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Social Cognition among Saudi Women with and without Postpartum Depression

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Social Cognition among Saudi Women with and without Postpartum Depression

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy in Nursing

by

Maha Alshammari

2024

ABSTRACT OF THE DISSERTATION

Social Cognition among Saudi Women with and without Postpartum Depression

by

Maha Alshammari

Doctor of Philosophy in Nursing

University of California, Los Angeles, 2024

Professor Nancy A. Pike, Co-Chair

Professor MarySue V. Heilemann, Co-Chair

Post-partum depression (PPD) is a significant mental health problem for women during the reproductive years and is highly prevalent among Saudi women. Studies have shown, Saudi women experience higher rates of PPD (up to 38.5%) compared to 12% of new mothers in the United States. PPD is associated with cognitive impairment and the potential for deficits in social cognitive function, which is the ability to identify, perceive, interpret, and respond to social stimuli. Social cognition has several components, including emotion recognition, empathy, and theory of mind (ToM). Impaired social cognition can impact the mother's ability to care for her infant, read infant cues, and can potentially affect the infant's development. However, there is little research on Saudi women with PPD and its effect on social cognition.

The aim of this study is to compare social cognitive performance in Saudi women with and without PPD, examine the relationship between biological, psychological, and

social variables on social cognition, and identify predictors of social cognition.
Participants were screened at 6 weeks postpartum for depressive symptoms and assigned
to either PPD or without PPD group using the Edinburgh Postnatal Depression Scale
(EPDS). Participants completed a demographic form and measures of social cognition
including Emotion Recognition Task (ERT), Interpersonal reactivity Index (IRI), and
Reading the Mind Test (RMET). In addition, participants completed the
Multidimensional Scale of Perceived Social Support (MPSS), the Generalized Anxiety
Disorder-7 (GAD-7), and the Perceived Stress Scale (PSS). Variables related to maternal
characteristics (planned pregnancy, delivery mode) and infant characteristics (birth
weight, gestational age) were extracted from medical records. Descriptive and inferential
statistics were used to assess group differences, correlations, and predictors of social
cognition.

One hundred and twenty-five eligible women (60 with PPD and 65 without PPD)
consented, enrolled, and completed all study measures. No significant differences were
noted between groups based on age, income, education, and employment status. Women
who had a C-section or an unplanned pregnancy or whose child was born less than 38
weeks gestation with a birth weight less than 3033 grams were more likely to screen
positive for PPD. Women with PPD performed significantly worse on emotional
recognition (58.6 vs. 70.3, $p<.001$), and better on the empathy (69 vs. 65.2, $p<.001$) and
ToM (22.8 vs. 20.6, $p<.001$) compared to women without PPD. Stress and anxiety were
higher and social support was lower in the PPD group compared to controls ($p<.001$).
Stepwise linear regression showed that anxiety scores accounted for 17% of the variance
of emotional recognition (F=13.54, $p <.001$), income and age accounted for 16% of the

variance of empathy (F=6.79, p=.002), and stress and birth weight accounted for 17% of the variance of ToM (F=6.9, p=.002). Age, income, anxiety, stress, and child's birth weight affected social cognition in this sample of Saudi women with PPD. This study highlights decreased ability among participants with PPD to recognize emotions, increased empathy, and heightened ability to interpret the mind of others through the eyes (ToM). This may reflect a maternal hypersensitivity to social stimuli due to their condition and/or a stressed or anxious state. Further research is needed to assess the functional impact of these findings on maternal health, mother-infant attachment, and development.

The dissertation of Maha Alshammari is approved.

Mary-Lynn Brecht

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University of California, Los Angeles

2024

DEDICATION

In the name of Allah, the Most Gracious, the Most Merciful.

This dissertation is dedicated to the incredible individuals who have been my steadfast supporters throughout this journey. First and foremost, I extend my deepest gratitude to Allah for His endless blessings, guidance, and strength. It is through His grace that I have been able to persevere and achieve this milestone.

To my parents, your unwavering love, sacrifices, and encouragement have been the bedrock of my achievements. You have believed in me every step of the way, instilling in me the confidence to pursue my dreams. Mother, your boundless love and dedication have been my guiding light. I will always remember how you stayed up all night during my first interview with UCLA and stayed up till 2:30 a.m. when I defended my dissertation. Your tireless support has been a source of immense strength, and I owe my success to your nurturing spirit and steadfast presence.

To my brothers, Sultan, Majed, and Fares, you have been my pillars of strength and my best friends. Your unwavering support, boundless encouragement, and constant presence in my life have provided me with immense comfort and inspiration. Through every challenge and triumph, you have been there, lifting me up and cheering me on. Your love and companionship have been invaluable, and I could not have come this far without you by my side.

That is the bounty of Allah, which He gives to whom He wills, and Allah is the possessor of great bounty (The Holy Quran, 62-4).

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CHAPTER ONE
INTRODUCTION

According to the World Health Organization (WHO) depression affects over 264 million globally (WHO, 2020). The prevalence of depression is higher for women than men, especially during childbearing years (Kuehner, 2017; WHO, 2020). In the United States (U.S.), women of childbearing age account for the largest segment of the population with depression (American College of Obstetricians and Gynecologist, 2007). One of the most challenging periods in life for women is the postpartum period which places them at an increased risk for psychological disorders such as postpartum depression (PPD) due to the biological, emotional, and social changes that occur in this period. PPD is defined as a specific episode of depression, with peripartum onset within four weeks following childbirth which is different from mood swings, and crying spells associated with "baby blues" (American Psychiatric Association, 2013). The prevalence rate of PPD in the U.S. is 10–15% (Centers for Disease Control and Prevention, 2017). In comparison to women in the U.S., 38.5% of Saudi postpartum women aged between 25-45 years old have PPD (Nasr et al., 2020). PPD can adversely affect both the mother, the infant, and their families (Nasr et al., 2020). Several PPD risk factors have been identified in the literature for women in the U.S. and in Saudi Arabia including an unsupportive partner, stressful life events, and a cesarean section were significant predictors of PPD among Saudi women (Nasr et al., 2020).

Although women in the U.S. and Saudi Arabia might have common PPD predictors they come from different cultures that influences their delivery and postpartum

experience differently. In a qualitative study that aimed to explore birth experiences among women in Saudi Arabia researchers found that the relationship between women and healthcare providers, and healthcare provider's attitude toward the mother during the delivery were essential to determine whether the birth experience was good or bad. Being supported, respected, and empowered by healthcare providers was associated with better delivery experience. In addition, women reported that the lack of hospital policies to support them during the delivery affected their birth experience negatively especially not allowing a family member to be present during the delivery (Jahlan et al., 2016).

PPD Comorbidities

Anxiety disorders such as panic attacks, compulsions, and obsessions are frequently reported in women with PPD (Reck et al., 2012). Research has demonstrated that anxiety during pregnancy is a predictor of PPD (Coelho et al.,2011; Robertson et al., 2004). All of these are major concerns, not only because of the suffering they bring to women, but also because of the ways they can affect women's relationships with their infants including their bond and attachment and with their surrounding families. PPD was found to be associated with poor infant functioning on cognitive tests, and poor mother-infant bond (Ko et al., 2017; Murray, 1992). Another psychiatric co-morbidity associated with PPD is substance abuse in new mothers (Homish et al., 2005; Salisbury et al., 2007). Commonly substances use are alcohol and drug use within one month after delivery (Substance Abuse and Mental Health Service Administration (SAMHSA), 2005). A serious outcome for women with PPD is the risk for progression to severe depression resulting in maternal suicide and infant homicide (Wisner et al., 2013).

Cognitive Function and PPD

Cognitive impairment in domains such as attention, decision making, and processing speed have been linked to functional and social disability in patients with Major Depressive Disorders (MDD) (Lam, 2014). Studies showed that PPD was associated with deficits in cognitive function (Edvinsson et al., 2017; Kataja et al., 2017; De Almeida et al., 2012; Mazor et al., 2018; Tang et al., 2019) with impaired short-term memory, working memory, and executive function. In addition, women with PPD had delayed reaction times indicating emotional numbing which is a cognitive impairment that can negatively affect the infant's social and emotional needs and how the mother responds to her infant. One aspect that may be challenging for mothers with PPD is the ability to recognize, process, and respond to social cues which is essential to social cognitive function (Wonch et al., 2016).

Social Cognition and PPD

Social cognition refers to the ability to identify, perceive, interpret, and respond to social stimuli (Weightman et al., 2014). Theory of Mind (ToM), which is the ability to infer information concerning the mental state of others, emotion recognition, and empathy are the three central components to social cognition (Weightman et al., 2014). Deficits in these central components can occur in people with various medical or psychological conditions that impair one's ability to interpret other people state of mind and social clues.

Social cognition is especially important for women with PPD caring for an infant (REF). Women with PPD can experience negative emotions, social isolation, lack of

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interest or display negligence in their infant's care. With impaired social cognition, women may also lack the ability to recognize and interpret social stimuli or "cues" such as a crying infant which is a threat to successful mother-infant attachment. Thus, determining the effect of PPD on social cognition will help identify areas of concerns that could benefit from future interventions in order to improve mother-infant relationship, interaction, and attachment.

With the increased prevalence of PPD in Saudi women that's is twice as high as the prevalence rate of PPD among American women, it is unclear if PPD affects social cognition which makes this study timely and important. In addition, no study up to this date explored whether biological, psychological, and social variables can predict social cognitive performance in Saudi women with PPD.

Statement of Purpose

The purpose of this study is to compare social cognitive performance (emotion recognition, ToM, and empathy), level of depression, and anxiety in postpartum Saudi women who give birth in Saudi Arabia and screen positive for PPD compared to postpartum Saudi women who give birth in Saudi Arabia and screen negative for PPD. In addition, this study aims to identify biological, psychological, and social predictors of cognitive function guided by the Biopsychosocial model (BPS).

With a focus on Saudi women who give birth in Saudi Arabia, this study is designed to answer the following questions:

1.   Is there a difference in social cognition between Saudi women with and without PPD?

2.   Is there a relationship between anxiety and stress and social cognition in Saudi women with PPD?

3.   What are the demographic, biological, psychological, and social variables that can predict impaired social cognition in Saudi women with PPD?

Based on the literature review and theoretical framework, the specific aims and hypotheses for this study are:

Aim 1: To describe and compare social cognition (emotion recognition, theory of mind, empathy) in Saudi women who screened positive for PPD compared to the postpartum control group who screen negative for depression.

Hypothesis 1: Saudi women with PPD will perform worse on social cognition measures compared to controls.

Aim 2: To examine the relationship between level of anxiety and depressive symptoms to social cognition in Saudi women with PPD.

Hypothesis 2: Among Saudi women with PPD, higher anxiety and depressive symptom scores will be associated with worse social cognition.

Aim 3: To identify biological (age, maternal health, mode of delivery, unplanned pregnancy, gestational age, birth weight), psychological (depression, anxiety and stress), and social (education, employment, income, and support) predictors of poor social cognition in women with PPD.

Significance of the Study

There is lack of research on social cognition in women with PPD, in particular Saudi women, regardless of the high prevalence rates in this population. Exploration of this concept could potentially lead to useful findings to improve postpartum women's mental health and their functional ability. This new knowledge can assist health care providers to better understand and identify which aspects of social cognition may be compromised in Saudi women with PPD. Thus, the results of this study hold promise for providing insights to develop individually-tailored medical care that will meet the needs of Saudi women to improve their function (activity of daily living, social cognitive function, social function)and maternal-infant attachment. This study will lay the foundation for establishing PPD screening protocols in Saudi Arabia. In addition, the results of this study will give insight to the utility of providing social cognitive training programs to postpartum women with PPD with the goal to improve social cognition skills and ultimately function and QOL outcomes.

Content of Dissertation

Chapter one provides an overview of the proposed research study, specific aims, and the significant of the study to both nursing research and clinical practice. Chapter two reviews the literature, including the prevalence, diagnosis, risk factors, differential diagnoses and comorbidities associated with PPD. This chapter also examined and discussed what is known about cognitive deficits and social cognitive function among women with PPD. Chapter three presents the conceptual framework that guides this study which is the Biopsychosocial Model (BPS). Chapter four provides a detailed description of the research methodology that will be used to answer the research questions, the

instruments, data collection procedure, and statistical analysis for the research aims. Chapter five presents and discusses the results of the data analysis. Chapter six provides an interpretation of our findings and the limitations of our study. Chapter seven provides implications for clinical practice and recommendations for future research.

Chapter Summary

PPD is a significant mental health problem for women during reproductive years and is highly prevalent among Saudi women. PPD is associated with cognitive impairment and the potential for deficits in social cognitive function, which can impact infant development and maternal attachment. However, there is a lack of research in PPD and its effect on social cognition. The proposed study will help to address this gap and provide new knowledge related to PPD in Saudi women. The study is aiming to examine the three components of social cognition (e.g. ToM, empathy and emotion recognition) in women with and without PPD to provide the groundwork for the development of future interventions to improve function and QOL.

References

American College of Obstetricians and Gynecologists (2007). The Challenges of

    Diagnosing and Treating Maternal Depression Women's Health Experts Weigh

    In. http://www.acog.org/ from_home/publications/press_releases/nr05-07-07-

    2.cfm

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental

    disorders (DSM-5®). Author.

Anderson, I. M., Shippen, C., Juhasz, G., Chase, D., Thomas, E., Downey, D., Toth, Z. G., Lloyd-

    Williams, K., Elliot, R., & Deakin, J. F. (2011). State-dependent alteration in face

    emotion recognition in depression. *The British Journal of Psychiatry, 198,* 302–308.

Centers for Disease Control and Prevention. (2017). Trends in postpartum depressive

    symptoms-27 states, 2004, 2008, and 2012.

    https://www.cdc.gov/mmwr/volumes/66/wr/mm6606a1.htm.

de Almeida, L. S., Jansen, K., Kohler, C. A., Pinheiro, R. T., da Silva, R. A., & Bonini, J. S.

    (2012). Working and short-term memories are impaired in postpartum depression.

    Journal of Affective Disorders, 136, 1238–1242.

Edvinsson, A., Skalkidou, A., Hellgren, C., Gingnell, M., Ekselius, L., Willebrand, M., &

    Poromaa, I. S. (2017). Different patterns of attentional bias in antenatal and postpartum

    depression. *Brain and Behavior,* 1–11.

Homish GG, Cornelius JR, Richardson GA, Day NL. Antenatal risk factors associated with

    postpartum comorbid alcohol use and depressive symptomatology. *Alcohol Clin Exp*

    Res. 2004;28:1242–1248.

Jahlan, I., Plummer, V., & McIntyre, M. (2016). What Women Have to Say about Giving Birth in Saudi Arabia. *Middle East Journal of Nursing*, *10*(1), 10–18. https://doi.org/10.5742/MEJN.2015.92779

Kataja, E. L., Karlsson, L., Huizink, A. C., Tolvanen, M., Parsons, C., Nolvi, S., & Karlsson, H. (2017). Pregnancy related anxiety and depressive symptoms are associated with visuospatial working memory errors during pregnancy. *Journal of Affective Disorders, 218*, 66–74.

Ko JY, Rockhill KM, Tong VT, Morrow B, Farr SL. Trends in Postpartum Depressive Symptoms — 27 States, 2004, 2008, and 2012. MMWR Morb Mortal Wkly Rep 2017;66:153–158. DOI: http://dx.doi.org/10.15585/mmwr.mm6606a1External

Kuehner, C. (2017). Why is depression more common among women than among men? *The Lancet Psychiatry, 4*(2), 146–158.

Lam, R. W., Kennedy, S. H., McIntyre, R. S., & Khullar, A. (2014). Cognitive dysfunction in major depressive disorder: effects on psychosocial functioning and implications for treatment. *Canadian journal of psychiatry. Revue canadienne de psychiatrie*, *59*(12), 649–654. https://doi.org/10.1177/070674371405901206

Mattern, M., Walter, H., Hentze, C., Schramm, E., Drost, S., Schoepf, D., Fangmeier, T., Normann, C., Zobel, I., & Schnell, K. (2015). Behavioral evidence for an impairment of affective theory of mind capabilities in chronic depression. *Psychopathology, 48,* 240–250.

Mazor, E., Sheiner, E., Wainstock, T., Attias, M., & Walfisch, A. (2018). The association between depressive state and maternal cognitive function in postpartum women. *American Journal of Perinatology, 36*, 285–290.

Murray L. The impact of postnatal depression on infant development. J Child Psychol

    Psychiatry. 1992 Mar;33(3):543-61. doi: 10.1111/j.1469-7610.1992.tb00890.x.

    PMID: 1577898.

Nasr, R. S. A., Altharwi, K., Derbah, M. S., Gharibo, S. O., Fallatah, S. A., Alotaibi, S.

    G., Almutairi, K. A., & Asdaq, S. M. B. (2020). Prevalence and predictors of

    postpartum depression in Riyadh, Saudi Arabia: A cross sectional study. PLOS

    ONE, 15(2), e0228666. https://doi.org/10.1371/journal.pone.0228666

Reck, C., Noe, D., Gerstenlauer, J., & Stehle, E. (2012). Effects of postpartum anxiety

    disorders and depression on maternal self-confidence. Infant Behavior and

    Development, 35(2), 264–272.

Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors

    for postpartum depression: a synthesis of recent literature. *General hospital

    psychiatry*, *26*(4), 289–295. https://doi.org/10.1016/j.genhosppsych.2004.02.006

Salisbury AL, Lester BM, Seifer R, LaGasse L, Bauer CR, Shankaran S, Bada H, Wright LL, Liu

    J, Poole K. Prenatal cocaine use and maternal depression: Effects on infant

    neurobehavior. *Neurotoxicol Teratol.* 2007;29:331–340.

Substance Abuse and Mental Health Services Administration (Office of Applied Studies). (2005).

    Substance use during pregnancy: 2002 and 2003 update.

Tang, W., Bao, C., Xu, L., Zhu, J., Feng, W., Zhang, W., Lin, C., Chen, L., Ding, P., Zhou, M.,

    Bao, Y., Yu, X., Zhao, K., & He, J. (2019). Depressive symptoms in late pregnancy

    disrupt attentional processing of negative-positive emotion: An eye-movement study.

    Frontiers in Psychology, 10, 1–10.

Weightman, M. J., Air, T. M., & Baune, B. T. (2014). A review of the role of social cognition in

    major depressive disorder. *Frontiers in Psychiatry*, *5*, 179.

Wisner, K. L., Sit, D. K., McShea, M. C., Rizzo, D. M., Zoretich, R. A., Hughes, C. L.,

    Eng, H. F., Luther, J. F., Wisniewski, S. R., Costantino, M. L., Confer, A. L.,

    Moses-Kolko, E. L., Famy, C. S., & Hanusa, B. H. (2013). Onset timing, thoughts

    of self-harm, and diagnoses in postpartum women with screen-positive depression

    findings. *JAMA psychiatry*, *70*(5), 490–498.

    https://doi.org/10.1001/jamapsychiatry.2013.87

World Health Organization. (2020). *Depression*. World Health Organization.

    https://www.who.int/news-room/fact-sheets/detail/depression.

CHAPTER TWO: REVIEW OF THE LITERATURE

This chapter presents a review of the literature in relation to neurocognitive outcomes, and components of social cognition in women with postpartum depression (PPD). Additionally, the chapter will explore scholarly work about the changes to social cognition, such as Theory of Mind (ToM), empathy, and emotion regulation in Major Depressive Disorders (MDD) and PPD.

Postpartum Depression

Empirical evidence shows that depression is a key public health problem that is more common in women than men, especially in the childbearing years (Kuehner, 2017). The postpartum period is a critical time for women that places them at higher risk of developing psychological disorders such as PPD. PPD is the most common complication after delivery and the leading cause for non-obstetric hospitalization.

According to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*, PPD is a specific episode of depression, with peripartum onset within four weeks following childbirth (American Psychiatric Association, 2013). According to Stewart et al. (2003), PPD is defined as an episode of non-psychotic depression, according to standardized diagnostic criteria, with an onset within four weeks to one year post-delivery. Markedly, there are controversial perspectives regarding the timeframe during which a depressive episode should be considered PPD. A number of experts propose extending this time from four weeks to three or six months (Closa-Monasterolo et al., 2017), whereas others suggest extending this to one year (Stewart et al., 2003).

Research studies widely indicate that PPD is readily detectable in routine practice and is amenable to treatment by a broad range of modalities that are effective for treating nonpuerperal major depression, which is characterized by major depression that does not occur during the postpartum period. Early PPD screening can optimize identification, initiation of treatment and result in better clinical outcomes (Bobo & Yawn, 2014).

Prevalence

Studies have shown that maternal PPD affects about 10–15% of women following childbirth in the United States (U.S.), but there are higher approximates, depending on the screening practices, geographical region, and cultural background of populations (Centers for Disease Control and Prevention, 2017; Closa-Monasterolo et al., 2017). A study conducted in the eastern region of Saudi Arabia showed that 17.8% of 450 participants screened positive for PPD (Alasoom & Koura, 2014). Another study in Guyana and Taiwan reported a PPD prevalence rate of 60% among women after giving birth (Halbreich & Karkun, 2006). In contrast, a meta-analysis showed 26% of women in the Middle East had PPD, 24% in Turkey, and 8% in Europe (Shorey et al., 2018). However, a recent study in the central region of Saudi Arabia reported approximately 39.6% women screened positive for PPD using an Arabic translated version of the Edinburgh Postnatal Depression Scale (EPDS) in a group of 174 highly educated women between the age 25-45 years old (Nasr et al., 2020). These studies show an increase PPD in Arabic women from 17.8% in 2006 to 38.5% in 2020.

Risk Factors

Risk factors associated with PPD include depression or anxiety during pregnancy, previous history of depression, poor social support, unsupportive spouse, and stressful life events (Ghaedrahmati et al., 2017; Nasr et al., 2020; Silverman et al., 2017). In a recent cross-sectional study, Saudi women reported that unsupportive partners, stressful life events (losing a job, death of a loved one), and having a cesarean section were significant predictors of PPD (Nasr et al., 2020). While another older study reported that moderate predictors of PPD included difficult infant temperament, maternal neuroticism, low self-esteem, and childcare stress (Beck & Gable, 2001).

Other studies have shown that social support and maternal self-efficacy are inversely related to PPD (Haslam et al., 2006) Two cross-sectional studies that included Saudi and Australian women reported that higher levels of depressive symptomatology are associated with

lower levels of partner support, parental support, and maternal self-efficacy (Haslam et al., 2006; Nasr et al., 2020). In contrast, lower levels of depressive symptomatology are associated with higher levels of partner support, parental support, and maternal self-efficacy. Another longitudinal study that included 798 German women also reported a correlation between lower levels of self-confidence in women who tested positive for PPD compared with healthy controls (Reck et al., 2012). These findings suggest a connection between PPD and anxiety disorders, both of which negatively affect self-confidence and self-efficacy in postpartum women. Furthermore, lower self-esteem and self-efficacy in the prenatal period were also significantly associated with prenatal maternal anxiety (Reck et al., 2012).

PPD Differential Diagnosis

Signs and symptoms of a variety of psychiatric conditions overlap with PPD and must be ruled out before diagnosing a woman with PPD (Bobo & Yawn, 2014). First, in general, postpartum blues occur in 50–80% of women after delivery and may overlap with PPD symptoms. The postpartum blues typically appear one or two days after delivery and may include signs of sleep problems, poor appetite, irritability, tearfulness, anxiety, and depressed mood. These changes are mild and often diminish within 10 days. However, up to 25% of new mothers with postpartum blues develop PPD (Bobo & Yawn, 2014). Some people refer to this as the baby blues (Seyfried & Marcus, 2003)

Further, PPD symptoms can also correspond with symptoms of bipolar disorders (type I or II), which are characterized by episodes of mania, depression, hypomania, and mixed episodes (mania concurrent with depression) (Bobo & Yawn, 2014). Postpartum is a period when some women may be at high risk for new-onset or recurrent bipolar depressive episodes. Based on the *DSM-5*, the peripartum onset specifier can be applied to both bipolar and unipolar depressive episodes (Bobo & Yawn, 2014).

Moreover, PPD can also be mistaken as postpartum psychosis, a rare (< two cases per 1,000 postpartum women) but critical condition that is associated with sleeping problems, rapid

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and severe mood swings, hallucinations, delusions, and obsessive preoccupation about the baby (Bobo & Yawn, 2014). Signs of postpartum psychosis and PPD can appear within one to four weeks following childbirth which demand urgent diagnosis and hospitalization, given the high risk of infanticide and suicide (Bobo & Yawn, 2014).

