SCREENING FOR POSTPARTUM DEPRESSION AT RAHIMA MOOSA MOTHER AND CHILD HOSPITAL

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Declaration

I Sameera Haroon Karolia declare that this research report is my own, unaided work (except where acknowledgements indicate otherwise). It is being submitted for the Degree of Master of Medicine in Obstetrics and Gynaecology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

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Signature

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Date

Dedication

To Imtiyaaz and Ebrahim

Your birth taught me that indeed sadness can exist in the face of the greatest joy

and

To the mothers of Rahima Moosa Mother and Child Hospital

whose experiences gave life to this study. May this little voice start great conversations.

Presentations

Obsterics and Gynaecology journal club meeting
Chris Hani Baragwanath Academic Hospital
1 February 2016

Obsterics and Gynaecology departmental meeting
Rahima Moosa Mother and Child Hospital
1 March 2016

Priorities in Perinatal Care Conference
Forever Resorts Warmbaths
8 March 2016

Abstract

Background

Postpartum depression is the most common psychopathology encountered in the period following childbirth. In addition to increasing the risk of maternal suicide and infanticide, it is associated with significant morbidity, adversely affecting the patient, infant and family. Despite postpartum depression being an important public health issue it remains poorly recognised and underdiagnosed.

The current South African context in which obstetric care is delivered to patients focuses predominantly on physical health. No screening policy for postpartum depression is currently recommended in South Africa.

The aim of this study was to determine the proportion of patients at risk of postpartum depression by screening mothers at six weeks postnatally using the Edinburgh postnatal depression scale.

Methods

Patients delivered by vaginal delivery and caesaerean section at Rahima Moosa Mother and Child Hospital were randomly selected from delivery records for recruitment to the study. A baseline sociodemographic, medical and obstetric questionnaire was completed at the enrolment visit in all patients that consented to participate. Participants were then contacted telephonically six weeks later. The Edinburgh postnatal depression scale was sent via text message to patients and they were allowed time to respond at their convenience. Participants were contacted to retrieve their responses and formulate scores. Screen positive patients were identified by a score of thirteen or greater on the Edinburgh postnatal depression scale or a positive response to thoughts of self or infant harm and were offered referral to the department of psychiatry.

Results

A total of 178 patients were screened for postpartum depression using the Edinburgh postnatal depression scale. The main outcome measured was the proportion of screen positive participants who exceeded the threshold score on the Edinburgh postnatal depression scale or responded positively to thoughts of deliberate self or infant harm. Forty-eight participants screened positive resulting in 27.0% of the study population being at risk of postpartum depression.

Sociodemographic, medical and obstetric variables were analysed in screen positive compared to screen negative participants to establish possible correlations between these variables and outcome. None of the variables proved to be significantly associated with being screen positive for postpartum depression.

Conclusion

The results of this study when compared to the prevalence findings of local and international studies suggest that postpartum depressive symptomology is common in urban South Africa. Since this study did not establish a statistically significant relationship between possible predisposing factors and the risk of postpartum depression, no specific variables have been implicated in predicting postpartum depression in our study population. These findings support the need for universal screening for postpartum depression in South Africa. Further research to investigate risk factors for postpartum depression in a South African setting is recommended.

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Table of Contents **Page**

List of Figures	Page

List of Tables	Page

List of Abbreviations

5HTT- 5- hydroxy tryptamine transporter

ACTH – adrenocorticotrophic hormone

BMI - body mass index

BPDS - Bromley postnatal depression screen

CEO- Chief Executive Officer

COMT- catechol-methyl transferase

CRH – corticotrophin releasing hormone

DNA- deoxyribonucleic acid

DSM – Diagnostic and Statistical Manual

EPDS – Edinburgh postnatal depression scale

GABA – gamma aminobutyric acid

HAD – Hospital Anxiety and Depression scale

HIV- Human immunodeficiency virus

HPA- hypothalamic-pituitary-adrenal axis

IDA – Irritability, Depression and Anxiety scale

MAO- monoamine oxidase

MDD- major depressive disorder

MINI- Mini international neuropsychiatric interview

MOU- midwife obstetric unit

NICE- National Institue for Health and Clinical Excellence

NPV – negative predictive value

PDSS – Postpartum depression screening scale

PHQ-9 – Patient Health Questionnaire-9

PPD – postpartum depression

PPV- positive predictive value

RCOG - Royal College of Obstetricians and Gynaecologists

RMMCH- Rahima Moosa Mother and Child Hospital

SD- standard deviation

SNP – single nucleotide polymorphism

T3 - triiodothyronine

T4 - tetraiodothyronine

TSH – thyroid stimulating hormone

UK- United Kingdom

USA- United States of America

WHO – World Health Organisation

1. Introduction

Mood disorders constitute the most common and serious maternal psychiatric conditions in the postpartum period.[1] The United Kingdom's confidential enquiries into maternal deaths identified mental illness as a major contributor to maternal death by suicide over the past two decades.[2,3] In addition to increasing the risk of maternal suicide and infanticide, postpartum depression (PPD) in particular is associated with significant morbidity.[4] The impact of depressive symptoms in the critical postpartum period extends beyond poor maternal health to adversely affect the infant and family structure at large.[4] Despite PPD being an important public health concern carrying significant morbidity and potentially life threatening complications, the condition remains poorly recognised and underdiagnosed.[4,5]

2. Literature Review

2.1 Perinatal Mental Illness

Perinatal mental illness comprises the psychiatric disorders that manifest during pregnancy and the period up to 12 months following childbirth.[10] These conditions complicate the antenatal and more commonly the postpartum period.[10] Postpartum psychiatric disorders can be classified into five main categories viz.

I) Postpartum blues

II) Postpartum depression

III) Postpartum psychosis

IV) Postpartum post-traumatic stress disorder

V) Postpartum anxiety and obsessive compulsive disorder.[5]

2.2 Postpartum Mood Disorders

A mood disorder is defined as a psychiatric condition characterised by an abnormality of emotional state.[11] The postpartum mood disorders are distinguished by their onset in the period following childbirth and comprise a spectrum of conditions of increasing severity i.e. the postpartum blues, postpartum depression and postpartum psychosis.[12]

2.2.1 Postpartum blues

The postpartum blues can be described as a transient disturbance in mood characterised by low grade depressive symptoms occurring in the first ten days following delivery. There are no established criteria for the diagnosis of the postpartum blues.[13] It is a common entity occurring in 50-85% of women.[12] The condition has been ascribed to rapid changes in a woman's hormone levels, the stress of childbirth and the awareness of the increased

responsibility of motherhood.[5] The symptoms are generally self limiting and do not impair functioning.[5] They generally require only supportive interventions. Despite this, a significant proportion, up to 20% of patients with postpartum blues can go on to develop PPD.[12,14] The postpartum blues are a recognised risk factor for the development of PPD.[4]

2.2.2 Postpartum depression (PPD)

PPD can be described as a moderate to severe emotional disturbance presenting with physical and psychological symptoms that define a major depressive episode as per the Diagnostic and Statistical Manual – edition V (DSM V). Onset of the symptom cluster occurs within the four weeks following delivery.[10] The depressive episode of PPD has no distinctive characteristics that allow for discrimination from a major depressive episode occurring at any other time in a woman's life.[10] Studies however have shown that anxiety symptoms occur more frequently with PPD than with depression at other times.[5] A large postpartum study that screened participants for PPD followed by diagnostic evaluation found that 66% of women with major depression had a co-morbid anxiety disorder diagnosis.[15] In severe cases the depression may even reach psychotic proportions.[13]

2.2.3 Postpartum psychosis

Postpartum psychosis occurs in 0,2% of women following parturition.[12] It is a psychiatric emergency characterised by an acute onset of delusions and/or hallucinations frequently superimposed on a pre-existing affective disorder in the postpartum period. The onset is usually within one month of delivery. Robust data indicate that postpartum psychosis essentially complicates an episode of a mood disorder, usually bipolar mood disorder or depressive disorder.[13] Women are at a greater risk of affective psychoses after birth than at any other time during their lives.[10] Infanticide is observed in 4% and suicide in 5% of women with postpartum psychosis.[5]

2.3 Postpartum Depression

2.3.1. A global public health concern

Major depressive disorder is the second leading cause of disability worldwide according to the 2013 global burden of disease study.[16] The United Kingdom's confidential enquiries into maternal deaths and morbidity for the period 2009-2013 reported that 23% of late maternal deaths which occurred after six weeks up to one year postpartum were attributed to mental health related issues.[17]

Women have twice the lifetime risk of developing major depressive disorder than men and the ages at which women have the highest rates of depression across their lifespan are within the reproductive years.[10,18] There is substantial evidence to suggest that the risk of developing depression is significantly elevated following childbirth and in particular the three months thereafter.[19] Cox et al in the first British study investigating the incidence and prevalence of depression in a group of postpartum women compared to non-postpartum controls found the period prevalence of depression to be similar in both groups.[20] The results however revealed a threefold increase in the incidence of depression in the first month postpartum.[20] This correlated with the earlier findings of Cooper et al who reported that 50% of newly diagnosed non-psychotic psychiatric illness in the postpartum period occurred within three months postnatally.[19] In the first three months after delivery 14,5% of women have a new episode of major or minor depression.[18,21]

PPD has been the focus of increasing global attention for a number of reasons. It is a common condition which impairs the pivotal maternal role in family and society with immediate and long term psychosocial morbidity. The negative effects of PPD impact on the wellbeing of the woman, her partner and children with recognised adverse outcomes on infant and child development.[3] Severe PPD is associated with potentially fatal consequences to the mother and infant.[4]

2.3.2 Prevalence and transcultural variation

The prevalence of postpartum depression, as quoted in international literature, is 10-15%.[5,14] In a meta-analysis of 59 studies on PPD the average prevalence rate of non psychotic PPD was found to be 13%.[22] Prevalence estimates in individual studies vary and are affected by the assessment method and the period over which prevalence is determined.[10,22]

There is also a wide range of reported prevalence of PPD from different countries ranging from 0% to 60%.[14] Significant transcultural variation exists in the interpretation and reporting of depressive symptoms.[14] A systematic review by Zubaran et al. examined the cultural characteristics of postpartum depressive symptomology. They found that cultural forces and socio-economic elements influence the expression of depression resulting in regional variation in prevalence rates. The stigma associated with mental illness in certain cultures result in maternal distress manifesting as somatisation of psychological symptoms leading to underreporting of depressive symptoms.[14]

In 1983 Stern and Krukman postulated that PPD was an infrequent condition in non-western cultures. The social structure in these settings and support of mothers in the puerperium by women in their families and communities was thought to be protective against PPD.[14] Subsequent studies investigating the prevalence of PPD in developing countries have found that prevalence rates in some low resource countries are twice those of developed countries.[23] An international study by Affonso et al. sampled cohorts from nine countries, representing five continents, with the aim of exploring differences in postpartum depressive symptomology. The highest depressive symptom scores were noted in participants from Asia and South America and the lowest amongst European and Australian women.[24]

The rates of PPD vary from 4,9% to 59.4% in low resource countries.[24] Although the physiology of pregnancy and parturition is similar in women, the event is conceptualised differently across cultures.[18] Prevalence rates of PPD are influenced by religious practices, cultural norms, socioeconomic deprivation and the lack of healthcare infrastructure in developing countries.[14] In a prospective study by Khalifa et al, 238 Sudanese women were screened for PPD at three months postnatally and evaluated using the Mini International Neuropsychiatric Interview (MINI). They established a prevalence rate of 9,2%. These lower than average global figures were attributed to the quality of social support in Sudan and to a culture that values and assigns a higher social status to women that are able to reproduce.[23]

Comparatively, a study by Cooper et al established the point prevalence of PPD in peri-urban South Africa at 34.7%. This is far higher than that of Sudan as well as the widely cited international mean of 13%.[10,25]

2.4 Aetiology

Childbirth is a notable precipitant for psychiatric illness in susceptible women.[26] No single aetiological factor is definitively implicated in the pathogenesis of PPD. A multifactorial aetiology is currently proposed. Biological factors appear to play a central role in the complex aetiology with psychosocial elements and cultural forces shaping the overall expression.[14]

2.4.1 Genetic factors

Major depression is a polygenetic illness and the presence of more than one vulnerable gene increases the likelihood of the disorder.[27] The expression of certain genes may also influence the subtype of depression expressed.[27] A single neucleotide polymorphism (SNP) is a genetic variation of a single base pair in the DNA sequence occurring in at least

one percent of the population.[28] Some of the biological changes related to PPD may be genetically determined by polymorphisms in susceptibility genes. A systematic review by e-Couto et al examined the relationship between genetic factors and PPD and set out to elucidate the genotypes of major depression and PPD. The 20 studies included in this review, were conducted in ten different countries and investigated genes associated with pathways hypothesised in the aetiology of PPD.[28] The majority of the research done focussed on polymorphisms of the 5HTT gene involved in serotonin metabolism, followed by genes associated with tryptophan metabolism, the catecolmethyl transferase (COMT) and monoamine oxidase (MAO) genes.[28] The data supports a significant association between specific polymorphisms in these genes and PPD.[28] As with other psychiatric disorders, genetic influence alone is insufficient for disease expression. Epigenetics and environmental triggers modify gene expression and elicit clinical disease in genetically predisposed subjects.[28] The genetic basis for major depression and PPD are similar and the review by e-Couto et al concludes that PPD is a temporal variant of major depression and not a unique diagnostic entity.[28]

2.4.2 Endocrine factors

2.4.2.1 *Gonadal steroids*

There are three key events that dictate the changes in gonadal steroid levels over the reproductive course.

