychological and developmental consequences on a child far beyond the impact on their academic potential (Streissguth et al., 2004). Additionally, an investigation of Canadian data found that youth with FASD were 19 times more likely to be in prison than youths without FASD in 2008/2009 (Popova et al., 2011). Statistics such as that highlight another potential challenge to adolescent learners with FASD – participation in crime, and interactions with the criminal justice system. One study investigating the academic achievement and school functioning of those with PAE stated that it is important to take external and environmental factors into account when evaluating and attempting to understand the academic functioning of those with PAE. Academic performance, for example, was impacted by a learner's school attendance, and their conduct during school hours. The study found that all participant learners showed the negative effects of low socio economic status (Howell et al., 2006). It has also been found that the combined impact of many risk factors markedly exceeds the impact of any individual risk factor (Yumoto et al., 2008).

## Cost burden of FASD

Ultimately, educating learners with PAE is complicated and difficult. In the Western Cape, with the highest recorded prevalence rates of FASD in the world it is important to determine the extent of the burden of PAE on as many areas of society as possible. This includes attempting to determine a cost value for the education of FASD learners. Many studies internationally have attempted to determine the cost burden of the varied impacts of FASD. Importantly as many of the studies that determined cost burdens were conducted using only the burden of FAS, and not all FASDs, these studies likely underestimate the total cost burden of PAE. Some studies have focused primarily on the healthcare costs, determining a \$6.7 million direct health care cost in Canada in 2008-2009 (Popova et al., 2012), and an annual societal cost for the utilization of health care services in the Western Cape of \$70,960,053.68 (Credé et al., 2011). Klug and Burd (2003) determined the costs of FAS and comorbid conditions that are significant in an educational context by averaging the total yearly healthcare costs of subjects with a specific disease over 2 years. Cumulative cost savings are the average yearly cost of children without the disease subtracted from the cost of children with the disease over consecutive years. For example the cumulative cost savings for preventing a single case of FAS after 10 years was \$8,340 for ADHD, and \$44,330 for learning disabilities (in USD). These costs show the healthcare implications of conditions that have a large educational impact. The primary value of determining the cost burden of FASD in an educational context would be as a motivator for prevention programs, early intervention programs and teacher training. Measuring the effectiveness or productivity of education is not easy considering the complicated nature of inputs and outputs involved, but one study using instruction time as an input in an investigation of effectiveness found that the amount of time spent in instruction is an important factor in determining average test scores of learners (Coates, 2003; Psacharopoulos, 2014). Another measurement could be that of education wastage. Psacharopoulos (2014) defines educational wastage as the total number of pupil-years spent by repeaters and dropouts. Repetition is considered the more wasteful of the two

elements for a number of reasons including the fact that a repeated year results in the loss of investments in educational services and an increase in unit costs of education. An approach to determining a cost burden in the education system would be to carry out an assessment of the impacts of cognitive and behavioural challenges associated with FASD in the classroom. Measuring education wastage and/or opportunity cost due to the loss of instruction time in a classroom should provide a basis for a burden of cost estimate due to FASD in the education system.

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## Part C. Journal Article

### 1. Introduction

The Western Cape province of South Africa has the highest recorded prevalence rates of fetal alcohol syndrome (FAS) in the world. FAS and partial fetal alcohol syndrome (PFAS) are the most severe diagnoses resulting from prenatal alcohol exposure. In the last decade rates of FAS and PFAS prevalence of 68.0 – 89.2 per 1000 (May et al., 2007), 67.2 per 1000 (Urban et al., 2008), and 59.3 – 91.0 per 1000 (May et al., 2013) have been published based on research conducted in the Western Cape. A recent systematic literature review found a prevalence for FAS in South Africa of 55.42 per 1000, and for PFAS of 28.29 per 1000 (Roozen et al., 2016). Olivier and colleagues (2013) published a prevalence rate of 17.5% for FAS and PFAS in a rural Western Cape community, while a combined prevalence rate for FAS and less clinically significant FASD of 11.3% was found in two urban suburbs in South Africa (Urban et al., 2015). The most substantial contributors to risk of a child born with FASD are the extent of alcohol exposure of the fetus and maternal drinking pattern according to the body of research (May and Gossage, 2011). According to (Ojo et al., 2010) 64% of current female drinkers in the Western Cape were high-risk drinkers, and 42.8% of pregnant women in one study conducted in the Western Cape admitted drinking alcohol in the pregnancy during which they were questioned (Croxford and Viljoen, 1999).

Prenatal alcohol exposure (PAE) has a range of impacts on neurodevelopment resulting in a characteristic pattern of cognitive deficits (Davis et al., 2013; Jacobson JL and Jacobson SW, 2002). Some areas impacted are intellectual ability, attention, executive functioning, language and literacy skills, quantitative reasoning, social cognition, and learning and memory (Davis et al., 2013). Alcohol exposed subjects were found to perform significantly worse on overall measures of IQ when compared to unexposed controls (Mattson et al., 1997). Comorbid diagnoses include ADHD and the percentage of those with FASD and ADHD may be as high as 41% according to (Bhatara et al., 2006). The association between FASD and ADHD is so pervasive that different measures of

attention have been used to attempt to create a diagnostic pathway for alcohol exposure (Lee et al., 2004). Subjects with PAE have been found to have clinically significant impairments in executive functioning across the spectrum of FASD diagnoses (Schonfeld et al., 2006), and poor performance on some tests within the executive functioning testing battery are so predictive of PAE that they could be used in clinical evaluation of alcohol exposure (Connor et al., 2000). Children with FASD performed significantly worse on receptive and expressive language tasks, struggling to match pictures to spoken words, and struggling to accurately describe the meaning of spoken words (Wyper and Rasmussen, 2011). Youth with PAE showed significant deficits on mathematical measures (Howell et al., 2006), and Rasmussen and Bisanz, (2011) found that deficits in mathematics performance among children with FASD are associated with impairments in working memory. All of the above impairments would impact both a learner's academic potential and their ability to learn in a typical classroom environment.

Lindinger et al., (2016) documented impacts of PAE on the social cognition of those affected. The social cognition and emotion processing deficits in FASD learners correlate with both parent and educator ratings of behavior problems on a number of assessment instruments (Greenbaum et al., 2009). Katwan et al., (2011) reported that behavioural and/or developmental disorders were positively associated with maternal drinking in children without even a confirmation of an FASD diagnosis. Students who have difficulty conforming to classroom behavior expectations both negatively impact their own learning, and pose a challenge to the whole class of students due to the diversion of teaching time.

Due to the cognitive difficulties faced by learners with FASD it is important to determine the extent of the burden of FAS and PFAS on the education system. Many studies have attempted to determine the cost burden of the varied impacts of FASD. Some studies have focused primarily on the healthcare costs, determining, for example, a \$6.7 million direct health care cost in Canada in 2008-2009 (Popova et al., 2012), and an annual societal cost for the utilization of health care services in the Western Cape of over \$70

million (Credé et al., 2011). Klug and Burd (2003) determined the costs of FAS and comorbid conditions that are significant in an educational context, finding the cumulative cost savings for preventing a single case of FAS after 10 years was \$8,340 for ADHD, and \$44,330 for learning disabilities (in USD). These costs show the healthcare implications of conditions that also have a large educational impact.