Psychiatric Comorbidity

Studies have reported that the prevalence rate of substance and alcohol abuse is higher in women with PPD compared to non-depressed postpartum women (19%-46%) (Homish et al., 2005; Salisbury et al., 2007). In addition, findings from at least two studies showed that postpartum depression was highly correlated with substance use in new mothers (Homish et al., 2005; Salisbury et al., 2007). According to a national survey conducted in the United States by the Substance Abuse and Mental Health Service Administration (SAMHSA), 14.9% of postpartum mothers, between the ages of 15 and 44, reported binge alcohol use, and 8.5% showed the use of illicit or nonmedical drugs within one month after delivery (SAMHSA, 2005). A 2019 record by the Addiction Center indicated that the most commonly abused substances by new mothers with PPD included alcohol (30–49%); cigarettes (3.9%), marijuana (6.6%); prescription psychoactive drugs, including benzodiazepines, stimulants, and opioids (3.6%); and cocaine (1.1%) (Bezrutczy & Hampton, 2019). Having a history of substance abuse is a risk factor associated PPD (Prevatt et al., 2017). In addition, Kuo et al. (2013) also noted that PPD and substance abuse are highly correlated resulting in adverse outcomes.

Similarly, anxiety disorders are frequently reported in women who test positive for PPD (Reck et al., 2012). Women with PPD frequently experience panic attacks, compulsions, and obsessions. According to Bobo and Yawn (2014), compulsions and obsessions are particularly troubling and can include thoughts about harming oneself or the baby. However, Sit and Wisner (2009) pointed out that compulsions and obsessions may be recognized by postpartum mothers as irrational or intrusive, and such symptoms do not typically predict infanticide or suicide. Studies have shown that mothers with PPD and co-existing anxiety disorders have also reported low

maternal self-efficacy and self-confidence (Reck et al., 2012; Zietlow et al., 2014). These findings suggest that PPD can result in lower maternal self-confidence postpartum, which suggests that such women may feel more insecure regarding their maternal roles and responsibilities (Reck et al., 2012; Zietlow et al., 2014).

Other studies have explored the effects of PPD on the infant's emotional and behavioral characteristics. Some of these investigations have reported that temperament and behavioral difficulties of the infant, are strongly associated with prenatal and postpartum maternal PPD and emotional stress (Austin et al., 2005; Davis et al. 2007; Hummel & Kiel, 2015). Bagner et al. (2010), reported that the effects of maternal depressive symptoms on the infant during their first year of life is considered formative in terms of the infant's emotional well-being. Mothers with PPD may fail to meet their infant's social and emotional needs (Bagner et al., 2010). One aspect that may be challenging for mothers with PPD is the ability to recognize, process, and respond to social cues which is essential to social cognitive function.

Social Cognition

The ability to interpret social information accurately is a vital part of successful interpersonal interactions. This necessitates the synthesis of a wide range of verbal and nonverbal cues, including body language, prosody in speech (e.g., expressiveness, intonation, rhythm, and emphasis on words when reading aloud), facial expressions, and the mental state of others. Together, such skills are referred to as *social cognition* and are critical elements of cognitive functioning (Greifeneder et al., 2017; Weightman et al., 2014; Wittmann et al., 2018). Defined broadly, social cognition denotes the various aspects of mental processing that are shaped by social interaction, which in turn influence social behavior. Social cognition is the mental process by which people make sense of their social world (Quinn et al., 2006). It generally refers to the process of social information in the brain that triggers the ability for people to detect other people's emotions and respond appropriately to such emotions (Henry et al., 2016). Social cognition encompasses the identification, interpretation, and perception of socially significant

information (Kandalaft et al., 2012). In addition, the *DSM-5* described social cognition as one of the six components of neurocognitive function, which includes complex attention, learning and memory, executive ability, language, visuoconstructional-perceptual ability, and social cognition (American Psychiatric Association, 2013). Emotion recognition, empathy, and theory of mind (ToM) are three central components of social cognition that allow people to interpret social information and respond appropriately (Weightman et al., 2014).

Theory of Mind

The ToM domain explicitly alludes to the ability to infer information concerning the feelings, intentions, and thoughts of others. ToM describes an individual's ability to assess the intentions of other people, as well as their beliefs and dispositions (Wolkenstein et al., 2011). ToM is necessary to understand that others have beliefs, desires, intentions, and perspectives that are different from one's own. This is crucial for everyday human social interactions and is used when analyzing, judging, and inferring others' behaviors.

Empathy

Empathy refers to feeling what others are feeling, knowing what they are feeling, and desiring to relieve their pain (Decety & Jackson, 2004). Empathy is also a multidimensional construct that involves two components: affective empathy and cognitive empathy. Affective empathy refers to the ability to recognize and feel the emotions of others, whereas cognitive empathy refers to the ability to mentalize and understand others' emotional states (Davis et al., 1994; Khanjani et al., 2015; Shamay-Tsoory et al., 2011).

Emotion Recognition

Emotion recognition refers to the ability to correctly identify different emotional states and facial expressions exhibited by other people (Harms et al., 2010). Emotion recognition is a vital component of social cognition and essential in social interactions and functioning.

Deficits in these three central components of social cognition can occur in people with various medical or psychological conditions that impair one's ability to interpret others, including

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infants. Although different aspects of social cognition have been defined and explored, the directional effects of depressive disorders and specifically PPD on neurocognitive function and social cognitive function, will be explored in this literature review to identify gaps in knowledge (Knight & Baune, 2018; LeMoult et al., 2009).

Literature Review

An extensive methodological search was conducted using the following databases— PubMed, Web of Science, Google Scholar, and the National Center for Biotechnology Information—to identify articles related to PPD, cognitive function, and the three components of social cognition (i.e., theory of mind, empathy, emotion recognition). The keywords used during this search included *"postpartum depression", "postnatal depression", "maternal depression", "depression" , AND "social cognition", "social cognitive" "function", "empathy", "affective empathy", "emotional empathy", "cognitive empathy", "emotion recognition", "emotional processing", "emotional identification", "theory of mind", "cognitive performance", "executive performance", "memory", and "attention".* Inclusion criteria led to the identification of peer reviewed articles written in English, published between 2000 and 2020, that included women in their study sample. Exclusion criteria guided the rejection of articles that offered only systematic reviews. However, due to the limited amount of articles that examined social cognition in women with PPD the literature search was expanded to include articles that examined social cognition in individuals with Major Depressive Disorders (MDD). The search yielded a total of 11 articles that investigated some aspect of cognitive function or social cognition in PPD or MDD.

Cognitive Function and PPD

A deficit of cognitive function is a hallmark of PPD. Various types of cognitive impairment (e.g., visuospatial, short-term memory, working memory, executive function, delayed reaction times) have been identified in women with PPD or concomitant anxiety disorders (Edvinsson et al., 2017; Kataja et al., 2017; De Almeida et al., 2012; Mazor et al., 2018; Tang et al., 2019).

Edvinsson et al. (2017) examined different patterns of attentional bias in 40 antenatal and 33 postpartum women with depression in comparison to 137 antenatal and 124 postpartum healthy controls using a longitudinal study design. Researchers used EPDS to screen for depression among antenatal and postpartum women at gestational week 17, gestational week 32, six weeks postpartum, and six months postpartum. The participants in the study were administered the emotional Stroop task with positive, negative, neutral, and negatively valanced words. Colored words with positive, negative, and neutral meaning were displayed in a computer screen. Women were asked to identify the color of each word and press a colored key that matches the word on the screen. The time to response was recorded for each word presented. The authors found no significant difference in emotional inference between women with antenatal depression and pregnant women who were not depressed. However, the researchers found that women with PPD had shorter reaction times when exposed to both positive ($p = .028$) and negative ($p = .022$) stimuli when compared to neutral stimuli. As such, although the researchers did not find evidence for attentional bias, there was evidence that the shorter reaction times to emotional stimuli may indicate a functional impairment that may be associated with decreased child development outcomes and well-being.

Mazor et al. (2018) examined the association between depressive symptoms and cognitive functioning in postpartum women. Specifically, the researchers evaluated the role that cognitive decline, such as maternal amnesia, may play in PPD. The researchers used a cross-sectional research design to examine cognitive function through objective neurocognitive measures, such as the Symbol Digit Modalities (SDMT) tests, as well as the Attention Function Index (AFI) which is a subjective self-assessment questionnaire. A total of 120 participants were screened for PPD using the EPDS at one to three days postpartum and the SDMT and AFI were administered at the same time. Mazor et al. (2019) found that the subjective measure was significantly correlated with PPD while the objective measure was not. Mothers with depressive symptoms showed significantly lower scores in the subjective neurocognitive questionnaire, as

well as the objective SDMT tests. Maternal depression was associated with subjective

neurocognitive decline (p = <0.001) but not with objective SDMT scores (p = 0.15) when

controlling for gestational age, maternal age, and ethnicity. As such, the researchers concluded

that PPD affected the subjective self-assessment of cognitive ability in their perinatal sample,

whereas their true cognitive ability remained intact which refers to the result of the objective

SDMT scores that measures concentration, visual scanning, and motor speed (Mazor et al., 2019).

However, these results do not support the findings of Edvinsson et al. (2017), which showed that

attention towards positive and negative stimuli was faster in women with PPD.

In contrast, De Almeida et al.'s (2012) cross-sectional study examined memory

impairment as a consequence of cognitive dysfunction in 395 individuals (222 women and 173

men) in Brazil. Specifically, the researchers investigated how working and short-term memory

were affected by PPD and how these changes correlated with sociodemographic variables. The

participants completed the EDPS, which has been validated in both men and women, and a word

span assessment. The cut-off score for PPD in the EDPS was greater than or equal to 13 resulting

in a prevalence of 16.2% of PPD among mothers and 5.2% among fathers. The individuals

diagnosed with PPD also showed lower scores on mnemonic activity via a word span test, which

evaluates working and short-term memory. As such, the researchers concluded that PPD

symptoms had an impact on short-term memory and working memory for their sample.

Two studies have examined changes in cognitive function in pregnant women with

depression (Kataja et al., 2017; Tang et al., 2019). Tang et al. (2019) investigated how depressive

symptoms in late pregnancy affected the attentional processing of negative and positive emotions

through eye movement among a sample of 89 women in China. The authors sought to understand

possible biases in processing negative and positive information through visual attention. The

researchers measured changes in eye movement using an eye-tracking paradigm while the study

participants were exposed to 24 different paired pictures, presented twice and consisted of

positive, negative, and neutral scenes. The participants with depressive symptoms in late

pregnancy demonstrated a decreased ability to recognize positive emotion pictures, whereas they had a significantly higher gaze score (p = 0.006) when presented with pictures depicting negative emotions than when presented with positive emotions pictures. These results with women during late pregnancy were different than those found in women with PPD, as the latter showed shorter reaction times to positive and negative symptoms, which may signal an increased ability to sense positive emotional stimuli in PPD compared to women who experience depression in late pregnancy (Edvinsson et al., 2017; Tang et al., 2019). Alternatively, participants with no depressive symptoms had a stronger attentional bias toward pictures that depicted positive emotions. Additionally, the researchers found a significant positive correlation (r = .254, p = 0.016) between the severity of depressive symptoms and the bias scores of initial-fixation directed toward pictures showing negative stimuli. As such, the researchers concluded that women with a risk of PPD in their sample showed a bias toward negative stimuli where they tended to look at negative pictures for longer times. This type of emotion processing may increase pregnant women's susceptibility to PPD. Furthermore, the researchers added that directing attention away from negative or positive stimuli may influence how emotional responses may be buffered (Tang et al., 2019).

Kataja et al. (2017) examined neuropsychological functioning in 230 pregnant women in Finland between 26-30 weeks gestation with varying levels of depression and anxiety, classified as low, moderate, and high. The study measures used were the EPDS for PPD, the Symptom Checklist-90 anxiety subscale to assess general anxiety symptoms, and the Pregnancy-Related Anxiety Questionnaire to assess anxiety symptoms related to the pregnancy. The researchers found that pregnant women with moderate and high levels of depression had decreased visuospatial working memory and executive functioning levels compared to pregnant women with low symptomology. Additionally, a significant correlation was identified between the pregnancy-related anxiety and errors made in the Groton Maze Learning Test that measures visuospatial working memory and executive functioning. However, general anxiety scores were

not associated with any changes in visuospatial working memory function. The researchers concluded that having depressive and anxiety symptoms together during pregnancy was associated with decreases in executive functioning and visuospatial working memory in their sample, in which depressive symptoms demonstrated a more direct link (Kataja et al., 2017).

Social Cognition and Neuropathology

Impaired social cognition can be an early and salient characteristic of numerous neurodegenerative, neurodevelopmental, and neuropsychiatric disorders, and often occurs after acute brain injury where certain brain regions are affected (e.g., dorsomedial prefrontal cortex, orbitofrontal cortex, amygdala, and dorsal anterior cingulate cortex) (Henry et al., 2016). Social cognition impairment is highly reported in a variety of psychiatric diseases, such as autism, schizophrenia, and major depressive disorder (MDD) (Harvey & Penn, 2010; Holdnack et al., 2011).

Social Cognition and MDD

A deficit in social cognition, or the application of cognition in a social context, has been demonstrated in patients with MDD, as well as individuals with acute depression (LeMoult et al., 2009). The cross-sectional study of Knight et al. (2018) investigated whether certain social cognitive domains such as affect recognition, prosody, and interpretation of meaning predicted overall psychosocial functioning in 182 participants (remitted MDD = 72, healthy controls =110). The researchers found that prosody interpretation, or the ability to understand patterns of intonation and stress in language, was associated with psychosocial dysfunction in individuals with MDD. However, the researchers did not find an association between facial affect or meaning interpretation and psychosocial dysfunction in MDD. The authors concluded that prosody functioning may highlight the importance of verbal interpretation in everyday communication skills with MDD. These results suggest that social cognitive dysfunction is associated with psychosocial functioning, and that the improvement of prosody interpretation can lead to higher functional outcomes among individuals with MDD (Knight & Baune, 2018).

ToM has also been studied in individuals with chronic depression. One component of social cognition, ToM, was assessed in patients with MDD using Brune's cartoon picture story test and the Werden and Elikann test. The case-control study in Germany by Zobel et al. (2010) found that 60 chronically depressed men and women showed deficits in ToM, in particular reading social interactions, compared to controls without depression. In addition, researchers reported a significant positive correlation between ToM and certain variables of cognition which are logical memory, short-term memory, and working memory. Additionally, research has shown that depressed patients with deficits in ToM are more likely to relapse into depression more frequently, which leads to chronic depression (Zobel et al., 2010). Lastly, researchers found that patients with deficits in ToM had difficulty understanding social interactions (Zobel et al., 2010).

Social Cognition and PPD

Few studies have examined aspects of social cognition related to PPD from a brain connectivity or neuroimaging perspective. In the U.S., Moses-Kolko et al. (2010) examined dorsomedial prefrontal cortical activity and connectivity of the amygdala in patients with PPD, in response to exposure to negative facial emotions. The researchers used functional magnetic resonance imaging (MRI) during a block-designed face versus shape matching task in a sample consisted of 14 women with PPD and 16 healthy controls. After this experimental task, the researchers performed an analysis to measure the effects of prefrontal cortical activity and amygdala connectivity from these stimuli. The results showed that women with PPD had a reduced left dorsomedial prefrontal cortical response when exposed to face-related stimuli. Furthermore, the researchers found a negative correlation between PPD severity and left amygdala activity (lateralization) and no infant-related hostility. Reduced amygdala connectivity in response to negative facial emotions was associated with greater severity of PPD and a decrease of maternal attachment in their sample (Moses-Kolko et al., 2010).

The amygdala activity in patients with MDD exhibit a heightened response during exposure to negative emotional stimuli (Drevets et al., 2008). Silverman and colleagues (2011)

used functional MRI to examine the neural processing of negative emotion in 17 patients with PPD. The researchers observed the amygdala response to threat-related emotional stimuli. However, Silverman and colleagues (2011) found patients with PPD to have decreased activation of the amygdala in response to threat-related words. The latter study supports similar findings by Moses-Kolko and colleagues (2011) on amygdala activation in patients with PPD. Some studies report that having an increased amygdala response to threats may be advantageous because it may increase protection of newborns (Cooper et al., 2007). As such, women with PPD may be at great disadvantage in terms of making decisions, which may increase risks for infants during their development.

In a Canadian study, Wonch et al. (2016) focused on differential activity in the amygdala and connectivity in the brain using MRI among 28 patients with PPD to examine how they responded to infants in comparison to 17 healthy controls. The researchers were interested in studying the anhedonic behaviors of women with PPD, and how this may be associated with the brain response to positive stimuli. Women with and without PPD viewed pictures of infants with smiles, as well as positive stimuli that did not feature infants. The MRI examined the activity of the amygdala as well as brain connectivity. The researchers found that mothers with PPD had an increased response of the amygdala compared to mothers without PPD. On the other hand, patients with PPD had decreased amygdala-insular cortex connectivity compared to mothers without PPD. This decreased connectivity was also associated with increased anxiety and depression symptoms. However, these results were only seen for positive-valanced stimuli rather than all positively valanced stimuli. The researchers concluded that mothers with PPD in their sample showed brain responses and connectivity involving regions that are important for processing emotion and social cues that were different from mothers without PPD (Wonch et al., 2016).

In a Japanese study, researchers examined the relationship between emotion recognition bias and antenatal depression and found that pregnant women with depressive symptoms had

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greater sensitivity to children's disengagement cues. There was a significant an association between antenatal depression and Facial Emotion Recognition (FER) bias for children's facial expressions (Takubo et al., 2022). The mother's ability to process the child's facial expressions and respond appropriately to social cues is critical to mother-infant interactions and the mother's psychological well-being.

Discussion

This review of the literature identified few studies that examined cognitive function and social cognitive function in women with PPD even though PPD affects a sizable percentage of women, specifically 10–15% of women following childbirth (Centers for Disease Control and Prevention, 2017; Closa-Monasterolo et al., 2017). Furthermore, no studies of Arab women were found that examined cognitive function or social cognition, even though Arab women had a higher (38.5%-17.8%) than average prevalence of PPD in comparison to American women (Alasoom & Koura, 2014; Nasr et al., 2020).

The majority of the studies that included postpartum women defined PPD as an episode of major depression, with symptoms that occurred 4 weeks to 1 year post-delivery (De Almeida et al., 2012; Edvinsson et al., 2017; Kataja et al., 2017; Mazor et al., 2018), and used the EPDS to screen and identify women at risk for PPD. The EPDS is a well-established tool, with 86% sensitivity, 78% specificity, and 88% reliability using the split-half method, and with cut-off points of 12–13 for "probable depression" and 9–10 for "possible depression" (Cox et al., 1987). The EPDS has been used to identify women at risk for depression during antenatal and postpartum periods. All the studies that included postpartum women screened them for PPD 6 to 20 weeks post-delivery, except for Mazor et al. (2018), who screened women for PPD 1 to 3 days post-delivery even though the EPDS. Because Mazor and colleagues screened the women so early after birth, it may have caused them to include mothers with "baby blues" (occurring 1 to 10 days after delivery) that resolved spontaneously without treatment (Seyfried & Marcus, 2003).

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There were only five quantitative studies that reported that PPD and antenatal depression were associated with deficits in cognitive function (e.g., visuospatial function, short-term memory, working memory, executive function, or delayed reaction times) and that there were changes in the mothers' corresponding emotional reactions to infants (De Almeida et al., 2012; Edvinsson et al., 2017; Kataja et al., 2017; Mazor et al., 2018; Tang et al., 2019). Three of the five studies examined cognitive function in women with PPD. In one of the three, participants had shorter reaction times to positively and negatively valenced words in comparison to neutral words, suggesting emotional numbing (Edvinsson et al., 2017). In another of these three studies, women with PPD also had worse short-term and working memory (De Almeida et al., 2012). In the third study, women experienced cognitive impairment 1 to 3 days immediately after delivery (Mazor et al., 2018). However, each of the 3 studies reviewed used different tools to measure a different aspect of cognitive function in postpartum women making it difficult to compare findings. Despite the lack of standardized cognitive testing used, the majority of participants with PPD in these 5 studies had lower cognitive function (e.g., working and short-term memory), associated with the severity of depressive symptoms (De Almeida et al., 2012).

Two of the five quantitative studies examined cognitive function in women with depression during the antenatal period (Kataja et al., 2017; Tang et al., 2019). The results of the two studies were similar in that women from both samples with PPD had worse visuospatial working memory. In addition, anxiety and depression were both significant predictors of working memory performance in the two samples (Kataja et al., 2017; Tang et al., 2019).

Despite the significant results of these two studies, there were major limitations in that both had small sample sizes and lacked standardized social cognitive testing (e.g., emotional stroop task, Cogstate test battery, word span test, SDMT, AFI, and eye-tracking). These limitations made it difficult to generalize findings related to social cognitive performance and the population of women with antenatal depression.

In addition to examining cognitive function, certain components of social cognition were investigated in women with PPD using neuroimaging in relation to regions of the brain central to processing social cues, such as the amygdala and dorsomedial prefrontal cortex in three studies (Moses-Kolko et al., 2010; Silverman et al., 2017; Wonch et al., 2016). These three studies reported that women with PPD had significantly diminished brain activity in these regions which are important for ToM and social perception (Moses-Kolko et al., 2010; Silverman et al., 2017; Wonch et al., 2016). Moses-Kolko et al. (2010) observed an inverse relationship between severity of depression and left amygdala activity. These findings were supported by Silverman et al. (2017), which observed amygdala non-responsivity in women with higher depression scores. Also, Moses-Kolko (2010) reported that higher activity in the right amygdala in women with PPD was associated with less hostility and aggression. In addition, one study examined the brain connectivity of healthy control participants exposed to faces with negative emotions and observed a connectivity between the left dorsomedial prefrontal cortex and left amygdala in the controls that was absent in women with PPD. This finding suggests that there is disengagement in the neural circuitry, critical in emotion appraising and regulation, in women with PPD (Wonch et al., 2016).

In addition to assessing cognitive function in women with PPD, three studies examined both cognitive and social cognitive function in patients with MDD (Knight et al., 2018; LeMoult et al., 2009; Zobel et al., 2010). One component of social cognition, ToM, was assessed in patients with MDD which showed deficits in ToM and difficulty in understanding social interactions (Zobel et al., 2010). Another component of social cognition is emotional recognition or identification. Another study examined participants who had a history of recurrent MDD and found they needed a greater emotional intensity to identify happy expressions, indicating a bias in the emotional processing of happy emotions (LeMoult et al., 2009). A third study reported that psychosocial functioning was highly predicted by cognitive functioning in participants with

remitted MDD. Poorer cognitive function performance was associated with psychosocial dysfunction (Knight et al., 2018).

Gaps in Knowledge

This literature review identified some gaps in knowledge related to social cognitive function in women with PPD. Several studies have examined certain aspects of social cognitive function among individuals with MDD but to our knowledge there are no studies that examined social cognitive function among women with PPD, and furthermore, none with Saudi women. The literature reveals a lack of data related to mothers with PPD and the ability to understand information concerning the feelings, intentions, beliefs, dispositions and thoughts of others, or ToM (Wolkenstein et al., 2011). In addition, there are no studies that examined all aspects of social cognition (ToM, emotion recognition, empathy) in PPD compared to healthy controls. Examining all components using valid and reliable instruments will provide us with an accurate and comprehensive assessment of social cognition. In addition, standardized testing will allow us to assess the relationship between severity of PPD and different components of social cognition. The ability to process social information is crucial in decision making. Women with impaired social cognitive function may be at risk for impaired decision making, attention, perception, and memory that could have deleterious effects to them and to their infant.

Implications for Nursing Science and Practice

There is a lack of research on social cognition in women with PPD and more specifically in Saudi women regardless of the high prevalence rates of PPD in this population. Exploration of this concept could lead to findings that can be used to benefit post-partum women's mental health and well-being and potentially optimize infant stimulation and development in the first year of life. Knowledge on this topic will help to build upon future interventions that can improve all or some aspects of social cognition in women with PPD. The hope is that improving social cognition will optimize the well-being of both the mother and infant in the future.