I) Pregnancy and its associated supraphysiological hormonal state

II) The hypogonadal state of the puerperium and

III) The resumption of cyclical ovarian function.[29]

The hormonal milieu of pregnancy is gradually arrived at as pregnancy progresses with levels of oestrogen and progesterone steadily rising to reach a maximum close to term. With delivery and placental separation these levels dramatically decline to pregravid levels.[30] The abrupt and rapid drop in levels of circulating oestrogen and progesterone have been postulated in the aetiology of PPD. Animal studies show that the precipitous withdrawal of these hormones alter central neurotransmission.[29] Modulation of neurotransmitter systems is the mechanism that links the gonadal hormones to depression since an imbalance in central neurotransmssion is strongly hypothesised in the aetiology of depression.[31]

Estradiol is the biologically active form of oestrogen produced by the placenta. It rises 50-100 fold above maximal menstrual cycle levels by the third trimester of pregnancy.[29,30] The

biologically active free fraction of hormone also undergoes considerable increases.[29] Steroid hormones are capable of penetrating the blood brain barrier and modulating monoaminergic neurotransmitter pathways.[26] Estradiol increases serotonin and noradrenalin activity in the brain.[31] It enhances serotonergic receptor density and increases the synthesis, transport and uptake of serotonin. Serotonin breakdown and noradrenalin metabolism is reduced by estradiol mediated inhibition of monoamine oxidase (MOA) enzyme activity.[30,31] Following parturition both estradiol and progesterone levels remain low in the prolonged hypogonadal state that ensues. Restoration of ovulation and return of the menstrual cycle varies in lactating and non-lactating women with levels of estradiol and progesterone remaining at low follicular phase levels until approximately 30 days prior to the first menses.[29]
Estradiol withdrawal has also been implicated in increasing dopamine D2 receptor sensitivity.[26,29] Presynaptic D2 dopamine receptors function as autoreceptors. Binding to the D2 receptor family reduces dopamine cell firing and decreases the amount of dopamine released with each action potential.[27,30] The decline in estradiol after delivery and the persistently low levels in the puerperium should therefore theoretically predispose to depression by reducing the intrasynaptic levels of serotonin noradrenalin and dopamine.[30]

A study comparing estradiol levels between day one and week eight following delivery found no difference in levels of total estradiol in women with and those without depression.[30] Similarly a study by Mehta et al which aimed to identify early biomarkers of PPD found no significant differences in plasma estradiol and estriol levels in euthymic compared to postpartum depressed mothers.[32] Levels of unbound estradiol however have not been studied in women with PPD and may merit examination. [30]

In a double-blinded randomised controlled trial, Gregoire et al examined the antidepressant effect of 17B estradiol supplementation in PPD. Estradiol was investigated as its mode of action specifically addressed the theories of PPD aetiology. The trial demonstrated the superiority of transdermal estradiol to placebo in relieving the dysphoric symptoms in patients with severe postnatal depression at baseline.[33] Eighty percent of patients in the treatment group scored below the threshold for major depression within three months of estradiol therapy compared to 31% in the placebo group. Independent variables including concurrent antidepressant therapy were factored into the analyses and found not to significantly influence the outcome measured.[33]

Similarly the sharp decline in levels of progesterone following delivery has been implicated in postpartum mood changes.[30] The proposed mechanism relates to progesterone modulating gamma amino butyric acid (GABA) neurotransmission. GABA is the major inhibitory neurotransmitter in the central nervous system. High levels of progesterone enhance GABA-A receptor activity inducing sedative and calming effects.[34] Progesterone withdrawal reduces GABA activity and is linked to dysphoric mood, sleep and anxiety disorders.[34] Studies have however failed to confirm a causal relationship between levels of total or free progesterone and PPD.[30]

The response in mood to the neurobiological changes that occur with gonadal steroid withdrawal may be related to the rapidity of withdrawal. This is supported by the observation of an increased occurrence in mood disturbances following abrupt hormonal decline after surgical menopause compared to the gradual hormone reduction that occurs with natural menopause. [29]

2.4.2.2 *Hypothalamic-pituitary-adrenal (HPA) axis*

HPA axis dysfunction is one of the most reproducible findings in major depression.[29] HPA axis dysfunction is observed in both major depression and PPD and normalization of the HPA axis is associated with improved mood.[29] The HPA axis in pregnancy is driven by placentally derived corticotrophin releasing hormone (CRH), produced by the placenta and secreted into maternal circulation in large amounts especially during the third trimester.[29] It results in hypersecretion of cortisol from the adrenal glands with increased basal plasma and urinary cortisol levels in pregnancy.[29] The feedback response to the elevated cortisol suppresses hypothalamic CRH levels with subsequent suppression of pituitary adrenocorticotropic hormone (ACTH).[29] Following parturition, plasma levels of placentally derived CRH fall sharply and cortisol levels decline. Suppression of the HPA axis due the down regulation of central CRH is however prolonged in the early puerperium. Hypothalamic CRH should gradually normalise within three months postpartum with a recovery in the ACTH response following the progressive downsizing of the hypertrophied adrenal glands.[35] The suppression of central CRH in the early postpartum period is associated with an increased vulnerability to psychopathology at this time.[35] Magiakou et al examined this hypothesis and found a pronounced and persistent blunting of ACTH response to exogenous CRH administered to patients with PPD compared to euthymic mothers. They suggest a potential role for ACTH as a biochemical marker of PPD.[35]

2.4.2.3 *Oxytocin*

The role of oxytocin during labour and in the initiation and maintenance of lactation is well established. Recent animal and subsequent human studies support a major role of oxytocin in maternal behavioural adaptation. Oxytocin promotes affectionate and stimulatory behaviour of mothers toward their infants and improves maternal-infant attachment and bonding. Low oxytocinon levels during pregnancy are associated with impaired maternal emotional adaptation in the puerperium.[36] In a prospective study Skrundz et al examined the association between plasma oxytocin levels during pregnancy and PPD. They concluded that low plasma oxytocin concentration in the third trimester is significantly associated with the development of postpartum depressive symptoms at two weeks post delivery.[36]

2.4.2.4 *Prolactin*

Prolactin levels rise considerably in late pregnancy and remain elevated, within physiological limits, for the duration of breastfeeding. In non-lactating mothers they return to pregravid levels within three weeks following delivery.[30] Pathological hyperprolactinaemia in non-pregnant women is associated with depression, anxiety and hostility.[30] In comparison, the role of prolactin in postpartum psychopathology has been examined but a significant association between levels of prolactin and PPD has not been established.[30]

2.4.2.5 *Thyroid hormones*

Pregnancy influences thyroid function in several ways.

I) The increased renal clearance of iodine predisposes to a relative iodine deficiency state.

II) Placental human chorionic gonadotropin stimulates the production of triiodothyronine (T3) and tetraiodothyronine (T4) by mimicking the effect of thyroid stimulating hormone (TSH) on the thyroid gland.[29]

III) Thyroid binding globulin levels are increased in response to elevated oestrogen.[29]

The net effect of these physiological changes result in levels of T3, T4 and TSH being maintained within normal limits. High cortisol levels during pregnancy have an immunosuppressive effect followed by a rebound immune phenomenon after delivery. Thyroid auto-antibodies occur in 11,6 % of mothers postpartum increasing the risk of developing overt hypothyroidism up to four years post delivery.[30]

The incidence of thyroid dysfunction is increased postnatally occurring at a rate of seven percent within the six months postpartum.[30] Mood disturbances may be a manifestation of thyroid dysfunction as the primary pathology as hypothyroidism decreases central serotonin

activity.[30] Abnormal thyroid hormone levels have not consistently been identified in patients with PPD but are of clinical relevance in a subgroup of women.[29] Pop et al conducted a prospective study on 293 pregnant women followed to 34 weeks postpartum with the aim of examining the relationship between thyroid dysfunction and PPD. The incidence of thyroid dysfunction was found to be 7% in this cohort with depression occurring in 38% of the thyroid disorder group. Depressive symptoms resolved upon correction of thyroid abnormalities.[37] Clinical suspicion should therefore prompt the evaluation of thyroid hormone profiles in the relevant group of patients with PPD as correcting the underlying hormonal irregularities confer therapeutic benefit.

There is no conclusive evidence to establish a causal relationship between absolute hormone levels or the changes thereof and PPD. PPD is therefore not simply a condition of hormone deficiency or excess.[29] Psychopathology in the postpartum period may be a reflection of extreme sensitivity to normal endocrine changes resulting in an abnormal response to normal hormone levels.[30,32]

2.5 Risk Factors

Pregnancy has historically been viewed as a period of emotional well being with parturition marking the culmination of months of anticipation.[3,8,28] In recent years evidence to the contrary has been mounting. The puerperium confers an increased risk for new onset or recurrence of mental disorders in susceptible women.[28] The experience of childbirth, the dramatic postpartum physiological changes and the demands of newborn care make the transition to motherhood a challenging time for the woman, her partner and family.[5] Several psychological and social determinants modify the risk of developing mental illness postnatally. Studies examining these psychosocial elements arrive at a similar constellation of risk factors for PPD.[4]

A meta analysis by O'Hara and Swain quantified the relationship between PPD and various risk factors examined in 77 independent studies.[22] Sociodemographic and obstetric factors as well as the impact of adverse life events were analysed and effect sizes generated for each variable investigated. The following risk factors were found to be significantly associated with the development of PPD viz. a history of or current mental illness, marital or partner conflict, recent life stressors, poor social support and low socioeconomic status.[3,12,22]

2.5.1 Psychological factors

Previous or current psychopathology has consistently been identified as the most powerful predictor of PPD. This includes:

I) A personal history of a depressive disorder or other mood or psychotic disorder

II) Previous premenstrual dysphoria

III) Antenatal depression or anxiety

IV) Postpartum blues in the index pregnancy.[3,4,38]

Women with a significant history of serious mental illness have a 50% risk of an affective disorder recurring after delivery even if they are well during pregnancy.[2] The results of the meta analyses by O'Hara and Swain indicate that a family history of depression is not a significant risk factor for PPD.[22]

Pregnancy and childbirth constitute major life events. Additional stressors at a vulnerable time may trigger the onset of PPD.[38] Life events of notable significance that impact the risk of developing PPD include the death of a loved one, extreme relationship changes, moving home and changes related to occupation or employment.[38] A meta-analysis by Beck in 2001 reviewed 84 studies on predictors of PPD and found a moderate relationship between perceived life stress and PPD.[39] This corroborated the findings of O'Hara and Swain of a strong association between experiencing a life event and the development of PPD.[22]

The transition to motherhood compels an abrupt adaptation to the various demands instantaneously imposed on the new mother.[5] The woman has to sustain her role in the relationship with her partner and family members; attend to her other children and conform to societal and self expectations while adapting to the physiological changes of the puerperium and constant care of the newborn. The disruption of the circadian rhythm and the sleep deprivation typical of the puerperium together with any pre-existing psychosocial stressors may aggravate mood destabilization.[5,10]

2.5.2 Social factors

Social support is a multidimensional concept encompassing informational, instrumental, emotional support and positive reinforcement provided by one's spouse, relatives and friends.[38,40] In a cross sectional study examining the impact of social support on PPD amongst Canadian women, both teenage and adult mothers were found to be at a five times greater risk of developing PPD if they received minimal social support.[40] Minimal support comprised

responses on survey of having received no, little or some support as opposed to receiving support most of the time or all the time.[40]

Women diagnosed with PPD perceive their partners as being less supportive despite levels of actual support.[38] This underrating could be attributed to the negative perceptions associated with depression.[38] The meta analysis by O'Hara and Swain specifically examined support from the baby's father antenatally as a predictor of PPD. Results revealed no significant association between antenatal partner support and the development of PPD but rather an inverse relationship between levels of support and the severity of subsequent depression. When analysing studies that scored the antepartum marital relationship using a validated scale, a small but significant association was found between low marital satisfaction scores and PPD.[22]

Socioeconomic deprivation has been implicated as a risk factor for PPD.[38] Despite methodological inconsistencies in individual studies with regard to the criteria that define "low" income, meta analyses suggest women with fewer financial resources are at an increased risk of PPD.[22,38] O' Hara and Swain demonstrated that family income and maternal occupation are weak but significant predictors of PPD.[22]

Sociodemographic variables including maternal age, level of education, parity and marital status were not found to be significantly associated with the development of PPD.[22]

2.5.3 Other risk factors

Owing to the substantial morbidity and deleterious consequences of PPD, several studies set out to determine additional risk factors for PPD in an attempt to timeously identify women at risk to enable early case detection, diagnosis and treatment.