Studies of educational effectiveness where instruction time is an input found that the amount of time spent in instruction is an important factor in determining average test scores of learners (Coates, 2003; Psacharopoulos, 2014). Previous research conducted in Canada states that children with FASD are both identified as difficult students to manage and likely to experience problems with education and literacy (Popova et al., 2016). These elements of educator experience require either individualized or limited instruction time reducing overall effectiveness.

Another possible measurement is education wastage. Psacharopoulos (2014) defines educational wastage as the total number of pupil-years spent by repeaters and dropouts. Brownell et al., (2013) found that children with FASD were three times as likely to repeat a year of schooling when compared to the general population, demonstrating the relevance of this measure of education wastage to children with FASD.

This study aims to estimate a cost burden of FAS and PFAS on the education system of the Western Cape using educator time, and educational wastage in repeated years.

## **2. Methods**

### **2.1. Study Design and Setting**

This investigation utilized and collected data from a sub-sample of a large longitudinal cohort study of children with varying levels of alcohol exposure *in utero* in Cape Town, South Africa (Jacobson et al., 2008). In this paper, the costs associated with the input of educator time for three specific educational outcomes of FASD were estimated: (1) the time taken to manage additional disruptions caused by learners with FAS/PFAS, (2) the

time taken to directly assist those with FAS/PFAS with lesson content, and (3) the additional instructor time used by learners with FAS/PFAS when repeating a year of schooling.

## 2.2. Population and Sample

A cohort of 98 pregnant women and their unborn children was recruited from mid-1999 to early 2002 for a longitudinal study assessing neurodevelopmental impacts of FASD over a participant's childhood and adolescence. The assembly of the cohort has been described in detail elsewhere (Jacobson et al., 2008). The cohort children were examined in September of 2005 by two expert dysmorphologists using a standard diagnostic protocol (Hoyme et al., 2005) in order to determine a FASD diagnosis for each child. Of the cohort, thirty children were identified with FAS (n=12) or PFAS (n=18) (Jacobson et al., 2008). This study included 71 children of whom 11 were children with FAS or PFAS, and 60 children categorized as either nonsyndromal heavily exposed (HE) or typically-developing non-exposed control (NC). Participants of the larger study who were undergoing testing during 2011 and 2012 were the participants for this study. Those not included had undergone the testing phase during which this study was undertaken before it began.

## 2.3. Data Collection

The educator and principal for each participant learner were each asked to complete a different short questionnaire (Appendices C and D) designed to provide information about the amount of teaching time lost due to disruptive learners and due to the need for direct assistance to the learners with classroom content. Information was also collected on the learners' attendance and if each learner had repeated a year of schooling. Principals of schools were asked to provide information on the number of educators and learners at each school. In completing the questionnaires the principals

and educators were not informed that the investigation they were assisting with was focusing on fetal alcohol spectrum disorders (FASD).

## 2.4. Data Analysis

The information gathered was tabulated, and cleaned for statistical analysis using Microsoft Excel, and STATA 10 (StataCorp, 2007). Participants were grouped into four FASD groups based on their diagnosis (viz., FAS, PFAS, HE or NC; Jacobson et al., 2008). For the purpose of this study, children with FAS and PFAS were combined (n=11) and compared to children in the HE or NC categories (n=60).

### 2.4.1 Educator salary calculation

To estimate the cost of educator time, the salary structure of educators in the Western Cape was used. Each educator working in the Western Cape is assigned a Relative Education Qualification Value (REQV) upon employment and, within each REQV, there are a number of notches corresponding to payment levels. Moving up in REQV or in notches within a REQV is how an educator's salary increases beyond the regular increase to offset inflation. Increases in notch or REQV are awarded for additional qualifications, merit and teaching experience. The minimum REQV for an educator to be hired by the Western Cape Education Department is 13, and REQV 13 encompasses notches 56-138 (Department of Education, 2000; Education Labour Relations Council, 2011). The basic pay increase for teachers based on teaching experience is a 1% increase or a single notch of progression up the pay scale for each year worked (Education Labour Relations Council, 2011). To obtain a conservative estimate for the earnings of each educator, educators were asked how long they had been qualified in the questionnaire. Therefore, starting with a baseline notch of 56 (the lowest pay at the entry level REQV), and increasing by one notch for each year of qualification generates a conservative (low) salary estimate for each educator in the year that data collection took place. The salary values for each notch were taken from a government gazette

publication on 17 August 2012 detailing the salary notches for the post full time employees: educators.

#### 2.4.2 Cost Calculation

Costs were attributed to each of the three dichotomous (yes/no) outcome measures of educator time, defined as follows:

- 1) participants who were disruptive in more than 50% of their classes or every class
- 2) participants who required additional assistance with lesson content
- 3) participants who had repeated a year of schooling at the time of data collection

All valuation methods were calculated for an individual learner. Table 1 shows the process followed to determine a cost for each of the three education impacts listed above. A description of the method of cost calculation for each education impact is below.

1. Classroom disruptions: To calculate the cost of the disruption impact, responses on a Likert scale had to be converted into a dichotomous classification. Educators responded to the question 'How often is this learner disruptive?' with one of four responses. Students were disruptive either never/ < 50% of classes / > 50% of classes / every class. Responses were grouped for the calculation of Risk Differences with cases as those students disruptive in more than 50% of classes or every class, and non-cases were students disruptive in less than 50% of classes or never. To determine a cost with these responses the average time taken to settle a disruption (4.4 minutes) was multiplied by half the average number of classes per day (3.78) resulting in the amount of class time used by a student who is disruptive in 50% of classes. As the disruption outcome was positive for all students disruptive in more than 50% of classes or every class this method produces a minimum cost for disruptions (50% of classes). This cost is the same for any learner.

2. Additional assistance with lesson content: Each educator was asked how much time in a lesson they spend directly assisting the index learner with lesson content. The mean

amount of time educators said they spent directly assisting learners with FAS/PFAS with lesson content was used to determine a cost for the additional assistance that learners with FAS/PFAS receive. To achieve a conservative cost estimate, the cost of a learner receiving additional assistance in a lesson only once per day was calculated.

3. Repeated years of schooling: The learner educator ratio (LER) for the study population was the mean number of students per educator for the participating schools. A cost for a repeated year of schooling in terms of teacher time was calculated by dividing the educator salary by the LER. This cost is the same for any learner.