Chapter Summary

This chapter reviewed the prevalence, diagnosis, risk factors, differential diagnoses and comorbidities associated with PPD. A review of the available literature examined and discussed what is known about cognitive deficits and social cognitive function among women with PPD. Furthermore, three essential aspects of social cognition (theory of mind, emotion recognition, and empathy) were explored. Since there is a scarcity of research related to women with PPD, in particular Saudi women, and social cognitive functioning, this study aims to produce results add to the literature related to the impact of PPD on theory of mind, emotion recognition, and empathy.

Table 1. Social Cognition in Women with Post-Partum Depression

Citation	Purpose	Sample & Setting	Methods	Results	Discussion & Limitations
Edvinsson, A., Skalkidou, A., Hellgren, C., Gingnell, M., Ekselius, L., Willebrand, M., & Poromaa, I. S. (2017). Different patterns of attentional bias in antenatal and postpartum depression. *Brain and Behavior,* 1–11.	To examine attentional bias to negatively and positively valanced words in women with antenatal and postpartum depressive disorders in comparison with healthy controls. To investigate attentional bias in women who were getting treatment with antidepressants for peripartum depression.	Sample size: 334. 177 pregnant women (137 without depression, 40 with antenatal depression) 157 postpartum (124 without depression, 33 with PPD) **Age:** mean age in all groups including controls 29.1-32 years of age. **Setting:** Recruited via clinic in Sweden and testing done at the Department of Women's and Children's Health, Uppsala University.	**Design:** Cross-sectional **Measures/Instruments used**: * EPDS *Montgomery–Åsberg Depression Rating Scale (MADRS-S) *Emotional Stroop task **Procedures:** Pregnant women screened using EPDS at 17 & 32 weeks gestational, 6 weeks & 6 months PP. **Description**: Control and disease group complete the Emotional Stroop task via the computer.	*signficantly longer reaction times to negatively valanced obstetric words. *Significant word category × depression interaction (p=.01), word category × antidepressant treatment (p=.009). *Significant interaction between antidepressant therapy and emotional word category (p=.01) *Significant depression × emotional word category interaction. *Women with postpartum depression displayed shorter reaction times to positive (p = .028) and negative (p = .022) stimuli than to neutral words in comparison with the nondepressed women. *Significant negative correlation between MADRS and EPDS scores and the emotional interference scores by positive and negative stimuli.	**Conclusions:** *Women with PPD had shorter reaction times to positively and negatively valanced words than to the neutral words. * Depression severity was inversely correlated with emotional interference. **Limitations:** *Findings cannot be generalized due to the small sample size. *Authors did not discuss the validity and reliability of the translated instruments. *Lack of a non-

					peripartum depressed control group.
Kataja, E. L., Karlsson, L., Huizink, A. C., Tolvanen, M., Parsons, C., Nolvi, S., & Karlsson, H. (2017). Pregnancy related anxiety and depressive symptoms are associated with visuospatial working memory errors during pregnancy. *Journal of Affective Disorders, 218*, 66–74.	To investigate the associations between diverse maternal neurocognitive functions and depressive and anxiety symptoms at three different time-points during pregnancy in a sample of pregnant women.	Sample size: n=230, pregnant females, mean age (31.4, 4.5). **Setting:** Turku University Hospital, Finland	**Design:** Longitudinal **Measures/Instruments used**: 1/ Cogstate test battery-consisted of 9 tasks 2/EPDS 3/ The Symptom Checklist-90 (SCL-90), anxiety subscale, 4/ The Pregnancy-Related Anxiety Questionnaire, revised 2 (PRAQ-R2), **Procedures:** Women recruited and consented at 12 weeks gestation. EPDS, SCL-90, and PRAQ-R2 questionnaires were mailed or completed over the phone at 14, 24, and 34 weeks. Cognitive measures (Cogstate test battery) were administered in person by 4 graduate students.	1/ mothers with high/moderate level of psychiatric symptoms had significantly more errors in visuospatial working memory/executive functioning task than mothers with low symptom level (p=0.004). 2/ Depression and anxiety symptoms were significant predictors of the performance in the cognitive task.	**Conclusions:** 1/ depressive symptoms and anxiety symptoms were both associated with deficits in visuospatial working memory/executive functioning. **Limitations:** 1/ cognitive function was screened at one point in time only. 2/ a computerized test method to assess cognitive function was used in the study; it has been validated in other populations in the past but not among

				pregnant women.
de Almeida, L. S., Jansen, K., Kohler, C. A., Pinheiro, R. T., da Silva, R. A., & Bonini, J. S. (2012). Working and short-term memories are impaired in postpartum depression. *Journal of Affective Disorders, 136*, 1238–1242.	1/ to assess working and short-term memory during the postpartum period in both parents.	**Sample size: n=**395 (222 female and 173 male) **Gender:** M, F **Setting:** 1/ sample recruited through the Public Health System in Pelotas, RS, Brazil. 2/ sample was assessed during home visits.	**Design:** Cross-sectional **Measures/Instruments used:** 1/EPDS. 2/ State-Trait Anxiety Inventory, Trait version (STAI-T). 3/Affect rating task. 4/fMRI. **Procedures:** 1/ Parents with children born between march-Dec 2008 were contacted. 2/ parents able to understand and sign the informed consent form were consented. **Description:** 1/ demographic data, daily life activity, medical history, and sleep pattern information were collected during home visits. 2/ All other tests, including depression and memory functioning, were conducted during home visits.	1/ PPD was associated with neutral (p≤0.001) and negative (p= 0.018) immediate memory and with neutral (p= 0.022) and negative (p= 0.020) recall memory.	**Conclusions:** Individuals with PPD (men, women) performed poorly on the memory tests. Thus, memory was affected by depression in this sample. **Limitations:** 1/Validity and reliability of the translated word span test was not discussed. 2/ fewer number of men in comparison to women in the study which might cause a prevalence bias. 3/Working and short term memory was assessed at only one point in time.

Mazor, E., Sheiner, E., Wainstock, T., Attias, M., & Walfisch, A. (2018). The association between depressive state and maternal cognitive function in postpartum women. *American Journal of Perinatology,* 36, 285–290.	To evaluate the prevalence of cognitive impairment among PP women and the role of postpartum depression and compare woman who are low risk for PPD (comparison group) and woman high risk for PPD (study group)	**Sample Size: n=**120 postpartum women. **Age:** Mean maternal age for study group vs comparison group (28.23 5.0 vs. 28.24 5.1) **Gender:** F **Setting:** the maternity wards of the Soroka University Medical Center (SUMC)-Israel	**Design:** Quantitative, cross sectional design. **Measures/Instruments used:** 1/ EPDS. 2/ The Symbol Digit Modalities Test (SDMT90, SDMT4). 3/ The Attention Function Index (AFI). **Procedures:** 1/ 189 PP women approached. 2/ 23 did not meet inclusion criteria,43 declined, 3 did not complete EPDS. 3/ written & oral explanation about the study was provided. 4/ consent obtained. 5/ sample divided into; depression high risk (EPDS ≥10) depression low risk (EPDS < 10) **Description:** 1/ study was performed 1-3 days PP. 2/ each woman was evaluated at a single time point and completed the study instruments.	1/ Mean SDMT90 score was 42.51 10 in the study group as compared with 47.27 12.6 in the comparison group (p=0.057) and mean self-assessment test score was 67.69 12.01 in the study group as compared with 79.05 14.3 in the comparison group (p < 0.001) 2/Depressed mothers scored significantly lower in the subjective AFI test	**Conclusion:** PPD affects maternal self-assessment of cognitive ability assessed by a subjective self-estimation questionnaire (Attention Function Index [AFI], rather than a true cognitive impairment assessed by an objective neurocognitive test (Symbol Digit Modalities Test, SDMT90, and SDMT4). **Limitations:** 1/ women were screened for PPD 1-3 days immediately after delivery which is not the onset time for PPD as defined by the

					APA (PPD is a specific episode of depression, with peripartum onset within 4 weeks following childbirth) which in this case might affect the validity and reliability of the results. 2/ small sample size.
Tang, W., Bao, C., Xu, L., Zhu, J., Feng, W., Zhang, W., Lin, C., Chen, L., Ding, P., Zhou, M., Bao, Y., Yu, X., Zhao, K., & He, J. (2019). Depressive symptoms in late pregnancy disrupt attentional processing of	To investigate biases for negative–positive information in component processes of visual attention (initial shift vs. maintenance of gaze) among women in late pregnancy with or without depressive symptoms.	**Sample Size:** 89 **Age:** major depressive symptoms (MDS) (29.8±4.50) suspicious depression symptoms (SDS) (28.5±3.60) no depression symptoms (NDS) (28.3±3.60) **Gender:** F **Diagnosis:** MDS, SDS, NDS **Setting:** Hospital of Wenzhou Medical University, China.	**Design:** quantitative, cross sectional **Measures/Instruments used:** 1/EPDS. 2/Eye tracking paradigm/system. **Procedures:** 1/ women were screened for PPD using EPDS. 2/ divided into 3 groups: EPDS score ≥13 was classified as major depressive symptoms (MDS), a score of 10 to 12 was classified as suspicious depressive symptoms (SDS), and an EPDS score	1/ the MDS group had a significantly higher initial gaze direction bias score for negative images than the NDS group. 2/ comparisons revealed that participants fixated faster on negative pictures than on positive pictures (p = 0.014) in both depressed groups.	**Conclusions:** 1/ (MDS) group were over-responsive to negative emotion-related pictures. 2/ (SDS) group had an attention bias toward both positive and negative emotion-related pictures.

| negative-positive emotion: An eye-movement study. *Frontiers in Psychology, 10*, 1–10. | | | ≤9 was classified as no depressive symptoms (NDS). 3/ standardized interviews were conducted by a trained interviewer to confirm diagnosis. 4/ Then eye tracking was used to assess visual attention bias. **Description**: 1/ The visual for attentional bias stimuli consisted of 24 different paired pictures, presented twice. 2/ participants seated in a chair, and watched a screen that displayed negative or positive, paired with a neutral scenes. | | 3/ (NDS) group had an attention bias toward positive emotion-related pictures and had an initial attention avoidance tendency for negative emotion-related pictures. 4/ Depression severity was not significantly correlated with attentional bias. **Limitations:** 1/ it is a cross-sectional study that only looked at women in late pregnancy which limit the ability to confirm a causal relationship |

					between depression and attentional bias. 2/ small study sample might limit the study generalizability.
LeMoult, J., Joormann, J., Sherdell, L., Wright, Y., & Gotlib, I. H. (2009). Identification of emotional facial expressions following recovery from depression. *Journal of abnormal psychology*, *118*(4), 828–833. https://doi.org/10.1037/a0016944	To investigate the identification of facial expressions of emotion in currently non-depressed participants who had a history of recurrent depressive episodes (recurrent major depression; RMD) and never-depressed control participants (CTL).	**Sample Size:** n=95 individuals (39 RMD and 56 CTL) **Age:** CTL (44.4, 5.1) RMD (42.6, 6.07) **Gender:** F **Diagnosis:** recurrent major depression (RMD) **Setting:** University of Miami	**Design:** Quantitative, cross-sectional **Measures/Instruments used**: 1/ Beck Depression Inventory—II (BDI–II). 2/ mood rating before and after the mood induction (a scale from 1 (very sad) to 5 (very happy). 3/ Morphing Task: Faces were selected from the Facial Expressions of Emotion: Stimuli and Tests series stimulus set. **Procedures:** 1/ women were phone interviewed for eligibility. 2/ after recruiting and consenting eligible women, they were invited to invited to participate in the	1/ mood induction before and after watching clips: Participants endorsed more negative affect after watching the video clip (M = 1.97, SD = 0.92) than before (M = 3.85, SD = 0.70). no Group × Time interaction, $F(1, 93) = 2.28$, ns. 2/emotion identification: - RMD participants required a greater intensity of emotional expression than did CTL participants to correctly identify happy faces, $t (93) = 3.34$, $p < .01$, $d = 0.69$. -CTL and RMD did not differ in their identification of sad or angry faces.	**Conclusions:** 1/ no group differences in the identification of sad or angry expressions. 2/ RMD participants required significantly greater emotional intensity in the faces to correctly identify happy expressions. 3/ biases in the processing of emotional facial

			Structured Clinical Interview for the DSM–IV. **Description**: 1/ eligible participants were scheduled for their second session after the clinical interview within 1 week. 2/Participants were randomly assigned into 3 groups to watch sad clips for mood induction. 3/ participants completed a mood assessment in 2nd session. 4/then were exposed to a negative mood induction and a second mood measurement before participating in the morphing task.		expressions are evident even after individuals have recovered from a depressive episode. **Limitation:** 1/ the current design was limited by the use of only three emotional expressions. 2/ As stated by the authors, the RMD group didn't meet criteria for a current major depressive episode.
Knight, M.J., Air, T., & Baune, B.T. (2018). The role of cognitive impairment in psychosocial functioning in	To explore the relationship between cognition and psychosocial functioning in remitted MDD and in healthy controls.	**Sample Size:** n=182 **Age:** 33.5 years (SD = 16.18) **Gender:** F, M **Diagnosis:** current or previous diagnosis of a depressive episode **Setting:**	**Design:** Quantitative, cross-sectional **Measures/Instruments used**: 1/ the Functioning and Assessment Short Test (FAST) 2/ The Repeatable Battery for the Assessment of	1/ In the remitted group only executive function significantly predicted overall dysfunction (p=.019), also older age was associated with increased psychosocial dysfunction (β = 0.441, p = .007).	**Conclusions:** psychosocial functioning in the remitted group was significantly predicted by executive functioning as

remitted depression. *Journal of Affective Disorders*,235, 129–134.		Participants recruited from a previous study the Cognitive Function and Mood Study (CoFaMS) in Australia	Neuropsychological Function (RBANS) 3/ Colorado Assessment Tests (CATS) 4/ Psychology Experiment Building Language (PEBL) **Procedures:** 1/Participants were screened for psychiatric illness with the MINI600 Neuropsychiatric Diagnostic Interview. 2/ divided into 2 groups remitted cases, healthy. **Description**: 1/Cognitive function in the 2 groups was tested using (BRANS, CATS, PEBL) 2/ FAST administered to assess Psychosocial functioning		the single cognitive domain, but poor executive performance was associated with psychosocial dysfunction. **Limitations:** Psychosocial functioning was measured with a clinical interview (FAST), and was therefore reliant on clinicians' judgement of impairment, as opposed to more objective measures of functioning.
Zobel, I., Werden, D., Linster, H., Dykierek, P., Drieling, T., Berger, M., & Schramm, E. (2010). Theory of mind deficits in chronically	1/ to compare the ToM performance of chronically depressed patients vs healthy control group. 2/ to examine the relation of ToM to cognitive functions	**Sample Size: n=60** **Age:** depressed 46.7 (11.9) control 46.2 (12.1) **Gender:** F **Diagnosis:** Depression **Setting:** Depressed patients recruited from the University Medical	**Design:** Quantitative, cross-sectional **Measures/Instruments used**: 1/ Brune's cartoon picture story test. 2/ WE.EL-test. 3/ the Wechsler Memory Scale-Revised (WMS-R	1/ Chronically depressed patients had significantly poorer ToM performance than healthy controls in all ToM assessments: 2/ significant positive correlations were found between verbal short-term and working memory and ToM scores (from r 5 0.26 to 0.54).	**Conclusions:** Chronically depressed patients were markedly impaired in ToM tasks and neuropsycholo gical tasks compared to

depressed patients. Depression and Anxiety,27(9), 821–828.		Center Freiburg, Department of Psychiatry and Psychotherapy and matched with healthy controls, Freiburg city, Germany	4/ Multiple choice - vocabulary intelligence test (MWT) **Procedures:** 1/After meeting the DSM-IV criteria, depressed participants were assessed using the Inventory of Depressive Symptoms Self Report (IDS-SR). **Description**: 1/ ToM was assessed using two tests in two groups. 2/ Cognitive function was assessed in both groups.	3/ significant positive correlations between all ToM tasks (except the first-order tasks of the WE.EL) and logical memory (from r 5 0.29 to 0.54).	healthy control **Limitations:** 1/ a differential assessment of cognitive and affective ToM was not applied. 2/Instruments validation to assess TOM was not presented.
Moses-Kolko, E. L., Perlman, S. B., Wisner, K. L., James, J., Saul, A. T., & Phillips, M. L. (2010). Abnormally reduced dorsomedial prefrontal cortical activity and effective connectivity with amygdala in response to negative	To examine dorsomedial prefrontal cortex and amygdala activity in response to negative emotional faces in mother with PPD in comparison to healthy controls.	**Sample Size: n**=30 (PPD=14, Healthy control=16) **Age:** HC (26.7, 4.8) PDD (26.8, 6.1) **Gender:** F **Diagnosis:** PPD **Setting:** University of Pittsburgh Medical Center, in Pennsylvania, United States.	**Design:** Quantitative, cross-sectional. **Measures/Instruments used**: 1/ EPDS 2/ Parent-to-Infant Attachment Questionnaire. 3/ The block-design paradigm 4/fMRI.	1/ healthy mothers showed significantly more activity than depressed mothers in response to face blocks (p<0.005). 2/ Edinburgh Postnatal Depression Scale scores were negatively correlated with face-related left amygdala activity (r≥−0.81, df=12, p<0.05 3/ significant positive correlation between the absence of hostility subscale of the Parent-to-Infant Attachment Questionnaire and activity in the right amygdala (r≥0.58, df=10, p<0.05. 4/ less hostility toward the infant was associated with	**Conclusions:** 1/ significant negative correlation between left amygdala activity and PPD severity 2/significant positive correlation between right amygdala activity and absence of infant-related hostility **Limitations:**

				greater right amygdala activity in depressed mothers.	1/ Sample size was relatively small.
emotional faces in postpartum depression. *The American Journal of Psychiatry, 167*(11), 1373–1380. https://doi.org/ 10.1176/appi.a jp.2010.09081 235					
Silverman, M. E., Loudon, H., Liu, X., Mauro, C., Leiter, G., & Goldstein, M. A. (2011). The neural processing of negative emotion postpartum: A preliminary study of amygdala function in postpartum depression. *Archives of Women's Mental*	To examine emotion regulation in women with ppd using (fMRI) techniques to assess the neuroanatomica-l responsivity of the amygdala.	**Sample size: n**=17 **Age:** mean (27) **Gender:** F **Diagnosis:** PPD **Setting:** Mount Sinai Medical Center, New York, USA	**Design:** Quantitative, cross-sectional **Measures/Instruments used**: 1/SCID-R. 2/HDI-17. 3/EPDS. 4/ Neuropsychological activation paradigm. 5/MRI. **Procedures:** 1/ structured psychiatric diagnostic interview (SCID-RV) used to ensure participants were free of any other psychiatric comorbidity. 2/ The Hamilton Depression Inventory (HDI-17) was used to identify depression symptoms	1/ a significant difference in valence (t= 3.06, p≤0.012) where threat words perceived more negative in valance than the negative stimuli with depressive content. 2/ significantly greater Blood Oxygenation Level-Dependent (BOLD) response to threat stimuli in the right amygdala (F(1, 15)=5.35; p≤0.035).	**Conclusions:** PPD symptoms were associated with failure to activate right amygdala regions in response to threat-related stimuli. **Limitations:** Due to the small sample size, the study findings cannot be generalized and future studies with larger sample

Health, 14, 355–359.			3/ EPDS was administered at week 6 and re-administered prior to entering the MRI. **Description**: 1/ women entered the MRI and were instructed to perform a right index finger button press immediately upon presentation of a word and a right middle finger button press upon presentation of scrambled letters. 2/After exiting the MRI women were asked to: recall words presented during scanning- were asked to rate a subset of stimulus words in order.		size is recommended.
Wonch, K. E., Medeiros, C. B. de, Barrett, J. A., Dudin, A., Cunningham, W. A., Hall, G. B., Steiner, M., & Fleming, A. S. (2016). Postpartum depression and brain response to infants:	To assess amygdala response and connectivity in response to infants' pictures in women with PPD.	**Sample Size:** women with PPD (n = 28) and HC (n = 17) **Age:** PPD (29.18, 1.19) HC (30.6, .93) **Gender:** F **Diagnosis:** PPD **Setting:** 1/ St. Joseph's Healthcare (SJH), Ontario, Canada	**Design:** Quantitative, cross-sectional. **Measures/Instruments used:** 1/EPDS. 2/ State-Trait Anxiety Inventory, Trait version (STAI-T). 3/Affect rating task. 4/fMRI. **Procedures:** After recruitment and consenting:	1/ both groups reported that they felt more positive when they viewed their own compared to other infants or non-infant pictures $(F(1,43) = 75.405, p = .001)$. 3/ bilateral AMY activity in mothers without PPD was greater for OwnView–OtherView. 4/ Average BOLD response in PPD mothers was greater for OwnView–OtherView only in the right AMY.	**Conclusions:** 1/PPD mothers, compared to non-PPD mothers, showed overall increased AMY response across conditions in the right AMY.

Differential amygdala response and connectivity. *Social Neuroscience, 11*(6), 600–617. https://doi.org/10.1080/17470919.2015.1131193			1/ Diagnostic Interview and Photography Session for infants. 2/ fMRI Session, 3/ Home Visit **Description:** 1/ mother–baby pairs attended a laboratory session at SJH, where a minimum of 50 positive infant facial expressions were photographed. 2/Photos were rated by 5 observers and rated on scale from 1-9 (1 = "not at all positive" and 9 = "extremely positive"). 3/ 20 photos were chosen for the fMRI session.	5/ In depressed mothers EPDS scores were positively correlated with left AMY response to NonInfantView (r = .39, = .043)	2/ women with PPD had decreased bilateral AMY–right insular cortex (IC) connectivity in comparison to non-PPD mothers when they view Own–Other infants. 3/Inverse relationship between depression severity and AMY–IC connectivity. **Limitations:** Small sample size which limits the findings generalizability
Takubo Y, Tsujino N, Aikawa Y, Fukiya K, Uchino T, Katagiri N, Ito M, Akiba Y, Mizuno M,	to clarify the relationship of facial emotion recognition (FER) bias for children's faces with antenatal depression and	72 pregnant women in their second trimester were recruited from the Department of Obstetrics and Gynaecology of the Saiseikai	**Design:** cross-sectional **Measures:** EPDS, Mother-to-Infant Bonding Questionnaire (MIBQ), and to assess FER Baby Cue Cards (BCC) was used, Japanese and Caucasian Facial Expressions of	These results suggest that maternal sensitivity to a child's disengagement cues might be significantly associated with antenatal depressive symptoms and bonding failure. Pregnant women who showed greater sensitivity to children's	1/ the small sample size and cross-sectional design, we could not conclude any

| Nemoto T. Relationship between Antenatal Mental Health and Facial Emotion Recognition Bias for Children's Faces among Pregnant Women. *Journal of Personalized Medicine*. 2022; 12(9):1391 | bonding failure among pregnant women | Yokohamashi Tobu Hospital in Japan | Emotion Task (JACFEE), Reading the Mind in the Eyes Test (RMET), The Social Cognition Screening Questionnaire (SCSQ). **Description:** The assessment was conducted between 15-27 weeks of gestation in a quiet examination room to ensure the confidentiality of the participants. Participants were asked to complete a questionnaire pertaining to their background information and self-administered measures | disengagement cues were significantly more likely to have had antenatal depressive symptoms | causal relationships 2/ this study was conducted during the COVID-19 pandemic; the effects of the pandemic on mental status and social cognitive abilities cannot be ignored |

References

Alasoom LI, Koura MR. Predictors of postpartum depression in the eastern province capital of Saudi

    Arabia. Journal of family medicine and primary care. 2014 Apr;3(2):146. pmid:25161973

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-*

    5®). Author.

Anderson, I. M., Shippen, C., Juhasz, G., Chase, D., Thomas, E., Downey, D., Toth, Z. G., Lloyd-

    Williams, K., Elliot, R., & Deakin, J. F. (2011). State-dependent alteration in face emotion

    recognition in depression. *The British Journal of Psychiatry, 198,* 302–308.

Austin, M. P., Hadzi-Pavlovic, D., Leader, L., Saint, K., & Parker, G. (2005). Maternal trait anxiety,

    depression and life event stress in pregnancy: Relationships with infant temperament. *Early*

    Human Development, 81(2), 183–190.

Bagner, D. M., Pettit, J. W., Lewinsohn, P. M., & Seeley, J. R. (2010). Effect of maternal depression on

    child behavior: A sensitive period? *Journal of the American Academy of Child & Adolescent*

    Psychiatry, 49(7), 699–707.