2.5.3.1 *Intimate partner violence*

Woolhouse et al explored the relationship between intimate partner violence and PPD.[41] From the Australian cohort, they concluded that emotional abuse was more common than physical violence or sexual abuse and that forty percent of women with PPD reported intimate partner violence.[41] There is a strong co-morbid relationship between PPD and intimate partner violence and the perinatal period provides an opportunity to identify and support women experiencing abuse.[41]

2.5.3.2 *Obstetric complications*

Results of independent studies examining the predictive value of obstetric variables on the development of PPD were aggregated and analysed yielding small but significant effect sizes.[22] Perinatal complications were found to increase the risk for PPD but the mode of delivery was not independently associated with the development of PPD.[21] Blom et al studied various obstetric and delivery complications as risk factors for PPD in a population of 4941 women in Rotterdam, Netherlands. They found that twin pregnancies, the gender of the infant and the five minute neonatal Apgar score were not associated with the development of PPD. After correcting for confounders, perinatal complications found to be significantly associated with PPD included, pre-eclampsia, hospitalisation of the mother during pregnancy, delivery by emergency caesarean section, the suspicion of fetal distress and hospitilisation of the neonate. They concluded that the risk for PPD increased with the number of perinatal complications present.[42] Mothers of preterm infants and infants admitted to the neonatal intensive care unit (ICU) are at a greater risk of PPD with aggravated symptomatology. The increased risk may be attributed to environmental, psychosocial and financial stressors. These include low lighting, the sight and sounds of medical equipment in the neonatal ICU, separation from the neonate, concerns regarding the wellbeing of the baby, feelings of helplessness and loss of the maternal role..[43]

2.5.3.3 *Body mass index (BMI)*

In a prospective study in urban Utah, USA the association between pre-pregnancy obesity and PPD was explored. Participants were screened for depression at six to eight weeks postpartum and the impact of pre-pregnancy body mass index (BMI) on outcome was assessed. Obesity was found to be an independent risk factor for PPD, the relationship between obesity and depression being bidirectional.[44]

2.5.3.4 *Pregnancy intention*

Unintended pregnancy is common with 40% of pregnancies worldwide being unintended in 2012.[45] Women with an unplanned pregnancy are at a greater risk of developing PPD up to a year following childbirth.[46]

2.5.3.5 *Risk factors for PPD in South Africa*

Meta analyses that aggregate data from a large number of studies may obscure the findings of smaller studies which hold significance in specific populations. The key risk factors for PPD as evidenced in the literature are not universally applicable to all populations groups. In the

meta analysis by O'Hara and Swain considerable heterogeneity in effect sizes for variables investigated were noted across studies, mainly attributable to the country in which the study was conducted and inconsistencies in the methods employed in individual studies.[22]

Ramchandani et al examined antenatal predictors of PPD in the socioeconomically deprived, urban setting of Soweto-Johannesburg, South Africa.[47] The only sociodemographic variable found to be significantly associated with PPD was maternal level of education. The higher the level of education attained by the mother the lower the risk of PPD.[47] The strongest independent risk factors for PPD identified in this cohort were partner conflict and societal stress. Societal stress, described as witnessing a violent crime or fear that one's life may be in danger is certainly unique to this study population as these mothers delivered during 1990 at a politically volatile and violent time in South African history.[47]

2.6 Diagnosis

2.6.1 Evolution of the DSM

Perinatal mental illness has been recognised since the time of Hippocrates but has proven to be a concept of much debate over the centuries as childbirth related depression is not viewed as a distinct clinical entity.[10] Research suggests that PPD is major depression recognised at a time of potential stress.[18] The DSM is the composite of diagnostic criteria used by mental health professionals to determine whether a cluster of symptoms constitute a disorder.[48] In May 2013 the American Psychiatric Association released the fifth edition of the DSM (DSM-V). The DSM has been reviewed from editions I to V and the diagnosis of depression has evolved with each revision.[48]

PPD is not distinguished as a unique diagnostic category in the DSM but is classified as major depressive disorder (MDD) with "postpartum onset." The onset specifier was only introduced into the classification system in 1994 with the publication of the DSM-IV.[48] Strictly defined in psychiatric nomenclature PPD is therefore MDD with postpartum onset occurring within four weeks following childbirth.[4,12]

A notable revision to the diagnostic criteria for MDD in the DSM-V is the removal of the bereavement exclusion.[48] In the previous classification, the occurrence of depressive symptoms within two months of a significant loss nullified the diagnosis. However in the current classification, the diagnosis may still be considered in the context of a recent loss.[48] There has also been a change to the onset specifier which is now titled "with peripartum

onset" defined as the most recent episode occurring during pregnancy or within four weeks after delivery.[48] Although the DSM stipulates that symptoms should occur within four weeks postpartum to qualify the diagnosis, many experts believe that women remain at risk for PPD up to a year following delivery.[18]

2.6.2 Summary of the DSM-V criteria for MDD with peripartum onset (Appendix A)
The presence of five or more symptoms present for most of the day almost every day for a two week period. Either a depressed mood or loss of interest or pleasure must be included to make the diagnosis.

1. Depressed mood
2. Loss of interest or pleasure
3. Significant weight gain or weight loss
4. Insomnia or hypersomnia
5. Psychomotor agitation or retardation observed by others
6. Fatigue or loss of energy
7. Feelings of worthlessness or excessive or inappropriate guilt
8. Diminished ability to think, concentrate or make decisions
9. Recurrent thoughts of death or suicidal ideation, a suicide attempt or plan.[49]

The symptoms must represent a change from the person's usual state and must have a negative impact on the patient's social or occupational functioning to be noted as significant. All these changes should not be as a result of a medical condition or substance use.
Onset of symptoms must coincide with pregnancy or within four weeks postpartum to be regarded as peripartum onset.[49]

2.7 Associated Morbidity and Complications
Depression in the antenatal period is associated with an increased risk of adverse birth outcomes including preterm labour, delivery of low birth weight and small for gestational age infants.[8,50] These complications result in the birth of premature infants who are at greater risk of perinatal morbidity and mortality.[51] The association of antenatal depression and low birth weight is higher in low-income and middle-income countries.[52] Field et al demonstrated an increased incidence of preterm labour and low birth weight outcomes in black women with clinical depression diagnosed antenatally in the USA.[51] In their study, they found elevated urinary cortisol levels. The authors proposed that hypersecretion of cortisol due to underlying depression and stress during pregnancy offers a possible mechanism in adverse neonatal

outcomes.[51] However, there is uncertainty as to whether the association is exclusively causal as maternal depression predisposes to high risk and negligent maternal behaviour including smoking, alcohol and substance abuse, poor nutrition and non compliance with medical care.[10,53]

The phenomenon of fetal programming refers to the capacity of the in-utero milieu to modify psychobiological parameters that will persist into adulthood. Fetal programming can alter the risk of physical and psychological ill health and is important in determining future psychopathology.[53] The Barker hypothesis of the fetal origin of adult disease was derived from the study demonstrating an association between reduced fetal growth in utero and a greater mortality from cardiovascular disease in adult life. Maternal nutrition was found to be associated with reduced fetal growth and fetal programming in this study.[54] Fetal overexposure to cortisol and inflammatory cytokines released due to prenatal maternal stress may also reduce intrauterine growth and is suggested to underlie fetal programming that predisposes to ill health in later life.[53]

Behavioural problems can be observed in neonates of depressed mothers shortly after birth. They exhibit a discontented temperament, sleep problems and increased fearfulness.[4,53] The adverse effects of antenatal stress on the neonate can be moderated by the quality of postpartum maternal care.[53] However, PPD impairs mothering behaviour and has a negative effect on maternal sensitivity.[55] The nurturing and responsive tendencies of a mother to her newborn infant are blunted and mothers tend to be inconsistent, unavailable, withdrawn and hostile toward the infant.[4,55] They do not engage in healthy infant developmental activities including reading and singing and tend to be negligent of child safety practices.[55] Women with PPD are less likely to initiate or maintain breastfeeding.[4]

The adverse short and long-term effects of PPD on child development are well established and include disturbances in various domains of development.[4,52] Infants of mothers with PPD tend to be irritable, cry excessively, have a heightened arousal and insecure attachment. [4,52] They display fewer facial expressions and vocalise less.[18,43] The negative mother-child interaction predisposes to delayed neurological, cognitive, emotional and behavioural development.[18] Persistence of maternal depressive symptoms correlates with delayed achievement of developmental milestones and poor cognitive outcomes.[52] Emotional maladjustment in these children predisposes to violent behaviour, poor social competence and an increased risk of developing clinical depression in adolescence.[52,55] Several large studies support the association of PPD and symptoms of attention deficit hyperactivity disorder in

children up to the age of sixteen[52] Chronic or recurrent maternal depression is related to stunted growth and underweight children in low-income and middle-income countries. In contrast, children of mothers with chronic depression in high-income countries are at an increased risk of obesity, which may be related to the early cessation of breastfeeding and introduction of solids.[52]

PPD has profound implications on the relationship of the woman and her partner. Marital discord or partner conflict constitutes both a risk factor for and a consequence of PPD.[55] A meta analysis by Paulson and Bazemore aimed to established the prevalence of paternal depression from the first trimester of pregnancy up to one year postpartum. Forty-three studies from 16 countries were reviewed and the prevalence of paternal perinatal depression was established at 10.4% with the highest rates of depression experienced at three to six months postpartum. They analysed the correlation with maternal depressive symptoms and a moderate association was demonstrated.[56] Although depression in one partner is moderately associated with the development of depression in the other, evidence is lacking to substantiate the role of maternal depression as a cause of subsequent paternal depression.[56,57]

The perinatal period has been identified as a time of high risk for psychiatric hospitalisation especially in patients with pre-existing bipolar mood disorder and MDD.[55] Untreated PPD poses an increased risk for postpartum psychosis, suicide and infanticide.[12] The United Kingdom's confidential enquiries into maternal deaths and morbidity for the period 2009-2013 revealed that one in seven women died by suicide. Recurrent depressive illness was the most frequent diagnosis accounting for almost half of all deaths by suicide.[17] The maternal psychiatric diagnosis was a depressive disorder in all cases of extended suicide where the baby or older children died with the mother. Maternal suicide is more likely to be violent with 82% of suicides in this enquiry completed by violent means demonstrating clear intent.[4,17]

Neonaticide is defined as the killing of a newborn within 24 hours after birth and is described when the pregnancy is unwanted in two subsets of patients. The first being a woman that is deliberately concealing her pregnancy while the other is a victim of a dissociative disorder with amnesia or depersonalisation surrounding the delivery.[4,58] Infanticide is the killing of an infant in the first year of life and may occur in the context of severe PPD as a result of abuse or neglect by the mother. This may happen as the child is unwanted or as revenge against the infant's father.[4] Depression complicated by psychosis has a greater association with

infanticide as opposed to non-psychotic maternal depression. In comparison to depression that may occur at other times in a woman's life, guilt occurs more frequently in PPD.[4,30] Obsessional thoughts relating to accidental or intentional harm to the infant are frequently experienced by mothers with PPD but rarely acted upon unless the condition reaches psychotic proportions.[58] In extreme cases intrusive thoughts coupled with the guilt that one is a bad mother may drive a woman to commit dual infanticide-suicide for perceived altruistic reasons. Between16-29% of mothers who kill their children commit suicide.[4] The paradox of infanticide is that the perpetrator may themselves be a victim of a psychiatric disorder. It is this recognition that underlies the legal disparity in different judicial systems. The Infanticide Act enforced in England mandates probation and psychiatric treatment for mothers guilty of infanticide.[58] This is in contrast with the United State's legislation that imposes a lengthy sentence or even the death penalty for the convicted mother. Interestingly, there is no difference in the prevalence of infanticide between these two countries.[58]

Inadequate treatment of PPD increases the risk of chronic depression, recurrent or refractory disease.[12] More than half of all women with PPD remain symptomatic a year later.[59] A substantial proportion of mothers with apparent refractory depression suffer from undiagnosed bipolar mood disorder and antidepressant monotherapy in these patients precipitates rapid cycling, mania and treatment resistance.[10]

2.8 Screening

2.8.1 Rationale for screening

Many studies have documented that PPD is both highly prevalent and debilitating and although effective treatment is available fewer than half of all cases are recognised.[18] Guilt is frequently associated with PPD preventing mothers from divulging their mood and anxiety symptoms.[4,30] There is often misinterpretation and minimisation of symptoms by the patient, family and even health care providers.[29] Changes in sleep patterns, appetite and energy levels may be considered characteristic of the puerperium further obscuring the diagnosis.[14]

Screening for depression in the postpartum period can improve the rate of detection and treatment of PPD.[14,18] The findings from a survey of members of the Washington Academy of Family Physicians revealed that the majority of physicians routinely screened for PPD but did so informally with only thirty percent of physicians using a validated instrument.[59] Informal assessments of PPD have proven to be ineffective in case detection.[18] A number of studies examining routine postpartum screening in various cohorts using a validated instrument were

consistent in their findings that screening improved the rate of diagnosis and subsequent treatment of PPD.[18] A systematic review of fourteen randomised control trials on screening for general depression in primary care found that screening with feedback to the primary health care provider increased the detection of depression two to three fold but did not always improve clinical outcomes.[18,60] Screening in collaboration with referral pathways directed toward treatment and follow up was associated with more positive patient outcomes.[60] Screening is feasible on an outpatient basis and the majority of mothers are comfortable with the idea of being screened for PPD.[18] Convenient opportunities for screening are provided by the mother's postpartum visit and the infant's well child visits. The well child visit provides a longitudinal opportunity to screen throughout the first postpartum year.[18] Primary health care personnel, obstetricians and paediatricians should be responsible for screening at these times.[14] Barriers to screening include the lack of expertise, time constraints and the concern of legal vulnerability on the part of the clinician particularly if the mother is suicidal. Poorly integrated primary health care and mental health services without strategies for referral compound the reluctance of physicians to screen for PPD.[4,18] Patient related barriers to screening and referral include social stigma, multiple health care worker visits and increased transport and health care costs. In addition obstacles unique to the puerperal mother include childminding during consultations; the effects of medication on the infant while breastfeeding and the fear of referral to child protection services.[18]

A structured clinical interview should always follow screening to confirm the diagnosis.[18] Prompt diagnosis allows for early intervention promoting a healthy mother-infant relationship and improved developmental outcomes for the child.[14] Screening for PPD is currently recommended in Australia and the USA and the policy in the UK is toward opportunistic case finding.[61] South Africa at present does not have a screening policy in place for PPD.

2.8.2 Screening instruments

The National Institute for Health and Clinical excellence's (NICE) guideline for antenatal and postnatal mental health recommends the use of the two question screen at every visit throughout pregnancy and the puerperium.[61]

1. During the past month have you been bothered by feeling down, depressed or hopeless?
2. During the past month have you been bothered by having little interest or pleasure in doing things?

