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Prevalence and associated factors of antenatal depression in post-conflict Rwanda: Implications for nurse midwifery policy and practice

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Prevalence and associated factors of antenatal depression in post-conflict Rwanda: Implications for nurse midwifery policy and practice

by

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Prevalence and associated factors of antenatal depression in post-conflict Rwanda: Implications for nurse midwifery policy and practice

Kathryn Millar

Abstract

Background: In low- and lower-middle-income countries (LLMICs), 16% of pregnant and 20% of postpartum women experience common maternal mental health disorders, far surpassing global rates of 10% and 13%, respectively. Maternal depression is associated with poor perinatal outcomes, including maternal, newborn, and early childhood outcomes. The Edinburgh Postnatal Depression Scale (EPDS) was recently validated in Rwanda, yet maternal depression prevalence and associated factors are unknown.

Objectives: The primary objectives of the study are to describe antenatal depression prevalence and its associated factors.

Methods: This is a secondary analysis of the Preterm Birth Initiative-Rwanda randomized controlled trial of group antenatal care (ANC) data obtained between June 2017 – June 2018. Thirty-four health centers in five districts were selected. At each health center, convenience sampling was used to ascertain EPDS scores from the first five women to present for initial ANC each calendar month. A cut-off EPDS score of ≥13 was used to define maternal depression. Multi-level simple and multiple logistic regressions were used to explore associated factors of antenatal depression. The study obtained informed consent and was approved by the Rwanda National Ethics Committee and the University of California, San Francisco institutional review board.

Results: Twenty-percent of women in the antenatal period screened positive for depression. In the adjusted multi-level multiple logistic regression model, family social support, age, ability to

communicate with partner, and perceived stress were significantly associated with antenatal depression.

Conclusions: Antenatal and postpartum depression prevalence in Rwanda exceeds LLMIC averages. The authors recommend universal depression screening and treatment for pregnant and postpartum women.

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Introduction

Statement of the Problem

National and district-level prevalence rates of common maternal mental health disorders (CMMHDs) in Rwanda are not currently measured and, therefore, are unknown. This is consistent with other low- and lower-middle-income countries (LLMICs), where only 8% and 15% report antenatal and postnatal prevalence of mental disorders, respectively (Fisher et al., 2012). Two unpublished reports, a master's thesis and policy brief, from Rwanda describe district-level prevalence of maternal depressive symptoms: at a single pediatric clinic in the Eastern Province, prevalence amongst 165 women was described as 50.3% (Umuziga & Adejumo, 2014) and the policy brief described an antenatal depression rate of 19.4% among 594 women in Bugesera District (Hynie et al., 2017).

CMMHDs, described as depressive, anxiety, adjustment, and somatic disorders, are experienced by a higher percentage of women in LLMICs than women in high-income countries. A systematic review by Fisher et al. (2012) revealed a 15.9% average prevalence of CMMHDs in the antenatal period and 19.8% average in the postpartum period in LLMICs (Fisher et al., 2012). This far surpasses the global rates of antenatal (10%) and postpartum CMMHDs (13%), which demonstrates a much higher burden of CMMHDs in LLMICs than in high-income countries (World Health Organization, n.d.).

Currently, maternal mental health conditions, including depression, are not routinely screened for during antenatal care (ANC) in Rwanda. While no guidelines exist, in the past, pregnant women have been identified and referred for very apparent mental health disorders, but no screening, referral, diagnosis, or treatment policies or procedures exist for depression or other mental health disorders.

Background

Depression. As defined by the Diagnostic and Statistical Manual, 5th edition (DSM-V), the diagnosis of depressive disorders includes several subtypes: major depressive disorder (MDD), major depressive episode, disruptive mood dysregulation disorder, persistent depressive disorder (or dysthymia), substance- or medication-induced depressive disorder, premenstrual dysphoric disorder, depressive disorder due to another medical condition, other specified depressive disorder, and unspecified depressive disorder (Scully & Kupfer, 2013). Each of these depressive disorders have common symptomology: depression must affect an individual's ability to function in day-to-day tasks and is specified by feelings of emptiness, sadness, irritable mood, and both somatic and cognitive symptoms (Scully & Kupfer, 2013).

In 2015, 322 million people worldwide were affected by depressive disorder resulting in 50 million years lived with disability (YLD) (World Health Organization, 2017). The global burden of depressive disorders has consistently ranked in the top five causes of YLD. A recent report by the WHO concluded that depressive disorders are the number one cause of YLD (World Health Organization, 2017). According to the 2016 Global Burden of Disease estimates by the Institute for Health Metrics and Evaluation and the World Health Organization (WHO), MDD (just one subtype of depressive disorders), ranked as the 5th greatest cause of YLD (Theo Vos et al., 2017). Depressive disorder prevalence and YLD remains unchanged over time, while the number of people living with a depressive disorder is increasing (Theo Vos et al., 2017; World Health Organization, 2017).

The 2016 GBD study did not report disease burden by age group, however, the 2015 GBD study reported that depression was the top cause of YLD for ages 20-24 years, the second most common cause for ages 15-19 years and 25-49 years, the third most common cause for ages

50-54 years, the fourth most common cause for ages 55-74 years, the fifth most common cause for ages 75-79 years, and the eighth most common cause for ages 80 years and older (T. Vos et al., 2016). In 2013, MDD was the leading cause of DALYs among adolescent girls aged 15-19 and the fourth most common cause among adult women. Lastly, self-harm is the leading cause of death among women aged 15 to 19 years globally and people with MDD have a 40% greater chance of premature death (IHME, 2016; Langer et al., 2015; WHO, 2013).

The cost of depression is reflected in both health care costs and lost productivity. In the United States alone, depression contributes $43 billion in health care costs and $17 billion in lost productivity each year (Dawson & Tylee, 2001). In high-income countries like the United States, 35-50% of people with severe mental disorders do not receive care. However, a greater unmet need is experienced in low- and middle-income countries where 76% to 85% do not receive any treatment (WHO, 2013).

Depression in Pregnancy. Perinatal depression was defined for the first time in 1994 by the DSM-IV as depression with onset during pregnancy or in the four weeks postpartum (W H O, 1995). Depression in pregnancy is poorly measured and understood, especially in low-and middle-income countries. This is likely due to the fact that past global maternal health priorities have focused on preventing maternal mortality and not morbidity (Fisher et al., 2012)**.**

Several studies have attempted to describe the etiology of perinatal depression, yet theories of hypothalamic-pituitary-adrenal axis dysregulation, hormone imbalances, behavioral mechanisms, and the possible role of monoamines do not fully explain its etiology (Dunkel Schetter, 2010; Hirschfeld, 2000; Kammerer, Taylor, & Glover, 2006). Recent studies suggest inflammation may play a key role in the development of perinatal depression (Leff-Gelman et al., 2016; Osborne & Monk, 2013).

Associated Factors. Several studies have summarized significant associated factors of perinatal depression – some risk factors and others protective. The most comprehensive summary of these factors was a systematic review done by Fisher et al (2013). Risk factors include poor relationship quality with mother-in-law, family, and friends; polygamy; intimate partner violence; positive human immunodeficiency virus (HIV) status; history of abortion; history of stillbirth; pregnancy in the third trimester; food insecurity; ethnic or religious minority; and first pregnancy. Risk factors that appear to be significant in some studies, but not all, include young age, single marital status, unemployment, difficult life events, relatively low socioeconomic status, poor relationship quality with significant other, known female sex of fetus, poor reproductive and general health status, history of mental health disorders, and unintended pregnancy. Protective factors include secure job status, a partner that is employed, predominant ethnicity, higher levels of education, healthy relationship with significant other, and receiving postpartum care from a trusted person (Figure 1) (Bisetegn, Mihretie, & Muche, 2016; Brittain et al., 2017; Dibaba, Fantahun, & Hindin, 2013; Dunkel Schetter, 2010; Fisher et al., 2012; Getinet et al., 2018; Målqvist, Clarke, Matsebula, Bergman, & Tomlinson, 2016; Manikkam & Burns, 2012)(Fisher et al., 2012). Other studies throughout Africa corroborate these findings (Biratu & Haile, 2015; Getinet et al., 2018; Hartley et al., 2011).

Associated Outcomes. Maternal depressive symptoms have a negative impact on the health of the woman, infant, and family. Maternal consequences of poor mental health include insufficient ANC, substance use, poor nutrition, pre-eclampsia, postpartum depression, suicide, work disability, and lower income (Gelaye, Rondon, Araya, & Williams, 2018; Kawakami et al., 2012; Lépine & Briley, 2011; Rahman et al., 2013). Consequences for newborn outcomes include prematurity and low birthweight. The mechanism by which antenatal depression causes

preterm birth and low birthweight is not well understood, though recent research suggests that anxiety, often comorbid with depression, is a mediator of prematurity, while depression is a mediator of low birthweight (Dunkel Schetter, 2010). Infant and early childhood outcomes associated with the presence of maternal depression include lower rates of immunization completion; delayed infant growth and development; and an increase in malnutrition, stunting, diarrheal disease, infectious disease, and hospital admissions (Fisher et al., 2012; Gelaye et al., 2018; Kawakami et al., 2012; Lépine & Briley, 2011; Li, Liu, & Odouli, 2009; Rahman et al., 2013). Depression in the postpartum period not only affects proximal outcomes, but distal outcomes, as well. For each incidence of postpartum depression a woman is at 25% increased risk of developing MDD later in life (Robertson, Grace, Wallington, & Stewart, 2004).

Little is known about the effect that treatment of maternal depression has on associated outcomes. In one small retrospective study, perinatal health outcomes of three groups were compared: pregnant women with untreated major depression; pregnant women with major depression treated with a selective serotonin reuptake inhibitor (SSRI); and pregnant women without major depression who were not taking SSRIs. The study showed that those women with untreated antenatal major depression had newborns with lower birth weight and gestational age (Şahingöz et al., 2014). In addition, treatment effects of interventions to address mental health disorders are difficult to quantify given the difficulty in measuring the severity of mental health disorders (Theo Vos et al., 2017).