Beck, C. T., & Gable, R. K. (2001). Comparative analysis of the performance of the Postpartum

    Depression Screening Scale with two other depression instruments. Nursing Research, 50(4),

    242-250.

Bezrutczyk, D., & Hampton, D. (2019). *Postpartum depression and addiction.* Addiction Center.

    Retrieved from: https://www.addictioncenter.com/addiction/postpartum-depression-addiction/

Bobo, W. V., & Yawn, B. P. (2014). Concise review for physicians and other clinicians: Postpartum

    depression. *Mayo Clinic Proceedings, 89*(6), 835–844.

Centers for Disease Control and Prevention. (2017). *Trends in postpartum depressive symptoms-27 states,*

    2004, 2008, and 2012. https://www.cdc.gov/mmwr/volumes/66/wr/mm6606a1.htm.

Chapman, S. L. C., & Wu, L. T. (2013). Postpartum substance use and depressive symptoms: A

    review. *Women & Health, 53*(5), 479–503.

Closa-Monasterolo, R., Gispert-Llaurado, M., Canals, J., Luque, V., Zaragoza-Jordana, M., Koletzko, B.,

    . . . Verduci, E. (2017). The effect of postpartum depression and current mental health problems

    of the mother on child behaviour at eight years. *Maternal and Child Health Journal, 21*(7), 1563–

    1572.

Cooper, C., Jones, L., Dunn, E., Forty, L., Haque, S., & Oyebode, F. (2007) Clinical presentation of

    postnatal and non-postnatal depressive episodes. Psychological Medicine, 37, 1273–1280.

Davis, E. P., Glynn, L. M., Schetter, C. D., Hobel, C., Chicz-Demet, A., & Sandman, C. A. (2007).

    Prenatal exposure to maternal depression and cortisol influences infant temperament. *Journal of*

    the American Academy of Child & Adolescent Psychiatry, 46(6), 737–746.

Davis, M. H., Luce, C., & Kraus, S. J. (1994). The heritability of characteristics associated with

    dispositional empathy. *Journal of Personality, 62*(3), 369−391. doi:10.1111/j.1467-

    6494.1994.tb00302.x

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and*

    Cognitive Neuroscience Reviews, 3, 71–100.

Decety, J., & Jackson, P. L. (2006). A social-neuroscience perspective on empathy.*Current Directions in*

    Psychological Science, 15, 54–58.

de Almeida, L. S., Jansen, K., Kohler, C. A., Pinheiro, R. T., da Silva, R. A., & Bonini, J. S. (2012).

    Working and short-term memories are impaired in postpartum depression. *Journal of Affective*

    Disorders, 136, 1238–1242.

de Melo, S. B., Jordao, R. R., Guimaraes, F. J., Perrell, J. G., Cantillnos, A., & Sougey, E. B. (2018).

    Depressive symptoms in postpartum women at family health units. Rev. Bras. Saúde Mater.

    Infant., Recife, 18, 163–169.

Dennis, C. L., & Dowswell, T. (2013). Psychosocial and psychological interventions for preventing

    postpartum depression. *Cochrane Database of Systematic Reviews*, (2).

Drevets, W.C., Price, J.L., & Furey, M.L. (2008). Brain structural and functional abnormalities in mood

    disorders: implications for neurocircuitry models of depression. Brain Structures and Function,

    213, 93–118

Edvinsson, A., Skalkidou, A., Hellgren, C., Gingnell, M., Ekselius, L., Willebrand, M., & Poromaa, I. S.

    (2017). Different patterns of attentional bias in antenatal and postpartum depression. *Brain and*

    Behavior, 1–11.

Ghaedrahmati, M., Kazemi, A., Kheirabadi, G., Ebrahimi, A., & Bahrami, M. (2017). Postpartum

    depression risk factors: A narrative review. *Journal of Education and Health Promotion*, *6*.

Greifeneder, R., Bless, H., & Fiedler, K. (2017). *Social cognition: How individuals construct social*

    reality. Psychology Press.

Harms, M. B., Martin, A., & Wallace, G. L. (2010). Facial emotion recognition in autism spectrum

    disorders: A review of behavioral and neuroimaging studies. *Neuropsychology Review, 20*(3),

    290–322. https://doi.org/10.1007/s11065-010-9138-6

Harvey, P. D., & Penn, D. (2010). Social cognition: The key factor predicting social outcome in people

    with schizophrenia? *Psychiatry (Edgmont), 7*(2), 41.

Haslam, D. M., Pakenham, K. I., & Smith, A. (2006). Social support and postpartum depressive

    symptomatology: The mediating role of maternal self-efficacy. *Infant Mental Health*

    Journal, 27(3), 276–291.

Henry, J. D., Von Hippel, W., Molenberghs, P., Lee, T., & Sachdev, P. S. (2016). Clinical assessment of

    social cognitive function in neurological disorders. *Nature Reviews Neurology, 12*(1), 28.

Homish GG, Cornelius JR, Richardson GA, Day NL. Antenatal risk factors associated with postpartum

    comorbid alcohol use and depressive symptomatology. *Alcohol Clin Exp Res.* 2004;28:1242–

    1248.

Hoekzema, E., Barba-Müller, E., Pozzobon, C., Picado, M., Lucco, F., García-García, D., Soliva, J. C.,

    Tobeña, A., Desco, M., Crone, E. A., Ballesteros, A., Carmona, S., & Vilarroya, O. (2017).

Pregnancy leads to long-lasting changes in human brain structure. *Nature Neuroscience, 20*(2), 287–296. https://doi.org/10.1038/nn.4458

Holdnack, J., Goldstein, G., & Drozdick, L. (2011). Social perception and WAIS-IV performance in adolescents and adults diagnosed with Asperger's syndrome and autism. *Assessment, 18*(2), 192–200.

Hummel, A. C., & Kiel, E. J. (2015). Maternal depressive symptoms, maternal behavior, and toddler internalizing outcomes: A moderated mediation model. *Child Psychiatry & Human Development, 46*(1), 21–33.

Kandalaft, M. R., Didehbani, N., Cullum, C. M., Krawczyk, D. C., Allen, T. T., Tamminga, C. A., & Chapman, S. B. (2012). The Wechsler ACS social perception subtest: A preliminary comparison with other measures of social cognition. *Journal of Psychoeducational Assessment, 30*(5), 455–465.

Kataja, E. L., Karlsson, L., Huizink, A. C., Tolvanen, M., Parsons, C., Nolvi, S., & Karlsson, H. (2017). Pregnancy related anxiety and depressive symptoms are associated with visuospatial working memory errors during pregnancy. *Journal of Affective Disorders, 218*, 66–74.

Khanjani, Z., Mosanezhad Jeddi, E., Hekmati, I., Khalilzade, S., Etemadi Nia, M., Andalib, M. and Ashrafian, P. (2015), Empathy and social functioning. Australian Psychologist, 50: 80-85. https://doi.org/10.1111/ap.12099

Knight, M.J., Air,T., & Baune, B.T.(2018).The role of cognitive impairment in psychosocial functioning in remitted depression. Journal of Affective Disorders,235,129–134.

Kuehner, C. (2017). Why is depression more common among women than among men? *The Lancet Psychiatry, 4*(2), 146–158.

Kuo, C., Schonbrun, Y. C., Zlotnick, C., Bates, N., Todorova, R., Kao, J. C. W., & Johnson, J. (2013). A qualitative study of treatment needs among pregnant and postpartum women with substance use and depression. *Substance Use & Misuse, 48*(14), 1498–1508.

LeMoult,J.,Joormann,J.,Sherdell,L.,Wright,Y.,&Gotlib,I.H.(2009).Identificationofemotionalfacialexpressi onsfollowingrecoveryfromdepression.JournalofAbnormalPsychology,118(4),828–833.

Lo, P. M. T., & Siu, A. M. H. (2018). Assessing social cognition of persons with schizophrenia in a Chinese population: A pilot study. *Frontiers in Psychiatry*, *8.* https://doi.org/10.3389/fpsyt.2017.00302.

Mattern, M., Walter, H., Hentze, C., Schramm, E., Drost, S., Schoepf, D., Fangmeier, T., Normann, C., Zobel, I., & Schnell, K. (2015). Behavioral evidence for an impairment of affective theory of mind capabilities in chronic depression. *Psychopathology, 48,* 240–250.

Mazor, E., Sheiner, E., Wainstock, T., Attias, M., & Walfisch, A. (2018). The association between depressive state and maternal cognitive function in postpartum women. *American Journal of Perinatology,* 36, 285–290.

Moses-Kolko, E. L., Perlman, S. B., Wisner, K. L., James, J., Saul, A. T., & Phillips, M. L. (2010). Abnormally reduced dorsomedial prefrontal cortical activity and effective connectivity with amygdala in response to negative emotional faces in postpartum depression. *The American Journal of Psychiatry, 167*(11), 1373–1380. https://doi.org/10.1176/appi.ajp.2010.09081235

Murray, L., & Cooper, P. J. (2003). Intergenerational transmission of affective and cognitive processes associated with depression: Infancy and the pre-school years. In I. M. Goodyer (Ed.), *Unipolar depression: A lifespan perspective* (pp. 17–46). Oxford University Press.

Nasr, R. S. A., Altharwi, K., Derbah, M. S., Gharibo, S. O., Fallatah, S. A., Alotaibi, S. G., Almutairi, K. A., & Asdaq, S. M. B. (2020). Prevalence and predictors of postpartum depression in Riyadh, Saudi Arabia: A cross sectional study. *PLOS ONE*, *15*(2), e0228666. https://doi.org/10.1371/journal.pone.0228666

Prevatt, BS., Desmarais, S.L. & Janssen, P.A. Lifetime substance use as a predictor of postpartum mental health. *Arch Womens Ment Health* **20,** 189–199 (2017). https://doi.org/10.1007/s00737-016-0694-5

Quinn, K. A., Macrae, C. N., & Bodenhausen, G. V. (2006). Social

cognition. *Encyclopedia of cognitive science*.

Reck, C., Noe, D., Gerstenlauer, J., & Stehle, E. (2012). Effects of postpartum anxiety disorders and

depression on maternal self-confidence. *Infant Behavior and Development, 35*(2), 264–272.

Salisbury AL, Lester BM, Seifer R, LaGasse L, Bauer CR, Shankaran S, Bada H, Wright LL, Liu J, Poole

K. Prenatal cocaine use and maternal depression: Effects on infant neurobehavior. *Neurotoxicol

Teratol.* 2007;29:331–340.

Shamay-Tsoory, S. G. (2011). The neural bases for empathy. *The Neuroscientist, 17*(1), 18−24.

doi:10.1177/1073858410379268

Seyfried, L. S., & Marcus, S. M. (2003). Postpartum mood disorders. *International Review of Psychiatry*,

15(3), 231–242. https://doi.org/10.1080/0954026031000136857

Shorey, S., Chee, C. Y. I., Ng, E. D., Chan, Y. H., San Tam, W. W., & Chong, Y. S. (2018). Prevalence

and incidence of postpartum depression among healthy mothers: A systematic review and meta-

analysis. *Journal of Psychiatric Research, 104*, 235–248.

Silverman, M. E., Loudon, H., Liu, X., Mauro, C., Leiter, G., & Goldstein, M. A. (2011). The neural

processing of negative emotion postpartum: A preliminary study of amygdala function in

postpartum depression. *Archives of Women's Mental Health, 14,* 355–359.

Silverman, M. E., Reichenberg, A., Savitz, D. A., Cnattingius, S., Lichtenstein, P., Hultman, C. M., . . .

Sandin, S. (2017). The risk factors for postpartum depression: A population-based

study. *Depression and Anxiety, 34*(2), 178–187.

Sit, D. K., & Wisner, K. L. (2009). The identification of postpartum depression. *Clinical Obstetrics and

Gynecology, 52*(3), 456.

Stewart, D. E., Robertson, E., Dennis, C. L., Grace, S. L., & Wallington, T. (2003). Postpartum

depression: Literature review of risk factors and interventions. *Toronto: University Health

Network Women's Health Program for Toronto Public Health*.

Substance Abuse and Mental Health Services Administration (Office of Applied Studies). (2005).

Substance use during pregnancy: 2002 and 2003 update.

Tang, W., Bao, C., Xu, L., Zhu, J., Feng, W., Zhang, W., Lin, C., Chen, L., Ding, P., Zhou, M., Bao, Y., Yu, X., Zhao, K., & He, J. (2019). Depressive symptoms in late pregnancy disrupt attentional processing of negative-positive emotion: An eye-movement study. *Frontiers in Psychology, 10*, 1–10.

Weightman, M. J., Air, T. M., & Baune, B. T. (2014). A review of the role of social cognition in major depressive disorder. *Frontiers in Psychiatry*, *5*, 179.

Wittmann, M. K., Lockwood, P. L., & Rushworth, M. F. (2018). Neural mechanisms of social cognition in primates. *Annual Review of Neuroscience*, *41*, 99–118.

Wolkenstein, L., Schönenberg, M., Schirm, E., & Hautzinger, M. (2011). I can see what you feel, but I can't deal with it: Impaired theory of mind in depression. *Journal of Affective Disorders, 132*(1-2), 104–111.

Wonch, K. E., Medeiros, C. B. de, Barrett, J. A., Dudin, A., Cunningham, W. A., Hall, G. B., Steiner, M., & Fleming, A. S. (2016). Postpartum depression and brain response to infants: Differential amygdala response and connectivity. *Social Neuroscience, 11*(6), 600–617. https://doi.org/10.1080/17470919.2015.1131193

Zietlow, A. L., Schlüter, M. K., Nonnenmacher, N., Müller, M., & Reck, C. (2014). Maternal self-confidence postpartum and at pre-school age: The role of depression, anxiety disorders, maternal attachment insecurity. *Maternal and Child Health Journal, 18*(8), 1873–1880.

Zobel, I., Werden, D., Linster, H., Dykierek, P., Drieling, T., Berger, M., & Schramm, E. (2010). Theory of mind deficits in chronically depressed patients.DepressionandAnxiety, *27*(9), 821–828.

CHAPTER THREE: THEORETICAL FRAMEWORK

This chapter will provide an in-depth analysis of the Biopsychosocial (BPS) Model as it applies to social cognition and Saudi women with post-partum depression (PPD). This chapter will describe the major components of the BPS model, theoretical underpinnings, concepts associated with the model and will utilize the BPS model as the foundation to explore social cognition in Saudi women with PPD.

Biopsychosocial Model Background

The BPS model is an interdisciplinary framework that examines the interconnection between biological, psychological, and socio-environmental factors that can affect an individual's health and well-being (Santos, 2018). In 1977, George Engel, who was a psychiatrist, developed the BPS model as an alternative to the one-dimensional biomedical model of disease. The BPS model allows for a better understanding of a person's subjective view of their illness through the complex interaction of social, psychological, and biological factors. Engel argued that health-care providers and researchers should holistically examine complex diseases by considering social and psychological factors. By developing this model, he challenged the long-held scientific assumption that a person's health is affected only by biological factors. The BPS model is "patient-centered" in that it considers a patient's experiences, emotional well-being, intellectual capacity, and social functioning (Santos, 2018). The BPS model consists of the following three variables: biological/physiological variables, psychological variables, and social variables. The original model views health and illness behaviors as a product of biological characteristics (such as genes), behavioral factors (such as lifestyle, stress and health beliefs) and social conditions (such as cultural influences, family relationships and social support). To provide a better explanation of what these factors meant

Engle used diabetes as an example in which he stated that biological factors that could play a role in diabetes could be genetic, anatomical, or biochemical factors. He also explained how psychological distress as a factor can lead to life threatening hyperglycemia which induce a state of ketoacidosis. Lastly, he discussed how culture could influence symptom presentation; he asserted that in some cultures, patients with diabetes tend to shy away from expressing pain or discomfort. In his original paper, Engel did not provide a model (diagram) but researchers have developed models based on what Engel explained narratively and adapted it to their research studies (Figure 1).

Theoretical Underpinnings of the BPS Model

The two theoretical underpinnings that will be discussed below are in alignment with Engel's views of how scientists and clinicians should examine and manage conditions. Engle (1977) shifted from a reductionist biomedical perspective of illness to a more holistic approach grounded in the general systems theory (GST) and ecological systems theory to view health and illness.

General Systems Theory

Von Bertalanffy, who is a biologist, developed the GST in 1968 because he noted that scholars from different fields were working in isolation and studying parts of phenomena independently rather than studying phenomena as a whole. He recognized the need for a multidisciplinary approach in which scholars from different fields such as biology, psychology, and physics could work collaboratively to study complex conditions. Von Bertalanffy defined a system as a set of complex elements that interact with each other and with the environment. A system can be biological, social, cultural, or physical. He claimed that by examining the relationship between these elements researchers will have a comprehensive understanding of the

phenomena (Santos, 2018). Von Bertalanffy advocated for the development of a holistic approach to solving problems and examining complex conditions. According to Engels (1977), the GST provides a "conceptual approach suitable not only for the proposed biopsychosocial concept of disease but also for studying disease and medical care as interrelated processes" (p.392).

Ecological Systems Theory

According to Santos (2018), the BPS model has a number of theoretical underpinnings and one of these is the Ecological systems theory (EST). The EST was developed by Urie Bronfenbrenner in 1979 and in it, he defined systems, depicted as four concentric systems that are in constant interaction with each other. These include the micro-system, the meso-system, the exo-system and the macro-system. The EST guided researchers to examine the influence of multi-level systems on human development and behavior (Bronfenbrenner, 1989). This theory recognizes that health can be influenced by an interaction of multiple factors such as individual, social, environmental, and organizational factors, which is in agreement with the BPS model. In addition, the ecological perspective supports one of the BPS concepts, the vulnerability of systems, which recognizes the individual as an open system in constant interaction with the environment (Santos, 2018).

BPS Concepts

According to Molina (1983), in order to understand the BPS model and its application, it is important to understand its four concepts. These include (1) the concept of illness multicausality, (2) the concept of vulnerability of systems, (3) the concept of holism, and (4) the dynamic process of an illness (Molina, 1983). While Molina (1983) refers to holism as a concept

and Santos (2018) refers to it as a philosophical underpinning, they both recognize the importance of holism in understanding the BPS model.

The concept of illness multicausality

According to Engel (1977), the biomedical model claims that biological indices are the only way to define a disease. However, he encouraged clinicians to take into account other contributing factors such as psychological factors and social factors that can help define and increase understanding of a medical condition (Engel, 1977). According to Molina (1983), a medical condition is an interaction of several factors; it is not due to just one single causative factor. To further explain the importance of this concept Molina (2018) used depression as an example of a complex health condition. According to Molina, researchers from different fields and scientific backgrounds have tried to study depression from different causal approaches. Biologically-oriented psychiatrists claim that depression is caused by a neurotransmitter dysfunction, while behavioral-psychiatrists believe that depression is caused by learned helplessness. Furthermore, cognitive behavioral therapists claim that negative thinking can potentially cause depression, which can lead to suicidal ideation but Molina claimed that depression can be caused by the interactions of all these factors (Molina, 1983).

The concept of the vulnerability of systems

The BPS concept of the vulnerability of systems is derived from the GST assumption that the human body is a set of systems in relationship with each other. The GST also views the human body as an open system in which the internal system (e.g., emotions, thoughts) can be affected or influenced by the external system (e.g., environment) resulting in vulnerability. (Molina, 1983). The BPS model further specifies the need to consider that vulnerability can be biological, psychological and/or social. By examining all these aspects of vulnerability, this will

help us better understand the dynamic process of the condition of a human being and provide better treatment for the person or patient (Molina, 1983). According to the BPS model, people who are biologically vulnerable are at higher risk for developing certain conditions due to genetic dispositions or exposure to certain risk factors. For example, an infant who is exposed to teratogenic drugs while in utero will be biologically vulnerable to develop congenital malformations. Furthermore, psychological vulnerabilities could be low self-esteem, learned helplessness, or poor frustration control. Lastly, social and cultural factors can place a person at risk for psychological vulnerability. For example, in certain cultures, the risk for PPD can be heightened when the women's partner has a particular gender (phenotypic sex) preference for the fetus especially if the women is aware that the fetus she carries has been identified as being of the opposite sex. If the child grows up aware of this preference, this could potentially affect the child's self-esteem later in life placing them in a vulnerable or at risk position to develop psychological disease in the future depending on the circumstances or inherent social stressors (Molina, 1983).

The concept of holism of human beings

Engel (1977) criticized the reductionist view of medical scientists and clinicians who devalued anything that could not be explained at a cellular or molecular level. In contrast to this traditional view, he viewed patients as whole sets of elements and took into consideration the physiological, emotional, social, and cultural domains (Engel, 1977). Another similar perspective holds that human beings should be viewed in relation to the body-mind interconnection and not as being comprised of two separate entities (Molina, 1983).

Illness as a dynamic process

With the BPS model, any illness needs to be observed as constantly changing or as a dynamic process. Illness should not be viewed as a steady state because biological, psychological, and social factors are in constant interaction with each other and with the external environment that surrounds and affects the individual (Molina, 1983). Egger (2013) shared similar views that health and illness are not states but highly complex and dynamic products of the constant interaction between many variables or factors.

BPS Model Application

The BPS model has been used in many research studies and has provided valuable contributions to clinical practice (Borrell-Carrió et al., 2004; Papadimitriou, 2017). Researchers have used the model to better understand and manage complex conditions. One such condition is depression which should be examined using a holistic approach taking into consideration the dynamic interaction between biological, psychological, and sociological variables (Kotsiubinskii, 2002; Schotte et al., 2006). The BPS model has allowed researchers to view and examine mental health conditions through a holistic and a multidimensional lens.

Maternal mental health has been mostly studied using the biomedical model that only recognizes biology as the cause of any health condition (Ross & Toner, 2004). This model attributed perinatal depression to the increased hormonal sensitivity that women experience during pregnancy (Bloch et al., 2000). However, other researchers that used a more holistic approach, found that perinatal depression could be attributed to a lack of social support and social isolation (Alhasanat & Fry-McComish, 2017; O'Hara, 1996). In an attempt to provide a holistic and multidimensional view of maternal mental health, Ross et al. (2004) examined mood changes during pregnancy in a sample consisting of 150 women using a BPS approach. The

study found that biological variables including genetic and hormonal factors have direct effect on psychosocial stress and anxiety. In addition, researchers reported that biological factors indirectly influenced depressive symptoms by affecting anxiety and social stressors which is associated with an increased depressive symptomology. This demonstrated the importance of the BPS model to obtain a more comprehensive understanding of complex conditions such as depression (Ross et al., 2004).

Postpartum Depression and Social Cognition

Because PPD is a complex and multidimensional condition, the BPS theoretical framework will be useful to guide the proposed study. By using the BPS model, we can achieve a better understanding of how social cognitive function is affected by biological, psychological, and social factors in women with and without PPD (Figure 2). The proposed study will examine the following variables concerning social cognition among women with PPD.

Biological Variables

In this study, biological variables will be age, anemia, incompetent cervix, eclampsia or pre-eclampsia, mode of delivery, unplanned or wanted pregnancy, gestational age at birth, and low birth weight.

Age. Previous research has shown an increased risk of PPD among women with advanced maternal age (AMA), defined as 35 years and older at the time of conception (Muraca & Joseph, 2014). In a Canadian study that included a sample of 2,326 women, researchers reported that PPD was significantly higher (17.0%) in women between the ages of 35–44 years in comparison to women younger than 35 years old (Muraca & Joseph, 2014). In addition, researchers found an inverse relationship between maternal age and risk for PPD in this sample. These findings were supported by a study that was conducted among Saudi women in which they

found that women above 25 years of age had a higher PPD rate (40%) in comparison to women younger than 25 years of age (35.6%; Nasr et al., 2020).

Anemia. Anemia during pregnancy has been defined by the World Health Organization (WHO) as hemoglobin (Hb) values less than 11 gm/dl, while it defines anemia during postpartum as Hb values less than 10 gm/dl (WHO, 2001). Several studies have examined the relationship between PPD and anemia (Alharbi & Abdulghani, 2014). In a Saudi sample that compared women with PPD (117 women) and healthy postpartum women (235 women), results showed that among 117 women with PPD, 56.4% had anemia during the postpartum period while 43.6% had normal Hb levels (Alharbi & Abdulghani, 2014). Eckerdal et al. (2016) reported similar results in a study conducted in Finland with a sample of 446 women; they found a significant association ($p = 0.014$) between depressive symptoms and low Hb levels during the postpartum period.