Table 1. Cost calculation process for three learner education impacts

	Recurrent Costs		Once-Off Cost
	Disruptions	Assistance with Lesson Content	Repeated year of Schooling
<b>Costing Method</b>	Percentage of educator’s time spent quieting disruptions attributable to FAS and PFAS	Percentage of educator’s time spent directly assisting learners with FAS and PFAS with class content	One learner’s proportion of an educator’s salary
<b>Valuation Method</b>	<ol style="list-style-type: none"> <li>Determine time value of education impact for one learner</li> <li>Convert time outcome to percentage of daily teaching time</li> <li>Annual cost is same percentage of annual salary</li> </ol>		<ol style="list-style-type: none"> <li>Determine one learner’s proportion of teaching responsibilities using LER<sup>a</sup></li> <li>Cost for repeated year is same proportion of annual salary</li> </ol>
<b>Assumption</b>	Daily teaching responsibilities are representative of annual responsibilities		

a. LER is Learner Educator Ratio

### 2.4.3 Risk Ratios and Risk Differences

Two by two tables were constructed to calculate the association between a child having FAS/PFAS and three education outcomes compared to children in the HE/NC groups. Measures of association were estimated as risk ratios (RR) and risk differences (RD) for each of the three educator time outcomes: disruption, additional assistance, and repeated years of schooling. A risk difference was calculated to determine the

proportion of additional instances of each outcome in the FAS/PFAS population. This proportion represented the additional burden on educator time as a result of FAS/PFAS.

#### 2.4.4 Expanding cost to population of the Western Cape

The risk difference calculated for each educational impact represents the proportion of additional instances of each impact in the FAS/PFAS population compared to the HE/NC controls. This Risk Difference was then applied to the total FAS/PFAS population in public primary schools in the Western Cape for 2012, calculated using published prevalence data (May et al., 2013), and education statistics (Department of Basic Education, 2014). The resulting estimate is the additional instances of the educational outcome (in time) attributable to FAS/PFAS amongst among learners in the Western Cape. This number of instances of the educational impact can then be multiplied by the cost value determined for each impact to arrive at a cost burden to the Western Cape Education Department. This process is outlined in Figure 1.

#### 2.4.5 Sensitivity Analysis

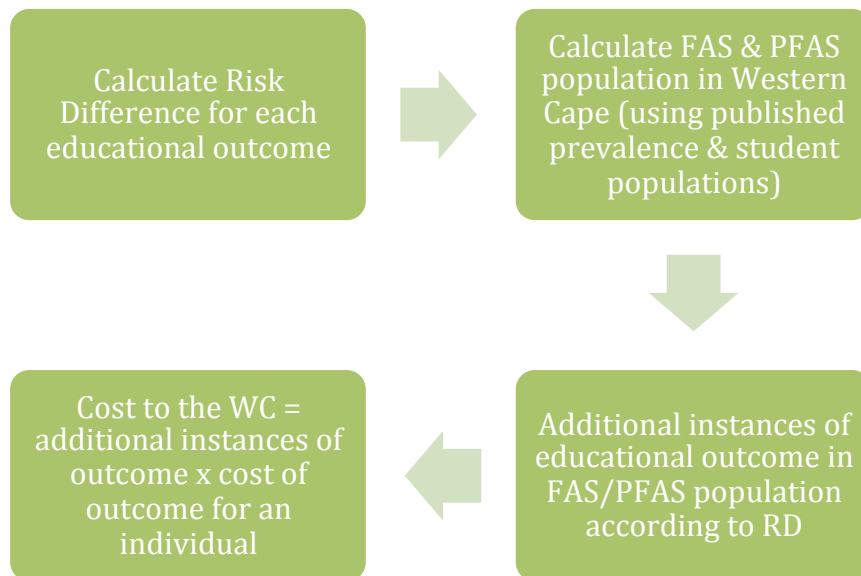
Sensitivity analysis was conducted on the FAS/PFAS prevalence rate range of 104.6 – 160.6 learners with FAS/PFAS per 1000 published after investigations in a Western Cape town using a comparable learner population (May et al., 2013). These upper and lower prevalence estimates determine a possible range of cost to the Western Cape Education Department.

#### 2.10 Ethics

Ethics approval was granted as an amendment to the approval of the larger study through the University of Cape Town Faculty of Health Sciences (HREC 187/2013 Addendum 1). This study was registered with the Western Cape Education Department (REF 20121115-0032). The women recruited were invited to participate in the longitudinal study with their children, and consent was obtained from them for every

round of testing in which they and their children have participated, including testing conducted in 2011 and 2012 (Appendix A). The parental consent for these visits included information to be provided by the educators of the individual participants for which an additional consent form was signed (Appendix B).

Figure 1. Process for scaling costs up to the Western Cape learner population



### 3. Results

#### 3.1 Sample

The 71 participant learners assessed in this study were drawn from 49 public primary schools in the Western Cape, and were enrolled between Grade 1 and Grade 6. Three of the schools attended are listed by the Western Cape Education Department as special education/special needs schools. Of the 71 participants, 11.3% (8) of the learners had been diagnosed with FAS, 4.2% (3) with PFAS, 40.9% (29) of the participants were classified as HE, and 43.7% (31) were NC participants. Educators and Principals did not respond to all questions for every participant, and the number of total responses for each question therefore varied. The response rates for questions regarding the three

outcomes principally used for the calculations of cost were 100%, 99% and 93%, respectively.

### 3.3 Educator Salaries

In 2012, the mean salary for the educators in the sample was USD12,710 ± USD1,295.

### 3.4 Cost Calculations

Variables used for cost calculations are listed in Table 2. The cost of an educator’s time taken to manage the disruptions caused by a learner who is disruptive in 50% of his/her classes for one academic year is USD708. The cost of an educator’s time taken to directly assist a learner with FAS/PFAS with lesson content for one academic year is USD374. The cost in a proportion of an educator’s salary for learner who had repeated a year of school is USD401.

Table 2. Variables used in Cost Determination

Variable	Value
Number of Lessons Taught in a day (mean)	7.55 ± 2.47
Length of each lesson in minutes (mean)	40.77 ± 11.23
Total average teaching time in a day (no. lessons x lesson length in minutes)	298.08 ± 84.47
Time per day it takes to settle a disruption in minutes (mean)	4.4
Time per day spent directly assisting FAS/PFAS learners with lesson content in mins (mean)	8.78
LER of study population	31.64
Study population mean educator salary (USD)	12,710

### 3.2 Risk Ratios and Risk Differences

Table 3 shows the RR and RD results. The RD results show that learners with FAS/PFAS had, on average, 194 additional instances of disruption cases per 1000, 301 additional

instances of assistance cases per 1000, and 189 additional instances of repeated year cases per 1000 when compared to HE/NC learners. None of the measures of association (RR and RD) were statistically significant at the 0.05 level, but all measures were positive implying that children with FAS/PFAS created additional burden in the classroom.

Table 3. Risk Differences (RD) and Risk Ratios (RR). Exposure defined as those learners with FAS/PFAS diagnosis, unexposed are HE/NC learners.

Question Asked	Education Impact +	Education Impact -	RD	Additional Cases per 1000	RR	P*
How often is this learner disruptive?	>50% of the classes or every class	<50% of classes or never	0.19	194	2.15	0.14
Does this learner require extra assistance with lesson content?	Yes	No	0.30	301	1.58	0.06
Has this learner had to repeat a year of schooling?	Yes	No	0.19	189	1.46	0.22

\* - P values were calculated with Fischer's exact test due to low expected frequencies.