Rwandan Context. Rwanda is a country in East Africa with a population of 11.9 million and land mass of 26,338 km^2. It is made up of five provinces and 30 districts. The World Bank classifies Rwanda as a low-income country and it ranks 159 of 188 countries on the Human Development Index (The World Bank, 2018; UNDP, 2016). Rwanda's government is a

multiparty democratic system with President Paul Kagame at the head. President Kagame has been president for 18 years and is positioned to continue in his presidency until 2034 (The World Bank, 2018). Rwanda has been a leader in making large strides during the Millennium Development Goal era during which they decreased maternal mortality by 84%, under-5 child mortality by 66%, and infant mortality by 62% from 1992 to 2015 (Abbott, Sapsford, & Binagwaho, 2017).

Genocide. The events and impact of the Rwandan genocide, which started in 1994, did not start nor stop with the one million deaths that took place over the three months of intense violence. This time of civil war, when the Tutsi minority group was targeted, included sexual violence, looting, planned and state-monitored attacks, and reprisal attacks that lasted until 1998. Seventy-five percent of Tutsi people were killed. Of the pre-genocide population of 7.8 million, over 10% were killed, two million fled to other countries, and 1.2 million people were imprisoned. The nature of the genocide was deeply personal: neighbors killed neighbors and entire families were destroyed. The remaining population – mostly consisting of women and children – were left alone, traumatized, vulnerable, and economically devastated (Rieder & Elbert, 2013).

Depression and PTSD in Rwanda. The 1994 genocide in Rwanda created a setting which predisposed the population to poor mental health outcomes. Current estimates from the 2016 Global Burden of Disease study estimate the prevalence of depressive disorders in Rwanda as 3.8% (World Health Organization, 2017). The same estimates rank MDD as the number two cause of YLD in Rwanda (Theo Vos et al., 2017). In addition, when depressive disorder prevalence is assessed by region and sex, females in the African region have the highest prevalence of depression (5.9%) (World Health Organization, 2017).

Studies which assessed post-traumatic stress disorder (PTSD) 14 and 13 years after the genocide report prevalence rates of 26.1% and 41%, respectively. The latter study measured PTSD rates specifically among widows (Munyandamutsa, Nkubamugisha, Gex-Fabry, & Eytan, 2012; Schaal, Dusingizemungu, Jacob, & Elbert, 2011). In each of these studies, PTSD was strongly associated with depression. In the former, the prevalence of depression among people with PTSD was 68.4% versus 6.6% amongst those without PTSD (Munyandamutsa et al., 2012). These results suggest high co-morbidity between PTSD and depression.

Mental Health Policy and Practice. National mental health policy was introduced in 1995 as a response to the 1994 genocide at a population level. The goal of this policy was to create mental health anchor points close to the community, from mobile care services to referrals to the hospital level. This program focused on the post-conflict context and addressed post-traumatic stress disorder through the creation of the national-level Ndera neuropsychiatric hospital and the Psycho-social consultation service. However, the Psycho-social consultation service is only available at district-level hospitals and has yet to be integrated at the health center level. While the current policy does not yet address the specific needs of those with depression, anxiety, and chronic mental illness, including maternal mental health disturbances, it creates a foundation and framework for further development of policy to address these issues.

While the aforementioned clinical services and policies have sought to address the needs of the population by creating systems that provide services to address post-traumatic stress and acute psychosis, the common mental health disorders of anxiety and depression have not yet been addressed by this system. By extension, maternal mental health has gone unscreened, unmeasured, and untreated.

Health System. Rwanda provides universal health coverage to its populace utilizing a decentralized health care system which is organized at the district level. Care is provided by both the public and private sectors. In the public sector, care is provided at three levels – central, intermediate, and peripheral. At the central level, services are based in the capital, Kigali, at teaching hospitals. At the intermediate level, there are 11 provincial health offices. At the peripheral level, each district has a district hospital and primary health centers that are within its catchment area (Ministry of Health & ICF International, 2012; Statistics National Institute (NIS) [Rwanda] Ministry of Health (MoH) [Rwanda] and Macro International Inc., 2008).

Throughout the country, there are 633 physicians and 6,970 nurses. Of the nurses, 90% have the lowest level of training, or are A2 nurses. In Rwanda, there is not a clear distinction between nurses and midwives, therefore, the number of nurses is likely inclusive of midwives as data on number of midwives in country is not available. The ratio of clinicians to people is 0.72 per 1,000 persons, which is less than a third of the WHO's recommended minimum density of 2.3 clinicians per 1,000 persons needed to provide basic health care (Moh, 2011; World Health Organization Regional Office for Africa, 2013). In a recent survey of health facility staffing levels in Rwanda, health centers only met 55% of their staffing goal while district hospitals met 80.5% of their staffing goal (Gitembagara, Relf, & Pyburn, 2015). This speaks to the overall scarcity of human resources for health, but also the disparity between health centers and district hospitals.

Maternal Mental Health in Rwanda. Recognition of and strategies to address maternal mental health issues in Rwanda commenced in 2012. That year a small project was initiated in a school of nursing and midwifery in the Eastern province where two district-level nurses were trained in maternal mental health. In 2014-2016, a study funded by Grand Challenges Canada

explored the prevalence, predictors, and outcomes of maternal depressive symptoms in Bugesera District. Given the current burden on community health workers (CHWs), this study team identified and trained 30 community women (not CHWs) in active listening and maternal mental health. These community women then made biweekly visits to pregnant women in their community for six months. The anticipated impact of these biweekly visits on decreasing maternal depressive symptoms was not realized, though the Ministry of Health is committed to continue investment in related work.

Prior to 2015-2016, nursing and midwifery curricula did not include training on mental health. Currently, there is a single unit that provides six to seven hours of education on mental health for midwifery students at the University of Rwanda. This curriculum covers how to screen, refer, and provide treatment for maternal mental health disturbances. However, nursing curricula at the University of Rwanda and nursing and midwifery curricula outside of the University of Rwanda do not incorporate training on mental health, nor maternal mental health, specifically.

Nursing and Midwifery Education. Until 1994, nurses and midwives were trained at the secondary education level. After six years of primary school, students would spend two to three years in a general nursing program at the secondary level and then be given the designation of an A2 nurse. This distinction was phased out in 2007 (Gitembagara et al., 2015). These nurses primarily work at health centers. Beginning in 1997, nursing and midwifery education was also provided at the university level; a 3-year post-secondary diploma was offered and graduates earned the distinction of an A1 nurse. These nurses primarily work at the district hospital level, with some working as supervisors at the health center level. This A1 program is currently being phased out and no new students are enrolling in diploma programs. In 2006, a five-year

bachelor's degree in nursing and midwifery was created – the graduates of this program work at referral and district hospitals and are given the distinction of an A0 nurse. There are currently two private schools and one public school that provide a bachelors in nursing (Gitembagara et al., 2015). In 2014, a master's degree in nursing was created. Students pick a specific track, choosing from operative, medical/surgical, physical care, pediatric, neonatal, and education and management nursing. Currently, mental health and midwifery are not offered as master's specialty tracks, though there are current efforts to create these specialties.

Role of Nurses and Midwives. In additional to other services, midwives and general nurses provide antenatal, intrapartum, and postpartum services at the health center and hospital level throughout Rwanda. Physicians also provide care, but not at the health center level. According to a household survey, nurses provided 93.7%, midwives 0.6%, and physicians 4.6% of ANC. Nurses assisted 69.6% of births, midwives 2.7%, and physicians 18.3%. Nurses and physicians provided postpartum care (referred to as postnatal care in Rwanda) to 41.1% of all postpartum women while midwives provided 1.7% of this care. Fifty-seven percent of women do not receive any postpartum care (Ministry of Health & ICF International, 2012). Estimates likely underestimate the role of midwives given they are often synonymous with nurses and this data comes from household surveys.

Currently, clinicians do not screen women for antenatal or postpartum depression. The lack of postpartum visits makes it especially hard to screen for and treat postpartum depression. However, ANC provides an ideal setting for screening given 91% of pregnant women attend ANC. Given the central role of nurses and midwives in providing perinatal care services, they are well-positioned to screen women for depressive symptoms and treat or refer women with depressive symptoms.

The current national mental health policy does not address maternal mental health. In addition, national maternal depression prevalence rates are not measured or monitored. In order to understand the national prevalence levels, routine screening of maternal mental health services must be conducted. Currently clinicians are not trained to screen and no policies or protocols support screening. In turn, midwives and nurses are not universally equipped to provide screening, diagnosis, and treatment of maternal depressive symptoms. District-level services are focused on acute psychosis and post-traumatic stress disorder. For all mental health disturbances, mental health services at the community and health center levels are not meeting current needs. To address these gaps, the MOH's plans to address mental health disturbances by training one nurse per health center to offer mental health services. The nurse will undergo one month of training in mental health over a course of a year to be able to screen, diagnose, and provide medication treatment with a few selected medications. This program has not yet started.

Significance

No published studies describe the prevalence and associated factors of depression in pregnant women in Rwanda. This is the first study to assess depression prevalence across more than one district. This knowledge is necessary to inform mental health policy, practice, education, and financing. In addition, this knowledge may affect the current practices and education of nurses and nurse midwives throughout the country. Based on personal communication with ministry officials, the Ministry of Health is eager for this knowledge since the detrimental health effects of antenatal depression are well-documented. The results of the study will inform the Ministry of Health's strategy, policy, and programs to address maternal mental health needs. Understanding the maternal mental health needs of a post-conflict context is

extremely timely given current levels of conflict throughout the world and the resulting record-breaking 68.5 million refugees as of 2017 (UNHRC, 2017).

Aim & Objectives

The primary aim of this research thesis is to describe the prevalence of antenatal depression in five districts in Rwanda. A secondary aim of the research is to explore the relationship between potential associated factors of antenatal depression amongst a cohort of pregnant Rwandan women in a post-conflict context.

The specific objectives of this research thesis are to (1) quantify the prevalence of maternal depression in the antenatal period across five districts, (2) quantify the relationship between associated factors and antenatal depression, and (3) review policy and practice recommendations for Rwandan clinicians to address maternal mental health depressive symptoms.