Incompetent Cervix. Researchers have identified that having a diagnosis of incompetent cervix is one of the risk factors that can increase maternal and fetal mortality and morbidity rates (Brandon et al., 2008). Other risk factors in addition to incompetent cervix are hypertension, diabetes, multiple pregnancies, toxemia, placenta previa, premature rupture of the membrane, and preterm labor (Brandon et al., 2008; Mbarak et al., 2019). However, incompetent cervix is the only risk factor significantly associated with severe depressive symptoms (Brandon et al., 2008). In a study that was conducted in the United States which included 129 women, Brandon and colleagues (2008) found a significant positive association relationship between PPD and incompetent cervix as an obstetric risk factor. The study attributed this finding to the management of the condition requiring bedrest confinement in the home or hospital. Several other studies examined the effects of bed rest on women with high-risk pregnancies and reported

that the women felt frustrated, anxious, and depressed (Gupton et al., 1997; Maloni & Park, 2005). In addition, women (mothers) were constantly worrying about the possibility of preterm labor, or loss of the pregnancy (Brandon et al., 2008).

Eclampsia and Preeclampsia. Several studies reported that pregnancy-related hypertension disorders were significant risk factors of PPD (Youn et al., 2017; Cetin et al., 2017). Cetin et al. (2017) investigated the association between preeclampsia severity and a woman's psycho-emotional state, including depression, in a sample consisting of 130 postpartum women (45 without pre-eclampsia, 44 with severe pre-eclampsia, and 41 with mild pre-eclampsia). After delivery, the women's psycho-emotional status was assessed which showed increased hospital anxiety and depression with severe preeclampsia compared to women with mild preeclampsia and healthy controls. These results also identified an inverse correlation between the disease severity and women's mental health.

A nationwide Korean study examined women who gave birth between January 1, 2010, and December 31, 2012, using data from the Health Insurance Review and Assessment (HIRA) service database (Youn et al., 2017). Of the 1,269,130 women in their sample, 17,483 (1.4%) had PPD. They reported a significant association ($p<0.001$) between preeclampsia and PPD even after adjusting for other obstetric complications.

Mode of Delivery. In a study that was conducted in Saudi Arabia with a sample size of 174 women, it was found that 45% of the 75 women who delivered via a caesarean section had PPD. Although few studies examined the effect of mode of delivery on PPD, they included these factors in their analysis. However, they did not find any significant differences in PPD between vaginal delivery and cesarean section. Furthermore, in an unpublished qualitative pilot project, the principal investigator (PI) of this research proposal (M.A) explored the lived experiences of

five Arab women living in the U.S. with PPD in 2019 and found that cesarean section had a negative influence on the mental health of some participants during their postpartum period. The PI felt this was attributed to the trauma associated with an emergency cesarean section, the long recovery period, feelings of failure and inadequacy, or being judged by others for not having a vaginal delivery (M.A).

Unplanned or Unwanted Pregnancy. Bener et al. (2012) conducted a cross-sectional study in Qatar with 2,091 women to examine the prevalence of depression, anxiety and associated risk factors. The study reported a significant correlation between depression and unplanned pregnancy. Alasoom and Koura (2014) conducted a study in Saudi Arabia among 450 women and found that unwanted pregnancy was a significant predictor of PPD. Similarly, AlModayfer et al. (2015) studied a Saudi sample and found that women who did not want the pregnancy had a higher PPD in comparison to women who wanted the pregnancy.

Gestational Age at Birth. Gulamani et al. (2013) examined the prevalence rate of PPD in women who had a full-term birth (170 women) compared to women who had a preterm birth (34 women), defined as less than 37 weeks gestation. The study found that women with a preterm birth had a higher rate of PPD (35.3%) compared to women with a full-term birth (15.3%). In another study that was conducted in Turkey, researchers reported that the prevalence rate of PPD in 149 women with late-term pregnancy (gestational age of $\geq$ 41 weeks), was 23.5% (Cirik et al., 2016). This increase in prevalence rate was thought to be the result of anxiety related to a prolonged pregnancy. Gestation prolongation can potentiate the fear of losing the baby or the need for an emergency caesarian section due to fetal distress (Cirik et al., 2016).

Low Birth Weight. The WHO has defined low birth weight as a birth weight that is <2500 grams (5.5lb; WHO, 2014). Alami et al. (2006) reported in a study conducted among 100

Moroccan women that low birth weight was a significant risk factor for PPD. Another study reported similar findings among Egyptian women (60 with PPD, 60 healthy controls) in that low birth weight was a significant risk factor for PPD ($p>0.001$) (Saleh et al., 2013).

Psychological Variables

In the proposed study, psychological variables will include the subjective evaluation of depression and anxiety during pregnancy and perceived stress using written instruments.

Depression and Anxiety during Pregnancy. It has been well-documented that depression and anxiety during pregnancy are significant predictors of PPD. In a study conducted in the United States, researchers found that antenatal depression and anxiety were significant risk factors for PPD in a sample of 50 Arab-American women (Alhasanat & Fry-McComish, 2017). Another study that included 798 German participants also reported that mothers with PPD had coexisting anxiety disorders (Reck et al., 2012).

Perceived Stress. Perceived stress is defined as the degree of perceived daily life stressors in the past month. In a longitudinal study that included 1316 postpartum women, researchers aimed to explore whether perceived stress mediated the relationship between perceived social support and depression, and if perceived stress or perceived social support can predict depressive symptoms (Leonard et al., 2020). The study found that perceived stress predicted depressive symptoms. In addition, it was reported that perceived stress mediated the association between perceived social support and depressive symptoms (Leonard et al., 2020).

In a quantitative study, Park et al. (2015) examined the relationship between perceived stress, social support, and empathy, a central component of social cognition that will be examined in the proposed study, in a sample of 2,692 medical students. They reported that

perceived stress is negatively correlated with empathy. In addition, stress and social support were found to be significant predictors of empathy.

Social Variables

In the proposed study, social variables will include the level of education, employment, level of income, and social support.

Maternal Education. There have been conflicting results when examining the relationship between the level of education and PPD. In a study of Saudi women, the PPD prevalence rate was higher in women with high educational levels (39.6%) in comparison to women with low educational levels (37%; Nasr et al., 2020). In contrast to these findings, a study conducted in Iran showed that women with low educational levels were at higher risk for PPD (Taherifard et al., 2013).

Employment. In a study conducted among 197 Iranian women after giving birth, women who were employed had a higher rate of PPD compared to unemployed women, which the researchers attributed to job stress (Taherifard et al., 2013). Inandi et al. (2002) reported different results in a cross-sectional study that examined PPD risk factors among 2,514 Turkish women who were randomly selected from five provinces of Turkey. They reported that the risk of PPD increased among unemployed mothers in comparison to employed mothers (Inandi et al., 2002). Similarly, another study conducted in Sweden found a positive relationship between unemployment and risk for PPD (Rubertsson et al., 2005).

Income. A study conducted in the United States reported that lower family income was a significant predictor of PPD because it increased the level of stress experienced by mothers (Beck, 2001). These findings were replicated in a study conducted in Saudi Arabia where

researchers found that women with lower income levels had a higher prevalence rate of PPD

(40.4%) compared to women with higher income levels (35.4%) (Nasr et al., 2020).

Social Support. Lack of social support has been reported as an essential risk factor for

PPD. In a Chinese study that examined the association between prenatal and postnatal social

support, researchers found that lack of postpartum social support was a stronger predictor of PPD

than lack of prenatal social support. In a quantitative study, Kizilirmak et al. (2020) assessed the

relationship between PPD and spousal support in a sample of 181 Turkish women. The study

found a significant inverse relationship between the level of spousal support and the level of

depressive symptoms. In a study conducted in Saudi Arabia, researchers examined the

prevalence rate of PPD and risk factors in a sample of 450 mothers. The study found that having

an unsupportive husband was the second-highest risk factor for PPD after a family history of

depression (Alasoom & Koura, 2014).

Social cognition

In this proposed study, social cognition is defined as the mental process by which people

make sense of their social world by which they perceive and process information (Quinn et al.,

2006). Social cognition is composed of three central components which are Theory of Mind

(ToM), empathy, and emotion recognition. These components are conceptualized as allowing

people to perceive, process, and interpret social information

ToM is defined as the ability to assess and understand the intentions of other people. It

also involves the ability to understand others' beliefs and thoughts that are different from one's

own beliefs and thoughts (Wolkenstein et al., 2011). ToM among women with PPD was

examined in only a limited number of studies from a neuroimaging perspective (Moses-Kolko et

al., 2010; Silverman et al., 2017; Wonch et al., 2016). Researchers who conducted these three

studies reported that women with PPD had significantly diminished brain activity in the dorsomedial prefrontal cortex and amygdala, which are important regions for ToM and social perception.

Empathy is defined as a person's ability to feel others' emotions and having the desire to relive their pain or discomfort (Decety & Jackson, 2004). In order to assess empathy we need to assess its two components which are affective empathy and cognitive empathy. Affective empathy is the ability to recognize and feel the emotions of others, whereas cognitive empathy is the ability to mentalize and understand others' emotional states (Davis et al., 1994; Shamay-Tsoory et al., 2011). Unlike ToM, empathy has not been examined in women with PPD.

Emotion recognition is defined as the ability to correctly identify different emotional states and facial expressions exhibited by other people. Researchers have found that patients diagnosed with MDD were less able to recognize the six basic human emotions (happy, sad, anxious, fear, anger, and frustration) compared to those in the healthy control group (Gur et al., 1992).

Chapter Summary

Postpartum Depression (PPD) is a complex health condition with several causative factors that are interrelated with each other. The mother's biological and psychological factors can play significant role in PPD. However, external factors such as her surrounding environment (e.g., partner, family) can also contribute to PPD. The proposed study investigated the association between PPD and social cognition (ToM, empathy, emotion recognition) and examine predictors of poor social cognition in Saudi women with PPD. Engle's BPS model guided the proposed study by providing a holistic approach due to the complexity of the

phenomenon. This holistic approach takes into account the interconnection between biological,

psychological, and social factors that can contribute to PPD in Saudi women.

Figure 1: Biopsychosocial Model Illustration (Taukeni, 2020)

BIOLOGICAL FACTORS
- Physical health
- Genetic vulnerabilities

SOCIAL FACTORS
- Peers
- Family circumstances
- Family relationships

PSYCHOLOGICAL FACTORS
- Coping skills
- Social skills
- Family relationship
- Self-esteem
- Mental health
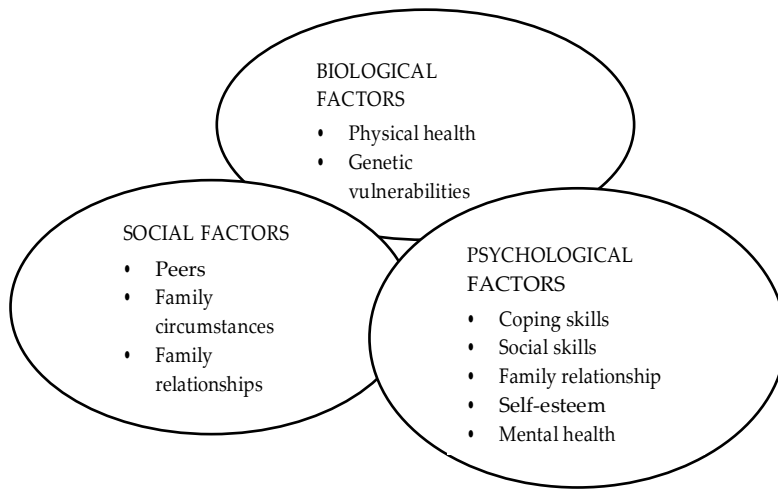
Figure 2: Biopsychosocial Model for Social Cognition in Postpartum Depression

Biological
Age
anemia
Incomptent cervix
Eclampsia and Preeclampsia
Mode of delivery
unplanned/unwanted pregancy
GA
birth weight

PPD

Social
Level of education
Employment
Level of income
Social support

Psycholgical
Antenatal depression
Antenatal anxiety
Perceviad stress

Social cognition

Theory of mind

Empathy

Emotion recognition
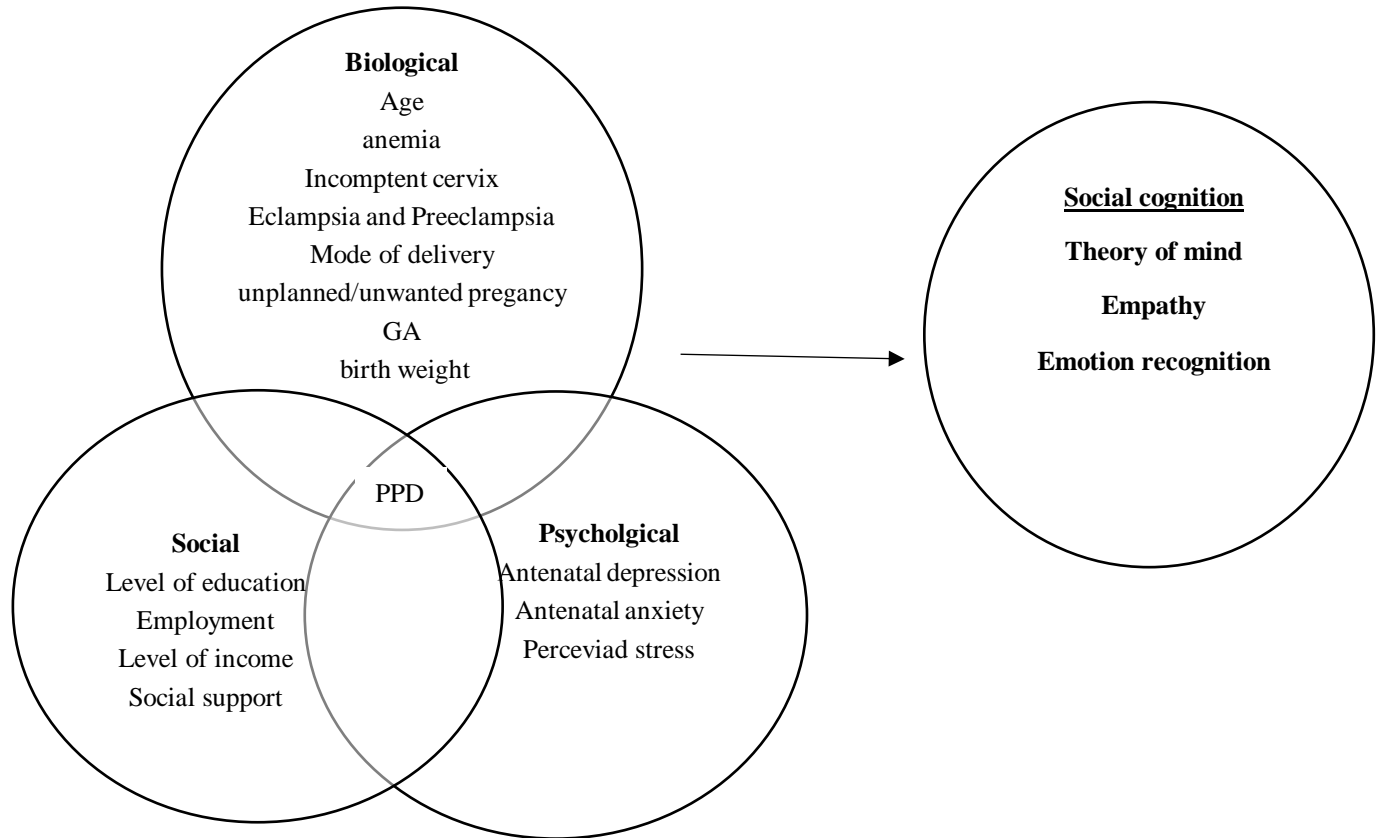
References

Alami, K. M., Kadri, N., & Berrada, S. (2006). Prevalence and psychosocial correlates of depressed mood during pregnancy and after childbirth in a Moroccan sample. *Archives of women's mental health*, *9*(6), 343–346. https://doi.org/10.1007/s00737-006-0154-8

Alasoom, L. I., & Koura, M. R. (2014). Predictors of postpartum depression in the eastern province capital of saudi arabia. Journal of family medicine and primary care, 3(2), 146–150. https://doi.org/10.4103/2249-4863.137654

Alharbi, A. A., & Abdulghani, H. M. (2014, February 17). Risk factors associated with postpartum depression in the Saudi population. Neuropsychiatric Disease and Treatment; Dove Press. https://doi.org/10.2147/NDT.S57556

Alhasanat, D., Fry-McComish, J., & Yarandi, H. N. (2017). Risk For Postpartum Depression Among Immigrant Arabic Women in the United States: A Feasibility Study. *Journal of midwifery & women's health*, *62*(4), 470–476. https://doi.org/10.1111/jmwh.12617

AlModayfer, O., Alatiq, Y., Khair, O., & Abdelkawi, S. (2015). Postpartum depression and related risk factors among Saudi females. International Journal of Culture and Mental Health, 8(3), 316–324. https://doi.org/10.1080/17542863.2014.999691

Alonso, Y. (2004). The biopsychosocial model in medical research: The evolution of the health concept over the last two decades. *Patient Education and Counseling*, *53*(2), 239–244. doi:10.1016/S0738-3991(03)00146-0

Bener, A., Gerber, L. M., & Sheikh, J. (2012). Prevalence of psychiatric disorders and associated risk factors in women during their postpartum period: a major public health problem and global comparison. International journal of women's health, 4, 191–200. https://doi.org/10.2147/IJWH.S29380

Bloch, M., P. J. Schmidt, M. Danaceau, J. Murphy, L. Nieman, and D. R. Rubinow. 2000. "Effects of Gonadal Steroids in Women With a Histow of Postparmm Depression." American Joarnal.fPsychiatry 157 (6): 924- 930

Borrell-Carrió, F., Suchman, A. L., & Epstein, R. M. (2004). The Biopsychosocial Model 25 Years Later: Principles, Practice, and Scientific Inquiry. *The Annals of Family Medicine*, *2*(6), 576. https://doi.org/10.1370/afm.245

Brandon, A. R., Trivedi, M. H., Hynan, L. S., Miltenberger, P. D., Labat, D. B., Rifkin, J. B., & Stringer, C. A. (2008). Prenatal Depression in Women Hospitalized for Obstetric Risk. The Journal of Clinical Psychiatry, 69(4), 635–643.

Bronfenbrenner, U. 1989. Ecological systems theory. Annals of Child Development. Vol. 6, 187-249.

Cetin O, Guzel Ozdemir P, Kurdoglu Z, Sahin HG (2017) Investigation of maternal psychopathological symptoms, dream anxiety and insomnia in preeclampsia. J Matern Neonatal Med 30:2510–2515. https://doi.org/10.1080/14767058.2016.1254185

Cirik, D. A., Yerebasmaz, N., Kotan, V. O., Salihoglu, K. N., Akpinar, F., Yalvac, S., & Kandemir, O. (2016). The impact of prenatal psychologic and obstetric parameters on postpartum depression in late-term pregnancies: A preliminary study. Taiwanese Journal of Obstetrics and Gynecology, 55(3), 374–378. https://doi.org/10.1016/j.tjog.2015.12.018

Corinna Reck, Daniela Noe, Jakob Gerstenlauer, Eva Stehle, Effects of postpartum anxiety disorders and depression on maternal self-confidence, Infant Behavior and Development, Volume 35, Issue 2, 2012, Pages 264-272, https://doi.org/10.1016/j.infbeh.2011.12.005.

C. T. Beck, "Predictors of postpartum depression: an update," *Nursing Research*, vol. 50, no. 5, pp. 275–285, 2001.

Davis, M. H., Luce, C., & Kraus, S. J. (1994). The heritability of characteristics associated with

    dispositional empathy. *Journal of Personality, 62*(3), 369−391. doi:10.1111/j.1467-

    6494.1994.tb00302.x

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral*

    and Cognitive Neuroscience Reviews, 3, 71–100.

Eckerdal, P., Kollia, N., Löfblad, J., Hellgren, C., Karlsson, L., Högberg, U., Wikström, A.-K., &

    Skalkidou, A. (2016). Delineating the Association between Heavy Postpartum

    Haemorrhage and Postpartum Depression. PLoS ONE, 11(1).

    https://doi.org/10.1371/journal.pone.0144274

Egger, J. W. (2013). Biopsychosocial Medicine and Health – the body mind unity theory and its

    dynamic definition of health. *M Edi z In*, 6.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. Science,

    196(4286), 129–136.

Gulamani, S. S., Premji, S. S., Kanji, Z., & Azam, S. I. (2013). Preterm Birth a Risk Factor for

    Postpartum Depression in Pakistani Women. Open Journal of Depression, 02(04), 72–81.

    https://doi.org/10.4236/ojd.2013.24013

Gupton A., Heaman M., Ashcroft T. Bedrest from the perspective of the high-risk pregnant

    woman. Journal of Obstetrics, Gynecologic, and Neonatal Nursing 1997; 26: 423–430

Gur RC, Erwin RJ, Gur RE, Zwil AS, Heimberg C, Kraemer HC. Facial emotion discrimination:

    II. Behavioral findings in depression. Psychiatry Res 1992; 42:241–251.

Inandi, O. C. Elci, A. Ozturk, M. Egri, A. Polat, and T. K. Sahin, "Risk factors for depression in

    postnatal first year, in eastern Turkey," *International Journal of Epidemiology*, vol. 31,

    no. 6, pp. 1201–1207, 2002.

Kızılırmak, A., Calpbinici, P., Tabakan, G., & Kartal, B. (2020). Correlation between postpartum

    depression and spousal support and factors affecting postpartum depression. *Health care*

    for women international, 1–15. Advance online publication.

    https://doi.org/10.1080/07399332.2020.1764562

Kotsiubinskii, A. (2002). A biopsychosocial model of schizophrenia. *International Journal of*

    Mental Health, *31*(2), 51–60. http://www.jstor.org/stable/41345017

Leonard, K. S., Evans, M. B., Kjerulff, K. H., & Symons Downs, D. (2020). Postpartum

    Perceived Stress Explains the Association between Perceived Social Support and

    Depressive Symptoms. *Women's Health Issues*, *30*(4), 231–239.

    https://doi.org/10.1016/j.whi.2020.05.001

Maloni J. A., Park S. Postpartum symptoms after antepartum bedrest. Journal of Obstetrics,

    Gynecologic, and Neonatal Nursing. 2005; 34: 163–171

Mbarak, B., Kilewo, C., Kuganda, S., & Sunguya, B. F. (2019). Postpartum depression among

    women with pre-eclampsia and eclampsia in Tanzania; a call for integrative intervention.

    BMC Pregnancy and Childbirth, 19(1), 270. https://doi.org/10.1186/s12884-019-2395-3

Mchichi Alami, K., Kadri, N. & Berrada, S. Prevalence and psychosocial correlates of depressed

    mood during pregnancy and after childbirth in a Moroccan sample. Arch Womens Ment

    Health 9, 343–346 (2006). https://doi.org/10.1007/s00737-006-0154-8

Molina J. A. (1983). Understanding the biopsychosocial model. *International journal of*

    psychiatry in medicine, *13*(1), 29–36. https://doi.org/10.2190/0uhq-bxne-6ggy-n1tf

Muraca, G. M., & Joseph, K. S. (2014). The Association Between Maternal Age and Depression.

    Journal of Obstetrics and Gynaecology Canada, *36*(9), 803–810.

    https://doi.org/10.1016/S1701-2163(15)30482-5

Nasr, R. S. A., Altharwi, K., Derbah, M. S., Gharibo, S. O., Fallatah, S. A., Alotaibi, S. G.,

    Almutairi, K. A., & Asdaq, S. M. B. (2020). Prevalence and predictors of postpartum

    depression in Riyadh, Saudi Arabia: A cross sectional study. *PLOS ONE*, *15*(2),

    e0228666. https://doi.org/10.1371/journal.pone.0228666

O'Hara, Michael, W., and Annette, M. Swain. 1996. "Rates and Risk of Postpartum Depression-

    A Meta-Analysis." InternationalRewiew ofPsychiaty 8: 37-54.

Papadimitriou, G. "The "Biopsychosocial Model": 40 years of application in

    Psychiatry." *Psychiatrike = Psychiatriki* vol. 28,2 (2017): 107-110.

    doi:10.22365/jpsych.2017.282.107

Park, K. H., Kim, D. H., Kim, S. K., Yi, Y. H., Jeong, J. H., Chae, J., Hwang, J., & Roh, H.

