SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA, LEGON

CHRONIC STRESS IN PREGNANCY: IMPLICATIONS ON MATERNAL MENTAL HEALTH IN LOWER MANYA KROBO MUNICIPALITY, GHANA

BY

DEMI PRISCILLA ABENA LETSA

(10552255)

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN PUBLIC HEALTH

JULY 2020

DECLARATION

I hereby declare that this thesis is the product of my original independent research conducted in the Lower Manya Krobo Municipality under the supervision of Professor Amos Laar, Professor Richard Adanu and Dr Adom Manu. I affirm that this work has neither been published nor submitted in whole or in part to any institution for any academic award. All references made to other researchers' works have been duly acknowledged.

……. 14th July 2021 …….

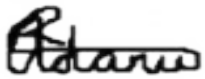
Demi Priscilla Abena Letsa — Date

(PhD Candidate)

……. 14th July 2021 …….

Professor Amos Laar — Date

Principal Supervisor



……. 14th July 2021 …….

Professor Richard Adanu — Date

Co-Supervisor

……. 14th July 2021 …….

Dr Adom Manu — Date

Co-Supervisor

ACKNOWLEDGEMENTS

I wish to express my profound gratitude to Professor Amos Laar. I am deeply grateful for your support, mentorship and supervision. Thank you for your encouragement, help and direction. Dr Adom Manu. I am grateful for your support, advice, and encouragement. For your guidance in more ways than one. May our professional and personal relationship grow. Professor Richard Adanu, I owe you an immense amount of appreciation, gratitude, and thankfulness. I am grateful that you were on my supervisory team, for the time you served as Dean and certainly for your kind direction always.

To the Head of Department, Professor Kwasi Torpey, I am deeply grateful to you. Your "not so subtle" reminders truly urged me on especially during the most difficult moments. Thank you for your support, advice and encouragement. Professor Augustine Ankomah, former Head of Department, you are a great mentor and an expert guide with incredible grace and patience. Always a listening ear, always a gentle voice and always full of insights. To the entire faculty and staff of the University of Ghana, School of Public Health, especially Professor Moses Aikins, Professor Richmond Aryeetey, Dr John Ganle, Dr Emmanuel Asampong. To the staff of the PFRH department, Pearl Tetteh and Amos Apreku, I appreciate your help and support. To my fellow PhD course mates, I am grateful that you shared this journey with me. To Tony Godi from the Biostatistics Department, I am grateful. Dr Naana Agyeman, thank you and thank you over and over again. Your valuable time, effort, dedication and support throughout this process has been amazing. Indeed, you are a true gem! Dr Priscilla Nortey and Dr Agnes Kotoh, thank you for your friendship and support. To Professor Isabella Quakyi, may my body of work in science follow

your exemplary lead. Many thanks to the staff and management of the Pan African Doctoral Institute (PADA) of the University of Ghana, Legon.

To faculty and staff of Johns Hopkins University, School of Nursing particularly Professor Phyllis Sharps, Dean Patricia Davidson, Professor Nancy Reynolds, Professor Nancy Perrin, Dr Yvonne Commodore-Mensah and Dr Ruth-Alma Turkson Ocran. I have never met a better group of world-class NURSE RESEARCHERS. You are my people! I am thankful for the time I spent as a student and a Visiting Scholar. It was a true academic learning experience that I will forever cherish. My friends at Pennsylvania State University, Professors Eileen and William Hennrikus, it is a true blessing to know you both. Dr Kristen Sznajder, thank you for the encouragement and the collaborations. Professor Ralph Kiel, thank you for the teaching, lessons, time and most importantly the belly laughs!

To the dean, faculty and staff of the Department of Linguistics, University of Ghana. I thank you all for allowing me to use your space and being so gracious about it. My special thanks to Professor Kofi Saah for your constant encouragement and the many lunch dates we had. I am beyond grateful. To Professor Dana Barthel of the Department of Psychiatry, Psychotherapy and Psychosomatics, University Medical Center, Hamburg, Germany. I am very grateful and thankful to you for your support and contribution to my work. To my friends at the Population Council, Ghana office. My special thanks go to Dr Kamil Fuseni and Dr Deladem Nai and Dr Placide Tapsoba (former Country Director). Your help, support and friendship will always be appreciated.

To the staff, management and clients of Atua Government Hospital, Akuse Government Hospital and St Martin *de Porres* Hospital all in the Lower Manya Krobo Municipality, thank you for allowing this study to be conducted in your facilities. My sincere gratitude to all the 603 women interviewed and recruited into the study. Thank you for sharing your stories.

To my dearest friends and personal cheerleading squad, Khabiso, Nana Efa, Elsie, thank you! Great appreciation and thankfulness go to my parents, Mr and Mrs Letsa, my siblings Michael, Jonathan and David and their wives, Irene and Sylvia. My children Julian, Daphne, and Wesley. You AMAZE me every day. I am thankful to you and proud to be your mother. May this achievement inspire you to prevail despite difficulties in any circumstance you may find yourself. And may you always make sure of the more important things. My husband RAD, my partner, my soulmate, my friend, my guardian, my love, my champion, and MY EVERYTHING. Thank you from the bottom of my heart. For your patience, your dedication to me and for believing in me even when I wanted to quit. You are truly a blessing and a most appreciated and valued one! Thank you for seeing me through this from the beginning to the end.

Most importantly, to my Grand Creator. May my life always remain dedicated to you, JEHOVAH, MY GOD, AND FATHER.

DEDICATION

To my children, Julian, Daphne, and Wesley. You are my eternal pride.

AND

To my husband, Reginald. You are my saving grace, my number one champion.

AND

To books, the pleasure of reading and the search for knowledge.

ABSTRACT

Background: *Chronic stress causes adverse effects both physiologically and psychologically. Research indicates that chronic stress during pregnancy may be significantly associated with high levels of antenatal depression and anxiety. Many factors may cause chronic stress for a pregnant woman. Moreover, extant literature indicates that pregnancy itself can be a source of chronic stress and that there are pregnancy-specific stressors that could contribute to depression and anxiety during pregnancy. In Ghana and other parts of sub-Saharan Africa, there are limited scientific data on chronic stress exposure during pregnancy and its implications on maternal mental health outcomes of depression and anxiety.*

Objective*: This study first catalogued the types of chronic stressors and pregnancy-specific stressors and determined the prevalence of these types of stressors. Secondly, it examined the association between chronic stress and (1) antenatal depression and (2) antenatal anxiety. Lastly, it identified factors associated with chronic stress and pregnancy-specific stress.*

Methods*: An analytical cross-sectional study in three health facilities in the Lower Manya Krobo Municipality of Ghana was conducted. Chronic stressors were assessed using survey tools. The Perceived Stress Scale (PSS-14) was administered to determine the prevalence of chronic stress. The Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7(GAD-7) scales were used to assess for depression and anxiety respectively. Mean scores of the 3 scales were taken and categorized into levels of stress, anxiety and depression. The Fischer's exact test was used to test the association between chronic stress, as the main exposure variable, and depression and anxiety and other characteristics. Multivariate logistic regression was used to identify independent predictors of chronic stress, pregnancy- specific stress, depression, and anxiety.*

***Results**: A total of 603 women were recruited into the study. Financial (65.9%, n=392), work-related (47.6%, n=287), and marital/relationship (25.2%, n=152) factors were the primary self-reported stressors. Fear of childbirth (61.2%, n=369), fear of giving birth to a child with a congenital anomaly (22.3%, n= 134), were primary pregnancy-specific stressors. The prevalence of stress, depression and anxiety were (49.9%, n= 301), (37%, n=223), and (17.4%, n=105) respectively. After adjustment for maternal socio-demographic and obstetric factors, the logit multivariate regression model revealed that marital status and pregnancy concerns about the ability to care for and nurture the child were predictors of chronic stress and pregnancy-specific stress. Participants who had high chronic stress had 83% increased odds of depression compared to those with lower stress (AOR: 1.83, 95% CI: 1.15-2.9). Depression increased by approximately one and a third times higher (AOR: 1.30, 95% CI: [1.02-1.67]) for each increase in the number of pregnancies a woman had had. For pregnant women who reported fear of birthing a child with a congenital anomaly as a pregnancy-specific stressor, the odds of anxiety were 64% higher (AOR: 1.64, 95% CI: [1.04-2.58]) compared to those who did not report this stressor.*

***Conclusion**: Chronic stress in pregnancy is influenced by several critical factors: marital status, education, employment and socioeconomic status. Pregnancy-specific factors like fear of childbirth and fear of a child with a congenital anomaly are key concerns of pregnant women. As hypothesized, chronic stress is a significant contributory factor to antenatal depression and anxiety and its ensuing adverse health outcomes.*

TABLE OF CONTENTS

DECLARATION i

ACKNOWLEDGEMENTS ii

DEDICATION v

ABSTRACT vi

LIST OF TABLES xvii

LIST OF FIGURES xix

LIST OF ABBREVIATIONS xx

DEFINITION OF TERMS xxi

CHAPTER ONE 1

INTRODUCTION 1

1.0 Chapter summary 1

1.1 Stress 1

1.1.1 Depression 5

1.1.2 Anxiety 7

1.2 Problem Statement 10

1.3 Objectives 12

1.3.1 Specific Objectives 12

1.4 Justification 12

1.5 Theoretical and Conceptual Framework 14

1.5.1 Theoretical Framework 14

1.5.2 Conceptual Framework 20

CHAPTER TWO 23

LITERATURE REVIEW 23

2.0 Chapter Summary 23

2.1 Stress: Historical Perspectives 23

2.1.1 Stress: Conceptual and Definitional Perspectives 25

2.1.2 Definitional Challenges 28

2.2 Types of Stress 29

2.2.1 Acute Stress 29

2.2.2 Episodic Acute Stress 30

2.2.3 Chronic Stress 32

2.2.4 Pregnancy-specific Stress 33

2.3 Neurobiology of Stress 35

2.3.1 The Fight or Flight Response 35

2.3.2 The Brain and Adaptation to Stress 35

2.4 Stress and Cognition 38

2.5 Key Gaps and Implications in Ghana 40

2.6 Measurement of Stress 41

2.6.1 Physiological 41

2.6.2 Psychological 42

2.7 Effects of Stress 45

2.8 Perinatal Mental Health 46

2.8.1 Conceptualization 46

2.8.2 Contextual Factors in SSA 47

2.8.3 Factors Associated with Perinatal Mental Health 48

2.8.4 The HPA Axis and Perinatal Mental Health 53

2.9 Depression 53

2.9.1 Overview 53

2.9.2 Antenatal Depression 54

2.9.3 Presentation of Depression 55

2.9.4 Neurobiological Models of Depression 57

2.9.5 Interventions for Antenatal Depression 58

2.9.6 Measurement and Screening of Antenatal Depression 60

2.10 Anxiety 62

2.10.1 Generalized and Antenatal Anxiety 62

2.10.2 Neurobiological Models of Anxiety 63

2.10.3 Interventions for Antenatal Anxiety 63

2.10.4 Measurement and Screening of Antenatal Anxiety 65

2.11 Key Gaps and Challenges in SSA and Ghana 66

CHAPTER THREE 71

METHODOLOGY 71

3.0 Chapter Summary 71

3.1 Study Design 71

3.2 Research Setting 72

3.2.1 Administrative Structure 73

3.2.2 Socio-demographic Characteristics 74

3.2.3 Climate, Vegetation and Agriculture 75

3.2.4 Occupation 76

3.2.5 Health Infrastructure and Health Services 76

3.3 Study Sites 78

3.4 Study Population 80

3.5 Sample Size Calculation and Sampling Strategy 80

3.5.1 Participant Selection 82

3.6 Survey Instruments 82

3.6.1 Demographic Questionnaire 83

3.6.2 Socioeconomic Status Assessment and Wealth Index 83

3.6.3 Catalogue of Stress 84

3.6.4 The Perceived Stress Scale (PSS-14) 86

3.6.5 The Patient Health Questionnaire-9 (PHQ-9) 88

3.6.6 The Generalized Anxiety Disorder-7 (GAD-7) 90

3.6.7 PHQ-9 and GAD-7 audio (Twi) 91

3.6.8 Transcription 92

3.7 Ethical Considerations 93

3.7.1 Information about the Study 93

3.7.2 Informed Consent 94

3.7.3 Parental Consent 94

3.7.4 Confidentiality 94

3.7.5 Voluntariness 95

3.7.6 Privacy 95

3.7.7 Gender sensitivity 95

3.7.8 Dissemination and Future Utilization of Study Findings 95

3.8 Pre-Data Collection 96

3.8.1 Research Team Composition and Training 96

3.8.2 Pretesting..... 97

3.9 Data Collection 98

3.9.1 Facility Data Collection Schedule 100

3.10 Study Variables..... 100

3.10.1 Variables and Scoring 100

3.10.2 Explanatory Variables..... 102

3.11 Quality Assurance..... 102

3.12 Data Analysis 103

3.12.1 Analysis of Outcome Variables (Depression and Anxiety)..... 104

CHAPTER FOUR..... 106

RESULTS 106

4.0 Chapter Summary 106

4.1. Enrolment details of study participants..... 106

4.2 Socio-demographic characteristics of study participants..... 106

4.3 Catalogue of Stressors..... 108

4.3.1 Chronic Stressors 109

4.3.2 Pregnancy-specific Stressors 109

4.3.3 Respondent Self-Stress Rating..... 109

4.4 Prevalence of Chronic Stress (PSS-14)..... 110

4.5 Depression (PHQ-9 Scale) 112

4.6 Anxiety (GAD-7 Scale) 114

4.7 Socio-demographic Characteristics and Chronic Stress 114

4.8 Socio-demographic Characteristics and Depression 117

4.9 Chronic Stressors and Depression 119

4.10 Pregnancy-specific Stressors and Depression 119

4.11 Perceived Stress and Depression 120

4.11.1 Self-reported Stress Rating and Depression 121

4.12 Background Characteristics and Anxiety 121

4.13 Chronic Stressors and Anxiety 124

4.14 Pregnancy-specific Stressors and Anxiety 125

4.15 Perceived Stress and Anxiety 126

4.15.1 Self-Stress Rating and Anxiety 127

4.16 Chronic Stressors and Perceived Stress 127

4.17 Pregnancy-specific Stressors and Perceived Stress 128

4.18 Predictors of Chronic Stress, Depression and Anxiety 129

4.18.1 Chronic Stress 130

4.18.2 Pregnancy-specific Stress 130

4.19 Depression 131

4.20 Anxiety 134

CHAPTER FIVE 136

DISCUSSION 136

5.0 Summary 136

5.1 Catalogue of Stressors 136

5.2 Prevalence of Chronic Stress 138

5.3 Prevalence of Pregnancy-specific Stressors 139

5.4 Predictors of Chronic Stress 142

5.5 Prevalence of Depression 144

5.6 Perceived Stress and Depression 147

5.7 Chronic Stressors and Depression 148

5.8 Pregnancy-specific Stressors and Depression 151

5.9 Factors Associated with Depression 153

5.10 Predictors of Depression 155

5.11 Prevalence of Anxiety 160

5.12 Perceived Stress and Anxiety 161

5.13 Chronic Stressors and Anxiety 162

5.14 Predictors of Anxiety 165

5.15 Strengths of the Study 166

5.16 Limitations of the Study 167

CHAPTER SIX 169

CONCLUSIONS AND RECOMMENDATIONS 169

6.1 Conclusions 169

6.2 Recommendations 170

6.3 Future Research 171

REFERENCES 173

APPENDICES 212

Appendix I: Demographic Questionnaire, Socioeconomic Assessment and Catalogue of Stress 212

Appendix II: The Perceived Stress Scale (14 Items) - Cohen et al, 1983 215

Appendix III: Patient Health Questionnaire (PHQ-9) 216

Appendix IV: Generalized Anxiety Disorder-7 217

Appendix V: Patient Health Questionnaire (PHQ-9) TWI Version 218

Appendix VI: Generalized Anxiety Disorder Questionnaire (GAD-7) TWI Version 220

Appendix VII: Participant Information Sheet and Consent Form 222

Appendix VIII: Minor Assent Form 226

Appendix IX: Ethical Approval Letter 232

Appendix X: Generalized Ordered Logistic Regression Model (Wald's Test) 233

Appendix XI: Test of Proportional Odds 234

LIST OF TABLES

Table 2.1 Characteristics of key stress instruments 44

Table 2.2 Characteristics of key depression screening instruments 61

Table 2.3 Characteristics of key anxiety screening instruments 65

Table 3.1: PSS-14 Scoring Rubric 101

Table 3.2: PHQ-9 Scoring Rubric 101

Table 3.3: GAD-7 Scoring Rubric 102

Table 4.1 Background characteristics of study respondents, LMKM 2018 108

Table 4.2 Catalogue of Chronic Stress and Pregnancy-specific Stress, LMKM 2018 110

Table 4.3 Frequency Distribution of the Perceived Stress Scale (PSS-14), LMKM 2018 111

Table 4.4 Frequency Distribution of the Patient Health Questionnaire (PHQ-9), LMKM 2018 113

Table 4.5 Frequency Distribution of the Generalized Anxiety Disorder Scale (GAD-7), LMKM 2018 114

Table 4.6 Socio-demographic Characteristics and Chronic Stress, LMKM 2018 116

Table 4.7 Socio-demographic Characteristics and Depression, LMKM 2018 118

Table 4.8 Chronic Stressors and Depression, LMKM 2018 119

Table 4.9 Pregnancy-specific Stressors and Depression, LMKM 2018 120

Table 4.10 Chronic stress, Self-stress Rating and Depression, LMKM 2018 121

Table 4.11 Background Characteristics and Anxiety, LMKM 2018 123

Table 4.12 Chronic Stressors and Anxiety, LMKM 2018 124

Table 4.13 Pregnancy-specific Stressors and Anxiety, LMKM 2018 126

Table 4.14 Chronic stress, Self-Stress Rating and Anxiety, LMKM 2018 127

Table 4.15 Chronic Stressors and Perceived Stress (PSS-14), LMKM 2018 128

Table 4.16 Pregnancy-specific Stressors and Perceived Stress (PSS-14), LMKM 2018 129

Table 4.17 Predictors of Stress, LMKM 2018 131

Table 4.18 Predictors of Depression, LMKM 2018 133

Table 4.19 Predictors of Anxiety, LMKM 2018..... 135

LIST OF FIGURES

Figure 1.1 Transactional Model of Stress, adapted from Lazarus and Folkman (1984) 17

Figure 1.2 Allostatic Load and the Physiologiocal Stress Response (adapted from Juster et al., 2010). 20

Figure 1.3 Conceptual Framework 22

Figure 2.1 Categories of stressors 27

Figure 3.1 Map of Lower Manya Krobo Municipality 73

Figure 3.2 Healthcare facilities in Lower Manya Krobo Municipality 78

LIST OF ABBREVIATIONS

ACTH	Adrenocorticotropic hormone
AL	Allostatic Load
ANA	Antenatal Anxiety
ANC	Antenatal Care
AND	Antenatal Depression
CBT	Cognitive Behavioral Therapy
CRF	Corticotropin-releasing hormone
DRI	Dopamine Reuptake Inhibitor
DSM-5	Diagnostic and Statistical Manual of Mental Disorders-5
GABA-A	ɣ Amino Butyric Acid
GAD-7	Generalized Anxiety Disorder-7
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
HPA	Hypothalamus Pituitary Axis
HSD11B2	11-β-dehydrogenase 2 gene
LMKM	Lower Manya Krobo Municipality
OCD	Obsessive Compulsive Disorder
PTSD	Post-Traumatic Stress Syndrome
SADD	Standardized Assessment of Depression Disorder
SSRI	Selective Serotonin Reuptake Inhibitor
TMS	Transactional Model of Stress

DEFINITION OF TERMS

Adrenal gland: endocrine glands that produce a variety of hormones including adrenaline and the steroids aldosterone and cortisol. Also known as the suprarenal gland.

Adverse pregnancy outcome: an event of preterm birth, stillbirth, low birth weight, perinatal death, or abortion.

Allostatic load: the cost of chronic exposure to elevated or fluctuating endocrine or neural responses resulting from chronic or repeated challenges that elicit stress.

Amygdala: the almond-shaped mass of nuclei involved in emotional responses, hormonal secretions, and memory.

Antenatal care: medical care received from healthcare professionals during pregnancy.

Antenatal: occurring before birth

Anxiety: the subjective experience of a range of psychosocial and physical symptoms of autonomic arousal, apprehension, fear and irritability among others.

Catecholamines: a monoamine neurotransmitter consisting of a catechol (aromatic compound) and an amine side chain. Catecholamines are synthesized in the adrenal glands in response to stress. Main catecholamines in the stress response are dopamine, epinephrine, and norepinephrine.

Cortisol: glucocorticoid produced by the zona fasciculata of the adrenal cortex responsible for gluconeogenesis and lipolysis, suppresses protein synthesis, inhibits inflammatory and immune responses, and has mild mineralocorticoid (for example, hypernatremia, kaliuretic, antidiuretic) effects.

Cytokines: small protein important for cell signaling and produced by immune cells, mast cells and endothelial cells.

Depression: a common and serious medical illness that negatively affects how one feels, the way one thinks and how one acts. Depression causes feelings of sadness and/or a loss of interest in activities once enjoyed.

Epigenetic: heritable changes in gene expression (active versus inactive genes) that do not involve changes to the underlying DNA sequence — a change in phenotype without a change in genotype — which in turn affects how cells read the genes.

Gestational Age: a measure of the age of a pregnancy from the beginning of a woman's last menstrual period, or the corresponding age of the gestation, as estimated by a more accurate method if available.

Hypothalamus: The region of the under-surface of the brain immediately above the pituitary gland. In the stress mechanism, the hypothalamus releases corticotrophin-releasing hormone which triggers the pituitary gland and subsequently the adrenal glands to release glucocorticoids.

Interleukins: cytokines that participate in the regulation of immune responses, inflammatory reactions, and hematopoiesis.

Limbic system: also known as the paleomammalian cortex, is a set of brain structures located on both sides of the thalamus that supports a variety of functions including emotion, behavior, motivation, long-term memory, and olfaction.

Low birth weight: weight at birth of fewer than 2,500 grams (5.5 pounds).

Neonatal: relating to or affecting the newborn and especially the human infant during the first month after birth**.**

Neonate: newborn of first 28 days after delivery or birth

Perinatal: the period from the 28th week of pregnancy to the end of the 1st week after birth.

Pituitary: an endocrine gland located at the base of the brain in a small recess of the sella turcica. The pituitary produces several hormones, including those that regulate growth, reproductive functions and the stress response.

Prenatal: occurring or existing before birth

Preterm birth: Preterm refers to a baby born before 37 weeks of pregnancy have been completed.

Stress: the process by which environmental demands tax or exceed the adaptive capacity of the organism.

Chronic stress: stress resulting from repeated exposure to situations that lead to the release of stress hormones; it is also the response to emotional pressure suffered for a prolonged period of time during which an individual perceives no control.

Psychosocial: relating to the interaction of social factors and individual thought and behavior

Pregnancy specific stress arises from the numerous changes that women experience during pregnancy from their concerns about childbirth and the health of their offspring.

Thalamus: a large, dual lobed mass of gray matter cells that relay sensory signals to and from the spinal cord and the cerebrum.

CHAPTER ONE

INTRODUCTION

1.0 Chapter summary

This chapter presents an overall background of the research and emphasizes the need for the study. It provides some contextual basis for the study, captures the problem statement along with the objectives. A conceptual framework in addition to significant stress-research theoretical frameworks relevant to the problem are discussed.

1.1 Stress

Stress is essentially an organism's reaction to external stimuli. A classic definition of stress is the "process by which environmental demands tax or exceed the adaptive capacity of the organism" (Cohen, Kessler, & Gordon, 1995). Stress is primarily categorized into two main types: acute and chronic. Acute stress is short-lived, such as stress experienced before or during a job interview or school examinations. Chronic stress occurs when exposure to the stressor is long-lived and has no immediate resolution and from which the subject has no escape or relief. Thus, chronic stress may be experienced when an individual's combined resources are not adequate to mitigate the stressor over a lengthy period. For this study, chronic stress is defined as exposure continuing or occurring for over three months (Bernell & Howard, 2016). The human brain serves as the primary source of regulation and adaptation to stress, therefore chronic exposure has a physiological and psychological effect on the person.

The physiological response to stress involves the production of stress hormones (primarily adrenaline and cortisol) and the activation of the nervous system for the "fight or flight" response (Beijers, Buitelaar, & de Weerth, 2014; Vijayaselvi et al., 2015). This enables the body to respond to the stressor or acute threatening event. After the physiological stress response, the body must recover and retain balance or homeostasis. However, very often the physiological stress response, along with resultant hormonal activation, is sustained because exposure has become chronic in nature. In modern society, chronic stress is prevalent and arguably exists to various degrees across the globe within various populations or groups. For instance, in low and middle-income countries (LMIC) in particular, high levels of poverty, unemployment, rapid unplanned urbanization, inadequate housing and other infrastructure, food insecurity, inadequate healthcare, environmental, social and societal factors can serve as stressors and contribute to chronic stress exposure and a lengthy sustained physiological response (Andrade et al., 2012; Evans & English, 2002; Rook et al., 2013).

The psychological response to chronic stress exposure is mainly emotional and behavioral in nature. Chronic stress can influence mood, emotional, psychological states leading to mental health disturbances (Marin et al., 2011). These may include social withdrawal, feelings of sadness, angry outbursts, frustrations, decreased emotional control, self-medication and substance abuse (Hofmann et al., 2013). The physiological response to stress over time augments the psychological response. The constant presence of stress hormones may alter the structure and function of some key nervous system structures that regulate our behavior, mood and emotion. Specifically, stress hormones may decrease the functioning of neurons in the hippocampus (brain area responsible for memory) and the prefrontal cortex (key in attention, problem-solving and judgement). As a

consequence, persons who experience chronic stress may as a result, experience confusion, difficulty concentrating, trouble learning new information, and/or problems with decision-making.

Chronic stress exposure over time culminates in a variety of poor health outcomes and diseases. For instance, chronic stress exposure is associated with obesity and metabolic syndrome (Scott, Melhorn, & Sakai, 2012; Tamashiro, Sakai, Shively, Karatsoreos, & Reagan, 2011). Chronic stress at the systemic level such as racial or socioeconomic disparity has been associated with physical health effects such as hypertension (Hicken, Lee, Morenoff, House, & Williams, 2014). A variant of stress, posttraumatic stress disorder (PTSD), often affecting persons in post-conflict areas or after traumatic events, is associated with alcohol abuse, hypertension, and diabetes (Atwoli, Stein, Koenen, & McLaughlin, 2015; Brady & Sinha, 2005; Kinzie, 2015). Chronic stress is associated with kidney disease (Bruce, Griffith, & Thorpe, 2015), infertility (Petraglia, Serour, & Chapron, 2013), cardiovascular disease (Esler, 2017), stomach ulcerations (Kumar, Ashwlayan, & Verma, 2019), and suicide (Stewart et al., 2019). For vulnerable populations such as pregnant women, chronic stress exposure is associated with preterm birth (Giurgescu, Engeland, Zenk, & Kavanaugh, 2013; Olson et al., 2015), low birth weight (Kajantie & Räikkönen, 2010), and epigenetic changes as well as overall frailty of the female reproductive system (Valsamakis, Chrousos, & Mastorakos, 2019).

The prospects of pregnancy and childbirth are milestones in a person's life. However, pregnancy itself can become a source of stress leading to "pregnancy-specific stress". Pregnancy-specific stress (PSS) rises from the several changes that a pregnant woman experiences, concerns about

childbirth, and the health of the child (Ibrahim & Lobel, 2020). Precisely, PSS refers to "fears about the health and well-being of one's baby, the impending childbirth, of hospital and healthcare experiences (including one's health and survival in pregnancy), birth and postpartum, and parenting or the maternal role" (Dunkel Schetter, 2010). Sometimes, PSS has been conceptualized amongst researchers as pregnancy anxiety, pregnancy-specific distress, and pregnancy-related stress (Alderdice et al., 2012). All of these, however, are variants of the above operational definition that identify and isolate PSS as a stand-alone syndrome.

Fear of childbirth (tokophobia), a subdomain of PSS, in a meta-analysis of studies across 18 countries and over 800,000 pregnant women had an estimated prevalence of about 14% (O'Connell et al., 2017). Tokophobia, as a pregnancy-specific stressor, is associated with a wide array of psychological disorders including depression and anxiety (Rouhe et al., 2011). Moreover, other domains of PSS such as fear of changes in the marital/relationship, fear about future mother/child or father/child relationships, and ability to care for, nurture and mother the child are associated with low maternal self-efficacy (Byrne et al., 2014), difficulty in transitioning to parenthood (Salomonsson, Gullberg, et al., 2013), a significant increase in the length of labor (Adams et al., 2012), greater labor pain (Garthus-Niegel et al., 2013; Weng et al., 2016), and a preference for and higher incidence of Caesarean sections (Eide et al., 2019; Fuglenes et al., 2011; Hellerstein et al., 2016). Likewise, studies across diverse populations using different research designs have identified pregnancy-specific stress as a risk factor for poor maternal mental health outcomes (Coussons-Read et al., 2012; Lobel et al., 2008), such as depression and anxiety (Herbison, Allen, Robinson, Newnham, & Pennell, 2017).

