

**Perinatal suicidality: Prevalence and Correlates in a South African Cohort**

**by**

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DECLARATION

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**List of abbreviations (in alphabetical order)**

AP – Antepartum

BDI – Beck Depression Inventory

CM – Childhood Maltreatment

CPMD – Common Perinatal Mental Disorders

CRF – Case Report Form

DCHS – Drakenstein Child Health Study

DRC – Departmental Research Committee

DSM-IV – Diagnostic and Statistical Manual of Mental Disorders (4<sup>th</sup> Edition)

EPDS - Edinburgh Postnatal Depression Scale

GCP – Good Clinical Practice

HIC – High Income Country

HDRS – Hamilton Depression Rating Scale

HREC – Human Research Ethics Committee

IPV – Intimate Partner Violence

LMIC – Low and Middle Income Countries

MDD – Major Depressive Disorder

MINI – Mini International Neuropsychiatric Interview

MPSS – Modified PTSD Symptom Scale

NSSI – Non-suicidal self-injury

PHQ – Patient Health Questionnaire

PP – Post-partum

PTSD – Post-traumatic stress disorder

SCID – Structured Clinical Interview for the DSM

SI – Suicidal Ideation

SIB – Suicidal Ideation and Behaviour

SOP – Standard Operating Procedure

UCT – University of Cape Town

WMA – World Medical Association

## Glossary

It is of critical importance that clinicians and researchers use standardised nomenclature to distinguish the following interrelated but distinct concepts (Silverman et al. 2007(b); Nock et al. 2008(a)):

- Non-fatal suicidal thoughts/ideation and behaviours (SIB)\*:
  - (1) *Suicidal ideation* – thinking about ending one’s life
  - (2) *Suicide plan* – making plans for an attempt including method, plans to avoid rescue, suicide note, getting affairs in order
  - (3) *Suicide attempt* – engaging in behaviour that could result in injury or death in which there is “at least some intent to die”
- Suicidal Intent – the wish to end one’s life. May be assessed by exploring frequency and intensity of *suicidal ideation*, lethality and comprehensiveness of *suicide plan* and whether there has been a *suicide attempt*.
- Suicide – the act of intentionally ending one’s own life

Note that people who successfully end their lives represent a heterogenous group with regards to suicidal intent; people may be very certain about their choice to end their life, they may be ambivalent or they may be accidentally successful (i.e. when misjudging what dose of a medication will be fatal).

- Non-suicidal self-injury (NSSI)

Deliberately injuring oneself without any intention to die, rather the aim is to alleviate psychological distress and/or communicate the severity of distress to others.

\*The focus of this thesis



## **Abstract**

**Background** – Suicide caused 1% of maternal deaths in South Africa in recent years. Suicidal ideation and behaviour (SIB) in the perinatal period is common and is associated with completed suicide. Data regarding perinatal SIB in low and middle-income countries (LMICs) are lacking, and available work is limited by reliance on self-report scales. There are even fewer data on risk categories of SIB, risk factors for SIB severity and the longitudinal course of SIB. We collected cross-sectional and longitudinal data on SIB, SIB severity, and potential correlates from peri-urban South African women who were enrolled in a birth cohort. A well validated screening measure for perinatal depression, the Edinburgh Postnatal depression scale (EPDS) has unknown sensitivity and specificity when assessing perinatal SIB (using question 10: EPDS-Q10) compared to a gold standard diagnosis.

**Objectives** – First, to determine the perinatal prevalence of SIB and its sociodemographic, psychosocial and psychiatric correlates, using a validated clinician-administered assessment tool in a broadly representative sample of South African women. Second, to analyse correlates for low, medium and high risk categories of SIB separately. Third, to determine the longitudinal course and correlates of SIB in the perinatal period. Fourth, to compare the sensitivity and specificity of the self-report EPDS – Q10 to a gold standard diagnostic measure.

**Methods** – Data were collected from participants in the Drakenstein Child Health Study (DCHS) cohort during pregnancy and at 6 months post-partum (PP). SIB was measured using the MINI International Neuropsychiatric Interview (MINI). Self-report and clinician-administered questionnaires assessed sociodemographic, psychosocial, and psychiatric risk factors. Multivariable analysis determined cross sectional risk and protective factors. To

determine predictors of the risk categories of SIB (None = 0, Low = 1-8, Medium = 9-16, and High  $\geq$  17), multinomial regressions were used.

Selecting women who never reported SIB as a reference group, multinomial regression analysis yielded information about risk and protective factors for reporting sustained or new SIB, as well as cessation of SIB. The ROC curve determined an optimum cut-off score and the area under the curve (AUC) indicated maximum sensitivity and specificity of the EPDS-Q10 when compared to the MINI - section B diagnosis of perinatal SIB in the same women.

**Results** – The antenatal prevalence of SIB was 19.9% and the post-partum prevalence was 22.6%. Factors independently predicting the presence of SIB included younger age antenatally and PTSD post-partum with depression positively associated with SIB at both time points. Depression and PTSD predicted belonging to the high risk SIB group while membership of the low risk SIB group was associated with both these mental illnesses as well as recent intimate partner violence (IPV), food insecurity and childhood trauma. Of the 121 women assessed at both time points, 71% women never reported SIB, 10.7% reported sustained SIB (i.e., SIB before and after the birth), 9.1% reported new SIB (i.e., no SIB antenatally but SIB post-partum) and 9.1% reported cessation of SIB (i.e., SIB antenatally but no SIB post-partum) Low participant numbers prohibited inferences regarding risk factors for sustained SIB or new onset SIB. The AUC of the EPDS-Q10 was 0.605 denoting low clinical utility for SIB screening.

**Conclusions** – The prevalence of perinatal SIB was consistent with previous findings in South Africa but relatively high compared to other LMICs and HICs. Findings on the association of perinatal SIB with younger age and Depression are consistent with previous work in LMICs. The association of perinatal SIB with PTSD in South Africa is a novel one, and underscores the importance of assessment of trauma exposure and outcomes in this

population. Different risk categories of SIB may have different aetiologies and causal pathways and require different interventions. A small but significant percentage of women experience persistent SIB throughout the perinatal period. An acceptable and feasible screening tool with high sensitivity and specificity for perinatal SIB is needed in this population where perinatal suicidality is highly prevalent.

**Keywords** Suicidality; Suicidal Ideation; Suicidal Behaviour; Perinatal; Maternal; Pregnancy; Post-partum; South Africa

## **Introduction**

### **Background and Rationale**

Suicide is the leading cause of death among perinatal women (Oates 2003; Chang et al. 2005), accounting for 0.65 to 3.55% of pregnancy-related mortality in LMICs (Fuhr et al. 2014). In South Africa 1% of maternal deaths between 2014 and 2016 were attributable to suicide. (National Committee for Confidential Enquiries into Maternal Deaths 2018). Suicidal ideation (SI) during pregnancy is one of the strongest predictors of suicidal ideation, suicide attempts, and completed suicide post-partum (Lindahl et al. 2005).

Perinatal suicidal ideation and behaviour (SIB), associated risk factors, pathways to development of SIB and progression to completed suicide is still poorly understood. Epidemiological data on perinatal SIB are therefore necessary in order to develop screening programs and ultimately implement treatment and prevention strategies. As evident by South African research, not only is maternal health and safety at stake, but also new-born birth outcomes (Brittain et al. 2015) and the mother-infant relationship (Cooper et al. 1999).

Pregnancy and the post-partum are a periods of increased physiological complexity. Normal pregnancy symptoms such as appetite and sleep disturbance may mimic mental illness. Conversely the symptoms of mental illness may falsely be attributed to the normal hormonal changes occurring during pregnancy and lactation post-partum. The complex pattern of “normal” (statistically speaking) perinatal mood, somatic and psychological symptoms in non-clinical samples has only recently begun to be explored (Castro et al. 2017). Treatment of pre-existing or newly arising mental illness increases in clinical complexity during the perinatal period when placental transmission of medication to the foetus or transmission to the new-born via breastfeeding and its impact on child health has to be considered. Women

may discontinue medication out of fear of harming their child (during fetal development or lactation) or because of changing side effects (due to normal pregnancy associated physiological changes such as increased liver metabolism or renal filtration).

Pregnancy and the post-partum period also cause changes in interrelated psychosocial factors. Known risk factors for SIB in the general population include female gender, younger age, lower education level, being unmarried, and having a mental disorder (Nock et al. 2008(b)). These factors may determine levels of social and health service support once pregnant and lead to an increase in perinatal SIB indirectly as well as directly. Another area of risk is the pregnancy itself; whether uneventful or complicated it may influence mental health, add pressure on financial resources and increase the risk for intimate partner violence (IPV) (Shamu et al. 2011), further increasing the risk for SIB through a third pathway.

Suicidal ideation and behaviour seems more common in pregnant women when compared to the general population (Lindahl et al. 2005; Gelaye et al. 2016), although studies comparing SIB to non-pregnant women of child bearing age in the same population are lacking. Evidence also suggests that SIB is more common in the post-partum period when compared to adults in general (Howard et al. 2011; Rodriguez et al. 2018). A multitude of associated factors are identified; mental illness (i.e., depression, PTSD), psychosocial stressors (i.e., intimate partner violence, childhood maltreatment) and sociodemographic risk factors (i.e., failure to complete high school, younger age) have been consistently reported for antepartum SIB (Gelaye et al. 2016) and post-partum SIB (Howard et al. 2011; Muzik et al. 2016). In the only two studies examining the longitudinal course of SIB, in Australia and South Africa respectively (Giallo et al. 2018; Rodriguez et al, 2018), despite their diverse populations and risk factor profiles, a small but significant percentage (7%) that translates as large numbers of women displayed a pattern of sustained suicidal ideation with adversity, trauma and mental illness being common predictors.

The literature on SIB in perinatal women has several limitations. First, there is limited research in low and middle income countries (LMICs) such as South Africa, where different socioeconomic circumstances make research findings from High income countries (HICs) less generalizable (Shamu et al. 2016; Rochat et al. 2013; Onah et al. 2017, Rodriguez et al. 2018). Second, even fewer studies employ more objective clinician-rated outcome measures that can capture the diverse clinical presentation of SIB. Third, prediction models focus on the presence versus absence of perinatal SIB rather than on more fine-grained analyses of SIB severity. Fourth, few of these studies assess SIB, and risk factors for this, longitudinally (Rodriguez et al. 2018). Lastly, while the Edinburgh Postnatal Depression Scale (EPDS) has been validated internationally (Eberhard-Gran et al., 2001) and in South Africa (Lawrie et al. 1998; De Bruin et al. 2004) for depression screening in perinatal women it is less certain whether one question (EPDS-Q10) is adequate screening for the complex cognitive phenomena and heterogenous behaviours that constitute SIB.

The Drakenstein Child Health Care Study (DCHS) is a birth cohort study in South Africa collecting observational data on a peri-urban population of women and their children (Zar et al. 2015; Stein et al. 2015). The study incorporates a clinician-rated measure of SIB, including SIB severity, administered at several time points. A wealth of data regarding the mothers are collected throughout the perinatal period via a comprehensive battery of self-administered and clinician-administered assessment measures. In this thesis I use data from the DHCS to assess perinatal prevalence of SIB and sociodemographic, psychosocial and psychiatric correlates of SIB. The measure will allow for finer distinction between risk categories of SIB and subgroup analysis. Correlations between risk and potential protective factors will be examined looking at cross sectional as well as longitudinal data. I will determine whether a simple self-assessment question can discriminate accurately between women with and without SIB.

This study aims to:

- 1) Determine the perinatal cross sectional prevalence of SIB using a validated clinician administered assessment tool in a broadly representative sample of South African women. Included in this aim is examining correlates of SIB – sociodemographic, psychosocial and psychiatric risk factors.
- 2) Explore the heterogenous risk categories of SIB and their correlates.
- 3) Determine the longitudinal course of SIB as well as predictors of new onset and sustained SIB.
- 4) Examine validity of an affordable, accessible, and self-administered screening tool (EPDS-Q10) when assessing SIB perinatally compared to the current gold standard (MINI-Section-B) in this population.

The research hypotheses are the following:

- 1) SIB will be highly prevalent in this community during pregnancy and postpartum.
- 2) Established risk factors may be strongest associated with the high risk SIB category.
- 3) A small but significant group of women will suffer from persistent SIB.
- 4) The EPDS-Q10 will be sensitive and specific when screening for SIB perinatally when compared to the clinician administered MINI - section B.

The perinatal period is a time of vulnerability and complexity and women in LMICs may face additional challenges. This thesis aims to address several gaps in the literature concerning perinatal SIB in a LMIC using data from a cohort of South African women. What percentage of perinatal women are affected by SIB? How does SIB change over time? What predicts SIB and how we can screen for SIB? Having briefly outlined the background and rationale for this study, I will review and discuss the relevant literature pertaining to perinatal SIB in the next chapter.

## **Chapter 1: Perinatal Suicide and SIB**

This chapter outlines the local and international research findings on perinatal suicide and SIB.

### **1.1 Perinatal suicide**

Suicide is a leading cause of death worldwide, with 79% of suicides estimated to occur in low- and middle-income countries (LMICs) (WHO 2016). Suicide is the leading cause of death among perinatal women (Oates 2003; Chang et al. 2005) accounting for between 5 – 20% of maternal deaths in high income countries (CEMACH, UK; Lang and King 2008; Thornton et al. 2013; Esscher et al. 2016). A recent systematic review of LMIC studies found a pooled prevalence rate of 0.65 to 3.55% for suicide as cause of pregnancy-related mortality (Fuhr et al., 2014). Whether obscured by more preventable causes of maternal mortality in poorer countries or gaining attention in countries with well-funded maternal health services, maternal suicide constitutes a devastating occurrence. The focus of research and prevention strategies has been identifying high risk individuals and elucidating causal pathways.

Comparison of suicides in women of child bearing age to suicides actually in the perinatal period has only been attempted more recently. Initial reports suggested women from the general population are less likely to commit suicide during pregnancy or post-partum. (Marzuk et al. 1997; Gissler et al. 2005). However when considering women with serious affective or psychotic mental illness the risk of suicide appears to be elevated (Appleby et al. 1998; Cantwell et al. 2011). Women in the perinatal period tend to choose more violent methods in contrast to their usual preference of non-violent methods (Esscher et al. 2016;



Khalifeh et al. 2016) possibly suggesting increased illness severity and more serious intent (Lindahl et al. 2005).