Operational definitions

- Antenatal care: Often called prenatal care in the U.S. context, ANC is the term commonly used in the global health setting. Care provided throughout the pregnancy will be called ANC throughout the paper.
- Antenatal Depression: In this thesis, antenatal depression describes depression screened for or diagnosed during pregnancy. The onset of depression did not have occur in pregnancy or postpartum period, but only had to be present during that timeframe.
- Perinatal Depression: According to DSM-IV, perinatal depression describes depressive symptoms that present for the first time during pregnancy or in the four weeks postpartum (W H O, 1995).

- Common Maternal Mental Health Disorders: In this paper, this term will be used to describe Goldberg's construct of mental health disorders, namely depression, anxiety, adjustment, and somatic disorders as presented by Fisher et al, 2013.
- Depression Screening: In this study, women were not diagnosed with depression, but a screening tool was used to determine if they screened positive for depression, or not.

Conceptual Framework

Langer et al. (2015) presented Women and Health – A Conceptual Framework, in the Lancet's Commission on Women and Health (Figure 2). This commission not only explores the state of reproductive health, but all aspects of women's health and the role of women in providing health care. This conceptual framework positions women's health under the lens of human development, gender equality, culture, social justice, and human rights. The conceptual framework supports the theory that the most minimally trained, underpaid, unsupported health workers are also those that care for the most vulnerable women. This is especially true to the Rwandan context as, previously described, the least trained nurses work at health centers caring for the most vulnerable women. This creates a double burden for vulnerable women in both their roles as providers and recipients of health care.

Several transitions in the conceptual framework affect women's health and health care workers. The economic transition describes a world and economy that is affected by globalism. As such, many well-trained and prepared clinicians in low- and middle-income countries leave for education and work opportunities outside of their country. This is defined as a "brain drain," and leaves health care systems with fewer and less trained health care work force (Langer et al., 2015). This is evident in Rwanda with a health workforce that reaches provider to population ratios at less than a third of WHO recommendations.

While not detailed in this conceptual framework, the concepts of the epidemiologic and obstetric transitions also impact how women's health is conceptualized and care provided (Omran, 2001; Souza et al., 2014). The obstetric transition, in particular, describes the consequences of decreased fertility and mortality as the ability to increase focus on quality of care and decreasing morbidity. The epidemiologic transition describes the shift of the global burden of disease from infectious, malnutrition, maternal, and child health mortality to those of non-communicable diseases. As global maternal health programs and policies follow these transitions, programming and epidemiology are shifting to describe and address maternal morbidity and ensure quality of maternal health care. As such, morbidity issues such as maternal depression are now more relevant from an epidemiologic, programing, and funding perspective in low- and middle-income country contexts.

The underpinnings of this framework are the driving forces of gender equality and women's empowerment. These concepts apply both to vulnerable women with disparate outcomes and disenfranchised health care workers. This is particularly important to the framework of this research given that women's employee, socioeconomic status, and relationship with their family, friends, and partner affect the incidence of maternal depression (Fisher et al., 2012). This conceptual framework guides this research as all study participants and caregivers receive and provide care at the lowest level of the health care system – health centers. Poor outcomes and lack of evidence-based care, like depression screening, are consequences not only of a potential lack of knowledge, but lack of support, ability to practice skills, time, and supplies. The analysis and recommendations made in this paper reflect not only the needs of pregnant women, but also the need for training and support of health care workers.

Methods

Study Design

This study is a secondary analysis of data obtained between June 2017 and June 2018 from a five-district, 34-health center randomized controlled trial conducted by the Preterm Birth Initiative-Rwanda, assessing the impact of group ANC on gestational length in Rwanda. The Rwanda Ministry of Health chose the five districts with the highest rate of preterm birth. All health centers in each of the five districts were assessed for basic characteristics such as ANC volume, number of staff, equipment and commodities, and available space for group ANC visits. Health centers were chosen if more than one staff member was assigned to provide ANC on the days of the week that ANC is offered at the facility. The resulting 34 health centers were then pair-matched by baseline questionnaire characteristics and then randomized to either group ANC or individual ANC (standard of care). Eligible participants included women who were English or Kinyarwanda-speaking, currently pregnant, and at least 15 years old. Eligibility based on gestational age changed throughout the study based on preferences of the Rwanda Biomedical Center. From May - October 2017, women were eligible only if they presented for initial ANC visit before 24 completed weeks gestation based on last menstrual period (LMP); from November 2017 to February 2018, women of all gestational ages presenting for their initial ANC visit were eligible for the study; and from March to June 2018, women were eligible if they presented for initial ANC prior to completing 28 weeks' gestation. All eligible women were invited to enroll in the study.

At each health center, convenience sampling was used to select the first five women each calendar month who enrolled in the study to take an additional baseline questionnaire. This baseline questionnaire assessed women's experience with ANC, use of insecticide treated bed

nets, measures of self-efficacy, Multidimensional Scale of Perceived Social Support (MSPSS) score, Perceived Stress Scale (PSS) score, and Edinburgh Postnatal Depression Scale score. The primary study is still ongoing.

Setting

This study was conducted at 34 health centers in five districts throughout rural and urban Rwanda: Bugesera of the Eastern Province, Burera of the Northern Province, Nyamasheke and Rubavu of the Western Province, and Nyarugenge in the City of Kigali. No districts from the Southern Province were sampled. These health centers provide antenatal, labor, birth, and postpartum care.

Sample Size

The sample size was predetermined by the number of observations available at the time of secondary analysis. A total of 1096 pregnant women were included in this secondary analysis. The work by Peduzzi et al. (1996) was used to test if the sample size is adequate for multi-level multiple logistic regression analyses. The equation $N=10k/p$ was used where N equals sample size, k equals the number of covariates in the regression, and p equals the smallest proportion of negative or positive cases. Given prior assessment of antenatal depression prevalence in Bugesera district of 0.194 (Hynie et al., 2017), this was used for value p, while k became the value to determine: $k=Np/10 = (1096)(0.194)/10 = 21.26$. For this sample size, the authors used no more than 21 covariates in multi-level multiple logistic regression (Friedman, 1989).

Instruments

Outcome Measure. The Edinburgh Postpartum Depression Screening (EPDS) tool was used to quantify depressive symptoms at first ANC visit. Given this is a cross-sectional study, temporality of onset of depression cannot be determined and therefore the designation of

perinatal depression will not be used (Scully & Kupfer, 2013). The EPDS is a 10-item scale to screen for depression during pregnancy and postpartum. Response items are summed with total scores ranging from 0 to 30. This instrument was administered as part of a larger survey.

In this study, depression prevalence will be described using a cut off of both 12 and 13 to determine presence of depression, given the original EPDS tool was validated for cut-off of either 12 or 13 and validation studies throughout the region use both cut offs. However, given current usage of a cut-off score of 13 or more in Rwanda, analyses evaluating the relationship between depression and its associated factors will only use a cut-off score of 13 or more to determine if a woman screens positive for depression or not.

Measures of Associated Factors. Several potential associated factors were included in this analysis. These include age, level of education, history of obstetric complication(s), ability to discuss pregnancy matters with spouse, substance use, self-efficacy score, MSPSS score, and PSS score. Other important associated factors from the literature such as parity, gestational age at initial ANC visit, HIV status, and presence of current obstetric complications were not available due to incomplete data but will be added at a later time.

Age was assessed as a continuous variable. During data processing, age was also made into a categorical available according to WHO definitions and clinically relevant cut-offs. A cut off of 19 years was created consistent with the WHO's definition of adolescence (Dick & Ferguson, 2015) and a cut off of 35 years was created consistent with WHO's definition of advanced maternal age (Laopaiboon et al., 2014).

Level of education was originally measured using the following categories: none, some primary, completed primary, some secondary, completed secondary, some university/college, and completed university/college. Given variation in number of years attended for categories

assessing “some” schooling, education was recategorized to describe completed levels of education. Education was recategorized as none, completed primary, completed secondary, and completed university.

History of previous obstetric complications describes women who have had a previous birth that was preterm birth, low birthweight, stillbirth, and/or a neonatal death. In addition, women were asked if they were able to discuss any matter related to their pregnancy with their partner. This measure acts as proxy of measuring women’s empowerment, self-efficacy, and relationship quality with partner. Substance use is described as a binary variable which describes women who use tobacco and/or consume alcohol.

Measures of self-efficacy were assessed as a cumulative score. These questions were asked in order to compare results to a simultaneous study of group ANC in Kenya and Uganda by a research team at Jhpiego who developed and uses these same measures. Women were asked if they strongly agreed, agreed, neither agreed nor disagreed, disagreed, or strongly disagreed, with scores of 1 to 5 points assigned respectively, with the following statements: (1) I can talk to others about difficult subjects, (2) I can let others know what I really think, even if it is different from them, (3) I like to make decisions for myself, (4) I am able to make decisions for myself, (5) during this pregnancy, if I don't understand something a provider is telling me I will tell them and ask them to explain a different way, (6) there are things I can do to help prevent problems and keep myself and my baby healthy, (7) I will talk with my husband/family about how to keep myself and our baby healthy, (8) I know how to recognize a problem with my pregnancy, (9) I know what actions I will take if I think there is a problem with my pregnancy, (10) I know how to recognize a problem with my newborn, (11) I know what actions I will take if I think there is a problem with my newborn, (12) I am good at making decisions related to the health of myself

and my family, and (13) I am confident I can ask my husband/partner to use a condom if I want him to use a condom. In the last question (14), women were asked to answer "who will usually make decisions about health care for yourself and your newborn" with possible answers of "you, your husband/partner, you and your husband/partner jointly, or someone else." A lower score was a measure of higher self-efficacy.

The MSPSS measures three sub-scales of social support associated with family, friends, and significant other. Created in 1988 by Zimet, et al., the MSPSS uses 12 questions – four questions per sub-scale – with an original seven-item Likert scale with response options ranging from very strongly disagree to very strongly agree (Zimet, Dahlem, Zimet, & Farley, 1988). Our scale was modified from the original seven-item to a five-item Likert scale with responses ranging from strongly disagree to strongly agree, representing one to five points, respectively. This change was made based on a recommendation from the Rwandan investigators and their perception that a seven-point scale would be confusing for respondents. Sub-scale scores were then divided by 4. Mean scale scores of (1.0 to 2.3) were considered low support, scores of (2.4 to 3.7) were considered moderate support, and scores from (3.8 to 5.0) were considered high support.