1.1.1 Depression

Chronic stress may cause depression. Depression across the globe is a leading source of morbidity that affects more than 264 million people (WHO, 2017). In a Lancet series of papers on the epidemiology of gender differences in the prevalence and incidence of depression, researchers found that women are twice as likely to develop depression over the life course (Kuehner, 2017). Explanatory psychosocial, biological, and neurohormonal factors have been cited as reasons for this gender difference in depression rates (Busfield, 2012; Noble, 2005; Parker & Brotchie, 2010). Depression, as a direct result of stress due to limbic system hyperactivity or higher stress reactivity in women was specified by Hammen et al., (2009). In this study and others, depression susceptibility in women was linked to hormonal changes or surges at different stages across the lifespan such as at puberty (gonadal steroid changes), during pregnancy, the post-partum period, and at menopause (Busfield, 2012; Hammen et al., 2009; Herbison et al., 2017; Melville et al., 2010). Stress exposure can have specific effects on emotional responsivity and hormonal regulations leading to an increased vulnerability to depression at certain critical periods such as during pregnancy (Hyer & Neigh, 2019).

1.1.1.1 Antenatal Depression

Depression during pregnancy has not been as widely studied as postnatal/postpartum depression. However, there is increasing evidence that rates of depression during pregnancy are at least as high, if not higher than the postnatal period (Heron, O'Connor, Evans, Golding, & Glover, 2004). The prevalence of depression amongst pregnant women in a large population-based study in the United States was estimated at 20%, which was similar in the non-gravid population (Ashley, Harper, Arms-Chavez, & LoBello, 2016). Similarly, an Australian cohort study determined the

prevalence of depression at 6%, and that psychosocial disadvantage was a significant risk factor for antenatal depression (Ogbo et al., 2018). In sub-Saharan Africa (SSA), some studies have reviewed the prevalence and associated risk factors of antenatal depression, but these studies are limited in number, do not address all associated factors, and consequently make conclusions or consensus a challenge. It is important however to state and describes some of these related studies in SSA as a critical review of present evidence is vital.

A cross-sectional study amongst urban women in Ethiopia indicated that one in four pregnant women had depression (Biratu & Haile, 2015a). Another cross-sectional study in rural South Africa concluded that almost half of the pregnant women surveyed were depressed (Rochat, Tomlinson, Bärnighausen, Newell, & Stein, 2011). Similar to the results in South Africa and Ethiopia, a Nigerian cohort of pregnant women had a 24 percent prevalence of antenatal depression (Thompson & Ajayi, 2016). In Ghana, the prevalence of antenatal depression in a large population-based study was at 10%. Factors associated with antenatal depression such as socioeconomic disadvantage and unplanned pregnancies were significantly associated with antenatal depression (Weobong, Soremekun, et al., 2014).

Evidently, antenatal depression exists in SSA and in Ghana for that matter. However, there are not enough data on the role or contribution of stress to antenatal depression. Also, antenatal depression is a highly significant risk factor for postnatal depression (Milgrom et al., 2008) with its associated risks for both the mother and newborn. Furthermore, findings from a population-based study in rural Ghana associated antenatal depression with a higher risk for postpartum complications, prolonged labour, and newborn illness (Weobong, Ten Asbroek, et al., 2014). Antenatal depression

is an important avenue of research because often without intervention it leads to poor mental and physical health outcomes for the mother and baby. It has been associated with decreased breastfeeding (Insaf et al., 2011), decreased fetal growth (Brittain et al., 2015), child health outcomes (Hanington et al., 2012), and some adverse birth outcomes (Staneva et al., 2015).

1.1.2 Anxiety

The group of anxiety disorders includes obsessive-compulsive disorder (OCD), panic disorder, social anxiety disorder, generalized anxiety disorder (GAD), and some phobias. Collectively, anxiety disorders constitute the most common psychiatric disorder with a global prevalence of over 35% (Bandelow & Michaelis, 2015). Anxiety disorders are substantially underrecognized, underdiagnosed, and undertreated, although symptoms often last across the lifespan (Alonso et al., 2004). Global assessments of risk factors of anxiety are genetic, behavioral, environmental, and developmental in nature. All forms of anxiety have been shown to have a high level of comorbidity with depression (Miyazaki, Benson-Martin, Stein, & Hollander, 2016). Many anxiety disorders such as GAD are chronic, with a frequent number of remissions, peak and trough over time, and may be triggered by stressful events (Zincir, 2016). The peak onset age for many mental health disorders including GAD and the other variations of anxiety is between 15 to 45 years old.

1.1.2.1 Antenatal Anxiety

The International Classification of Diseases-10 (ICD-10) defines anxiety as the subjective experience of a range of psychological and physical symptoms such as autonomic arousal, feelings

of apprehension, fear, and irritability (WHO, 2010). Antenatal anxiety (ANA) or maternal anxiety during pregnancy is related to poor infant outcomes. In a systematic review that detailed studies from over 30 countries, the researchers indicated that higher ANA rates were found in LMIC than in developed countries (Dennis, Falah-Hassani, & Shiri, 2017). The same study found a 15% prevalence particularly amongst mothers who were between 1 to 24 weeks of gestation (Dennis et al., 2017). Comparably, in a large population study amongst women in early pregnancy, ANA had a high prevalence and was significantly associated with fear of childbirth, and a higher rate of Cesarean sections particularly with women who were under 25 years of age (Rubertsson, Hellström, Cross, & Sydsjö, 2014). In women with higher gestational age in China, ANA likewise had a high prevalence (20%), and the associated risk factors were lower educational status, family disharmony, and lower life satisfaction (Kang et al., 2016).

Van Heyningen et al., (2017), sought to determine the risk factors associated with antenatal anxiety in an urban poor population in South Africa. They found that stress related to food insecurity, unplanned/unwanted pregnancy, pregnancy loss, and the experience of traumatic life events put pregnant women at risk for ANA and its adverse consequences (van Heyningen et al., 2017). A closer look at the literature, however, reveals some gaps and shortcomings. Firstly, there are not enough data available in SSA that provides contextual information about the risk factors and/or other associated factors of ANA. Secondly, one of the few studies in Ghana that researched antenatal anxiety found that it was not related to birth outcomes such as low birth weight and preterm birth (Bindt et al., 2013). Other literature, on the contrary have indicated an association between ANA and birth outcomes, making it difficult to draw a conclusion (Ding et al., 2014; Hasanjanzadeh & Faramarzi, 2017). Lastly, even though the findings of this large population study

in Ghana and Cote d'Ivoire revealed a high prevalence of ANA, no study to date has explored the contribution of stress exposure to anxiety during pregnancy, predisposing factors, and other related variables.

As has been indicated, pregnancy-specific stress is directly related to the condition of being pregnant. Some caveats of ANA are related and specific to the condition of being pregnant. During the antenatal period, there is evidence that factors such as "fear of giving birth", "fear of bearing a handicapped child", and "concern about one's appearance" (Huizink, Mulder, Robles De Medina, Visser, & Buitelaar, 2004), contribute to high levels of anxiety. Anxiety, occasioned by such thoughts has been identified to be significantly associated with adverse pregnancy outcomes than generalized anxiety during pregnancy (Roesch, Schetter, Woo, & Hobel, 2004). Evidence from mothers admitted to specialist psychiatric services found that ANA had a higher prevalence than antenatal depression (Brockington, Macdonald, & Wainscott, 2006). Accordingly, research that classifies related risk factors, modifiers, and possible socio-demographic correlates of antenatal depression is critical.

Variations of anxiety-related disorders during pregnancy, such as panic disorder (Marchesi et al., 2014), post-traumatic stress disorder (Modarres, Afrasiabi, Rahnama, & Montazeri, 2012), obsessive-compulsive disorder (Vasconcelos et al., 2007), may occur de novo in pregnancy, relapse, or worsen during pregnancy. The sequence of ANA, which leads to functional impairment, affects mother to child bonding, breastfeeding and a host of other adverse outcomes across the lifespan for the mother and the unborn child (Miyazaki et al., 2016). Chronic stress exposure and pregnancy-specific stress are closely associated with anxiety. Research in Ghana about antenatal

stress exposure and its associations with ANA is limited at best. Additionally, depression is often a comorbid condition with anxiety and thus, pregnant women may be at a double risk of adverse mental health outcomes.

1.2 Problem Statement

In societies across the globe, stress is experienced to varying degrees and is estimated to cost billions of dollars a year (Fink, 2016). Chronic stress exposure leads to a variety of disease outcomes over time. Stress via its disease-promoting mechanisms has been associated with physiological conditions such as cardiovascular disease (An et al., 2015), migraines (Malone, Bhowmick, & Wachholtz, 2015), reproductive health (Petraglia et al., 2013; Valsamakis et al., 2019), hypertension (Atwoli et al., 2015; Kinzie, 2015) and gastrointestinal ulcers (Kumar et al., 2019). Similarly, stress exposure is closely associated with psychological adverse conditions such as substance abuse (Brady & Sinha, 2005; Kinzie, 2015), depression (Kobrosly, van Wijngaarden, Seplaki, Cory- Slechta, & Moynihan, 2014), a decline in cognitive function (Marin et al., 2011), and suicides (Stewart et al., 2019).

Maternal mental health is a primary public health concern across the globe because of its dual effect on the fetus/newborn and the mother. The ensuing effects of chronic stress exposure is a key area of research. Stress during pregnancy is associated with some poor pregnancy outcomes such as preterm birth (Olson et al., 2015) and low birth weight (Stewart et al., 2015). Similarly, chronic stress exposure during pregnancy has been linked to high rates of antenatal depression (Beydoun & Saftlas, 2008; Hartley et al., 2011; Liou, Wang, & Cheng, 2014) and anxiety (Blackmore,

Gustafsson, Gilchrist, Wyman, & O'Connor, 2016; Rubertsson et al., 2014). Evidence on the prevalence, associated factors, sequelae of antenatal depression and anxiety as a result of chronic stress exposure during pregnancy, is multifactorial and requires rigorous or robust data to inform interventions and programs.

Although research suggests that the prevalence of common mental health disorders, such as depression and anxiety are higher in developing countries than in developed countries (Fisher et al., 2012), there is a dearth of evidence in developing countries. A significant body of evidence indicates that chronic stress exposure is a contributory factor to higher prevalence rates of depression and anxiety during pregnancy (Kammerer et al., 2006; Melville et al., 2010; Rallis et al., 2014). However, in developing regions such as SSA, the mental health outcomes of chronic stress have not been adequately studied amongst pregnant women. Consequently, minimal evidence has been generated in these areas that consider contextual factors. Furthermore, interventions to manage or reduce maternal stress exposure cannot be comprehensive or effective without ample valid data. Considerations such as resource constraints need to be carefully reviewed as they relate to mental health in SSA and Ghana. Lastly, much of the evidence available on the subject are studies that were conducted in Western societies in North America and Europe, which do not support the generalizability of findings.

In Ghana, empirical and anecdotal evidence suggests that chronic stress is prevalent amongst pregnant women. However, data on the prevalence, types, outcomes, and associated factors of chronic stress during pregnancy in the nation has not been documented. To the best of knowledge,

in Ghana, this study is the first of its kind to attempt to document chronic stressors and pregnancy-specific stressors during pregnancy and determine their associations with depression and anxiety as outcome variables.

1.3 Objectives

This study catalogued the types of chronic stressors and pregnancy-specific stressors amongst pregnant women and determined their prevalence, examined the factors associated with chronic stress and pregnancy-specific stress. Further, the study assessed the association between chronic stress and maternal mental health outcomes of: *(i)* depression and *(ii)* anxiety in three health facilities the Lower Manya Krobo Municipality of Ghana.

1.3.1 Specific Objectives

The study was conducted specifically to:

1. Catalogue the types of chronic stressors and pregnancy-specific stressors among pregnant women at the antenatal clinic.
2. Determine the prevalence of chronic stress and pregnancy-specific stress among the antenatal clinic attendees.
3. Identify factors associated with chronic stress and pregnancy-specific stress.
4. Assess the association between chronic stress, pregnancy-related stress and mental health outcomes (depression and anxiety).

1.4 Justification

Studies indicate that chronic stress can have significant effects on maternal mental health, pregnancy outcomes, and even human development across the lifespan (Coussons-Read, 2013).

Beyond the immediate pregnancy and childbirth period, maternal chronic stress exposure can lead to offspring neurodevelopmental deficiency, cognitive impairment, difficult temperament, and some psychiatric disorders (van den Heuvel, Johannes, Henrichs, & Van den Bergh, 2015). Chronic stress may be psychosocial, cultural, or environmental and may range from severe (e.g., trauma) to moderate (e.g., life events) to mild (e.g., daily hassles) (Coussons-Read, 2013; Kopp et al., 2010;). Moreover, pregnancy-specific stress, which is the stress that is directly related to the pregnancy itself is a matter of concern. Pregnancy specific stress can have a marked effect on the mother, pregnancy, and human development (Ibrahim & Lobel, 2020; Lobel et al., 2008). Women are thus at a high risk of experiencing both types of stressors during pregnancy.

To date, the only study identified in Ghana to have examined stress in pregnant women found that as much as 28.6% had high levels of stress (Boakye-Yiadom et al., 2015). Similar rates of chronic stress exposure have been identified in the literature; however, these data have come from developed countries mainly. Generating local/in-country insight into the dynamics of chronic stress and pregnancy-specific stress will provide a greater understanding of the nature and significance of the issue. This knowledge will, in turn, lead to better opportunities for prioritizing interventions to improve overall maternal mental health in Ghana. Globally maternal mental health problems such as depression and anxiety are major public health challenges. Overall maternal health and wellbeing include not only indicators such as maternal mortality but also decreased life expectancy, morbidity and disability-adjusted life years (DALYs) from depression and anxiety.

Unfortunately, in Ghana mental health and maternal mental health, for that matter, are often neglected. However, to have comprehensive maternal and child health services in the country, an

integrated approach that includes mental health must be strongly considered. Comprehensive healthcare services that factor mental health have a significant impact not only on the mothers but also on the growth and development of children. For instance, if left unaddressed, depression and anxiety may lead to an increased risk of ill health, suicide, and psychotic illness. These conditions can also hamper the mother-to-infant attachment, breastfeeding, and general infant care, leading the poorer health outcomes for the child. Early and regular antenatal care is strongly recommended because it leads to improved birth outcomes and fewer obstetric complications. The quality of ANC delivered directly affects the health outcomes of pregnant women and their newborns. A tailored or focused approach to ANC delivery must include mental health screening, assessment, and education. Research such as this study, which provides a greater understanding of maternal mental health during the antenatal period, can support interventions to improve ANC in Ghana.

1.5 Theoretical and Conceptual Framework

1.5.1 Theoretical Framework

The theoretical framework for this study was based on scholarly work on the psychological and physiological response to stress exposure. The psychological response is related to appraisal and related affective or emotion-based reactions, cognitive and behavioral responses to stress(Lambert & Lazarus, 1970). The physiological response refers to the neurobiological mechanisms activated internally after stress exposure (McEwen, 2007). Because both stress response categories occur simultaneously and contribute to depression and anxiety as outcome variables, two theoretical framework mechanisms were proposed for this study and served as the guiding principles for the research.

1.5.1.1 The Transactional Model of Stress

The psychological theoretical framework that guided this study was the Transactional Model of Stress (TMS). Lazarus and Folkman (1984) theorize that a state of stress is created when individuals are confronted with circumstances that tax or exceed their ability to manage them. Therefore, the imbalance in a person's resources and demands of the environment creates stress. Based on these antecedents, researchers' proffer the TMS in which stress is viewed as a transaction between an individual and their environment (Lazarus and Folkman, 1984). This is a fluid and continuous process within which the environment makes demands on the individual and the individual responds accordingly. Stress is however created when there is an imbalance as in the case where a person's resources cannot meet the demands of the environment. A person makes an initial appraisal of the stressor known as the primary appraisal. In the primary appraisal, an individual evaluates whether the stressor is *(1)* of no significance or benign, *(2)* desirable or positive, and *(3)* harmful or threatening (Lazarus and Folkman 1984).

The primary appraisal is a cognitive and educative process that serves to estimate the degree of threat of a potential stressor. The secondary appraisal is next during which the individual evaluates their control over the potential stressor. This is a self-assessment of their ability to cope with the stressor (self-confidence). During this process, the individual examines perceived control over the outcome as well as perceived control over their emotional response (Lazarus and Folkman 1987). The secondary appraisal may result in pulling internal coping resources such as strength, determination, resilience, and will power. External coping mechanisms such as social resources and support are also recruited to mitigate the stressor and provide relief and/or adaptation. When an individual can cope or adapt to the stressor, positive stress is the result. Conversely, if unable

to cope or adapt, negative stress s generated, and the psychological outcomes are high levels of depression or anxiety (Figure 1.1).

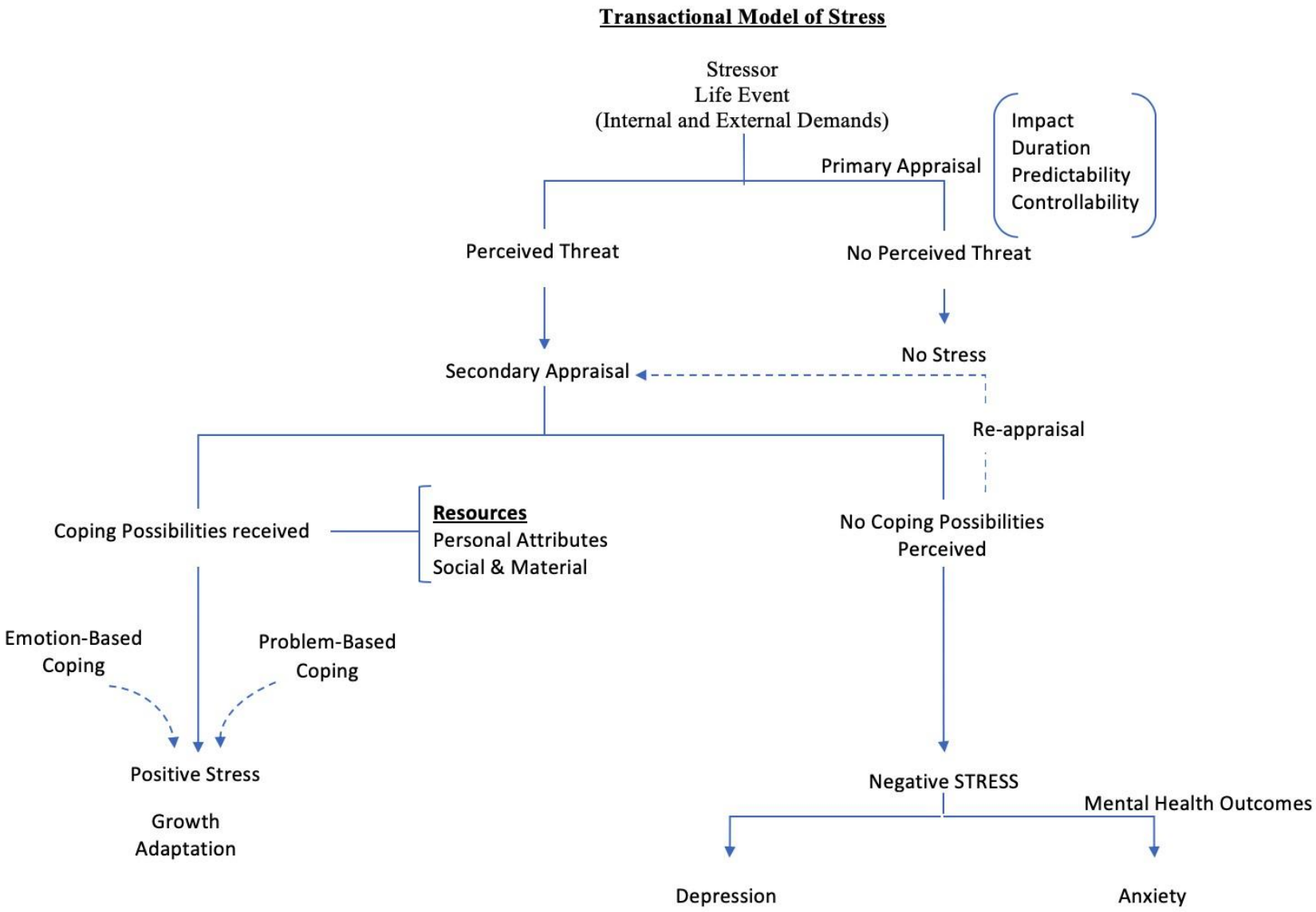


Figure 1.1 Transactional Model of Stress, adapted from Lazarus and Folkman (1984)

1.5.1.2 Allostatic load

Based on the above psychological stress response, there are corresponding critical physiological processes that take place to mediate or mitigate the possible damaging effects of negative stress. The physiological mechanism of stress exposure via the allostatic load (AL) theoretical framework will augment the conceptual framework, the TMS theoretical framework and further ground the study in a comprehensive manner. Therefore, this secondary theoretical framework (Allostatic Load) will supplement the TMS since the stress mechanism is a dual psychological and physiological experience.

Allostasis is the physiologic adaptation to changes and the maintenance of all functions at regular levels despite the assault of stress (McEwen, 2007). It is the body's adaptation to an external or environmental stressor. Allostatic load refers to the effects of chronic exposure to stress on the body's physiological functioning and regulation (Juster et al., 2010). In response to exposure to stress, the human brain activates the sympathetic-adrenal medullary (SAM) axis to secrete catecholamines (epinephrine and norepinephrine) and the hypothalamic-pituitary-adrenal (HPA) axis to secrete glucocorticoids (cortisol) (Sapolsky et al. 2000 and Juster et al 2010). The SAM axis and the HPA axis work synergistically for effective adaptation to stress. These two hormonal pathways mobilize resources for the response to a potential threat or stressful situation: the SAM axis being the immediate response or the "fight or flight" and the HPA axis as the slower more sustained response to the stressor.

Within the AL theoretical framework, the primary hormones (cortisol, epinephrine, and norepinephrine) along with cytokines (pro and anti-inflammatory) are referred to as primary

mediators to the stress response. However, over a prolonged period, the synergistic effects of these molecules compromise physiological integrity and produce changes in other organ systems that are known as secondary outcomes. These secondary outcomes include metabolic changes (insulin resistance, high-density lipoprotein imbalance, low-density lipoprotein imbalance, visceral fat deposits, triglyceride imbalance, and cholesterol imbalance); cardiovascular changes (systolic and diastolic blood pressure); and in immune function (fibrinogen and C-reactive protein dysregulation) (Juster et. al 2010). These serve as quantifiable, measurable biomarkers of chronic stress exposure. Furthermore, the hormones implicated in the physiological stress response also play a critical role in mood and affect regulation. Consequently, stress exposure overtime via the AL framework may lead to affective state disorders such as depression and anxiety (McEwen, 2003, 2007; Palazidou, 2012).

These changes if they remain unchecked or unregulated, the final stage of AL is reached where lasting physiologic changes result in “disordered, decreased and diseased” systems (Juster et al., 2010). This last stage is known as the tertiary outcome. Thus, chronic exposure to stress from environmental, cultural, psychosocial, and behavioral factors leads to physiologic changes in the body thereby putting individuals at risk for tertiary outcomes (disease) (Figure 1.2).

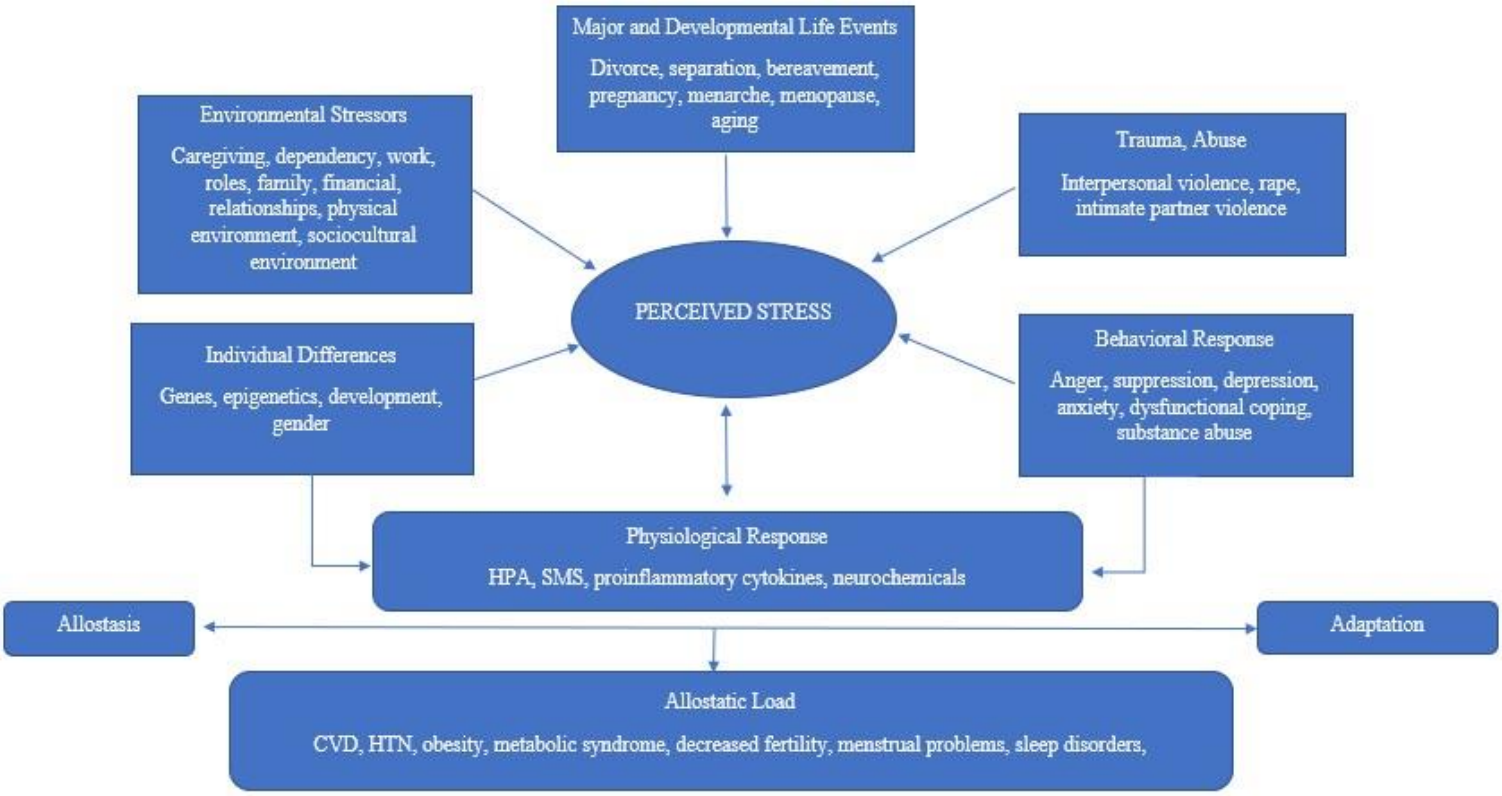


Figure 1.2 Allostatic Load and the Physiological Stress Response, adapted from Juster et al., (2010).

1.5.2 Conceptual Framework

Based on the theoretical framework material presented, the conceptual framework of the study served as the researcher's (PhD Candidate) suggested ideas of how all variables in this study connect with each other. It thus provides a roadmap of the relationships, concepts and findings from the literature that relate to the research study and objectives.

Bio-psychological correlates of chronic stress involve the personality, genetic, epigenetic, and environmental factors that may lead to depression and anxiety. Certain personality types have been implicated in a stronger, more sustained response to stress exposure (Lecic-Tosevski et al., 2011).

Therefore, personality is a stress factor that may predispose an individual to higher levels of exposure and ensuing mental health outcomes. Genes and epigenetic mechanisms are a crucial element of the stress response (McEwen et al., 2012; Yang et al., 2012). Environmental assaults related to stress exposure at the molecular level cause these genetic and epigenetic changes and alter the normal stress response (Nabeshima & Kim, 2013). Through these pathways, chronic stress may be experienced and lead to depression and anxiety. Depression and anxiety, although distinct in nature, are highly correlated and have common biological and genetic diathesis (Bech et al., 2014; Binder & Nemeroff, 2010; Dunkel Schetter & Tanner, 2012; Falah-Hassani et al., 2017; Rallis et al., 2014; Smith & Rudolph, 2012). They also often appear as a co-morbidity in perinatal women (Adewuya et al., 2018; Cougle et al., 2009; Dikmen-Yildiz et al., 2017; Radoš et al., 2018). The factors of the conceptual framework thus assume that depression and anxiety are similarly influenced, as has been found in other studies. Sociodemographic factors such as maternal age, income, education for instance may contribute to depression and anxiety in a similar manner (Liang et al., 2019; Meyer & Paul, 2011)

Psychosocial factors such as social support and lifestyle could contribute to higher exposure to chronic stress and possibly a higher risk for depression and anxiety. A lack of social support is closely associated with increased chronic stress exposure and is a predictor of depression, particularly in women (Peñacoba-Puente et al., 2013; Taylor, 2012). Over the lifespan, women are almost twice as likely to experience depression (Kuehner, 2017). Social support then, is a critical factor to explore in outlining the possible mechanism by which women are exposed to stress, and experience depression and anxiety as a function thereof.