### 3.5 Expansion of costs and sensitivity analysis

Table 4 shows the variables used in the calculations to scale up the costs determined above to a cost for the learner population of the Western Cape. Using the lower value for the FAS/PFAS prevalence in a WC community of 10.46% the following values were calculated (May et al., 2013):

1. The additional burden of disruptions caused by learners with FAS/PFAS for the WC Education Department is USD 7,010,166 in educator time for one academic year
2. The additional burden for learners with FAS/PFAS requiring additional assistance with lesson content to the Western Cape is USD 5,754,885 in educator time for one academic year
3. The additional cost burden of public primary school learners with FAS/PFAS who had repeated a year of schooling was USD 3,876,565 in educator time based on 2012 salaries

Table 4. Variables used to scale up costs to the Western Cape Learner Population

Variable	Quantity
<b>Study Population Mean Educator Salary (USD)</b>	12710
<b>Total Daily Teaching Time (minutes)</b>	298.08
<b>WC Student Population (2012)<sup>a</sup></b>	487394
<b>Low value of FAS/PFAS prevalence range (%)<sup>b</sup></b>	10.46
<b>Number of learners at low FAS/PFAS prevalence</b>	50981.41
<b>High value of FAS/PFAS prevalence range (%)<sup>b</sup></b>	16.06
<b>Number of learners at high FAS/PFAS prevalence</b>	78275.48

a. number of learners in public primary schools in the Western Cape in 2012 (Department of Basic Education, 2014) b. (May et al., 2013)

A sensitivity analysis (Table 5) showed that there was a large increase in the additional cost burdens of the educational impacts to the WC Education Department when the upper limit of the FAS/PFAS prevalence range was used.

Table 5. Sensitivity Analysis using bottom and top values of the FAS/PFAS prevalence ranges in May et al., 2013

<b>Educational Impact</b>	<b>Cost Per Learner (USD)</b>	<b>Low Cost Estimate for WC (USD)</b>	<b>High Cost Estimate for WC (USD)</b>
Disruptions (annual cost)	708	7,010,166	10,763,219
Assistance with Lesson Content (annual cost)	374	5,754,885	8,835,894
Repeated year of Schooling	401	3,876,565	5,951,973
<b>Total annual cost<sup>a</sup></b>		<b>12,765,051</b>	<b>19,599,113</b>
<b>Total Cost<sup>b</sup></b>		<b>16,641,617</b>	<b>25,551,086</b>

a. Total annual cost is the cost annually of the additional burden of disruptions by FAS/PFAS learners and extra assistance with class content required by FAS/PFAS learners. b. Total cost represents the total cost of one year of lost educator time due to disruptions and additional assistance with lesson content as well as the cumulative cost of all students who had repeated a year of schooling at the end of data collection in 2012.

## 4. Discussion

The budget of the Western Cape Education Department for the 2012/2013 financial year was USD 1.08 billion (Western Cape Education Department Budget Speech, 2012).

The calculated costs therefore represent between 1% and 2% of the total budget of the Western Cape Education Department for 2012/2013. As this type of investigation into the cost burden of FASD in the education system has not been attempted for a South African population before there is nothing to directly compare the results to. However, the study by Crede et al. (2010) evaluating the cost burden of health care services for children with FAS in the Western Cape reached a cost estimate that represented 5% of the budget of the Western Cape Department of Health for 2010/11. Together these studies illustrate the large cost burden of what has been referred to as a “significant and underestimated health problem in South Africa” (Olivier et al., 2013).

### Costing

Due to the complicated historical system of salary increases for educators potential increases based on additional qualifications or merit were not included in the calculations. The method of salary calculation chosen is simple enough to attempt extrapolation for teachers throughout the province while still providing a conservative estimate of costs. The actual average salary of educators in the Western Cape, and as a result the costs calculated, could be much higher. Using repeated years of schooling as a measurement of education wastage produces a cost, in educators salaries, representative of a loss of investment in education and increase in unit costs (Psacharopoulos, 2014). A loss of investment that represents up to 2% of the annual budget of the Western Cape Education Department should be addressed in the future planning of investments.

### Use and purpose of results

Determining a cost burden for educating learners with the challenges associated with FASD in mainstream classroom environments could provide support for advocacy to address FASD prevention and management.

The data yielded are pertinent to those advocating for FAS prevention and intervention programming and could be used to motivate for more training for educators in the educational challenges that learners with FASD present. Other possible applications

include greater awareness of the burden of FASD in programs like the *First 1000 Days* campaign run by the Western Cape Government.

### Limitations and Future Directions

The study sample was too small to achieve statistically significant results for risk differences. Nevertheless, the findings were consistent across the three outcomes and were all elevated for exposed children. Bearing in mind the wide uncertainties, the risk estimates could still be used to estimate costs, this being an exploratory study.

This study can be viewed as a pilot study for the robustness of this method of investigation into estimating a cost burden for the education system. The questionnaires provided sufficient information for costing calculations, and much more information than was used directly in this investigation. Some small design changes, such as altering questions to produce quantitative data, and reducing the number of variables to focus more on those that are relevant to costing would be useful if the instruments were to be used again.

There are many factors inside and outside of the classroom that contribute to learners' ability to perform academically. Factors such as home environment, comorbid diagnoses and socio-economic status (SES) all have an impact on a learner and could confound type of investigation. Learners who have FAS will likely come from families with other risk factors that can increase their adverse outcomes in an educational context, for example having a parent with very little formal education could alter a student's ability to perform academically as could a lack of resources that result from low SES. In this study, additional risk factors were not controlled for, and this gives results representative of the full impact of all factors on a learner's capacity. This full impact of all risk factors is what is experienced by educators in the classroom, and the resulting cost values are representative of the educator experience of their learners. This educator experience is a result of all of the risk factors, and due to the contribution of all factors involved it is not possible to attribute 100% of the calculated costs directly to the in utero alcohol exposure of the learner.

Another element of this study that attempted to reflect educator experience was the decision to group HE learners with CON learners. The data were processed with HE learners grouped with FAS/PFAS learners, removed from the cohort completely, and with HE learners in the comparison group with CON learners. Grouping the HE learners with FAS/PFAS learners was not, ultimately representative of the question this investigation wanted to address – what is the cost burden of the most extreme results of PAE (FAS and PFAS) on the education system, but is a direction that could be taken in a future study if the goal was the cost burden of all FASD. Separate analyses (not presented here but available from the author) showed that removing HE completely from the investigation resulted in only slightly greater RDs, and would have produced slightly higher costing results. However, grouping HE and CON as the comparison group is more reflective of the true situation faced by educators where HE children are part of the greater population of learners. These learners may be more disruptive, and may find lesson content more challenging than learners whose mothers abstained from alcohol during pregnancy, which has had an impact on the costing results in this study.

## **Conclusions**

The costing results found in this investigation, representing a conservative estimate of the economic burden of FAS/PFAS on the education system of the Western Cape, are considerable. Investment in education and prevention addressing the negative consequences of alcohol consumption during pregnancy may reduce the number of children born with FAS and PFAS, and consequently reduce the cost burdens on the Western Cape Department of Education. Another avenue that is essential to pursue in light of this cost burden in education is to implement educational policies that include training for teachers in the appropriate educational strategies for children with FAS, PFAS or any FASD in the classroom.