A number of systematic reviews and large studies on associated risk factors for completed suicide in the perinatal period have been done. First, a systematic review of risk factors for suicide during pregnancy listed the following: women that have a current or past history of psychiatric disorders, lower age, being unmarried, unemployment, having incurred an unplanned pregnancy (eventually terminated with an induced abortion), addiction to illicit drugs and/or alcohol, lack of psychosocial support, and episodes of sexual or physical violence (Gentile 2011). Second, the UK National Confidential Inquiry into Suicides and Homicides by People with Mental Illness (1997 – 2012) reported on people who died by suicide within a year of contact with Psychiatric services. Perinatal suicide was defined as occurring during pregnancy or in the 1<sup>st</sup> year post-partum. Of the 1485 women of childbearing age (20-35) to die by suicide, 4% (n = 74) were in the perinatal period. The perinatal suicides were associated with a diagnosis of depression, shorter illness duration, no alcohol use and the women were less likely to be receiving any active treatment at the time of death. They were comparatively younger and more likely to be married. There were no differences in clinic visits or treatment compliance. (Khalifeh et al. 2016). Overlapping but distinct risk factor profiles therefore characterise women who die by suicide perinatally when compared to well established risk factors (mental illness, trauma, lack of psychosocial support) for completed suicide in any person (Bantjes & Kagee 2013).

## **1.2 Linking Perinatal Suicide with Perinatal SIB**

Not everyone who considers suicide advances to attempt it; an important objective of the WHO's comprehensive suicide prevention plan is identifying groups at high risk for attempted or completed suicide. In a worldwide mental health survey (WHO WMH survey) lifetime prevalence of suicidal ideation, plans and attempts were found to be 9.2, 2.7 and

3.1% respectively, confirming that more people think about suicide than actually attempt it. It is important to note that the majority of people who make a suicide plan and proceed to attempt suicide do so within the first year after the onset of suicidal ideation (Nock et al. 2008(b)). In the United Kingdom, data from the National Comorbidity Survey and follow-up surveys show a similar progressive pattern from the onset of suicidal ideation to planning and then attempting suicide (Kessler et al. 2005). During pregnancy, comparable trends are observed; suicidal ideation during pregnancy is one of the strongest predictors of suicidal ideation, attempts and completed suicide post-partum (Lindahl et al. 2005). Understanding perinatal SIB is thus a critical foundation to eventually predicting and ultimately preventing perinatal suicide.

### **1.3 Perinatal SIB – Global Estimates**

A systematic review of the prevalence of suicidal ideation among pregnant women from both high- and low-income countries found a range from 5 to 14%, with higher figures found in low-income countries (Lindahl et al. 2005). A more recent epidemiologic review (Gelaye et al. 2016) concluded that available global evidence indicates that pregnant women are more likely to report suicidal thoughts compared to the estimated rate in the general population of 9.2 % (Nock et al. 2008(b)). Prevalence varied widely with a range of 3 – 33%; rates differed within countries (higher in urban vs rural USA) and between countries (maximum upper range was 20% for LMIC), according to ethnicity (lower for non-white Hispanics in the USA) and also maternal age (higher in younger mothers). The risk factors that were consistently associated with antepartum suicidal ideation include depression, intimate partner violence (IPV) and not completing a high school education (Gelaye et al. 2016). Table 1 contains a summary of worldwide perinatal studies with populations sampled, screening tools used, cross sectional prevalence of SIB and positive correlates. These studies will be discussed and compared below.

[ [Table 1 here](#) ]

### **1.3.1 Perinatal SIB – High Income Countries**

In the United States of America (USA) estimates of perinatal SIB have varied between 2.7 – 33% depending on the populations sampled (clinical vs non-clinical; lower income vs diverse socioeconomic backgrounds) and the instruments used to measure SIB. In a Johns Hopkins university trial among three urban clinics where predominantly African-American pregnant women who had low incomes were surveyed, researchers found a SIB prevalence of 22.89% that was positively associated with IPV and Depression (Alhusen et al. 2015). In a sample of pregnant women who were racially diverse (but two thirds Caucasian) and of different socio-economic backgrounds attending a university-based clinic, the prevalence of antenatal suicidal ideation was significantly lower at 2.7%, correlated with depression and psychosocial stress (Gavin et al. 2011). Among women with a history of neuropsychiatric illness presenting for pregnancy care in Atlanta, a higher prevalence of SIB was measured at 33%. Thus a third of women reported SIB on at least one of 2 rating scales, the Hamilton Rating Scale for Depression (HDRS) and the Beck Depression Inventory (BDI), and 13.1% reported SIB on both these scales. SIB was correlated with current depression, comorbid anxiety disorder and an unplanned pregnancy (Newport et al. 2007). A review of hospitalisation records and ICD diagnoses (Zhong et al. 2016) of the National Inpatient Sample shows that the hospitalization rate of pregnant women for SIB, deliberate self-harm or a suicide attempt has doubled from 47.5 to 115 per 100 000 women. These hospitalized women were more likely to be younger (range 12-18 years), of a lower income group and of African-American ethnicity.

Post-partum American studies report similar findings to investigations during pregnancy. Kim et al. (2015) found in a review of a large non-clinical sample of medical records that 4.1% of women antepartum and 3.4% post-partum report SIB on the EPDS – Q10. In Michigan post-

partum suicidal ideation (SI) was evaluated among women who experienced maltreatment in childhood. SI peaked at 4 months (37%) and a quarter of women (25%) persistently reported SI for the duration of the study. Resilience, marital status, shame related to the childhood maltreatment, and family support were correlated with SI and at some assessments, severity of SI. However, these associations were varied widely over time (Muzik et al. 2016). In Pittsburgh 1 in 5 depressed mothers (21%) interviewed 4 – 6 weeks after giving birth reported SIB on the EPDS-Q10. Childhood physical abuse strongly predicted SIB, but when absent the presence of current anxiety symptoms and sleep disturbance were associated with SIB (Sit et al. 2015).

Cross sectional findings in other HICs follow similar patterns to American data. In the United Kingdom (in the RESPOND trial, a primary care study) more than 4000 women were screened for depression at 6-8 weeks post-partum using the EPDS ; 9% reported some suicidal ideation (including hardly ever); 4% reported that they thought of harming themselves sometimes or quite often. A follow-up screening at 18 weeks (253 completed the EPDS again) found suicidal ideation was associated with age (younger), parity (higher) and more severe depressive symptoms in the multivariate analysis (Howard et al. 2011). In Canada, Pope et al. (2013) found SIB rates of 16.8% and 6.2% using the EPDS-Q10 and HDRS-Q3 respectively in post-partum women with depression or bipolar affective disorder type II; severity of depressive symptoms and hypomanic symptoms were correlated with SIB. A recent study from Japan reports a 10-fold increase in risk for post-partum SIB in mothers who were younger than 25 with a history of 3 or more childhood adverse events (ACEs) (Doi & Fujiwara 2019). In Italy a non-clinical sample of women reported antenatal and post-partum SIB of 6.9% and 4.3% when using the MOODS-SR scale and post-partum SIB of 12% and 8.6% when employing the EPDS – Q10. Major and minor depressive episodes and lifetime suicidality were associated with SIB ante- and post-partum. Low education and unemployment were associated with SIB only in pregnancy and only as measured by the EPDS (Mauri et al. 2012).

Only one study has explored the longitudinal course of SIB in a HIC. Screening 1507 Australian women participating in a prospective cohort using the EPDS resulted in cross sectional findings that a fairly consistent percentage of women (4–5%) reported suicidal ideation at each assessment time-point (at pregnancy, 3-, 6-, 12-, and 18 months and 4 years PP). Suicidal ideation was most frequently reported in the first 12 months post-partum (4.6%) and 14.7% of women reported suicidal ideation at least once during the study. Considering the course of SIB it emerged that 7% of women had an enduring pattern of suicidal ideation that was associated with unemployment, having a high perceived need for social support, having a past history of childhood physical abuse, and depressive symptoms during pregnancy and the early PP (Giallo et al. 2011).

### **1.3.2 Perinatal SIB – Low and middle income countries (LMIC)**

Less is known about SIB during pregnancy and the post-partum period in developing countries. Evidence from the Asian subcontinent includes a study from rural Bangladesh that found depression among a third of women in the third trimester – of those 14 % reported thoughts of self-harm (Gausia et al. 2009). An urban Pakistani cohort showed a suicidal ideation prevalence of 11% among pregnant women, correlated with Depression, Anxiety and IPV (Asad et al. 2010). In a low-income, urban South Indian population the prevalence of SIB in pregnancy was 7.6 %, 2.4 % made some suicidal plans and 1.7 % disclosed that they had actually made a suicidal attempt during the current pregnancy. The severity of depression and a lifetime history of suicidal ideation correlated strongest with current SIB. (Supraja et al. 2016). The instruments used, pregnancy gestation at time of assessment and populations sampled are all potential causes for variation in findings.

In South America a variety of studies replicate findings as outlined above. Using clinician-administered scales resulted in higher reported SIB prevalences during pregnancy at 19.6 % (Vaz et al. 2014), and post-partum namely 11.5% (Tavares et al. 2012). Younger women are

more at risk of experiencing and reported SIB during pregnancy (Freitas et al. 2002); 16,7% reported SIB on the Beck scale for suicidal ideation (BSI) – this was associated with depression, not having a partner at the time as well as a general lack of social support. Other perinatally associated factors were common mental disorders, single marital status, past psychiatric history, and tobacco smoking (Huang et al. 2012). One study found that religion was protective for SIB among high obstetric risk pregnant women (Benute et al. 2011).

### **1.3.3 SIB during Pregnancy – Sub-Saharan Africa (Zimbabwe and South Africa)**

Local studies of perinatal SIB have the most relevance when developing research hypotheses and planning clinical intervention. In Harare, Zimbabwe, 842 women were interviewed at 6 postnatal clinics. One in five women (21.4%) met the diagnostic criteria for post-partum depression whilst 21.6% reported post-partum suicide thoughts and 4% reported suicide attempts. Two thirds (65.4%) reported any form of IPV. Suicidal ideation was associated with emotional IPV (Shamu et al. 2016). In South Africa, among a rural east coast population heavily affected by HIV (45%) and Depression (46.7%), a high suicidal ideation prevalence rate of 27.5% was found with a positive association with antenatal depression (Rochat et al. 2013). This represents a rate similar to the rate reported by the general population in Kwazulu Natal; a SIB rate of 25% was found in community based samples (Schlebusch et al. 2012). A lower suicidal ideation prevalence rate of 18% was demonstrated in another urban (Western Cape) South African study. Correlates were mental illness (major depressive episode and any anxiety disorders), lower socioeconomic status, food insecurity, interpersonal violence, higher parity, and history of a suicide attempt (Onah et al. 2017).

A single study examined the course of SIB; a longitudinal “prevention of mother to child transmission (PMTCT) of HIV” study in Mpumalanga province yielded both the largest South

African study sample and the first local prospective data about SIB in the perinatal period. The authors examined suicidal ideation among 681 pregnant women living with HIV (WLHIV) in conditions of poverty (50% had an income of less than R600 per month) and followed them up at 6 and 12 months post-partum. During pregnancy 39% of women experienced SIB as measured by the EPDS and this was associated with intimate partner violence and HIV stigma, which interacted to multiply risk. Interpretation of post-partum results were limited by high levels of attrition, however suicidal ideation continued for 7% at 12 months (total followed up n = 403), 13% experienced incident suicidal ideation and thus 1 in 5 of these mums were experiencing SIB when their children were 1 years old. Intimate partner violence and depression predicted sustained suicidal ideation. Increased income (unexpectedly) and greater stigma predicted incident suicidal ideation. Younger age, disclosure of HIV status to partner, and greater stigma predicted, somewhat surprisingly, post-partum cessation of suicidal ideation (in 77 women, 19% of the antenatal suicidal group that were assessed again) (Rodriguez et al. 2018).

#### **1.4 SIB during pregnancy – Making sense of the evidence**

From this review of the literature a number of key points emerge. First, It is difficult and possibly not a useful endeavour to try to simplify or combine the prevalence data from countries with different incomes, and even in one country with different socioeconomic populations. Studies examining clinical populations (i.e. pregnant women referred for mental health problems) are likely not generalizable to a non-clinical population of pregnant and post-partum women in a primary care setting. Prevalence data differ not only depending on the choice of outcome measure but also by authors' interpretation of items and decisions regarding cut-off scores. Second, correlates are potentially influenced by sample selection and base rates of risk factors in the sampled population. What emerges clearly however is that mental illness, and particularly depression is consistently predictive of SIB during pregnancy as well as the post-partum period. Trauma (both current IPV and childhood

maltreatment) as well as conditions of socioeconomic adversity are associated with perinatal SIB across cultures and continents. Third, virtually all studies report on SIB as a dichotomous outcome; “no SIB” or “any SIB present”. This means that a nuanced analysis of SIB as occurring on a continuous spectrum and potentially fluctuating is rarely undertaken. Fourth, existing data is limited by the use of screening tools that were primarily designed for diagnosing depression in perinatal populations; one diagnostic criteria of a Major Depressive Episode is the presence of suicidal ideation and thus a question on SIB is necessary. The EPDS – Q10, Patient Health Questionnaire – Question 9 (PHQ-9) and the Hamilton Depression Rating Scale Question 3 (HDRS – Q3) are the most frequently used screening tools in the reviewed literature. These single items on questionnaires are quite simple considering the complexities of the construct being evaluated. Only 2 studies used the more objective clinician-administered MINI and a third employed the more detailed Beck Scale for Suicidal Ideation. Whether instruments were developed for use or validated in the study population or administered in the participants’ first language may also influence findings.

The next chapter will explore approaches and instruments for the assessment of perinatal SIB.



## **Chapter 2: Identifying Suicidal Ideation and Behaviour**

This chapter will explore current approaches to screening for SIB in clinical populations and specifically in the perinatal period.