The PSS was originally developed in 1983. This scale uses 10 questions, each with a possible 0 to 4 points assigned for a total possible score of 0 to 40. There is a direct relationship between scores and perceived stress. Suggested cut-offs attribute 0 to13 to low stress, 14 to 26 to moderate stress, and 27 to 40 to high perceived stress (Cohen, Kamarck, & Mermelstein, 1983). This score was kept as a continuous variable for purposes of our analysis based on research which demonstrates categorizing continuous variables can cause residual confounding and decreased power (Royston, Altman, & Sauerbrei, 2006).

Validity and Reliability

Outcome Measure. The original validation of the EPDS tool was tested in Edinburgh and Livingston new town, Scotland amongst 84 women at three months postpartum, on average. The women's mean age was 26 years old. The authors recommend a positive depression screen cut-off score of 12 or 13, which had a sensitivity of 86% and specificity of 73% when compared to Research Diagnostic Criteria for depression. The EPDS tool has been validated as a screening tool, not a diagnostic tool (Cox, Holden, & Sagovsky, 1987)

The EPDS tool has been used and validated in many settings to screen for both antenatal and postpartum depression. However, cut-off scores to determine if the woman screens positive for depression differ. Currently, the American Academy of Pediatrics recommends a cut-off of >10, while others recommend a cut-off of >12 (Su et al., 2007). Extensive work in Nigeria (Gureje et al., 2015) and Ethiopia (Bisetegn et al., 2016) used a cut off of ≥ 12 to screen for positive for depression. While work in Ethiopia (Biratu & Haile, 2015; Dibaba et al., 2013), Swaziland (Målqvist et al., 2016), and South Africa (Brittain et al., 2017) have used a cut-off of ≥13. Validation studies of the EPDS have taken place in rural Malawi using a cut-off of ≥ 12 (Stewart, Umar, Tomenson, & Creed, 2013), in Nigeria with a cut off of ≥10 with 86.7% sensitivity and 91.5% specificity for minor and major depression and with a cut off of ≥12 with 100% sensitivity and 96.1% specificity for major depression when compared to diagnosis using the DSM-IV criteria (Adewuya, Ola, Dada, & Fasoto, 2006), and South Africa, where the construct validity and internal reliability was confirmed (De Bruin, Swartz, Tomlinson, Cooper, & Molteno, 2004). In addition, a systematic review determined that the EPDS tool can reliably and validly measure and screen for perinatal depression in African countries. This study also determined that, based on 14 studies, an EPDS cut off of ≥9 has a sensitivity and specificity of

94% and 77%, respectively (Tsai et al., 2014). Although the EPDS is a screening and not diagnostic tool, it generally serves as a first step toward diagnosis.

The EPDS tool is the only depression screening tool that has been used in the perinatal period in Rwanda. University of Rwanda researchers report that the EPDS, EPDS-3, and Whooley tools have been validated for use in Rwanda with an EPDS cut off of ≥13, though their results are not yet published.

Measures of Associated Factors. The MSPSS was originally validated in 1998 with undergraduate students with a Cronbach's alpha of 0.91, 0.87, and 0.85 for significant other, family, and friends subscales, respectively, with a comprehensive coefficient of 0.88. These values indicate good internal reliability. Construct validity was tested using correlations between MSPSS scores and Hopkins Symptom Checklist scores for depression and anxiety. The MSPSS as a whole had a significant inverse relationship with depression, $r = -0.25$, $p < 0.01$ (Zimet et al., 1988). These same authors validated the MSPSS with 265 pregnant women, 74 adolescents who still lived with their family of origin, and 55 pediatric residents in Europe and demonstrated that the scale has internal reliability across sample subject groups, factorial validity, and subscale validity (Zimet, Powell, Farley, Werkman, & Berkoff, 1990).

The PSS was tested in three groups: 332 freshman college students at the University of Oregon, 114 students in an introductory personality psychology class, and 64 community members in a University of Oregon smoking-cessation program. The score proved reliable with Cronbach alphas of 0.84, 0.85, and 0.86, respectively (Cohen et al., 1983).

Analysis Plan

Before analysis, all duplicate cases and cases with missingness were dropped, based on an assumption of missing-at-random (MAR). Duplicates made up 9.4% of the original sample

and cases with missingness made up an additional 13.3% in the dependent and independent variables of the model. The results were assumed to be unbiased estimates based on the MAR assumption. Significance level was set at $p<0.05$.

Simple descriptive analyses were used to assess demographic characteristics of sample subjects including age, district, education, whether or not the pregnant woman contributes earnings to the household, and stove location and fuel type (as proxies for socioeconomic status). Demographic characteristics were presented by depression screening result, as determined by an EPDS score of ≥13. Chi-squared tests were used to determine if demographic characteristics differ significantly by depression screening result.

Next, EPDS scores were described by both the total EPDS score (continuous variable) across the sample and the proportion of subjects who screened positive for depression based on a cut-off EPDS score of both ≥12 and ≥13. Analyses quantified aggregate and district-level antenatal depressive symptom prevalence. Skewness and kurtosis assessments were completed with the continuous total EPDS score variable to determine if parametric or non-parametric statistics should be used.

Magnitude of intraclass correlation coefficient (ICC) between observations, clustered at the health center level was assessed. A value of greater than 0.10 suggests substantial non-independence between observations. Assuming a substantial ICC, fixed-effects multi-level simple and multiple logistic regressions were used to describe the relationship between positive depression screening using a cut-off score of ≥13 and generally accepted associated factors, as described earlier.

For categorical independent variables with more than two groups, an omnibus test was performed to assess if there are significantly different odds ratios of screening positive for

depression between all possible category combinations in the dependent variable. If the omnibus test was significant, pairwise comparisons were utilized to quantify the odds ratios of positive depression screen using Bonferroni corrected z scores and p-values between all possible category combinations. Multi-level simple logistic regression analyses will provide the odds ratio of screening positive for depression by each associated factor.

All variables used in the multi-level simple logistic regression were added to a multi-level multiple regression model. Backward step-wise regression was used to remove the variables with the highest p-values (least significant) until all variables had a significant relationship at the <0.05 level. This method produces the least biased prediction models.

No goodness of fit test is agreed upon for multi-level logistic regressions. Akaike's information criterions (AICs) were calculated and compared for the full model and the simplified model using a likelihood ratio test to assess for significant improvement in fit of the models. If there was no significant difference in the AICs of the two models, the most parsimonious model was used. Adjusted odds ratios for each independent variable and its associated significance were reported.

Human Subjects Assurance

All participants provided written informed consent. If the participant could not read or write, next of kin was required to read the consent form aloud to the participant and sign for them, witnessing and speaking for their consent. In addition, the original study was approved by both the Rwanda National Ethics Committee, IRB 00001497, and the University of California, San Francisco institutional review board, IRB number 16-21177. For the secondary analysis, the primary researcher was added to the IRB as study personnel and a data-sharing agreement was completed and approved by the study principal investigators from the University of California,

San Francisco and the University of Rwanda. No patient identifiable health information was available in the secondary analysis.

Results

During data processing and cleaning, 131 duplicate cases and 167 cases with missingness were dropped with a resulting sample size of 1096. Demographic characteristics of the sample are described in Table 1. Significant differences in sample distribution by depression screening status were seen for district, age categories, and cooking stove location (outside versus inside).

Prevalence of Antenatal Depression

The continuous EPDS variable was assessed for skewness and kurtosis and was deemed to not have a normal distribution with a joint chi-squared (X^2) score of 60.58 ($p < 0.001$). Therefore, distribution is described with non-parametric tests. The median total EPDS score across all districts was 6 with an interquartile range (IQR) of 2 to 11. This reflects the right-skewed nature of the EPDS score distribution, with the IQR representing the middle 50% of scores. Medians and IQRs are reported in Table 3 for each district, which were significantly different ($p<0.001$). When an EPDS cut-off score of ≥12 was used, aggregate prevalence of depression was 24.4% and significantly different between districts ranging from 17.4% to 34.8% ($p<0.001$) (Table 3). When an EPDS cut-off score of ≥13 was used, aggregate prevalence of depression was 20.6%, and significantly different between districts ranging from 12.4% to 30.0% ($p<0.001$) (Table 3) (Figure 3).

Associated Factors of Antenatal Depression

Health center level ICC was 0.17, which is substantial and suggests multi-level modeling should be used to control for clustering.

Fixed-effects Multi-level Simple Logistic Regressions. Several independent variables were statistically significant as associated factors of depression in the multi-level simple logistic regressions. The omnibus test for the three category *Significant Other* MSPSS sub-scale was statistically significant (p=0.02). Pair-wise comparisons showed that women with high social support from their significant other had 55.7% fewer odds of screening positive for depression than those who reported low social support from their significant other (OR: 0.44, 95% CI: 0.22-0.89) (Table 4). The omnibus test for the three category *Friend* MSPSS sub-scale was statistically significant (p=0.03). Pair-wise comparisons showed that women with low friend social support had 2.63 greater odds of depression than those with moderate friend social support (95% CI: 1.22-5.65, p=0.007) and those with reported high friend social support had 66.2% fewer odds of depression than those who reported low friend social support (95%CI: 0.16-0.72, p=0.002). The omnibus test for the three category *Family* MSPSS sub-scale was statistically significant (p<0.001). Pair-wise comparisons showed that women with reported low family social support had a 2.64 greater odds of depression than those with moderate family social support (95%CI: 1.10-6.34, p=0.03), those with reported high family social support had 44.3% fewer odds of depression than those who reported moderate family social support (95%CI: 0.34-0.90, p=0.01), and those with reported high family social support had 78.9% fewer odds of depression than those who reported low family social support (95%CI: 0.09-0.49, p<0.001).