A past history of depression and anxiety are robust risk factors for these problems during pregnancy (Brittain et al., 2015; Kader Maideen et al., 2014; Radoš et al., 2018). Chronic stress

exposure and a past history of depression or anxiety may augment each other and may predispose an individual to further adverse mental health outcomes. Stress factors themselves such as chronic stress, acute stress, episodic stress, life events and others contribute significantly to the onset, recurrence or exacerbation of depression and/or anxiety. The figure below further outlines stress, bio- psychological, psychosocial, psychological, physiological, obstetric and behavioral factors that contribute to the study outcomes: depression and anxiety (Figure 1.3).

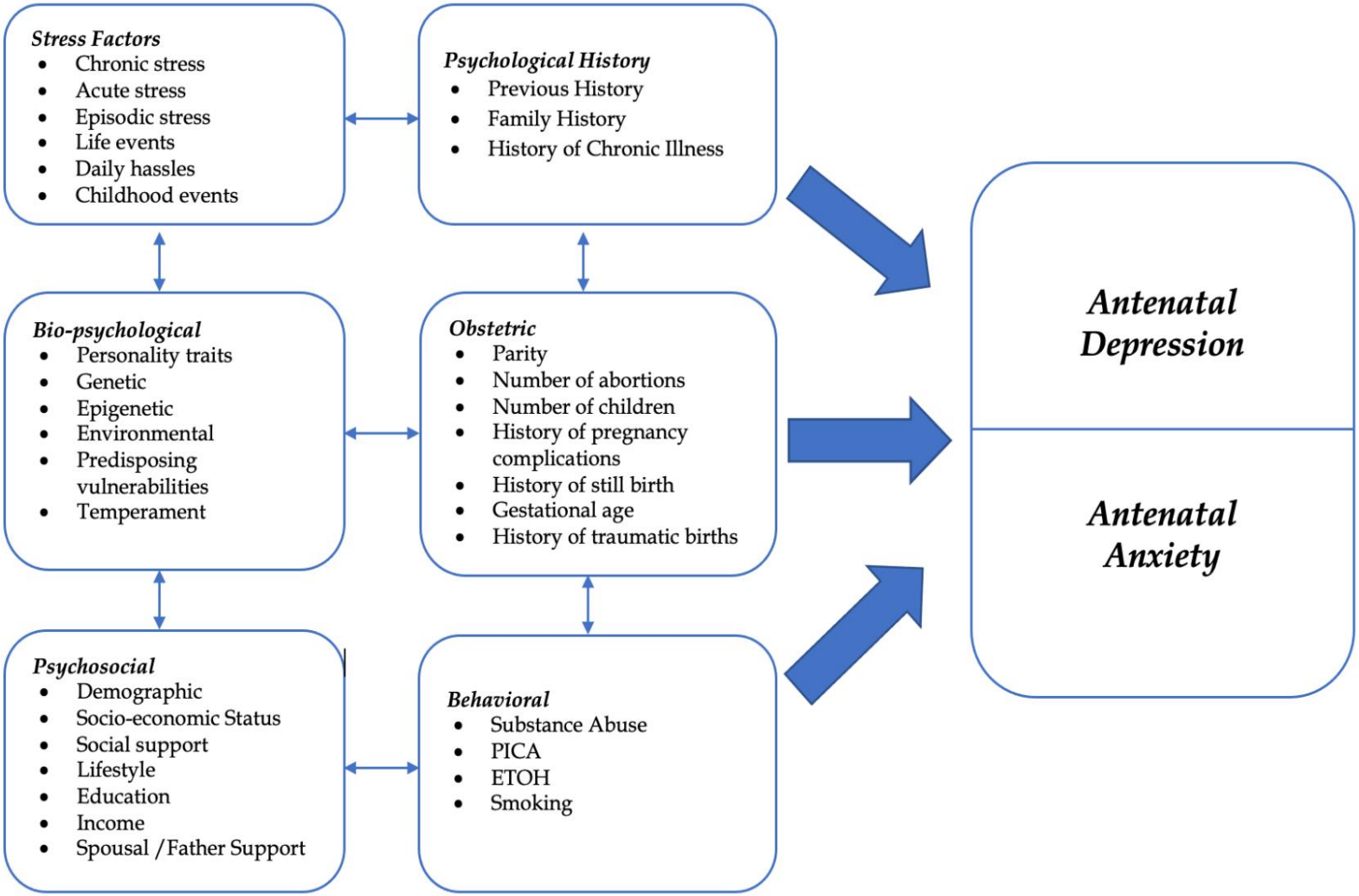


Figure 1.3 Conceptual Framework

CHAPTER TWO

LITERATURE REVIEW

2.0 Chapter Summary

This chapter presents relevant theoretical and empirical scholarship related to the study objectives. The following themes are covered: the history of human stress as a field of study, the biology and psychology of stress, stress in pregnancy, perinatal mental health, antenatal depression and antenatal anxiety. It also details an overview of measurement tools and scales for stress, depression and anxiety during pregnancy. Moreover, methodological weaknesses of previous studies and other gaps in the literature are discussed.

2.1 Stress: Historical Perspectives

To set the stage for a detailed scholarship into stress and a review of the evidence, it is important, to begin with a historical perspective of the subject under discussion. The development of stress as a medical field of study was primarily based on the work of Claude Bernard, Walter Cannon, and Hans Selye. The renowned physiologist Claude Bernard in the 1850's first developed the concept that the body had biologically determined set points for many processes such as acid-base balance, oxygen and carbon dioxide regulation, and ion concentration. He termed this the "milieu interieur", the internal medium that buffers change in the body (Cooper, 2008; Noble, 2008).

Walter Cannon in the 1930s first used and further developed the concept of "homeostasis" as the mechanism by which standard ranges of essential physiological variables are maintained. This

maintenance of a steady state that required sensors at key positions in the body and regulatory mechanisms to return any imbalance to normal was described in his 1932 book, *The Wisdom of the Body*. Cannon coined the term "fight or flight" to describe an animals' response to a threat after observing important changes in adrenal gland hormonal secretions in response to threats from the environment (Cannon, 1929). He consequently further extended the concept to include psychosocial and environmental threats to homeostasis or steady state. Epinephrine or adrenaline was then initially proposed as an important hormone and neurotransmitter in the "fight or flight" response (Cannon and Lissak 1939).

Building on Bernard's and Cannon's work, Hans Selye, a physician endocrinologist, further developed the principles of human stress exposure and reaction. Selye is credited with conceiving our present understanding of the term "stress".[1] His description of General Adaptation Syndrome (GAS) specifies how stress induces hormonal autonomic responses in the human body. Selye theorized that these hormonal changes over time can lead to ulcers, high blood pressure, and allergies. Published in *Nature* in 1936, his seminal paper "A Syndrome Produced by Diverse Nocuous Agents" detailed his research work in stress and stress reactivity (Selye, 1936). In experiments, rats were subjected to noxious agents and subsequent reactions were categorized into three distance stages: alarm, resistance, and exhaustion. In the alarm phase, the fight or flight mechanism is activated. The resistance phase consists of sustained arousal in an attempt to cope with the stressor. Finally, in the exhaustion stage, body systems are no longer able to cope and from which point diseases of adaptation such as high blood pressure may develop.

[1] "Stress" or strain here refers to human stress. Hitherto stress had primarily referred to nervous strain or tension. Stress has also been used in physics to explain the concept of elasticity as expressed in Hooke's Law of 1658

The GAS overtime was proved to have some gaps, but Selye essentially put stress on the map and path to further exploration, thus, earning the name "father of stress". His interdisciplinary approach to the study of human stress involved physiology, sociology, psychology, and endocrinology. This approach is presently encouraged and used in modern-day stress research. Indeed, advances in stress research have been a combination of increased developments in biochemistry, physiology, and psychology.

2.1.1 Stress: Conceptual and Definitional Perspectives

A consensus on a single operational definition of stress has yet to be achieved amongst past and present scholarship on the subject. However, many developments in research laid the foundation for not one definition of stress but many. These definitions are thus offered here to provide a comprehensive understanding of the subject matter. Selye defined stress as the "nonspecific response of the body to any demand made upon it" (Selye, 1956). This response definition (primary focus on the organismal response) postulates that physical and emotional stressors can stimulate an identical physiological response (nonspecific) in organisms. Selye made this inference based on a series of laboratory experiments where he exposed animals to noxious stimuli such as blaring lights, deafening noise, extreme temperatures et. cetera. He noted that upon exposure, the animals exhibited similar pathologic changes including stomach lining alterations, adrenal enlargement, and lymphoid tissue enlargement (Selye, 1936). In his 1936 published letter to *Nature*, he described a pathological triad or stress syndrome (adrenal enlargement, gastrointestinal ulceration, and thymic lymphatic involution) as the lasting physiological result or consequence of any variety of stressors. This definition emphasizes "non-specificity" as a core component of the corresponding stress response to stressors (agents that cause stress). Although Selye's theory does

not deny the possible presence of stressor-specific response mechanisms, it underscored that such a response did not constitute stress, i.e., the shared non-specific component.

In contrast to Selye, Walter Cannon documented the importance of the psychological as opposed to the physical stress response process (Cannon, 1929; 1939). Based on evolutional theories, he examined whether a stereotyped response pattern was adaptive, thereby recognizing that a non-specific response would most likely not have provided enough gains in natural selection and therefore would not have evolved. In the 1970's J.W. Mason in an attempt to clarify, update, and revise the concepts and definitions of stress noted that the hypothalamus-pituitary-adrenal axis could increase, decrease, or remain unaffected in response to different stressors. This implied that the presence of a pathological triad may not necessarily indicate the occurrence of stress (Mason 1975). Mason critiqued Selye's non-specificity principle and included psychological factors such as anxiety and fear as contributors to the nonspecific response when exposed to various stressors (Mason 1971). Furthermore, in experiments by Pacák and Palkovitz (2001), it was evidenced that different stressors activate different biological systems and different brain mechanisms. Their inquiry showed that the neurological mechanisms for hypothermia, for instance, was significantly different from the pathway for hypoglycemia (Pacak et al., 1995; Pacák & Palkovits, 2001). Follow up experiments to these findings thus indicated a specific rather than a non-specific response to stress thereby making it necessary for expanded definitions of stress.

Several contemporary views exist on the meaning of stress and how to approach a consensus in defining the concept. However, no such consensus has been reached to date. Goldstein defined

stress as the state where "expectations, whether genetically programmed, established by prior learning, or deduced from current circumstances, do not match present or anticipated perceptions of the internal or external environment" (Goldstein & Kopin, 2007). This difference between what is observed or sensed and what is expected or programmed results in compensatory responses (Pacák and Palkovits, 2011).

Yet another significant contribution to the definition of stress by Chrousos and Gold states that stress is a "state of disharmony or of threatened homeostasis that evokes both specific and non-specific responses" (Chrousos, 2009). This state of threatened homeostasis induces physiological and behavioral adaptive responses. This expanded concept includes significant factors or determinants in the individual stress response such as environmental factors, gene expression, and alterations. Homeostasis may be threatened or disrupted by several stimuli or stressors. Stressors may be classified into three main categories (physical, psychological and environmental), although stressors often act in tandem with each other (Figure 2.1).

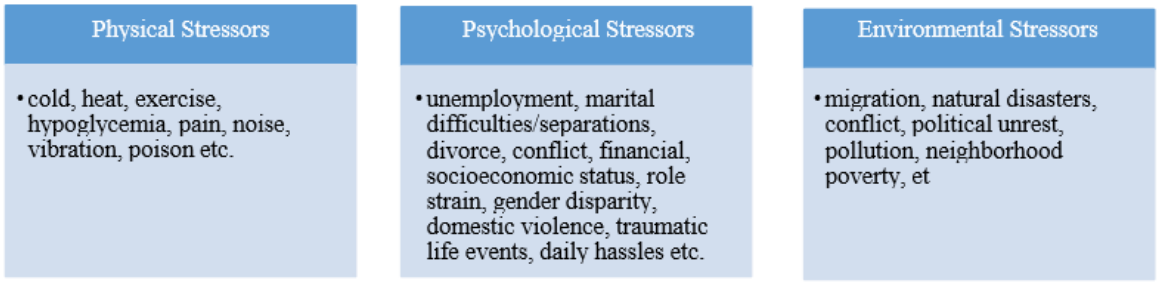


Figure 2.1 Categories of stressors[1]

[1] (Cohen & Janicki-Deverts, 2012; Evans & English, 2002; McEWEN, 1998; Pacák & Palkovits, 2001; Tessner et al., 2011)

Sapolski (1990) and McEwen (2010) presented and discussed new aspects of stress science such as the adverse effects of stress in different brain regions such as the hippocampus (McEwen, Wingfield, 2010; Sapolsky, 1990). What is more, this concept of stress includes the central action of glucocorticoids (released upon exposure to stress) which is associated with neurochemical, neurodegenerative, and behavioral changes. Worthy of mention is that their investigations at the time indicated that most neurodegenerative changes occur in the hippocampus; one of the brain regions involved in memory and other cognitive functions and the regulation of the HPA axis. Early research revealed that continued exposure to glucocorticoids, secondary to chronic stress exposure, can lead to early age-related changes in the hippocampus (Kim et al., 2015) and neuronal and dendritic atrophy often accelerated upon exposure to other neurobiological insults such as hypoxia (Sapolsky et al., 1990). Extensive research has since been conducted and published based on these early studies in stress, concepts, definitions, and effects on the human brain and body.

2.1.2 Definitional Challenges

Although psychologists, neurologists, biologists, sociologists have not reached a consensus on a single construct or definition of stress, some early theories and foundational work have been described above. There has been significant progress in the field even though there is a lack of consensus in the definition of stress. Progress notwithstanding, it is worthwhile to note that this long-standing and highly nuanced debate about how to define stress has led to some challenges. To illustrate, circularity in the field about a response-based versus a stimulus-based definition has led to difficulties in comparing research work, particularly if different fundamental definitions of stress were used. Secondly, stress and its definitions need to precisely capture and represent the complex and often interrelated social, psychological, and biological phenomena related to stress and the experience thereof. To understand and characterize all factors associated with the

occurrence and experience of stress (such as vulnerability, cognitive appraisal, coping, and personal attributes) definitional precision and consensus is imperative.

2.2 Types of Stress

According to the American Psychological Association (APA), there are three (3) different types of stress. These are acute stress, episodic acute stress, and chronic stress. Each of these stress types presents with variations in duration, symptoms, characteristics, and treatment (APA, 2012). The types of stress may also be in the form of single, repeated, complicated, or chronic. For this reason, each stress type requires different levels and types of management and/or clinical treatment or otherwise. Factors that affect the presentation and symptom management of all 3 types of stress include individual lifestyle, personality, the environment, coping resources, and developmental history (APA, 2012).

2.2.1 Acute Stress

Acute stress is mostly brief (a period of minutes to hours), and it is the most frequent type of stress experienced. It is often caused by reactive thinking. Reactive thinking is generated when a person has "negative thoughts that dominate their mind in situations that have occurred recently, future situations, or near-future demands" (Contrada & Baum, 2011). For example, a person may on occasion have negative thoughts that induce acute stress immediately or soon after an argument. Or perhaps an impending deadline may induce negative thoughts thereby causing acute stress. Acute stress can cause a variety of symptoms[2]:

[2] Cited from The Handbook of Stress Science (Contrada & Baum, 2011).

- Transient gastrointestinal problems, such as heartburn, constipation, diarrhea, flatulence, acid stomach and other bowel problems.
- Transient musculoskeletal distress such as headaches, tension back pain, jaw pain, neck pain, etc.
- Transient emotional problems such as a combination of irritability, or anger, anxiety, and depression.
- Transient hyperarousal including hypertension, tachycardia, dizziness, migraines, insomnia, shortness of breath, chest pain, heart palpitations, arrhythmias, and cold hands or feet.

2.2.2 Episodic Acute Stress

This type of stress is experienced when acute stress occurs frequently. More often than not, people who experience acute episodic stress live a life that is highly demanding, chaotic, and are very often in crisis mode (Miller & Smith, 2014). Acute episodic stress is significantly associated with certain personality types: 'Type A' and 'Type D' (Brebner, 2001). Stress goes beyond a stimulus-response process or reaction into the interface between an individual and the environment. This involves a subjective perception and assessment of stressors by an individual. The term personality is used to describe the "consistent individual patterns of thoughts, emotion, and behavior" that characterize each person across time and situations (Crum et al., 2013; Lecic-Tosevski et al., 2011). Personality is thought to be influenced by both an inherited "genetic" component (usually called temperament) and by their interactions with the environment (Vollrath, 2001). Some individuals may thus be more prone to experience personality variations in response to stress. The stress response is consequently a highly personalized process in which individual personality type

factors play a key role (Crum et al., 2013; Folkman et al., 1986). People with 'Type A' personality tend to be highly competitive, aggressive, impatient, and have a strong sense of urgency (Vollrath, 2001). Such individuals often tend to experience a high amount of acute episodic stress leading sometimes to adverse health outcomes (Lecic-Tosevski et al., 2011). Multiple researchers have found that people with 'Type A' personality are more likely to develop heart disease (Denollet et al., 1996; Friedman & Booth-Kewley, 1987; Kajantie & Räikkönen, 2010; Myrtek, 2001).

On the contrary, the 'Type D', also known as "distressed" or "disease-prone" personality tends to be worried, irritable, and constantly has negative thoughts that cause stress particularly acute episodic stress and often chronic stress (Lecic-Tosevski et al., 2011). There is a tendency for 'Type D's' to experience illnesses particularly stress-related illnesses such as cardiovascular disease (Kupper & Denollet, 2007; Sher, 2005; Yu et al., 2010). Apart from the adverse physical health effects related to stress exposure, 'Type D' persons tend to experience poor mental health outcomes such as depression and anxiety (Staniute et al., 2015). Some symptoms of episodic acute stress[3] are:

- Immune system compromise: constant allergies, reoccurring flu colds, etc.
- Cardiovascular changes: hypertension, tachycardia, arrhythmias and palpitations, cold extremities (hands and feet).
- Gastrointestinal system disturbances: irritable bowel syndrome, constipation, diarrhea, flatulence, acid stomach, heartburn, and other digestive tract related problems.

[3] Cited from The Handbook of Stress Science (Contrada, 2011).

- Musculoskeletal problems: ligament and tendon problems, pulled muscles, frequent headaches, jaw pain, back pain, and body tension.
- Cognitive stress: manual fatigue, compromised new learning abilities, decreased processing speed, decreased attention, and concentration.
- Emotional distress: tenseness, impatience, a short temper, depression, anxiety, irritability, and anger issues.
- Deterioration of interpersonal relationships: work, family and other social networks are vastly affected.

2.2.3 Chronic Stress

The most harmful type of stress is chronic stress, which left unchecked, over an extended period, may lead to irreversible mental and physical health damage. Chronic stress is the slow grinding wear and tear on the physiology and psychology of a person. An individual may experience chronic stress from any of the following, poor work environments, long term poverty, unemployment, repeated abuse of all forms, family dysfunction, work/career problems, and an unhappy marriage. Usually, chronic stress is present in situations that have no immediate resolution, unpredictable, and out of the control of the person experiencing it (Seib et al., 2014). Chronic stress exposure via its disease-promoting mechanisms has been associated with physiological conditions such as cardiovascular disease (An et al., 2015), migraines (Malone, Bhowmick, & Wachholtz, 2015), reproductive health problems (Petraglia et al., 2013; Valsamakis et al., 2019), hypertension (Atwoli et al., 2015; Kinzie, 2015), and gastrointestinal ulcers (Kumar et al., 2019). Similarly, it is closely associated with psychological or behavioral sequelae such as substance abuse (Brady & Sinha, 2005; Kinzie, 2015), depression (Kobrosly, van Wijngaarden, Seplaki, Cory-Slechta, &

Moynihan, 2014), a decline in cognitive function (Marin et al., 2011), and unfortunately suicides (Stewart et al., 2019).

2.2.4 Pregnancy-specific Stress

Pregnancy itself can lead to adverse mental health outcomes for the mother to be. Stress in pregnancy is the "imbalance that a pregnant woman feels when she is unable to cope with demands" (Vijayaselvi et al., 2015). Pregnancy-specific stress (PSS) includes fear of labor and childbirth, unplanned pregnancy, fear of adverse birth outcomes, and the impending responsibility of providing for a child (Laszlo et al., 2013; Lucita, 2015). Vijayaselvi et al., (2015), documented that a significant risk factor for stress during the antenatal period for women in Southern India was the income level of the spouse or the partner's employment status. As is often the case, people with high levels of stress and consequent poor mental health statuses often are at risk for even poorer health choices and behavior. For example, in a study reviewing PSS and health behavior, PSS was associated directly with preterm birth (PTB), smoking, caffeine consumption, unhealthy diets, and inversely associated with vitamin use and exercise (Guardino & Schetter, 2014; Lobel et al., 2008). Other publications have differentiated PSS as a phenomenon that is distinct from general stress exposure during pregnancy and thus, must be closely researched further (Faramarzi, Amiri, & Rezaee, 2016; Lobel et al., 2008). Although PSS has been identified as a syndrome on its own, there are still challenges in presenting a definite categorization and etiology that includes findings of studies from SSA. On the contrary, however, Morrison et al., (2013), found that allostatic load biomarkers, a proxy measure for chronic stress exposure may not be associated with chronic stress exposure during pregnancy (Morrison et al., 2013). One limitation is that these researchers however conceded that the study did not consider all pregnancy-specific factors (Morrison et al., 2013).

Nonetheless, more recent work on the factors related to PSS indicates an association with sociodemographic and obstetric characteristics, perceptions of pregnancy, health behaviors, maternal health, and birth outcomes (Ibrahim & Lobel, 2020). Despite these and other developments in the evidence, there are questions that arise. Firstly, do pregnant women in Ghana experience PSS? Secondly, are the associated factors identified identical to or dissimilar from those of pregnant women in Ghana? Answers to these are yet to be gathered through robust research.

A sentinel prospective longitudinal study reviewed anxiety associated with being pregnant or PSS and child executive function and cognition between the ages of 6 and 9 years. This investigation concluded that stress and anxiety specifically related to being pregnant was significantly associated with lower visuospatial working memory performance in both boys and girls (Buss et al., 2011). Another informative prospective study examined PSS and its related anxiety with parenting difficulties. In this study, Huizink et al., (2017) found from their analyses that mothers with high pregnancy-specific stress and anxiety had appreciatively higher levels of parenting stress (Huizink et al., 2017). Conclusively, PSS affects parenting and children of mothers exposed. Similar longitudinal studies that follow mother-child dyads across different populations and socio-economic strata will provide further data to translate research into practice. This thesis is primarily focused on chronic stress and pregnancy-specific stress as they relate to anxiety and depression.

2.3 Neurobiology of Stress

2.3.1 The Fight or Flight Response

The fight or flight response is elicited upon activation of the sympathetic adrenal medullary (SAM) system at critical times such as an encounter with a predator. Upon SAM activation, certain key physiological changes allow for the fight or flight reaction based on brain signals and secretion of epinephrine by the adrenal medulla (McEwen, 2007). These include[4], increased blood flow to the skeletal muscles, glucose release from the liver, bronchial dilation for increased oxygenation along with reduced blood flow to non-essential organs such as the skin, reproductive and digestive systems. Homeostasis, as described earlier, must be established after a certain amount of time to maintain physiological balance.

2.3.2 The Brain and Adaptation to Stress

The brain is the primary mediator in the stress response. As the central organ in the cascade of events, the brain regulates the stress response via neuroendocrine, autonomic, immune, and metabolic pathways. Adaptation to stressful stimuli from the external environment is an active process during which some wear and tear are inevitable. Nevertheless, this wear and tear over prolonged periods, lead to allostatic overload and thus, the disease-promoting mechanisms of stress exposure. Overload and its systemic adverse effects are the consequence of toxic stress exposure. In response to chronic stressors, the HPA axis is activated.

[4] Stress: Concepts, Cognition, Emotion and Behaviour by George Fink (Fink, 2016)

2.3.2.1 Hormones and Neurotransmitters in the Stress Response

The primary hormones released in the physiological stress response are glucocorticoids and catecholamines. Glucocorticoids, specifically, cortisol is the endpoint product of activation of the hypothalamus, pituitary, and adrenal glands (HPA) axis. Catecholamines are a group of amine-based compounds that act as hormones and neurotransmitters. Catecholamines include dopamine, epinephrine (adrenaline), and norepinephrine (noradrenaline). In the acute stress response, epinephrine and norepinephrine are released by the sympathetic adrenal medullary (SAM) axis activation. These hormones facilitate several physiological changes that act in tandem to facilitate the "fight or flight response" to a threatening physical stressor, particularly during acute stress.

For chronic stress, however, the HPA axis is activated with cortisol/glucocorticoids as the endpoint hormone released by the adrenal glands. Glucocorticoids increase appetite, food-seeking behavior, and locomotor activity; all useful to replenish our energy reserves after expenditure. Where the immediate threat or stressor is chronic and therefore prolonged, such as marital problems or chronic poverty, rather than an acute physical threat that is resolved within a short amount of time, it results in sustained glucocorticoid production (sustained HPA axis activation). Glucocorticoid dysregulation impedes glucose uptake, insulin action, increases fat deposits, and the formation of atherosclerotic plaque in coronary arteries often leading to increased risk for heart disease and other diseases (Harris & Seckl, 2011; Logan & Barksdale, 2008).

2.3.2.2 Epigenetics and the Stress Response

Psychologically, stress and the stress response may result in adverse behavior outcomes. However, more and more emerging science in the past decade shows that adverse behavior develops from

complex brain functions and interactions at the cellular level (Park & Friston, 2013). Stress, at the cellular and molecular levels, causes changes based on the mechanism of the physiology of stress. Cogently, stress must be present and act to shape the emergence of brain networks and interactions within which related behavior may be explained. Two questions of primary interest arise in the literature; *(1)* what role do genetics and epigenetics play in influencing responses to stress, and *(2)* how might these factors combine to mediate the development of the brain network function or dysfunction?

The term "epigenetics" was introduced to conceptualize how genetic interactions with the environment produce phenotypes (observable characteristics or traits) (Deichmann, 2016). To be precise, epigenetics refers to the environmental factors and events that can affect gene expression or chromatin (material of which chromosomes are made of) structure (Vinci, 2012). Epigenetic changes[5] result in an alteration in the DNA structure without necessarily altering the genetic code (Wei et al., 2017). These changes also may either be hereditary or not.

Epigenetic changes (primarily via DNA methylation) in the HPA axis genes[6] in the brain, and in pituitary cells are sometimes caused by high levels of cortisol (Klengel et al., 2013; Yang et al., 2012). Furthermore, glucocorticoid-induced or stress-induced epigenetic changes persist long after cessation of exposure (Klengel et al., 2013; Lee et al., 2010). Research endeavors during the past few decades have presented fascinating evidence suggesting that stressful life experiences

[5] Epigenetic change mechanisms include DNA methylation, histone modifications involving the addition or deletions of chemical groups to the core proteins around which DNA is wound, noncoding RNAs which bind to messenger RNAs.
[6] HPA axis genes such as FK506 binding protein 5 and FKBP5

particularly, during pregnancy, exert long-term consequences on maternal mental health and even that of the child. Human epidemiological and animal studies indicate that stressful experiences in utero or during early life may increase the risk of neurological and psychiatric disorders, arguably via altered epigenetic regulation (Deichmann, 2016; Wei et al., 2017). Epigenetic mechanisms, such as mRNA expression and DNA methylation often occur in response to stressful experiences and hostile environmental factors (Wei et al., 2017). Altered epigenetic regulation secondary to stress exposure is a critical avenue for stress research and worthy of consideration as epigenetic changes may affect cognition, decision making, intuition, mood and other high order brain functioning activities.

2.4 Stress and Cognition

Stress is characterized by adaptation to environmental demands on our physical, mental or emotional resources. Perception, based on a cognitive appraisal of a stressor, is central in the psychological stress response as detailed in the conceptual framework of this study (Folkman et al., 1986). Hence, central to the tenets of the conceptual framework (the Transactional Model of Stress) is the role of cognition in the appraisal process of stress. Based on this theoretical framework, stress is the person-environment interaction wherein a potential stressor is appraised as threatening and potentially leading to stress or as benign and eliciting no stress response (Folkman et al., 1986). This appraisal is a cognitive activity entailing a conscious and thoughtful analysis. Prolonged stress often causes functional cognitive deterioration and possible structural damage to some brain structures such as the hippocampus, the brain region associated largely with memory (Pechtel & Pizzagalli, 2011; Sandi, 2013).