A significant proportion of people (1 in 5) who commit suicide have had contact with mental health professionals during the month prior to their death (Mann 2014). When widening the scope, up to 80% of people who die by suicide had contact with general medical professionals in the last year (Stene-Larsen & Reneflot 2019) compared to less than a third meeting with psychological or psychiatric staff in the same time (Walby, Myhre & Kildahl, 2018). However the presence of SIB is often missed because people deny SIB (Busch, Fawcett & Jacobs, 2003) or the risk for completed suicide is erroneously deemed low (Berman & Silverman 2014), especially when assessment is based on clinical interview alone. Structured clinical interviews significantly improve the detection of SIB when compared to routine clinical interviews (Bongiovi-Garcia et al. 2009). In a review of suicide risk assessment instruments and approaches Lotito and Cook (2015) conclude that detailed clinical interview combined with the use of a structured assessment scale repeated over time is the approach of choice when assessing suicide risk.

### **2.1 Screening tools for SIB in clinical populations**

The process of assessing suicide risk is complicated by the fluctuation in SIB (Simon 1999), multifactorial aetiology of SIB and completed suicide (Bantjes & Kagee 2013) and limited resources in underfunded mental health facilities. There is no one measure with significantly superior sensitivity or specificity (Silverman & Berman 2014); high false positives and high false negatives are limitations of all screening tools for SIB. A recent study (Brown et al.

2015) conducted with patients presenting to three psychiatric emergency departments assessed the agreement between clinical and standardized assessments when evaluating SIB. Agreement was substantial for both suicide attempts and non-suicidal self-injury behaviour. However, 18% of patients who were identified as having made a suicide attempt in the past week by the Columbia Suicide Severity Rating Scale (C-SSRS) (Posner et al. 2011) were missed by the clinical assessment. Nevertheless, the potential lethality of attempts by patients who were identified by both methods was significantly greater than that for patients who were identified by the C-SSRS only. While research abounds with screening tools being compared to each other and to clinical assessment, few studies have explored the predictive value of these suicide risk assessments. The MINI suicidality module has been shown to be a valid predictor of future suicidal behaviour in psychiatric patients during the first year after discharge (Roaldset et al. 2012) as well as in a large sample of homeless people with mental illness (Katz et al. 2019).

## **2.2 Screening for SIB in the perinatal period**

Screening women in the perinatal period present particular challenges; they often fail to access mental health services, even when these are readily available (Dennis & Chung-Lee 2006). New mothers may have limited mental health literacy; they may be unaware that their experiences deviate from the average or that effective interventions exist (Jorm, Christensen & Griffiths, 2006). Women in the perinatal period may be especially reluctant to disclose SIB; the social desirability bias in reporting SIB is compounded by societal expectations of pregnant and new mothers as well as the stigma attached to mental illness. This stigma presents a major barrier to reporting difficulties and accessing treatment in the perinatal period (Bilszta et al. 2011). Women experience a two-fold stigma when mentally unwell in the perinatal period; not only are they mentally ill, but they may think themselves or believe society views them as “bad mothers” (McLoughlin 2013). The stigma of mental illness and

the fear of losing child custody were identified as the two main feared negative consequences prohibiting disclosure in a metasynthesis of qualitative data from the UK (Megnin-Viggars 2015).

There are no measures specifically designed to screen for SIB in the perinatal period – the instruments most commonly used are either designed with different populations in mind (i.e. the general public, or clinical samples of all genders and ages) or primarily to assess another related construct (i.e. the EPDS, BDI, HDRS and PHQ for depression). It is thus not surprising that multiple studies (Mauri et al. 2012, Pope et al. 2013, Zhong et al. 2015) have found a relatively small overlap when using different tools simultaneously for screening for perinatal SIB, and that prevalence estimates across studies with similar clinical samples vary significantly according to choice of instrument (Newport et al. 2007 versus Sit et al., 2015). The EPDS is the only relevant scale designed with the unique presentation of mental illness in the perinatal period in mind (Cox, Holden & Sagovsky 1987), although scales like the postpartum depression screening scale (PDSS) and patient health questionnaire (PHQ-9) have been adapted and tested in this period (Learman 2018). Post-partum depression is a heterogenous disorder and thus a latent class analysis was undertaken recently using the EPDS (Meltzer-Brody et al. 2015). The most severe postnatal depression was associated with SIB, as well as anxiety, onset during pregnancy, and obstetric complications.

The utility of clinician versus patient rated screening instruments warrants exploration. To identify risk factors for perinatal suicidal ideation 842 women at high risk for post-partum depression were examined by Coker and colleagues in the USA (2017). Almost a quarter of women admitted SIB on at least one rating scale, despite the majority (79%) receiving pharmacological psychiatric treatment. Importantly, patient-rated depression scales (BDI and EPDS) were found to be more sensitive screening tools than the clinician-rated depression scale (HDRS) for SIB in the post-partum period. When analysing data only from the women who completed all three scales (n = 505), only 14.6% screened positive for SIB on all three

measures, suggesting that different scales may assess different aspects of suicidality, or that the sensitivity of all utilized scales is poor. The scale with the highest sensitivity however, was the EPDS with only 2.9% of women deemed to have SIB being missed if the EPDS was the only scale utilized. In fact, both in pregnant (Newport et al. 2007) and post-partum (Pope et al. 2013) samples the self-report EPDS-Q10 and BDI picked up higher rates of SIB than the clinician rated HDRS. Both of these studies sampled women with neuropsychiatric illness. The American study found a SIB during pregnancy rate of 29.2% on the BDI and 16.9% when using the HRSD; a third (33.0%) of women reported SI on at least one of the rating scales and 13.1% endorsed SI on both rating scales (Newport et al. 2007). The Canadian study found a post-partum SIB rate more than double (16.79 vs 6.16 %) when using the EPDS vs the HDRS (Pope et al. 2013). The Italian study found that not all self-report measures are equal - the MOODS-SR fared poorly when compared to the EPDS with almost half the rates of SIB picked up both during pregnancy and post-partum (Mauri et al. 2012).

### **2.3 Clinical Screening and Research Diagnosis**

Screening programs implemented by public mental health policy makers aim to select a group of individuals in whom further investigation or intervention is warranted. There is always a balance to be struck between improving health outcomes for the largest number of individuals considering the financial and human resources available at the time. In research settings exploratory analysts are exempt from the duty to intervene, but the imperative is to examine the full spectrum of perinatal SIB.

Most perinatal studies have opted to dichotomise the outcome of SIB – they compare two groups of women; those who never reported SIB and those who report any SIB. These are of course relevant analyses and a valuable starting point. However only one study attempted

to explore the different degrees to which SIB may present clinically by separating Suicidal ideation (SI) from Suicidal behaviour (SB) (Onah et al. 2017). Such nuanced analyses are only possible when using a comprehensive screening measure like the clinician-administered MINI - section B, or a designed-for-purpose suicide assessment scale like the Columbia Suicide Severity Rating Scale (C-SSRS).

## **2.4 Perinatal Mental Health Screening in South Africa**

In state funded perinatal clinics and hospitals in South Africa women are not routinely asked about suicidal thoughts or behaviour (Department of Health, 2015, Guidelines for maternity care in South Africa). While self-report questionnaires (i.e. EPDS, BDI) and clinician administered tools (HDRS, MINI, SCID) are available and can be translated, only the EPDS (Lawrie et al. 1998 and De Bruin et al. 2004) and the Whooley Depression screen (Marsay et al. 2017) have been validated in South African research contexts. Possible problems with these include the length of the former and the culturally foreign language used in the latter, especially for people who speak English as a second or third language. Staff training and clinic time per patient is limited by the financial constraints of a country with a large population of low socioeconomic status with a high burden of competing physical and mental disease, as is the case in most other LMICs. The future of screening for Common perinatal mental disorders (CPMD) in South Africa is the possible addition of a three question screening measure to the newest version of the maternity case records. These questions were developed and tested in a local obstetric unit, and validated against the MINI. The instrument may be employed by nursing staff provided that a referral system and adequate mental health services are available. Two of these questions enquire about depressed mood and anxious mood, and the third relate to suicidal ideas and behaviours (Abrahams et al. 2019; Van Heyningen et al. 2019).

The sensitivity and specificity of one question, whether from the locally designed 3 question measure or the EPDS-10, for assessing SIB and suicide risk remains to be explored. Studies of perinatal suicidality in South Africa employed the MINI (Onah et al. 2017), questions based on the SCID (Rochat et al. 2013) and the EPDS – Q10 (Rodriguez et al. 2018). Item 10 on the EPDS, namely “the thought of harming myself has occurred to me”, was found to have good sensitivity (77%) and excellent specificity (92%) for detecting suicidal ideation in a South African study; the positive likelihood ratio (LR+) weighted by prevalence indicated that those women who scored positive on EPDS – Q10 were almost four times more likely to experience SIB when they were assessed with the DSM based SCID (Rochat et al. 2013). Scoring positive on this item was significant regardless of whether women reported a frequency of : “hardly ever”, “sometimes”, or “quite often” – this is in keeping with convention across the literature to use a cut-off score on the EPDS of  $\geq 1$  as denoting positive screening for SIB and a score = 0 as negative to ensure maximum sensitivity. However these results were not replicated by others in South Africa (Garman et al. 2019) and furthermore; the EPDS is mostly employed in research settings and not used in routine clinical care.

## **2.5 Summary of perinatal screening for SIB**

There is consensus that the perinatal period presents unique challenges when choosing or designing screening instruments for SIB. Furthermore, this is an important period in which to address clinical need since many South African women that ordinarily have limited contact with health services present during the perinatal period. Whether the most clinically useful instruments will be self-rated (usually more cost-effective) or clinician-administered (usually more valid), and whether a few crucial questions (expedient) or more detailed exploration (likely more valid) is needed remains to be seen. Clear answers will require longitudinal studies in specific populations with adequate follow-up comparing different risk assessment methods; continued suicidal ideation, suicidal behaviour and completed suicide within a predetermined period of time should be used as final outcomes.

The next chapter will describe the study design and research methods, including the population sampling procedures, outcome measure instruments and the statistical tests chosen for analyses.

## **Chapter 3: Study Design and Research Methods**

### **3.1 Design**

This thesis reports cross sectional ante- and post-partum as well as longitudinal data from the Drakenstein Child Health Study (DCHS). The DCHS is a multidisciplinary birth cohort investigating the epidemiology and aetiology of childhood respiratory disease. Data were collected regarding a broad range of possible risk factors that may influence child health; maternal mental health was thus deemed an important avenue of investigation. Follow-up takes place for mother-infant dyads until children reach 8 years of age (Zar et al. 2015).

### **3.2 Setting**

The Drakenstein sub-district is a peri-urban area containing the relatively stable, low socioeconomic communities of Mbekweni and Paarl East. Participants were recruited from two primary health care clinics that serve these communities respectively – Mbekweni Clinic (serving a black African population) and TC Newman Clinic (serving a mixed ancestry population). These communities are characterized by a high prevalence of substance use, exposure to trauma, HIV infection and poverty (Stein et al. 2015).

### **3.3 Participants**

From March 2012 until September 2015 consenting pregnant women aged 18 or older who were of 20-28 weeks' gestation were recruited from the two primary health care clinics. Exclusion criteria were designed to maximize generalizability of findings and was thus limited to people not primarily residing in the catchment areas or those planning to leave the area within the following year.



### **3.4 Sample size**

About a quarter of the final sample of mothers enrolled in the larger cohort attended an antenatal appointment with a medical officer where suicidal ideation and behaviour was assessed, providing an antenatal sample size of  $n = 347$ . At 6 months post-partum, 522 women were assessed. There were 121 women who were seen both antenatally and for the post-partum visit. A total of 748 individuals were assessed during at least one time point. This sample size is similar to that of two comparable local studies (Onah et al. 2017, Dewing et al. 2013).

### **3.5 Procedures**

Pregnant women were assessed at a follow-up antenatal visit between 28 and 32 weeks' gestation ("ANC2 visit") following the first visit for screening, enrolment and consent. Participants completed a comprehensive set of self-report and clinician-administered measures at each visit. Experienced field workers assisted with the self-report questionnaires and clarified questions when necessary. Participants were also assessed at this visit by a medical officer using DSM-IV criteria as outlined in the Mini Neuropsychiatric Interview (MINI) version 6. This process was repeated at 6 months post-partum. Since data collection on maternal mental health commenced some time after the start of the study, many women were missed during the antenatal period. Since resources were limited and the antenatal and 18 month visits were prioritised, not all women were seen at 6 months post-partum. This explains the different totals at each time point, and the lower numbers when compared to the total number of women enrolled in the cohort.

### **3.6 Measures**

The original English versions of all measures were translated into Xhosa and Afrikaans (the predominant first languages spoken in Mbekweni and Paarl East respectively) by professional bilingual and bicultural translators. These were then translated back to English by different translators who had not seen the original versions. The two sets of English questionnaires were compared and translation differences were discussed until a consensual decision regarding final wording was reached. All tools were tested in the community for feasibility by interviewing a group of individuals similar to the proposed study population. Clinical conversations with participants were conducted in Xhosa, English or Afrikaans according to the spoken first language or preference as far as possible, while a Xhosa or Afrikaans staff member assisted with translation when needed.

### **3.6.1 Sociodemographic Measures**

The interviewer administered **Sociodemographic questionnaire** was designed for the purposes of the DCHS. It was adapted from a questionnaire used in the South African Stress and Health Study (SASH), and includes information on the participants' population group, the highest level of education they completed and an assessment of their employment status (Myer et al. 2008). Information was also gathered regarding maternal age, parity, marital status and whether a monthly government grant is received. A composite SES score was developed for this cohort in order to categorise participants into quartiles. This was calculated based on current employment status, educational attainment, household income and a composite asset index. Variables were extracted as follows:

i) *Educational attainment* – participants with only a primary school education scored 0, those with some secondary education scored 1, those who had completed high school scored 2, and those with any tertiary education were given a score of 3.

- ii) *Employment status* – this data was collected as a dichotomous variable, with participants unemployed at the time of completing the questionnaire scoring 0, and those currently employed scoring 1.
- iii) *Household income* – total household income of less than 1,000 South African rand per month was scored 0, monthly income between 1,000 and 5,000 South African rand was scored 1, and households with an income greater than 5,000 South African rand per month were assigned a score of 3.
- iv) *Assets/Infrastructure* - Participants were asked to indicate whether they had the following household appliances, infrastructure and resources available (a score of 1 was assigned for each available item): electricity, a tap or running water, a domestic servant, a flush toilet inside, a built-in kitchen sink, an electric stove or hotplate, a working telephone (including cell phone) and at least 1 motor car or truck, a motorcycle or scooter, and/or a bicycle. Adding the positive (score = 1) answers then provided a composite asset/infrastructure score for each participant.
- v) *Market access score* – economic access was assessed via the following questionnaire items: shopping at supermarkets, using any financial services (such as bank account, ATM card or credit card) and/or having an account at a retail store (i.e. Pep). A total score was obtained by adding each affirmative item (score = 1).
- vi) *Composite Asset Index* - calculated as the sum of assets/infrastructure (iv) and market access (v).
- vi) *Total SES score* = Standardized income + standardized education + standardized assets + (0.5)(employment) (Koen et al. 2014).