    (2015). The relationships between empathy, stress and social support among medical

    students. *International journal of medical education*, *6*, 103–108.

    https://doi.org/10.5116/ijme.55e6.0d44

Quinn, K. A., Macrae, C. N., & Bodenhausen, G. V. (2006). Social cognition. *Encyclopedia of*

    cognitive science.

Reck, C., Noe, D., Gerstenlauer, J., & Stehle, E. (2012). Effects of postpartum anxiety disorders

    and depression on maternal self-confidence. *Infant Behavior and Development*, *35*(2),

    264–272. https://doi.org/10.1016/j.infbeh.2011.12.005

Ross, L. E., Sellers, E. M., Gilbert Evans, S. E., & Romach, M. K. (2004). Mood changes during

    pregnancy and the postpartum period: development of a biopsychosocial model. *Acta*

    psychiatrica Scandinavica, *109*(6), 457–466. https://doi.org/10.1111/j.1600-

    0047.2004.00296.x

Ross, L. E., & Toner, B. (n.d.). Applying a BiopsychosociaI Model to Research on Maternal

    Health. 8.

Rubertsson, C., Wickberg, B., Gustavsson, P. *et al.* Depressive symptoms in early pregnancy, two months and one year postpartum-prevalence and psychosocial risk factors in a national Swedish sample. *Arch Womens Ment Health* **8,** 97–104 (2005). https://doi.org/10.1007/s00737-005-0078-8

Saleh, e., El-Bahei, W., Del El-Hadidy, M. A., & Zayed, A. (2013). Predictors of postpartum depression in a sample of Egyptian women. Neuropsychiatric disease and treatment, 9, 15–24. https://doi.org/10.2147/NDT.S37156

Santos, J. C., Bashaw, M., Mattcham, W., Cutcliffe, J. R., & Giacchero Vedana, K. G. (2018). The Biopsychosocial Approach: Towards Holistic, Person-Centred Psychiatric/Mental Health Nursing Practice. In J. C. Santos & J. R. Cutcliffe (Eds.), European Psychiatric/Mental Health Nursing in the 21st Century: A Person-Centred Evidence-Based Approach (pp. 89–101). Springer International Publishing. https://doi.org/10.1007/978-3-319-31772-4_8

Schotte, C. K. W., Van Den Bossche, B., De Doncker, D., Claes, S., & Cosyns, P. (2006). A biopsychosocial model as a guide for psychoeducation and treatment of depression. *Depression and Anxiety*, *23*(5), 312–324. https://doi.org/10.1002/da.20177

Shamay-Tsoory, S. G. (2011). The neural bases for empathy. *The Neuroscientist, 17*(1), 18−24. doi:10.1177/1073858410379268

Taherifard, P., Delpisheh, A., Shirali, R., Afkhamzadeh, A., & Veisani, Y. (2013). Socioeconomic, Psychiatric and Materiality Determinants and Risk of Postpartum Depression in Border City of Ilam, Western Iran. *Depression Research and Treatment*, *2013*, 653471. https://doi.org/10.1155/2013/653471

Taukeni, Simon George. "Psychology of Health". Intecopen. 2019. https://www.
    intechopen.com/books/psychology-of-health-biopsychosocial-approach . (erişim,
    16.11.2019)

Youn H, Lee S, Han SW, Kim LY, Lee TS, Oh MJ, Jeong HG, Cho GJ (2017) Obstetric risk
    factors for depression during the postpartum period in South Korea: a nationwide study. J
    Psychosom Res 102:15–20. https://doi.org/10.1016/j.jpsychores.2017.09.003

WHO (2001) Iron deficiency anemia: assessment, prevention and control. WHO/NHD/01.3,
    Geneva. World Health Organization, Switzerland

WHO (2014). Global Nutrition Targets 2025: Low birth weight policy brief. Retrieved
    https://www.who.int/nutrition/publications/globaltargets2025_policybrief_lbw/en/

Wolkenstein, L., Schönenberg, M., Schirm, E., & Hautzinger, M. (2011). I can see what you feel,
    but I can't deal with it: Impaired theory of mind in depression. *Journal of Affective
    Disorders, 132*(1-2), 104–111.

CHAPTER FOUR

METHODS

This chapter presents the research methods for this study which will examine social cognition in Saudi women with postpartum depression (PPD) compared to postpartum women who screen negative for depression. The research questions, aims and hypotheses, study design, sample selection and settings, data collection procedures, protection of human subjects, study measures, and statistical analysis will be described.

Purpose and Specific Aims

The purpose of this study was to compare social cognitive performance (emotion recognition, theory of mind, and empathy) in Saudi women with and without PPD. In addition, the aim of the study is to examine the relationship between social cognition, anxiety, and stress in Saudi women with PPD. Lastly, we aim to identify biological, psychological, and social predictors of cognitive function.

This study is designed to answer the following questions:

1. Is there a difference in social cognition between Saudi women with and without PPD?

2. Is there a relationship between of anxiety and stress and social cognition in Saudi women with PPD?

3. What is the demographic, biological, psychological, and social variables that can predict impaired social cognition in Saudi women with PPD?

Based on the literature review and theoretical framework, the specific aims and hypotheses for this study are:

Aim 1: To describe and compare social cognition (emotion recognition, theory of mind, empathy) in Saudi women who screened positive for PPD compared to the postpartum control group who screen negative for depression.

> Hypothesis 1: Saudi women with PPD will perform worse on social cognition measures compared to controls.

Aim 2: To examine the relationship between social cognition, anxiety, and stress in Saudi women with PPD.

> Hypothesis 2: Among Saudi women with PPD, anxiety and stress will be associated with worse social cognition.

Aim 3: To identify biological (age, maternal health, mode of delivery, unplanned pregnancy, gestational age, birth weight), psychological (anxiety and stress), and social (education, employment, income, and support) predictors of poor social cognition in women with PPD.

Methods

Study Design

A comparative, cross-sectional design was used to assess the three components of social cognition in women who screened positive for PPD compared to women who screen negative.

Sample Size

In order to determine the required sample size a G*Power 3.1 (Faul, Erdfelder, Lang & Buchner, 1996) analysis was initially performed for each aim for detecting medium effects; this yielded a total sample size of 199 postpartum women [135 with PPD and 64 without PPD] for this study. As detailed below, a maximum of 135 with PPD was initially calculated for Aim 3 and 64 without PPD for Aim 1.

Aim 1: a sample size of 128 subjects would allow detection of a medium (0.5) effect size on a two tailed independent two-sample t-test at an alpha of 0.05 and power of 0.80.

Aim 2: a sample size of 84 subjects with PPD would allow detection of a medium (r=0.3) effect size on a two tailed correlation bivariate test at an alpha of 0.05 and power of 0.80.

Aim 3: a sample size of 135 subjects would allow a detection of a medium (f^2=0.15) effect size for multivariate linear regression model at an alpha of 0.05 and power of 0.80 for 14 predictors in the model.

Because recruitment proved more difficult than expected, study intake was stopped at n=60 subjects with PPD and n=65 without PPD; additional details on sample accrual appears in the Results chapter. The final sample size was sufficient to detect medium effects of d=.51 for Aim 1 and medium-to-large effects of r=.35 for Aim 2 with power=.80; for Aim 3 the sample was sufficient to detect large effects for model significance (f^2=0.30) for a model with as many as all 14 possible predictors; note that the analysis process resulted in models with a maximum of 2 predictors, with the sample thus allowing detection of medium model effects (f^2=0.15).

Sample Inclusion/Exclusion Criteria

The study inclusion criteria were:

1. Postpartum Saudi women who gave birth in Saudi Arabia.

2. Age 21 to 45 years.

3. Speak and read either Arabic or English.

The PPD group was defined as postpartum women who score ≥ 10 points on the EPDS. The control group (without PPD) was defined as postpartum women who score < 10 points on the EPDS.

Women were excluded if they are taking medication with psychotropic activity or side effects; if they have a history or diagnosis of a psychiatric disorder (e.g., schizophrenia, bipolar disorders, MDD, PTSD, anxiety, and personality disorders), developmental or learning disorders (e.g., autism, ADHD), neurodegenerative disorders (e.g., multiple sclerosis, Huntington's disease, Parkinson disease), cognitive or physical disabilities precluding self-report (e.g. genetic condition with associated cognitive delays or visual impairment), traumatic brain injury, stroke, substance use disorder; and women who have had an intra-uterine demise (e.g., fetal death, stillbirth, or abortion), chronic medical conditions (e.g. asthma, seizure, non-gestational diabetes or hypertension).

Settings

A convenience sample was recruited from one hospital in the eastern region of Saudi Arabia that serves the study population. The recruitment site was King Fahad Military Medical City (KFMMC) located at Dammam city which serves only the military employees and their families, and their estimated total number of births is 3,600 per year.

Protection of Human Subjects in Research

Human subject protection approval was obtained from the University of California, Los Angeles (UCLA), KFUH, and KFMMC Institutional Review Boards (IRB). The principal investigator (PI) completed the training courses required by UCLA and the recruitment site.

The current study involved minimal risks to participants. Anticipated risks included evoking negative feelings and emotions that may upset the research participants during the data collection phase. Additionally, during the screening process, using the Edinburgh Postnatal Depression Scale (EPDS) tool, the PI could identify participants who are suicidal or severely depressed. In preparation for these scenarios, the PI chose a recruitment sites that have an

emergency room, psychiatric outpatient clinics, inpatient departments, and on-call physicians. Additionally, the PI established a relationship with three psychiatrists who agreed to accept referrals based on the EPDS scoring results. Participants, regardless of their EPDS scoring results, received a list of resources that serve patients with psychological problems or concerns in the eastern region.

The participant and PI signed and dated two copies of the informed consent. The participant received one copy, and the PI kept the other in a locked cabinet in the PI's office in Saudi Arabia. The consent form described in detail the purpose of the study, its risks, its potential benefits, the data protection methods, participants' rights, and the PI's contact information. The participants were informed that: (a) their participation in the study is voluntary and will not affect the care they or their infants receive, (b) they have the right to withdraw from the study at any time, and (c) the information collected during this study will be used for scientific purposes only.

Data Collection Procedure

The recruitment and data collection process was coordinated with the collaborating obstetricians at the recruitment site, nursing staff in the labor and delivery rooms, and the postpartum unit at each site where women would stay after delivery. Flyers of the study were available at the obstetrician's clinic and posted in the clinic waiting area. A waiver of consent was be obtained from the IRB to allow the PI to access patients' medical records to screen for eligibility. The PI screened daily admissions for eligibility. Women who are eligible and met the inclusion criteria were approached by the PI during their stay in the postpartum unit, and a flyer was offered that briefly described the study and what it entailed. If the patient showed interest, more details were provided about the study purpose, procedures, and how the information

obtained would be used. Time was allowed for potential participants to ask questions. If the patient agreed to participate in the study, then the participants' contact information was obtained by the PI. The PI contacted the participant one week after hospital discharge to schedule their study visit six weeks postpartum. Informed consent was obtained by the PI the day of the study visit in a private office or exam room.

Collaborators at KFMMC organized a well-women clinic in the evening, where participants were called for postpartum visits. After consent was obtained, the participants completed a demographic form and given the EPDS to determine group assignment [with or without PPD]. All participants provided self-report on anxiety, depression, stress, social support, and social cognition tasks or questionnaires. This took approximately 75-90 minutes to complete. At the end of all study measures, participants were compensated for their time. The collaborating obstetrician then saw the patients to provide medical care. Recruitment and data collection occurred during the period December 2022 to February 2024.

In order to maintain data confidentiality, the PI created a master list and on it, each participant was assigned a study identification code; only the PI had access to the master list. Study data was saved on the PI's password protected laptop, and consents / paper documents were stored in a locked file cabinet in the PI's office. The data will be saved until 6 years after the research study has been completed. After 6 years, information will be destroyed / deleted and / or shredded.

Study Measures

Demographic Data

The PI provided a form for participants to complete to capture demographic data (Appendix A). The following data were self-reported by participants: level of education, marital status, current employment status, and income level.

EPDS

EPDS is a 10-item self-administered instrument that asks women to report how they felt in the last 7 days (Cox et al., 1987). Each item is rated on a scale from 0 to 3, with a maximum score of 30. The cutoff point has been reported as 12/13 for "probable depression" and 9/10 for "possible depression," with a sensitivity of 86% and specificity of 78%. The internal consistency of the instrument has been assessed using the split-half method to determine the reliability of the instrument, which was found to be 0.88. EPDS has been translated into Arabic and validated in a sample of 95 postpartum Arabic women. Using a cutoff score of 10, the Arabic version demonstrated a sensitivity of 91% and specificity of 84%. The internal reliability of the scale was 0.84 (alpha Cronbach).

Interpersonal Reactivity Index (IRI)

The IRI is a self-reported instrument used to measure cognitive and affective empathy. The instrument consists of 28 items with 4 subscales (perspective-taking, fantasy, empathic concern, and personal distress) measured on a 5-point Likert scale ranging from 0 to 4. The perspective-taking and fantasy subscales are used to measure cognitive empathy, whereas the empathic concern and personal distress subscales are used to measure affective empathy (Davis, 1980, 1983). Internal reliability of each subscale has been reported as follows: perspective-taking subscale ($\alpha = 0.80$), fantasy subscale ($\alpha = 0.85$), empathic concern subscale ($\alpha = 0.84$), and personal distress subscale ($\alpha = 0.77$; Davis, 1980, 1983). The instrument was translated using back translation method; this included translating the source items by the PI from English into

Arabic and then back translating the items from Arabic into the source language (English) by the collaborating obstetrician. The back translated version will be compared against the original in English for discrepancies which was discussed by the PI and the collaborating obstetrician to review word meaning and rectify the discrepancies for accuracy. To assess content readability and understanding, the instrument was evaluated by a focus group of four adult Saudi women.

The Reading the Mind in the Eyes Test (RMET)-Revised

The RMET is a self-report test that measures ToM in adults. The RMET was developed and revised by Simon Baron-Cohen, a psychologist and professor at the University of Cambridge (Baron-Cohen et al., 1997, 2001). It includes 36 pictures of the eye region only showing different emotions. Participants have to choose from four options, the one that best described the emotional status of the people in the pictures. Scores range from 0 to 36, scores indicate the total number of correct responses. The options include complex emotions only (e.g., arrogant, reflective, amused). The reported reliability of RMET is r=0.67. The tool is available in Arabic through the publisher.

The Emotion Recognition Task (ERT)

The ERT task is used to assess facial emotion recognition. It is web based tool that is administered using an iPad that consist of 90 computer-morphed images derived from the facial features of real individuals, each showing a specific emotion, are displayed on the screen one at a time. Each face is displayed for 200ms and then immediately covered up to prevent residual processing of the image. The subject must select which emotion the face displayed from 6 options (sadness, happiness, fear, anger, disgust or surprise). Women were handed the iPad and had only 9 minutes to look at 90 images and complete the test. The scores range from 0 to 90 and

the higher the score the better emotion recognition. The tool is available through the publisher in Arabic language.

Generalized Anxiety Disorder 7-Item (GAD-7)

The GAD-7 is a 7-item self-administered tool that was developed by Robert L. Spitzer, Janet B. W. Williams, and Kurt Kroenke in 2006. The GAD-7 asks patients about anxiety symptoms they experienced in the last two weeks, including (a) feeling nervous, anxious, or on edge; (b) being able to stop or control worrying; (c) worrying too much about different things; (d) having trouble relaxing; (e) being restless; (f) becoming easily annoyed or irritable; and (g) feeling afraid as if something awful might happen. Each tool item is scored from 0 to 3, with a total score of 21. Scores of 15, 10, and 5 represent cut-off points for severe, moderate, and mild anxiety. The tool was evaluated in a sample of 2,740 primary care patients and demonstrated positive construct and convergent validity. Internal consistency was $\alpha = .92$, and test–retest reliability was 0.83 (Spitzer et al., 2006). The tool is available in Arabic through the publisher.

The Multidimensional Scale of Perceived Social Support (MSPSS)

The MSPSS scale measures perceived support from three different resources: family, friends, and significant others (Zimet et al., 1988). It is a 12-item scale, and each item is rated on a 7-point Likert scale ranging from very strongly disagree (= 1) to very strongly agree (= 7), with total scores ranging between 12 and 84. Internal reliability was reported for family, friends, and significant others as .87, .85, and .91, respectively. Total scale internal reliability was $\alpha = 0.88$ (Zimet et al., 1988). Test–retest reliability for family, friends, and significant others sub-scales was reported as .85, .75, and .72, respectively; for the MSPSS as whole scale, it was reported as .85. Moderate construct validity was reported based on the significant correlation between MSPSS and the Hopkins Symptom Checklist depression and anxiety subscales (Zimet et al.,

1988). The scale has been translated to Aarbic and validated in a Lebanese community sample that consisted of 221 adults, including both women and men. The internal consistency for the total score reported by the authors is $\alpha = 0.87$. Internal reliability was reported for family, friends, and significant others as .82, .86, and .95, respectively (Merhi & Kazarian, 2012).

The Perceived Stress Scale (PSS-10)

The PSS-10 is a self-reported measure of people's own perceptions of life events as stressful (Cohen et al., 1983). Sheldon Cohen developed the original version (PSS-14) in 1983 and later revised to a 10-item scale in 1988. Cohen removed four questions that did not load on the two factors obtained using exploratory factor analysis. The two factors included negative emotions and the inability to handle stress, as well as positive emotions and ability to act in stressful situations (Cohen et al., 1988). The 10-item scale is rated on a 5-point Likert scale ranging from 0 to 4 (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often). The total score ranges from 0 to 40 (higher scores indicate worse perceived stress).

An Arabic version of PSS-10 has been validated in a sample of 113 pregnant women, 97 postpartum women, and 58 controls who were neither pregnant nor postpartum (Chaaya et al., 2010). Validity was assessed by determining the correlation between the Arabic version of PSS-10 and the Arabic versions of the General Health Questionnaire (GHQ-12) and EPDS, which showed a significant positive correlation among PSS-10, GHQ-12, and EPDS. The reported internal consistency reliability of the PSS-10 Arabic version was 0.74.

Statistical Analysis

The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 27.0 [IBM; Somers, NY]. Scales scores was computed according to the instrument instructions for EPDS, IRI, RMET-R, ERT, GAD-7, MSPSS, and PSS-10. The

Shapiro-Wilk test was used to assess the normality of distribution of the data. Descriptive statistics of frequency and percentages were used for categorical variables (marital status, education status, employment status, income, unplanned pregnancy, mode of delivery) while means and standard deviation were used for continuous variables (maternal age, gestational age, birth weight, postpartum depression [EPDS], anxiety [GAD-7], Perceived stress [PSS-10], perceived social support [MSPSS], emotion recognition [ERT], empathy [IRI], theory of mind [RMET]). For all analyses to answer research questions, statistical significance was set at $p < 0.05$.

Aim 1. To describe and compare social cognition (emotion recognition, theory of mind, empathy) in Saudi women who screened positive for PPD compared to the postpartum control group who screen negative for depression.

Statistical analysis plan for Aim 1. To examine differences between groups for normally distributed variables, independent two-sample t-test were planned to be used and Mann-Whitney U for variables that were not normally distributed.

Aim 2. To examine the unconditional relationship anxiety and stress to social cognition in Saudi women with PPD.

Statistical analysis for Aim 2. To examine the relationship between anxiety and stress to social cognition, analysis included Spearman's Rho . Analyses were also extended to examine the relationship of social cognition to selected biological, psychological, and social variables to be considered as independent variables in Aim 3. The non-parametric correlation was applied for assessing all relationships because several of the independent variables were found to be non-normally distributed.

Aim 3. To identify biological (age, maternal health, mode of delivery, unplanned pregnancy, gestational age, birth weight), psychological (depression, anxiety and stress), and social (education, employment, income, and support) predictors of poor social cognition in women with PPD.

Statistical analysis for Aim 3. A multi-step process was used to build multivariable models for the three components of social cognition (ToM, empathy, emotion recognition). Variables associated at a $p <.25$ from Aim 2 analyses were used as potential predictors in a stepwise estimation procedure with least squares regression; models were estimated separately for each of the three social cognition components. Final models contained only predictors significant at p<.05 for each component of social cognition in PPD women. Assumptions for linear regression were assessed and include normality of residuals, homoscedasticity of residuals (where the scatter plot follows a linear line), and no multicollinearity across predictors; no violations of assumptions were found (Figure. 3) (Figure. 4) (Figure. 5).

Chapter Summary

This chapter provided a detailed description of the methodology that was used to answer the research questions and specific aims. A comparative, cross-sectional design was proposed to compare social cognitive performance (ToM, empathy, emotion recognition) in Saudi women with and without PPD. A sample of 125 (60 women with PPD, 65 control) was recruited through military hospital in the eastern region of Saudi Arabia. A set of reliable and valid instruments was used to address and answer the study aims.

Figure 3. Empathy Normality Linearity of Residuals

Histogram
Dependent Variable: Empathy

Mean = 2.52E-16
Std. Dev. = 0.992
N = 125
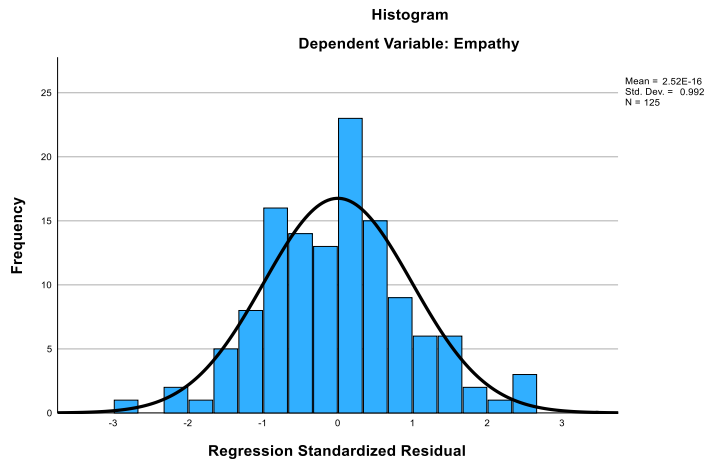
Figure 4. Emotion Recognition Linearity of Residuals

Histogram
Dependent Variable: Emotion recognition

Mean = 1.25E-15
Std. Dev. = 0.996
N = 125

87
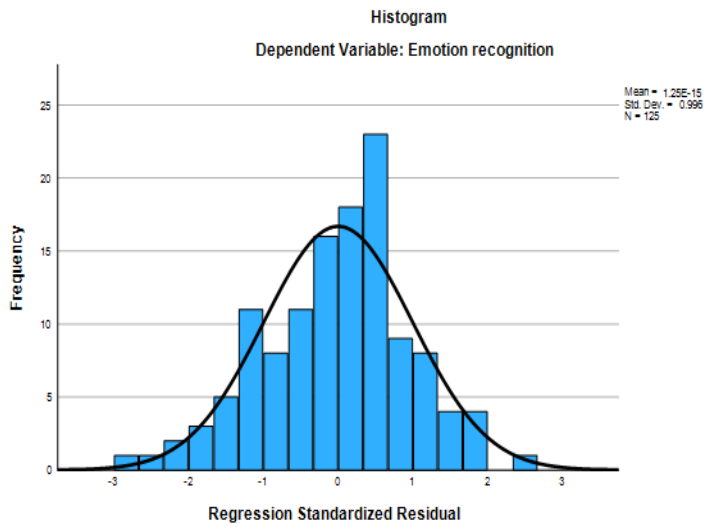
Figure 5. ToM Linearity of Residuals
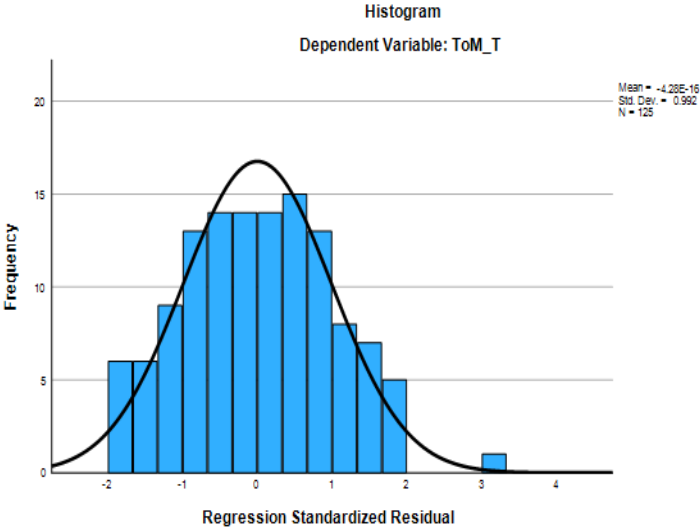
CHAPTER FIVE

RESULTS

This chapter presents the results of this study with a sample of Saudi postpartum women, which include the sample description and maternal and infant sample characteristics; mean scores for social cognition performance (emotion recognition, empathy, Theory of Mind [ToM]); and psychological, biological, and social independent variables in women with and without postpartum depression (PPD) at six weeks postpartum. The data was examined for normality using the Shapiro-Wilk test, which showed that the data was not normally distributed, so non-parametric testing was used. The results of testing each hypothesis were examined using Mann-Whitney U, Spearman's Rho for correlations, and stepwise linear multiple regression analyses to identify predictors of social cognition among women with PPD.