The available evidence for the impact of chronic stress on some functional aspects of cognition, such as memory in healthy humans, is limited primarily due to the high ethical limitations inherent in exposing humans to prolonged stress for research purposes. Indirect data are available from studies that have reviewed neuropsychiatric disorders and their linkage to stress. These studies have shed light on the relationship between prolonged exposure to stress and impaired cognitive brain function in humans (Kim, Pellman, & Kim, 2015; Marin et al., 2011; Pechtel & Pizzagalli, 2011; Sandi, 2013; Schwabe, Joëls, Roozendaal, Wolf, & Oitzl, 2012; Wingenfeld & Wolf, 2011).

Some studies have suggested a pathway via which prolonged levels of glucocorticoids (the stress hormone) lead to altered cognitive function. Pechtel and Pizzagalli (2011), hypothesize that chronic elevations of glucocorticoids inhibit neurogenesis (the formation of new neurons or synapses), which in turn damage important memory and cognitive function in the hippocampus. Hippocampal dysfunction as a result of glucocorticoid level dysregulation over extended periods has been implicated in psychological disorders such as depression, anxiety, post-traumatic stress disorder and schizophrenia (Chen et al., 2018; Gagnon & Wagner, 2016; Kim et al., 2015; Kim et al., 2019; Korte, Koolhaas, Wingfield, & McEwen, 2005; Segal, Richter-Levin, & Maggio, 2010; Snyder, Soumier, Brewer, Pickel, & Cameron, 2011). These findings notwithstanding, the actual causal line of evidence remains somewhat unclear and therefore clinical therapy and decision making for stress-induced psychiatric and psychological conditions are still undergoing research (Feduccia, Holland, & Mithoefer, 2018; Iovino et al., 2018; Jarero & Artigas, 2018; Kim et al., 2015; Wingenfeld & Wolf, 2011).

2.5 Key Gaps and Implications in Ghana

Epidemiological, experimental, and clinical research findings indicate that internal and external environmental conditions during the preconception, perinatal and post-natal periods are closely linked to a higher risk for chronic disease conditions later in life (Babenko et al., 2015; Maccari et al., 2014; Provenzi et al., 2016; Vaiserman, 2015; von Ehr & von Versen-Höynck, 2016). These studies have developed and built on the term fetal programing although some of the more nuanced aspects of these are yet to be clarified (Faa et al., 2016; Hong et al., 2020). To cite a specific example, maternal diet, particularly a high-fat diet has been associated with HPA axis dysfunction and ensuing higher risk for affective disorders such as anxiety via metabolic programming mechanisms (Dyer & Rosenfeld, 2011; Rincel et al., 2016; Sasaki et al., 2013). However, it is unknown if particular patterns of high-fat diets in Ghana amongst pregnant women would lead to the same conclusions. Moreover, maternal and childhood obesity are on the rise in Ghana as are other noncommunicable diseases (Aryeetey et al., 2017; Bosu, 2015; Ofori-Asenso, Agyemang, Laar, & Boateng, 2016; Van Der Linden et al., 2016). Although fetal programming reveals some predictors and risk factors for these conditions in childhood and adulthood, it has not been fully established or eliminated as a causal factor in Ghana.

Additionally, interventions have been put in place in recognition of the crucial first 1000 days of life (approximately just before conception to two years of age) to early brain development (Dewey, 2017; Edmond et al., 2015; Twum-Danso et al., 2014). These interventions, however, have not considered the contribution of stress to fetal programming and ensuing higher risk for psychological disorders over the lifespan. This critical gap needs to be addressed if better health outcomes and total wellbeing are to be attained in Ghana. Due to the scarcity of local and

contextual evidence, it is presently unclear what specific interventions will be effective for mitigating the effects of fetal programming. Also, what are the modulating factors, possible diagnostic tools and parameters for fetal programming? Finally, what treatment, pharmacological or otherwise will be effective and affordable in Ghana?

2.6 Measurement of Stress

Due to the dual nature of the stress response, human stress may be measured either by physiological indices or psychosocial questionnaires.

2.6.1 Physiological

The perception and interpretation of a situation as stressful leads to the activation of the HPA axis, and to the ultimate secretion of cortisol and catecholamines. These end products (cortisol and catecholamines) are fairly easy to measure in blood, urine and saliva (Lupien, 2013). Other markers of HPA activation such as corticotropin-releasing factor (CRF) and adrenocorticotropin hormone (ACTH) are more challenging to measure. ACTH can only be measured in blood and CRF can only be measured in cerebrospinal fluid (Binder & Nemeroff, 2010). Many studies have validated proxy measures such as cortisol and catecholamines, as physiological indices of stress in humans (An et al., 2015; Hellhammer et al., 2010; Juster et al., 2011; Kudielka & Wüst, 2010). Other studies have utilized physiological stress measures in pregnant women to examine the role of stress in obstetric and birth outcomes (Henley et al., 2014; Hobel, 2004; Hobel et al., 2008; Morrison et al., 2013; Olson et al., 2015). Worthy of mention is the fact that some studies amongst pregnant women have combined the physiological measurement of stress in addition psychological measurement modalities (Harville, Savitz, et al., 2009; Solivan et al., 2015).

2.6.2 Psychological

Early studies and scales to measure psychosocial stress were primarily based on life events (Cochrane & Robertson, 1973; Holmes & Rahe, 1967). Life events are happenings that occur in a person's daily life and may act as a source of stress or a stressor. Life events may be defined as personal or environmental occurrences that require major changes or adjustments and represent potentially stressful situations or environmental conditions (Lobel, 1994). These events have been studied most and are often measured in prenatal stress research. This is mainly based on an attempt to have an objective measure of an individual's stress levels. The study of life events as an indicator of personal stress levels is based on the hypothesis that stress results from an accumulation of major changes which require adaptation to cope.

However, there are certain limitations to using life events only as an objective measure of perceived stress during pregnancy. These issues include the impact of these life events, parameters likely to have harmful consequences for pregnant women, the additional variables that influence stress itself and the context within which the stressful events take place (Graignic-Philippe et al., 2014). Context in life event stress measurement is important. For instance, a life event such as a car accident due to its random nature might be different from a job loss (that occurs at a more predictable time i.e., when a person is working).

Additionally, prenatal stress studies based on life events as predictors of stress, provide data on stress exposure measurements and not necessarily on stress response measures (Graignic-Philippe et al., 2014). Similarly, assessing life events only during pregnancy may be relatively low over a 40-week gestational period as opposed to over the life course. Also, the additional contribution

that may exist from chronic stress might not be factored into the measurements (Chen, Grobman, Gollan, & Borders, 2011). Therefore, whereas older studies relied more on a checklist of life events, more recent studies have attempted to use a more multidimensional concept of stress that combines measures of life events with an assessment of other factors (Beydoun & Saftlas, 2008). In 2004, Huizink and colleagues further developed earlier work by Lazarus and Folkman (1984), in the multidimensionality of stress measurement. These include factors: *(1)* that provoke stress (e.g., chronic or acute life events), *(2)* that act as stress mediators (e.g., coping, social support) and *(3)* that result from stress (e.g. anxiety, perceived stress). Thus, indicating necessary incorporation of both psychosocial stress assessment and physiological stress assessment tools.

Consequently, some investigators have expanded their classifications and measurements of psychosocial stress to include perceived stress, anxiety, depression, racism, lack of social support, coping mechanisms, job strain, acculturation stress, and domestic violence (Dunkel Schetter, 2010; Halbreich, 2005; Hobel, 2004; Hobel et al., 2008; Latendresse, 2009). Standardized, validated, psychometric scales available for perinatal stress research are particularly extensive in variability. These factors have made it exceedingly difficult for investigators to reach a clear consensus on the contribution of psychosocial stress to pregnancy outcomes, such as preterm birth, despite many years of research study. For instance, in a systematic review of stress and preterm birth by Chen et al., (2011), of 136 studies reviewed, a total of 85 different instruments were used. Notably, of the 85 validated instruments analyzed in this review, many measured different domains of stress such as external stressors (n=18), perceived stress (n=13), enhancers of stress (n= 22), buffers of stress (n=22) and others (n=10) (Chen et al., 2011). Due to these challenges, a full consensus on the best measurement option for the operational definition of stress, the

conceptualization of all stress domains into scales, and the development of a comprehensive psychometric tool to measure stress during pregnancy are yet to be achieved.

2.6.2.1 Psychometric Scales for Stress

Despite some challenges highlighted above, psychometric scales have been developed and successfully used in various studies across a variety of populations and locations. Psychometric scales "comprise of multiple items measuring the same focal variable in a reliable and valid manner and yielding parametric data"(Cipresso & Immekus, 2017) Psychometric scales for stress assess the level, severity, and impact of stress on our wellbeing in modern society. Table 2.1 highlights some characteristics of key psychometric scales used to measure stress.

Table 2.1 Characteristics of key stress instruments

Name of scale	Items	Domains tested	Setting		
			Clinical	Population	Primary care
DHS - The Daily Hassles Scale (Kanner et al., 1981)	117	Future security, time pressures work, household responsibilities, health, inner concerns, financial responsibilities, and neighborhood/environment within the past month	Applicable	Applicable	Applicable
EPCL – The Everyday Problems Checklist (Vingerhoest 1994)	114	Family life, living and working conditions, physical appearance, transactions, and business in the past 2 months	Applicable	Applicable	Applicable
SRRS – The Social Readjustment Rating Scale (Holmes & Rahe, 1967)	43	Life events of varying severity, from death of a spouse to minor violations of law	Applicable	Applicable	Applicable
IRLE – Interview for Recent Life Events (Paykel, 1997)	64	Work, education, finance, health, bereavement, migration, cohabitation, legal, family and social relationships and marriage	Applicable	Applicable	Applicable
LEDS – Life Events and Difficulties Schedule (Brown & Harris, 2012)	95	Events and difficulties in areas of health, role changes, leisure, employment, housing, money, crises, forecasts, marriage, interactions with parents, and resources over the last 12 months	Applicable	Applicable	Applicable
PDQ – The Prenatal Distress Questionnaire (Ibrahim & Lobel, 1999)	12	Aspects of pregnancy including physical and emotional symptoms, relationships, body image and mothering ability	Applicable	Applicable	Applicable

2.7 Effects of Stress

Stress presents in a variety of forms and may often have emotional, cognitive, physical and interpersonal effects on an individual. The emotional effects of stress may include shock, terror, irritability, blame, anger, guilt, grief/sadness, emotional numbing, helplessness, loss of pleasure derived from familiar activities, difficulty feeling happy, and difficulty experiencing loving feelings[7]. Indeed, the psychosocial response to stress is highly interrelated to emotion, particularly some negative emotional responses presented earlier. Negative emotion as a result of exposure to stress leads to negative behavior and a decrease in problem-solving skill. In a study examining the relationship between stress and negative emotion amongst teachers, findings revealed that participants who had high-stress levels displayed many of the negative emotional effects of stress and led to burnout and high rates of resignations (Harmsen et al., 2018).

[7] Adapted from the Handbook of Stress and Health: A Guide to Research and Practice by Eva-Ellen Weiß (Weiß, 2018)

These negative emotions experienced secondary to stress exposure, often affect cognition. In fact, cognitive impairment is one of the effects of stress that has been outlined clearly in the body of evidence (Yeh et al., 2015). Some of the effects of stress on cognition are impaired concentration, impaired decision-making ability, memory impairment, disbelief, confusion, nightmares, decreased self-esteem, decreased self-efficacy, self-blame, intrusive thoughts/memories, worry, and dissociation (e.g., tunnel vision, dreamlike or "spacey" feeling)[7]. The prefrontal cortex is the principal center for human mammalian emotional regulation. Stress and impaired cognitive function are therefore inextricably related (Section 2.4).

During and after exposure to stress, the emotional and cognitive toll may lead to interpersonal effects. Some of these are increased relational conflict, social withdrawal, reduced relational intimacy, alienation, impaired work performance, impaired school performance, decreased satisfaction, distrust, externalization of blame, externalization of vulnerability, feeling abandoned/rejected, over-protectiveness (American Psychological Association [APA], 2012; Cohen & Janicki-Deverts, 2012; Häusser et al., 2010; Miller & Smith, 2014; Shields et al., 2017). Apart from emotion, cognition and interpersonal effects, there are physical effects of stress that often include fatigue, exhaustion, insomnia, cardiovascular strain, startle response, hyperarousal, increased physical pain, reduced immune response, headaches, gastrointestinal upset, decreased appetite, decreased libido, vulnerability to illness (Clow & Hamer, 2010; de Weerth & Buitelaar, 2005; Marin et al., 2011; Sheets & Craighead, 2014).

2.8 Perinatal Mental Health

2.8.1 Conceptualization

The term perinatal mental health (PMH) often refers to the several mental health disorders experienced by women during pregnancy and the postnatal period. The specific length of time of this period varies across present data. One body suggests the time frame from conception through to the end of the first postnatal year (Austin & Priest, 2005). PMH includes a previous history of a mental disorder, signs and symptoms revealed in the antenatal period and the range of disorders that occur in the postnatal period (Stewart & Henshaw, 2002). Difficulties of PMH may present across all levels of healthcare provision, however, the often-gradual onset of symptoms makes it difficult for a health professional to recognize changes in behavior and mood (Muzik & Borovska, 2010). The specific origins or causes of PMH remain unclear. There are ample data that suggest contributory factors include biological, genetic, psychological and social aspects (Adeponle et al., 2017; Fisher et al., 2012; Howard et al., 2014; Muzik et al., 2010).

2.8.2 Contextual Factors in SSA

Perinatal mental health has become a matter of public health concern, particularly over the past 30 years in the developing world. Before this shift in focus, most consideration was given to reducing maternal mortality, which remains significantly higher in SSA and a research and policy priority. PMH and overall maternal wellbeing in SSA is a key area of focus that requires further developments. Undoubtedly, women face many contextual, gender, gender-based violence, socioeconomic and empowerment challenges that are sometimes more pronounced in developing countries. In a study assessing the factors associated with maternal mental health disorders in West Africa, the investigators identified intimate partner violence as a primary factor (Ola et al.,

2011). Another study examining context-related risk factors for or predictors of adverse maternal mental health in a South African sample identified poverty, food insecurity and insecure accommodation as significant predictors (Kathree et al., 2014). From these, context-related items in SSA such as intimate partner violence, food insecurity and lack of adequate accommodation may be contributory factors to stress exposure thereby, making individuals susceptible to depression and anxiety.

A cross-sectional study amongst women of reproductive age in Ethiopia indicated that lack of social support particularly from a spouse and extended family networks were significant predictors of perinatal depression (Tefera et al., 2015). In a large population-based study in Ghana, a contextual factor related to predictors of adverse mental health in women was gender disempowerment particularly in intimate relationships (Sipsma et al., 2013). That and other evidence are cross-sectional and consequently are unable to fully determine cause and effect over time (Kesmodel, 2018; Sedgwick, 2014). Moreover, some important contextual and associated factors such as religiosity, ethnicity, culture, social norms, political and environmental influences need to be closely examined and understood since they may play a key role in mental health outcomes.

2.8.3 Factors Associated with Perinatal Mental Health

The perinatal period has been recognized both as a risk factor for relapse of existing mental illness and a time of relative protection. It is, therefore, important to ascertain whether the antenatal period differs considerably from other times in a woman's life in terms of either developing a new mental illness or experiencing a relapse of an existing disorder. From the body of evidence, the peak age of onset for many mental disorders occur during the reproductive years of women that are between

15 and 45 years of age (Busfield, 2012). Depression, anxiety, and other common mental health disorders are significantly associated with risk factors that are often interconnected and occur concurrently such as gender-based roles, and stressors (negative life events and experiences).

Some gender-specific risk factors for common mental disorders that disproportionately affect women include gender-based violence, socioeconomic deprivation, low income and income inequality, low subordinate social status and rank and constant responsibility for the care of others (Afifi, 2007; Busfield, 2012; World Health Organization, 2014). The high prevalence of sexual violence to which women are exposed resulting in a subsequently high rate of Post-Traumatic Stress Disorder (PTSD), renders women the leading single group of people affected by this anxiety disorder (Howard et al., 2013; World Health Organization, 2017). The mental health impact of exposure to long term, cumulative psychosocial adversity has to be investigated in female populations to inform present gaps in detection, treatment, and provision of services.

The scientific discourse of maternal mental health and other related disorders still focuses mostly on the postnatal period. For instance, the symptoms, risk factors and consequences of postpartum depression have been methodically studied in the present body of evidence (Gelaye et al., 2016; Thompson & Fox, 2011). Nevertheless, there is evidence that depression is at least as common during pregnancy itself as it is in the postnatal period (Ashley et al., 2016; Biratu & Haile, 2015; Giardinelli et al., 2012; Heyningen et al., 2016). Besides, a study that reviewed the predictors of maternal mental health and wellbeing indicated that depression (both antenatal and post-natal) was a strong predictor of poor maternal psychological wellbeing (Escribà-Agüir et al., 2013). These studies notwithstanding, maternal mental health, particularly during pregnancy in LMIC, remain under-researched, under-diagnosed, under-prioritized and under-funded (Sweetland et al., 2014a).

Consequently, data on the risk factors, environmental contextual factors for intervention planning are very limited. Indeed, this critical disparity must be prioritized because some key studies in LMIC have identified a significant prevalence of some common mental health disorders such as depression and anxiety amongst pregnant women. For instance, Fisher et al., (2012), in a systematic review, established that the prevalence of antenatal mental health conditions in LMIC was about 15%. In an urban South African cohort, Ramchandani et al., (2009) found that as much as 16% of women were probable cases of postnatal depression. In this study, some of the risk factors identified were exposure to societal stressors (such as crime and danger) and reported relationship difficulties with their partners (Ramchandani et al., 2009). In a similar study in Ethiopia, the prevalence of prenatal depression was 25% (Biratu and Haile, 2015). In this study, the major predictors of antenatal depression were unplanned pregnancy, lack of father's support and previous history of depression. In a study in rural Ghana, Weobong et al., (2014), found that the prevalence (9.9%) of antenatal depression was similar to rates in high- income countries as well as other SSA studies. In Ghana, the major determinants of antenatal depression were primarily related to chronic social and economic disadvantage (Weobong et al., 2014). Although these studies did identify that environmental and other psychosocial circumstances may lead to adverse mental health during pregnancy, the contribution of chronic stress resulting from these factors is yet to be fully investigated.

Severe mental health problems are noted to occur much more frequently in women exposed to IPV. Amongst pregnant women, for instance, researchers found suicidal ideations were significantly more frequent amongst those who were exposed to intimate partner violence and the resulting stress related to this (Alhusen et al., 2015). Still, in a population of pregnant women, maternal stress

exposure, secondary to intimate partner violence resulted in a transgenerational impact where it caused epigenetic changes in psychological functions of infants born to these mothers (Radtke et al., 2011). In Ghana, intimate partner violence, although exists, is not often talked about nor adequately addressed. In fact, Cantalupo et al., (2006), referred to domestic violence in Ghana as an "open secret" (Cantalupo et al., 2006). During pregnancy, researchers identified that as much as 33% of the pregnant women had experienced physical violence; of particular risk were women who lived in urban areas of the nation (Owusu- Adjah & Agbemafle, 2016; Pool et al., 2014). Ensuing studies that examine these data on domestic violence amongst pregnant women have been limited in Ghana. A high percentage of the evidence have primarily been gathered from developed countries with scant contributions from SSA. Apart from domestic and intimate partner, there are other psychosocial and sociocultural issues that factor significantly into exposure to chronic stress. These need to be examined further in Ghana and by extension in SSA.

Negative major life events may be tragic, difficult to overcome and cause chronic stress and/or mental health difficulties. During the perinatal period, major life events could occur and consequently put a pregnant person at high risk for poor mental health. Situations such as bereavement and divorce during pregnancy have been identified as risk factors. Burger and associates in 2015, observed that mothers who experienced negative major life events during pregnancy had a higher prevalence of depression (Burger et al., 2015). Death of a primary relative such as a child or a spouse is known to be a major source of stress regardless of coping and support mechanisms. For example, a study in Sweden, researchers found that maternal bereavement of a primary relative during pregnancy was associated with an 18% higher risk of stillbirth (Laszlo et al., 2012).

Other adverse major life events such as terrorist attacks, environmental/chemical disasters, natural disasters (hurricanes, destructive rainstorms etc.) and pandemics often lead to chronic stress exposure and a higher risk for depression and anxiety. Harville et al., (2010) in a systematic review found that disasters such as these impact maternal mental health and some perinatal health outcomes, specifically among highly exposed women (Harville et al., 2010). In a sequel study of Hurricane Katrina victims in the American state of Louisiana, exposed pregnant women suffered adverse birth outcomes and maternal complications as well as post-traumatic stress disorder (Harville, Xiong, et al., 2009). Ghana has had its share of natural disasters that caused devastation and loss. The June 3rd, 2016, rainstorm and ensuing fire at the Kwame Nkrumah Circle left lasting damage. The perinatal mental health outcomes of this disaster to exposed victims, some of whom may have been pregnant during the disaster are yet to be studied.

Although there is good evidence that several psychosocial risk factors account for poor maternal mental health outcomes during pregnancy, these factors do not explain all the cases observed. Research on the neurobiology and hormonal regulation and dysregulation during pregnancy imply that there may be significant with adverse mental health outcomes. There are major changes in levels of many psychologically active hormones over the prenatal period such as progesterone, 17β-Estradiol and cortisol, particularly over the perinatal period (Lommatzsch et al., 2006). Studies have examined the possible biological risk factors that contribute to perinatal depression, for instance, using the HPA axis as a working hypothesis (Kammerer et al., 2006). Early work, as well as current work, indicate that in addition to the large rise and fall in estrogen and progesterone levels during pregnancy, key alterations in HPA axis function may contribute to perinatal affective disorders (Brummelte & Galea, 2010; Glover et al., 2010; Kammerer et al., 2006; Kramer et al.,

2013; Tsigos & Chrousos, 2002). This consequently puts pregnant women at double risk for reduced mental health and wellbeing (psychosocial and physiological).

2.8.4 The HPA Axis and Perinatal Mental Health

The HPA axis is central to the endocrinology of the stress response (Tsigos & Chrousos, 2002). However, further examination indicates that it is increasingly considered as significant in affective disorders and their biology. HPA axis dysfunction has been related to bipolar disorder (Belvederi Murri et al., 2016); decreased prefrontal cortex activity in depressed patients (Palazidou, 2012); and increased risk for affective disorders (Porter & Gallagher, 2006). The function of the HPA axis undergoes substantial changes during pregnancy and the postpartum period (Duthie & Reynolds, 2013; Mastorakos & Ilias, 2003). Even though cortisol levels rise threefold by the third trimester, the fetus is to a degree protected from high cortisol by the action of the enzyme 11β-hydroxysteroid dehydrogenase type 2 (HSD11B2) (Duthie & Reynolds, 2013). Maternal stress and disease may modify activities of HPA axis and HSD11B2, allowing greater transfer of glucocorticoids across the placental barrier to the fetus from the mother. In-utero overexposure to glucocorticoids is hypothesized to be a key mechanism associating early life development with later life disease (Brunton, 2013). On the more immediate term, however, for the mother, these changes in HPA axis function may result in increased susceptibility to mood disturbances. Additional understanding of the alterations in the HPA axis during pregnancy and all psychosocial risk factors for perinatal depression may ultimately allow for early identification of those at risk of poor mental health during the antenatal and immediate postpartum period.

2.9 Depression

2.9.1 Overview

Depression is one of the leading affective disorders and public health concern across the globe. A Lancet review in 2016, determined that globally, almost one billion people suffer from affective disorders with depression in the lead (Rehm & Shield, 2019). Depression if untreated may lead to high morbidity rates, high costs in human quality of life, economic costs and many others (Chisholm et al., 2016). Furthermore, depression affects more women than men over the lifespan but particularly during reproductive age (15-45) (Busfield, 2012; Woody et al., 2017). As the rates of depression and other affective disorders rise across the globe, SSA has equally seen a corresponding rise in the prevalence rates. A 27-year review of the burden of disease in SSA indicates that mental health disorders such as depression are on the rise and exert a high human disability cost (Gouda et al., 2019). However, regardless of the increasing prevalence, SSA faces a double burden of inadequate resources to screen for, diagnose, manage and treat many of these common mental health disorders such as depression (Lund et al., 2015).

2.9.2 Antenatal Depression

Depression during pregnancy is a substantial public health problem especially in LMIC where women may be at a higher risk of developing antenatal depression (Rochat et al., 2011; Sawyer et al., 2010). In a sentinel systematic review of antenatal depression in African countries, the estimated prevalence was 11.3% (Sawyer et al., 2010). Similarly, in an urban South African cohort, a prevalence rate of 22% was noted for pregnant women with depression (Heyningen et al., 2016). In a comparable study in Malawi, the researchers found an antenatal prevalence rate of about 19% amongst a group of pregnant women attending antenatal care (Chorwe-Sungani & Chipps, 2018).

In Ethiopia, Ayano et al., (2019) indicated a pooled prevalence of 21% for antenatal depression. Similarly, Biratu, in 2015, in the same nation identified a rate of 25% (Ayano et al., 2019; Biratu & Haile, 2015). A Nigerian team of researchers identified a prevalence rate of 24.5% whilst another team in the same country noted a similar rate of 26% (Gadanya et al., 2018; Thompson & Ajayi, 2016). In a large population-based study in Ghana and Cote d'Ivoire, prevalence 26.9% and 32.9% respectively of antenatal depression (Bindt et al., 2012).

Without proper screening and treatment, antenatal depression can lead to poor health behaviors and adverse birth outcomes (Rochat et al., 2011; Stewart, Umar, Tomenson, & Creed, 2014). On the contrary, however, in the Ghana and Cote d'Ivoire studies, the researchers did not find an association between antenatal depression and adverse birth outcomes (Bindt et al., 2013). Further, antenatal depression has been implicated in poor child development outcomes (Barthel et al., 2016; Raskin et al., 2016; Turney, 2011).

Notably, antenatal depression is the strongest predictive factor for postpartum depression (Bisetegn et al., 2016; Faisal-Cury & Menezes, 2012; Guo et al., 2013). In addition, several studies have revealed that postpartum depression is prevalent in Ghana and that antenatal depression, or a history of depression is a risk factor (Anokye et al., 2018; Gold et al., 2013; Ramakrishnan et al., 2013; Sefogah et al., 2020). Considering these established prevalence rates of antenatal depression, it is critical that healthcare workers detect probable cases for early intervention. To achieve this, it is key to understand the presentation, expression and manifestation of depression and antenatal depression.

2.9.3 Presentation of Depression

Although several biochemical, genetic, environmental, and psychosocial factors contribute to depression, there are a range of signs and symptoms that support a clinical or diagnosis of probable depression. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) outlines the following criteria to make a diagnosis of depression. The individual must be experiencing five or more symptoms during the same 2-week period and at least one of the symptoms should either be (1) depressed mood or (2) loss of interest or pleasure[8]:

a. Depressed mood most of the day, nearly every day.
b. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day.
c. Significant weight loss when not dieting or weight gain or decrease or increase in appetite nearly every day.
d. A slowing down of thought and a reduction of physical movement (observable by others, not merely subjective feelings of restlessness or being slowed down).
e. Fatigue or loss of energy nearly every day.
f. Feelings of worthlessness or excessive or inappropriate guilt nearly every day.
g. Diminished ability to think or concentrate, or indecisiveness, nearly every day.
h. Recurrent thoughts of death, recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

To fully diagnose depression, these symptoms must cause the individual clinically significant distress, impairment in social, occupational, and other important areas of functioning. Additionally, any symptoms must also not be a result of substance abuse or another medical condition.

[8] DSM-5 criteria (American Psychiatric Association, 2013).

2.9.4 Neurobiological Models of Depression

To set the stage for a comprehensive consideration of the evidence on depression during pregnancy[9], a brief review of the neurobiological basis of depression is relevant. Neurotransmitters and neuropeptides have been implicated in the biological origins of depression, although a clear path to pathogenesis has been elusive (Hasler, 2010; Werner & Coveñas, 2010). Some researchers have indicated that systemic inflammation and interactions with important brain chemicals or neurotransmitters lead to the development of depression and added non-responsiveness to available pharmacological treatment (Miller & Raison, 2016). Similarly, Sperner-Unterweger et al., (2014) outlined a pathway during which inflammatory conditions such as infections, cancer, and autoimmune diseases result in the systemic release of pro-inflammatory stimuli that interfere with important mood-regulating neurotransmitters such as serotonin; thereby resulting in depression.