The **Household Food Insecurity Access Scale (HFIAS)** was used to assess food security (Coates, Swindale & Bilinsky 2006). This questionnaire asks nine questions about household access to food and household members' experiences and perceptions of hunger during the preceding four weeks. These 9 questions are grouped into 3 themes; anxiety about access to food, quality of diet (i.e. food variety and choice) and food consumption (i.e.

skipping meals). Each question is rated on a scale from 0 to 3 as follows: '0' (none), '1' (rarely), '2' (sometimes), or '3' (often). Responses are summed to yield a score ranging from 0 to 27; this score can be interpreted as representing a continuum of food insecurity. This method is based on the premise that the experience of food insecurity causes predictable and measurable emotional and behavioural responses. On the basis of the total HFIAS score a household is categorized as being:

- 1) *Food secure* - rarely concerned about food supply
- 2) *Mildly food insecure* – concerned about food supply and/or limited food variety/eats less preferred food
- 3) *Moderately food insecure* – often reduces quality and diversity of diet, sometimes or rarely cuts back on meal size/frequency
- 4) *Severely food insecure* – Often has to reduce meal size/frequency, has run out of food completely, has gone to bed hungry, has not eaten for a 24h period (Devereux & Taverner-Smith 2019).

### **3.6.2 Psychosocial Stressor Measures**

The **Planning of Birth/Partner Support Questionnaire** was developed for the DCHS and adapted from questions used in the SASH (Myer et al. 2008) to assess the effect of varying degrees of social support in pregnant women. This measure assesses whether the pregnancy was planned, whether contraceptives were used at the time of conceiving, and the level of support received from the partner. Positive responses were scored as affirmative (1) or negative (0). Thus a higher score indicates a greater degree of birth planning and/or social support and a lower maternal risk profile.

**The Childhood Trauma Questionnaire (CTQ)** (Bernstein et al. 1994) is a 28-item inventory assessing three domains of childhood abuse (sexual, physical, and emotional), and two domains of childhood neglect (physical and emotional), occurring at or before the age of 12

years. This questionnaire has shown excellent sensitivity and specificity in the classification of childhood abuse and neglect. Participants rate the frequency of occurrence on a 5-point-scale as follows: (1) never true, (2) rarely true, (3) sometimes true, (4) often true, and (5) very often true. Thus, each subscale yields a score range from 5 (no history of abuse or neglect) to 25 (very extreme history of abuse and neglect). Three items are also included as a Minimization/Denial scale to detect potential underreporting of abuse by participants. These items are dichotomized (i.e. a response of “never” is scored 0; all others are scored 1) and added, with a sum total  $\geq 1$  indicating possible underreporting (Bernstein and Fink 1998; Villano et al. 2004). In our sample, participants were given a total continuous score by adding up individual items (excluding the three questions forming the Minimization/Denial scale). Higher scores therefore indicate greater severity of abuse. Further, a binary variable was created by dividing participants into dichotomized categories: those with a history of childhood trauma, and those without. Cut-off scores for each clinical domain as defined in the CTQ manual (Bernstein & Fink 1998) were used. Participants scoring within the “none or minimal” range were defined as below threshold for a history of childhood trauma; those in any other category (i.e. “low to moderate”, “moderate to severe” or “severe to extreme”) were defined as above-threshold (Koen et al. 2014).

The **World Mental Health Traumatic Life Events Questionnaire (TLEQ)** (Kubany et al. 2000) is a 17-item instrument which enquires about stressful and negative life events during the last year. The questionnaire used in this study is based on the items used in the SASH study in South Africa (Myer et al. 2008). A participant’s total score is obtained by adding the number of life events reportedly experienced during the preceding 12 months; higher scores thus indicate exposure to more stressful life events.

**The Intimate Partner Violence (IPV) Questionnaire** used in the DCHS was adapted from the WHO multi-country study (Jewkes 2002) and the Women’s Health Study, Zimbabwe (Shamu et al. 2011). This questionnaire assessed past and recent (over the last 12 months)

experience of emotional, physical and sexual abuse. *Emotional abuse* was explored with the following items: being insulted or made to feel bad about oneself; being belittled or humiliated in public; being purposefully scared or intimidated; and being threatened. *Physical abuse* was investigated by asking women about the following scenarios: a history of having been slapped or having had something thrown at them which could hurt them; being pushed or shoved; being hit with a fist or with something else that could hurt them; being kicked, dragged, beaten, choked or burnt; and being threatened with or actually abused with a gun, knife or other weapon. Lastly, *sexual abuse* was enquired about by listing the following descriptions: having been physically forced to have sex when one did not want to; having sex with one's intimate partner when one did not want to out of fear of what he might do; and/or having been forced to do something sexually that was degrading or humiliating. A 4-point scale was used to record the frequency these listed events occurred: (1) never, (2) once, (3) few times, and (4) many times. Scoring guidelines were newly developed for use in this study; these were based on earlier work in similar South African studies (Dunkle et al. 2004). Participants were assigned to the category "no exposure to IPV" if all responses were "never" or if there was a singular response of "once" (i.e. isolated episode) in the questionnaire. The category "low frequency" was assigned if they reported a frequency of "once" for more than one item, "mid frequency" if more than one response of a "few times" (but no response of "many times" was given) and "high frequency" if there were any responses of "many times" in the questionnaire. Participants were also allocated continuous scores by adding the frequency scores of all items (Koen et al. 2014).

**HIV tests** in cases where the status was unknown were voluntary and included pre- and post-test counselling. HIV testing is routinely offered in South African antenatal clinics where uptake has been high (99%) in the PMTCT ("prevention of mother to child transmission") programme. (2017 statistics, published in 2019 by South African Department of Health/SADOH)

### 3.6.3 Psychiatric Disorder Measures

**The Edinburgh Postnatal Depression Rating Scale (EPDS)** (Cox et al. 1987) is a self-report measure consisting of 10 questions enquiring about depressive (and anxious) symptoms over the preceding 7 days. It has shown good psychometric properties in studies evaluating validity abroad (Eberhard-Gran et al. 2001) and locally (Lawrie et al. 1998, De Bruin et al. 2004). This tool was originally developed for use in postnatal women with the understanding that symptoms attributed to a depressive disorder on many standard screening questionnaires may simply be physiologically normal symptoms of the perinatal period (i.e. appetite and sleep changes). It has also been validated for use in pregnancy (Murray & Cox 1990). The EPDS assesses changes in mood characteristic of postnatal depression (low and/or anxious mood), anhedonia, guilt and insomnia specifically caused by anxiety, all within the preceding week. Each item is scored on a frequency scale, ranging from 0 to 3. A continuous score was obtained by summing the individual items; the higher the score, the greater the symptom severity. A binary variable was created by using 13 as a cut-off score; participants were classified as “probable cases” if they scored >13 on the EPDS. This threshold has been established by a similar study conducted in a LMIC context in South Africa (Hartley et al. 2011).

In this population, post-partum, the EPDS conferred a sensitivity of 67% and specificity of 88% when used at the cut-off score of 13 compared to the MINI as diagnostic gold standard when diagnosing depression (Van der Westhuizen et al. 2018).

**The Modified Posttraumatic Stress Disorder Symptom Scale (MPSS)** (Foa et al. 1993) is a 17-item self-report questionnaire that was used as a rapid screening tool for posttraumatic stress disorder (PTSD) in the DCHS study population. It corresponds to the DSM-IV criteria for PTSD and was chosen for application due to its established reasonably good diagnostic validity for PTSD. Participants rate items on a four-point frequency scale, from 0 (absence of symptom) to 3 (symptom occurs five or more times per week/very much/almost always). To

evaluate duration of symptoms, a final item was also included, with the following response options: < 1 month; 1–3 months; 3 months–1 year; and > 1 year. As no MPSS cut-off score for PTSD has been clearly established (Binder et al. 2008), the DSM IV criteria were applied to the MPSS items to confirm or exclude a PTSD diagnosis with high probability. The re-experiencing symptom cluster was scored as “above threshold” if at least 1 of the relevant items was positive; for the avoidance/emotional numbing cluster at least 3 were needed; and for the increased arousal cluster a minimum of 2. “Suspected PTSD caseness” was assigned to participants who scored above threshold across all three symptom clusters, and reported symptom duration of at least 1 month.

The **Alcohol, Smoking and Substance Involvement Screening Test (ASSIST)** was used to assess the self-reporting of substance abuse during and after pregnancy. This tool was developed by the WHO to detect substance use and dependence in primary care settings. It has shown good reliability, feasibility and validity in international, multisite studies (WHO ASSIST Working Group 2002; Humeniuk et al. 2008), and has clinical utility in comprehensive assessment of substance misuse in people who have other mental illnesses (“dual diagnosis”) and people who abuse multiple substances. The scope of substances enquired about is wide; 10 categories are assessed: tobacco products, alcoholic beverages, cannabis, cocaine, amphetamine-type stimulants, inhalants, sedatives or sleeping pills, hallucinogens, opioids, and a general category entitled “other”, in which the participant is required to specify the substance used. The ASSIST first screens for lifetime use of alcohol and other drugs with an initial screening question. Individuals responding “no” to question 1 are classified as “screening negative” and no further questions are asked. For those “screening positive”, i.e. answering “yes” to any of the substances six more questions are asked about each substance. Questions 2-7 enquire about frequency of use over the preceding 3 months, cravings, functional impairment, unsuccessful attempts to reduce or stop use and social and legal complications experienced due to use. Frequency scales with a range of 0 – 6 are used. Question 8 assesses a history of intravenous drug use. Questions



2–7 were then summed to yield a total score for each substance. For our purposes, only data for **alcohol and tobacco** use were extracted from the ASSIST, as reports of other substance use were negligible (as confirmed with the clinician administered MINI and urine drug analysis). Participants were assigned continuous scores for each of these two substances.

The clinician-administered **Mini International Neuropsychiatric Interview for DSM-IV (MINI-IV)** is an abridged version of the Structured Clinical Interview for DSM-IV and is extensively used, including in South Africa (Myer et al. 2008; Spies et al. 2009) and has well established validity (Lecrubier et al. 1997; Sheehan et al. 1997; Sheehan et al. 1998). The MINI provides information on common psychiatric diagnoses during the last month (Major depressive disorder / MDD, Bipolar Affective Disorder, Psychosis, Post-traumatic stress disorder / PTSD, Obsessive Compulsive disorder / OCD, Anxiety disorders), the last 3 months (Eating disorders), the last 6 months (Generalised Anxiety disorder / GAD) and the last year (alcohol and substance abuse and dependence) and as such provided a comprehensive impression of maternal mental health during pregnancy and post-partum. Each section starts with a screening question for the particular disorder with subsequent questions based on DSM-IV operational criteria.

#### **3.6.4 Outcome Measures: Suicidal Ideation and Behaviour**

**Section B (B1-14) of the MINI** assesses Suicidal Ideation and Behaviour (SIB). It contains heterogeneous questions and encompasses symptoms from the last month (B1-B13) as well as previous suicide attempts (B14). The symptoms and signs enquired about range from assessing intent and planning of an attempt as well as precautions to avoid detection and recent failed / interrupted attempts. The maximum score is 79 and scores are divided in three risk categories: Low (1-8), Medium (9-16) and High ( $\geq 17$ ). A score of 0 denotes the absence of SIB (Sheehan et al., 1998).

**The EPDS – Question 10** states “The thought of harming myself has occurred to me” and thus assesses suicidal ideation by requiring a response of “Yes, quite often”, “Sometimes”, “Hardly ever” or “Never” in the past week. EPDS-10 has been found to have good sensitivity (77%) and excellent specificity (92%) for suicidal ideation in previous studies in South Africa (Rochat et al. 2013). Coding any affirmative response as suicidal and only the response of “Never” as non-suicidal yields dichotomous data; this approach has been used in previous research among pregnant women (Rochat et al., 2013; Zhong et al. 2015; Rodriguez et al. 2018)

### **3.7 Data management**

Data was linked to a 4-digit Participant ID (PID) and stored in an online database (REDCAP) that facilitates data monitoring, data cleaning and data exports for analysis. Participant responses were initially documented on paper case report forms (CRFs) and then entered into the database. Original CRFs were readily available for reference if data queries arose. Quality control and data monitoring was contemporaneously and continuously performed by experienced senior study staff members. Paper records will be retained for 5 years following the closure of the cohort study while electronic data will be stored indefinitely.

### **3.8 Statistical analysis**

Numerical data was changed to categorical data using cut-off scores. Variables with multiple categories were simplified to binary data by merging categories. Data analysis was performed using STATA 14.2 (StataCorp Inc., College Station, Texas, USA).

Descriptive statistical methods, namely prevalence ratios were used to describe the prevalence of SIB at cross sectional time points during pregnancy and at 6 months post-partum. To assess baseline sociodemographic differences between those who reported SIB at any time point (SIB > 0) and those who never endorsed SIB (SIB = 0) bivariate analyses were used ( $\chi^2$  or Fisher exact tests for categorical variables, independent t-tests for continuous variables). For participants who completed the MINI at both time points, the assessment at ANC was utilized unless the participant reported no SIB at ANC but did report any SIB at 6 months post-partum. Differences at baseline may elucidate possible associations between SIB and potential risk factors. Variables found to be associated with suicidal ideation in bivariate analyses at  $p < 0.05$  were included in the multivariable model. Binary logistic regressions were used to separately describe predictors of SIB (dichotomous) at ANC and 6 months post-partum. The set of independent variables was divided into 3 groups; sociodemographic factors (ethnicity, age, food security, SES score), psychosocial stressors (HIV positive, unplanned pregnancy, IPV, childhood trauma, traumatic life events) and mental illness factors (MDD, PTSD, alcohol and substance abuse). Variables found to be significantly associated with suicidality in bivariate analyses at  $p < 0.05$  were included in multivariable regression models for each time point; we quantified the strength of the association with an Odds Ratio (OR) with 95% confidence intervals (CI) reported.