A positive response to either or both questions should prompt further assessment using

the EPDS or the Patient Health Questionnaire (PHQ-9).[18,61,62]

A systematic review of thirty-six studies on screening for PPD evaluated eight screening instruments. The results of this review suggested that the EPDS is the most extensively studied screening scale with moderate psychometric soundness.[18] The Patient Health Questionnaire (PHQ-9) is a nine item self report instrument that evaluates depressive symptoms as per the diagnostic criteria for major depression. It measures the severity of depression by rating the frequency of symptoms experienced. The psychometric properties of the questionnaire confer validity for use in screening and monitoring of general depression but the instrument has not been validated for PPD.[18]

Other tools that have been developed include the postpartum depression screening scale (PDSS) and the Bromley postnatal depression scale (BPDS). The PDSS has been developed more recently as a self report instrument to identify PPD.[14] It evaluates seven conceptual domains of maternal mental well being viz. sleep and appetite disturbances, anxiety or insecurity, emotional lability, cognitive impairment, loss of self esteem, guilt or shame and suicidal thoughts. These seven themes emerged from the author's previous qualitative research on the maternal experience of PPD. Each of the seven domains are assessed by five introspective statements resulting in a 35 item instrument. The responses to each item are indicated in grades of agreement or disagreement with the statement using a likert scale. Items are scored based on severity with the total possible score ranging between 35-175. Using a threshold score of 80 to indicate major depression, the first validation study performed using this instrument demonstrated a sensitivity of 94% and a specificity of 98%.[14]

The BPDS developed in 1992 is a ten item instrument which identifies previous and pre-existing episodes of PPD.[14] It allows the reporting of mood and behaviour symptoms pertaining to the current and past pregnancies and postnatal periods thereby establishing a temporal course of depressive symptomology. Evidence to substantiate its reliability is however limited.[14]

2.8.3 The Edinburgh Postnatal Depression Scale (Appendix B)

The EPDS was developed by Cox et al in 1987 in response to the findings of their earlier studies. A prospective study they conducted in 1982 recruited 101 participants antenatally and followed them up postnatally. Thirteen out of the 101 participants were found to have marked postnatal depressive illness. The majority of these mothers received no treatment and were not

referred to psychiatric services by their primary health care provider. The three women who were actually referred to psychiatric services were found not to be depressed.[63] A follow up study found that half of the mothers diagnosed with depression had not recovered by one year postpartum.[64] This was a cause for much clinical concern. The emphasis of screening scales for general depression is mainly on somatic symptoms which may be attributed to the physiological changes of the puerperium. Having identified the limitations of conducting screening scales for general depression on postnatal mothers a need to develop a screening instrument specific for PPD was realised and addressed.[64] Existing instruments were analysed by Cox et al and items suitable for detecting PPD were extracted and adapted appropriately. The initial scale comprised thirteen items; six adapted from the Irritability, Depression and Anxiety scale (IDA) and the Hospital Anxiety and Depression Scale (HAD) and seven newly constructed items. Two items relating to irritability and one item concerning the 'enjoyment of motherhood' were considered to be non-depression factors and subsequently removed to improve the specificity of the final instrument.[64]

The EPDS is a ten item self report scale evaluating symptoms experienced in the past seven days. It measures the emotional symptoms of PPD with less emphasis on somatic symptoms except for one item measuring sleep difficulties.[14] Each item has a scaled response based on the severity of the symptom experienced and is scored between 0-3 in increasing severity. The total possible score is between 0-30. A score of ten or greater indicates possible depression and is a marker for minor depression while a score of 13 or greater identifies probable depression or major depression.[61] The scale was validated on 84 potentially depressed participants at six weeks postnatally and found to have a sensitivity of 86%, a specificity of 78% and a positive predictive value (PPV) of 73% at a threshold score of 13.[64]

The EPDS has since then been tested at different cut off points in various subgroups in a number of countries and languages yielding variable psychometrics.[14] A systematic review of thirty-seven studies validating the EPDS investigated whether the instrument compared favourably to a structured clinical interview in detecting PPD across various settings. A large variation in estimates of sensitivity and specificity between studies was found. The degree of heterogeneity suggested that the EPDS is not an equally valid screening tool across all cultures.[61] The accuracy of the tool depends on the clinical setting and the country and language of administration. A cut off point of 12 or 13 was found to provide strong evidence for the presence of major depression but did not convincingly exclude the disorder.[61] Therefore in selecting a threshold score for a particular study population the importance of

ruling in compared to ruling out the disorder has to be considered based on the characteristics of the population, the availability of resources and the impact of over-diagnosis versus missed diagnosis.[61] The sensitivity of the scale is influenced considerably when translated into other languages and the tool may be most sensitive when administered in English.[61] A study by Matthey et al examined the use of unvalidated cut off scores and the impact of different wording or formatting of the EPDS. They recommended that a threshold score of 13 or more be used when reporting on probable major depression in postnatal English speaking women and that the scale should be worded and formatted as originally described by the authors.[65]

2.9 A South African Perspective

Perinatal depression has received increasing interest in South African literature especially over the past two decades. A study conducted by Cooper et al on the impact of PPD on the mother-infant relationship in the peri-urban settlement of Khayelitsha, Cape Town in 1999 established the point prevalence of PPD at 34.7%.[25] In a later study on the prevalence of PPD in HIV infected mothers in the Nkangala district of Mpumalanga, Peltzer and Shikwane reported a 45,1% prevalence of PPD in this subgroup.[66] These figures indicate a high prevalence of PPD in peri-urban or rural South Africa. Whether these prevalence rates can be extrapolated to the population at large is uncertain. The EPDS was used as a screening instrument in the latter study as well as in a study by Mannikam and Burns to determine the prevalence of antenatal depression at a teaching hospital in Kwazulu Natal.[8] The EPDS had been validated for use in South Africa by Lawrie et al at Coronation Hospital, Johannesburg in 1998 (The hospital has since been renamed RMMCH). They reported a sensitivity of 76.0% and a specificity of 81.8 %; a PPV of 51.3% and a negative predictive value (NPV) of 91.3% at a threshold score of 12 or 13 for major and minor depression combined.[67] Following the validation of the EPDS in this trial, the authors used it in a subsequent randomised controlled trial to investigate the effect of norethisterone enanthate administration on the later development of PPD.[68] They found that the use of injectable progestogen within forty-eight hours following delivery was associated with an increased risk of developing PPD.[68] The proposed mechanism underlying this association being that synthetic progestogens suppress endogenous progesterone which has mood elevating properties.[68]

3. Problem Statement and Aim

Maternal mortality remains the most discrepant health indicator between the developed and developing world. A mother has a one in sixteen chance of dying from pregnancy and childbirth related complications in sub-Saharan Africa compared to a one in four thousand risk in the developed world.[6] The millennium development goals endorsed in 2001 aimed for a three quarter reduction in maternal mortality ratio by the year 2015. This commitment to maternal health has been reaffirmed by the sustainable development goals which aims for a reduction in the global maternal mortality ratio below seventy per hundred thousand live births by 2030.[7] South Africa is striving toward reducing maternal and perinatal mortality with policies and priority directed at this aim. Both antenatal and postnatal care delivered to patients accessing public health services focuses predominantly on physical health.[8] The 2015 Guidelines for maternal care in South Africa lists counselling and advise for 'mood problems' amongst other concerns to be addressed at the three to six day postnatal visit without further mention or elaboration.[9] Maternal mental health, despite its prevalence and associated morbidity remains a neglected part of obstetric care and no routine screening policy for PPD is currently recommended in South Africa.

Studies on the prevalence of PPD in the general urban postnatal population of South Africa are lacking. The aim of this study was to determine the proportion of mothers at risk of developing PPD, by screening women who delivered at Rahima Moosa Mother and Child Hospital (RMMCH) for PPD at six weeks postnatally using the Edinburgh postnatal depression scale (EPDS).

4. Objectives

I. To determine the proportion of women who delivered at RMMCH who are at risk of PPD using the EPDS at six weeks postnatally

II. To analyse sociodemographic, medical and obstetric data with respect to outcomes.

III. To compare screen positive to screen negative patients and comment on correlations between possible predisposing factors and outcomes.

5. Methodology

5.1 Study Design

The study is a prospective observational cohort study conducted on 200 participants with the exposure being parturition and the outcome PPD.

5.2 Study Approval

The research protocol was submitted and approved by the University of Witwatersrand's Human Research Ethics committee (number: M141015) and institutional approval was obtained from the CEO of RMMCH. (Appendix D)

5.3 Study Setting

RMMCH is a regional hospital affiliated to the University of Witwatersrand. It serves region B and part of region C of the Johannesburg metropolitan area, receiving high risk referrals from local clinics. Region B comprises a number of residential areas including Rosebank, Bryanston and Randburg and region C areas including Thulani, Florida and Bramfischerville. Patients accessing care arise mainly from low income households and a growing immigrant population in the catchment area. There is only one midwife obstetric unit (MOU) that delivers intrapartum care to this community. The Discoverers MOU conducts approximately one hundred deliveries monthly. Therefore, in addition to referrals, many low risk pregnancies are delivered at RMMCH. There are on average 800 to 1000 deliveries per month at the hospital with one third of the patients comprising foreign nationals. The patient population at RMMCH is therefore representative of the general obstetric population in the area served.

5.4 Study Population

English speaking women who delivered a live baby after 26 weeks completed weeks of gestation, either by vaginal delivery or caesarean section at RMMCH were recruited immediately postpartum during the period April to July 2015. Minors, under the age of eighteen were not included in the study. Demise of the infant prior to the six week follow-up was a criterion for exclusion.

Intrauterine fetal demise or the loss of or an infant following delivery is associated with distinct grief and requires prompt psychiatric assessment and management as part of standard care. Early intervention in the form of support and counselling can prevent the progression of grief into a pathological condition.[69] Patients that suffered such losses were not included in the study sample to be screened for PPD later as the immediate referral to psychiatric services was warranted in these patients.

Non-English speaking patients were excluded from the study to allow the psychometrics of the EPDS to confer maximum validity. The participants' proficiency in English were not objectively determined. The patient's preferred language of communication was

established at recruitment and they were asked if they understood and were comfortable with being spoken to in English. They were then asked if they could read English and sufficiently understand the written language. A subjective competence affirmed by the participant was taken as an indication of proficiency in English.

The World Health Organisation (WHO) defines the years between ages 15 to 44 as the female reproductive years. An adolescent female is 15 to 19 years old and an adult female is 20 years or older (according to South African law, an adult is 18 years or older).[70] The Royal College of Obstetricians and Gynaecologists (RCOG) identifies the optimal biological period for childbearing as the years between ages 20 to 35, recognising that fertility and pregnancy outcomes change with age.[71] Advanced maternal age is defined as pregnancy in a woman 35 years or older.[72] The age of participants were recorded and analysed based on these obstetrically relevant age categories.

Poverty lines in South Africa define the levels below which earnings constitute poverty. In 2014 the income level below which one is able to afford food and non-food necessities but is still considered impoverished was set at R753 per person per month.[73] Monthly household income was stratified with the lowest level corresponding to the poverty threshold (Appendix C).

Postnatal mothers were recruited by random sampling using an electronic random number generator from the delivery records in labour ward and caesarean section theatre in a two-third to one-third proportion i.e. for every two patients randomly selected from the register in labour ward, one patient was selected from theatre records. The objective was to generate a study sample that would reflect the caesarean section rate at RMMCH of 33.2% (from 01 July 2013 to 30 June 2014) and therefore be
representative of the general obstetric population. Inclusion and exclusion criteria were then applied to potential participants and patients that qualified were invited to participate in the study.

5.5 Data Collection

Written informed consent was obtained from participants while hospitalised immediately post-delivery. A sociodemographic, obstetric and medical questionnaire (Appendix C) was then completed by interview and review of the patients' hospital records. At the end of the enrolment interview participants were given an example of a Likert scaled question in

order to familiarise them with the construct of questions they will be asked at the screening interview.

Participants were contacted telephonically at a pre-arranged time at their convenience six weeks post-delivery to complete the follow up interview and EPDS. The identities of mothers were verified at the onset of the interview by asking them to confirm both their own and their infant's dates of birth. An enquiry regarding the wellbeing of the baby was made. If this revealed that the infant had demised, the mother was excluded from the study but referred to the department of psychiatry for further management.

Participants who were eligible for screening were reminded about the study and that the purpose of the telephonic interview was to complete the screening instrument. Their willingness to participate further was confirmed. A text message containing the EPDS was then sent to the patient on their cellular phone to allow them to read the questions at their leisure and a follow up appointment scheduled to complete the interview. Participants were again contacted telephonically as scheduled and their understanding of the questions on the EPDS established. The researcher then completed each item of EPDS with the participant. In addition, all mothers were asked if they had considered harming their babies. The score was then tallied and they were informed of their performance and the interpretation of the score.

Mothers that screened positive with a total score of thirteen or greater or responded positively to having thoughts of self or infant harm were offered referral to the department of psychiatry at RMMCH. All patients that declined further psychological assessment offered an explanation for their decision. At the end of the interview all participants were encouraged to contact the researcher should they develop any symptoms of depression at a later stage and a five rand airtime voucher was then transferred to their cellular phones to facilitate this.

5.6 Data Analysis

Data was captured electronically onto the REDCap data collection programme and analysed using Stata Version 11 (Statacorp, College Station, Texas, USA). Categorical variables were analysed and reported as frequencies and percentages. Continuous data were reported using means and standard deviations. Possible explanatory variables to outcomes measured were dichotomized. Binary variables were then tabulated against screen outcomes and non-parametric tests viz. Pearson's Chi-squared and Fischer's exact tests were conducted. A

p-value ≤ 0.05 conferred statistical significance. Variables that were not significantly associated with the outcome measured but were found to exhibit a trend were analysed further using multiple backward logistic regression.

5.7 Funding

A five rand airtime voucher was issued to participants after the telephonic interview to allow them to contact the researcher should symptoms develop at a later stage.