While a significant relationship was assessed between PSS score and screening positive for depression (OR: 1.17, 95%CI: 1.11-1.24, p<0.0001), no relationship was seen with the categorical PSS score designation of low-, moderate-, and high-stress after pair-wise comparisons were done (Table 4).

The omnibus test for education categories was not statistically significant and there was no significant relationship between education and screening positive for depression (Table 4). The omnibus test for the three age categories was statistically significant (p=0.003). The pair-wise comparisons showed that adolescents had 3.4 greater odds of screening positive for depression than those aged 20-34 years old (95% CI: 1.44-8.14, p=0.002) and women with advanced maternal age had 69.5% fewer odds of screening positive for depression than adolescents (95% CI 0.12-0.79, p=0.008) (Table 4). When women said that they felt they could discuss any matter related to their pregnancy with their partner, they had 74.2% fewer odds of screening positive for depression, compared to those who could not (95%CI: 0.15-0.43, p<0.0001) (Table 4).

No significant relationship was seen between total self-efficacy score and screening positive for depression (p=0.17). Likewise, no significant relationship was seen between history of obstetric complication or substance use and depression screening (Table 4). Random effects intercepts for each model are reported in Table 4. A forest plot representing odds ratios and 95% confidence intervals for all multi-level simple regressions are in Figure 4.

Fixed-effects Multi-level Multiple Logistic Regression. A full multi-level multiple logistic regression model was generated with all exploratory independent variables. The AIC for the large model was 945.93. After step-wise backward regression, the remaining significant associated factors of screening for depression are *Family* MSPSS score, age, cumulative PSS score, and whether or not a woman felt she could discuss any matter related to pregnancy with her partner. The AIC for the final model was 932.83. The likelihood ratio test comparing the two AICs was not significant with an LR chi-square of 6.9 (p=0.73) showing that the fit of each model is not significantly different.

The omnibus test for *Family* MSPSS sub-scale was significant (p=0.0002) and resulting Bonferroni z-scores and p-values were significant for women reporting high family social support who had a 45.3% fewer odds of depression compared to those with moderate family social support (95%CI: 0.33-0.90, p=0.01) and women reporting high family social support who had a 72.7% fewer odds of depression compared to those with low family social support (95%CI: 0.11-0.67, p=0.002) (Table 5).

The omnibus test for age was significant (p=0.02) and pair-wise comparisons in the adjusted-model showed that adolescents have 2.97 greater odds of screening positive for depression than women 20-34 years old (95%CI: 1.19-7.44, p=0.01) and women of advanced maternal age had 67.3% fewer odds of screening positive for depression when compared with adolescents (95%CI: 0.12-0.90, p=0.02). A forest plot representing odds ratios and 95% confidence intervals are in Figure 5.

Discussion

Twenty-percent of pregnant Rwandan women in this sample screen positive for antenatal depression. This prevalence rate is twice that of women in high-income countries and 32% higher than the average prevalence of antenatal depression in women in LLMICs (20.6% vs. 15.6%, respectively) (Fisher et al., 2012). Given that the estimates presented by Fisher et al. (2012) include other common mental health disorders and not only depression, the antenatal depression prevalence in Rwanda is likely even more disparately high than experienced in high-income and LLMICs. Though over 90% of Rwandan women attend ANC, another factor that may result in an underestimation of antenatal depression rates is that studies show women who are depressed have decreased rates of antenatal care attendance, potentially excluding them from our sample (Ayele et al., 2016). The increased burden of depression shouldered by Rwandan

women is consistent with the Women and Health – A Conceptual Framework (Langer et al., 2015), which describes women in the most vulnerable sectors of the health system experiencing the highest burden of disease. This suggests that Rwandan women experience a higher burden of depression in pregnancy, which the literature demonstrates has a significant impact on maternal, newborn, and childhood health outcomes.

The overall antenatal depression prevalence rate of 20% is consistent with the Bugesera District rate of antenatal depression in the study done by Hynie, et al (2017). However, when this sample's prevalence is stratified by district, our sample experienced less antenatal depression in Bugesera District compared to the estimates generated by Hynie, et al (2017) (16.7% versus 19.4%). Our estimates are much lower than those presented by Umuziga (2014), however, they used an EPDS cut-off score of >10.

Differences in antenatal depression among districts was statistically significant in our sample. More than a two-fold increase in antenatal depression was demonstrated between Rubavu district with the highest prevalence (30.0%) and Nyarugenge District with the lowest prevalence (12.4%). This analysis did not assess differences in demographic factors by district, which may have shown disparities in both socioeconomic factors (e.g. education,stove type and location) or in antenatal depression associated factors. However, when promotion rates from lower secondary school are compared between these two districts, Rubavu ranks 27th out of 30 districts and Nyarugenge ranks 7th out of 30 districts (NISR, 2016). In addition, the prevalence map created in Figure 3 suggests higher levels of antenatal depression in the sample in districts farthest from Kigali, the country's capital – both potentially demonstrating a disparity in antenatal depression between rural and urban populations. Several studies conducted in developed settings have shown that antenatal depression is typically higher in urban versus rural

areas (Bilszta, Gu, Meyer, & Buist, 2008; Vigod et al., 2013), though, consistent with this study, results from other studies in LLMICs show rural women experiencing more antenatal depression than urban women (Jarahi, Zavar, & Shahi, 2014; Waqas et al., 2015). Further, and also consistent with this study, studies show women living in areas with poor socioeconomic opportunity also have the highest rates of perinatal depression (Hartley et al., 2011; Patel, Rodrigues, & DeSouza, 2002; Tomlinson et al., 2014; Van Heyningen, Honikman, Tomlinson, Field, & Myer, 2018).

The adjusted model in our analysis shows that scoring high on perceived family social support, increased maternal age, low perceived stress, and being able to discuss pregnancy with a partner were protective for antenatal depression. In this multi-level multiple logistic regression analysis, associated factors of both perceived significant other and friend social support, which were significant in the multi-level simple logistic regression, were no longer significant. This suggest collinearity between both perceived significant other and friend social support and family social support. The significant associated factors in our adjusted model (family support, age, stress, and partner relationship) are consistent with findings in the literature (Fisher et al., 2012). However, associated factors that are significantly associated with antenatal depression in the literature that were not significant in our model are perceived significant other and friend social support, education, and obstetric history of adverse outcome (Fisher et al., 2012).

The associated factor with the greatest impact on antenatal depression was perceived family social support, women with high perceived family support had 73% fewer odds to have antenatal depression compared with those with low scores in family support. Women with low perceived social support had twice the odds of reporting depression compared to those with moderated social support. Possible reasons for this relationship include improved health

behaviors, biological processes, and health outcomes related to improved social support (Hogan, Linden, & Najarian, 2002; Holt-Lunstad, 2018; Schetter, 2016).

Given the impact that the 1994 genocide had on families and resulting PTSD, perceived family social support may act as a mediator of family adverse experiences and resulting antenatal depression rates. In particular, women who were widowed during the genocide experience higher rates of PTSD than the general population and may now have children who are pregnant (Munyandamutsa, Nkubamugisha, Gex-Fabry, & Eytan, 2012; Schaal, Dusingizemungu, Jacob, & Elbert, 2011). If a pregnant woman's mother or mother-in-law was widowed or greatly affected by the genocide, this may impact family relationships and perceived social support.

Methods of bolstering social support have been studied, though few high-quality studies have been done. Types of interventions include, but are not limited to, behavioral training of friends and family, inclusion of friends and family in the persons' care, group care, increased social support by clinicians, support groups, social support skills training (Hogan et al., 2002). A review of social support intervention studies concludes that of the 39 interventions, 22 had a positive effect on health outcomes, 17 had no benefit, and two showed potential harm. However, each of the interventions differed enough that comparisons between types of interventions and their effects was difficult to assess (Hogan et al., 2002). Implications for midwifery and nursing practice in Rwanda include assessing context appropriate and specific social support interventions and piloting their use and effect on antenatal depression and other health outcomes.

The second most impactful factor was whether or not a woman felt she could discuss any matter related to her pregnancy with her partner, with those who felt they could discuss matters 70% less likely to screen positive for depression. . As previously discussed, this was used as proxy for gender equality, empowerment, and partner relationship quality. The relationship

between better health outcomes and these factors is consistent with the Women and Health conceptual framework (Langer et al., 2015) and other studies showing improved perinatal depression with improved partner relationship (Rahman, Iqbal, & Harrington, 2003; Gausia, Fisher, Ali, & Oosthuizen, 2009; Ho-Yen, Bondevik, Eberhard-Gran, & Bjorvatn, 2007; Nhiwatiwa, Patel, & Acuda, 1998; Owoeye, Aina, & Morakinyo, 2006)

The associated factor with the third greatest impact was age, with adolescents experiencing three times the odds of screening positive for antenatal depression when compared with women aged 20-34 years and women 35 years and older experiencing 67% fewer odds of screening positive for depression when compared to adolescents. This is consistent with previous research (Abiodun, 2006; Nakku, Nakasi, & Mirembe, 2006; Xie et al., 2007). The greater burden of antenatal depression that adolescents bear may be due to the conflict of simultaneous maternal role attainment and establishing her own identity (R.Rubin, 1967).Theoretically, if a person has not yet established their own identify, it is difficult to assume new identities, such as a mother. The adolescent pregnancy rate in Rwanda 5.2%, which is relatively low compared to other neighboring countries such as Uganda, Kenya, and Tanzania where adolescent pregnancy rates are 33%, 25.9%, 28.3%, respectively (Loaiza & Liang, 2013). This suggests that Rwanda has already made substantial progress in addressing the health needs of adolescents. For those who do become pregnant, group ANC has shown to decrease perinatal rates of depression by 31% and improve birth outcomes in adolescents (Felder et al., 2017). Given this secondary analysis comes from an RCT that studies the effect of group ANC on perinatal outcomes, the impact of group ANC on depressive symptoms at initial ANC and at 8-weeks postpartum will be assessed. If improvement in depressive symptoms with group ANC is demonstrated in this study,

the results will add to the evidence base that may be considered as policy and practice changes are made in Rwanda.