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## **Appendix A: Parental Consent Form**

## Parental Permission/Research Informed Consent

### Title of Study: Neural Bases of Eyeblink Conditioning in FASD

We are pleased to invite you and your child \_\_\_\_\_ to continue to take part in the study that you have been in since you were pregnant and your baby was born. Please read this form and ask us any questions you have before agreeing to be in the study. The people conducting this study are doctors and scientists from the Faculty of Health Sciences of the University of Cape Town School in South Africa and Wayne State University School of Medicine in the United States: Ernesta Meintjes, Ph.D., and Christopher Molteno, M.D., from University of Cape Town, and Sandra W. Jacobson, Ph.D., and Joseph L. Jacobson, Ph.D., from Wayne State University in the United States. It is being paid for by the National Institute on Alcohol Abuse and Alcoholism in the United States and the Department of Science and Technology and the National Research Foundation of South Africa.

**Study Purpose:** In this study we want to learn whether some aspects of a child's thinking and behavior are different when a mother drinks or and smokes during pregnancy, and whether genes (characteristics that you inherit from your parents) make it more or less likely that the child will show these differences. Other purposes of the study are to see whether your child's abilities when s/he was a baby and 5 years old predict how he or she is doing at 8-10 years of age. To help decide whether or not to agree to take part with your child in this study, a project staff member has talked with you about the risks and benefits of the study. This consent form summarizes the information given to you by the project staff member during this informed consent process.

The study will use new methods for studying the brain called MRI neuroimaging to better understand how drinking alcohol and smoking during pregnancy can affect a child's development. In neuroimaging, the child lies in a scanner that uses magnets to take pictures of the brain. In this part of the study, we will take pictures on the new scanner at Tygerberg Hospital while your child lies still and watches a video and does some simple finger tapping, attention, and memory tasks.

**Study Procedures:** If you agree to have your child take part in this study, we will bring you and your child to the our laboratory at the University of Cape Town (UCT) for 2-3 visits that will each take about 4 hours and to Tygerberg Hospital for one visit that should take about 3-4 hours in total.

- During the visits to University of Cape Town, your child will do simple tasks involving finger tapping, attention, learning and memory, arithmetic, word meanings, puzzles, circle drawing, and mazes (Wechsler Intelligence Scale for Children; paced/unpaced finger tapping; Circle Drawing task; timing and pitch perception tasks; California Verbal Learning Test).
- We will test your child's vision.
- In one task, your child will put on a special helmet. While your child is watching a video, a puff of air from the helmet will cause him/her to blink while hearing a tone to see if s/he learns to use the tone as a signal to blink before the air puff arrives.
- We will weigh and measure your child and take a photograph to look for facial features that often relate to alcohol exposure during pregnancy.
- During this visit, we will ask you some questions about your child's behavior and attention (Disruptive Behavior Disorders assessment), daily activities (Child Behavior Checklist), school and health history, and any medications that s/he is taking.
- We will ask you to update us about stressful experiences in your daily life during the past year (Life Events Scale), your current drinking, smoking, and drug use, attention problems you may have had as a child (Barkley-Murphy ADHD Scale), and stressful feelings that you experience, including sadness, anxiety, and distress (Beck Depression Inventory; Structured Clinical Interview for DSM-IV).
- At the end of the first visit, our research driver and nurse will take you and your child to a nearby clinic, where a technician/nurse will take a 5 cc blood sample (approximately 1 teaspoon) from your child's vein to test for lead and iron deficiency anemia. About 10 cc of blood (about 2 teaspoons) will be obtained from your child and yourself to study genetic differences that you and your child inherited from your family and have been found to be related to differences in alcohol use, depression, attachment, or child attention/behavior and development. We will also ask you and your child to give a small sample of

saliva (about 1 teaspoon) to study genetic differences that have been found to be related to differences in alcohol metabolism, depression, attachment, or child attention/behavior, and development. These samples will be stored and used for future genetic analyses.

- During the visit to Tygerberg, your child will first practice the finger tapping, and attention and memory tasks s/he will be doing on a computer while lying in the scanner. During the neuroimaging, your child will lie on a padded plastic bed that slides into the scanner. We will ask him/her to lie as still as possible while the pictures are being taken. Taking these pictures of the brain does not hurt and is used every day by many people in the hospital. During some of the time in the scanner, your child will watch videos and during some of the time s/he will do the finger tapping and other tasks that were practiced before entering the scanner. There will be two sessions in the scanner—both on the same day—one in the morning and one after lunch, which we will give you and your child while you are at Tygerberg. Each session in the scanner will last no longer than 45-60 minutes. Children with the following may not have an MRI but will take part in the rest of the visits: implanted medical devices, such as aneurysm clips in the brain, heart pacemakers, and cochlear (inner ear) implants; lead-based tattoos; or pieces of metal close to or in an important organ (such as, the eye); claustrophobia or fear of being in a small space.

**Benefits:** There may be no direct benefits for you; however, information from this study may help other people now or in the future. We will give you information about your child's development at this age. We will use the findings from this study for research purposes only. However, if a serious problem is found, we will tell you and refer your child to a doctor and/or someone who can help, if you would like us to do so. If your child is suffering from any major illness, we will send you to Red Cross Children's Hospital. No information about your child will be given to any doctors, hospitals, or schools unless you ask us and allow us to do so in writing.

**Risks:** None of the procedures we use at UCT or Tygerberg are dangerous for you or your child. The risks of drawing blood include some temporary discomfort or swelling, and rarely, infection. These risks that will be minimized because the procedure will be done by a trained phlebotomist (nurse/technician who has been specially trained to draw

blood). We will begin by introducing you and your child to the research staff and will give you both breakfast each day before the assessment begins. You will be present in a room nearby during all of your child's assessments and will be present with your child during the physical examination and blood draw. During the MRI neuroimaging assessment, certain metal objects, such as, watches, credit cards, hairpins, and writing pens, may be damaged by the MRI scanner or pulled away from the body by the magnet. For these reasons, we will ask your child to remove these before going into the scanner. When the scanner makes the pictures, the bed may shake, and your child will hear loud banging noises. S/he will be given earplugs or headphones to protect the ears. Also, some people feel nervous in a small closed space, such as when they are in the scanner. Your child will be able to see out of the scanner at all times, and we will not start until s/he tells us that s/he is comfortable. S/he will be able to stop the scanning at any time by squeezing a ball that s/he will hold in one hand and can talk to us using an intercom that is built into the scanner. There are no known harmful long-term effects of the magnetic fields used in this study. There is little risk that anything we tell you will be told to people outside the study and we will do everything we can to keep this information secret, as described below, except that evidence of child abuse or neglect will be reported to the appropriate authorities, as required by law, and may report other illegal activities that are reported to us during the visit.

**Research Related Injuries:** If you or your child is injured during the study, you will get treatment including first aid, emergency treatment and follow-up care, as needed. No reimbursement, compensation, or free medical care is offered by Wayne State University or the University of Cape Town. If you think that your child has suffered a research related injury, let the investigator know right away.