The airtime vouchers were sponsored by Dr Karlyn Fran

6. Results

6.1 Sample

Of the 217 patients that were randomly selected for participation, seventeen were excluded prior to recruitment as nine were non English speaking, three were minors and five had delivered a stillbirth. A further four patients were excluded at follow up due to infant demise and eighteen participants were lost to follow up resulting in 178 patients finally being screened for PPD. (Figure 6.1)

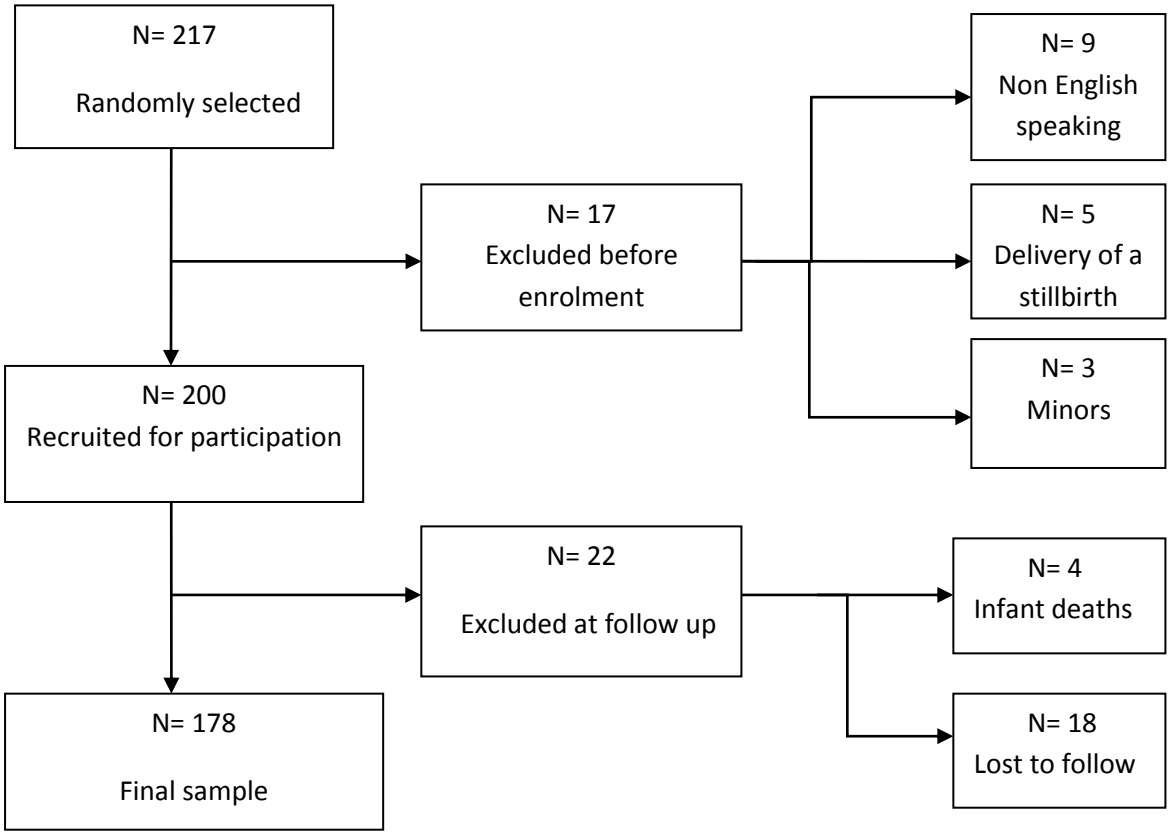


Figure 6.1 Selection of final sample

6.2 Sociodemographic Characteristics

6.2.1 Age

Participants were aged 18 to 43 years with a mean age of 27.5 (standard deviation (SD) ± 5.94) years. The majority (81.0%) of participants were in the optimal childbearing age group. Adolescent mothers comprised 5.5% of the sample and mothers of advanced age the remaining 13.5%. (Figure 6.2)

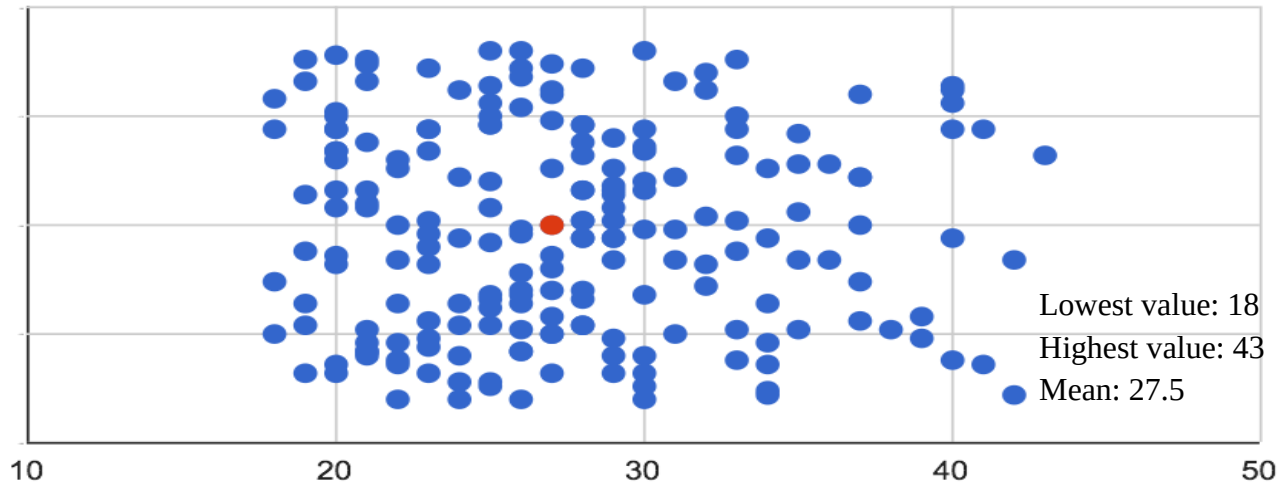


Figure 6.2. Scatterplot of participants' ages.

6.2.2 Race

The racial distribution of the cohort comprised 75.0% black patients, 17.5% colour4.0% Asian and 3.5% white patients. (Figure 6.3)

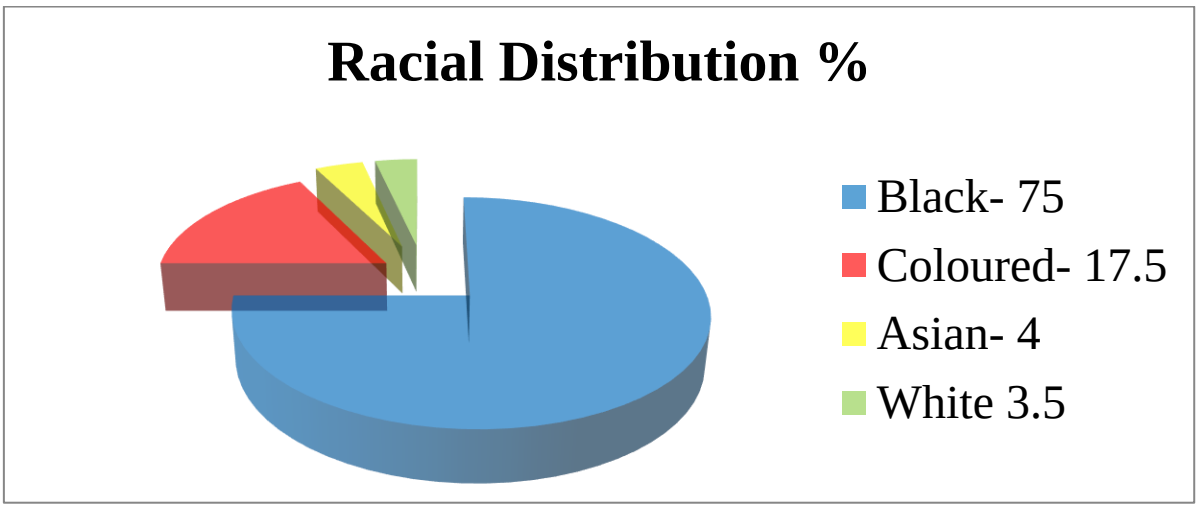


Figure 6.3: Racial distribution of participants

6.2.3 Nationality

Sixty-seven percent of the study population were South African nationals and 33.0% were immigrants mainly from Zimbabwe, Malawi and Somalia. (Figure 6.4)

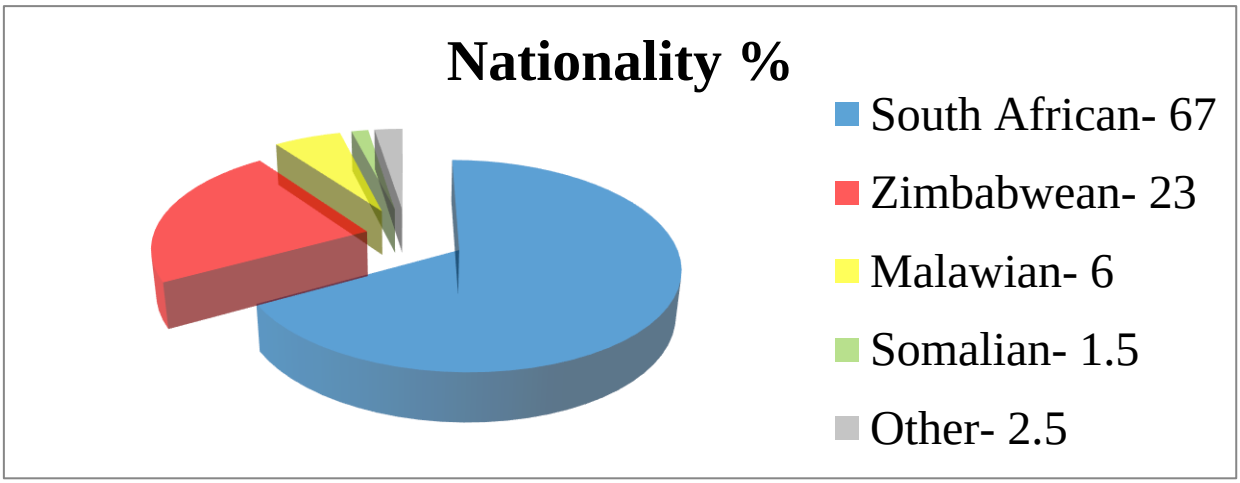


Figure 6.4: Nationality

6.2.4 Level of education

Overall it was a well-educated cohort with 98.0% of participants having received secondary education and 69.0% attaining a grade twelve or higher qualification.

6.2.5 Employment status

Unemployed mothers comprised 59.5% of the sample and 40.5% of participants were employed.

6.2.6 Relationship status

A third (33.5%) of participants were married, 59.5% were co-habitating or in a relationship with their partners at recruitment and 7.0% were single mothers.

6.2.7 Monthly household income (Table 6.1).

One third (34.0%) of participants earn an income below the poverty threshold.[73]

Table 6.1 Monthly household income of study sample

6.2.8 Residence post delivery

Most mothers (89.0%) returned to a house or flat after delivery with the remaining 11.0% residing in informal settlements. Almost all (98.5%) have access to electricity and running water. Those homes without electricity rely on paraffin as a source of energy.

6.2.9 Support structures

Three percent of women reported having no support system in the puerperium. Amongst the participants that have support, 28.8% relied on their partners as the main support person and the remainder on family and friends.

6.3 Medical and Obstetric characteristics

6.3.1 Parity (Table 6.2)

Primiparous mothers comprised 32.5% and grand multiparous females 2.5% of the postnatal sample with the majority of mothers (61.0%) having delivered their second or third babies

Table 6.2 Parity of women recruited to the study

Parity	Frequency (N=200)	Percentage (%)
1	65	32.5
2	70	35.0
3	52	26.0
4	8	4.0
5	4	2.0
8	1	0.5

Monthly household income	Frequency (N=200)	Proportion %
< R2000	68	34.0
R2000 - R5000	77	38.5
R5000 - R10 000	36	18.0
> R10 000	19	9.5

6.3.2 Pregn

ancy Intention

The proportions of planned and unplanned pregnancies were almost equal in the study population with 47.5% of pregnancies planned and 52.5% unplanned. With the exception of one patient 99.5% of mothers wanted to keep their babies following delivery regardless of previous pregnancy intention.

6.3.3 Pregnancy type

The majority (97.5%) of pregnancies were singleton, the remainder (2.5%) were twin pregnancies.

6.3.4 Gestational age (Table 6.3)

The mean gestational age at delivery was 38.0 (SD ± 2.30) weeks with a range of 29 to 42 weeks. Forty-three deliveries were preterm below a gestational age of 37 completed weeks. This constituted 21.5% of the total deliveries. The gestational age in 125 (62.5%) patients was calculated using the last normal menstrual period. Other methods of dating used included early ultrasound in 43 (21.5%) patients, first palpation of the symphyseal-fundal height in 19 (9.5%) and late ultrasound in 13 (6.5%) patients.

Table 6.3 Gestational age at delivery

Gestational age (weeks)	Frequency (N=195) [Twins (N=5)]	Percentage (%)
29	2	1.0
30	1	0.5
31	2	1.0
32	1	0.5
33	2	1.0
34	5	2.5
35	7	3.5
36	23	11.5
37	27	13.5
38	35	17.5
39	45	22.5

40	27	13.5
41	19	9.5
42	4	2.0

6.3.5 Human Immunodeficiency Virus (HIV) infection

The majority (85.5%) of patients tested negative for HIV antenatally with 14.5% of the study population being HIV infected. Of the HIV infected patients 93.1% were on antiretroviral therapy at recruitment. The CD4 count was unknown in 55.2% of HIV infected individuals and the CD4 count ranged from 62 – 1026 cells/mm^3 in the remaining 44.8%. Nine patients had a CD4 count below 500 cells/mm^3.

6.3.6 Co-morbidities

The frequencies of associated medical, obstetric and psychiatric conditions are tabulated (Table 6.4). Two patients had more than one condition.