Perceived stress had the fourth greatest impact on antenatal depression in this sample. While some studies describe perceived stress as a predictor of depression (Abujilban, Abuidhail, Al-Modallal, Hamaideh, & Mosemli, 2014; Bayrampour, McDonald, & Tough, 2015; Bunevicius et al., 2009; Fisher et al., 2013; Shakeel et al., 2015; Verreault et al., 2014), both conditions have overlapping symptoms which may suggest stress and depression are comorbidities rather than stress as a predictor of depression (Lee, 2012). Therefore, interventions which target antenatal depression will likely also decrease perceived stress.

Interventions that address the associated factors of antenatal depression that also have impacts on other areas of health and well-being, especially family support and women's empowerment, may have an impact on overall health status, not only antenatal depression. Therefore, interventions to address antenatal depression will have the greatest impact on overall health status if implemented at a national level across all genders and ages.

Implications for Policy and Practice

Perinatal Depression Screening. Due to the high prevalence of maternal depressive symptoms in this setting, universal screening of antenatal and postpartum depression is recommended. Universal screening is consistent with recommendations from the U.S. Preventative Services Task Force and the American College of Obstetricians and Gynecologists (O'Connor, RC, Henninger, HC, & BU, 2016; The American College of Obstetricians and Gynecologists, 2015). A recent review demonstrated that universal screening of pregnant women resulted in a 18-59% decrease in symptoms three to five months after depression screening when compared to women who were not screened (O'Connor et al., 2016). However, other

organizations in Canada and the United Kingdom do not recommend universal perinatal depression screening due to weak evidence and potential harm (The Lancet, 2016). Reasons for potential harm include not having referral or treatment available for someone who screens positive for perinatal depression and stigma, which is often associated with perinatal depression especially in LLMICs (Fisher et al., 2013). This is consistent with the WHO's recommended Wilson and Jungner classic screening criteria, if screening is to be done, the disease for which one screens needs to fulfill the following requirements:

> "(1) the condition should be an important health problem, (2) there should be an accepted treatment for patients with recognized disease, (3) facilities for diagnosis and treatment must be available, (4) there should be a recognizable latent or early symptomatic stage, (5) there should be a suitable test or examination, (6) the test should be acceptable to the population, (7) the natural history of the condition, including development from latent to declared disease, should be adequately understood, (8) there should be an agreed policy of whom to treat as patients, (9) the cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole, and (10) case-finding should be a continuing process and not a "once and for all" project." (Ross L.F., Saal H.M., Anderson R.R., & David K.L., 2013)

In addition, given limited human resources for health in Rwanda and the length of the full EPDS tool, the recently validated EPDS-3 (Kabir, Sheeder, & Kelly, 2008) and two-question Whooley depression screening tool (Whooley, Avins, Miranda, & Browner, 1997) may be more appropriate for this setting. The screening strategy with the best outcomes, as identified by three randomized controlled trials (Leung et al., 2011; Morrell et al., 2009; Yawn et al., 2012), was joint screening and treatment for perinatal depression. These results also proved cost-effective

(Dukhovny et al., 2013; Morrell et al., 2009). Current mental health policy in Rwanda creates a framework for integrating perinatal depression screening. In order to assess the feasibility and acceptability of universal perinatal depression screening in Rwanda, a small-scale pilot study may be considered.

Perinatal Depression Treatment. Evidence of effective interventions for perinatal depression in LLMICs is limited. The WHO recommends cognitive behavior therapy (CBT) as the first-line treatment for perinatal depression and has created the *Thinking Healthy* program (THP) (World Health Organization, 2015). This program utilizes pictorial guides and activities to assist minimally trained health care workers in providing CBT and adjunct physical relaxation and social network reactivation to improve social support. This program was designed specifically to be appropriate for women with low-literacy and to reduce stigma associated with depression. One study which implemented the THP in Pakistan trained CHW over a 3-day period and randomized women who screened positive for antenatal depression in the third trimester to either receive the THP intervention or standard care. The results showed that at 6 and 12 months postpartum, women who received the THP intervention had a 77% fewer odds of maternal depression compared to the control group. When analyzed in a systematic review, the THP intervention Pakistan had the greatest effect on maternal depression when compared to other interventions (Rahman et al., 2013). Given its effects, CBT may be considered as a treatment option for perinatal depression in Rwanda in addition to expert consultation and local evidence.

Implications for Nursing and Midwifery Education

Midwifery and nursing associations are key to creating curriculum requirements – core competencies – to which nursing and midwifery educational programs must comply. The International Confederation of Midwives (ICM) states that midwives should have the basic

knowledge of how to recognize the signs and symptoms of severe mental depression in the postnatal period (International Confederation of Midwives, 2013). While ICM core competencies do not address depression throughout pregnancy and postpartum, this basic requirement of training is not met at all nursing midwifery programs in Rwanda. In order for ICM core competencies to be met in Rwanda, a comprehensive look at prevention and treatment of maternal depression should be considered by the midwifery association, the schools of nursing and midwifery, and the Ministry of Health.

A systematic review, which sought to describe the educational needs of perinatal clinicians, educational interventions, and perinatal outcomes, found a dearth of formal education and a consistent need for professional development related to perinatal mental health. Educational interventions evaluated focused on improving clinicians' knowledge of and how to screen for antenatal depression and discuss psychosocial issues with pregnant women. The outcomes of these educational interventions showed improvement in clinicians ability and confidence in perinatal depression screening, increased knowledge about perinatal depression, and reduced EPDS scores in women (Legere et al., 2017). Given these results, nursing and midwifery programs in Rwanda may consider maternal mental health curriculum development and implementation which includes previously described evidence-based practices of screening and CBT. In addition, for clinicians who are already practicing, in-service trainings may be considered.

Limitations & Strengths

Several limitations for this study exist. Since the study was conducted in districts with the highest preterm birth prevalence rates, the study sample may be at higher risk for poor health outcomes when compared to the country as a whole. This may limit the generalizability of the

prevalence estimates of antenatal depression. In addition, we used depression screening status, not diagnosis, as our outcome measure. Though screening score, which according to sensitivity and specificity calculations previously cited, is likely associated with a diagnosis of depressive disorder or depression, our interpretation of the relationship between depression and associated factors may be limited. Lastly, this was a cross-sectional study and the requirements to demonstrate causality between predictors and the outcome of depression cannot be met.

Strengths of the study include that it is the first of its kind to be done in Rwanda and corroborates prior research done by Hynie (2017). This research aids in filling a gap in public health knowledge to better care for pregnant women and families and prevent poor outcomes known to be associated with maternal depression symptoms. Other strengths include the geographical diversity of the study, with all but one province represented in the sample. The sample size allows for multi-level analysis of data that are not normally distributed without stratification and allows for greater power to determine relationships among and between the variables of interest.

Implications for Future Research

Future research is needed to corroborate the findings of this study and identify effective methods for screening and treating perinatal depression in LLMICs. Future studies may be more generalizable by recruiting women from more heterogenous groups. In addition, longitudinal studies assessing depression and its associated factors may provide stronger models for causation and better delineate timing of depression onset, especially in relation to family exposure to genocide trauma. Future studies would be strengthened by providing depression diagnosis and not only screening. In order to improve antenatal depression prevalence rates, pilot studies that assess the effectiveness of screening and treatment for antenatal depression are needed. In

addition, more research is needed in LLMICs to identify best practices for both pre-service and in-service educational programs to address the needs of clinicians in low-resource settings.

Data Tables

Table 1. Sample Characteristics

FACTOR	VALUE
N	1096
DISTRICT	
BUGESERA	330 (30.1%)
NYAMASHEKE	289 (26.4%)
RUBAVU	210 (19.2%)
BURERA	146 (13.3%)
NYARUGENGE	121 (11.0%)
AGE, MEDIAN (IQR)	28 (24, 33)
AGE	
≤19 YEARS OLD	48 (4.4%)
20-25 YEARS OLD	313 (28.6%)
26-34 YEARS OLD	509 (46.4%)
≥35 YEARS OLD	226 (20.6%)
EDUCATION LEVEL COMPLETED	
NONE	531 (48.4%)
PRIMARY SCHOOL	445 (40.6%)
SECONDARY SCHOOL	105 (9.6%)
UNIVERSITY	15 (1.4%)
EARNS MONEY FOR HOUSEHOLD	
NO	812 (75.0%)
YES	270 (25.0%)
COOKING FUEL TYPE	
WOOD	780 (71.2%)
OTHER SOLID FUEL	301 (27.5%)
GAS	14 (1.3%)
STOVE LOCATION	
OUTDOOR	842 (78.2%)
INDOOR	235 (21.8%)

Table 2. Sample Characteristics by EPDS Screening Result

DEMOGRAPHIC CHARACTERISTIC	NOT DEPRESSED	DEPRESSED	P-VALUE
N	870	226	
DISTRICT			<0.001
BUGESERA	275 (31.6%)	55 (24.3%)	
NYAMASHEKE	219 (25.2%)	70 (31.0%)	
RUBAVU	147 (16.9%)	63 (27.9%)	
BURERA	123 (14.1%)	23 (10.2%)	
NYARUGENGE	106 (12.2%)	15 (6.6%)	
AGE, MEDIAN (IQR)	28 (24, 34)	29 (23, 33)	0.44
AGE			0.029
≤19 YEARS OLD	30 (3.4%)	18 (8.0%)	
20-25 YEARS OLD	254 (29.2%)	59 (26.1%)	
26-34 YEARS OLD	405 (46.6%)	104 (46.0%)	
≥35 YEARS OLD	181 (20.8%)	45 (19.9%)	
EDUCATION LEVEL COMPLETED			0.28
NONE	416 (47.8%)	115 (50.9%)	
PRIMARY SCHOOL	351 (40.3%)	94 (41.6%)	
SECONDARY SCHOOL	91 (10.5%)	14 (6.2%)	
UNIVERSITY	12 (1.4%)	3 (1.3%)	
EARNS MONEY FOR HOUSEHOLD			0.39
NO	642 (74.5%)	170 (77.3%)	
YES	220 (25.5%)	50 (22.7%)	
COOKING FUEL TYPE*			0.14
WOOD	607 (69.9%)	173 (76.5%)	
OTHER SOLID FUEL	250 (28.8%)	51 (22.6%)	
GAS	12 (1.4%)	2 (0.9%)	
STOVE LOCATION**			<0.001
OUTDOOR	700 (82.1%)	142 (63.4%)	
INDOOR	153 (17.9%)	82 (36.6%)	