To determine predictors of the risk categories of SIB (None = 0, Low = 1-8, Medium = 9-16, and High  $\geq 17$ ), multinomial regressions were used. Variables found to be significantly associated ( $p < 0.05$ ) with at least one categories of SIB risk in the bivariate models were included in the multivariable model. For the multinomial multivariate regression, betas and 95% CIs are reported.

In order to understand predictors of patterns of SIB from the antenatal period to post-partum (6 months), prospective data – following the course from ante- to post-partum SIB in the same women - were analysed by using multinomial logistic regression. The dependent

variable consists of four categories without a natural order, i.e. it is a nominal variable.

These groups are: women endorsing no antenatal and no post-partum suicidal ideation at 6 months follow-up (“never SIB” reference group), women endorsing antenatal and post-partum suicidal ideation at baseline (pregnancy) and 6 months (“persistent SIB”), women who did not endorse suicidal ideation at baseline but newly reported suicidal ideation at 6 months (“new SIB”), and women who endorsed antenatal suicidal ideation at baseline but reported no longer endorsing post-partum suicidal ideation at 6 months follow-up (“ceased SIB”). The independent variables that correlate with these groups to a statistically significant degree are therefore predictive/risk factors for sustained/new SIB or protective factors predicting cessation of SIB or belonging to the group never endorsing SIB.

We also tested the sensitivity and specificity of the EPDS-10 compared to the MINI-section B for our population. The sensitivity analysis uses a receiver operating characteristic curve (ROC curve) and plots the sensitivity (true positive) on the y-axis and 1- specificity (false positives) on the x-axis at various threshold settings. The “elbow” of the curve denotes the optimum cut-off score to achieve maximum sensitivity and specificity. The area under the curve can be used to assess the accuracy of a diagnostic test, with a larger area denoting that the test will miss or misdiagnose fewer cases.

The next chapter will outline the precautions and procedures for ensuring compliance with the ethical principles for research in human subjects as agreed upon by the World Medical Association’s (WMA) declaration of Helsinki, most recently updated in 2013.

## **Chapter 4: Ethical Considerations**

### **4.1 Ethical Approval**

The study is conducted in full accordance with principles of the Declaration of Helsinki (2013) and Good Clinical Practice (GCP) guidelines. This includes approval regarding scientific validity of this thesis' protocol from the Psychiatry and Mental Health Departmental Research Committee (DRC) following presentation to staff members and two independent reviewers. Ethical approval for conducting this secondary analysis was obtained from the University of Cape Town's (UCT) Human Resource Ethics Committee (HREC). Ethical considerations regarding the larger DCHS Cohort are reviewed yearly when the application for renewal of approval is prepared. Protocol deviations and adverse events are reported when they arise for review. The DCHS UCT HREC approval reference number is HREC 401/2009.

### **4.2 Informed consent**

Informed consent was obtained from all participants at enrolment and again at pertinent intervals throughout the study. Potential risks and benefits were explained in the participants' first language (Xhosa or Afrikaans) as far as possible; translators assisted when someone's grasp of English was not sufficient. Participants who are unable to read or write were protected by having an independent person read and sign the consent form after witnessing the verbal informed consent process. The signed consent forms are stored safely and confidentially and the participants received a copy with contact details of relevant study staff. It was made clear that participation is voluntary, and that there would be no impact on routine clinical care should people decline to participate or decide to withdraw consent at a future date.

### **4.3 Risks and benefits**

The proposed secondary analysis poses no additional risks beyond those already identified and described in the larger cohort protocol. In summary this observational cohort study poses the risk of participant fatigue – a risk ameliorated by the provision of food and drinks and breaks as required. Participant burden was kept in mind and reviewed frequently as the study progressed and decisions had to be made about number and duration of assessment measures. The benefits to participants include vigilant health and social screening and referral to relevant services as needed. Participants were reimbursed with a grocery store voucher to the value of R100 for travel costs incurred as well as for their time and effort.

### **4.4 Privacy and confidentiality**

Identifying information is kept strictly confidential and a 4-digit Participant ID used to de-identify data. No explicitly identifying information (e.g. names, medical record numbers) are entered into the REDCAP data systems. Access to REDCAP is restricted to personnel involved in the study through the use of passwords. Paper-based records such as signed consent forms and case CRFs are kept in secure locations, locked filing cabinets inside locked offices, and are only accessible to study personnel. Confidential information is only shared with other health care providers and pertinent staff in the event of a routine referral or due to identification of risk of harm to the participant or others.

### **4.5 Emergency and Routine Clinical Care**

The Drakenstein Child Health Study - and this sub-study - do not offer treatment to participants. If clinical or severe social problems are identified, participants are referred to

the appropriate health care provider for emergency or elective treatment according to the study Standard Operating procedure (SOP) as outlined in the following. The study personnel have built professional relationships with the local government hospital (Paarl Hospital) and community clinic (TC Newman and Mbekweni) staff facilitating referral for routine and emergency medical care for children or mothers in the appropriate setting; outpatient or emergency departments. Local social services serve the community from two centres; Mbekweni Thusong and Paarl East Thusong. Referral to the social worker on duty at the appropriate centre for social issues including IPV, alcoholism and unemployment is part of the SOP. Study staff liaise with local community centres that provide training and assist with finding employment (i.e. by drafting CVs and providing internet access), local soup kitchens and clothes banks to ease the burden of poverty faced by participants. In the event that psychological distress, mental illness or SIB are identified during the course of reviewing self-report measures or while administering the structured clinical interviews a consultation with the study doctor is arranged. Following a review of symptoms and risk the decision is made to refer to the emergency department at Paarl hospital or to the Psychiatry Outpatient Clinic (at TC Newman) staffed by a visiting consultant psychiatrist, clinical psychologist and three psychiatric nurses. Goodhope Psychological Services, a non-profit non-government organization (NGO), offers another avenue for referral for counselling, particularly when psychological or physical trauma have occurred.

#### **4.6 Indemnity**

The Cohort and as a result this sub-study is covered by an annually renewed UCT Institutional Insurance Policy that will cover costs should accidental injuries occur as a result of study participation, provided that participants take reasonable precautions to ensure their safety.

## **Chapter 5 : Results**

### **5.1 Perinatal prevalence of Psychiatric Disorders**

#### **5.1.1 Mental Health during Pregnancy and Post-partum**

At the antenatal assessment (Table 2) 1 in 5 of the women reported lifetime depression whether to a clinician (19.27% - MINI) or on the self-assessment measure (20.38% - EPDS). Post-partum the prevalence remained the same when considering the MINI (19.96%) but dropped to 14% with the EPDS. The MINI diagnosis of Posttraumatic stress disorder (PTSD) was confirmed by a clinician in 17.68% of women during pregnancy and 15.15% at 6 months post-partum. The self-report measure (MPSS) yielded a lower percentage during pregnancy (12%) and was unavailable post-partum.

With regards to substance abuse almost 1 in 10 women (9.29%) met criteria for alcohol dependence during pregnancy and the proportion halved to 4.45% post-partum. The self-report ASSIST measure yielded higher results for alcohol use during pregnancy (16.46%) and showed an increase in alcohol use to 1 in 5 mothers (21.07%) post-partum. A quarter of mothers (26.81%) admitted to smoking during pregnancy and this percentage increased to three quarters (76,9%) at 6 months post-partum.

#### **5.1.2 Prevalence of SIB during Pregnancy and Post-partum**

The 1 month prevalence of Antenatal SIB was 19.9% (Table 2); 69 women scored between 1- 52 on the MINI - section B. The risk stratification of those experiencing SIB during pregnancy was as follows: 53 participants were deemed low risk (76.8%), 6 medium risk (8.6%) and 10 high risk (14.5%). This meant that of the whole group 15,3% exhibited low



risk suicidal ideation and behaviours, 1.7% medium SIBs and 2.9% high risk SIBs, while 81,1 % reported no SIB in the preceding month.

The post-partum 1 month period prevalence of SIB as assessed at 6 months was 22.6%.

The risk stratification of the post-partum SIB group was as follows: 94 participants were deemed low risk (79.7%), 11 medium risk (9.3%) and 13 high risk (11%). This meant that of the whole group 18% exhibited low risk suicidal ideation and behaviours, 2.1% medium SIBs and 2.5% high risk SIBs post-partum, while 82% reported no SIB in the month prior to assessment.

[ [Table 2 here](#) ]

## **5.2 Baseline Characteristics of Suicidal and Non-Suicidal Group**

We compared women who endorsed SIB at any time point vs women who never endorsed SIB. (Table 3) This comparison uses the largest possible sample size in this study increasing the power to elucidate possible associations between SIB and potential risk factors. Mothers who endorsed SIB on the MINI were more likely to be from the TC Newman clinic (53 of the suicidal group vs 37% of the non-suicidal group were from TC Newman). Women who reported SIB at any point perinatally were also more likely to be younger (29 vs 31), weigh less (63 vs 69kg), be less educated (29% completed high school vs 37%), be unemployed (84 vs 76%) and experience food insecurity (43 vs 32%). While the women were equally distributed among 4 SES categories, they were less likely to belong to the highest SES group if they experienced perinatal SIB. A quarter of women (24.36%) were HIV positive, but HIV status did not predict SIB in this sample. Childhood trauma (58 vs 25%), traumatic life events (2 vs 1 average) and recent IPV (55 vs 29%) were significantly associated with perinatal SIB. PTSD as measured by the MINI was significantly correlated with perinatal SIB; however this correlation was not found when using the self-report MPSS to diagnose PTSD (which uses the categories of suspected PTSD and trauma exposed).

Depression, whether measured by the self-report EPDS or clinician administered MINI was significantly different by SIB category. Alcohol and substance abuse as elicited with the MINI as well as smoking and drinking during pregnancy as self-reported on the ASSIST questionnaire were also strongly associated with belonging to the perinatal SIB group.

[ [Table 3 here](#) ]

### **5.3 SIB during Pregnancy – Correlates**

#### **5.3.1 Socio-demographic correlates**

Bivariate analysis (Table 4) indicated that the TC Newman study site, younger age, lower weight and food insecurity were significantly positively correlated with SIB. On multivariable analysis only younger age (AOR = 0.92,  $p = 0.027$ ) remained significantly associated with SIB.

#### **5.3.2 Psychosocial stressor correlates**

Recent IPV and childhood trauma conferred a 3 times increased risk for antenatal SIB and stressful life events in the last year were also significantly positively associated with SIB. However, on multivariable analysis none of these risk factors remained significantly associated with SIB.

#### **5.3.3 Psychiatric Disorder correlates**

Bivariate analysis indicated that MDD, PTSD (MINI diagnosis) and tobacco use during pregnancy were significantly positively associated with SIB. The only statistically significant correlation that remained after logistic regression was that of depression; MDD measured by

both the MINI (AOR = 5.41,  $p < 0.001$ ) or EPDS (AOR = 3.48,  $p = 0.003$ ) were significant predictors of SIB antenatally. The association with PTSD was approaching significance ( $p = 0.058$ ).

[ [Table 4 here](#) ]

## **5.4 Post-partum SIB – Correlates**

### **5.4.1 Socio-demographic correlates**

At 6 months bivariate analysis (Table 5) indicated that the only sociodemographic factor with a significant positive correlation was TC Newman site; this association became statistically insignificant upon multivariable analysis.

### **5.4.2 Psychosocial stressor correlates**

Recent IPV, childhood trauma and stressful life events in the last year were significantly positively associated during bivariate analysis with post-partum SIB. However, on multivariable analysis none of these risk factors remained significantly associated with SIB.

### **5.4.3 Psychiatric Disorder correlates**

Bivariate analysis indicated that MDD, PTSD (MINI diagnosis), alcohol use during pregnancy and alcohol as well as substance dependence as verified by a clinician with the MINI were significantly positively associated with post-partum SIB. Two statistically significant correlations remained after logistic regression. Firstly, depression, as measured with the EPDS (AOR = 3.73,  $p = 0.001$ ) and as measured with the MINI (AOR = 4.71,  $p < 0.001$ ) was

retained as risk factor. Secondly for PTSD, as measured by the MINI, an AOR of 2.34 (1.03 – 5.31) with a p value of 0.042 was yielded.

[ [Table 5 here](#) ]

### **5.5 SIB Categories: Low, Medium and High risk**

Table 6 explores whether any risk factors predicted with statistical significance, an increased severity of SIB when compared to being in the no risk group for SIB (at any time point).

Compared to those in no risk group, participants in the low risk group were more likely to experience food insecurity (beta = 0.62, p = 0.03), have recent experiences with IPV (beta = 0.67, p = 0.011), met criteria for childhood trauma (beta = 0.68, p = 0.011), have MDD (MINI beta = 1.56, p<0.001 and EPDS beta = 0.55, p = 0.047) and met criteria for PTSD (beta = 0.94, p = 0.004). For those in the medium risk group, participants were more likely to have MDD (MINI beta = 1.94, p = 0.002; EPDS beta = 1.42, p = 0.015) compared to those in the no risk group. Finally, for those in the high risk group, participants were more likely to have MDD (MINI only beta = 2.92, p<0.001) and PTSD (beta = 1.95, p = 0.003).

[ [Table 6 here](#) ]

### **5.6 Longitudinal data on SIB – course and correlates**

Table 7 elucidates the course of SIB from pregnancy to the post-partum period using data from the 121 women who completed assessment at both time points. The course of SIB was as follows: 71% women never reported SIB, 10.7% reported sustained SIB, 9.1% reported new SIB and 9.1% reported cessation of SIB. Correlation analysis with the women who never reported SIB as a reference group did not yield positive results. While trends were observed it was not possible to identify with statistical certainty that any of the risk factors

predicted whether a woman would remain suicidal, become suicidal or cease to experience SIB. Specifically the risk factor that consistently and strongly predicted SIB during pregnancy and post-partum, depression, did not predict whether someone would remain or become suicidal in this sample.

[ [Table 7 here](#) ]

### **5.7 Comparing EPDS – Q10 to MINI – Section B – Sensitivity and Specificity (ROC Curve)**

Comparing the self-report measure, the EPDS - Q10 to the clinician rated MINI -section B when assessing SIB led to the following findings: using a cut-off score of 1 on the EPDS yielded a high specificity (91.57%) and increasing the cut-off score incrementally led to increases in specificity; a cut-off score of 3 improves specificity to 98.63%. However sensitivity is poor even when using the lowest cut-off score of 1 (29.17%). The proportion of participants correctly classified as experiencing SIB using the EPDS with the MINI as gold standard remained 78% whether a cut-off of 1, 2 or 3 was used (1 – 78.18%, 2 – 78.71%, 3 – 78.78%). As displayed in figure 1, the area under the receiver operating characteristic (ROC) curve was 0.605 (CI 0.562 – 0.648) denoting that the EPDS-Q10 performed poorly as a screening tool when using the MINI - section B as gold standard of a diagnosis of SIB.