**Study Costs:** There will be no cost to you or your child for taking part in this research study, and you and your child will be transported to the laboratory at University of Cape Town and Tygerberg Hospital by our driver.

**Compensation:** For taking part in this research study, we will give you R150 (\$25) for each visit and a photo of your child, and we will give your child a small gift. You and your child will also be given breakfast and lunch each time you and your child come to University of Cape Town or Tygerberg Hospital.

**Confidentiality:** We will keep all information collected about you and your child during the study secret to the extent permitted by law. This information will not be used in any way that can allow anyone else to know what you or your child has told us, except that evidence of child abuse or neglect will be reported to the appropriate authorities, as required by law. You and your child's names will not be in the research records, only your code number. We will not give out any information that names you or your child unless you give us written permission, but your records may be reviewed by the study sponsor, the Human Investigation Committee at Wayne State University, the University of Cape Town Research Ethics Committee, or governmental agencies with appropriate regulatory oversight. The list linking names and code numbers will be stored in locked file cabinets in the research laboratory. Only project staff members who need to contact you by telephone or in person will be allowed to look in these files. Information from this study, including photos may be presented in scientific meetings or journals or for teaching purposes, but your and your child's names will be kept secret.

**Voluntary Participation/Withdrawal:** Taking part in this study is voluntary. You may decide to have your child take part and later change your mind and quit the study. You and your child are also free not to answer any questions or to stop any task before it is finished. Withdrawal from the study would not lead to any problems for you or your child. The researcher or the sponsor may also stop your child's taking part in this study without your agreeing to it.

**Questions:** If you have any questions now or in the future, you may contact Drs. Ernesta Meintjes or Christopher Molteno at 021-406-6212 or Dr. Sandra W. Jacobson at 001-313-993-5454. If you have questions or concerns about you or your child's rights as a research participant, you can contact the Chairs of either the University of Cape Town Research Ethics Committee (021 406-6338) or the Wayne State University Human Investigation Committee (001-313-577-1628).

**Consent to Participate in a Research Study:** To voluntarily agree to have your child take part in this study, you must sign on the line below. If you decide to take part with your child, you or your child may quit at any time. You are not giving up any of your or your child's legal rights by signing this form. Your signature shows that you have read,

or had read to you, this whole consent form, including the risks and benefits, and that we have answered all your questions. We will give you a copy of this consent form to take home.

---

\_\_\_\_\_  
Signature of Parent or Legally Authorized Guardian

Date

---

\_\_\_\_\_  
Printed Name of Parent or Authorized Guardian

Time

---

\_\_\_\_\_  
Oral Assent (children age 7-12 years)

Date

---

\_\_\_\_\_  
\*\*Signature of Witness (When applicable)

Date

---

\_\_\_\_\_  
Printed Name of Witness

Time

---

\_\_\_\_\_  
Signature of Person Obtaining Consent

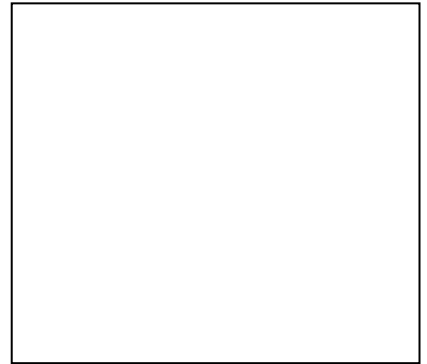
Date

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\_\_\_\_\_  
Printed Name of Person Obtaining Consent

Time

\*\* Use when parent has had consent form read to them (i.e., illiterate, legally blind, translated into foreign language).



## **Appendix B: Parental Consent for information gathering at schools**

# UNIVERSITY OF CAPE TOWN



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## Child Development Research Laboratory

Faculty of Health Sciences  
University of Cape Town  
Observatory Cape 7925  
South Africa  
Tel: + 27 21 406 6212  
Fax: + 27 21 447 7943

Dear \_\_\_\_\_

Your student \_\_\_\_\_ is participating in a research study on child growth and development at the University of Cape Town. Most of the assessments are conducted in our laboratory at the university. We would be very grateful if we could obtain information from you about how s/he is doing in school.

We have discussed this aspect of the study with his or her parent(s) and obtained their consent, as indicated below. I am writing to ask you to fill out the attached questionnaire and return it to me at the University of Cape Town in the enclosed stamped envelope. Thank you for your assistance.

Sincerely

Professor Christopher D. Moltano M.D.

---

## PARENTAL RELEASE

To: \_\_\_\_\_

I hereby give permission for you to provide the information about my child  
\_\_\_\_\_ which has been requested by Prof. Molteno in this  
letter.

Thank you.

\_\_\_\_\_  
(date)

\_\_\_\_\_  
(parent's signature)

## **Appendix C: Educator questionnaire**

**Cape Town 9 year Follow-up  
Education Assessment - Educator**

ID

Day  Month  Year

**Please write 'DK' (Don't Know) next to any items for which you don't know the answer**

**Fill in the circle that best fits your response**

How many lessons do you teach in a day?

How long is each lesson?  30 minutes  45 minutes  60 minutes  other

If other, please specify.  mins

How many disruptions are caused by learners due to unruly behaviour in an average lesson?  none  1  2  3  4  5  6  7

In general how long does it take to settle the class after a disruption?  2 minutes  5 minutes  10 minutes  15 minutes

What percentage of your teaching time is used settling disruptions in the class?  <20%  20% - 40%  >40%

Are there learners in your class who require additional assistance to understand the lesson content?  Yes  No

If yes, are you able to assist these learners during class time?  Yes  No

What percentage of your teaching time is used to directly assist learners who are struggling with the content?  <20%  20% - 40%  >40%

**Fill in the circle that best describes the learner to whom the parental consent form applies.**

How disruptive is this learner in comparison to the rest of the class?  Less  The Same  More

How often is this learner disruptive?  Never  <50% of classes  >50% of classes  Every class

How many times in a week would this learner disrupt your class?

Does this learner require extra assistance with lesson content?  Yes  No

If yes, are you able to assist this learner during class?  Yes  No

If yes, how many minutes would you spend with this learner specifically during class?  2 min  5 min  8 min  10 min  12 min

Do you provide extra support of any kind to this learner compared to other learners?

Yes  No

If yes, please provide details.

---

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---

Does this learner require any additional classroom resources?  Yes  No

If yes, please describe these resources.

---

---

Are there any consequences for disruptive behaviour for learners in your class eg. detention?

Yes  No

Does this learner regularly receive the consequences for disruptive behaviour?

Yes  No

Has this learner had to repeat a year of schooling?

Yes  No

If yes, how many times?

1  2  more

How many days in a week is this learner absent from school on average?

none  1  2  3

How many days in a month is this learner absent from school on average?

none  1  2  3  4  5  6  more

When compared with other learners how often is this learner absent from school?

less  the same  more

Does this learner attend any afterschool programs for additional help or discipline reasons?

Yes  No

For how many years have you been an educator in this school?

--	--

For how many years have you been a qualified educator?

--	--

## **Appendix D: Principal questionnaire**

**Cape Town 9 year Follow-up  
Education Assessment - Principal**

ID 

--	--	--

Day 

--	--

 Month 

--	--

 Year 

--	--	--	--

**Please write 'DK' (don't know) next to any items for which you don't know the answer**

How many educators are employed at your school? 