***n=1095**

****n= 1077**

Table 3. EPDS Depression Screen Prevalence

FACTOR	TOTAL	RUBAVU	NYAMASHEKE	BUGESERA	BURERA	NYARUGENGE	P-VALUE
N	1096	210	289	330	146	121	
EPDS SCORE, MEDIAN (IQR)	6 (2, 11)	8 (4, 14)	5 (2, 12)	6 (1, 10)	6 (2, 10)	5 (2, 10)	<0.001
SCREENED DEPRESSED (EPDS ≥12)							<0.001
NOT DEPRESSED	75.6%	65.2%	72.7%	79.4%	82.2%	82.6%	
DEPRESSED	24.4%	34.8%	27.3%	20.6%	17.8%	17.4%	
SCREENED DEPRESSED (EPDS ≥13)							<0.001
NOT DEPRESSED	79.4%	70.0%	75.8%	83.3%	84.2%	87.6%	
DEPRESSED	20.6%	30.0%	24.2%	16.7%	15.8%	12.4%	

Table 4: Multi-Level Simple Logistic Regression

	ODDS RATIO	P-VALUE	95% CI
Significant Other MSPSS			
Low Support	1.93	0.028	1.07 – 3.48
Moderate Support	Ref		
High Support	0.86	0.42	0.58-1.25
var(_cons)	1.48		0.75-2.95
Significant Other MSPSS - Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
Low v Mod	1.93	0.085	0.94-3.96
High v Mod	0.86	1.00	0.54-1.36
High v Low	0.44	0.02	0.22-0.89
Friend MSPSS	**ODDS RATIO**	**P-VALUE**	**95% CI**
Low Support	2.63	0.002	1.41 – 4.92
Moderate Support	Ref		
High Support	0.89	0.52	0.62-1.28
var(_cons)	1.45		0.72-2.89
Friend MSPSS - Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
Low v Mod	2.63	0.007	1.22-5.65
High v Mod	0.89	1.00	0.57-1.39
High v Low	0.34	0.002	0.16-0.72
Family MSPSS	**ODDS RATIO**	**P-VALUE**	**95% CI**
Low Support	2.64	0.008	1.28 – 5.41
Moderate Support	Ref		
High Support	0.56	0.004	0.38-0.83
var(_cons)	1.38		0.68-2.77
Family MSPSS - Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
Low v Mod	2.64	0.03	1.10-6.34
High v Mod	0.56	0.011	0.34-0.90
High v Low	0.21	0.000	0.09-0.49
Education Completed	**ODDS RATIO**	**P-VALUE**	**95% CI**
None	Ref		
Primary school	1.11	0.54	0.78-1.59
Secondary school	0.62	0.16	0.32-1.21
University	0.57	0.44	0.14-2.38
var(_cons)	1.54		0.78-3.04

	ODDS RATIO	P-VALUE	95% CI
Age			
≤19 years old	3.42	0.001	1.68 – 6.96
20-34 years old	Ref		
≥35 years old	1.04	0.84	0.69-1.58
var(_cons)	1.57		0.79-3.11
Age - Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
≤19 v 20-34	3.42	0.002	1.44-8.14
≥35 v 20-34	1.04	1.00	0.63-1.73
≥35 v ≤19	0.31	0.008	0.12-0.79
	ODDS RATIO	**P-VALUE**	**95% CI**
Self-efficacy Score	1.02	0.17	0.992 – 1.047
var(_cons)	1.53		0.77-3.03
Perceived Stress Score	1.17	0.000	1.11-1.24
var(_cons)	1.56		0.78-3.10
History of OB complication			
- Yes	0.96	0.90	0.53-1.74
- No	Ref		
var(_cons)	1.52		0.77-3.02
Discuss with Partner			
- Yes	0.26	0.000	0.15-0.43
- No	Ref		
var(_cons)	1.69		0.85-3.33
Substance use			
- Yes	0.73	0.25	0.42-1.25
- No	Ref		
var(_cons)	1.51		0.76-3.00

Table 5: Multi-level Multiple Logistic Regression

	Odds ratio	P-value	95% CI
MSPSS Family			
Low Support	2.00	0.08	0.93 – 4.30
Moderate Support	Ref		
High Support	0.55	0.004	0.36-0.82
Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
Low v Mod	2.00	0.23	1.10-6.34
High v Mod	0.55	0.011	0.33-0.90
High v Low	0.27	0.002	0.11-0.67
Age			
≤19 years old	2.97	0.005	1.40-6.30
20-34 years old	Ref		
≥35 years old	0.97	0.894	0.63-1.51
Pairwise comparison		**Bonferroni P-Value**	**Bonferroni 95% CI**
≤19 v 20-34	2.97	0.01	1.19-7.44
≥35 v 20-34	0.97	1.00	0.57-1.66
≥35 v ≤19	0.33	0.02	0.12-0.90
Perceived Stress Score	1.16	0.000	1.09-1.23
Partner Discuss			
Yes	0.30	0.000	0.17-0.51
No	Ref		
Var(_cons)	1.59		0.79-3.21

Figure 1: Associated Factors of Antenatal Depression

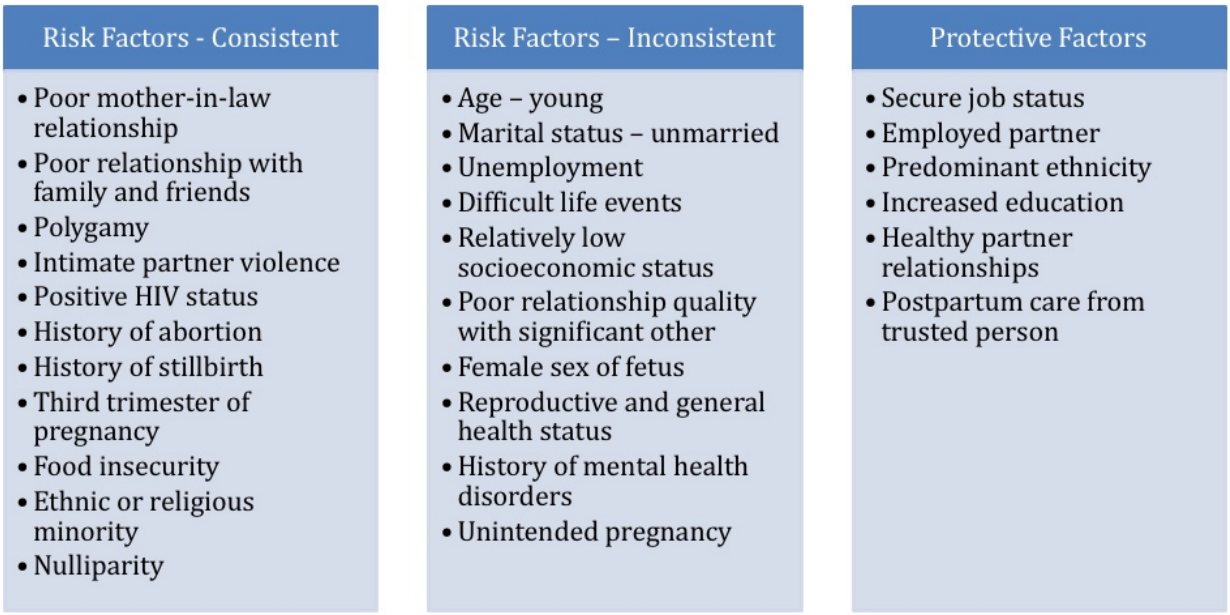
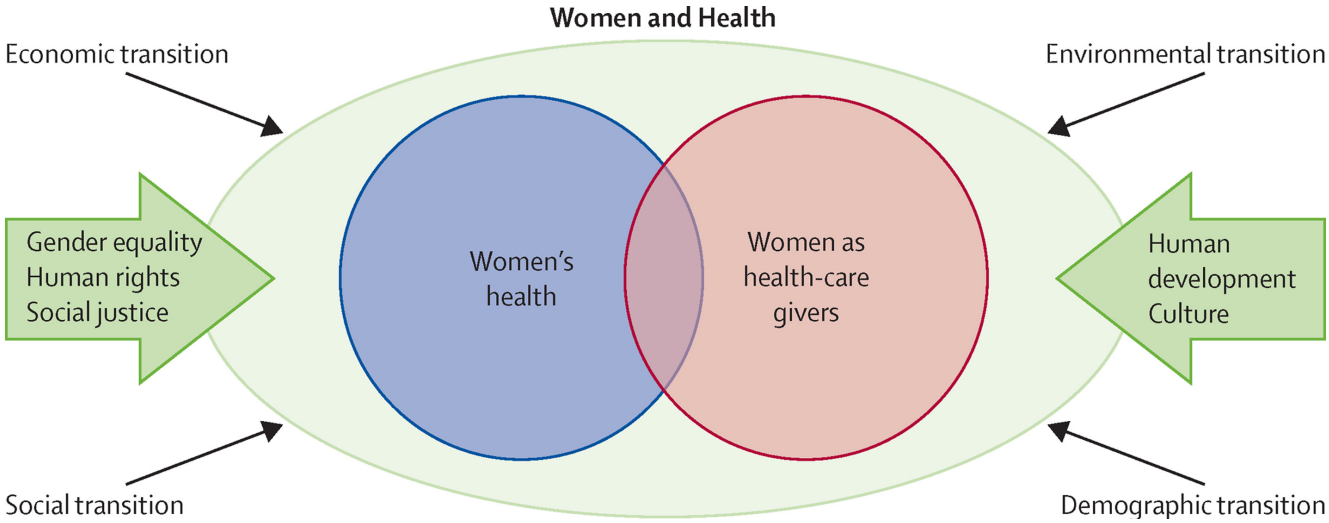


Figure 2: Women and Health – A Conceptual Framework



(Langer et al., 2015)