Bio-psychosocial models for depression have been suggested where interactions between genetic makeup and environmental conditions may precipitate the development of depression (Uher and Zwicker, 2017). Further details on the environmental stress factors or stressors that contribute directly or indirectly in the risk of depression have been provided in support of clinical decision making and interventions. This connection between environmental stressors and depression has been well established in the available body of evidence (Jesulola et al., 2018; Nabeshima & Kim, 2013; Sarris et al., 2014; Saveanu & Nemeroff, 2012; Schmitt et al., 2014; Shadrina et al., 2018; Waszczuk et al., 2015). Environmental, life and other stress factors result in HPA axis activation and consequently, stress hormone irregularities. Kuhlman et al., (2015), examined the association

[9] Interchangeably referred to as antenatal depression.

between HPA axis dysregulation and childhood stress/trauma, a key predisposing factor for major depression. The study discovered that there was increased cortisol reactivity and delayed recovery (all factors related to HPA axis dysfunction) after exposure to acute stress (Kuhlman et al., 2015). Similarly, HPA axis dysfunction is implicated in studies of individuals with depression (Lu et al., 2016; Tofoli et al., 2011; Wingenfeld & Wolf, 2011). Also, during pregnancy, HPA axis dysregulation secondary to stress exposure may result in depressive symptoms. This is an important fact since the physiological response to stress may be gender-specific, leading women to be more predisposed to stress than men, especially during pregnancy (Busfield, 2012; Kendler et al., 2002). Although women are more prone to depression, and depressed mood during pregnancy has been associated with HPA-axis dysfunction, there are minimal studies that review the contribution of stress to HPA dysfunction and consequently depression. Likewise, the critical role of stress factors in the sequelae of depression is one that needs close examination in SSA as majority of present evidence is not detailed within the continent.

2.9.5 Interventions for Antenatal Depression

2.9.5.1 Pharmacological

Antidepressant therapy is a key component in the management of depression. Many studies, systematic reviews, and meta-analyses have been successfully conducted to assess the benefits and efficacy of pharmacological treatment of depression (Gartlehner et al., 2017; Khan et al., 2012; Krause et al., 2019; Pigott et al., 2010; Wagner et al., 2018). The goal of pharmacological management is for full remission, elimination of depression symptoms and a 50% or more decrease in depression scores (Osuch & Marais, 2017). The choice of medication should be guided by safety, tolerability, contraindications, history and previous treatment response, and patient

compliance (Osuch & Marais, 2017). These factors are particularly critical for pregnant women with depression. In 2014, McDonagh et al., in a systematic review and meta-analyses of drug therapy outcomes in pregnant and post-partum women, indicated that the present body of evidence is not conclusive, and choice of medications should be based on a comparative review of the risks and benefits (McDonagh et al., 2014). Likewise, Koren et al., (2012), and others, indicate that for pregnant, post-partum, and breastfeeding women, a risk/benefit analysis in addition to shared decision-making can inform pharmacologic therapy choice (Becker et al., 2016; Hayes et al., 2012).

A group of widely prescribed antidepressant medications are selective serotonin reuptake inhibitors (SSRIs). These include citalopram, escitalopram, sertraline, fluvoxamine, fluoxetine and paroxetine. For the management of depression during pregnancy, SSRI indication or contraindication is unclear. Some researchers have associated SSRI use during pregnancy with PTB (Eke et al., 2016), whilst others recommended a tapered or controlled dosing of the medication (Molenaar et al., 2016; Sie et al., 2012). Citalopram, escitalopram, and sertraline are SSRIs designated as safe during pregnancy, whereas fluvoxamine, paroxetine, and sertraline are preferred in breastfeeding women because they lead to the lowest serum medication levels in breastfed infants (Langan & Goodbred, 2016). Other prescription medications used in managing depression include tricyclic antidepressants (TCAs), monoamine oxidase inhibitors (MAOIs), serotonin-noradrenaline reuptake inhibitors (SNRIs), tetracyclic antidepressants, dopamine reuptake inhibitors (DRIs), and melatonergic antagonists.

2.9.5.2 Psychotherapy

There are many types of psychotherapy used in the management of depression. The general goal of psychotherapy is to evaluate and understand the causes of depression on an individual basis and consequently take measures to help in symptom management. Psychotherapy may include individual, group, couples or even family therapy. Psychotherapy may be used alone or in combination with pharmacological treatment. A systematic review of interventions that combined both treatment modalities were found to be effective (Cuijpers et al., 2009; Khan et al., 2012). In systematic reviews, interpersonal psychotherapy has been effective in managing antenatal depression (Cuijpers et al., 2011; Law, 2011; Malta et al., 2012; Wilfley & Shore, 2015). More so, evidence has validated psychotherapy interventions in comparison to pharmacological management for the treatment of depression during pregnancy (Cuijpers et al., 2019; Stuart & Koleva, 2014; Yonkers et al., 2009).

2.9.6 Measurement and Screening of Antenatal Depression

Screening is a vital part of a functional primary care system where probable cases of any condition can be identified at the first point of contact with the healthcare system. For antenatal depression, screening during ANC or at the community level is effective in classifying probable cause or those who require follow up. A critical part of this process is the need for brief and effective instruments. Systematic reviews and meta-analyses are tools that have been used to synthesize the screening scales for depression. Studies have used these psychometric scales to screen for depression in pregnant populations across the globe and in SSA (Austin & Lumley, 2003; Biaggi, Conroy, Pawlby, & Pariante, 2016; Castro Couto et al., 2015; Chorwe-Sungani & Chipps, 2017; Gentile, 2017; Leigh & Milgrom, 2007; Pereira et al., 2011; Tsai et al., 2013). Table 2.2 further details some characteristics of key depression screening instruments.

Table 2.2 Characteristics of key depression screening instruments

Name of scale		Items	Description	Setting		
				Clinical	Population	Primary care
EPDS – The Edinburgh Postnatal Depression Scale (Murray & Cox, 1990)		10	Feelings of depression experienced over the past 7 days	Not Applicable	Applicable	Applicable
BDI – The Beck Depression Index (Beck, 1961)		21	Sadness, crying, guilt or guilty feelings, and suicidal thoughts over the previous 2-week period	Applicable	Applicable	Applicable
K-10 – The Kessler-10 (Bougie et al., 2016)		10	Measures both anxiety and depression related over the past 4 weeks	Applicable	Applicable	Applicable
CES-D – The Center for Epidemiological Studies Depression Scale (Radloff, 1977)		20	Measures depressive symptoms in the general population	Applicable	Applicable	Applicable
HSCL-25 – The Hopkins Symptom Checklist 25 (Derogatis et al., 1974)		15	Mental health symptoms related to depression and anxiety including somatization, obsessive-compulsive, and interpersonal sensitivity	Applicable	Applicable	Applicable
HAM-D – The Hamilton Rating Scale for Depression (Hamilton, 1960)		21	Symptoms of depression experienced over the past week	Applicable	Applicable	Applicable
EuroQol (EQ-5D) The EuroQol Group (1990)		5	Measures 5 domains of mobility, self-care, usual attributes, pain/discomfort, anxiety and depression	Non-Applicable	Applicable	Applicable
Montgomery-Asberg Depression Rating Scale (MADRS) Montgomery, & Åsberg, M. (1979)		10	Measures severity of depression. The scale has a greater sensitivity to change over time.	Applicable	Applicable	Applicable
Geriatric Depression Scale (Yesavage et al., 1982)		30	Specifically to screen for and measure depression and cognitive dysfunction in older adults	Applicable	Applicable	Applicable

2.10 Anxiety

Anxiety disorders are relatively common with a lifetime prevalence across various countries ranging between 1.4% and 70 % across various sub-groups such as adults, adolescents, European descent, Asian descent, people with chronic diseases and so forth (Remes et al., 2016). Although every person experiences anxiety from time to time, pathological anxiety is typically more intense, persistent and overwhelming, with the person having no control over it (Fink, 2009). Anxiety, at pathological levels, is significantly associated with distress, a high level of functional impairment as well as direct and indirect costs. The DSM-5 states that anxiety disorders include: panic disorder, agoraphobia, social anxiety disorder, generalized anxiety disorder (GAD), separation anxiety disorder and selective mutism (American Psychiatric Association, 2013). Obsessive- compulsive disorder (OCD) and post-traumatic stress disorder are closely related to anxiety disorders, but the DSM-5 classifies them elsewhere (American Psychiatric Association, 2013). Anxiety disorders are often under-recognized and misdiagnosed particularly during pregnancy when complaints are usually considered as part of pregnancy discomforts (Rubertsson et al., 2014).

2.10.1 Generalized and Antenatal Anxiety

Generalized anxiety disorder (GAD) is the susceptibility to engage in excessive worry, panic, or anxiety regarding situations and events that may not have happened yet. This disorder mainly features pathological worry perhaps related to several stressors such as intimate relations, family, health, work, or finances and more. Zincir et al., (2016) noted that the risk factors for GAD are a combination of genetic, behavioral, environmental and developmental factors in addition to other still being detailed (Zincir, 2016). GAD often features as a comorbidity with depression and substance abuse as well as major vocational and interpersonal morbidities (DeMartini et al., 2019).

Some key features of GAD are tension, nervousness on edge, irritability, hypervigilance and an uncontrollable pattern of "what if" thinking (Starcevic, 2014). Again, the GAD presents with somatic symptoms such as muscle tension, tension headaches, tightness, stiffness, neck/back/shoulder pain, difficulty concentrating, sleep disturbances, fatigue, and exhaustion (Locke et al., 2015). For pregnant women with GAD or antenatal anxiety[10], these symptoms may be masked by pregnancy symptoms and consequently go unrecognized, unassessed, and untreated.

2.10.2 Neurobiological Models of Anxiety

Numerous neurobiological mechanisms have been postulated to play a role in the pathogenesis of GAD. For example, hyperactivity of the norepinephrine system and decreased function of γaminobutyric acid (GABA-A) receptors have been suggested (Cryan & Kaupmann, 2005; Miyazaki et al., 2016). GABA-A is an inhibitory central nervous system neurotransmitter that is closely related to the neuropsychiatry and pathology of anxiety (Babaev et al., 2018). Thus, when nerve impulses are too rapid and result in anxiety, GABA-A works to slow down these signals and therefore is essential for anxiety pharmacotherapy.

2.10.3 Interventions for Antenatal Anxiety

2.10.3.1 Psychological

During pregnancy, treatment of GAD often aims to reduce related behaviors, increase coping skills, prevent recurrences or complications, improve function and finally improve quality of life (Möhler, 2012). Systematic reviews and meta-analyses of

[10] GAD during pregnancy and antenatal anxiety are used interchangeably in this thesis. They refer to the second outcome of the study: anxiety

interventions to reduce antenatal anxiety have revealed varying treatment modalities to address the goals mentioned above (Carpenter et al., 2018; Otte, 2011; Remes et al., 2016). Presently, cognitive-behavioral therapy (CBT) has received the most review and feedback (Beijers et al., 2015; Carpenter et al., 2018; Cuijpers et al., 2014). Mindfulness-based therapy, a modification of CBT has demonstrated a high level of efficacy for pregnant women in many intervention studies, systematic reviews and meta-analyses (Bondolfi, 2013; Dhillon et al., 2017; Goodman et al., 2014; Weng et al., 2016; Woolhouse et al., 2014).

The main goal in mindfulness and CBT for antenatal anxiety is to change thought and behavioral patterns that may reduce vulnerability to anxiety and/or decrease the risk of relapse post-treatment (Hofmann et al., 2013). However, intervention studies have mostly been conducted in other locations. Therefore, in Ghana, it firstly remains unclear if both CBT and mindfulness therapy would be effective, and secondly, if either CBT or mindfulness therapy would be accepted and feasible for pregnant women given our constrained resources. Furthermore, there may be certain context-specific antenatal anxiety domains that may require new and novel treatment options.

2.10.3.2 Pharmacological

Pharmacological treatment of antenatal anxiety is principally aimed at symptom management rather than improvement in coping mechanisms. For most medications, its effectiveness halts once they are no longer consistently and properly ingested. The larger objective of medication is to reduce symptoms to zero or near zero. Medications used to treat GAD in pregnancy include selective serotonin reuptake inhibitors (SSRIs), serotonin and norepinephrine reuptake inhibitors, pregabalin (Rubinchik et al.,2005).

2.10.4 Measurement and Screening of Antenatal Anxiety

Antenatal anxiety and its consistent association with adverse outcomes call for further research and intervention methods. Psychometric scales measure the domains of anxiety and the severity of symptoms. These instruments or scales should be comprehensive, and evidence-based. Preceding research has employed a variety of anxiety instruments to assess and screen for anxiety. Some instruments have focused on worry and others on a wider array of psychosocial factors relevant to the experience of anxiety.

Table 2.3 Characteristics of key anxiety screening instruments

Name of scale	Items	Description	Setting		
			Clinical	Population	Primary care
BMWS – The Brief Measure of Worry Scale (Austin & Lumley, 2003; Gladstone et al., 2005)	8	Assesses severe, dysfunctional and pathological worry	Applicable	Applicable	Applicable
STAI – The State-Trait Anxiety Inventory (Spielberger, 2008; Spielberger et al., 1970)	21	A tool used in anxiety assessment which closely considers the difference between anxiety as an emotional state and as a trait or personality attribute	Applicable	Applicable	Applicable
PASS – The Perinatal Anxiety Screening Scale (Somerville et al., 2014)	31	Assesses and screen for anxiety in ANC, other outpatient, and inpatient settings	Applicable	Applicable	Applicable
HADS – Hospital Anxiety and Depression Scale (Spinhoven et al., 1997)	14	Measures the severity and caseness of anxiety and depression	Applicable	Applicable	Applicable
BAI – The Beck Anxiety Inventory (Beck et al., 1988)	21	Commonly used scale in the screening and measurement of anxiety symptoms	Applicable	Applicable	Applicable
GAD-7 The Generalized Anxiety Disorder - 7 (Spitzer et al., 2006b)	7	Captures the emotional and cognitive symptoms of anxiety over the past 2-week period.	Applicable	Applicable	Applicable

2.11 Key Gaps and Challenges in SSA and Ghana

Accurate estimates of prevalence rates of antenatal depression are important for public health officials, healthcare workers and policymakers to develop effective interventions. It must be stated that varying rates of prevalence estimates across regions across the globe and in SSA may be due to different screening scales used in the various studies. This makes comparability of estimates difficult. However, in resource-constrained settings, brief, valid, and reliable instruments with high levels of sensitivity and specificity are vital for antenatal depression screening. To this end, Chorwe-Sungani and Chipps (2017), conducted a systematic review of screening instruments for antenatal depression in low resource settings. In this review, only eleven studies were eligible. Out of these eleven, a total of 7 screening tools had been utilized with varying levels of accuracy.

This review notwithstanding, a crucial issue is yet to be addressed. A significantly large majority of scales for stress, depression and anxiety and other common perinatal mental health disorders, to the best of knowledge, were developed in Westernized societies. Pointedly, in SSA, there may be critical cross-cultural considerations that might not be well captured. Anderson et al., (2015), in a South African cohort, examined the assessment of depression in persons living with HIV/AIDS. Because survey participants perceived somatic symptoms as medically important, these were most reported as depressive symptoms (Andersen et al., 2015). Consequently, the affective, cognitive and behavioral symptoms of depression were reported less often (Andersen et al., 2015). In summary, scales address the symptoms of depression or anxiety, but the manifestations, meanings and salience of individual scale items may not carry equal meaning across cultures and thus, may miss some important aspects of depressive symptoms and consequently affect screening in these locations. A key challenge here is the lack of ethnographic assessments that address local context understandings of depression/anxiety. Due to the minimal amounts of such evidence, the

development of a local, validated, effective screening tool for probable cases of antenatal depression and anxiety is challenging (Sweetland et al., 2014b). Another challenge is that probable cases identified with screening scales require follow up and assessment for diagnostic purposes (Giardinelli et al., 2012). Moreover, because of cultural sensitivities, the feasibility and acceptability of screening scales, follow up and treatment modalities are currently not fully context-specific (Leigh & Milgrom, 2007).

Very early work by Majodina and Johnson (1983) in the Accra Psychiatric Hospital, Ghana, identified a distinctive set of depressive symptomology not fully captured in the WHO's Standardized Assessment of Depressive Disorders (SADD) scale (Majodina & Johnson, 1983). Importantly, however, the study recognized changes in the presentation of depression in Ghana over a thirty-year period (the 1950s to 1980s) (Majodina & Johnson, 1983). Although the study's recruitment process was highly selective (English-speaking and treatment-seeking), it can be inferred that from 1983 to date, education levels and other developmental outcomes may presently influence the presentation of depression in Ghana. However, there are no longitudinal studies (past or ongoing) that may or may not support this assertion that depression symptomology is changing in Ghana. Therefore, earlier evidence cannot be corroborated or otherwise.

The socio-cultural context related to pregnancy and childbearing must be considered. For example, the social norms, beliefs, and discourse surrounding pregnancy and motherhood in Ghana expect that these should be periods of happiness, ease and minimal difficulty. A high value is placed on pregnancy and childbearing, thus any deviations from this social construct may have significant implications on individual mental health. Local studies indicate that infertility, for example, is associated with depression (Alhassan et al., 2014; Donkor et al., 2017), stress and

anxiety (Naab et al., 2013), as well as social isolation (Tabong & Adongo, 2013). The social construct within which pregnancy and childbirth is placed, may thus be a contributory factor for anxiety and depression particularly when challenges occur. To illustrate, a pregnant woman may fail to recognize symptoms of depression and fail to seek help because the surrounding cultural messaging is that pregnancy is to be a happy time filled with positivity and joy. Similarly, as childbirth is generally viewed as a time of great happiness, challenges such as post-partum depression may not be well-understood by surrounding family members, the community and even some healthcare workers. The surrounding culture, therefore, does affect mental health in various ways. By way of illustration, Kyei et al., (2014), have studied the subjective perceptions of depression, anxiety, somatization, and spirituality in Ghana. The researchers indicated that respondents across the major religious groups (Christian, Muslim and Traditionalists) in Ghana, each had their subjective perceptions of depression and anxiety. Also, although the first option of treatment was spirituality based, a large number were willing to seek psychological/psychiatric help for their symptoms (Kyei et al., 2014). A qualitative study of perinatal depression by Scorza et al., (2015), similarly indicate that women sought help primarily through religious organizations rather than medical services. Consequently, for Ghana, interventions for pregnant women experiencing stress-related depression and anxiety, could be designed with personal, family and community-level factors. Interventions, follow-up and treatment may then be more effective considering contextual resource constraints.

In SSA there is a significant mental health treatment gap. Contributing factors to this treatment gap are low prioritization of mental health, low budget allocation, few mental health facilities, and a lack of trained mental health professionals (Chidarikire et al., 2018). Case in point, in Europe, there

is an average of one psychiatrist per 12,000 people whereas, in SSA, there are about one psychiatrist for 2 million people (Chisholm et al., 2016; Cooper, 2016; Wynchank & Wynchank, 2017). To further illustrate, in Chad, where 12 million people live, there is only one trained and registered psychiatrist (Wynchank & Wynchank, 2017). Ghana is similarly plagued by some of these challenges. A high treatment gap of mental health disorders has been identified in various pockets of the population. For instance, Lloyd-Sherlock et al., (2019) in a group of older adults (50 years and above) in a large health facility in Ghana, about 83% of those with probable cases of depression were not treated or followed up. In a similar health facility primary care setting, Ademola et al., (2019), found that amongst individuals seeking treatment for hypertension, 41% of them were depressed (the PHQ-9 scale was utilized), and were neither screened, evaluated or treated (Ademola et al., 2019). Also, in 2011, it was estimated that 2.4 million people suffered from a mental health disorder, but only 2.8% received treatment (Roberts et al., 2014). Additionally, government expenditure on mental health is about 1.4 % of the total health expenditure budget (Roberts et al., 2014). Mental health nurses and community mental health workers provide majority of the care across large parts of the nation. However, Agyapong et al., (2012) identified high levels of burnout and staff retention issues.

The challenges discussed so far include a lack of adequate prevalence estimates for public health program design decision-making, a need for context-specific reliable screening tools, societal perceptions that directly or indirectly influence perinatal mental health and the challenges in the treatment and management of mental health in Ghana and SSA. In term of research, there are minimal amounts of epidemiological studies in mental health in Ghana across any population group. Most of the present data are either anecdotal or an extrapolation from international findings. From 1955 to 2009, a thorough systematic review of the evidence by Read and Doku (2012), revealed a total of 98 published articles in Ghana related to mental health. Many of the studies published during this 54-year period have also been plagued with methodological and study design problems (Read & Doku, 2012). Presented above are key challenges and gaps in knowledge related to this thesis's outcome variables (depression and anxiety). This study sought to quantitatively examine stress as a contributory factor to depression and anxiety during pregnancy in a low resource setting in Ghana.

CHAPTER THREE

METHODOLOGY

3.0 Chapter Summary

This chapter presents the methodology used to achieve the study objectives and details the following: study location, study design, study sites, field procedures, study population, sample size and the sampling procedure, ethical considerations, data collection techniques, study instruments, outcome measures, data management, data analysis and quality assurance measures used in the study. Details about the study area were obtained from the Lower Manya Krobo Municipal Assembly.

3.1 Study Design

An analytical facility-based cross-sectional study design was implemented to answer the research questions. Data on demographic, socio-economic, obstetric and reproductive history of the study participants were gathered. Quantitative measures using psychometric scales were administered to assess chronic stress exposure, pregnancy-specific stress and study outcomes of depression and anxiety. Quantitative data collection methods have been effectively used in mental health research. This research design affords a "breadth" of understanding related to the topic in question by quantifying information in numerical format and analysis with statistical and mathematical methods (Millsap & Maydeu-Olivares, 2012). In mental health, science, public health, psychology, behavioral, social and other related research, quantitative methods are governed by principles of

validity, reliability, generalizability and objectivity (Cohen, 1992). Thus, to best achieve the objectives of this study, a quantitative methodological approach was adopted.

3.2 Research Setting

The study was carried out in the Lower Manya Krobo Municipality (LMKM) of the Eastern region of Ghana. The LMKM is located in the south-eastern section of the country. It is one of the twenty-six (26) districts in the Eastern Region. Odumase Krobo serves as the major urban city and district/administrative capital. The LMKM lies between latitudes -6.2-6.5^{0}N and Longitudes -0.3 - 0.00 W of the Greenwich Meridian and at an altitude of 457.5m (Ghana Statistical Service, 2014). In November 2007, the Upper Manya Krobo district was carved from the then Lower Manya Krobo District. The LMKM was then designated as a Municipality through a legislative instrument in 2012 (Figure 3.1). The LMKM Assembly is the decision-making body and is sub-divided into four (4) sub-districts (Urban and Area councils) namely: Odumase Urban Council, Akuse-Amedeka, Oborpa-Ayermesu and Kpong area councils (Ghana Statistical Service, 2014). The LMKM has a total population of 89,246 according to the 2010 Population and Housing Census (Ghana Statistical Service, 2014).

The LMKM's features, properties and population characteristics are relatively generalizable and comparable in nature to other districts in the Eastern region and Ghana. However, it is important to mention that until 2016, it was the district with the highest HIV prevalence rates in Ghana; presently the Brong Ahafo region has the highest HIV prevalence rate (Ghana AIDS Commission, 2016). Also, the LMKM has been the site for many research studies that have identified equally generalizable data (Boateng & Poku, 2019; Doku et al., 2015; Garcia et al., 2013; Gyamfi et al.,

2017; John-Engelbert, 2014; Laar et al., 2018; Laar et al., 2013; Nartey et al., 2012; Tenkorang et al., 2017). Therefore, for the study of stress during depression, the LMKM was chosen in anticipation of producing similarly generalizable data out of which inferences may be made.

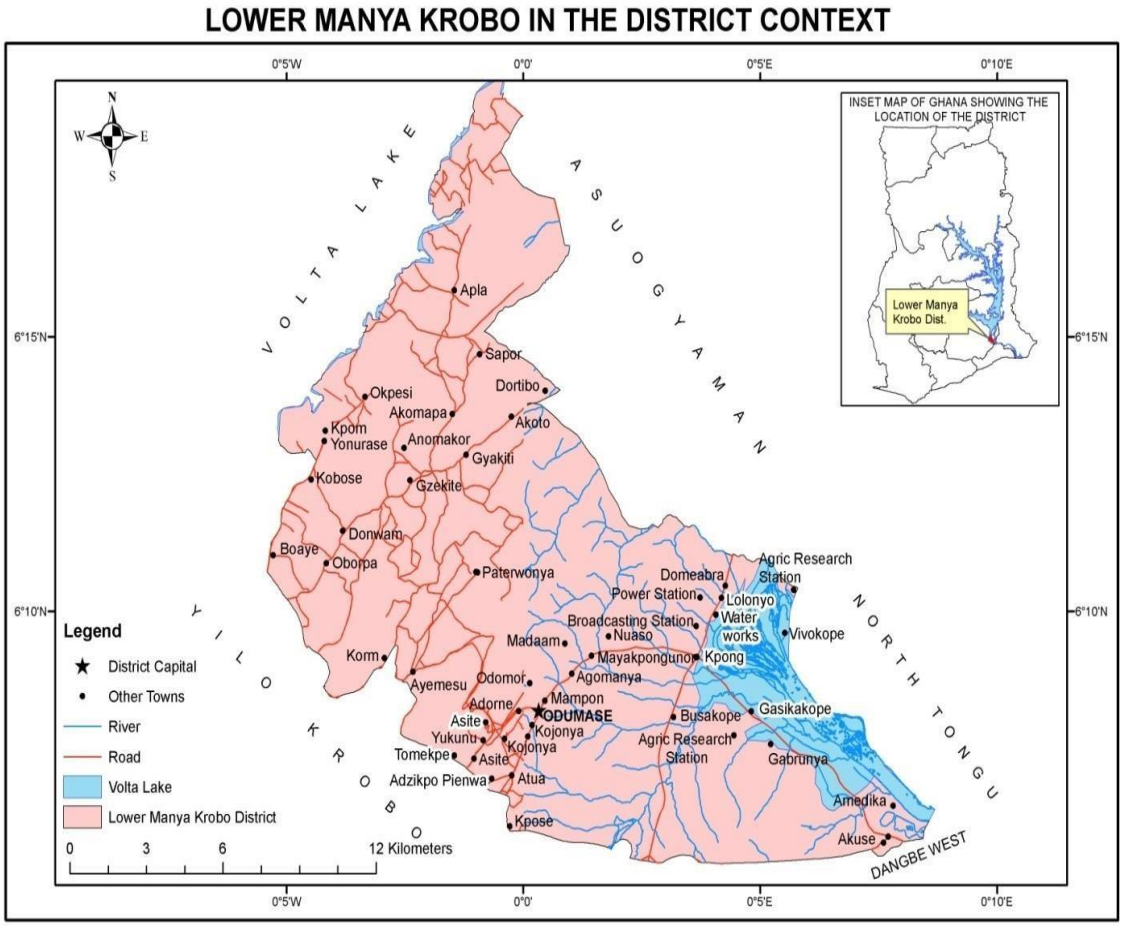


Figure 3.1 Map of Lower Manya Krobo Municipality

3.2.1 Administrative Structure

The LMKM Assembly is the largest political and administrative body in the district. The Assembly has a 45-member General Assembly consisting of 31 elected members, 11 government appointees, the Municipal Chief Executive, and the elected Member of Parliament. The Assembly works

through an Executive Committee with 7 members and the District Chief executive as its Chairman. The day-to-day administration of the Municipality is conducted by the Central Administration office that consists of the core staff of the Municipal Assembly and the decentralized departments under the direction of the Municipal Coordinating Director.

The traditional system of governance is made up of the Traditional Council and several Chiefs and Queen mothers from the various communities and clans. They represent the custodians of the culture of the people in LMKM. The Municipal traditional governance is led by the Paramount Chief called *Kornor*, resident in Odumase-Krobo. There are also custodian Divisional Chiefs (*Wetsomantsemei*) present in communities all over the Municipality. Under the Divisional Chiefs are sub-chiefs called *Asafoatse* and *Dademantsemei* (farming chiefs), the Queen Mothers and Elders. Equally significant in the hierarchy are clan heads, family elders and opinion leaders who generally represent various interest groups in the communities (Mr Lawerh, personal communication, March 2018). Altogether, these parties play various roles in the management of development initiatives and foster peaceful coexistence within the LMKM and surrounding communities.

3.2.2 Socio-demographic Characteristics

LMKM has a high number of young people, with 64.4% of the population lower than 30 years. It has a slightly higher number of females (53.5%) than males (Ghana Statistical Service, 2014). Of the number of females, about 54% of them reside in the urban areas of the Municipality. This may be because of job opportunities in the informal sector such as trading. The Municipality is largely urban with about 83.7% of the area classified as urban whereas 16.3% is rural (Ghana Statistical Service, 2014). Those who have never married account for 43.7% of people aged 18 and above,

while 30.7% are married with the rest either in non-formal unions, separated, divorced or widowed (Ghana Statistical Service, 2014). About 33.8% of the population are literate (able to read and write a language) in English, and 61.5% in English and a Ghanaian language (Ghana Statistical Service, 2014). The predominant ethnic group is the Krobo, which make up approximately 66% of the population whilst other ethnic groups such as Akan (7%), Ewes (18%), and other ethnicities (9%) are represented in the Municipality (Ghana Statistical Service, 2014). Krobo is the leading language spoken, however, Ewe is spoken widely amongst the fishing communities dotted along the Volta Lake. The primary religious affiliations are Christian, Islam and Traditional.