[ [Figure 1 here](#) ]

## **Chapter 6: Discussion**

### **6.1 Main findings**

This study had a number of key findings: First, In this peri-urban African (LMIC) setting, a high prevalence of SIB was found in pregnant women and post-partum. Factors independently predicting the presence of SIB include younger age during pregnancy and PTSD at 6 months post-partum. Depression was positively associated with SIB at both time points.

Second, depression and PTSD predicted belonging to the high risk (high severity) SIB group while membership of the low risk SIB group was associated with both these mental illnesses as well as a number of psychosocial contextual factors; recent IPV, food insecurity and childhood trauma.

Third, 1 in 10 women who were followed up reported sustained SIB. No statistically significant risk factors for sustained SIB or new onset SIB or protective factors for the cessation of SIB were discovered in this analysis.

Fourth, The AUC of the EPDS-Q10 was 0.605 denoting low clinical utility for SIB screening. Using a cut-off score of 1 confers sensitivity of 29.17% and specificity of 91.6%. Different cut-off scores did not significantly alter the percentage of women correctly classified (stable at 78%) meaning that about a quarter of women would be mislabelled during screening. So while the false positive rate is acceptable ( $FPR = 1 - \text{specificity}$ ), meaning that an undue burden of falsely diagnosed people will not be placed on services, the true positive rate ( $TPR = \text{sensitivity}$ ) is completely unacceptable as less than a third of women would be correctly identified as suicidal.

Additional important findings on mental health in this population include the high prevalence of depression (1 in 5 experienced at least one depressive episode in their lifetime) and more than one in ten reported PTSD following trauma exposure. Substance abuse is problematic in this population with 1 in 10 women meeting criteria for alcohol abuse or dependence during pregnancy and 1 in 20 post-partum. Smoking is endemic with a quarter of mothers admitting to smoking tobacco during pregnancy and three quarters were smoking by the time their babies were 6 months old. These findings are important because they present information about a vulnerable population in South Africa with high unemployment (78%) food insecurity (35%) and recent IPV (35%). Furthermore, the levels of mental illness were comparable to that of the general population in a large community survey (SASH - Herman et al. 2009) where anxiety disorders (15.8%), mood disorders (9.7%) and substance use disorders (13.3%) were prevalent. This suggests that findings in this sample are generalisable to the broader South African population.

### **6.2.1 Comparison to existing research – Cross sectional data**

A similar prevalence of SIB during pregnancy was found when compared to studies where the MINI was also utilised in South Africa (18%: Onah et al. 2017) and in another LMIC, Brazil (19.7%: Vaz et al. 2014). Two local studies found higher SIB rates antepartum and post-partum using simpler self-report measures (Rochat et al. 2013; Rodriguez et al. 2018). We found a higher post-partum SIB rate than studies employing the MINI in South Africa (7.6%: Dewing et al. 2013) and Brazil (11.5%: Tavares et al. 2012). The SIB correlates of Mood disorder and Anxiety disorder (Onah et al. 2017; Tavares et al. 2012), IPV (Onah et al. 2017) and food insecurity (Onah et al. 2017; Dewing et al. 2013) were all previously described. The only other study describing PTSD as an independent risk factor was by Brazilian researchers in Pelotas (Tavares et al. 2012). The significant risk factor of 'educational duration less than 12 years' identified by the most recent review of perinatal

suicidality (Gelaye et al. 2016) was not evident in our analysis, possibly because of the high percentage of women not completing high school (64.6%). In our study, despite an HIV infection rate of 24.4%, HIV was not associated with SIB, a lack of association also found in another perinatal study in Natal (Rochat et al. 2013), despite the association of HIV with SIB in adults (Catalan et al. 2011).

To put these findings in context, comparisons between studies in the local general population and other LMICs and HICs utilizing a variety of outcome measures in different populations are made next. The prevalence of perinatal SIB was similar to that of the general population in RSA; South Africans had the highest frequency of suicidal ideation (25.4%) in the WHO multisite intervention study on suicidal behaviours (SUPRE-MISS) among eight LMICs (Bertolote et al. 2005). The prevalence of antenatal SIB was high compared to other LMICs, but similar to a study in Bangladesh where the sampled populations were comparable (Gausia et al. 2009) and one in the USA where the sample consisted of depressed pregnant women (Newport et al. 2007). A lower income African-American population in the USA also had a similar rate of SIB during pregnancy (Alhusen et al. 2015). Post-partum SIB was also high when compared with LMIC and HIC studies; rates were only similar when the study samples were preselected with childhood maltreatment histories (Muzik et al. 2016) or depression (Sit et al. 2015) or any neuropsychiatric illness (Coker et al. 2017). Depression is well established as consistent perinatal risk factor in all cited studies. Younger age during pregnancy has been identified as a risk factor for SIB (Zhong et al. 2016; Freitas et al. 2002) and anxiety disorders as a risk factor for SIB perinatally is described in other LMICs and HICs (Asad et al. 2010; Newport et al. 2007; Sit et al. 2015).

### **6.2.2 Comparison to existing research – Risk Category data**



There were no available data on risk factor profiles for the different risk categories as identified by the MINI - section B. Evidence indicates that Suicide and SIB are heterogenous conditions; for example 2 different groups of patients with different associated factors are identified based on the mean age at the first suicide attempt. There is an early onset suicidal subgroup (mean age 19.5 years) associated with anxiety disorders, substance abuse, and a history of physical or sexual abuse compared to the late onset subgroup (mean age 38.5 years), which suffers from major depressive disorders (Slama et al. 2009). Understanding the pathology in different subgroups can lead to improved, more nuanced screening, treatment and prevention of SIB. At the moment available data is limited to results using the binary categories (SIB present if score > 0) yielded by the MINI. In a retrospective study of patients admitted to a psychiatric emergency unit, the MINI could distinguish suicide attempters from non-attempters with a ROC-AUC of 0.84 (Innamorati et al. 2011). In prospective studies the MINI suicidality module has demonstrated validity in predicting future suicidal behaviour in patients during the first year after discharge (Roaldset et al. 2012) as well as in a large sample of homeless people with mental illness (Katz et al. 2019). However no data was found regarding predictive value of the risk categories as designated by the original authors. (Sheehan et al. MINI version 6 – October 2010).

### **6.2.3. Comparison to existing research – Longitudinal data**

The current longitudinal data available for South Africa (Rodriguez et al. 2018) has limitations in that a pre-selected group of HIV positive mothers were assessed in a RCT designed to examine effectiveness of a prevention protocol for mother to child transmission of the virus – this means that particular risk factors may have been selected in. HIV seropositivity on its own has been found to be positively associated with SIB (Catalan et al. 2011) and HIV infection may be associated with other psychosocial and mental health factors; this in turn makes results less generalizable to all women in the population. Nevertheless our groups of women never endorsing SIB, having persistent SIB, having new

onset SIB and ceasing to experience SIB were of similar sizes to this local study, as well as comparable to the group of women with persistent SIB in Australia (Giallo et al. 2011). The risk factors identified in the Australian women were depressive symptoms, childhood physical abuse, unemployment, and high perceived need for social support; in the South African women (Rodriguez et al. 2018) the risk factors were depression and IPV; we were unable to replicate these findings on risk factors. It is possible that our small longitudinal sample size (121 – see table 7) failed to demonstrate the associations by chance as we had comparatively small cell sizes (13 women had sustained SIB , 11 new SIB and 11 ceased to have SIB).

#### **6.2.4 Comparison to existing research – EPDS – Q10 as screening tool**

Previous researchers in South Africa had more optimistic results with the EPDS-Q10 screening for SIB perinatally; they used adapted questions from the SCID question guide and further qualitative probes as gold standard (Rochat et al. 2013). The EPDS-Q10 (“the thought of harming myself has occurred to me” ) was found to detect suicidal ideation with a sensitivity of 77% and specificity of 92%; the positive likelihood ratio (LR+) weighted by prevalence demonstrated that women scoring positive on EPDS-Q10 were almost four times more likely to report suicidality when assessed with the more detailed SCID (AOR 3.83 [1.8 - 8]). The majority of studies examining perinatal SIB have employed the EPDS in both HICs and LMICs (see table 1); the disparate findings regarding the diagnostic validity of the EPDS – Q10 for SIB in South Africa raise some questions regarding the applicability of their findings to our population. None of the numerous studies employing the EPDS-Q10 for perinatal SIB screening compared its sensitivity and sensitivity to the MINI - section B.

### **6.3 Clinical Implication of findings; suggestions for future research and intervention**

Suicidal thoughts and suicidal behaviour are perhaps not the first words that come to mind when thinking of pregnancy. However extensive research confirms that, contrary to the conventional wisdom that “motherhood and the imperative social role this entails militate strongly against self-destruction” (Kendall 1991; Appleby 1991) pregnant women and women who have recently given birth do think about self-harm and suicide, deliberately harm themselves and complete suicide (Fuhr et al. 2014; Gelaye et al. 2016).

Describing the scope of the problem of perinatal SIB adds to a growing body of knowledge regarding challenges faced by pregnant women and new mothers in this low resource setting, where violence and substance abuse is endemic. This analysis provides preliminary data for larger replication studies in future that may more accurately elicit associations and produce more generalizable prevalences. There is opportunity here to examine the breadth of SIB and its impact on fetal development and infant outcomes, beyond the previous research in this regard focusing almost exclusively on the impact of self-poisoning (Gelaye et al. 2016). Our findings that risk factors for SIB are complex, interrelated and likely not exhaustively identified combined with a recent review of risk factor analysis for SIB in the general population over the last 5 decades (Franklin et al. 2017) dictate that future research should include machine learning-based risk algorithms. Pathway analysis to explore the various ways in which one risk factor can influence the outcome directly or indirectly (via different interactions with other risk and protective factors) is also imperative. For example in this study the mediating effects of PTSD when analysing the relationship between childhood trauma and SIB warrants further investigation – however it was beyond the scope of this thesis.

Research regarding mental health literacy, stigma and other barriers to accessing mental health care may explain why women experiencing distress may not seek help voluntarily. Since a significant proportion of suicidal mothers were not depressed or suffering from PTSD, contextual risk factors should continue to be explored, together with personality and resilience factors that may expose or protect women. Prospective research regarding long

term outcome will elucidate the risk factors for progressing from SIB to completed suicide and identify other potential harmful outcomes (i.e. substance misuse, impaired parenting) that may be predicted by SIB.

Antepartum and post-partum prevalences of SIB are relatively high; 1 in 5 women reporting perinatal SIB represents a significant health burden in this population. The confirmation that depression increases the risk of SIB during pregnancy and in the first 6 months after birth in this particular population makes it imperative that adequate screening for ante- and post-partum depression and treatment programs are implemented in tandem with an already comprehensive antenatal visit. We observed a high prevalence of documented risk factors for antenatal depression namely low socioeconomic status, stressful life events, intimate partner violence and unplanned pregnancy (Howard et al. 2014). Anxiety disorders as risk factor for SIB in the general population was confirmed by Sareen and colleagues (2005) and as outlined before in the perinatal period. Post-partum PTSD as risk factor for SIB is newly described in Africa and underlines the need for screening for trauma exposure and sequelae with treatment for stress related disorders. This represents a bottom-up approach to reducing the burden of SIB by providing an evidence based foundation for treatment strategies. A systematic review of perinatal PTSD suggest antenatal prevalence of PTSD of 3.3%, with postpartum studies mostly focusing on obstetric complication induced PTSD (Yildiz et al. 2017). There is thus little comparison between the prevalence and causes of perinatal PTSD in prior literature and in this study. Reducing unwanted pregnancies in young women will reduce the impact of the risk factor “younger age”; the effective and moral strategies to achieve this is beyond the scope of this thesis.

The data point to a difference between women who are displaying high risk behaviours and those who have never reported any SIB – the former are more likely to have depression or PTSD. This confirms the identification and treatment of these mental illnesses as a possible

prevention strategy. The low risk group of women, those who report “not wanting to be here anymore” but report no suicidal behaviour or plans are also more likely to suffer from mental illness (specifically depression and PTSD) when compared to the “no SIB” group. However different interlinking pathways may be involved because contextual psychosocial risk factors are also significant – food insecurity, recent IPV and a history of childhood trauma may mean these women require different interventions to ameliorate their risk.

Confirming the presence of 1 in 10 women that experience SIB from pregnancy and throughout the first 6 months of their babies’ life have significant implications for maternal mental health and child developmental health service delivery decisions. Further research is needed to explore the underlying causes of persistent SIB and the way these factors potentiate each other. Exploring the protective factors present in the groups who never endorsed SIB or those who ceased to experience SIB may also provide valuable information on which to base intervention strategies.

On the strength of our findings we would not suggest using the EPDS-Q10 as screening tool for SIB in local perinatal populations. The recent development of a novel ultra-short screening tool, the first of its kind to be developed in South Africa for screening for common perinatal mental disorders (CPMD) shows promise (Van Heyningen et al. 2019). This tool screens women in the perinatal period for mood symptoms, anhedonia, anxiety symptoms and suicidal ideation. A short and simple tool with proven validity and reliability would be ideal for the low resource and high volume settings of South Africa; however both our findings and the complexities of SIB as a construct outlined before necessitate a somewhat more comprehensive approach to target SIB specifically. Further research is needed to determine the optimum screening tool and cut-off scores for ensuring both sensitivity and specificity in order to minimize risk and not overburden the health system.