Figure 3: Rates of Depression by District – A Map

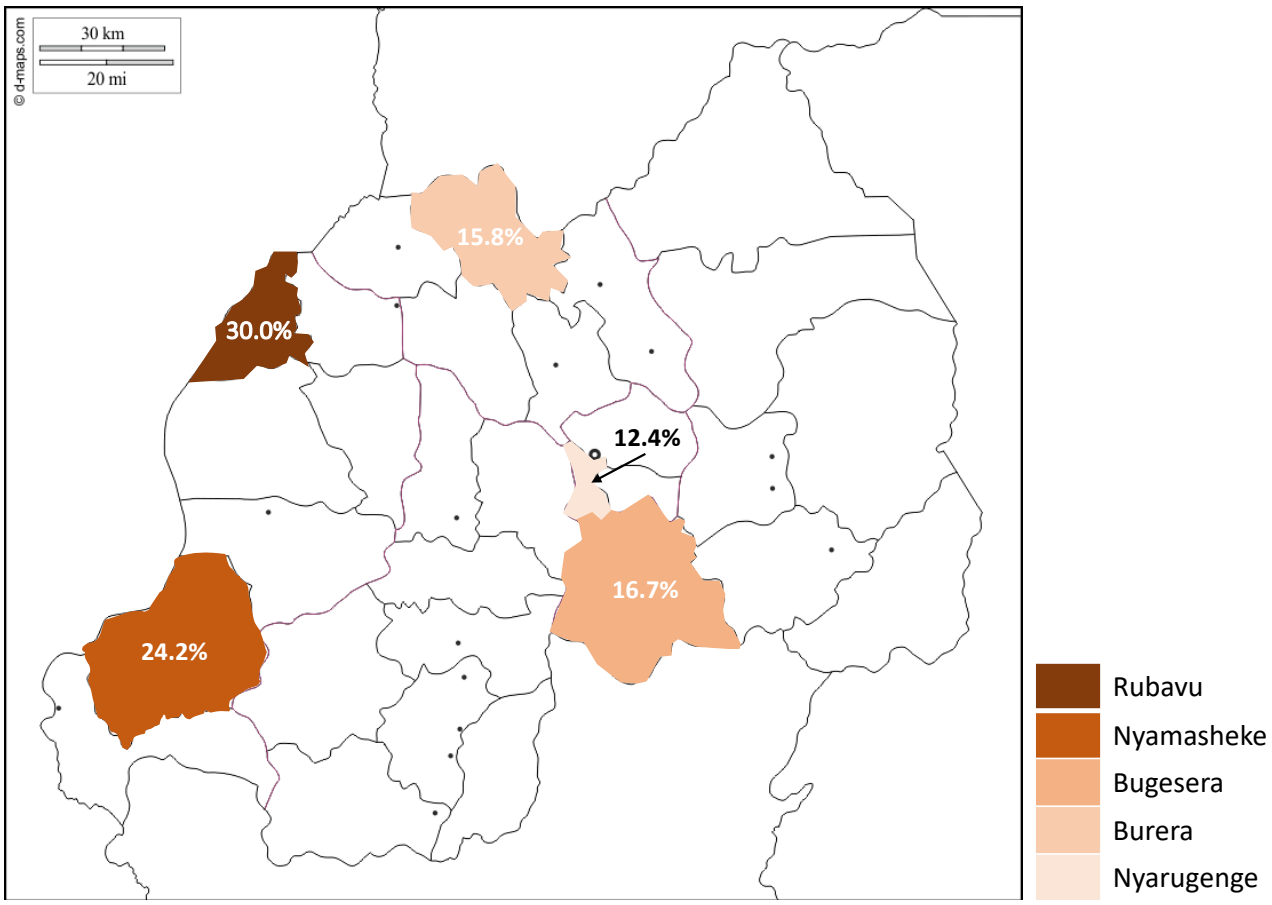


Figure 4: Forest Plot of Multi-level Simple Logistic Regression Models

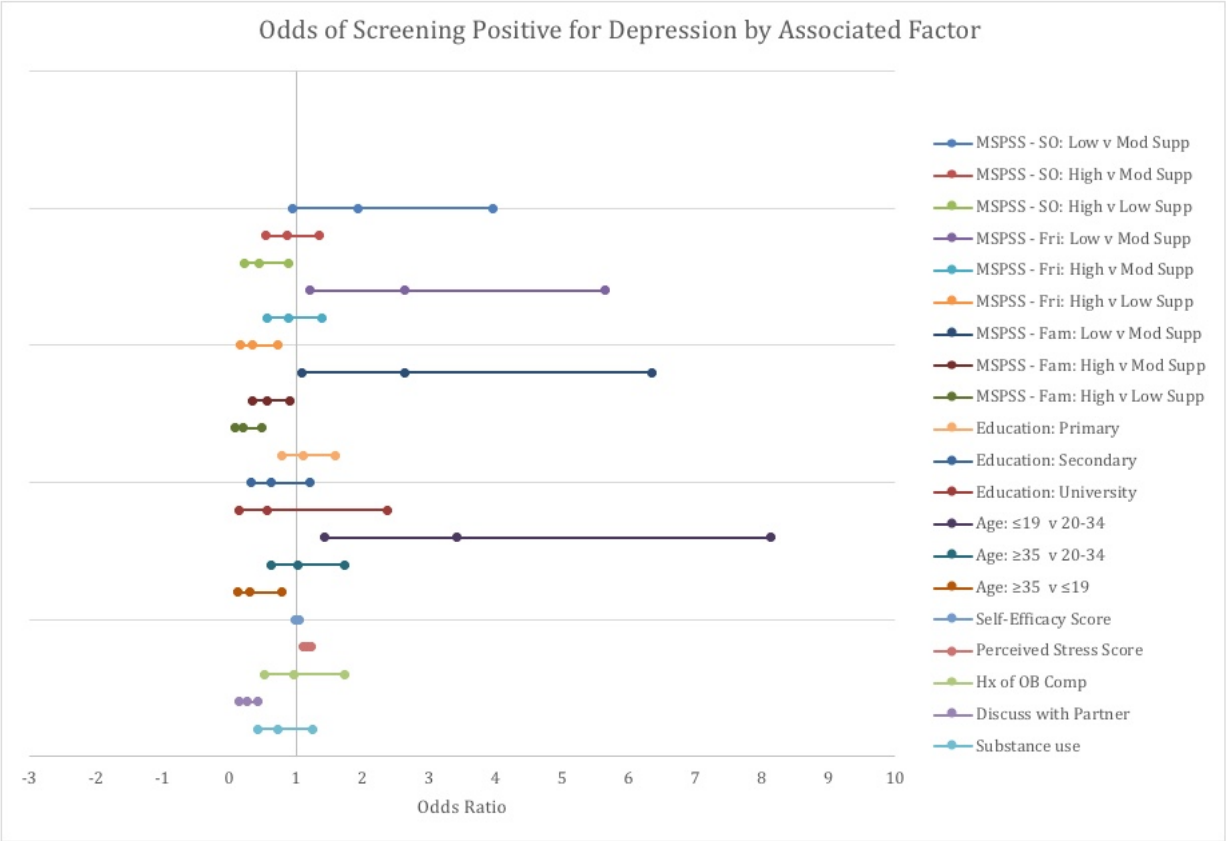
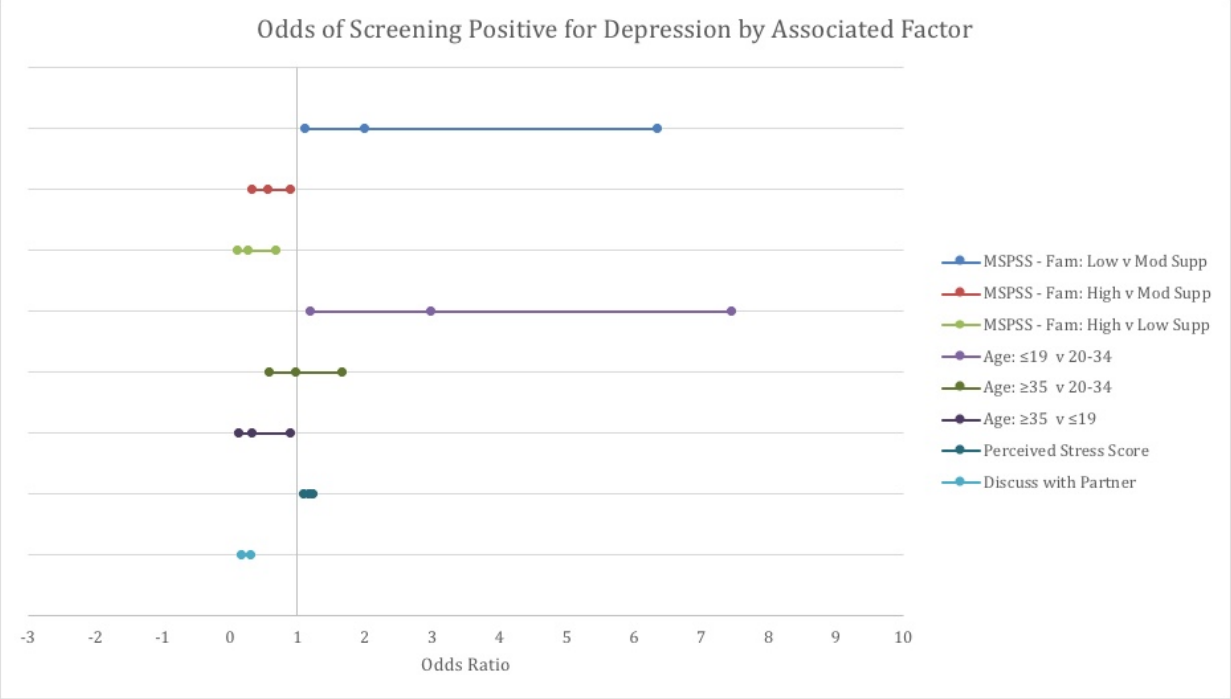


Figure 5: Forest Plot of Multi-level Multiple Logistic Regression Models



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