3.2.3 Climate, Vegetation and Agriculture

LMKM is within the semi-equatorial climate belt and sees an average rainfall of about 900mm to 11500mm, typically from March to July with a second minor rainy season from September through October (Ghana Meteorological Agency, Climate Data Library, February 2018). The dry season lasts generally from November through February with relative humidity at about 55% to 60% (Ghana Meteorological Agency, Climate Data Library, February 2018). Temperatures generally range from 26 degrees Celsius to 35 degrees Celsius. In terms of vegetation, dry semi-deciduous forest zones are mostly located in the southern part of the Municipality with trees such as neem, ceiba, acacia, mango, and palm. The middle to inner parts of the Municipality has a high density of such forests with perennial grass, shrubs, and herbs. Human activities, however, have given rise to many scattered patches of secondary or broken forests. The Municipality has isolated hilly areas to the northeast whilst the rest of the locality is relatively flat. The Volta Lake marks the border to the east with the North Torgu and Asuogyaman Districts. The Lake creates a large expanse of banks/shores that offer tourist attractions and irrigation for agricultural purposes and recreational or commercial fishing.

3.2.4 Occupation

The economy of the Municipality is predominantly agriculturally based. Approximately, 20% of the population is engaged in farming accounting for the largest labor force in the location (Ghana Statistical Service, 2014). Common crops cultivated include maize, cassava, plantain, oil palm and mangoes. Livestock reared primarily include goats, sheep, pigs, and cattle. The Volta Lake is a primary resource for fishing and transportation within the Municipality. Other economic or occupational sectors include service and salaried workers, traders, and other general merchants. Nearly 3 out of every 10 employed persons are service and sales workers (Ghana Statistical Service, 2014). One-quarter of the working community are craft and related artisan workers. Major small-scale industry or artisan activities are tailoring, basket weaving, bead making, batik tie-and-dye, cassava processing, carpentry/ woodworks, milling, blacksmithing, etc.

3.2.5 Health Infrastructure and Health Services

Health services are supported by the Ghana Health Service, the governmental agency for health service delivery. Health posts and sub-district centers largely see to basic and preventative healthcare services. Each of the 5 sub-districts in LMKM (Odumase, Kpong, Asitey, Oborpa and Akuse) have health centers, hospitals, clinics, Community-based Health Planning Services (CHPS) compounds, or another type of health facility (Ghana Health Service, 2013). CHPS facilities are tasked to deliver essential primary health services to communities in deprived sub-districts or zones (Ghana Statistical Service, 2014). CHPS compounds in the Municipality are the Yonguase, Tseledom, Djekiti, Kpone Wawase, Ayemesu, Kpong, Amedeka, Okwenya, Kodjunya and Paterhunya facilities. LMKM is serviced by 2 government hospitals and one mission hospital that serve as referral facilities. These are the Atua Government, Akuse Government, and St. Martin's *de Porres* Hospitals.

At the sub-district level are health centers that serve as the first point of contact between the formal health delivery system and a resident in the Municipality. They are headed by a medical assistant and staffed with a variety of healthcare workers such as midwives, laboratory technicians, and public health nurses. By the Ghana Health Service (GHS) regulations, each health center serves a population of approximately 20,000 providing preventive and curative services. There are health centers located at Oborpah and Kpong communities as well as a privately-owned clinic in Asitey township. Another privately owned facility in the Municipality is the Lydia Maternity Home. The Volta River Authority (VRA), the governmental agency that generates, transmits and distributes electricity has a clinic in the town of Kpong. Figure 3.2 shows healthcare facilities in LMKM.

Other community-based healthcare providers are licensed Over-the-Counter Medical Sellers (OTCMS), traditional healers, traditional birth attendants (TBAs), and community health volunteers. In the Municipality, technical and administrative support to health service providers is provided by the Municipal Health Administration (MHA). Among other things, the MHA provides training, resource mobilization and ensures that all health services provided are in line with national health standards and protocols. Worthy of mention is the fact that until recently, the LMKM had been associated with a high prevalence of HIV/AIDS. Comparatively in 2012, the national HIV/AIDS prevalence in Ghana was 2.1% whereas the prevalence in Agormanya, a town in LMKM, was at 10.1% Similarly, in 2013, the national prevalence was 1.9%, whereas, in Agormanya, the rate was 11.6% (Ghana Statistical Service, 2014). The LMKM Assembly and the Municipal AIDS Committee coordinate the implementation of the national HIV Strategic Plan (2011-2015) in the Municipality (Ghana AIDS Commission, 2015).

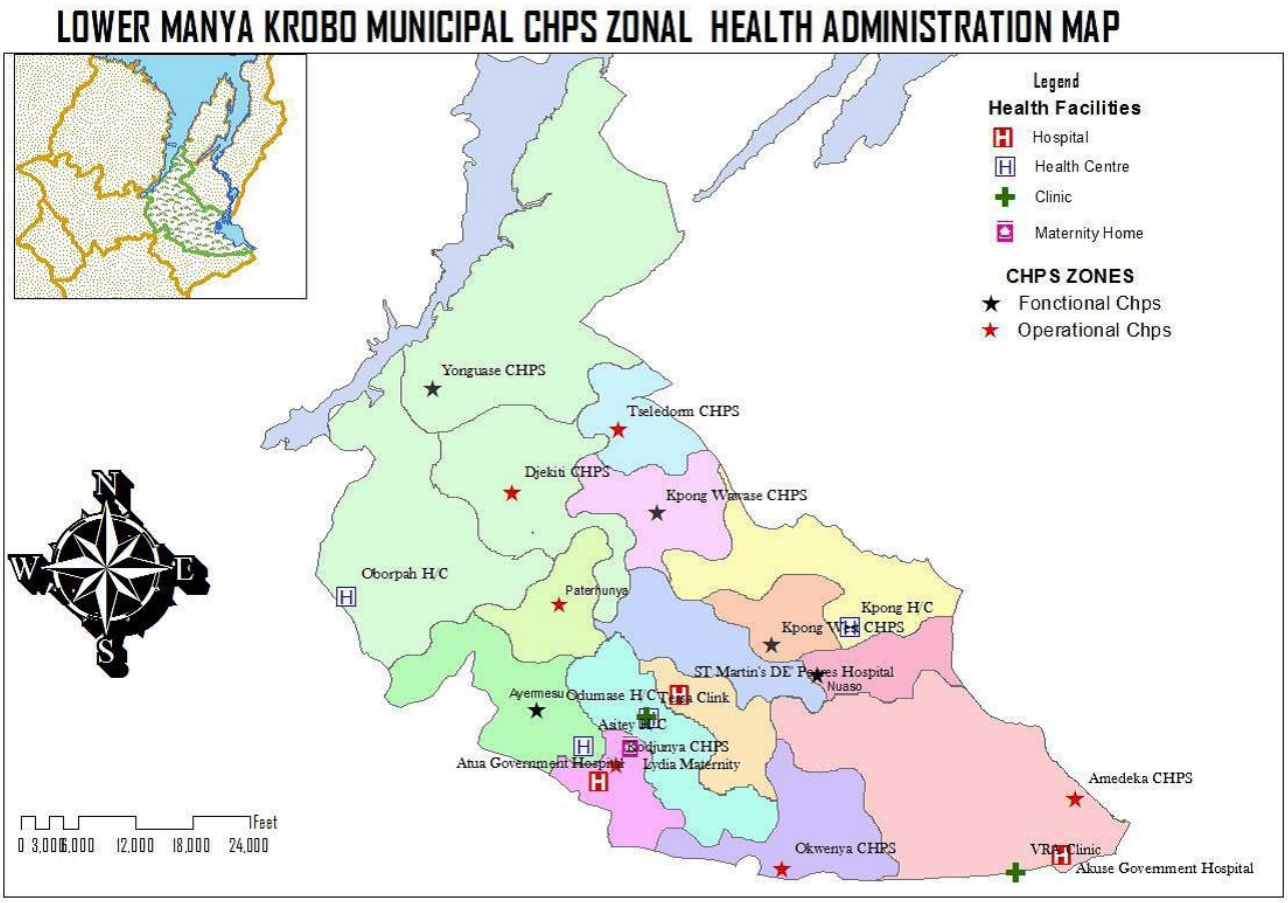


Figure 3.2 Healthcare facilities in Lower Manya Krobo Municipality

3.3 Study Sites

This study was conducted in the following three hospitals located in the Municipality:

1. Atua Government Hospital
2. Akuse Government Hospital
3. St Martin *de Porres* Hospital

The Atua and Akuse Government Hospitals are managed by the Ghana Health Service Eastern Regional Health Directorate as district hospitals. These district hospitals are to serve an average population of 100,000 to 200, 000 people in a clearly defined geographical area by Ghanaian

regulations. The number of beds in a district hospital is usually between 50 and 60. It is the first referral hospital and forms an integral part of the district health system in the Municipality. The St Martin *de Porres* Hospital is a network member of the National Catholic Health Service and the Christian Health Association of Ghana (CHAG) that was established in 1946. The hospital is part of a network of 59 hospitals, 72 clinics, 22 health centers, 13 primary healthcare centers and 9 training facilities that are managed by the CHAG. St Martins Hospital's mission is to provide healthcare to the most vulnerable and underserved population groups in the Municipality. The facility also serves clients from neighboring districts such as Asuogyaman, Yilo-Krobo and Fanteakwa all in the Eastern region. It provides services such as surgical, radiology, obstetrics and gynecology, pediatrics to name a few.

Health services provided at these 3 facilities range from preventive to medical and surgical in and out-patient treatment. All three facilities accept the National Health Insurance for services provided and have collectively increased access to healthcare for residents in the Municipality. For pregnant women in LMKM, antenatal care, delivery and well-baby checks are provided across the selected study facilities. Some routine ANC service provision at the facilities include:

a. Assessment and screening for anemia, blood grouping and rhesus factors.
b. Routine clinical assessment such as weight, breast examinations, pelvic examination, blood pressure.
c. Management of common pregnancy symptoms such as heartburn, nausea and vomiting, etc.
d. Screening for infections such as bacterial vaginosis, syphilis, HIV/AIDS and other sexually transmitted diseases.

e. Clinical management of pregnancy symptoms including preeclampsia, placenta previa, gestational diabetes, breech presentation.

f. Nutritional advice.

g. Distribution of iron and folate supplements.

h. Malaria prophylaxis.

i. Urine testing for protein and ketones.

j. Birth preparedness and complication readiness education.

k. Tetanus toxoid vaccination.

l. Introduction of contraceptives after delivery.

3.4 Study Population

They comprised all pregnant women residing in LMKM and seeking antenatal care in the 3 selected study facilities. From this population, women who met the inclusion criteria and consented to participate were recruited.

3.5 Sample Size Calculation and Sampling Strategy

A. Sample size

The sample size was determined using the formula:

$$\mathbf{N} = \frac{(Z_{1-\alpha/2})^2 \times p\,(1-p)}{\mathbf{d}^2}$$

Where:
N = required sample size
$Z1-\alpha/2$ = confidence level at 95% (standard value of 1.96)
p = estimated prevalence of stress amongst pregnant women
d = margin of error

In the absence of documented local data on the expected frequencies (prevalence of stress amongst pregnant women), an estimate prevalence rate of 57% from a similar study in the Democratic Republic of Congo was used (Tandu-Umba et al., 2014). Statistical parameters of a 95% confidence level (z), and a margin of error (d), of 5% were assumed. The sample size calculation proceeded as follows:

$$N = \frac{1.96^2 \times 0.57(1 - 0.57)}{(0.05)^2}$$

$$N = \frac{0.9416}{0.0025}$$

$$N = 376.64$$

N=376

B. Sampling Technique

A consecutive sampling technique was employed as the sampling strategy. The method entailed recruiting all pregnant women attending ANC at the selected facilities who desired to be part of the study within the data collection period. A Similar sampling technique has been employed in other studies with pregnant women sampled from ANC settings (Abajobir et al., 2016; Mogre et al., 2016; Morrison & Ludington-Hoe, 2012; Patel et al., 2016; Ugwu et al., 2014).

3.5.1 Participant Selection

3.5.1.1 Inclusion Criteria

- All pregnant women attending ANC in the study facility were eligible to enroll if they were not concurrently registered and attending ANC in the other selected facilities for the study.
- Those resident in the study areas, willing to accept possible follow up calls, and planned on delivering in that health facility.
- Pregnant women willing to participate and signed an informed consent form were included.
- Pregnant women with a non-complicated pregnancy, where no clinical diagnosis was documented in their ANC clinic record book.
- Women who met all the inclusion criteria were enrolled regardless of chronological age (Section 3.11.3 and Appendix VIII) and gestational age.

3.5.1.2 Exclusion criteria

Out of the pool of individuals who met the inclusion criteria, they were excluded from the study if they:

- declined to participate further in the study.
- were unable to communicate in English, Ga, Krobo or Twi.
- were eligible minors but were unwilling to give assent or have a parent or guardian give consent.

3.6 Survey Instruments

Detailed attention to questionnaire design, pretesting and administration lead to improved response rates and, hence, improved reliability and validity of quantitative studies (Taherdoost, 2018). The

construction of the participant background/demographic and catalogue of stress questionnaires were subjected to rigorous critique at several stages of development and design prior to finalization. The PSS-14 was used to assess the primary exposure variable (stress). Outcome variables of depression and anxiety were assessed with the PHQ-9 and GAD-7, respectively.

3.6.1 Demographic Questionnaire

This questionnaire contained questions on subjects' background, socioeconomic, demographic, obstetric and reproductive history (Appendix I). Specific data collected include age, ethnicity, religion, marital status, education level, rural versus urban residence, number of living children, number of times pregnant, past pregnancy complications, number of ANC visits for current pregnancy and plan to give birth in the facility.

3.6.2 Socioeconomic Status Assessment and Wealth Index

Wealth indices were used as a proxy measure of socioeconomic status. The wealth index, constructed by collecting data on asset ownership and other variables is a widely used method to measure equity in developing countries (Howe et al., 2008; Smits & Steendijk, 2015). This method of socioeconomic assessment is additionally used in large national surveys such as the GDHS and studies have indicated a high level of comparability (Ghana Statistical Service, 2014b; Rutstein & Staveteig, 2014). A principal component analysis (PCA) was then used to construct the indices representing 5 categories of socioeconomic status: poorest, poorer, middle, richer richest (Angeles, 2009; Smits & Steendijk, 2015; Vyas & Kumaranayake, 2006).

Data collected to construct these indices via PCA were questions which included "yes or no" answers to household availability or ownership of electricity, radio, television, video deck/CD/DVD player, refrigerator, freezer, mobile telephone, non-mobile telephone, desktop/laptop/tablet computer, fan, bicycle, motor bicycle, car and tractor. Reference to participant household items such as main material on the floor of a residence, the main source of drinking water for the household, the main method of sewage disposal, main toilet facility for household, and type of fuel normally used for cooking were assessed. These set of questions had response items or multiple-choice items from standard GDHS to ensure standardization in data collection measures (Appendix I).

3.6.3 Catalogue of Stress

A primary study objective was to catalogue the types of stressors experienced by the sampled pregnant women in LMKM. This questionnaire was designed to include assessment questions on the subjects' stated causes/sources of stress based on two categories (chronic stress and pregnancy-specific stress) without prompting. A specific study objective was to determine if stressors identified from research studies elsewhere, would apply to the sampled population in LMKM. The second set of stressor questions, therefore, were designed with stressors pulled from an in-depth scoping search through a variety of research databases. A list of stressors (chronic stress and pregnancy-specific) was extracted from available data on the subject. This process was methodically conducted as follows:

1. An in-depth literature search and synthesis of present evidence on academic databases, peer-reviewed journals and institutional repositories (Google Scholar, Science Direct, EMBASE, PubMed, JStor, PsycINFO, PubPsych, Web of Science, Scopus and Medline

and EBSCO) using key terms such as stress, stressors, psychosocial stress, daily hassles, life events, chronic stress, distress, socio-environmental stressors, adversity, early life stress, intrauterine stress, mental disorder, prenatal stress exposure, strain, and trauma.

2. Eligible studies were those that included pregnant women as the primary population across all studies from 2000 to date. This search was conducted between January 2017 and December 2017.
3. From this search, six themes/ catalogues of stress were identified for use in this study namely: financial matters, marital/relationship, work/job-related stress, family, health, social support, neighborhood/environmental/ living conditions.
4. A similar process was carried out for pregnancy-specific stressors using the key search engine terms: pregnancy-specific, maternal anxiety, pregnancy fear, pregnancy-related stress, maternal distress, pregnancy anxiety, pregnancy worry, pregnancy concerns, parenting stress, childbirth stress and pregnancy strain.
5. After a detailed review of eligible studies, six themes for pregnancy-specific stress were outlined: fear of childbirth, fear of giving birth to a child with abnormalities/deformities, changes in the marital/ relationship, concerns about future mother-child and/or father-child relationship, concerns about ability to care, nurture and mother-child.

This list of stressors was afterwards used to design the questionnaire for data collection (Appendix I). Participants were asked questions that were not prompted (to state) or prompted (given options from the catalogue of stressors). Types of data collected based on the questionnaire designed include:

1. What are the usual causes of stress in your life? (not prompted)

2. What are the usual causes of stress in your life? (prompted). Prompts include financial matters, marital/relationship, work/job-related stress, family, health, social support, neighborhood/environmental/ living conditions, and an "other" section for respondents to state.
3. What are the usual causes of stress since you have been pregnant? (not prompted)
4. What are the usual causes of stress since you have been pregnant? (prompted). Prompts include fear of childbirth, fear of giving birth to a child with abnormalities/deformities, changes in the marital/ relationship, concerns about future mother-child and/or father-child relationship, concerns about ability to care, nurture and mother-child and an "other" section for participants to state.
5. State and rate the topmost source of stress in your life. Responses include the stressor stated by the participant and the rating (slight stress, average stress, above-average stress, severe stress).

3.6.4 The Perceived Stress Scale (PSS-14)

The PSS-14 was used in this study to determine the prevalence of stress amongst pregnant women recruited into the study (Appendix II). The PSS questions ask about feelings and thoughts during the last month. Based on a 5-point response item, participants were asked to choose how often they felt or thought a certain way. The responses are never, almost never, sometimes, fairly often and very often.

Background

The PSS evaluates the degree to which an individual perceives their life as unpredictable, *uncontrollable, and overloading*. These three factors have been repeatedly classified as principal components of the stress experience by early scholarship on stress (Averill, 1973; Lazarus, 1966; Seligman, 1975). The PSS by design measures "the degree to which situations in a person's life are appraised as stressful" (Cohen, 1994). The PSS-14 was designed based on the theoretical perspective of Lazarus which emphasizes that the stress experience is as a product of the interpretation or perceived meaning of an event and the evaluation of the adequacy of coping resources (Lambert & Lazarus, 1970).

The psychometric properties of the PSS have been tested across the globe with different populations. In Greece, the reliability and validity were tested by Andreou et al., (2011). It has also been used in a large population-based survey in Denmark (Danish National Health Survey) (Nielsen et al., 2016). Orucu & Demir (2009), evaluated the psychometric properties of the PSS amongst Turkish university students. Eklund et al., (2014), also conducted a similar study in the Swedish version of the PSS. Another study established the Portuguese version of the PSS reliability, validity and thus appropriate for use in a Brazilian population (Siqueira Reis et al., 2010). The PSS has likewise been translated into Vietnamese, Malay, Arabic, and Chinese and used in various studies of stress across various populations (Al-Dubai et al., 2014; Almadi et al., 2012; Dao-Tran et al., 2017; Leung et al., 2010).

Regarding pregnant women, the PSS-14 has been used widely. In Iran, the Arabic version of the scale was used to determine the relationship between maternal general stress and pregnancy-

specific stress (Hasanjanzadeh & Faramarzi, 2017). In another study of perinatal maternal stress and depression and anxiety, the PSS-14 was utilized amongst a pregnant cohort in China (Liou et al., 2014). In comparison with other scales to measure stress levels amongst pregnant women, the PSS is a highly effective scale and in agreement with other perinatal stress scales. For instance, Sullivan et al., (2015), assessed the level of agreement between the classification of stress from the PSS and the assessment of stress portion of the Prenatal Psychosocial Profile (PPP) in a population of post-Hurricane Katrina pregnant women (Solivan et al., 2015). In SSA the PSS-14 has been used in the Democratic Republic of Congo to assess maternal prenatal stress and its sequelae in a population of urban to peri-urban pregnant women (Tandu-umba et al., 2014). In Ghana, researchers utilized a version of the PSS to assess the association between maternal stress and food insecurity amongst HIV positive pregnant women in a peri-urban setting (Garcia et al., 2013). Another study in Ghana though not amongst pregnant women, used the PSS to assess perceived stress in a population of female pharmacy school students (Opoku-Acheampong et al., 2017).

3.6.5 The Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 was utilized in this study to assess the maternal mental health outcome of depression (Appendix III). The PHQ-9 evaluates if a participant has been concerned by certain themes over the last 2 weeks. These themes include little or no pleasure in doing things, feeling down/hopeless/ depressed, trouble falling asleep/ sleeping too much, feeling tired of having little energy, poor appetite or overeating, feeling bad about oneself, trouble concentrating, restlessness and thoughts that you would be better off dead. These questions are assessed based on a 4-point response

indicating how often the participants have experienced the various categories of questions. These are: not at all, several days, more than half the days and nearly every day.

Background

The PHQ-9 evaluates the presence and severity of 9 DSM-IV depression criteria (Kroenke et al., 2001). The PHQ-9 has been validated and used in several settings across different populations across the globe. In a systematic review of studies conducted in primary care settings and obstetric/gynecological settings, the PHQ-9 indicated as an appropriate measure to detect and monitor depression (Kroenke et al., 2010). Arrol et al., (2010), similarly validated the PHQ-9 in a primary care setting with significant findings for the scale's utility for depression screening (Arroll et al., 2010). In a large clinical trial for post-partum women, researchers compared the PHQ-9 to the Centers for Disease Control (CDC) Pregnancy Risk Assessment (PRAMS-6) and found that although there was some variability, both screening instruments were highly effective (Davis et al., 2013). Another validation study amongst pregnant women identified that the PHQ-9 effectively identified women who met the criteria for depression and even further identified categories of women with sub-diagnostic symptoms (Sidebottom et al., 2012). The scale was similarly validated in a South African urban sample, which at that time was the first validation study of the PHQ-9 in an African primary healthcare setting sample (Cholera et al., 2014).

The PHQ-9 has been used in several published research studies in Ghana amongst pregnant women. For instance, Woebong et al., (2014) looked at the prevalence of antenatal depression in 7 districts of the Brong Ahafo region using the PHQ-9 as the screening instrument. In an additional study that screened for depression in Cote d'Ivoire and Ghana, Barthel et al., (2015) found the

psychometric properties of PHQ-9 to be suitable for depression screening in pregnancy (Barthel et al., 2015). Based on this study in rural postpartum Ghanaian women, the PHQ-9 proved superior to other common depression screening measures as compared to a semi-structured clinical interview as a standard of reference (Weobong et al., 2014a). The PHQ-9 was thus, deemed the most appropriate psychometric scale in the assessment of probable depression in this study.

3.6.6 The Generalized Anxiety Disorder-7 (GAD-7)

The GAD-7 was used to assess the maternal health outcome of anxiety (Appendix IV). This 7- item scale evaluates if in the past 2 weeks the participant has been bothered by the following: feeling nervous/ anxious/ on edge, not able to stop or control worrying, worrying too much about different things, trouble relaxing, being restless, becoming easily annoyed or irritable, feeling afraid that something awful might happen. These items are assessed based on a 4-point response indicating how often participants have been troubled by stated items. These are: not at all, several days, more than half the days and nearly every day.

Background

The GAD-7 is a commonly used and well-validated tool to measure anxiety according to seven DSM-IV categories (Spitzer et al., 2006). The GAD-7 captures the emotional and cognitive symptoms of anxiety over the past 2-week period. It is a screening tool for anxiety and has been validated and used various studies across varying populations including perinatal groups. The scale has good operating characteristics for detecting a spectrum of anxiety disorders such as generalized anxiety, panic, social anxiety and post-traumatic stress disorder (PTSD) (Kroenke et al., 2010; Spitzer et al., 2006a). Additionally, it was modelled after the PHQ-9 and utilizes DSM-5 criteria

to assess probable GAD (Kroenke et al., 2010; Spitzer et al., 2006b). also, in primary care settings, the GAD-7 can measure symptom severity over time and offer insights for treatment plans and modalities. The scale has thus been used in similar settings across various populations (Cuijpers et al., 2014; Dear et al., 2011; Goodman et al., 2014; Locke et al., 2015). The scales' psychometric properties were also analyzed in a large study by Barthel et al., (2014) and Dear et. al., (2011) in low resource settings (Barthel et al., 2014; Dear et al., 2011). Amongst pregnant women, the GAD-7 has been used to identify prenatal or antepartum anxiety in a large cohort in Ghana and Cote d'Ivoire (Bindt et al., 2012). Similarly, other researchers reviewed anxiety using the GAD-7 during the prenatal and postpartum period in a large longitudinal study, found that the scale was highly effective as a screening tool (Barthel et al., 2016). For these reasons, the GAD-7 was deemed as the most appropriate measure of probable GAD in this study.

3.6.7 PHQ-9 and GAD-7 audio (Twi)

The PHQ-9 and the GAD-7 have been previously translated into Twi by researchers (Guo et al., 2013; Weobong et al., 2014a). For this study, the Twi language translated *audio* versions of the PHQ-9 and the GAD-7 were obtained from Professor Dana Barthel of the Department of Psychiatry, Psychotherapy, Psychosomatics, University Medical Center, Hamburg, Germany. Professor Barthel was contacted via email by the principal investigator (PhD candidate) based on identified scholarship, previously published and cited work, and use of the identified scales in a similar geographic setting and study population. In collaboration with the Kintampo Health Research Centre (KHRC), Professor Barthel and other the researchers from the University Medical Center translated and validated the PHQ-9 and GAD-7 into the Twi language, a variation of Akan which is widely spoken in Ghana (Barthel et al., 2014). The Akan language is spoken by 47.5% of Ghanaians and is generally understood by 70% of the population (Ghana Statistical Service,

2013). In the Eastern region, where the study was conducted, 51% are native Akan and the female literacy rate is 79% (Ghana Statistical Service, 2014a). Thus, it can be assumed that a large percentage of the women in LMKM can read and write English or another language and can also understand Akan/Twi. For these reasons, the Twi and English language versions were used to assess study outcomes of depression (PHQ-9) and anxiety (GAD-7). Moreover, the Twi versions of the instruments have successfully been used in Ghana by several researchers (Barthel et al., 2014, 2016; Bindt et al., 2012; Weobong et al., 2014b).

3.6.8 Transcription

The obtained audio translated Twi version of the questionnaire was subsequently transcribed in order to have a paper format to guide data collection. These word for word transcription of the audio Twi questionnaire was done by the Department of Linguistics of the University of Ghana. Trained Akan transcribers played the audio version of all items on the scale with corresponding answer choices and wrote word for word on paper. The team of 3 transcribers detailed verbatim scale items, typed and edited the transcribed paper versions from the audio translated in addition to several "playbacks" of the audio to assure meticulousness, accuracy and precision. A trained language expert from the Linguistics department conducted an independent translation to verify the process prior to finalization. The entire transcription process was rigorously conducted to ensure that transcription of the audio versions of the questionnaire did not cause any compromise in the questionnaire audio translated version (Cipresso & Immekus, 2017). The subsequent transcribed paper version of the questionnaire was part of an initial pretest and subsequently used to survey the participants during the data collection. During actual data collection, each item on

the scale was repeated to the participant based on the audio Twi language translation and/ or read in Twi or read in English (Appendices III-VI).

3.7 Ethical Considerations

This entire research study from proposal writing to the dissemination of findings was guided by the Belmont Report principles of beneficence, non-maleficence, autonomy, and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978). These principles are widely accepted and used in human subject research (Lawrence, 2007; Miracle,2016). Due to the psychological and mental health considerations of this study, the American Psychological Association's mandate for integrity, honesty and truthfulness in all research served as guiding principles (Roberts et al., 2019). Ethical approval for the study was obtained from the Ghana Health Service Ethical Review Committee (GHSERC). The approval reference number: **GHS-ERC 012/09/17,** approved on October 19th, 2017 (Appendix IX). An application to amend (add an additional study site) and extend the duration of the study protocol was presented to the GHSERC on June 13th, 2018, along with all relevant materials and a detailed progress report on the status of the study. The amendment was successively approved 30th June 2018 and the study progressed as scheduled.

3.7.1 Information about the Study

Participants were screened for eligibility and given a detailed oral explanation about the study, objectives, rationale and expected outcomes. Each participant received an information sheet explaining in simple, non-technical terms all study procedures, any potential risks, and hoped-for benefits (Appendix VII).