Aim 1:

To describe and compare social cognition (emotion recognition, empathy, ToM) in a sample of Saudi women who screened positive for PPD compared to women in the postpartum control group who screened negative for depressive symptoms.

Sample Description and Recruitment

The principal investigator (PI) identified and approached 164 Saudi postpartum women who were eligible for study participation. Out of the 164 potential participants, 11 declined participation due to a lack of interest in the study. Overall, 153 postpartum women showed interest in the study, and contact information was obtained to schedule data collection appointments at six weeks postpartum. Out of 153 participants, 28 failed to attend the data collection appointment due to a lack of transportation or family engagements. The remaining 125

participants attended the appointment, and after informed consent was obtained, completed all study requirements.

Participants were screened for PPD using the Edinburgh Postnatal Depression Scale (EPDS) and assigned to PPD or without PPD groups. The PPD group was defined as those with EPDS scores $\geq$ 10 points at six weeks postpartum, and the group without PPD as those with EPDS scores < 10 points at six weeks postpartum (Table 1). There was a statistically significant difference in women with and without PPD (14.62 $\pm$ 3.75 vs. 4.85 $\pm$ 2.27; p <.001) (Table 2).

Maternal Characteristics between Groups

The demographic characteristics of postpartum women who participated in the study are listed in Table 2. There was no statistically significant difference in maternal age, education, income, and employment between women with and without PPD. The mean maternal age in women with and without PPD was 30.7 (6.4) compared to 32.1 (standard deviation [SD]=5.7) years. In the total sample we had zero cases with incompetent cervix, seven with anemia, and six with eclampsia and pre-eclampsia. Fifty-three percent of women with PPD held college or university degrees, and 46% held only a high school degree. Meanwhile, 60% of women without PPD held college or university degrees, and 40% had high school degrees. Under half, 45%, of women with PPD had an income of more than 10,000 Saudi riyals per month in comparison to 56% of women without PPD. Seventy-five percent of women with PPD were unemployed in comparison to 72% of women without PPD.

There was a statistically significant difference in mode of delivery and planned pregnancy between women with and without PPD. Seventy percent of women with PPD had cesarean section deliveries and 30% had vaginal deliveries compared to 63% of women without PPD had a vaginal delivery, and 37% had a cesarean section (p < .001). Sixty-six percent of

90

women with PPD had unplanned pregnancies, and 33% were planned, whereas women without PPD had a 49% unplanned pregnancy rate and 51% planned (*p= .049)* (Table 2).

Infant Characteristics between Groups

The infants' characteristics in this study are listed in Table 2. There were statistically significant differences between groups based on gestational age and birth weight. The mean gestational age of infants born to women with and without PPD was 37.9 ± 1.4 weeks vs. 38.5 ± 1.01 weeks (*p*=.019), respectively. The mean birth weight (grams) in infants born to women with and without PPD was 3032.5 ± 431.5 vs. of 3152.8 ± 492.2 (*p*=.044), respectively. (Table 2).

Descriptive Statistic for Dependent Variable Social Cognition [Emotion Recognition, Empathy, ToM] between Groups

The mean scores for the three components of social cognition are listed in Table 2. The Emotion Recognition Task (ERT) was used to compare emotion recognition between women with and without PPD. A statistically significant difference was found in the mean score of emotion recognition performance in women with and without PPD (58.6 ± 5.7 vs. 70.37 ± 4.5; *p*<.001), respectively. The PPD group had worse emotional recognition scores compared to those without PPD.

The Interpersonal Reactivity Index (IRI) was used to examine empathy in women with PPD in comparison to women without PPD. There was a statistically significant difference in the mean scores of empathy among women with and without PPD (69 ± 8.7 vs. 65.2 ± 7.8; *p*<.001), respectively. However, the PPD group had better empathy scores compared to those without PPD.

Reading the Mind in the Eyes [RMET] was used to measure ToM in both groups. There was a statistically significant difference in mean scores among women with and without PPD

(22.88 ± 2.56 vs. 20.69 ± 2.44; *p*<.001), respectively. The PPD group had better ToM scores compared to those without PPD.

Descriptive Statistic for Independent Variables [Stress, Anxiety, Social Support]

The mean scores for the independent variables are listed in Table 2. The Perceived Stress Scale (PSS-10) was used to assess and examine the difference in perceived stress between the two groups. There was a statistically significant difference in PSS-10 mean scores among women with and without PPD (21.92 ± 6.04 vs. 14.60 ± 6.2; *p*<.001), respectively. The PPD group had worse perceived stress scores compared to those without PPD.

The Generalized Anxiety Disorder 7-item (GAD-7) was used to screen for anxiety and assess the difference between women with and without PPD. There was a statistically significant difference in GAD-7 mean scores among women with and without PPD (11.12 ± 4.25 vs. to 4.51 ± 3.62 ; *p*<.001), respectively. The PPD group had higher anxiety scores compared to those without PPD.

The Multidimensional Scale of Perceived Social Support (MSPSS) was used to assess perceived social support in both groups. There was a statistically significant difference in MSPSS mean scores among women with and without PPD (4.15 ± 1.58 vs. 5.10 ± 1.12; *p*<.001) , respectively. The PPD group had less social support compared to those without PPD.

Hypotheses

Hypothesis 1. Saudi women with PPD will perform worse on social cognition measures compared to controls.

A significant difference in social cognition across the three measures (emotion recognition, empathy, ToM) was found between groups. Women who had PPD performed significantly worse on the emotional recognition measure in comparison to controls. However,

women with PPD performed better in empathy and ToM measures compared to controls. The hypothesis was partially accepted.

Aim 2:

To examine the relationship between social cognition, anxiety, and stress in Saudi women with PPD.

Spearman's Rho correlations were computed on the dependent variables of social cognition (emotion recognition, empathy, ToM) in relation to the independent variables (psychological variables [anxiety, stress], biological variables [age, mode of delivery, unplanned pregnancy, gestational age, birth weight], and social variables [education, employment, income, and support]) in Saudi women with PPD.

Correlations between psychological, biological, and social variables and emotion recognition

Emotion recognition was negatively related to anxiety ($r = -.394$, $p =.002$) and stress ($r = -.154$, $p = .241$) in women with PPD. In contrast, emotion recognition was found to be positively correlated with social support ($r = .205$, $p = .116$), income ($r = .205$, $p =.115$), and mode of delivery ($r = .195$, $p = .134$) (Table 3). Note that correlations are mentioned in the text in this section and shown in Table 3 if p<.25; this criterion was used to select predictors for the initial multivariable regression models for Aim 3.

Correlation of psychological variables, biological variables, and social variables and empathy

In women with PPD, empathy was found to be negatively correlated with anxiety ($r = -.289$, $p = .025$), stress ($r = -.243$, $p = .062$), and age ($r = -.242$, $p = .062$). In contrast, empathy was positively related to social support ($r = .241$, $p = .064$), income ($r = .356$, $p =.005$), education ($r = .156$, $p = .235$), and mode of delivery ($r = .153$, $p = .244$) (Table 3).

Correlations between psychological, biological, and social variables and ToM

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In women with PPD, ToM was positively correlated with stress ($r = .373$, $p = .003$) and birth weight ($r = .264$, $p = .042$). Conversely, ToM was negatively correlated with income ($r = -.178$, $p = .173$) and education ($r = -.207$, $p = .113$) (Table 3).

Hypothesis 2. Among Saudi women with PPD, anxiety and stress will be associated with worse social cognition.

In women with PPD, a statistically significant correlation was not found between anxiety and ToM scores. However, a significant correlation was found between stress and ToM. Anxiety was found to have a significant negative correlation with emotion recognition scores and stress had a negative correlation with P value <0.25. In addition, anxiety had a significant negative correlation with empathy scores and stress had negative correlation with p value < 0.25. The hypothesis was partially accepted.

Aim 3:

To identify biological (age, mode of delivery, unplanned pregnancy, gestational age, birth weight), psychological (anxiety, and stress), and social (education, employment, income, and support) predictors of social cognition in women with PPD

Independent variables with a *p* value of at least 0.25 in correlation to emotion recognition, empathy, and ToM were entered into the regression models to identify predictors of social cognition among women with PPD. All regression assumptions were met to create an accurate and reliable model for prediction.

Predictors of Emotion Recognition

Anxiety was identified as the only statistically significant predictor of emotion recognition. An increase of 1 point in anxiety was associated with a .59 decrease in emotion recognition score, accounting for 17% of the variance (F=13.54, *p*<.001)(Table 4).

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Predictors of Empathy

Income and age were identified as significant predictors of empathy. An increase in income category was associated with a 6.41 increase in empathy score. A 1-year increase in age was associated with a .40 decrease in empathy scores. These two variables accounted for 16% of the variance of empathy (F=6.79, p=.002)(Table 4).

Predictors of ToM

Stress and birth weight were identified as ToM predictors. A 1 point increase in stress was associated with a .14 increase in the ToM score. In addition, a 1 gram increase in birth weight was associated with a .002 increase in ToM. These two variables accounted for 19% of the variance of ToM (F=6.98, p=.002)(Table 4).

Hypothesis 3. Biological (age, mode of delivery, unplanned pregnancy, GA, birth weight), psychological (anxiety, and stress), and social variables (education, employment, income, and social support) will predict social cognition in women with PPD.

In women with PPD, anxiety was a predictor of emotion recognition, income and age were found to be significant predictors of empathy, and stress and birth weight were significant predictors of ToM. The hypothesis was accepted.

Table 1. Study Recruitment Table

```
┌─────────────────────────────────────────┐
│  164 women eligible for participation    │
└─────────────────────────────────────────┘
                 │
                 │────────────►┌──────────────────────────────────────┐
                 │             │ 11  declined to participate in the   │
                 │             │     study due to Lack of interest    │
                 │             │     in the study                     │
                 ▼             └──────────────────────────────────────┘
┌─────────────────────────────────────────┐
│  153 women agreed to participate in the  │
│  study and contact information were      │
│  obtained                                │
└─────────────────────────────────────────┘
                 │
                 │────────────►┌──────────────────────────────────────┐
                 │             │ 28 women could not attend the data   │
                 │             │ collection appointment due to Lack   │
                 │             │ of transportation and family         │
                 │             │ obligations                          │
                 ▼             └──────────────────────────────────────┘
┌─────────────────────────────────────────┐
│  125 women consented to participated     │
│  and completed all study requirements    │
└─────────────────────────────────────────┘
                 │
         ┌───────┴───────┐
         ▼               ▼
┌──────────────┐  ┌──────────────────┐
│ With         │  │ Without          │
│ Postpartum   │  │ Postpartum       │
│ Depression   │  │ Depression       │
│ N=60         │  │ N=65             │
└──────────────┘  └──────────────────┘
```

Table 2. Sample Characteristics, Child Characteristics, Psychosocial Measures, and Social Cognition between Groups [n=125]

Variables	PPD [n=60]	Without PPD [n=65]	P value
	n (%) or mean [SD]		
Sample Characteristics			
Age, years	30.7(5.3)	32.11(5.7)	.155
Mode of delivery*			< .001
Vaginal delivery	18 (30%)	41 (63%)	
Cesarean section	42 (70%)	24 (37%)	
Planned pregnancy*			.049
Planned	20 (33%)	33(51%)	
Unplanned	40 (66%)	32(49%)	
Child Characteristics			
Gestational age, weeks	37.9 (1.4)	38.5 (1.01)	.019
Birth weight, grams	3032.5 (431.5)	3152.8 (492.2)	.044
Psychological Measures			
Stress (PSS-10)	21.92(6.04)	14.60(6.21)	<.001
Anxiety (GAD-7)	11.12(4.25)	4.51(3.62)	<.001
Postnatal Depression (EPDS)	14.62 (3.76)	4.85 (2.27)	<.001
Social Measures			
Social support (MSPSS)	4.15(1.58)	5.10(1.12)	.001
Employment			.734
Employed	15 (25%)	18 (27%)	
Unemployed	45 (75%)	47 (72%)	
Income, Saudi Riyal (SR)*			.185
5000-10000	33 (55%)	28 (43%)	
>10000	27 (45%)	37 (56%)	
Education, highest achieved*			.452
High school	28 (46%)	26 (40%)	
College or university degree	32 (53%)	39 (60%)	
Social Cognition Measures			
Emotional Recognition	58.6 (5.7)	70.37 (4.5)	<.001
Empathy	69 (8.7)	65.2 (7.8)	<.001
Theory of the Mind	22.88 (2.56)	20.69 (2.44)	<.001

PSS-10 = The Perceived Stress Scale; GAD-7 = General Assessment of Anxiety-7; EPDS = Edinburgh Postnatal Depression Scale; MSPSS=The Multidimensional Scale of Perceived Social Support.

Table 3. Spearman's Rho Correlations between Social Cognition [Emotional Recognition, Empathy and ToM] and Selected Independent Variables in **Women with PPD**[n=60]

Dependent Variable	Independent variable	Correlation Coefficient (r)	p-Value
Emotion Recognition	Anxiety	-.394	.002
	Stress	-.154	.241
	Social Support	.205	.116
	Income	.205	.115
	Mode of Delivery	.195	.134
Empathy	Anxiety	-.289	.025
	Stress	-.243	.062
	Social Support	.241	.064
	Income	.356	.005
	Education	.156	.235
	Age	-.242	.062
	Mode of Delivery	.153	.244
Theory of Mind (ToM)	Stress	.373	.003
	Birth Weight	.264	.042
	Income	-.178	.173
	Education	-.207	.113

Note that only independent variables with Spearman rho p values <.25 are listed in this table and were used in regression models whose results are shown in Table 4.

Table 4. Significant Predictors of Social Cognition in Women **with PPD** –Results from Stepwise Regression (n=60)

Model 1 – Emotional Recognition					
Variable	B	R^2	Adjusted R^2	F	p-value
Anxiety	-.591	.189	.175	13.54	<.001

Model 2 – Empathy					
Variable	B	R^2	Adjusted R^2	F	p-value
Income	6.41	.133	.118	6.79	.002
Age	-.401	.192	.164		

Model 3 – ToM					
Variable	B	R^2	Adjusted R^2	F	p-value
Stress	.145	.117	.102	6.98	.002
Birth Weight	.002	.197	.169		

Independent variables with p values < .25 (as shown in Table 3) were used as potential predictors in a

stepwise estimation process; results include only predictors significant at p<.05.

CHAPTER SIX

DISCUSSION

This chapter presents a discussion of the study's findings related to the components of social cognition (emotion recognition, empathy, ToM). The results of comparing social cognition in Saudi women who screened positive for PPD compared to the postpartum control group who screened negative for depression will be discussed. In addition, this chapter will address the psychological, biological, and social predictors of social cognition in Saudi women with and without postpartum depression (PPD) at six weeks postpartum. To help explain our findings, we will discuss the results in relation to what has been published in the literature.

Overall, the women in our sample who had PPD were struggling with many more difficulties compared to those who did not have PPD. These difficulties were related to their own physical and mental health. For example, women with PPD had significantly more unplanned pregnancies, C-sections, and babies of lower gestational age and birthweight. Participants with PPD reported more stress and more than double the anxiety of those without PPD. In addition, women with PPD reported less social support than those without PPD, so they had fewer people to rely on at a time when they were dealing with more difficulties and stressors than the women who did not have PPD.

Social Cognition and PPD

Our findings showed that the components of social cognition varied among our sample based on whether or not women had PPD. Women with PPD had worse emotion recognition in comparison to women without PPD, which made it difficult for them to accurately recognize and correctly classify the different ranges of emotions that were displayed on the ERT instrument. These findings were similar to the majority of studies that examined emotion recognition and attentional bias in pregnant women with depression and women with PPD (Arteche et al., 2011;

Pearson et al., 2010; Takubo et al., 2022). In a study that examined the effect of PPD on the processing of infant faces, Arteche et al. (2011) found that mothers in the United Kingdom (U.K.) who had PPD had less accuracy in recognizing happy faces and emotions than the non-depressed group. On the other hand, Arteche et al. (2011) did not find evidence that having PPD had effects on the accuracy of identifying sad faces. In another study that was conducted in Japan, researchers examined the relationship between emotion recognition bias and antenatal depression and found greater maternal sensitivity to the child's disengagement cues in pregnant women with antenatal depressive symptoms in comparison to non-depressed pregnant women. Emotion recognition is crucial because the infant's cues are primarily nonverbal, the mother's ability to process the child's facial expressions and respond appropriately to social cues is critical to mother-infant interactions and the mother's psychological well-being (Takubo et al., 2022). According to Pearson et al. (2010), pregnant women with depression in their sample in the UK tended to disengage from photographs of distressed infant faces more quickly than non-depressed women; those who were not depressed displayed an engagement bias towards distressed infant faces and social cues.

Unexpectedly, our results with the other two components of social cognition (empathy and ToM) showed that participants with PPD were more empathetic and had better ToM than women without PPD. In contrast to our findings, a study done in Italy that examined empathy toward children in parents with depressive symptoms found that parents with greater depressive symptoms reported lower levels of empathy (Salo et al., 2020). However, the study sample included both men and women with both acute and chronic MDD in the U.S. (Salo et al., 2020). In contrast to our findings that women with PPD had better ToM scores, in a study that was conducted in Germany, researchers examined ToM in men and women with MDD who did not

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have PPD, and found that participants with MDD showed deficits in ToM and difficulty in understanding social interactions (Zobel et al., 2010). In addition, they found that ToM impairment in MDD was significantly related to the severity of depressive symptoms. The difference between our findings and Zobel et al. (2010) could be due to the impact of hormonal changes during the postpartum period and coexisting anxiety that was prevalent in our sample of women with PPD. According to the literature, women with PPD experience coexisting anxiety. Differences in ToM performance might be attributed to the role of oxytocin. This hormone is essential for uterine contraction during labor, stimulation of lactation, and infant bonding (Stratheran, 2012). In a double-blind, placebo-controlled study, Domes and colleagues (2007) tested male volunteers for their ability to infer the affective mental state of others using the RMET after intranasal administration of oxytocin. The study found that oxytocin improved performance on the RMET compared with placebo suggesting that oxytocin may play a role in altered ToM responses in women (Domes et al., 2007).

One potential explanation for the higher level of empathy and stronger performance of ToM among the participants with PPD could be the combination of the study sample's culture and clinical condition. In terms of culture, our sample consisted of Saudi women, who were also practicing Muslims, and used Islamic guidelines and practices in their daily lives. The role of religion in Muslims life, emphasize the importance of religious practices like prayer, fasting, remembrance of God (Dhikr), and reading the Qur'an in promoting mental well-being and spiritual growth. These practices are seen as ways to cultivate inner peace, self-discipline, empathy towards others, and a sense of spiritual connection, contributing to overall mental health and well-being according to Islamic teachings.

Muslim patients are encouraged to perceive different experiences of health and illness with compassion and empathy toward others so God can bless them with what their hearts desire; many of which are health and recovery from disease. Since these women were struggling with PPD, they may have had cultural reasons to focus on enhancing their empathy towards others and to work harder to read the mind through the eyes of others to be more compassionate and fit with cultural and religious norms.

Holy Scripture may have also impacted the women with PPD. Empathy is a widely promoted concept in Islam; the scriptures show that the Prophet Muhammad (PBUH) said, *"None of you truly believes until he loves for his brother what he loves for himself"* (Tirmidhi, 1970). In the holy Quran, many verses talk about empathy and compassion between humankind; one of them is as follows:

> *O mankind, indeed we have created you from male and female and made you peoples and tribes that you may know one another. Indeed, the noblest of you in the sight of Allah is the most righteous of you* (The Holy Qur'an, 49:13).

Since Islam and the holy Quran encourage all humans to have empathy and compassion towards each other during times of sickness and health, this might explain the presence of empathy in both the depressed and non-depressed groups of participants in our study. In addition, Islam has emphasized the therapeutic nature of being empathetic and giving charity to those who are in need as a way of healing one's self. The Prophet Muhammad (PBUH) said, *"Treat your sickness with charity."* (Tirmidhi, 1970).

Psychological Variables and Social Cognition in Women with PPD

The results of our study showed that higher average anxiety and stress levels were found among women with PPD compared to controls in our sample. In addition, higher anxiety and

stress scores were associated with a lower ability to recognize emotions in others. Similar findings from other studies revealed that adult participants with anxiety disorders had a significant impairment in emotion recognition and their ability to correctly identify different emotional states. This might be due to the attentional bias toward negative emotions such as fear or anger among individuals with anxiety, which might lead them to incorrectly misclassify a facial expression (Kessler et al., 2007; Mohlman et al., 2007).Coexisting anxiety is not uncommon in women with PPD (Reck et al., 2012). Nakić Radoš and colleagues (2018) found in sample of 272 postpartum women living in Croatia that 22.4% reported depressive symptoms and of the women reporting depressive symptoms, 68.9% reported anxiety symptoms as well.

Three in four anxious women suffered from comorbid depressive symptoms, and two in three depressed women suffered from comorbid anxiety symptoms (Nakić Radoš et al., 2018). Our findings showed that most women with PPD had moderate anxiety based on the mean scores.

Furthermore, the negative correlation between emotion recognition and stress was seen in another study conducted in Canada which examined the effect of acute social anxiety on emotion recognition among a sample of 42 adult male participants. Results showed that people struggling with social anxiety also demonstrated impairment in identifying six emotional states in others (anger, fear, disgust, happiness, surprise, and sadness) (Daudelin-Peltier et al., 2017). Our findings also showed that anxiety and stress were negatively associated with empathy in women with PPD. Researchers in Korea conducted a study to investigate the impact of stress on empathy in both male and female students, revealing a negative correlation between empathy and stress (Park et al., 2015).

Our study showed that women with PPD who suffered from high stress had better ToM scores. It is possible that stress can be helpful when reading the mind in the eyes as ToM is linked to executive function due to shared neuronal connections in the prefrontal cortex (Blair et al., 2005; Lupien et al., 2002). Furthermore, studies conducted in adult and pediatric populations showed that exposure to stress and the increase cortisol levels were associated with improve executive function or cognition and thus could potentially enhance ToM (Blair et al., 2005; Lupien et al., 2002). However, these studies were not in women with PPD who have the addition of hormonal changes which may produce different results. While there is a lack of studies that examined the relationship between ToM and executive function in adults, studies in healthy children who experienced stress due to living in low income families showed a significant correlation between ToM and executive function tasks, regardless of their age and verbal skills. They also confirmed that whenever there was a deficit in ToM in their sample, there was consistently an impairment in executive function (Pellicano, 2007). The results of these studies might explain why women with PPD who were more stressed than women without PPD had better ToM scores.

Conversely, our results do not align with Zobel et al. (2010) who found that chronically depressed men and women showed deficits in ToM, particularly in reading social interactions, compared to controls without depression (Zobel et al., 2010). The chronically depressed patients in Zobel et al. (2010) were pharmacologically treated with antidepressants, which can make you feel less alert or unable to concentrate possibly affecting ToM testing. This might explain the difference in better ToM in our population with PPD who were not on medication.

Biological Variables and Social Cognition in Women with PPD

Our study's results revealed that women with PPD who had a cesarean section had more difficulty with emotion recognition than women who had vaginal delivery. The stress and anxiety that a mother might feel when undergoing a surgical procedure, as well as the unknown outcome of her and her baby's well-being, may have caused uncertainty. Chen and colleagues (2017) conducted a population-based cohort study with 25,238 Taiwanese women and examined the effect of cesarean birth on postpartum stress symptoms and anxiety. They found that cesarean birth was significantly associated with an increased incidence of postpartum stress symptoms during the entire one-year postpartum period (Chen et al., 2017). Since our results showed that stress affected emotion recognition negatively, this might explain why women who had cesarean sections had more difficulty with emotion recognition in comparison to women who had vaginal deliveries.