#### **6.4 Study strengths and limitations**

There are a number of important limitations. First, no demographic or psychological data is available for mothers who declined to participate in the study; although the sample was based on consecutive cases seen, women with more severe mental illness may not have presented for care. Second, the study is limited by size; whether our sample size has sufficient statistical power to draw robust conclusions, is an important question. The issue of appropriate power calculations for the analyses used here is a complex one, that is beyond the scope of this thesis. I would emphasize, however, that our sample sizes are similar to, or larger than, most other studies that have focused on the questions raised here. Third, only 121 women had an assessment at both time points (i.e. only 35% were followed up after the antenatal assessment) – the women who were lost to follow-up may potentially have had more psychosocial stressors and psychopathology. Fourth, adolescent mums were excluded due to ethical considerations regarding conducting research with minors. However, since younger people are more likely to experience SIB during pregnancy (Freitas et al. 2002) and arguably have fewer personal and financial resources to deal with the implications of pregnancy, this neglected an at risk group. Fifth, we did not collect data on the prevalence of borderline personality traits or disorder, and considering the well-established link between this personality structure and SIB (Black et al. 2004) it would have added to the completeness of the findings. Finally, while comprehensive risk factor data was collected there is limited information on individual protective factors (e.g., resilience) that may be targeted by an intervention. Data on obstetric (e.g., traumatic birth), medical (e.g., chronic pain) and treatment (e.g., SSRI treatment) factors that may correlate with SIB were not available for analysis. Sixth, the fact that the assessment of Depression includes an item on suicidal ideation means there is a possibility of predictor correlation bias leading to a spurious association – we were unable to analyse this further as item level data for the MINI are not available. Seventh, the EPDS-10 asks about self-harm in a way that may have been interpreted by women as referring to Non-suicidal self-injury, leading to its poor predictive value here.

Nevertheless, the study has a number of important strengths. First, the comprehensive assessment of SIB with a clinician-administered, internationally validated tool allows for the reliable and valid assessment of the presence and severity of SIB. Second, the collection of data on a large number of potential risk and protective factors facilitates a comprehensive assessment and description of correlates and potential causes of SIB. Third, the separation of the SIB group into risk categories made possible by the MINI allows for finer analysis of correlates and eventually more exact identification of causal pathways. Fourth, the prospective longitudinal data on perinatal SIB allows exploration of the course of SIB, on which data are scant. Fifth, the concurrent assessment of SIB with a validated self-report scale for perinatal depression (EPDS) allows comparison with the MINI. This facilitates evaluation of the validity and by implication clinical utility of the EPDS-Q10 as a screening tool for perinatal SIB. Finally, the demographic characteristics of the study population represent both the most vulnerable mothers as well as reflect a large proportion of women living in South Africa today, allowing for generalization of findings and relevance to health policy makers.

## **Summary and Conclusions**

The prevalence of perinatal SIB was consistent with previous findings in South Africa but relatively high compared to other LMICs and HICs. Findings on the association of perinatal SIB with younger age and Depression are consistent with previous work in LMICs. The association of perinatal SIB with PTSD is a novel one, and underscores the importance of assessment of trauma exposure and outcomes in this population. Different risk categories of SIB may have different aetiologies and causal pathways and require different interventions. A small but significant percentage of women experience persistent SIB throughout the perinatal period. An acceptable and feasible screening tool with high sensitivity and specificity is needed in this population where perinatal suicidality is highly prevalent.



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## Addenda

Table 2: Perinatal prevalence of Psychiatric Disorders

Variables	Pregnancy (N=347)		Post-partum (N=522)	
	n	%	n	%
EPDS (Above threshold)	65	20,38	56	14,25
Major depressive episode (MINI)	63	19,27	104	19,96
Trauma/PTSD				
Suspected PTSD	38	11,99	-	-
Trauma Exposed	30	9,46	-	-
PTSD (MINI)	58	17,68	78	15,15
Alcohol dependence (MINI)	30	9,29	23	4,45
Substance dependence (MINI)	6	1,85	7	1,35
Alcohol use during pregnancy	52	16,46	83	21,07
Tobacco use during pregnancy	85	26,81	303	76,9
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Suicidal Ideation and Behaviour (SIB)	69	19.9	118	22.6

Note: percentages are based on n's for each individual variable not the total N for the time point

Figure 1: Sensitivity and Specificity of EPDS-10 compared to MINI as diagnostic gold standard

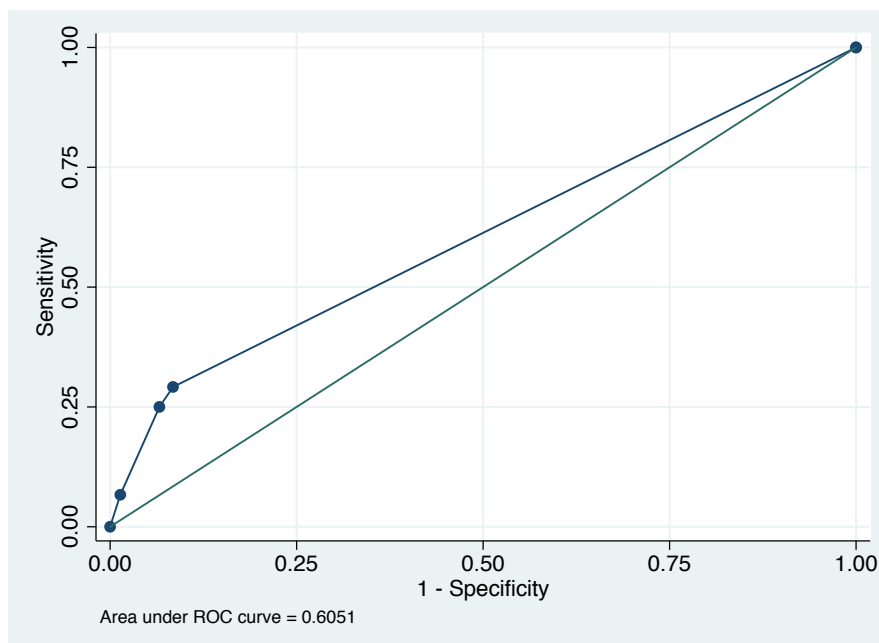


Table 3: Baseline characteristics of mothers who were administered the MINI at either ANC or 6 months post-partum by suicidality at either time point (N=748)

Variables	Total	Not Suicidal	Suicidal	p-value
Number of mothers	748	574	174	
<b>Sociodemographics</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	
Site				
Mbekweni	441 (58.96)	360 (62.72)	81 (46.55)	<0.001***
TC Newman	307 (41.04)	214 (37.28)	93 (53.45)	
SES				
Lowest SES	198 (26.47)	152 (26.48)	46 (26.44)	0.027*
Low-moderate SES	201 (26.87)	141 (24.56)	60 (34.48)	
Moderate-high SES	201 (26.87)	157 (27.35)	44 (25.29)	
High SES	148 (19.79)	124 (21.60)	24 (13.79)	
Education				
Primary and some secondary	483 (64.57)	359 (62.54)	124 (71.26)	0.035*
Completed Secondary and Any tertiary	265 (35.43)	215 (37.46)	50 (28.74)	
Unemployed	581 (77.67)	435 (75.78)	146 (83.91)	0.024*
Government grant	386 (51.74)	298 (52.01)	88 (50.87)	0,793
Food insecure	241 (34.63)	171 (32.14)	70 (42.68)	0.013*
Marital Status				
Married/co-habiting	305 (40.83)	232 (40.49)	73 (41.95)	0,731
Single	442 (59.17)	341 (59.51)	101 (58.05)	
Maternal Age (Median [IQR])	25.54 [21.65, 30,72]	26.01 [21.84, 31.04]	24.40 [21.31, 28.90]	0.021*
<b>Physical Health and Pregnancy</b>				
Weight (Median [IQR])	67.95 [57.1, 82.25]	69.0 [58.3, 83.6]	62.6 [53.0, 78.0]	<0.001***

Multigravida	481 (64.30)	369 (64.29)	112 (64.37)	0,984
HIV-infected	180 (24.36)	143 (25.27)	37 (21.39)	0,298
Unintended pregnancy	520 (69.61)	403 (70.33)	117 (67.24)	0,438
<hr/>				
Psychosocial Variables				
IPV any recent (Above threshold)	238 (34.90)	151 (28.82)	87 (55.06)	<0.001***
Childhood Trauma (Above threshold)	220 (32.26)	129 (24.62)	91 (57.59)	<0.001***
EPDS (Above threshold)	161 (23.61)	95 (18.13)	66 (41.77)	<0.001***
Major depressive episode (MINI)	144 (19.38)	59 (10.35)	85 (49.13)	<0.001***
Life time Events (Median [IQR])	1 [0, 3]	1 [0, 2]	2 [1, 5]	<0.001***
Trauma/PTSD				
Suspected PTSD	25 (11.57)	18 (10.78)	7 (14.29)	0,779
Trauma Exposed	21 (9.72)	16 (9.58)	5 (10.20)	
PTSD (MINI)	113 (15.31)	60 (35.29)	53 (9.33)	<0.001***
Alcohol dependence (MINI)	46 (6.25)	24 (4.24)	22 (12.94)	<0.001***
Substance dependence (MINI)	12 (1.62)	4 (0.70)	8 (4.71)	<0.001***
Alcohol use during pregnancy	104 (15.36)	65 (12.48)	39 (25.00)	<0.001***
Tobacco use during pregnancy	177 (26.03)	114 (21.84)	63 (39.87)	<0.001***

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 4: Bivariate and multivariable regressions for predictors of suicidality at ANC (during pregnancy)

	<b>Bivariate regressions</b>					<b>Multivariate regressions</b>	(N=287)		
<i>Sociodemographics</i>	N	Unadjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value
Mbekweni	347	(Reference)							
TC Newman		1,71	1,01	2,91	0,047*	0,77	0,26	2,28	0,633
Lowest SES	347	(Reference)							
Low-moderate SES		1,45	0,70	3,03	0,317				
Moderate-high SES		0,74	0,34	1,62	0,457				
High SES		0,85	0,38	1,90	0,69				
Completed Secondary and Any tertiary	347	0,66	0,37	0,21	0,148				
Unemployed	347	0,85	0,44	1,63	0,627				
Government grant	347	0,74	0,44	1,25	0,259				
Food insecure	330	1,96	1,14	3,38	0,015*	1,33	0,59	2,98	0,487
Married/co-habiting	347	0,76	0,44	1,31	0,322				
Maternal Age	347	0,95	0,90	0,99	0,042*	0,92	0,86	0,99	0,027*
<i>Physical health</i>									
Weight	344	0,97	0,96	0,99	0,003**	0,99	0,97	1,01	0,423
Multigravida	347	0,84	0,49	1,46	0,543				
HIV-infected	341	0,86	0,44	1,67	0,65				
Unintended pregnancy	346	0,87	0,49	1,53	0,624				
<i>Psychological stressors and mental illness</i>									
IPV any recent (Above threshold)	319	3,10	1,76	5,46	<0,001***	1,68	0,80	3,52	0,169
Childhood Trauma (Above threshold)	319	3,00	1,70	5,27	<0,001***	1,40	0,66	2,97	0,381
EPDS (Above threshold)	319	4,30	2,35	7,89	<0,001***	3,48	1,58	7,68	0,003**



Major depressive episode (MINI)	327	6,14	3,35	11,25	<0.001***	5,41	2,37	12,34	<0.001***
Life time Events	318	1,22	1,09	1,37	0.001**	1,06	0,90	1,25	0,498
Trauma/PTSD									
No exposure	317	(Reference)							
Suspected PTSD		1,62	0,73	3,57	0,232				
Trauma Exposed		1,38	0,56	3,41	0,486				
PTSD (MINI)	328	3,73	2,01	6,90	<0.001***	2,30	0,97	5,43	0,058
Alcohol dependence (MINI)	323	2,16	0,96	4,88	0,063				
Substance dependence (MINI)	324	2,02	0,36	11,30	0,422				
Alcohol use during pregnancy	316	1,62	0,81	3,21	0,171				
Tobacco use during pregnancy	317	2,32	1,30	4,15	0.004**	1,29	0,50	3,35	0,602

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 5: Bivariate and multivariable regressions for predictors of suicidality at 6 months post-partum

		<b>Bivariate Regressions</b>				<b>Multivariable Regression (N=294)</b>			
	N	Unadjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value
<i>Site</i>									
Mbekweni	522	(Reference)							
TC Newman		2,09	1,38	3,16	0,001**	1,09	0,50	2,38	0,828
<i>SES</i>									
Lowest SES	522	(Reference)							
Low-moderate SES		1,00	0,58	1,72	0,988				
Moderate-high SES		0,65	0,37	1,16	0,142				
High SES		0,69	0,38	1,26	0,228				
Completed Secondary and Any tertiary	522	0,71	0,46	1,09	0,117				
Unemployed	522	0,85	0,52	1,40	0,524				
Government grant	500	0,96	0,57	1,63	0,885				
Food insecure	444	1,20	0,54	2,70	0,653				
Married/co- habiting	496	1,29	0,85	1,96	0,237				
Maternal Age	522	0,97	0,94	1,01	0,15				
<i>Physical Health and Pregnancy</i>									
Multigravida	522	1,10	0,71	1,69	0,672				
HIV-infected	519	0,79	0,48	1,28	0,339				
Unintended pregnancy	522	1,39	0,89	2,15	0,144				
<i>Psychosocial Variables</i>									

IPV any recent (Above threshold)	475	4,12	2,63	6,46	<0.001***	1,82	0,89	3,72	0.1
Childhood Trauma (Above threshold)	393	6,50	3,56	11,86	<0.001***	1,57	0,77	3,19	0.271
EPDS (Above threshold)	521	9,14	5,65	14,80	<0.001***	3,73	1,73	8,07	0.001**
Major depressive episode (MINI)	394	1,33	1,18	1,50	<0.001***	4,71	2,18	10,19	<0.001***
Life time Events (Median [IQR])	517	4,09	1,76	9,54	0.001**	1,02	0,87	1,20	0.77
PTSD (MINI)	515	5,53	3,32	9,21	<0.001***	2,34	1,03	5,31	0.042
Alcohol dependence (MINI)	517	4,09	1,76	9,54	0.001**				
Substance dependence (MINI)	519	21,92	2,61	184,05	0.004**				
Alcohol use during pregnancy	394	1,95	1,13	3,36	0.016*	1,00	0,42	2,40	0.998
Tobacco use during pregnancy	394	0,76	0,44	1,32	0,329				

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 6: Multinomial multivariable regression predicting risk categories / severity of SIB