3.7.2 Informed Consent

Informed consent for all participants was obtained after all required information relevant to the study were communicated and explained. Illiterate or participants unable to provide a signed informed consent were provided stamp pads to append a thumbprint in place of a signature. An independent, literate witness then signed their attestation that this process had occurred, and that verbal consent had been provided. Participants under 18 years of age were given a consent form, a minor assent form along with a parental consent form to sign after all necessary explanations.

3.7.3 Parental Consent

All pregnant women who were eligible for the study were recruited regardless of age. For participants who were less than 18 years of age (legal age in Ghana), a parental consent form was required for participation. The assent of the pregnant adolescent was also sought. If the minor pregnant woman was not accompanied by a parent or guardian who was willing to sign a parental consent form, that participant was not eligible for recruitment into the study (Appendix VIII).

3.7.4 Confidentiality

Individuals who consented to the study were interviewed away from the general ANC area, in a designated section for interviews to ensure confidentiality. Participants were given unique identification numbers instead of using their names to further ensure confidentiality. Data were stored on a server with one username and password. Only the trained research assistants and the researcher had access to the data. All data such as phone numbers, hospital record numbers and other identifiers were collected privately and stored confidentially as described above.

3.7.5 Voluntariness

Participation in this research project was solely on a voluntary basis. Participants were consequently informed as such. Study participants were not paid to participate in the research and were informed before their recruitment. Participants who chose to leave the study were free to do so at any point without consequence.

3.7.6 Privacy

Separate interviews were conducted for each study participant. All study interviews were conducted in a separate location away from other ANC clients to ensure privacy. This guaranteed that participants were comfortable enough to provide appropriate answers to various questions without concern of others overhearing. Before each interview, each participant was assured of privacy and that any resulting information would be for research purposes and available to the research team only.

3.7.7 Gender sensitivity

To minimize any potential discomfort that may have been experienced during the interview process, participants could opt for a male or female interviewer. This option was afforded with the knowledge that participants may be uncomfortable revealing information about their personal or private lives to a member of the opposite sex.

3.7.8 Dissemination and Future Utilization of Study Findings

All relevant study findings were disseminated to the staff and management of the three healthcare facilities within which the study was conducted. Full anonymity in all present and future

dissemination is and will be ensured to minimize the risk of stigmatization or exacerbate possible negative stereotypes related to mental health. Active engagement with local stakeholders, healthcare workers, peer groups, social groups and association was kept paramount at all dissemination planning sessions.

3.8 Pre-Data Collection

3.8.1 Research Team Composition and Training

The research team comprised of the principal investigator (PhD candidate), three research assistants and one field supervisor. The research assistants were recruited from the University of Ghana, School of Languages, Department of Linguistics. These were recent undergraduate degree graduates who had majored in Linguistics and had experience collecting data and administering local language questionnaires. The primary responsibility of the research assistants was to conduct the quantitative assessments in the respective health facilities. The field supervisor was an enrolled registered mental health nurse with experience practicing in the LMKM. The responsibility of the field supervisor was to support the research assistants and the PhD candidate with all data collection measures and procedures.

A comprehensive two-day training was organized for the field research assistants. All research assistants were either university graduates or enrolled nurses. All four team members (research assistants and supervisor) were trained by the principal investigator (PhD candidate). The training provided an in-depth overview of the study, key concepts, objectives, selection of participants, informed consent process, interviewing skills with emphasis on interaction pregnant women, review of all questionnaires and checklists, listening to audio Twi language translations of the

PHQ-9 and GAD-7, mock interviewing role-playing, and return demonstrations. Special attention was given to the local language version of the questionnaires to ensure that the research assistants understood and sufficiently grasped any possible language inflexions. All ethical considerations related to the study were thoroughly reviewed during the training. To increase efficiency, all study questionnaires were built into a mobile data collection tool (ONN). Mobile devices (phones and tablets) were used for data collection rather than paper-formats. The research assistants and supervisor were trained exhaustively on the mobile device application, mobile data collection procedures and related quality tracking measures.

3.8.2 Pretesting

Pretesting was conducted at the Shai-Osudoku Government Hospital in the Shai-Osudoku District of Greater Accra Region. This government facility is similar in size to two of the selected facilities the study and serves a similar population of pregnant women or potential respondents. This facility delivers antenatal care to a large population of rural and urban women. For these reasons, the Shai-Osudoku Government Hospital was deemed appropriate to serve as a pretest site. All required documentation was presented to the facility's regulatory body for approval and permission before the pretest. From the 11th to the 15th of December 2017, 30 participants were interviewed using the tools (demographic, catalogue of stress, PSS-14, PHQ-9 and GAD-7 questionnaires) identified to measure the study objectives. The questionnaires were pretested to ensure the following:

1) Clarity of questions
2) Suitability to the participants
3) Assess the amount of time required for each participant interview
4) Determine the comprehensiveness of questions to achieve study objectives

5) Assess potential obstacles ahead of the actual data collection

The demographic questionnaire was revised to ensure clarity and reliability based on feedback from the pre-testing exercise. The PSS-14 was determined to be an appropriate measure of perceived stress within the sampled pretest participants. This in addition to other factors described above (Section 3.6.4) led to the choice of the PSS-14 as the stress assessment tool for the study. The validated Twi language audio version of the PHQ-9 and GAD-7 were tested to determine if the language translations captured intended meanings in the study population. Seminal contributions indicate some variance in the sample population might affect the way that people interpret the items of scales that have previously been validated and thus how they respond to them (Bolarinwa, 2015; Collins, 2003). A pretest of the instruments for the study outcomes depression and anxiety (PHQ-9 and GAD-7) was conducted. The objective was to expose potential problems, such as lack of clarity in the items, which may threaten the validity and reliability of the study. After the pre-test, the standardized scales (PHQ-9 and GAD-7) were not revised and confirmed its use and utility in measuring depression and anxiety respectively in the study.

3.9 Data Collection

Respondent recruitment and interviews were conducted between February 28, 2018 and December 20, 2019. Actual data collection across all three facilities proceeded as follows:

1. Letters from the University of Ghana and the approval letter from the Ghana Health Service Ethical Review Committee (**GHS-ERC 012/09/17)** were presented to the GHS Eastern Regional Health Directorate in Koforidua for permission to conduct the approved protocol in the selected facilities within the LMKM.

2. All approval documentation was then presented to the Medical Superintendents/ Executive Heads at all three facilities for permission to conduct the study in the facility.
3. Upon granted permission from the facility management and all key/required regulatory bodies, introductions were made to the in-charge midwife or nurse at the ANC unit of the health facilities.
4. An introductory announcement was then made on each data collection day (section 3.14.1) to the women present in the ANC waiting area by the midwife or nurse about the purpose and nature of the study. During this announcement, the data collectors geared in identifying research study t-shirts were introduced to the pregnant women at the ANC waiting area.
5. Women who met the inclusion criteria and consented to be interviewed (evidenced by understanding and signing the consent form) were recruited to be part of the study.
6. Interviews and study instruments were then administered in a private and designated area on a one-on-one basis.
7. Participant interviews lasted between 35 minutes to 1 hour. Participants were, however, informed that if it were their turn to be seen by the midwife or physician, they could leave and continue after they had been seen. Research participants who returned continued with their interviews as outlined.
8. All participant interviews were conducted on the health facility premises. However, if the entire interview was not concluded given the participant's time and schedule, permission was sought to finish by phone calls.
9. Follow up phone calls were made during official working hours between 9 to 5 pm. If the participant permitted, the interview was concluded over the phone.

3.9.1 Facility Data Collection Schedule

The following is a schedule of participant recruitment days agreed upon by the midwives at the ANC in each facility (to coincide with their maternity clinic days or pregnancy school days, where many regular ANC pregnant women are present as well as other community pregnant women) and the research team for the entire duration of the data collection period:

a. Atua Government Hospital: Tuesdays and Thursdays
b. Akuse Government Hospital: Wednesdays and Fridays
c. St Martins Hospital: Tuesdays and Wednesdays and Fridays

3.10 Study Variables

3.10.1 Study Variables and Scoring

A. Perceived Stress

Seven out of the fourteen items of PSS-14 are considered negative (1, 2, 3, 8, 11, 12, 14) and the remaining seven as positive (4, 5, 6, 7, 9, 10, 13), representing perceived helplessness and self-efficacy, respectively. Each item was rated on a five-point Likert-type scale (0 = never to 4 = very often). Total scores are calculated after reversing positive items' scores and then summing up all scores. Although the PSS-14 does not have pre-set cut-offs, the categories used were based on previously published data that used the scale (Almadi et al., 2012; Dao-Tran et al., 2017; Lemma, Gelaye, Berhane, Worku, & Williams, 2012; Leung et al., 2010) (Table 3.1).

Table 3.1 PSS-14 Scoring Rubric

Total Score	Interpretation	Recommended Action
0-13	Low stress	Continue to monitor
14-26	Moderate stress	Continue to monitor, patient stress management education
27-40	High stress	Patient stress management education, repeat PSS-14 at next follow up,
40-56	Severe stress	Patient stress management education, further evaluation

B. Depression

The non-diagnostic screening tool and questionnaire PHQ-9 (Kroenke et al., 2001) was used to assess for probable depression. The total range of scores: 0-27 (Kroenke et al., 2001)

Table 3.2 PHQ-9 Scoring Rubric

Total score	Interpretation	Recommended Action
0-4	Minimal depression	Continue to monitor
5-9	Mild depression	Continue to monitor, repeat PHQ-9 at next follow up visit
10-14	Moderate depression	Further evaluation
15-19	Moderate to severe depression	Further evaluation
20-27	Severe depression	Further evaluation

Response options generate a continuous score ranging from 0 (no symptoms) to 27 (all symptoms present nearly every day); scores 10–14 represent moderate and 15–27 moderately severe to severe depression symptoms. A threshold score of greater than 10 has a sensitivity of 88% and a specificity of 88% for major depression (Kroenke et al., 2010) was used for case classification. It

is necessary to note that the term *''depression''* does not refer to a clinical diagnosis but the result of a screening procedure in a cross-sectional study with the above-mentioned properties.

C. Anxiety

The non-diagnostic screening tool and questionnaire the GAD-7 (Spitzer et al., 2006a) has a total range of scores: 0-21. The recommended cut-off for further evaluation is a score of 10 or greater (Spitzer et al., 2006a).

Table 3.3 GAD-7 Scoring Rubric

Total Score	Interpretation	Recommended Action
0-5	Minimal to none	Continue to monitor
6-9	Mild anxiety	Continue to monitor, repeat GAD-7 at next follow-up visit
10-14	Moderate anxiety	Further evaluation
15-21	Severe anxiety	Further evaluation

3.10.2 Explanatory Variables

Explanatory variables include maternal age, socioeconomic status, wealth index, marital status, education level, employment status, ethnicity, previous history of complications, ever pregnant, number of living children and antenatal clinic attendance.

3.11 Quality Assurance

A. Before Fieldwork

Qualified and well-trained field workers were recruited for the study. Interviewers and supervisors participated in a 2-day in-depth training program to ensure the collection of quality data (Section

3.8.1). Survey instruments and procedures were pre-tested for appropriateness, readability, and comprehension (Section 3.8.2).

B. During Fieldwork

During fieldwork, effective supervision was employed regularly to ensure proper data collection. Re-training assessment needs of research assistants were carried out as necessary. Regularly scheduled biweekly team meetings were held to review and discuss data collection progress and any problems identified were resolved.

C. After fieldwork

Data were carefully reviewed for accuracy post data collection and in preparation for analysis.

3.12 Data Analysis

The data were entered into SPSS® and later exported into STATA® version 15 for further analysis. Microsoft Excel 2016 was also used in the creation of results tables and graphs. Frequencies and percentages were used to describe the baseline socio-demographic and other categorical characteristics of study respondents. Means and standard deviation were also used to summarize continuous variables. All statistical significance levels of association were considered at the 0.050 alpha level.

A composite score for chronic stress was computed from the Perceived Stress Scale of 14 items (PSS-14) after items numbered 4, 5, 6, 7, 9, 10 and 13 on the scale were appropriately reversed (Cohen et al., 1983). Similar to previous studies, composite scores were then further put into four categories: low to no chronic stress (scores <14), moderate chronic stress (scores from 14 to 26),

high chronic stress (scores from 27 to 40) and severe chronic stress (scores from 41 to 56) (Andreou et al., 2011; Klein et al., 2016; Santiago et al., 2019; Siqueira Reis et al., 2010)

3.12.1 Analysis of Outcome Variables (Depression and Anxiety)

For depression, a composite score was also computed from the PHQ-9 scale. The scores were then further put into four categories namely minimal (scores < 5), mild (scores from 5 to 9), moderate (scores from 10 to 14) and severe (scores from 15 to 27). For anxiety, a composite score was also computed from the GAD-7 scale. The scores were then further put into four categories namely minimal (scores < 5), mild (scores from 5 to 9), moderate (scores from 10 to 14) and severe (scores from 15 to 21).

Cross-tabulation of exposure variables with the independent variables were done using row percentages and frequencies within the various categories of the characteristics of study participants. The Pearson chi-square test was used to test the association between socio-demographic characteristics of study participants and the exposure variable (chronic stress) and the outcome variable (depression and anxiety) in the study.

For each of the three variables, the Generalized Ordered Logit (GOL) regression model was used to assess the proportional odds of having higher levels of the outcome variables among the pregnant women (Williams, 2006, 2016). The user-written command "*gologit2*" in STATA as described by Williams (2006) was used to estimate the proportional odds ratio and in some instance the odds ratio of the outcomes in the study. The Wald's test for proportional odds or parallel lines assumption was performed for both the overall model and each of the individual factors in the

model. For the individual factors that violated the assumption, individual odds were estimated for the various levels of the outcome from higher to low. All statistical significance in the study was at 0.050 alpha level. 95% confidence intervals of odds ratio were also presented.

The GOL regression model (Williams, 2016) estimated the adjusted odds of chronic stress, depression and anxiety. Due to overfitting, empty outputs of results and satisfaction of parallel line assumption variables from the Pearson's chi-square test with p-values less than 0.250 only were considered in the models (Hosmer et al., 2013; Menard, 2011). Items such as age, number of pregnancies and number of children of study participants were considered in the model as continuous variables irrespective of their significance level from the Pearson's chi-square test. From the Wald's test, the parallel line or proportional odds assumption test for the entire model produced a p-value of 1.000 indicating a non-violation of the assumption in estimating the adjusted odds ratio (Appendix X). Also, the proportional odds assumption test for the individual factor levels were all non-significant (p-value>0.05) indicating non-violation of the assumption (Appendix XI).

CHAPTER FOUR

RESULTS

4.0 Chapter Summary

This chapter presents the descriptive demographic statistics and the outcomes of the study according to the four main objectives set out. Foremost, the catalogue of chronic stressors and pregnancy-specific stressors are detailed. Subsequently, chronic stress prevalence levels are presented as well as factors associated with both chronic and pregnancy-specific stress. Similarly, depression and anxiety findings are detailed in addition to their associations with chronic and pregnancy-specific stress. Lastly, a predictor model for stress, depression and anxiety are presented.

4.1. Enrolment details of study participants

Six hundred and six (606) women were contacted and consented to participate in the study. Three people voluntarily opted out after the consent process. A final number of 603 women completed all enrolment procedures and data collection interviews.

4.2 Socio-demographic characteristics of study participants

Of the 603 study participants recruited into the study, the mean age of the pregnant women was 27.8 (±6.04) years with about half (51.6%, n=311) of them within the 20-29-year age group. The total age range of participants was from 14 to 45 (please see the methods section for minors' assent procedures). Less than a fifth (17.1%, n=103) of them had never married, about a third (32.0%, n=193) were married

and 47.4% (n=286) were living together with their partners whilst 3.5% were either divorced separated or widowed. Most (47.8%, n=288) of them had Middle/JSS level of education with 4.8% (n=29) no formal education and 10.1% (n=61) with tertiary education. Slightly less than half (47% n=287) of the participants resided in rural areas of the district and a slightly higher number (52.4%, n=316) of the participants resided in urban areas (Table 4.1).

A principal component analysis (PCA) was used to compute the wealth index score from categories of asset ownership and some household characteristics of the study participants (Howe et al., 2008; Smits & Steendijk, 2015) as described in the methodology section. The PCA computed scores were then indexed into 5 quintiles as shown in Table 4.1. Of the 603 recruited, 20.4% (n=123) fell into the poorest quintile, 19.9% (n=120) into the poorer quintile, 21% (n=129) into the middle quintile,18.4% (n=111) into the richer quintile and 19.9% (n=120) into the richest quintile (Table 4.1).

Table 4.1 Background characteristics of study respondents, LMKM 2018

Characteristics	Frequency (n=603)	Percentage
Age group in years (mean ± SD)	(27.8 ± 6.0)	
<20	48	8.0
20-29	311	51.6
30-39	225	37.3
>40	19	3.2
Ethnicity		
Akan	66	11.0
Ga/Dangme	324	53.7
Ewe	141	23.4
Other	72	11.9
Religion		
Christians	583	96.7
Non-Christians	20	3.3
Marital status		
Never married	103	17.1
Married	193	32.0
Living together	286	47.4
Divorced/Separated/widowed	21	3.5
Highest education		
No Education	29	4.8
Primary	64	10.6
Middle/JSS	288	47.8
Secondary	161	26.7
Tertiary	61	10.1
Currently employed		
Yes	445	73.8
Ever experienced pregnancy complications		
Yes	112	18.6
Wealth index		
Poorest	123	20.4
Poorer	120	19.9
Middle	129	21.4
Richer	111	18.4
Richest	120	19.9

SD: standard deviation

4.3 Catalogue of Stressors

Table 4.2 shows the catalogue of chronic and pregnancy-specific stress factors. This categorized list of causes of stress are known as *stressors*.

4.3.1 Chronic Stressors

A slight majority (65.9%, n=392) reported financial issues as a chronic stressor, 25.2% (n=152) marital or relationship issues, work or job-related issues among 47.6% (n=287) of them and family issues for a fifth (20.2%, n=122) of the study participants (Table 4.2).

4.3.2 Pregnancy-specific Stressors

Slightly more than half (61.2%, n=369) of the pregnant women reported fear of birth as a pregnancy-specific stressor. Over a fifth (22.3%, n=134) reported fear of giving birth to a child with a congenital anomaly as a pregnancy-specific stressor whereas concerns about the parent-child relationship was a pregnancy-specific stressor among 34.5% (n=208) of them (Table 4.2).

4.3.3 Respondent Self-Stress Rating

A fifth (20.1%, n=121) of the pregnant women rated their stress levels as slight, 37.2% (n=224) as average, 31.0% (n=187) as above average and 11.8% (n=71) as severe levels of stress (Table 4.2). A majority (61.2%, n=369) of the pregnant women reported fear of birth as a cause of stress during their pregnancy. Over a fifth, (22.3%, n=134) of them reported fear of giving birth to a deformed child as a cause of stress during their pregnancy whereas concerns about the parent-child relationship was a cause of stress during current pregnancy among 34.5% (n=208) of them (Table 4.2).

Table 4.2 Catalogue of Chronic Stress and Pregnancy-specific Stress, LMKM 2018

Catalogue of stress	Frequency (n=603)	Percentage
Chronic Stress: [M]		
Financial issues	392	65.0
Marital/relationship issues	152	25.2
Work- or job-related issues	287	47.6
Family issues	122	20.2
Health issues	73	12.1
Social support	50	8.3
Neighborhood/environment/living conditions	46	7.6
Others	40	6.6
Pregnancy-specific stress: [M]		
Fear of childbirth	369	61.2
Fear of giving birth to a child with congenital anomalies	134	22.3
Changes in marital/relationship	64	10.6
Concerned with future mother-child/ father-child relationship	105	17.4
Concerns about ability to care, nurture and mother-child	208	34.5
Others	116	19.2
Self-stress rating		
Slight stress	121	20.1
Average	224	37.2
Above average	187	31.0
Severe stress	71	11.8

Note: [M]: Multiple response items

4.4 Prevalence of Chronic Stress (PSS-14)

Table 4.3 below shows the frequency distribution of the 14-item PSS-14 scale administered. With a possible minimum score of zero (0) and a possible maximum score of (56), a mean score of 26.1 (±5.8) was scored among the 603 study participants. Eleven (11) of the study participants had low stress level (scores <14) representing 1.8%, 48.3% (n=291) had moderate stress level (scores of 14 to 26), 49.4% (n=298) had high chronic stress level (scores of 27 to 40) and 0.5% (n=3) had severe stress level (scores between 40 to 56). Due to low frequency in the severe stress category, the high and severe category are combined in the subsequent analysis as the high category (Table 4.3).

Table 4.3 Frequency Distribution of the Perceived Stress Scale (PSS-14), LMKM 2018

In the last month, how often have you…	Never	Almost Sometimes	Often	Fairly	Very
	n (%)	n (%)	n (%)	n (%)	n (%)
… been upset because of something that happened unexpectedly?	58(9.6)	142(23.6)	245(40.6)	108(17.9)	50(8.3)
… felt that you were unable to control the important things in your life?	53(8.8)	168(27.9)	290(48.2)	85(14.1)	6(1.0)
… felt nervous and "stressed"?	49(8.1)	120(19.9)	236(39.1)	165(27.4)	33(5.5)
… not dealt successfully with day-to-day problems and annoyances?	32(5.3)	188(31.2)	264(43.8)	101(16.8)	18(3)
… not felt that you were effectively coping with important changes that were occurring in your life?	30(5.0)	158(26.2)	346(57.4)	54(9.0)	15(2.5)
… not felt confident about your ability to handle your personal problems?	36(6.0)	195(32.3)	296(49.1)	65(10.8)	11(1.8)
… not felt that things were going your way?	17(2.8)	142(23.6)	318(52.7)	104(17.3)	22(3.7)
… found that you could not cope with all the things that you had to do?	26(4.3)	160(26.5)	323(53.6)	84(13.9)	10(1.7)
… not been able to control irritations in your life?	34(5.6)	190(31.5)	274(45.4)	90(14.9)	15(2.5)
… not felt that you were on top of things?	11(1.8)	111(18.4)	359(59.5)	97(16.1)	25(4.2)
… been angered because of things that happened that were outside of your control?	63(10.5)	174(28.9)	199(33.0)	121(20.1)	46(7.6)
… found yourself thinking about things that you have to accomplish?	15(2.5)	51(8.5)	273(45.3)	187(31.0)	77(12.8)
… not been able to control the way you spend your time?	43(7.1)	199(33.1)	250(41.5)	90(15.0)	20(3.3)
…feltdifficultieswerepilingupsohighthatyoucouldnotovercomethem?	93(15.5)	211(35.1)	197(32.7)	80(13.3)	21(3.5)
SUMMARY					
Score (Mean ± SD)	26.1 ± 5.8				
Stress level					
Low stress	11 (1.8)				
Moderate stress	291 (48.3)				
High	298 (49.4)				
Severe stress	3 (0.5)				

n (%): Frequency (row percentage). SD: standard deviation

4.5 Depression (PHQ-9 Scale)

Table 4.4 shows the responses from the 603 pregnant women recruited into the study on the PHQ-9 depression scale. The 9-item depression scale has four possible responses for each item. The table shows the frequency and percentage distribution of the responses to the items among the study participants. With a possible minimum score of zero (0) indicating no depression and a possible maximum score of 27 indicating severe depression. Of the 603 study participants, 28.5% (n=172) of them had no depression (a score of 4 or below), 34.5% (n=208) had mild level of depression (a score from 5 to 9), 29.4% (n=177) of them had moderate level of depression (a score from 10 to 14) and 7.6% (n=46) had severe level of depression (a score of 15 to 27) (Table 4.4).

Table 4.4 Frequency Distribution of the Patient Health Questionnaire (PHQ-9), LMKM 2018

Over the last 2 weeks, I have felt bothered by…	Not at all	Several Days	More than half the days	Nearly every day
	n (%)	n (%)	n (%)	n (%)
… little interest or pleasure in doing things	230(38.1)	226(37.5)	105(17.4)	42(7)
… feeling down, depressed, or hopeless	229(38)	230(38.1)	111(18.4)	33(5.5)
… trouble falling asleep or sleeping too much	195(32.3)	136(22.6)	181(30)	91(15.1)
… feeling tired or having little energy	93(15.4)	215(35.7)	213(35.3)	82(13.6)
… poor appetite or overeating	246(40.8)	133(22.1)	147(24.4)	77(12.8)
… feeling bad about yourself- or that you are a failure or have let yourself or family down	415(68.8)	92(15.3)	71(11.8)	25(4.2)
… trouble concentrating on things, such as reading the newspaper or watching television	315(52.2)	175(29)	91(15.1)	22(3.7)
… moving or speaking so slowly that other people could have noticed or the opposite being so fidgety or restless that you have been moving around a lot more than usual	350(58)	118(19.6)	116(19.2)	19(3.2)
… thoughts that you would be better off dead, or of hurting yourself in some way	522(86.6)	39(6.5)	31(5.1)	11(1.8)
SUMMARY SCORE				
Depression level				
Low/No	172 (28.5)			
Mild	208(34.5)			
Moderate	177(29.4)			
Severe	46(7.6)			

SD: standard deviation. n (%:): Frequency (row percentage)

4.6 Anxiety (GAD-7 Scale)

Table 4.5 shows the responses from the 603 pregnant women recruited into the study on the GAD-7 anxiety scale. Item questions were asked of them in relation to anxiety with four possible responses for each item. The table shows the frequency and percentage distribution of the responses to the items among the study participants. With a possible minimum score of zero (0) indicating no anxiety and a possible maximum score of 21 indicating severe anxiety. Of the 603 study participants, 37.7% (n=227) of them had no anxiety (a score of 4 or below), 44.9% (n=271) had mild anxiety (a score from 5 to 9), 13.1% (n=79) of them had moderate anxiety (a score from 10 to 14) and 4.3% (n=16) had severe anxiety (a score of 15 to 21) (Table 4.5).

Table 4.5 Frequency Distribution of the Generalized Anxiety Disorder Scale (GAD-7), LMKM 2018

Over the last 2 weeks, I have felt bothered by…	Not at all	Several Days	More than half the days	Nearly Every day
	n (%)	n (%)	n (%)	n (%)
… feeling nervous, anxious, or on edge	215(35.7)	237(39.3)	129(21.4)	22(3.7)
… not being able to stop or control worrying	246(40.8)	243(40.3)	82(13.6)	32(5.3)
... worrying too much about different things	216(35.8)	251(41.6)	98(16.3)	38(6.3)
… having trouble relaxing	251(41.6)	210(34.8)	95(15.8)	47(7.8)
… being so restless that it is hard to sit still	211(35)	197(32.7)	141(23.4)	54(9)
… becoming easily annoyed or irritable	215(35.7)	205(34.1)	132(21.9)	50(8.3)
…feelingafraidasifsomethingawfulmighthappen	387(64.3)	108(17.9)	83(13.8)	24(4)

SUMMARY SCORE	
Anxiety level	
Low/No	227(37.7)
Mild	271(44.9)
Moderately	79(13.1)
Severe	16(4.3)

SD: standard deviation. n (%:): Frequency (row percentage)

4.7 Socio-demographic Characteristics and Chronic Stress

Table 4.6 shows the frequency and percentage distribution of chronic stress by the socio-demographic characteristics of study participants. Due to low frequency in the severe stress category (n=3), severe

and high categories are combined. The Pearson's chi-square test was also used to test the association between the various socio-demographic characteristics of study respondents and their chronic stress levels. Among the 103 study participants who had never married, 41.8% (n=43) had high chronic stress, compared to the 40.9% (n=79) of the 193 married participants, 57.3% (n=164) of the participants who were living with the partners, and the 71.4% (n=15) of the 21 who were divorced or separated. There was a significant association between the level of chronic stress and the marital status of study participants (p-value < 0.001).

Of the 29 study participants who had no formal level of education, 51.7% (n=15) of them had high chronic stress, 60.9% (n=39) of the 64 with primary education, 53.5% (n=154) of the 288 with Middle/JHS education, 46.0% (n=74) of the 161 with secondary education and 31.2% (n=19) of the 61 with tertiary education had high chronic stress. Pearson's chi-square test showed a significant association between the level of education and chronic stress level (p-value = 0.029). Of the 287 participants who resided in the rural areas, 44.6% (n=128) had high chronic stress level whereas 54.8% (n=173) of the 316 participants had high chronic stress level. There was significant association between area of residence and the chronic stress level (p-value = 0.006). The percentage of high chronic stress level was highest, 61.8% (n=76) amongst poorest wealth quintile category of those within the poorest category, 56.7% (n=68) of those within the poorer category, 48.1% (n=62) of those within the middle category, 43.2% (n=48) of those within the richer category and 39.2% (n=47) of those within the richest category had high chronic stress (Table 4.6).