Our findings also showed that the older women with PPD were less empathetic than women without PPD. There may be a connection between aging and empathy. For example, Beadle and De la Vega (2019) conducted a large nationally representative cross-sectional study of US adults born between 1920 and 1999, ages 18 to 90, and found an inverse relationship between age and empathy. They concluded that empathy increased from young adulthood and peaked in middle age before declining in older age (Beadle & De la Vega, 2019). In another study that examined the association between empathy and age among adult men and women living in the U.K., researchers found differences in empathy between genders as well as age-related variances. For women, empathy improved with age and then started to decline at the age of 45 (Sommerlad et al., 2021).

Finally, our findings showed that as the infant's birth weight increased, the mothers had better ToM scores. No other studies have resulted in similar findings. Thus, additional research will be needed to explore the reason for this perplexing finding.

Social Variables and Social Cognition in Women with PPD

Our results showed that as income increases and social support increases, the ability to recognize emotions increases among women with PPD in our sample. This is an important finding as it suggests that financial and social resources can impact something very important for competent parenting, namely, emotion recognition. Our previous findings, which demonstrated that anxiety is negatively associated with emotion recognition, support this finding by suggesting that women with better socioeconomic status experience less anxiety and worry. As anxiety increases, the ability to recognize emotions decreases in our sample.

In addition, our results showed that having a higher income, more social support, and higher education were associated with higher level of empathy among women with PPD in our sample. In a study that examined socioeconomic status on cognition and socioemotional processes, researchers found that people with low socioeconomic status (SES) tend to have reduced cognitive abilities and executive functions due to lack of access to stimulating activities, education, good nutrition, and the stress of living in a low income household (Migeot et al., 2022). Additionally, this study highlights that low SES indirectly affects social cognition, including emotion recognition and Theory of Mind (ToM), as well as counter-empathy, through a combination of affective, cognitive, and executive impairments. This suggests that socioeconomic factors can impact various aspects of cognitive and social functioning (Migeot et al., 2022). Interestingly, although not statistically significant, we found the relationship in the

opposite direction for ToM, such that women who had higher income and education had worse ToM, which does not align with Migeot et al.'s (2022) findings.

Predictors of Social Cognition

Emotion Recognition. Our study sample showed that higher levels of anxiety can explain part of the variability in emotion recognition. The higher the anxiety level, the greater the deficits in recognizing the emotions of others among Saudi women with PPD.

Empathy. We found that as age increases in postpartum women in our sample, their level of empathy decreases. Conversely, as household income increases, empathy levels among Saudi women with PPD increase, which might be due to less stress because, as our study found that stress negatively affects empathy levels.

ToM. The results showed that as stress levels increased in our sample of Saudi women with PPD, their ability to read the mind in the eyes increased, which might be due to the effect of the stress-releasing hormone cortisol on the brain's executive function, which, as shown in previous studies, has been linked to improved ToM because the brain region responsible for both executive function and ToM is the same.

Overall, the biological, psychological, and social components explained a small percentage of the variance of social cognition 16-18% only (emotional recognition, empathy, and ToM) in Saudi women with PPD. Further research is needed to identify other aspects that could be impacting social cognition.

Limitations

The results of this study must be viewed in light of some limitations. Our sample was primarily recruited from one institution, a military hospital that serves military workers and their families. The families of military sector employees have similarities in SES due to the

unification of salary scales. Furthermore, the military culture deeply entrenches mental health stigma, potentially influencing women's reluctance to participate in the study or attend data collection appointments, and avoiding disclosure or seeking help for mental health difficulties (Alduraywish, 2022; Iversen et al., 2011). This stigma may discourage military personnel from helping their wives seek the necessary mental health support. Lastly, due to the small sample size, we cannot generalize our findings to all Saudi women, and we cannot possibly determine any causal relationship between the independent variables and the dependent variables.

Conclusion

Our sample of Saudi women showed significant differences in social cognition (emotional recognition, empathy, and ToM) between women with and without PPD. Women with PPD scored lower on emotion recognition, but higher on empathy and ToM. Age, income, anxiety, stress, and child's birth weight affected social cognition in this sample of Saudi women with PPD. This study highlights decreased ability among participants with PPD to recognize emotions, increased empathy, and heightened ability to interpret the mind of others through the eyes (ToM). This may reflect a maternal hypersensitivity to social stimuli due to their condition and/or a stressed or anxious state.

References

Alduraywish, M. (2022) The Awareness of PTSD in Military Personnel among Clinical Social

Workers and Psychologists in Health-Care Centers. *Advances in Applied Sociology*, **12**,

613-633. doi: 10.4236/aasoci.2022.1210043.

Arteche, A, Joormann, J, Harvey, A, Craske, M, Gotlib, IH, Lehtonen, A, Counsell, N, Stein, A (

2011). The effects of postnatal maternal depression and anxiety on the processing of

infant faces. Journal of Affective Disorders 133, 197–203

Beadle, J.N. & De la Vega, C.E. (2019). Impact of aging on empathy: Review of psychological

and neural mechanisms. *Frontiers in Psychiatry*, *10*(331), pmid:31244684.

Blair, Clancy & Granger, Douglas & Razza, Rachel. (2005). Cortisol Reactivity Is Positively

Related to Executive Function in Preschool Children Attending Head Start. Child

development. 76. 554-67. 10.1111/j.1467-8624.2005.00863.x.

Chen, H. H., Lai, J. C., Hwang, S. J., Huang, N., Chou, Y. J., & Chien, L. Y. (2017).

Understanding the relationship between cesarean birth and stress, anxiety, and depression

after childbirth: A nationwide cohort study. *Birth (Berkeley, Calif.)*, *44*(4), 369–376.

https://doi.org/10.1111/birt.12295

Daudelin-Peltier, C., Forget, H., Blais, C. Deschenes, A & Fiset, D. (2017). The effect of acute

social stress on the recognition of facial expression of emotions. *Scientific Reports* 7,

1036.

Domes, G., Heinrichs, M., Michel, A., Berger, C., & Herpertz, S. C. (2007). Oxytocin improves

"mind-reading" in humans. *Biological psychiatry*, *61*(6), 731–733.

https://doi.org/10.1016/j.biopsych.2006.07.015

Hodges, S. D., Kiel, K. J., Kramer, A. D., Veach, D., & Villanueva, B. R. (2010). Giving birth to

empathy: The effects of similar experience on empathic accuracy, empathic concern, and

perceived empathy. Personality and Social Psychology Bulletin, 36(3), pp. 398-409. doi:10.1177/0146167209350326

Iversen, A. C., van Staden, L., Hughes, J. H., Greenberg, N., Hotopf, M., Rona, R. J., & Fear, N. T. (2011). The Stigma of Mental Health Problems and Other Barriers to Care in the UK Armed Forces. BMC Health Services Research, 11, Article No. 31.

Kessler H., Roth J., von Wietersheim J., Deighton, R.M., & Traue, H.C. (2007). Emotion recognition patterns in patients with panic disorder. *Depression and Anxiety, 24*(3), 223–226.

Lupien, S. J., Wilkinson, C. W., Briere, S., Menard, C., YingKin, N., & Nair, N. (2002). The modulatory effects of corticosteroids on cognition: Studies in young human populations. Psychoneuroendocrinology,27, 401 – 416

Migeot J, Calivar M, Granchetti H, Ibáñez A, Fittipaldi S. Socioeconomic status impacts cognitive and socioemotional processes in healthy ageing. Scientific Reports. 2022 Apr;12(1):6048.

Mohlman J., Carmin, C.N., & Price, R.B. (2007). Jumping to interpretations: Social anxiety disorder and the identification of emotional facial expressions. *Behaviour Research and Therapy 45*(3), 591–599.

Nakić Radoš S, Tadinac M, Herman R. Anxiety During Pregnancy and Postpartum: Course, Predictors and Comorbidity with Postpartum Depression. Acta Clin Croat. 2018 Mar;57(1):39-51. doi: 10.20471/acc.2017.56.04.05. PMID: 30256010; PMCID: PMC6400346.

Park, K.H., Kim, D., Kim, S.K., Yi, Y.H., Jeong, J.H., Chae, J.E., Hwang, J., & Roh, H. (2015).
The relationships between empathy, stress and social support among medical students. *International Journal of Medical Education, 6*, 103 - 108.

Pearson, R. M., Cooper, R. M., Penton-Voak, I. S., Lightman, S. L., & Evans, J. (2010).
Depressive symptoms in early pregnancy disrupt attentional processing of infant emotion. *Psychological medicine*, *40*(4), 621–631.
https://doi.org/10.1017/S0033291709990961

Pellicano, E. Links between theory of mind and executive function in young children with autism: clues to developmental primacy. Dev. Psychol. 43, 974–990 (2007).

Salo, V.C., Schunck, S.J., & Humphreys, K.L. (2020). Depressive symptoms in parents are associated with reduced empathy toward their young children. *PLoS One*, 15(3), e0230636. doi: 10.1371/journal.pone.0230636

Sommerlad, A., Huntley, J., Livingston, G., Rankin, K. P., & Fancourt, D. (2021). Empathy and its associations with age and sociodemographic characteristics in a large UK population sample. *PloS one*, *16*(9), e0257557. https://doi.org/10.1371/journal.pone.0257557

Strathearn L. (2011). Maternal neglect: oxytocin, dopamine and the neurobiology of attachment. *Journal of neuroendocrinology*, *23*(11), 1054–1065.
https://doi.org/10.1111/j.1365-2826.2011.02228.x

The Holy Qur'an 49.13 (Translated by M.A.S. A. Haleem)

Takubo Y, Tsujino N, Aikawa Y, Fukiya K, Uchino T, Katagiri N, Ito M, Akiba Y, Mizuno M, Nemoto T. Relationship between Antenatal Mental Health and Facial Emotion Recognition Bias for Children's Faces among Pregnant Women. *Journal of Personalized Medicine*. 2022; 12(9):1391

Tirmidhī, Muḥammad ibn ʻĪsá, -892. (1970). Jami al-Tirmidhi. Maa sharḥihi Tuḥfat al-aḥwadhi /

li-Abd al-Raḥman al-Mubarakfuri. Beirut (Lebanon) :Dar al-Kitab al-Arabi,

Zobel, I., Werden, D., Linster, H., Dykierek, P., Drieling, T., Berger, M., & Schramm, E. (2010).

Theory of mind deficits in chronically depressed patients. *Depression and Anxiety, 27*(9),

821–828.

CHAPTER SEVEN

CONCLUSION

Postpartum depression (PPD) presents a significant mental health challenge for women in their reproductive years, particularly among Saudi women, where it is highly prevalent. PPD is linked with cognitive difficulties and potential deficits in social cognitive function, which involves the capacity to recognize, understand, and respond to social cues. Since social cognition encompasses various aspects, including emotion recognition, empathy, and theory of mind (ToM), impairments in social cognition can hinder a mother's ability to attend to her infant's needs and interpret their cues, potentially influencing the infant's development. Despite its importance, there is limited research on Saudi women with PPD and its impact on social cognition. This study compared the social cognitive abilities of Saudi women with and without PPD; investigated the role of biological, psychological, and social factors in relation to social cognition; and identified factors predictive of social cognitive functioning.

Implications for clinical practice and policy

Our study identified a high prevalence rate of PDD among Saudi women at six weeks postpartum, at 48%. The American Academy of Pediatrics (AAP) recommended that pediatricians screen mothers for postpartum depression (PPD) during the infant's 1, 2, 4, and 6-month well-child (WC) visits (Lamere & Golova, 2022). Although the prevalence rate of PPD is high among our sample, there is currently no routine screening of maternal mental health during antenatal visits, postpartum periods, or WC visits in Saudi Arabia. In fact, the obstetrics and gynecology clinics do not routinely offer a postpartum visit, so once the woman delivers, she will not be seen in the clinic unless she has complications or is referred by her primary physician.

Early detection of women with depressive symptoms during the antenatal and postpartum periods will assist healthcare providers in providing a variety of preventative and treatment modalities to this population. To advocate for women's well-being during the postpartum period, comprehensive policies are essential. Both public and private hospitals should implement health policies mandating early screening for PPD using validated tools, alongside a standardized 6-week postpartum visit to assess mothers' physical and emotional health. It is imperative to ensure that obstetricians and pediatricians receive proper training to effectively screen for PPD, enabling early identification and intervention. Additionally, a collaborative referral protocol should be established among obstetricians, pediatricians, and psychiatrists to streamline the process of identifying and referring women with PPD symptoms for specialized care. Finally, to enhance accessibility, telehealth and home health services should be widely implemented and provided, offering convenient avenues for women to receive support and treatment for PPD. In addition, our study was able to identify aspects of social cognition that are compromised in Saudi women with PPD. The results of our study will help healthcare providers and policy decision makers develop health policies, guidelines, and individually-tailored medical care that will meet the needs of Saudi women to improve their function (activity of daily living, social cognitive function, and social function).

Directions for Future Research

Future research is needed to expand our knowledge on the effect of mental health and PPD specifically on social cognitive function among Saudi women by including a greater diversity of samples from different health institutions and geographical locations so it will represent the diversity in Saudi society. Due to the small sample size and the lack of diversity within our sample, a small percentage of the variance of social cognition was explained by the

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biological, psychological, and social variables that we included, so further research is needed with a larger sample size to identify other aspects that could be impacting social cognition. In addition, utilizing a mixed-method approach, incorporating both quantitative and qualitative research designs, is essential for fully comprehending the complexity of PPD. By combining these approaches, researchers can gain a more holistic understanding of PPD, facilitating the development of targeted interventions tailored to individuals' unique needs.

Lastly, future research should take into consideration the choice of instrument that is appropriate for the studied population because in our research study most women voiced concerns regarding using the ERT instrument since it was the only instrument that was web-based and women had to use an iPad to answer the questions.

References

Lamere, K., & Golova, N. (2022). Screening for Postpartum Depression During Infant Well

Child Visits: A Retrospective Chart Review. *Clinical pediatrics*, *61*(10), 699–

706. https://doi.org/10.1177/00099228221097272

Appendix A

Consent Form

University of California, Los Angeles

CONSENT TO PARTICIPATE IN RESEARCH

Social Cognition among Saudi Women with and without Postpartum Depression (PPD)

INTRODUCTION

Maha alshammari BSN, MSN,RN Principal Investigator (PI) and Dr. Nancy Pike, Dr. Marysue Heilemann, Dr. Mary-Lynn Brecht, and Dr. Wei-Ti Chen (Faculty Sponsors) from the School of Nursing at the University of California, Los Angeles are conducting a research study. You were selected as a possible participant in this study because you are six weeks postpartum Saudi woman. Your participation in this research study is voluntary.

WHAT SHOULD I KNOW ABOUT A RESEARCH STUDY?

- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

WHY IS THIS RESEARCH BEING DONE?
This study will help us examine social cognition in women with and without postpartum depression. Social cognition means our ability to understand and respond to social stimuli such as crying baby. This study will examine how postpartum women with and without PPD recognize facial emotions, understand the mental states and what others think, and examine their empathy. Also, this study will help us know if there is any relationship between postpartum depression, anxiety, stress, and social cognition.

HOW LONG WILL THE RESEARCH LAST AND WHAT WILL I NEED TO DO?

Participation will take a total of about 70-90 minute, and it will be only one time visit. If you volunteer to participate in this study, the researcher will ask you to schedule a study visit 6 weeks postpartum. The PI will ask you to do the following:
- On the day of participation in this study, the PI will obtain verbal and written informed consent for your participation (10 minutes).

- You will allow the PI to screen for PPD using questionnaire designed for this named EPDS (10 minutes)
- You will Complete demographic data form and six questionnaires that assess anxiety, social support, stress, and three social cognition questionnaires (50-70 minutes)
- You will allow the PI to review your medical chart regarding your past medical history, pregnancy, delivery, and baby's health.

ARE THERE ANY RISKS IF I PARTICIPATE?
There are minimal risks involved with participating in the research study. You might experience an increased awareness of feelings and emotions may arise during the data collection visit.

ARE THERE ANY BENEFITS IF I PARTICIPATE?
Although there are no direct benefits to your participation in the research study, the results of this study will provide valuable information to understand how women with postpartum depression receive, recognize, and respond to social stimuli in comparison to women without postpartum depression. This information will help healthcare providers to recognize women with postpartum depression needs and provide better care and it will help future research to examine this issue more in depth based on the results.

HOW WILL INFORMATION ABOUT ME AND MY PARTICIPATION BE KEPT CONFIDENTIAL?
The researchers will do their best to make sure that your private information is kept confidential. Information about you will be handled as confidentially as possible, but participating in research may involve a loss of privacy and the potential for a breach in confidentiality. Study data will be physically and electronically secured. As with any use of electronic means to store data, there is a risk of breach of data security.

Use of personal information that can identify you:
Any information that is obtained in connection with this research study and that can identify you will remain confidential. It will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of using a unique identifying code in lieu of personal identity.

How information about you will be stored:
Completed questionnaires will be sealed in an envelope with only code number for immediate transport to the research office and secured under lock and key.

People and agencies that will have access to your information:
Only the PI, her sponsor faculty members, and authorized UCLA personnel may have access to study data and records to monitor the study. Research records provided to authorized, non-UCLA personnel will not contain identifiable information about you. Publications and/or presentations that result from this study will not identify you by name.

How long information from the study will be kept:
The data will be saved until 6 years after the research study has been completed. After 6 years, information will be destroyed / deleted and / or shredded.

USE OF DATA FOR FUTURE RESEARCH
Your data, including de-identified data may be kept for use in future research.

WILL I BE PAID FOR MY PARTICIPATION?
You will receive a gift card to a local store for the amount of 75 Saudi Riyal.

WHO CAN I CONTACT IF I HAVE QUESTIONS ABOUT THIS STUDY?

The research team:
If you have any questions, comments or concerns about the research, you can talk to the one of the researchers. Please contact:
Maha Alshammari MSN, BSN, RN, By phone: By email:

UCLA Office of the Human Research Protection Program (OHRPP):

If you have questions about your rights as a research subject, or you have concerns or suggestions and you want to talk to someone other than the researchers, you may contact the UCLA OHRPP by phone: (310) 206-2040; by email: participants@research.ucla.edu or by mail: Box 951406, Los Angeles, CA 90095-1406.

WHAT ARE MY RIGHTS IF I TAKE PART IN THIS STUDY?

- You can choose whether or not you want to be in this study, and you may withdraw your consent and discontinue participation at any time.
- Whatever decision you make, there will be no penalty to you, and no loss of benefits to which you were otherwise entitled.
- You may refuse to answer any questions that you do not want to answer and still remain in the study.

You will be given a copy of this information to keep for your records.

HOW DO I INDICATE MY AGREEMENT TO PARTICIPATE?

If you want to participate in this study you should sign and date below.

SIGNATURE OF THE PARTICIPANT

_____
Name of Participant

_____   _____
Signature of Participant   Date

SIGNATURE OF PERSON OBTAINING CONSENT

_____   _____
Name of Person Obtaining Consent   Contact Number

_____   _____
Signature of Person Obtaining Consent   Date

Appendix B

Demographic Data Form

Subject Code # _____   Date: _____

Site Code: [ ] KFMMC

Subject Type: [ ]Disease   [ ]Control

<u>Demographic Information</u>

Please complete the following information to the best of your knowledge. Remember there is no right or wrong answers. If you have any questions or do not understand a question, please ask the investigator or research assistant.

Age: _____

What is <u>your</u> current marital status?
[ ] Married
[ ] Married, living alone (separated)
[ ] Divorced
[ ] Widowed

What is your highest level of education you have completed?
[ ] Less than high school
[ ] High School
[ ] College or University degree
[ ] Graduate Degree [master's, PhD]

What is your current employment status?
[ ] Full time
[ ] Part time
[ ] Student
[ ] Unemployed

What is your occupation if working?

_____

What is your husband current employment status?
[ ] Employed
[ ] Unemployed
What is your family monthly income?
 [ ] 5000-10000
[ ] >10000

Who currently lives with you in your home? [check all that applies]
[ ] Extended family [grandparents, aunts/uncles]
[ ] Spouse
[ ] Siblings
[ ] Help/ Maid
[ ] Other _____

How many children do you have?

How old is your youngest child?

Was this pregnancy planned?

Appendix C

Chart Review Form

Date: _____

Subject code:	Site Code: [ ] KFMMC
1. Obstetric history	Gravida: Term pregnancies (≥ 37 weeks of gestation): Preterm pregnancies (< 37 weeks of gestation): Abortions (elective or spontaneous before 20 weeks gestation): Living children or live births:
2. Obstetric complications	[ ] eclampsia/ pre-eclampsia [ ] Anemia [ ] Incompetent cervix [ ] Gestational Diabetes [ ] Placenta previa [ ] Abruptio placenta [ ] hyperemesis gravidarum [ ] polyhydramnios [ ] oligohydramnios [ ] Multiple gestation
3. Complication of labor	[ ] Breech presentation [ ] Limb presentation [ ] Meconium-stained ammonitic fluid [ ] preterm labor [ ] premature rupture of membrane

	[ ] dystocia
	[ ] uterine rupture
	[ ] prolapsed umbilical cord
4. Postpartum complications	[ ] postpartum hemorrhage
	[ ] postpartum infection
5. Infant weight	
6. APGAR scores	
7. Past medical history	-Psychiatric history
	-Infectious disease
	-Immunization
	-Operations
	-previous hospitalization
	-Chronic conditions (DM, HTN, Asthma)
	-Medications
	-Allergies
9. Family history	-Mental illness [ ] yes [ ] No
	If yes specify

References

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the Mind in the Eyes" Test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *42*(2), 241–251.

Baron-Cohen, S., Jolliffe, T., Mortimore, C., & Robertson, M. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or asperger syndrome. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *38*(7), 813–822. https://doi.org/10.1111/j.1469-7610.1997.tb01599.x

Carter, C. S., Barch, D. M., Gur, R., Gur, R., Pinkham, A., & Ochsner, K. (2009). CNTRICS final task selection: Social cognitive and affective neuroscience-based measures. *Schizophrenia Bulletin*, *35*(1), 153–162. https://doi.org/10.1093/schbul/sbn157

Chaaya, M., Osman, H., Naassan, G., & Mahfoud, Z. (2010). Validation of the Arabic version of the Cohen perceived stress scale (PSS-10) among pregnant and postpartum women. BMC Psychiatry, 10(1), 111. https://doi.org/10.1186/1471-244X-10-111

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. Journal of Health and Social Behavior, 24(4), 385–396. https://doi.org/10.2307/2136404

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *The British journal of psychiatry : the journal of mental science*, *150*, 782–786. https://doi.org/10.1192/bjp.150.6.782

Davis, M.H. (1980). A multidimensional approach to individual differences in empathy. JSAS

    Catalog of Selected Documents in Psychology, 10, p.85. Davis, M. H. (1983). Measuring

    individual differences in empathy: Evidence for a multidimensional approach. Journal of

    Personality and Social Psychology, 44(1), 113- 126. DOI: 10.1111/1467-

    6494.ep7383133.

Erdfelder, E., Faul, F. & Buchner, A. GPOWER: A general power analysis program. *Behavior*

    Research Methods, Instruments, & Computers 28**,** 1–11 (1996).

    https://doi.org/10.3758/BF03203630

Ghubash, R., Abou-Saleh, M. T., & Daradkeh, T. K. (1997). The validity of the Arabic

    Edinburgh Postnatal Depression Scale. *Social Psychiatry and Psychiatric Epidemiology*,

    32(8), 474–476. https://doi.org/10.1007/BF00789142

Merhi, R., & Kazarian, S. S. (2012). Validation of the Arabic translation of the Multidimensional

    Scale of Perceived Social Support (Arabic-MSPSS) in a Lebanese community sample.

    Arab Journal of Psychiatry, *23*(2), 159–168.

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing

    generalized anxiety disorder: the GAD-7. *Archives of internal medicine*, *166*(10), 1092–

    1097. https://doi.org/10.1001/archinte.166.10.1092

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The Multidimensional Scale

    of Perceived Social Support. *Journal of Personality Assessment*, *52*(1), 30–41.

    https://doi.org/10.1207/s15327752jpa5201_2