Description	Group 0		Group 1			Group 2				Group 3			
	None (0; n=574)	Adjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value
Site		(reference)	-	-	-	(reference)	-	-	-	(reference)	-	-	-
Mbekweni													
TC Newman	-	0.64	-0.03	1.31	0.06	-0.90	-2.57	0.78	0.30	0.38	-1.23	2.00	0.643
Education (Matriculated)	-	-0.06	-0.60	0.48	0.83	0.15	-1.05	1.36	0.80	-0.15	-1.55	1.26	0.840
Food insecurity	-	0.62	0.07	1.18	0.03*	0.08	-1.14	1.29	0.90	1.06	-0.25	2.38	0.114
Married/co-habiting	-	-0.16	-0.71	0.40	0.58	-0.23	-1.57	1.10	0.73	1.02	-0.33	2.37	0.139
Maternal age	-	-0.04	-0.09	0.00	0.07	-0.09	-0.20	0.02	0.12	-0.09	-0.20	0.03	0.143
IPV any recent (Above threshold)	-	0.67	0.15	1.18	0.011*	-0.34	-1.58	0.90	0.59	0.00	-1.27	1.26	0.996
Childhood Trauma (Above threshold)	-	0.68	0.16	1.19	0.011*	0.47	-0.75	1.69	0.45	1.39	-0.12	2.89	0.07
EPDS (Above threshold)	-	0.55	0.01	1.10	0.047*	1.42	0.28	2.57	0.015*	0.24	-1.09	1.56	0.728
Major depressive episode (MINI)	-	1.56	0.98	2.13	<0.001** *	1.94	0.71	3.16	0.002* *	2.92	1.46	4.37	<0.001***
Life time Events	-	-0.02	-0.13	0.10	0.75	0.08	-0.15	0.31	0.48	0.16	-0.05	0.38	0.131
PTSD (MINI)	-	0.94	0.30	1.59	0.004**	1.11	-0.18	2.41	0.09	1.95	0.68	3.22	0.003**
Alcohol dependence (MINI)	-	0.41	-0.46	1.28	0.36	0.53	-1.29	2.34	0.57	-0.11	-2.07	1.84	0.909
Substance dependence (MINI)	-	0.95	-0.85	2.75	0.30	2.83	-0.02	5.68	0.051	2.11	-0.64	4.87	0.133
Alcohol use during pregnancy	-	0.29	-0.38	0.96	0.39	1.25	-0.09	2.59	0.07	1.28	-0.07	2.64	0.064
Tobacco use during pregnancy	-	0.16	-0.50	0.82	0.64	-0.26	-2.09	1.58	0.79	-0.77	-2.41	0.87	0.358

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 7: Multinomial multivariable regression predicting patterns of suicidality between ANC and 6 months post-partum

	Group 1	Group 2				Group 3				Group 4			
Description	Never SIB (N = 86)	Sustained SIB (N = 13)				New SIB (N = 11)				Ceased SIB (N = 11)			
Variables	(ref group)	Adjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value	Adjusted OR	95% CI LL	95% CI UL	p-value
Secondary education complete and more	-	-2,40	-5,04	0,23	0,074	-2,69	-5,60	0,23	0,071	-1,53	-3,60	0,55	0,149
Maternal Age	-	-0,08	-0,23	0,07	0,288	0,04	-0,10	0,18	0,577	-0,14	-0,30	0,03	0,118
IPV	-	1,62	-0,26	3,50	0,092	1,16	-0,71	3,03	0,225	0,52	-1,33	2,36	0,582
Childhood Trauma	-	-0,22	-2,17	1,72	0,821	1,33	-0,59	3,26	0,175	0,19	-1,57	1,96	0,831
EPDS	-	1,80	-0,27	3,88	0,089	-1,05	-4,06	1,97	0,497	2,54	0,47	4,60	0,016
Depression (MINI)	-	1,44	-0,42	3,30	0,128	0,19	-2,00	2,39	0,862	0,88	-1,05	2,82	0,373
Lifetime traumatic events	-	-0,08	-0,62	0,45	0,764	-0,16	-0,76	0,44	0,597	-0,40	-0,98	0,18	0,181
<i>Trauma / PTSD:</i>													
No exposure	-	(ref)				(ref)				(ref)			
Suspected PTSD	-	0,53	-1,99	3,05	0,68	0,70	-2,16	3,55	0,633	1,69	-0,62	4,00	0,152
Trauma Exposed	-	1,04	-2,16	4,25	0,523	2,63	-0,24	5,49	0,072	2,61	-0,14	5,35	0,063
Smoking in pregnancy	-	0,61	-1,44	2,65	0,559	1,51	-0,63	3,64	0,168	-0,28	-2,40	1,84	0,798

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Table 1: Global evidence on Perinatal suicidality**

<b>Authors</b>	<b>Year</b>	<b>Location</b>	<b>Sample/setting</b>	<b>Perinatal time</b>	<b>Measures of SIB</b>	<b>Prevalence of SIB (%)</b>	<b>Positive Correlates</b>
<b>United States of America</b>							
Zhong et al.	2016	USA	National Inpatient Sample (nationwide)	Pregnancy	Hospitalization records (ICD-11 codes)	2006: 47.5 2012: 115 per 100 000	Lower income, younger age (12 – 18), race (African-American)
Alhusen et al.	2015	Baltimore, Maryland, USA	166 African American women, lower income	Pregnancy	EPDS – Q10	22.8	Depression IPV
Kim et al.	2015	Illinois, Chicago, USA	22 118 – records review	Pregnancy & 6 weeks post-partum	EPDS – Q10	3.8 (4.1 AP, 3.4 PP)	Prior mental illness, single, non-Caucasian, PP lacerations
Wisner et al.	2013	Illinois, Chicago, USA	10 000 sequential records - general population	Post-partum	EPDS – Q10	3.2	19% of women with EPDS score >10
Gavin et al.	2011	Seattle, Washington, USA	2159	Pregnancy	PHQ short form	2.7	Depression Psychosocial stress
Melville et al.	2010	Seattle, Washington, USA	1888 pregnant women	Pregnancy	PHQ short form	2.6	28/49 had probable major depression

Newport et al.	2007	Atlanta, Georgia, USA	383 women with Neuropsychiatric illness	Pregnancy	BDI and HDRS	33	Depression Comorbid Anxiety D Unplanned Pregnancy
Coker et al.	2017	Atlanta, Georgia, USA	842 women with Neuropsychiatric illness	Post-partum	EPDS, BDI, HDRS	22.3	Depression < college education, unplanned pregnancy past suicide attempt Childhood Trauma (CTQ)
Sit et al.	2015	Pittsburgh, USA	628 depressed mothers at 4 – 6 weeks PP	Post-partum	EPDS – Q10	21	Childhood physical abuse, sleep disturbance, anxiety symptoms
Muzik et al.	2016	Michigan, USA	116 mothers with childhood maltreatment histories	Post-partum	PDSS – suicidal ideation subscale	37 (4m PP) 25 (minimum)	Variable – resilience, marital status, shame, family support
<b>Other High Income Countries</b>							
Howard et al.	2011	UK	4000 women in Primary Care (RESPOND)	Post-partum	EPDS – Q10	9	younger age, higher parity, higher levels of depressive symptoms
Doi & Fujiwara	2019	Japan	8074 mothers 3 month health check-up	Post-partum	EPDS – Q10	–	Combination of younger age (<25) and ACE (adverse childhood events)
Mauri et al.	2012	Pisa, Italy	1066 women (non-clinical sample)	Pregnancy & Post-partum	MOODS-SR (1) EPDS – Q10 (2)	6.9 AP, 4.3 PP (1) 12 AP, 8.6 PP (2)	Major and minor depressive episodes, Lifetime suicidality. Low education and unemployment (pregnancy only, EPDS only)

Pope et al.	2013	Ontario, Canada	147 women with Depression or BPAD II	Post-partum	EPDS – Q10 (1) HDRS – Q3 (2)	16.79 (1) 6.16 (2)	Depression severity Hypomanic symptoms
Giallo et al.	2018	Australia	1507 women	Pregnancy & Post-partum	EPDS - Q10	4-5	Depressive symptoms, childhood physical abuse, unemployment, high perceived need for social support
<b>Asian Subcontinent</b>							
Supraja et al.	2016	South India	462 women <20 weeks pregnant	Pregnancy	SBQ-R (Suicide behaviour questionnaire) EPDS – Q10	7.6	Depression Severity Lifetime history of SI
Asad et al.	2010	Urban Pakistan	1369 women 20-26 weeks' gestation	Pregnancy	AKUADS (Aga Khan University Anxiety and Depression Scale)	11	Anxiety / Depression Verbal, physical, sexual abuse
Gausia et al.	2009	Rural Bangladesh	361 women 34-35 weeks' gestation	Pregnancy	EPDS – B (Bangla version)	14	–
<b>South America</b>							
Vaz et al.	2014	Rio de Janeiro, Brazil	234 women (study re omega-6 fatty acids)	Pregnancy	MINI	19.6	Arachidonic Acid levels Adrenic Acid levels
Zhong et al.	2015	Lima, Peru	1517 women	Pregnancy	PHQ – 9 (1) EPDS – Q10	15.8 (1) 8.8 (2)	Depression Migraine combination



Huang et al.	2012	Sao Paulo, Brazil	831 women	Pregnancy	SRQ - 20	6.3	CMD – common mental disorders Single Psychiatric History Smoking (Tobacco)
Benute et al.	2011	Sao Paulo, Brazil	268 high risk pregnant women	Pregnancy	PRIME – MD (Portuguese version)	5	Religion protective Variety of symptoms; low mood, guilt, agitation, insomnia, fatigue, poor concentration, low appetite
Tavares et al.	2012	Pelotas, Brazil	919	Post-partum	MINI	11.5	Low educational levels Comorbid Mood or Anxiety Disorder (includes PTSD)
Freitas et al.	2002	Sao Paulo, Brazil	120 adolescents	Pregnancy	BSI (Beck scale for suicidal ideation)	16.7	Depression Single No social support
Tabb et al.	2018	Sao Paulo, Brazil	701 Low income women	Post-partum	CIS-R	4	IPV
<b>Sub-Saharan Africa</b>							
Rochat et al.	2013	Rural KZN, South Africa	High rates of HIV, Depression	Pregnancy	Qualitative interview based on SCID (also used EPDS-Q10)	27.5	Depression
Dewing et al.	2013	RSA	249 women 59.8% with severe food insecurity	Post-partum	MINI	7.6	Food insecurity

Onah et al.	2017	Hanover Park, Cape Town, South Africa	376 women – low resource community	Pregnancy	MINI	18	Depression, Anxiety, lower SES, food insecurity, IPV, multiparousity, and lifetime suicide attempt
Rodriguez et al.	2018	Mpumalanga province, South Africa	681 Women living with HIV and poverty	Pregnancy & Post-partum	EPDS – Q10	39 (AP) 20 (PP)	Depression, IPV
Shamu et al.	2016	Harare, Zimbabwe	842 women	Post-partum	Asked about Suicidal ideation “ever” and “last 4 weeks”	21.6	Emotional IPV



## B. SUICIDALITY

Points

In the past month did you:

B1	Have any accident? This includes taking too much of your medication accidentally. IF NO TO B1, SKIP TO B2; IF YES, ASK B1a:	NO	YES	0
B1a	Plan or intend to hurt yourself in any accident either actively or passively (e.g. by not avoiding a risk)? IF NO TO B1a, SKIP TO B2: IF YES, ASK B1b:	NO	YES	0
B1b	Intend to die as a result of any accident?	NO	YES	0
B2	Feel hopeless?	NO	YES	1
B3	Think that you would be better off dead or wish you were dead?	NO	YES	1
B4	Think about hurting or injuring yourself or have mental images of harming yourself, with at least some intent or awareness that you might die as a result?	NO	YES	4
B5	Think about suicide (killing yourself)?	NO	YES	6

IF NO TO B5, SKIP TO B7. OTHERWISE ASK:

Frequency

Intensity

Occasionally	<input type="checkbox"/>	Mild	<input type="checkbox"/>
Often	<input type="checkbox"/>	Moderate	<input type="checkbox"/>
Very often	<input type="checkbox"/>	Severe	<input type="checkbox"/>

B6	Have difficulty restraining yourself from acting on these impulses?	NO	YES	8
B7	Have a suicide method in mind (e.g. how)?	NO	YES	8
B8	Have a suicide plan in mind (e.g. when or where)?	NO	YES	8
B9	Intend to act on thoughts of killing yourself?	NO	YES	8
B10	Intend to die as a result of a suicidal act?	NO	YES	8
B11	Take any active steps to prepare to injure yourself or to prepare for a suicide attempt in which you expected or intended to die? This includes times when you were going to kill yourself, but were interrupted or stopped yourself, before harming yourself. IF NO TO B11, SKIP TO B12.	NO	YES	9
B11a	Take active steps to prepare to kill yourself, but you did not start the suicide attempt?	NO	YES	
B11b	Start a suicide attempt, but then <b>you stopped yourself</b> before harming yourself (aborted attempt)?	NO	YES	
B11c	Start a suicide attempt, but then <b>someone or something stopped you</b> before harming yourself (interrupted attempt)?	NO	YES	
B12	Injure yourself on purpose without intending to kill yourself?	NO	YES	4
B13	Attempt suicide (to kill yourself)?	NO	YES	10

A suicide attempt means you did something where you could possibly be injured,  
with at least a slight intent to die.

IF NO, SKIP TO B14:

Hope to be rescued / survive   
Expected / intended to die

**In your lifetime:**

B14 Did you ever make a suicide attempt (try to kill yourself)? NO YES 4

“A suicide attempt is any self injurious behavior, with at least some intent (> 0) to die as a result or if intent can be inferred, e.g. if it is clearly not an accident or the individual thinks the act could be lethal, even though denying intent.”  
(C-CASA definition). Posner K et al. Am J Psychiatry 164:7, July 2007.

IS AT LEAST 1 OF THE ABOVE (EXCEPT B1) CODED YES?

IF YES, ADD THE TOTAL POINTS FOR THE ANSWERS (B1-B14)  
CHECKED 'YES' AND SPECIFY THE SUICIDALITY SCORE AS INDICATED IN THE DIAGNOSTIC BOX:

MAKE ANY ADDITIONAL COMMENTS ABOUT YOUR ASSESSMENT OF THIS PATIENT'S CURRENT  
AND NEAR FUTURE SUICIDALITY IN THE SPACE BELOW:

NO	YES
<b>SUICIDALITY CURRENT</b>	
1-8 points Low	<input type="checkbox"/>
9-16 points Moderate	<input type="checkbox"/>
≥ 17 points High	<input type="checkbox"/>