Condition	**Frequency (N = 202)**	**Percentage (%)**
Chronic Hypertension	5	2.5
Gestational Hypertension	12	6.0
Pre-eclampsia	5	2.5
Pregestational Diabetes mellitus	2	1.0
Gestational Diabetes mellitus	4	2.0
Epilepsy	2	1.0
Asthma	3	1.5
Cardiac conditions	0	0

Anaemia in pregnancy	6	3.0
Current psychiatric disorder	1	0.5
No co-morbid condition	162	81

Table 6.4 Co-morbid conditions of study sample

6.3.7 Psychiatric history

One patient had a history of PPD in a previous pregnancy and three patients reported a history of depression in a first degree relative. One participant was suicidal having attempted an overdose on antenatal supplements during the index pregnancy. This patient was admitted and referred to both psychiatric and social services.

6.4 Perinatal Events

6.4.1 Mode of delivery

Approximately two thirds (65.5%) of the study sample delivered vaginally and 34.5% by caesarean section. Included in the vaginal deliveries were patients who required assisted deliveries as well as successful vaginal births after caesarean section which each comprised 1.5% of the total deliveries (Figure 6.5).

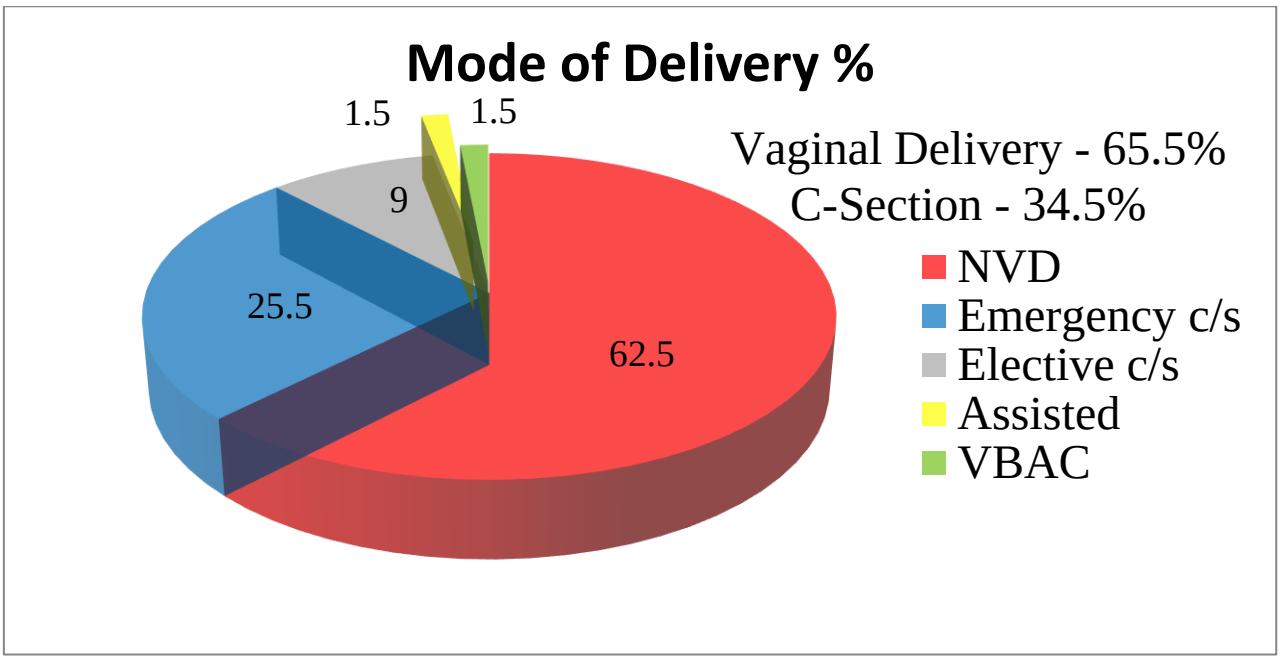


Figure 6.5: Mode of delivery

6.4.2 Characteristics of parturition

6.4.2.1 *Induction of labour*

Labour was induced in 6.0% of participants for indications as tabulated (Table 6.5). Of these mothers, 58.3% delivered vaginally and 41.7% by caesarean section. The indications for caesarean section were suspected fetal compromise in 60.0% of patients and poor progress in the remaining 40%.

Table 6.5 Induction of labour- Indications and delivery outcomes in participants recruited

Indication	Frequency (N=12)	Percentage (%) of inductions	Vaginal Delivery (N=7)	Caesarean Section (N=5)
Prelabour rupture of membranes at term	4	33.3	2	2

Postdates	2	16.7	2	
Hypertensive disease at term	3	25	2	1
Diabetes mellitus at term	1	8.3		1
Intrauterine fetal growth restriction	1	8.3	1	
Poor obstetric history	1	8.3		1

6.4.2.2 *The duration of labour*

The mean duration of the latent phase of labour from first assessment was 7.8 (SD ± 5.2) hours with a range of one to twenty-four hours. The active phase of labour ranged from 0.5 to 17.0 hours with a mean of 4.4 (SD ± 3.8) hours. Prolonged labour defined as a greater than six-hour duration in active phase occurred in 19.9% of participants. The duration of the second stage of labour ranged from one to ninety minutes with a mean of 16.6 (SD ± 14.7) minutes.

6.4.2.3 *Support and analgesia in labour*

The majority (71.8%) of patients were not accompanied by a support person in labour and a large proportion (67.9%) received no analgesia in labour. The partogram and prescription charts were reviewed to obtain information regarding analgesia administered in labour. Patients that received analgesia were given either intramuscular opioids and anxiolytics or had epidural analgesia.

6.4.3 Caesarean section

Emergency caesarean section accounted for 73.9% of total caesarean deliveries, the remaining 26.1% were elective cases. Indications for caesarean section are tabulated (Table 6.6).

Table 6.6 Indications for caesarean section in participants recruited to the study

Indication	Frequency (N =69)	Percentage (%) of total caesarean sections
Suspected fetal compromise	25	36.2
Previous caesarean section	24	34.8
Poor progress	7	10.1

Cephalopelvic disproportion	3	4.4
Malpresentation	3	4.4
Prolonged second stage of labour	2	2.9
Twins	2	2.9
Antepartum haemorrhage	1	1.4
Other	2	2.9

6.4.4 Complications

Following vaginal delivery, retained products requiring evacuation of the uterus occurred in 3 patients (2.3%). Twenty-seven (20.6%) patients that delivered vaginally required an episiotomy to facilitate delivery and 8 (6.1%) sustained second degree tears. No patients sustained third or fourth degree tears and one case necessitated examination under anaesthesia to repair extensive tears. One patient had a postpartum haemorrhage secondary to uterine atony following vaginal delivery and was successfully managed medically. Haemorrhage at caesarean section resulted in a hysterectomy in one patient. No other major intra-operative complications occurred.

6.5 Neonatal Outcomes

6.5.1 Birth weight

The mean infant birth weight was 2976.2 (SD ± 586.1) grams (g) with a range of 810.0 to 4610.0g. Low birth weight infants (less than 2500g) comprised 38 neonates (18.5%) of the total sample), 30 (78.9%) of low birth weight infants were born at term.

6.5.2 Gender

The neonatal population comprised 51.2% males and 48.8% females. Overall 97.5% of mothers were happy with the gender of their babies. The remaining 5 mothers (2.5%) had hoped for a baby of the opposite gender.

6.5.3 The five minute Apgar score

The neonatal Apgar score at five minutes after birth ranged between 2 and 10. The median and mode were both 10.

6.5.4 Neonatal admission

Twenty-eight (14%) of neonates required admission following paediatric assessment after delivery. The duration of separation from their mothers ranged from one to seventy-two hours. For babies that were admitted to the paediatric ward at the time of recruitment, the duration of separation was calculated up to the time of the enrolment interview.

6.5.5 Method of feeding

The majority (93.0%) of mothers opted to breastfeed. Amongst the 6.0% who chose to formula feed, the majority (71.4%) were HIV infected. Reasons stated other than the desire to decrease HIV transmission to the neonate, were mothers having to return to work and difficulty breastfeeding previously.

6.6 Follow-up interview and screening

6.6.1 Population screened

The mean follow up at which the EPDS was completed was 8.0 (SD ± 2.6) weeks. Nine percent of the participants recruited to the study were lost to follow up as they were not reachable at the contact numbers provided at enrolment. A further 2.2% were excluded at the time of follow up due to infant demise after the enrolment interview. This resulted in a final sample of 178 participants being screened for PPD.

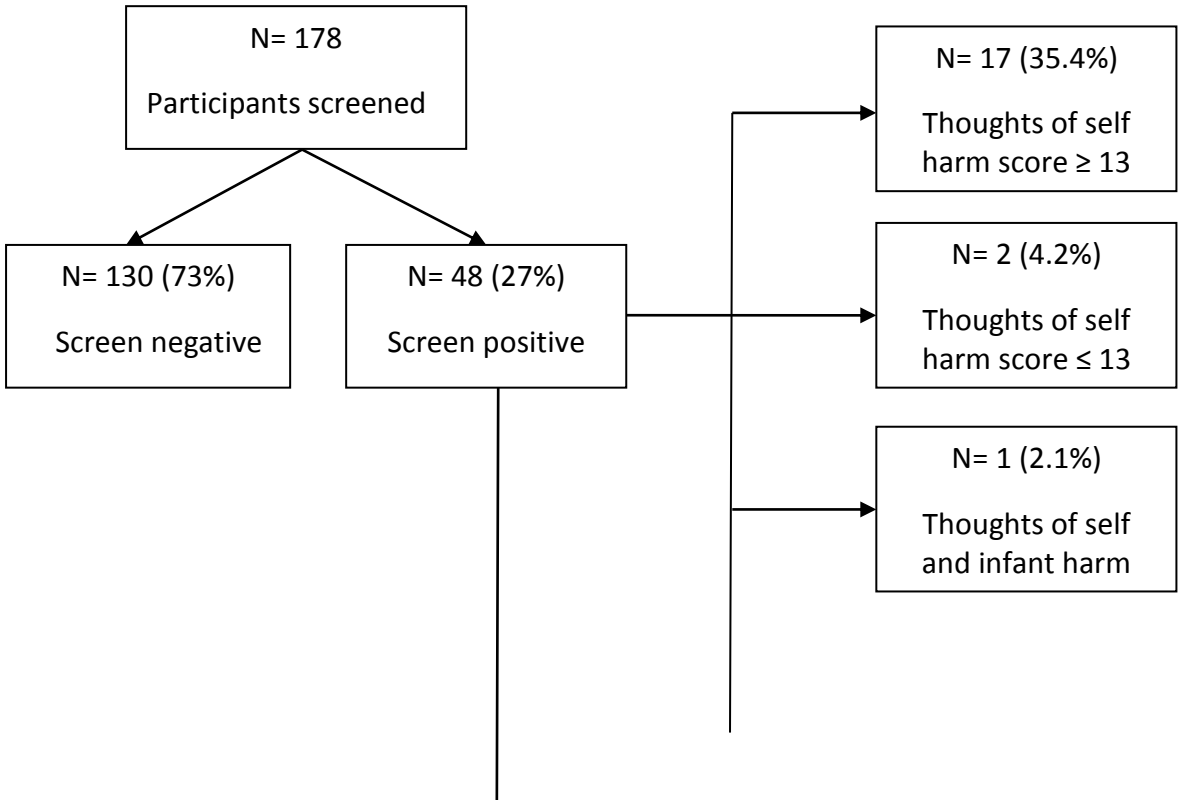
6.6.2 Results of screening

The main outcome measured was a screen positive score (≥ 13) on the EPDS or a positive response to the items relating to self or infant harm. Twenty-seven percent of the final sample screened positive for being at risk of PPD. The mean score on the EPDS was 9.1 (SD ± 5.5,

range 0 - 23). Two participants scored below the threshold of 13 but were screen positive based on thoughts of deliberate self-harm. Both these patients had a score of 11. Of the screen positive participants, 39.6% responded positively to the question on self-harm and one patient (2.1%) had considered harming herself as well as her baby. (Figure 6.7)

6.6.3 Referral

All screen positive participants were referred to the department of psychiatry at RMMCH for formal evaluation and treatment. Over half (54.2%) declined referral for various reasons including time constraints; having adequate social support and opting for treatment in the private healthcare sector. All these patients were offered an unrestricted opportunity to access psychiatric care at the hospital at their convenience should they choose to do so. These patients were followed up after the screening interview to ensure their wellbeing and remind them of the services available to them at RMMCH. Text messages with the details of the department of psychiatry were sent to their mobile phones and all participants were encouraged to contact the researcher for any assistance in this regard. (Figure 6.7)



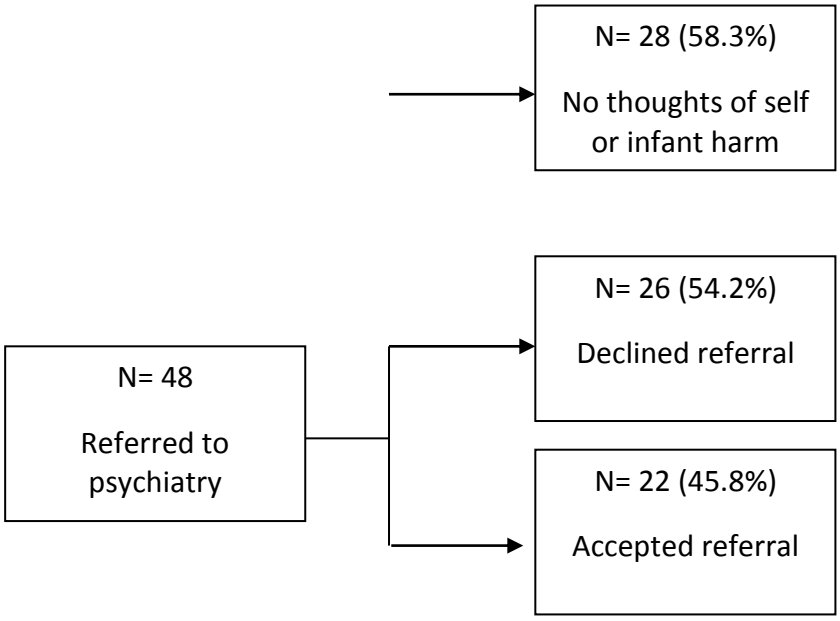


Figure 6.6 Screening and referral outcome of women delivered at RMMCH and screened for PPD by EPNDS at six weeks postnatally

6.6.4 Characteristics of the screen positive population

The mean age of participants found to be at risk of PPD was 26.6 (SD ± 5.2) years, with a range 18 to 42 years. The racial distribution of the screen positive subgroup comprised 70.8% black, 22.9% coloured, 4.2% Asian and 2.1% white patients. Participants who screened positive were mainly South African (64.5%). Approximately two thirds (68.8%) of the screen positive cohort completed grade twelve but the majority (58.3%) were unemployed with 35.4% arising from households with a monthly income below R2000.