--	--	--	--

How many learners attend your school? 

--	--	--	--

What is the annual school fee contribution for each learner at your school?

---

Does your school run additional after hours programs for learners who struggle with class content?

Yes  No

If yes, how many days per week?

1  2  3  4  5

How many supervising educators participate in the program on each day?

--	--

For how many hours does the program run?

1  2  3  4

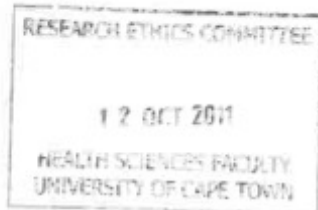
## **Appendix E: UCT Ethics approval**

**Amendment Form**

Date	10 October 2011
HREC REF Number	187-2008
Protocol number (if applicable) & Protocol title	Neural Bases of Eyeblink Conditioning in FASD: Addendum 1 (additional teacher questionnaire)
Principal investigator	A Prof EM Mentjies
Department / Office Internal Mail Address	Human Biology Anatomy Building Room 7.02 Health Sciences Faculty, Anzio Road Observatory 7925

**List of Proposed Amendments with Revised Version Numbers and Dates**

1. Education Cost Assessment – Educator, version 1, 10 October 2011
2. Education Cost Assessment – Principal, version 1, 10 October 2011



**HREC office use only (FWA00001637; IRB00001938)**

<input type="checkbox"/> Approved	<input checked="" type="checkbox"/> Type of review: Expedited	<input type="checkbox"/> Full committee
This serves as notification that all changes and documentation described above are approved.		
Signature Chairperson of the HREC	<b>Signed</b>	Date 13 Oct 11

PP

## **Appendix F: Education Department Research Registration**

[Audrey.wyngaard2@pgwc.gov.za](mailto:Audrey.wyngaard2@pgwc.gov.za)

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

wced.wcape.gov.za

**REFERENCE:** 20121115-0032

**ENQUIRIES:** Dr A T Wyngaard

Miss Emma Makin  
Faculty of Health Sciences  
UCT  
Observatory

**Dear Miss Emma Makin**

**RESEARCH PROPOSAL: COST OF FETAL ALCOHOL SPECTRUM DISORDERS IN THE EDUCATION SYTEM – AN INVESTIGATION IN THE WESTERN CAPE**

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Approval for projects should be conveyed to the District Director of the schools where the project will be conducted.
5. Educators' programmes are not to be interrupted.
6. The Study is to be conducted from **16 January 2013 till 30 August 2013**
7. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
8. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
9. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
10. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.

11. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.

12. The Department receives a copy of the completed report/dissertation/thesis addressed to:

**The Director: Research Services**  
**Western Cape Education Department**  
**Private Bag X9114**  
**CAPE TOWN**  
**8000**

We wish you success in your research.

Kind regards.