Almost one third (31.3%) of the screen positive population were first time mothers. Of the screen positive group, 8.3% were HIV infected and 12.5% had a co-morbid medical or obstetric condition. Three quarters (75%) of mothers with probable major depression delivered vaginally and 25% by caesarean section. Amongst participants that delivered

vaginally and screened positive for PPD, 23.3% had prolonged labours in the active phase, 64.3% had no support and 59.5% received no analgesia in labour. Male infants were born to 52.1% and female infants to 47.9% of screen positive mothers. Amongst mothers whose infants were admitted to the paediatric ward post-delivery, 16.7% screened positive for PPD. (Table 6.7)

6.7 Associated variables

Categorical variables representing potential risk factors for PPD were cross-tabulated against screen outcomes. Sociodemographic variables tested included adolescent mothers, mothers of advanced maternal age, race, nationality, level of education, employment status, low income and marital status as well as residence and support post-delivery. Obstetric variables tested against outcomes comprised first-time mothers, pregnancy intention, single and multiple gestations, preterm delivery, induction of labour, mode of delivery, prolonged labour, second degree tears and episiotomies, support and analgesia during labour. Too few complications occurred following vaginal delivery or intra-operatively at caesarean section to examine the impact of complications on screen positive outcomes. Medical variables tested included the presence of co-morbid conditions and HIV status. Variables relating to neonatal outcomes analysed with respect to screen outcomes included the infant's gender, low birth weight infants, neonatal admission and separation from the mother after delivery. None of the variables tested yielded statistically significant (p value <0.05) associations with screen positive outcomes. (Tables 6.7, 6.8, 6.9)

Table 6.7 Associated sociodemographic variables

Variable	Screen positive N (%)	Screen negative N (%)	Fisher's exact p value	Pearson's chi square p value
Age				
18-19 (adolescent mother)	1 (2.1%)	8 (6.2%)	0.45	
20-34	44 (91.7%)	100 (76.9%)		
35-43 (advanced maternal age)	3 (6.3%)	22 (16.9%)	0.09	
Race				0.29

Black	34 (70.8%)	102 (78.5%)		0.19
Coloured	11 (22.9%)	19 (14.6%)	0.61	
Asian	2 (4.2%)	5 (3.8%)	0.59	
White	1 (2.1%)	4 (3.1%)		
Nationality				0.77
South African	31 (64.6%)	87 (66.9%)		
Foreign national	17 (35.4%)	43 (33.1%)		
Level of education - grade 12				0.87
Yes	33 (68.8%)	91 (70.0%)		
No	15 (31.3%)	39 (30.0%)		
Employment status				0.94
Employed	20 (41.7%)	55 (42.3%)		
Unemployed	28 (58.3%)	75 (57.7%)		
Household monthly Income				
Less than R2000	17 (35.4%)	45 (34.6%)		0.92
Marital status				0.85
Married	17 (35.4%)	44 (33.8%)		
Unmarried	31 (64.6%)	86 (66.2%)		
Residence post delivery				0.75
House/flat	42 (87.5%)	116 (89.2%)		
Informal settlement	6 (12.5%)	14 (10.8%)		
Support post delivery			0.15	
Yes	48 (100.0%)	124 (95.4%)		
No	0	6 (4.6%)		

Table 6.8 Associated antenatal and intrapartum variables

Variable	Screen positive N (%)	Screen negative N (%)	Fisher's exact p value	Pearson's chi square p value
Pregnancy Intention				0.72
Planned	24 (50.0%)	61 (46.9%)		
Unplanned	24 (50.0%)	69 (53.1%)		
Parity				
Primiparous	15 (31.3%)	45 (34.6%)		0.67
Multiparous	33 (68.8%)	85 (65.4%)		
Pregnancy Type			0.71	
Singleton	47 (97.9%)	127 (97.7%)		
Multiple	1 (2.1%)	3 (2.3%)		
Preterm delivery				0.77
Yes	9 (18.8%)	27 (20.8%)		
No	39 (81.3%)	103 (79.2%)		
co-morbid conditions				0.41
Medical	2 (4.2%)	7 (5.3%)		
Obstetric	4 (8.3%)	17 (13.0%)		
None	42 (87.6%)	107 (81.7%)		
HIV infection			0.23	
Yes	4 (8.3%)	22 (16.9%)		
No	44 (91.7%)	108 (83.1%)		
Psychiatric co-morbidities			0.31	
Pre existing psychiatric illness	1 (2.1%)	0		
History of PPD	0	1(0.8%)		
Family history	1(2.1%)	1(0.8%)		
Induction of labour			0.63	
Yes	2 (4.2%)	6 (4.6%)		
No	46 (95.8%)	124 (95.4%)		
Prolonged labour				0.54
Yes	7 (23.3%)	16 (18.2%)		
No	23 (76.7%)	72 (81.8%)		

Variable	Screen positive N (%)	Screen negative N (%)	Fisher's exact p value	Pearson's chi square p value
Support in labour				0.22
Yes	15 (35.7%)	27 (25.7%)		
No	27 (64.3%)	78 (74.3%)		
Analgesia in labour				0.11
Yes	17 (40.5%)	28 (26.9%)		
No	25 (59.5%)	76 (73.1%)		
Perineal tears				0.14
Second degree tear	1 (2.1%)	7 (5.4%)		
episiotomy	6 (12.5%)	20 (15.4%)		

Table 6.9 Associated **N**eonatal outcomes

Variable	Screen positive N (%)	Screen negative N (%)	Fisher's exact p value	Pearson's chi square p value
Infants gender				0.76
Male	25 (52.1%)	71 (54.6%)		
Female	23 (47.9%)	59 (45.4%)		
Low birth weight				0.19
Yes	11 (22.9%)	19 (14.6%)		
No	37 (77.1%)	111 (85.4%)		
Neonatal admission				0.37
Yes	8 (16.7%)	17 (13.1%)		
No	40 (83.3%)	113 (86.9%)		
Separation from mother				0.79
Yes	7 (14.6%)	17 (13.1%)		
No	41 (85.4%)	113 (86.9%)		

7. Discussion

7.1 Objective 1

To determine the proportion of women who delivered at RMMCH who are at risk of PPD using the EPDS at six weeks postnatally

7.1.1 Screening

An asymptomatic postnatal population that comprised of both low risk and high risk obstetric patients was screened using a validated, inexpensive and acceptable instrument to detect a treatable condition which is of significant public health concern. A considerable proportion (43.8%) of patients exhibited symptoms of major and minor depression. Twenty-seven percent of the postnatal sample screened positive for probable major depression in the postpartum period. Thoughts of deliberate self-harm were frequent, occurring in 41.7% of participants that screened positive for PPD. The literature varies in terms of cut off scores used to indicate positivity on the EPDS. The threshold score of 13 or greater used in this study was based on the cut off score validated by the original authors and the recommendations of a large systematic review.[61,64] The value of the EPDS in resource restricted settings lies in its high NPV calculated at 93.1% at a threshold score of 12 or13.[23,61]

Since the EPDS is a screening instrument and not a diagnostic tool the screen positive rate cannot be equated to prevalence but may be considered an estimate of prevalence in the population studied. The prevalence estimates from fifty-nine studies on PPD were included in a meta-analysis conducted by O' Hara and Swain. A number of these studies used self-report measures including the EPDS, which was used in twelve studies to estimate the prevalence of PPD in various contexts. The average prevalence rate of non-psychotic PPD was found to be 13%.[22] In our study the EPDS was used to screen an ethnically diverse, urban postnatal sample and resulted in a far higher estimate of PPD prevalence (27%) compared to the average prevalence of 13% determined by O'Hara and Swain.[22]

When compared specifically to other screening studies for PPD conducted in South Africa, the proportion of patients that screened positive in this study is higher than the 16.4% screen positive rate found amongst mothers who delivered in 1990 in the socioeconomically deprived neighbouring urban settlement of Soweto, Johannesburg.[47] The Pitt depression questionnaire was used to screen participants at six months postnatally in that study. The variability in findings may be due to the different assessment methods employed and the

different periods postpartum at which participants were screened. HIV infected women were screened for PPD within the first year after delivery using the EPDS in the Nkangala district in rural South Africa. Overall 45.1% of this population scored above a threshold of 14. Despite a higher threshold score used to indicate probable depression in that study, the proportion of screen positive participants far exceed the findings in our study. This may be attributed to the significant association between the stigma of HIV infection and the experience of discrimination with the development of PPD as demonstrated by the authors.[66] The rate of HIV infection in our study was 14.5%, less than half the rate of 32.5% in the study in Nkangala.[66] Over half of the HIV infected patients on our study did not have a documented CD4 count on their antenatal record. It appears that in the majority of cases the results were not followed up. The opportunity to perform additional investigations for the patients with low CD4 counts and prescribe prophylactic co-trimoxazole and isoniazide antenatally was therefore missed.

The study conducted by Lawrie et al, in which the EPDS was validated for use in urban South Africa, has the most comparable results to our study. They reported a 24.5% incidence of PPD in their study conducted at RMMCH in 1998.[67] Interestingly, the risk of PPD appears to be similar in the communities attending RMMCH almost 20 years later.

7.1.2 Referral to psychiatric services

All patients approached at recruitment and contacted at follow-up agreed to participate in the study. There were no refusals amongst participants implying that mothers were comfortable with being screened for PPD. However, more than half of all participants that screened positive and were referred for formal psychiatric evaluation declined referral, despite being offered sessions at their convenience at RMMCH. The main reason given by the majority of participants was that they felt they had adequate social support. This reinforces the role of social support in moderating the impact of depressive symptoms.[40] However patient-centred barriers including social stigma, cost implications, time constraints and childminding during consultations may to varying degrees influence patients' decisions and compliance.[18]All participants that were referred to psychiatry at the follow-up interview due to infant demise accepted referral.

7.2 Objectives 2 and 3

To analyse sociodemographic, medical and obstetric data with respect to outcomes and to compare screen positive to screen negative patients and comment on correlations between possible predisposing factors and outcomes.

7.2.1 Characteristics of the screen positive population

The mean age of screen positive participants was 26.6 (SD ± 5.2) years, with a range 18 to 42 years. This is comparable to the mean age of participants in the study sample [27.5 (SD ± 5.9) years] as well as the screen negative population [27.8 (SD ± 6.3) years]. Over a third (36.7%) of the total coloured population screened were found to be at risk of PPD. This exceeded the proportion of Asian (28.6%), black (25%) and white (20%) patients screened who had a positive result. Participants were mainly South African (64.5%) owing to the larger component of South African nationals in the population screened. However, a greater proportion of foreign nationals (28.3%) compared to South Africans (26.2%) were found to be at risk of PPD at screening. Married participants comprised 35.4% of the screen positive group. Paradoxically, all patients that reported having no support structures in the puerperium screened negative for PPD while all screen positive participants reported having social support at recruitment. A possible explanation is that mothers not expecting support were psychologically motivated and equipped to cope independently while women that experienced depressive symptoms may have received less support than expected.

Owing to the small sample size, very few patients screened for PPD had a personal or family history of psychiatric illness. One patient with a history of depression in a first degree relative and one patient with a current psychiatric diagnosis screened positive for PPD. The small sample size however precludes a definitive deduction from these findings.

7.2.2 Sociodemographic variables

The exclusion of minors diminished the true adolescent pregnancy rate in this study. Examining the association of young maternal age with the risk of developing PPD is imperative given the vulnerability of adolescent mothers to develop mental health problems.[74] Minors excluded constitute 1.4% of the randomly selected sample. When factored into analyses, the true adolescent pregnancy rate for this study sample is calculated at 6.5%. This is comparable to the teenage pregnancy rate of 7.2% at RMMCH for the period 2014 to 2015 as well as to average national figures of 5.2% in 2014.[75] Statistical tests demonstrate no

significant association between adolescent mothers (excluding minors) and the development of PPD in this study.

Poverty was identified as a trigger of PPD in mothers from a low socioeconomic district in the North West province of South Africa.[76] Unemployment and low household income were examined in our study but a significant correlation between these factors with the risk of developing PPD did not emerge from statistical analyses.

Maternal age, marital status and level of education were not significantly associated with screen positive outcomes in this study. This is compatible with the findings of a large meta- analysis that found these sociodemographic variables not to be significant predictors of PPD.[22] The considerable foreign national component (33.0%) of this cohort was tested against screen positive outcomes but yielded no statistically significant association to strengthen the literature that suggests that immigrant status is associated with PPD as a consequence of acculturation stress.[1]

7.2.3 Medical and obstetric variables

Depressed mood was found to be common amongst HIV infected mothers in rural South Africa. However HIV infected participants in this study were not found to be at an increased risk of developing PPD. [66] Contrary to the findings of the meta-analysis by O'Hara and Swain that previous psychopathology is a powerful predictor of PPD, the one patient in this study that reported previous PPD scored well below the threshold score at screening.[22] However, no inferences can be drawn from this isolated finding due the small sample size.