Signed: Dr Audrey T Wyngaard

for: **HEAD: EDUCATION**

**DATE: 15 November 2012**

## **Appendix G: 2012 Educator Salary Scales**

**SCHEDULE 1: SALARY NOTCHES WITH EFFECT FROM 1 MAY 2012 FOR FULL-TIME EMPLOYEES: EDUCATORS**

Notches			Notches			Notches			Inclusive Package		
Notch Code	1/7/2010	1/5/2011	Notch Code	1/7/2010	1/5/2011	Notch Code	1/7/2010	1/5/2011	Notch Code	1/7/2010	1/5/2011
001	67 101	71 666	79 980	082	147 545	157 570	168 033	183	327 334	349 501	374 052
002	67 773	72 381	77 448	083	148 022	159 159	170 238	184	330 603	353 085	377 823
003	68 454	73 110	78 226	084	150 510	160 748	171 939	185	333 969	356 616	381 679
004	69 136	73 827	79 009	085	152 010	162 254	173 710	186	337 257	360 199	385 401
005	69 823	74 574	79 794	086	154 501	163 971	175 449	187	340 620	363 783	389 247
006	70 512	75 306	80 577	087	155 089	165 809	177 207	188	344 095	367 418	393 138
007	71 209	76 038	81 363	088	156 824	167 274	178 983	189	347 472	371 100	397 073
008	71 925	76 819	82 191	089	158 104	168 942	180 700	190	350 549	374 814	401 052
009	72 634	77 595	83 028	090	159 714	170 840	182 566	191	354 456	378 598	405 037
010	73 393	78 372	83 859	091	161 364	172 338	184 407	192	358 022	382 347	409 170
011	74 127	79 187	84 758	092	162 969	174 199	186 262	193	361 578	386 100	413 366
012	74 899	79 941	85 542	093	164 516	175 809	188 115	194	365 196	390 030	417 332
013	75 620	80 742	86 394	094	166 200	177 667	190 096	195	368 844	394 024	421 500
014	76 353	81 589	87 258	095	167 922	179 360	191 894	196	372 524	397 899	425 718
015	77 115	82 359	88 125	096	169 589	181 121	193 609	197	376 246	401 593	429 984
016	77 899	83 164	89 007	097	171 290	182 937	195 744	198	380 025	405 387	434 277
017	78 713	84 024	89 907	098	172 969	184 757	197 697	199	383 829	409 309	438 821
018	79 448	84 940	90 789	099	174 733	186 721	199 663	200	387 690	414 251	443 001
019	80 203	85 922	91 722	100	176 484	188 854	201 873	201	391 523	419 198	447 428
020	81 006	86 877	92 837	101	178 244	190 366	203 024	202	395 448	424 305	452 192
021	81 847	87 896	93 956	102	180 021	192 101	204 719	203	399 458	429 507	457 201
022	82 743	88 959	94 480	103	181 827	194 100	207 783	204	403 442	434 747	462 508
023	83 577	89 196	95 439	104	183 642	196 311	209 859	205	407 442	439 147	467 806
024	84 343	90 001	96 387	105	185 478	198 690	211 854	206	411 510	443 694	473 289
025	85 181	90 894	97 383	106	187 338	200 075	214 030	207	416 666	449 688	479 962
026	86 037	91 867	98 319	107	189 216	202 083	216 228	208	421 772	448 517	478 700
027	86 942	92 901	99 442	108	191 106	204 102	218 389	209	426 867	452 817	484 518
028	87 957	94 013	100 417	109	193 000	206 153	220 643	210	432 561	457 302	489 344
029	88 981	95 237	101 407	110	194 943	208 200	222 774	211	437 827	461 910	494 744
030	89 743	96 779	102 416	111	196 867	210 276	224 904	212	443 627	466 030	499 188
031	89 637	95 733	102 480	112	198 864	212 388	227 236	213	441 158	471 158	504 185
032	90 524	96 680	102 450	113	200 841	214 407	228 617	214	448 598	476 939	508 228
033	91 421	97 647	104 481	114	202 804	216 454	231 819	215	450 054	480 657	514 302
034	92 355	98 634	106 557	115	204 873	218 511	234 129	216	454 551	485 402	519 441
035	93 284	99 606	108 670	116	206 940	221 071	238 484	217	459 109	490 323	524 546
036	94 203	100 603	107 652	117	209 004	223 242	238 841	218	464 104	495 227	529 609
037	95 142	101 613	108 729	118	210 141	224 432	240 541	219	468 342	500 190	535 205
038	96 081	102 615	109 797	119	212 238	226 971	242 336	220	473 018	505 179	540 543
039	96 988	103 683	110 822	120	214 284	229 828	244 253	221	477 723	510 265	546 568
040	96 703	104 695	112 014	121	216 319	231 240	247 428	222	482 532	515 343	551 416
041	96 515	105 747	113 148	122	218 367	233 415	249 842	223	487 344	520 402	556 517
042	96 459	106 800	114 276	123	220 433	235 515	252 353	224	492 228	525 659	562 407
043	100 955	107 662	115 413	124	222 028	238 227	254 904	225	497 146	530 955	568 122
044	102 306	108 942	118 968	125	225 297	240 813	257 450	226	502 116	536 259	573 790
045	103 922	110 917	117 747	126	227 647	243 021	260 231	227	507 126	541 811	579 525
046	104 256	111 732	118 911	127	229 914	245 442	263 823	228	512 205	547 035	585 377
047	105 269	112 245	120 103	128	232 126	247 911	266 296	229	517 329	552 954	591 180
048	106 162	113 072	121 305	129	234 447	250 387	267 915	230	522 482	558 021	597 081
049	107 223	114 513	122 629	130	236 793	252 900	270 650	231	527 727	563 013	603 066
050	109 201	116 858	123 753	131	239 183	255 436	273 306	232	533 037	568 250	609 099
051	109 314	116 911	124 999	132	241 666	257 983	276 045	233	538 323	574 336	615 160
052	110 457	117 988	126 228	133	243 989	260 559	278 789	234	542 708	580 982	621 327
053	111 588	119 148	127 485	134	246 458	263 153	281 560	235	546 153	586 454	627 549
054	112 811	120 338	128 757	135	248 959	265 782	284 388	236	549 646	592 382	633 828
055	113 809	121 548	130 056	136	251 582	268 445	287 293	237	553 196	598 390	640 173
056	114 336	122 751	131 343	137	253 878	271 148	290 124	238	556 795	604 287	646 554
057	116 091	125 884	132 803	138	256 413	273 848	293 019	239	571 449	610 308	653 031
058	117 265	128 255	134 021	139	258 918	276 588	296 060	240	577 157	616 413	659 562
059	118 419	129 871	135 324	140	261 588	279 345	298 859	241	582 947	622 541	666 192
060	119 604	131 737	136 630	141	264 186	282 130	301 881	242	588 944	628 694	672 944
061	120 804	133 818	138 048	142	266 870	284 964	304 911	243	595 196	634 874	679 911
062	122 016	136 014	139 437	143	269 647	287 811	307 959	244	601 644	641 089	687 084
063	123 228	138 227	140 820	144	272 478	290 685	311 084	245	608 294	647 339	694 373
064	124 408	140 621	142 224	145	275 360	293 592	314 143	246	615 144	653 624	701 776
065	125 700	143 247	143 643	146	278 295	296 529	317 286	247	622 194	660 044	709 291
066	126 961	145 991	145 083	147	281 284	299 499	320 469	248	629 444	666 599	716 914
067	128 244	148 862	146 553	148	284 329	302 499	323 673	249	636 894	673 289	724 747
068	129 513	151 821	148 002	149	287 430	305 514	326 901	250	644 544	680 114	732 791
069	130 819	154 710	149 490	150	290 587	308 549	330 189	251	652 394	687 579	740 944
070	132 117	157 550	150 976	151	293 802	311 567	333 483	252	660 444	695 194	749 307
071	133 448	160 321	152 498	152	297 076	314 588	336 860	253	668 694	702 949	757 880
072	134 716	163 042	154 017	153	299 411	317 618	340 319	254	677 144	710 844	766 563
073	136 131	165 789	155 659	154	302 806	320 667	343 861	255	685 794	718 879	775 356
074	137 450	168 523	157 116	155	306 251	323 734	347 486	256	694 644	727 054	784 269
075	138 844	171 208	158 631	156	309 746	326 829	351 194	257	703 694	735 369	793 292
076	140 250	173 797	160 272	157	313 291	329 954	354 986	258	712 944	743 824	802 425
077	141 681	176 294	161 874	158	316 886	333 109	358 861	259	722 394	752 429	811 668
078	143 127	178 791	163 418	159	320 531	336 294	362 819	260	732 044	761 174	821 021
079	144 528	181 294	165 053	160	324 226	339 509	366 851	261	741 894	770 069	830 584
080	146 029	183 847	166 786	161	327 971	342 754	370 966	262	751 944	779 114	840 357
081	146 986	186 618	168 528	162	331 766	346 029	375 157	263	762 194	788 319	850 240

## Appendix H: Tabulation of Cost Calculations

Education Impact					
		<b>Disruptions</b>	<b>Assistance with content</b>	<b>Repeated years of schooling</b>	<b>Assumptions(A)/Notes(N)</b>
<b>Time used</b>		16.61 minutes daily	8.78 minutes daily	1/31.64 of an educator's time	
<b>% of time</b>		5.57	2.95	3.16	(A): Daily use of an educator's time is representative of their annual use of time
<b>Cost (ZAR) for one learner with the education impact</b>		9336.74	4935.37	5295.68	(N): cost for repeated years of schooling is not repetitive. Costs for disruption and assistance are repetitive.
Scaling up to Western Cape Population					
<b>Risk Difference</b>		0.1941	0.3015	0.1893	(N): Learners with FAS/PFAS had x additional instances of educational impact per 1000 compared to learners without FAS/PFAS
<b>Number of learners in WC public primary schools with FAS/PFAS</b>	10.46% prevalence	50,981.41	50,981.41	50,981.41	(A): study population in May et al., 2013 is representative of WC learner population
	16.06% prevalence	78,275.48	78,275.48	78,275.48	
<b>Additional instances of educational outcome in</b>	10.46% prevalence	9897.78	15371.67	9650.05	(A): study population is representative of WC learner population
	16.06% prevalence	15196.78	23601.25	14816.43	

<b>FAS/PFAS population</b>				
<b>Cost to the WC (individual cost x above # of learners)</b>	10.46% prevalence	92,412,920.26	75,864,923.73	51,103,596.7
				0
	16.06% prevalence	141,888,288.6	116,480,944.0	78,463,074.8
		6	8	6

All monetary values were converted to USD at an exchange rate of ZAR13.1827 to USD1.

## **Appendix I**

Author Instructions for : ***Drug and Alcohol Dependence***

**Full-length Reports** reporting original results of research within the field of drug, alcohol and tobacco use and dependence. A Full-length Report typically should not exceed 4000 words (for the introduction, methods, results and discussion).

### ***Subdivision - numbered sections***

Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

### ***Introduction***

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

### ***Material and methods***

Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described.

### ***Results***

Results should be clear and concise.

### ***Discussion***

This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

### ***Conclusions***

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.