Consistent with the findings of a large meta-analysis, primiparous mothers were not found to be at a greater risk of developing PPD in this study.[22] The evidence from local and international studies support that unintended and unwanted pregnancies contribute to the development of PPD.[46,75] However, no significant association between unplanned pregnancies and screen positive outcomes were demonstrated in this study population. One baby was unwanted following delivery and the mother pursued avenues to have the baby adopted. This participant screened positive for PPD. Obstetric complications may predispose to the development of PPD.[42] There was one patient in our study who was classified as a 'near-miss' as a result of haemorrhage at caesarean section necessitating an emergency hysterectomy. Despite this significant peripartum complication, this patient screened negative for PPD.

7.2.4 Perinatal events

The mode of delivery was tested against screen outcomes and the results of this study support the findings of Sword et al that mode of delivery does not significantly influence the risk of developing PPD.[21] The experience of childbirth may well have been unpleasant for a considerable proportion of mothers who received no analgesia and were not accompanied by a support person in labour. These variables however did not significantly impact screen positive outcomes.

According to the 2014 WHO low birth weight policy brief, the majority of low birth weight deliveries occur in low and middle-income countries. The rates of pre-term labour (21.5%) and small for gestational age infants at term (19.1%) in this study exceed the WHO regional estimates for sub-Saharan Africa.[77]

There is a cultural preference and pressure on women to bear male infants in many low and middle income countries.[78] The infant's gender was not significantly associated with screening positive for PPD in our study. Mothers of premature infants and infants admitted to the neonatal intensive care unit are more likely to experience PPD with depressive symptomology being more pronounced in this subgroup.[43] This study however did not demonstrate a statistically significant association between preterm delivery or neonatal admission and the development of probable major depression.

7.2.5 Association between possible predisposing factors and outcomes.

Sociodemographic, medical, obstetric and perinatal variables were analysed with respect to screen outcomes. All variables tested yielded no significant association with screening positive for PPD. No reliable predictors of outcome are therefore implicated by these findings. The success of selective screening for PPD would depend on identifying high risk patients to be screened. The complex aetiology of PPD, the considerable number of potential risk factors that exist and the inconsistent association between these factors and established disease make it difficult to reliably recognise high risk patients. Selective screening may therefore result in a number of cases going undetected. The morbidity and complications associated with PPD emphasize the importance of "ruling in" as opposed to "ruling out" the condition by screening. Universal screening would offer a distinct advantage in detecting patients who are at risk of developing PPD.

7.3 Generalisability of findings

Approximately two-thirds of the participants enrolled into this study completed grade twelve. The exclusion of non-English speaking patients may have contributed toward a better educated cohort being recruited. Despite high levels of education amongst participants, this urban population is socioeconomically disadvantaged with almost two-thirds being unemployed and 74.5% arising from households with a monthly income below five thousand rands. One third of the study sample comprised foreign nationals. All immigrants were from developing countries, mainly in sub-Saharan Africa. The findings of this study are applicable but not necessarily generalisable to low socioeconomic urban populations in the developing world.

7.4 Limitations

This study is limited by its small numbers and additional 9.0% loss to follow up. No significant association between potential explanatory variables and screen positive outcomes were demonstrated in this study which may be attributed to the small sample size. Non-English speaking patients were excluded from the study. This comprised 4.1% of the initial sample selected. It is uncertain whether the results are impacted significantly as a result of this exclusion. The exclusion of minors may have undermined the true impact of adolescent motherhood on the development of PPD. Important variables that constitute recognised predisposing factors to screen positive outcomes which were not assessed in this study include maternal obesity, marital satisfaction scores, intimate partner violence and the use of injectable progestogens immediately postpartum.[22,40,41,68]

7.5 Recommendations

Adequately powered studies examining factors that may be associated with the risk of developing PPD in a South African setting are recommended. Further research to evaluate the feasibility and practical elements of screening for PPD in South Africa is warranted. This includes identifying the ideal screening instrument for use in both rural and urban settlements and the timing and opportunities for screening. The postnatal follow up occurs at primary health care level and it is our recommendation that greater detail and emphasis on PPD be included in the next maternal care guidelines. There is a high reliance on public sector health care in South Africa and a number of barriers exist to patients accessing adequate care. Studies evaluating established and potential mental health referral and follow up networks as well as examining the barriers to psychiatric care is recommended.

8. Conclusion

The DSM prescribes that symptoms of major depression should occur within four weeks of childbirth to establish the diagnosis of PPD. This study has demonstrated that postpartum depressive symptomology is common in the general obstetric population beyond 4 weeks postnatally supporting the literature that allows for the diagnosis of PPD beyond this time frame. The condition is too often underdiagnosed raising the importance of clinical acumen on the part of healthcare providers in recognising symptoms and detecting patients at risk of PPD in the puerperium and the months that follow. The aetiology and precipitants of PPD are multifactorial. No significant association between potential predisposing factors and screening positive for probable major depression in the postpartum period were established in this study. It can therefore be challenging to reliably identify patients antenatally or immediately postpartum who at risk of developing PPD. These findings are support the rationale of universal screening for PPD in South Africa.

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Appendix A

Major Depressive Disorder - DSM V

Diagnostic Criteria

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning: at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

Note: Do not include symptoms that are clearly attributable to another medical condition.

1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful).
2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation).
3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day.
4. Insomnia or hypersomnia nearly every day.
5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
6. Fatigue or loss of energy nearly every day.
7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms cause clinically significant distress or impairment in social, occupational or other important areas of functioning.

C. The episode is not attributable to the physiological effects of a substance or to another medical condition.

Note: Criteria A-C represent a major depressive episode.

Note: Responses to a significant loss (e.g., bereavement, financial ruin, losses from a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss.

D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizophreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders.

E. There has never been a manic episode or a hypomanic episode.

With peripartum onset: This specifier can be applied to the current or, if full criteria are not currently met for a major depressive episode, most recent episode of major depression if onset of mood symptoms occurs during pregnancy or in the 4 weeks following delivery.

Note: Mood episodes can have their onset either during pregnancy or postpartum. Although the estimates differ according to the period of follow-up after delivery, between 3% and 6% of women will experience the onset of a major depressive episode during pregnancy or in the weeks or months following delivery. Fifty percent of "postpartum" major depressive episodes actually begin prior to delivery. Thus, these episodes are referred to collectively as *peripartum* episodes. Women with peripartum major depressive episodes often have severe anxiety and even panic attacks. Prospective studies have demonstrated that mood and anxiety symptoms during pregnancy, as well as the "baby blues," increase the risk for a postpartum major depressive episode.

Peripartum-onset mood episodes can present either with or without psychotic features. Infanticide is most often associated with postpartum psychotic episodes that are characterized by command hallucinations to kill the infant or delusions that the infant is possessed, but psychotic symptoms can also occur in severe postpartum mood episodes without such specific delusions or hallucinations. Postpartum mood (major depressive or manic) episodes with psychotic features appear to occur in from 1 in 500 to 1 in 1,000 deliveries and may be more

common in primiparous women. The risk of postpartum episodes with psychotic features is particularly increased for women with prior postpartum mood episodes but is also elevated for those with a prior history of a depressive or bipolar disorder (especially once a woman has had a postpartum episode with psychotic features, the risk of recurrence with each subsequent delivery is between 30% and 50%. Postpartum episodes must be differentiated from delirium occurring in the postpartum period, which is distinguished by a fluctuating level of awareness or attention. The postpartum period is unique with respect to the degree of neuroendocrine alterations and psychosocial adjustments, the potential impact of breast-feeding on treatment planning, and the long-term implications of a history of postpartum mood disorder on subsequent family planning.

Source: American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Arlington, VA, American Psychiatric Association, 2013. pp 160-187.

Appendix B

Edinburgh Postnatal Depression Scale (EPDS)

In the past 7 days:

A. I have been able to laugh and see the funny side of things

0. As much as I always could
1. Not quite so much now
2. Definitely not so much now
3. Not at all

B. I have looked forward with enjoyment to things

0. As much as I ever did
1. Rather less than I used to
2. Definitely less than I used to
3. Hardly at all

***C.** I have blamed myself unnecessarily when things went wrong

3. Yes, most of the time
2. Yes, quite often
1. Not very often
0. No, not at all

D. I have been anxious or worried for no good reason

0. No, not at all
1. Hardly ever
2. Yes, sometimes
3. Yes, very often

***E.** I have felt scared or panicky for no very good reason

3. Yes, quite a lot
2. Yes, sometimes
1. No, not much
0. No, not at all

*** F.** Things have been getting on top of me

3. Yes, most of the time I haven't been able to cope at all

2. Yes, sometimes I haven't been coping as well as usual

1. No, most of the time I have coped quite well

0. No, I have been coping as well as ever

***G.** I have been so unhappy that I have had difficulty sleeping

3. Yes, most of the time

2. Yes, sometimes

1. Not very often

0. No, not at all

***H**. I have felt sad or miserable

3. Yes, most of the time

2. Yes, some of the time

1. Not very often

0. No, never

*** I.** I have been so unhappy that I have been crying

3. Yes, most of the time

2. Yes, quite often

1. Only occasionally

0. No, never

* **J.** The thought of harming myself has occurred to me

3. Yes, quite often

2. Sometimes

1. Hardly ever

0. Never

Supplementary question - Have you ever thought of harming your baby?

Scoring

QUESTIONS A, B, & D

are scored with top box scored as 0 and the bottom box scored as 3.

QUESTIONS C, E - J (marked with an *)

are reverse scored, with the top box scored as a 3 and the bottom box scored as 0.

Maximum score: 30

At risk for Depression: 13 or greater

Source:

Cox, J.L., Holden, J.M. & Sagovsky, R. 1987. Detection of postnatal depression: development of the 10-item Edinburgh postnatal depression scale. *Br J Psychiatry*.,150:782-786.

Wisner, K. L.,Parry, B. L. & Piontek, C. M. 2002. Postpartum Depression. *N Engl J Med*., 347(3):194-199.

Appendix C - Data Sheet

Study ID _____

Date of Registration _____

First Name _____

Last Name _____

Hospital Number _____

date of admission _____

Date of birth _____

Age (years) _____

Race
- ◯ Asian
- ◯ Black
- ◯ Coloured
- ◯ White

Nationality _____

highest level of education attained _____

employed
- ◯ Yes
- ◯ No

Monthly household Income
- ◯ less than R2000
- ◯ R2000-R5000
- ◯ R5000-R10000
- ◯ more than R10000

Parity _____

Gravidity _____

HIV
- ◯ Yes
- ◯ No

CD4 _____

ART
- ◯ Yes
- ◯ No

Previous Pregnancies _____

Partner status
- ◯ married
- ◯ single
- ◯ divorced
- ◯ partner

Planned pregnancy
- ◯ Yes
- ◯ No

Wanted pregnancy
- ◯ Yes
- ◯ No

number of fetuses - current pregnancy
- ◯ 1
- ◯ 2
- ◯ 3

Gestational age at delivery _____

gestational age by	◯ sure dates ◯ early ultrasound ◯ first palpation ◯ late ultrasound
Co-morbidity Medical	◯ Chronic Hypertension ◯ Diabetes Mellitus ◯ Epilepsy ◯ Asthma ◯ Cardiac ◯ Other medical condition
Co-morbidity Obstetric	◯ Gestational hypertension ◯ Pre-eclampsia ◯ Gestational Diabetes
Co-morbidity Psychiatric	◯ pre existing psychiatric disorder ◯ history of psychiatric disorder ◯ history of postpartum depression ◯ history of postpartum psychosis ◯ family history of psychiatric disorder (details)
Medication	_____
induction of labour	◯ Yes ◯ No
indication for Induction of labour	_____
mode of delivery	◯ normal vaginal delivery ◯ assisted delivery ◯ caesarean section
method of assisted delivery	◯ forceps ◯ vantoux
Duration of latent phase of labour from first assessment in labour	_____
Duration of the active phase of labour	_____
Duration of second stage of labour	_____
support during labour	_____
analgesia during labour	_____
complications	◯ retained placenta or products ◯ second degree tear ◯ third degree tear ◯ fourth degree tear
Indication for caesarean section	_____
surgical complications	◯ bleeding ◯ damage to contiguous structures
gender	◯ male ◯ female
Is mum happy with the gender of the baby	◯ Yes ◯ No
birth weight	_____
5 minute apgar score	_____

Neonatal admission	◯ Yes ◯ No
Duration of separation from baby	_____
Residence post delivery	◯ house/flat ◯ informal settlement
Access to running water	◯ Yes ◯ No
electricity	◯ Yes ◯ No
Support post delivery	◯ Yes ◯ No
Main support person	_____
Method of feeding	◯ breastfeeding ◯ formula feeds
Phone number	_____ (Include Area Code)
service provider	_____
What is a convenient/appropriate time to call you	_____
Test question Now that my baby has arrived, I will still be able to do things that I enjoy:	◯ as much as I ever did ◯ rather less than I used to ◯ definitely less than I used to ◯ hardly at all
expected date of follow up	_____

R14/49 Dr Sameera Haroon Karolia

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M141015

NAME: (Principal Investigator)	Dr Sameera Haroon Karolia
DEPARTMENT:	Obstetrics and Gynaecology Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	Screening for Postpartum Depression at Rahima Moosa Mother and Child Hospital
DATE CONSIDERED:	31/10/2014
DECISION:	Approved unconditionally
CONDITIONS:	Title Change (03/03/2016) Additional Supervisor Dr KA Frank (12/12/2016)
SUPERVISOR:	Dr Amy Wise and Dr KA Frank
APPROVED BY:	Professor A Woodiwiss, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	03/06/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in October and will therefore be due in the month of October each year.

Karolia
Principal Investigator Signature

11/01/2017
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

SCREENING FOR POSTPARTUM DEPRESSION AT RAHIMA MOOSA MOTHER AND CHILD HOSPITAL

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