Table 4.6 Socio-demographic Characteristics and Chronic Stress, LMKM 2018

Characteristics	Total	Chronic stress				
		Low	Moderate	High		
	603	n (%)	n (%)	n (%)	χ^2	P-value
Age group (years)					9.3	0.156
<20	48	1(2.1)	16(33.3)	31(64.6)		
20-29	311	4(1.3)	146(47.0)	161(51.8)		
30-39	225	5(2.2)	118(52.4)	102(45.3)		
>40	19	1(5.3)	11(57.9)	7(36.8)		
Ethnicity					12.4	0.054
Akan	66	4(6.1)	37(56.1)	25(37.9)		
Ga/Dangme	324	4(1.2)	151(46.6)	169(52.2)		
Ewe	141	3(2.1)	65(46.1)	73(51.8)		
Other	72	0(0.0)	38(52.8)	34(47.2)		
Religion					2.7	0.265
Christians	583	10(1.7)	279(47.9)	294(50.4)		
Non-Christians	20	1(5.0)	12(60.0)	7(35.0)		
Marital status					29.1	**<0.001**
Never married	103	6(5.8)	54(52.4)	43(41.8)		
Married	193	2(1.0)	112(58.0)	79(40.9)		
Living together	286	3(1.1)	119(41.6)	164(57.3)		
Divorced/Separated	21	0(0.0)	6(28.6)	15(71.4)		
Highest education					17.1	**0.029**
No Education	29	1(3.5)	13(44.8)	15(51.7)		
Primary	64	1(1.6)	24(37.5)	39(60.9)		
Middle/JSS	288	5(1.7)	129(44.8)	154(53.5)		
Secondary	161	4(2.5)	83(51.6)	74(46.0)		
Tertiary	61	0(0.0)	42(68.9)	19(31.2)		
Currently employed					11.6	**0.003**
No	158	3(1.9)	58(36.7)	97(61.4)		
Yes	445	8(1.8)	233(52.4)	204(45.8)		
History of pregnancy complications					2.6	0.272
No	491	11(2.2)	237(48.3)	243(49.5)		
Yes	112	0(0.0)	54(48.2)	58(51.8)		
First ANC visit					6.2	**0.045**
No	520	11(2.1)	259(49.8)	250(48.1)		
Yes	83	0(0.0)	32(38.6)	51(61.5)		
Area of residence					10.1	**0.006**
Rural	287	9(3.1)	150(52.3)	128(44.6)		
Urban	316	2(0.6)	141(44.6)	173(54.8)		
Wealth index					19.8	**0.011**
Poorest	123	0(0.0)	47(38.2)	76(61.8)		
Poorer	120	2(1.7)	50(41.7)	68(56.7)		
Middle	129	2(1.6)	65(50.4)	62(48.1)		
Richer	111	4(3.6)	59(53.2)	48(43.2)		
Richest	120	3(2.5)	70(58.3)	47(39.2)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.8 Socio-demographic Characteristics and Depression

Among the 66 Akan's in the study, 12.1% (n=8) of them had severe depression, 5.6% (n=18) of the 324 Ga/Dangme, 10.6% (n=15) of the 141 Ewes and 6.9% (n=5) of the 72 study participants of other ethnicity also had severe depression (Table 4.7). Ethnicity showed significant association with depression (p-value < 0.001). Among the 103 who had never married 16.5% (n=17) of them had severe depression, 4.2% (n=8) of the 193 participants who were married had severe depression, 5.9% (n=17) of the 286 participants who were living together with their partners had severe depression and 19.1% (n=4) of the 21 who were divorced or separated also had severe depression. There was a significant association between marital status and depression (p-value <0.001). A tenth (10.8%, n=17) of the 158 unemployed study participants had severe depression whereas 6.5% (n=29) of the 445 currently employed study participants had severe depression. Employment status of the study participants showed a significant association with depression (p-value = 0.009). The place of residence (rural/urban) was significantly associated with depression (p-value < 0.001). Wealth index also, showed a significant association with depression (p-value = 0.027) (Table 4.7).

Table 4.7 Socio-demographic Characteristics and Depression, LMKM 2018

Characteristics	Total	Depression				P-value
		Low/No	Mild	Moderate	Severe	
	603	n (%)	n (%)	n (%)	n (%)	
Age group (years)						0.346
<20	48	11(22.9)	12(25)	22(45.8)	3(6.3)	
20-29	311	88(28.3)	107(34.4)	88(28.3)	28(9)	
30-39	225	66(29.3)	82(36.4)	62(27.6)	15(6.7)	
>40	19	7(36.8)	7(36.8)	5(26.3)	0(0)	
Ethnicity						**<0.001**
Akan	66	28(42.4)	18(27.3)	12(18.2)	8(12.1)	
Ga/Dangme	324	113(34.9)	110(34)	83(25.6)	18(5.6)	
Ewe	141	23(16.3)	50(35.5)	53(37.6)	15(10.6)	
Other	72	8(11.1)	30(41.7)	29(40.3)	5(6.9)	
Religion						0.976
Christians	583	166(28.5)	201(34.5)	171(29.3)	45(7.7)	
Non-Christians	20	6(30)	7(35)	6(30)	1(5)	
Marital status						**<0.001**
Never married	103	21(20.4)	35(34)	30(29.1)	17(16.5)	
Married	193	66(34.2)	65(33.7)	54(28)	8(4.2)	
Living together	286	84(29.4)	102(35.7)	83(29)	17(5.9)	
Divorced/Separated	21	1(4.8)	6(28.6)	10(47.6)	4(19.1)	
Highest education						0.382
No Education	29	6(20.7)	12(41.4)	9(31)	2(6.9)	
Primary	64	23(35.9)	22(34.4)	17(26.6)	2(3.1)	
Middle/JSS	288	76(26.4)	93(32.3)	94(32.6)	25(8.7)	
Secondary	161	51(31.7)	52(32.3)	44(27.3)	14(8.7)	
Tertiary	61	16(26.2)	29(47.5)	13(21.3)	3(4.9)	
Currently employed						**0.009**
Yes	445	134(30.1)	164(36.9)	118(26.5)	29(6.5)	
History of pregnancy complications						0.103
No	491	147(29.9)	169(34.4)	143(29.1)	32(6.5)	
Yes	112	25(22.3)	39(34.8)	34(30.4)	14(12.5)	
First ANC visit						0.923
No	520	149(28.7)	179(34.4)	151(29)	41(7.9)	
Yes	83	23(27.7)	29(34.9)	26(31.3)	5(6)	
Area of residence						**<0.001**
Rural	287	119(41.5)	92(32.1)	58(20.2)	18(6.3)	
Urban	316	53(16.8)	116(36.7)	119(37.7)	28(8.9)	
Wealth index						**0.027**
Poorest	123	37(30.1)	28(22.8)	47(38.2)	11(8.9)	
Poorer	120	31(25.8)	42(35)	40(33.3)	7(5.8)	
Middle	129	43(33.3)	50(38.8)	28(21.7)	8(6.2)	
Richer	111	36(32.4)	43(38.7)	22(19.8)	10(9)	
Richest	120	25(20.8)	45(37.5)	40(33.3)	10(8.3)	

Bolded p-value ≤ 0.05

4.9 Chronic Stressors and Depression

Concerns about marital or relationships issues (χ^2 = 11.2, p-value = 0.011) was found to have a significant association with the depression (Table 4.8).

Table 4.8 Chronic Stressors and Depression, LMKM 2018

		Depression					
	Total	**Low/No**	**Mild**	**Moderate**	**Severe**	χ^2	**P-value**
Catalogue of Stressors	**603**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Financial issues						2.2	0.537
No	211	63(29.9)	69(32.7)	59(28)	20(9.5)		
Yes	392	109(27.8)	139(35.5)	118(30.1)	26(6.6)		
Marital/relationship						11.2	**0.011**
No	451	140(31)	150(33.3)	134(29.7)	27(6)		
Yes	152	32(21.1)	58(38.2)	43(28.3)	19(12.5)		
Work or job related						3.1	0.374
No	316	91(28.8)	100(31.7)	101(32)	24(7.6)		
Yes	287	81(28.2)	108(37.6)	76(26.5)	22(7.7)		
Family issues						5.6	0.134
No	481	140(29.1)	171(35.6)	139(28.9)	31(6.4)		
Yes	122	32(26.2)	37(30.3)	38(31.2)	15(12.3)		
Health issues						2.1	0.558
No	530	156(29.4)	182(34.3)	153(28.9)	39(7.4)		
Yes	73	16(21.9)	26(35.6)	24(32.9)	7(9.6)		
Social support						1.7	0.626
No	553	161(29.1)	187(33.8)	163(29.5)	42(7.6)		
Yes	50	11(22)	21(42)	14(28)	4(8)		
Neighborhood/environment/living conditions						2.5	0.483
No	557	163(29.3)	192(34.5)	160(28.7)	42(7.5)		
Yes	46	9(19.6)	16(34.8)	17(37)	4(8.7)		
Others						9.4	**0.025**
No	562	153(27.2)	201(35.8)	164(29.2)	44(7.8)		
Yes	40	19(47.5)	7(17.5)	12(30)	2(5)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.10 Pregnancy-specific Stressors and Depression

Fear of childbirth (p-value = 0.003), fear of giving birth to deformed child (p-value = 0.011), concerns about changes in the marital or relationship status (p-value < 0.001), concerns with future parent-child

relationship (p-value < 0.001), and concerns about ability to mother the child (p-value < 0.001) were the pregnancy-specific stress factors that showed significant association with depression among study participants (p-value < 0.05) (Table 4.9).

Table 4.9 Pregnancy-specific Stressors and Depression, LMKM 2018

Pregnancy-specific	Depression							
	Total	Score	Low/No	Mild	Moderate	Severe	χ^2	P-value
Stressors	**603**	**Mean ±SD**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Fear of childbirth							13.9	**0.003**
No	234	8.3±4.4	50(21.4)	87(37.2)	83(35.5)	14(6)		
Yes	369	7.5±4.7	122(33.1)	121(32.8)	94(25.5)	32(8.7)		
Fear of giving birth to a child with anomalies							11.2	**0.011**
No	468	7.5±4.5	143(30.6)	159(34)	138(29.5)	28(6)		
Yes **Changes in marital/relationship**	134	8.7±5	28(20.9)	49(36.6)	39(29.1)	18(13.4)		
							29.2	**<0.001**
No	539	7.4±4.4	166(30.8)	190(35.3)	150(27.8)	33(6.1)		
Yes	64	11±5	6(9.4)	18(28.1)	27(42.2)	13(20.3)		
Concerned with future mother-child/ father-child relationship							28.4	**<0.001**
No	498	7.4±4.6	163(32.7)	169(33.9)	131(26.3)	35(7)		
Yes	105	9.8±4.1	9(8.6)	39(37.1)	46(43.8)	11(10.5)		
Concerns about ability to care, nurture and mother-child							43.1	**<0.001**
No	395	6.9±4.5	145(36.7)	132(33.4)	95(24.1)	23(5.8)		
Yes	208	9.5±4.3	27(13)	76(36.5)	82(39.4)	23(11.1)		
Others							5.9	**0.116**
No	487	7.9±4.7	141(29)	158(32.4)	147(30.2)	41(8.4)		
Yes	116	7.3±4.2	31(26.7)	50(43.1)	30(25.9)	5(4.3)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.11 Perceived Stress and Depression

The percentage of severe depression was higher among the study participants who had higher levels of perceived stress (Table 4.10). Of the 301 participants who had high perceived stress, 12.0% (n=36) had severe depression, 3.4% (n=10) of the 291 who had moderate perceived stress and none of the 121 who

had low perceived stress had severe depression. There was a significant association between perceived stress and depression from the Pearson's chi-square test (χ^2 = 64.7, p-value < 0.001).

4.11.1 Self-reported Stress Rating and Depression

The percentage of severe depression was higher among the study participants who self-reported higher levels of stress (Table 4.10). Of the 258 participants who self-reported high stress, 15.1% (n=39) had severe depression, 1.8% (n=4) of the 224 who self-reported moderate stress, and 2.5% (n=3) of the 121 who self-reported low stress had severe depression. There was a significant association between self-reported stress and depression (χ^2 = 119.0, p-value < 0.001).

Table 4.10 Chronic stress, Self-stress Rating and Depression, LMKM 2018

		Depression					
	Total	**Low/No**	**Mild**	**Moderate**	**Severe**	χ^2	**P-value**
Perceived Stress	**603**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Self-stress rating						119.0	**<0.001**
Low	121	55(45.5)	46(38)	17(14.1)	3(2.5)		
Moderate	224	90(40.2)	82(36.6)	48(21.4)	4(1.8)		
High	258	27(10.5)	80(31.0)	112(43.4)	39(15.1)		
Chronic stress (PSS-14)						64.7	**<0.001**
Low	11	4(36.4)	4(36.4)	3(27.3)	0(0)		
Moderate	291	127(43.6)	97(33.3)	57(19.6)	10(3.4)		
High	301	41(13.6)	107(35.6)	117(38.9)	36(12.0)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.12 Background Characteristics and Anxiety

Of the respondents who were Akan, 3.0% (n=2) of them had severe anxiety, 4.6% (n=15) of the 324 Ga/Dangme, 3.6% (n=5) of the 141 Ewes and 5.6% (n=4) of the 72 study participants of other ethnicities also had severe anxiety (Table 4.11). The ethnicity of study participants showed significant association with the anxiety level (p-value = 0.005).

Among the 103 who had never married 8.7% (n=9) of them had severe anxiety, none of the 193 participants who were married had severe anxiety, 4.9% (n=14) of the 286 participants who were living together with their partners had severe anxiety and 14.3% (n=3) of the 21 who were divorced or separated also had severe anxiety. Marital status was significantly associated with anxiety (p-value <0.001). Of the 287 rural residents in the study, 5.9% (n=17) of them had severe anxiety whereas 2.9% (n=9) of the 316 urban residents had severe anxiety (Table 4.11).

Table 4.11 Background Characteristics and Anxiety, LMKM 2018

		Anxiety					
	Total	**Low/No**	**Mild**	**Moderate**	**Severe**	χ^2	**P-value**
Characteristics	**603**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Age group (years)						7.8	0.556
<20	48	11(22.9)	27(56.3)	8(16.7)	2(4.2)		
20-29	311	125(40.2)	133(42.8)	41(13.2)	12(3.9)		
30-39	225	82(36.4)	103(45.8)	28(12.4)	12(5.3)		
>40	19	9(47.4)	8(42.1)	2(10.5)	0(0)		
Ethnicity						23.8	**0.005**
Akan	66	33(50)	23(34.9)	8(12.1)	2(3)		
Ga/Dangme	324	138(42.6)	138(42.6)	33(10.2)	15(4.6)		
Ewe	141	39(27.7)	70(49.7)	27(19.2)	5(3.6)		
Other	72	17(23.6)	40(55.6)	11(15.3)	4(5.6)		
Religion						2.0	0.573
Christians	583	217(37.2)	263(45.1)	77(13.2)	26(4.5)		
Non-Christians	20	10(50)	8(40)	2(10)	0(0)		
Marital status						41.0	**<0.001**
Never married	103	30(29.1)	39(37.9)	25(24.3)	9(8.7)		
Married	193	84(43.5)	88(45.6)	21(10.9)	0(0)		
Living together	286	111(38.8)	131(45.8)	30(10.5)	14(4.9)		
Divorced/Separated	21	2(9.5)	13(61.9)	3(14.3)	3(14.3)		
Highest education						9.5	0.663
No Education	29	10(34.5)	13(44.8)	6(20.7)	0(0)		
Primary	64	24(37.5)	30(46.9)	6(9.4)	4(6.3)		
Middle/JSS	288	105(36.5)	133(46.2)	41(14.2)	9(3.1)		
Secondary	161	61(37.9)	71(44.1)	18(11.2)	11(6.8)		
Tertiary	61	27(44.3)	24(39.3)	8(13.1)	2(3.3)		
Currently employed						7.2	0.065
No	158	46(29.1)	78(49.4)	25(15.8)	9(5.7)		
Yes	445	181(40.7)	193(43.4)	54(12.1)	17(3.8)		
History of pregnancy complications						6.4	0.095
No	491	196(39.9)	214(43.6)	62(12.6)	19(3.9)		
Yes	112	31(27.7)	57(50.9)	17(15.2)	7(6.3)		
First ANC visit						2.7	0.44
No	520	202(38.9)	228(43.9)	67(12.9)	23(4.4)		
Yes	83	25(30.1)	43(51.8)	12(14.5)	3(3.6)		
Area of residence						41.4	**<0.001**
Rural	287	142(49.5)	96(33.5)	32(11.2)	17(5.9)		
Urban	316	85(26.9)	175(55.4)	47(14.9)	9(2.9)		
Wealth index						9.1	0.697
Poorest	123	41(33.3)	56(45.5)	20(16.3)	6(4.9)		
Poorer	120	41(34.2)	59(49.2)	15(12.5)	5(4.2)		
Middle	129	57(44.2)	57(44.2)	11(8.5)	4(3.1)		
Richer	111	41(36.9)	52(46.9)	14(12.6)	4(3.6)		
Richest	120	47(39.2)	47(39.2)	19(15.8)	7(5.8)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): frequency(row percentage). Bolded p-value statistical significance at p<0.05.

4.13 Chronic Stressors and Anxiety

Among the 392 study participants who reported financial issues as a chronic stressor, 3.1% (n=12) had severe anxiety compared to 6.6% (n=14) of the 211 who did not report financial issues as a chronic stressor. There was a significant association between financial issues as chronic stressors and anxiety (p-value = 0.002). Of the 152 study participants who had marital or relationship issues as a chronic stressor, 7.2% (n=11) had severe anxiety level whereas 3.3% (n=15) of the 451 who did not report marital or relationship issues. Marital or relationship issues, as a self-reported chronic stressor was significantly associated with anxiety (p-value = 0.006) (Table 4.12).

Table 4.12 Chronic Stressors and Anxiety, LMKM 2018

		Anxiety					
	Total	**Low/No**	**Mild**	**Moderate**	**Severe**	χ^2	**P-value**
Chronic Stressors	**603**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Financial issues						14.6	**0.002**
No	211	87(41.2)	75(35.6)	35(16.6)	14(6.6)		
Yes	392	140(35.7)	196(50)	44(11.2)	12(3.1)		
Marital/relationship						12.4	**0.006**
No	451	185(41)	198(43.9)	53(11.8)	15(3.3)		
Yes	152	42(27.6)	73(48)	26(17.1)	11(7.2)		
Work- or job-related						7	0.071
No	316	130(41.1)	126(39.9)	46(14.6)	14(4.4)		
Yes	287	97(33.8)	145(50.5)	33(11.5)	12(4.2)		
Family issues						6.7	0.081
No	481	191(39.7)	212(44.1)	61(12.7)	17(3.5)		
Yes	122	36(29.5)	59(48.4)	18(14.8)	9(7.4)		
Health issues						6.9	0.077
No	530	208(39.3)	235(44.3)	64(12.1)	23(4.3)		
Yes	73	19(26)	36(49.3)	15(20.6)	3(4.1)		
Social support						2.6	0.466
No	553	212(38.3)	244(44.1)	72(13)	25(4.5)		
Yes	50	15(30)	27(54)	7(14)	1(2)		
Neighborhood/environment/living conditions						0.3	0.963
No	557	211(37.9)	250(44.9)	72(12.9)	24(4.3)		
Yes	46	16(34.8)	21(45.7)	7(15.2)	2(4.4)		
Others						9.2	**0.027**
No	562	203(36.1)	260(46.3)	74(13.2)	25(4.5)		
Yes	40	24(60)	11(27.5)	4(10)	1(2.5)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.14 Pregnancy-specific Stressors and Anxiety

Out of the participants who reported fear of giving birth to a child with a congenital anomaly as a pregnancy-specific stressor, 6.7% (n=9) had severe anxiety compared to 3.6% (n=17) severe anxiety among those who did not report this pregnancy-specific stressor (Table 4.13). Tests of association revealed a significant relationship between fear of childbirth as a pregnancy-specific stressor and anxiety amongst study participants (p-value <0.001). Also, changes in the marital or relationship status was significantly associated with anxiety (p-value < 0.001). Among the 105 study participants whose concerns about the future parent-child relationship as a pregnancy-specific stressor, 6.7% (n=7) had severe anxiety compared to the 3.8% (n=19) among the 498 who did not report concerns about future parent-child. There was a significant association between reportage on concerns about the future parent-child relationship as pregnancy-specific stressor and anxiety amongst study participants (p-value < 0.001).

Also, of the 208 study participants whose concerns about their ability to nurture a child was a pregnancy-specific stressor, 5.8% (n=12) had severe anxiety compared to the 3.5% (n=14) among the 395 who did not report concerns about their ability to nurture a child as a usual cause of stress in pregnancy. There was a significant association between reportage on concerns about ability to nurture a pregnancy-specific stressor and anxiety amongst study participants (p-value < 0.001) (Table 4.13).

Table 4.13 Pregnancy-specific Stressors and Anxiety, LMKM 2018

Pregnancy-specific stressors	Total	Anxiety				χ^2	P-value
		Low/No	Mild	Moderate	Severe		
	603	n (%)	n (%)	n (%)	n (%)		
Fear of childbirth						1.4	0.697
No	234	94(40.2)	103(44)	27(11.5)	10(4.3)		
Yes	369	133(36)	168(45.5)	52(14.1)	16(4.3)		
Fear of giving birth to a child with anomalies						30.7	<0.001
No	468	198(42.3)	206(44)	47(10)	17(3.6)		
Yes **Changes in marital/relationship**	134	28(20.9)	65(48.5)	32(23.9)	9(6.7)		
						29.6	<0.001
No	539	218(40.5)	240(44.5)	63(11.7)	18(3.3)		
Yes	64	9(14.1)	31(48.4)	16(25)	8(12.5)		
Concerned with future mother-child/ father-child relationship						21.4	<0.001
No	498	208(41.8)	208(41.8)	63(12.7)	19(3.8)		
Yes	105	19(18.1)	63(60)	16(15.2)	7(6.7)		
Concerns about ability to care, nurture and mother-child						22.8	<0.001
No	395	175(44.3)	156(39.5)	50(12.7)	14(3.5)		
Yes	208	52(25)	115(55.3)	29(13.9)	12(5.8)		
Others						5.1	0.163
No	487	173(35.5)	228(46.8)	65(13.4)	21(4.3)		
Yes	116	54(46.6)	43(37.1)	14(12.1)	5(4.3)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at $p<0.05$.

4.15 Perceived Stress and Anxiety

The percentage of severe anxiety was higher among participants who had higher levels of perceived stress (Table 4.14). Of the 301 participants who had high perceived stress scores, 7.3% (n=22) had severe depression, 1.4% (n=4) of the 291 who had moderate perceived stress and none of the 121 who had low perceived stress had severe anxiety. Perceived stress and anxiety were significantly associated (p-value < 0.001).

4.15.1 Self-Stress Rating and Anxiety

Self-reported stress was significantly associated with anxiety (p-value < 0.001). The percentage of severe anxiety was higher among the study participants who self-reported higher levels of stress (Table 4.14). Of the 258 participants who self-reported high stress, 7.8% (n=20) had severe depression, 1.8% (n=4) of the 224 who self-reported moderate stress and 1.7% (n=2) of the 121 who self-reported low stress had severe anxiety (Table 4.14).

Table 4.14 Chronic stress, Self-Stress Rating and Anxiety, LMKM 2018

		Anxiety					
	Total	**No/Low**	**Mild**	**Moderate**	**Severe**	χ^2	**P-value**
Perception of Stress	**603**	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Self-stress rating						131.1	<0.001
Low	121	85(70.3)	28(23.1)	6(5)	2(1.7)		
Moderate	224	104(46.4)	98(43.8)	18(8)	4(1.8)		
High	258	38(14.7)	145(56.2)	55(21.3)	20(7.8)		
Chronic stress (PSS-14)						87.0	<0.001
Low	11	8(72.7)	2(18.2)	1(9.1)	0(0.0)		
Moderate	291	158(54.3)	107(36.8)	22(7.6)	4(1.4)		
High	301	61(20.3)	162(53.8)	56(18.6)	22(7.3)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.16 Chronic Stressors and Perceived Stress

Financial issues (p-value <0.001), marital or relationship issues (p-value <0.001) and other the chronic stressors showed significant association with perceived stress (Table 4.15).

Table 4.15 Chronic Stressors and Perceived Stress (PSS-14), LMKM 2018

Chronic Stressors	Total	PSS-14 Stress Score			χ^2	P-value
		Low	Moderate	High		
	603	n(%)	n(%)	n(%)		
Financial issues					17.2	**<0.001**
No	211	9(4.3)	114(54.0)	88(41.7)		
Yes	392	2(0.5)	177(45.2)	213(54.3)		
Marital/relationship issues					24.4	**<0.001**
No	451	10(2.2)	242(53.7)	199(44.1)		
Yes	152	1(0.7)	49(32.2)	102(67.1)		
Work- or job-related issues					11.2	**0.004**
No	316	11(3.5)	156(49.4)	149(47.2)		
Yes	287	0(0.0)	135(47.0)	152(53.0)		
Family issues					2.1	0.355
No	481	9(1.9)	239(49.7)	233(48.4)		
Yes	122	2(1.6)	52(42.6)	68(55.7)		
Health issues					2.0	0.360
No	530	9(1.7)	251(47.4)	270(50.9)		
Yes	73	2(2.7)	40(54.8)	31(42.5)		
Social support					2.1	0.358
No	553	11(2.0)	263(47.6)	279(50.5)		
Yes	50	0(0.0)	28(56.0)	22(44.0)		
Environmental living conditions					6.3	**0.044**
No	557	8(1.4)	271(48.7)	278(49.9)		
Yes	46	3(6.5)	20(43.5)	23(50.0)		
Others					2.9	0.236
No	562	11(2.0)	266(47.3)	285(50.7)		
Yes	40	0(0.0)	24(60.0)	16(40.0)		

χ^2: Pearson's chi-square. SD: standard deviation. n (%): Frequency (row percentage). Bolded p-value statistical significance at $p<0.05$.

4.17 Pregnancy-specific Stressors and Perceived Stress

Study participants identified categories of pregnancy-specific stressors. They also were administered the PSS-14 which is a measure of perceived stress. Changes in the marital or relationship (p-value <0.001), concern about the future parent-child relationship (p-value <0.001), concerns about the ability to mother a child (p-value <0.001) were pregnancy-specific stressors that showed a significant association with chronic stress as measured via the PSS-14 (Table 4.16).

Table 4.16 Pregnancy-specific Stressors and Perceived Stress (PSS-14), LMKM 2018

Pregnancy-specific Stressors	Total	PSS-14 Stress Score			χ^2	P-value
		Low	Moderate	High		
	603	n(%)	n(%)	n(%)		
Fear of child birth					0.8	0.670
No	234	5(2.1)	108(46.2)	121(51.7)		
Yes	369	6(1.6)	183(49.6)	180(48.8)		
Fear of giving birth to a child with a congenital anomaly					1.0	0.607
No	468	9(1.9)	230(49.2)	229(48.9)		
Yes	134	2(1.5)	60(44.8)	72(53.7)		
Changes in marital/relationship					16.2	**<0.001**
No	539	11(2.0)	274(50.8)	254(47.1)		
Yes	64	0(0.0)	17(26.6)	47(73.4)		
Concerned with future parent-child relationship					27.9	**<0.001**
No	498	10(2.0)	264(53.0)	224(45.0)		
Yes	105	1(1.0)	27(25.7)	77(73.3)		
Concerns about ability to nurture a child					47.4	**<0.001**
No	395	11(2.8)	226(57.2)	158(40.0)		
Yes	208	0(0.0)	65(31.3)	143(68.8)		
Others					6.4	**0.040**
No	487	7(1.4)	226(46.4)	254(52.2)		
Yes	116	4(3.5)	65(56.0)	47(40.5)		

χ^2: Pearson's chi-square. n (%): Frequency (row percentage). Bolded p-value statistical significance at p<0.05.

4.18 Predictors of Chronic Stress, Depression and Anxiety

The generalized ordered logistic regression model was used to estimate the adjusted odds of chronic stress, depression and anxiety. Due to over fitting and satisfaction of parallel line assumption variables from the Pearson's chi-square test, p-values less than 0.25 were only considered in the model. Few variables though not significant at p less than 0.25 were added based on previous models. Age, number of pregnancies and number of children were considered in the model as continuous variables irrespective of their significance from the Pearson's chi-square test. From the Wald's test (Appendix X), the parallel line or proportional odds assumption test for the entire model produced a p-value of 1.000 indicating a non-violation of the assumption in estimating the adjusted odds ratio (Appendix XI).

4.18.1 Chronic Stress

After adjusting for covariates, married pregnant women were about twice as likely (AOR: 1.99, 95% CI: [1.07-3.69]) to have chronic stress compared to those who had never married. Also, when compared to the pregnant women who had never married, the odds of chronic stress were about 3 times higher (AOR: 2.89, 95% CI: [1.61-5.17]) for pregnant women who were living with partners in informal unions. Additionally, women who reported marriage or relationship issues as a self-identified stressor, were approximately twice as likely (AOR: 1.96, 95% CI: [1.23-3.13]) to experience chronic stress in comparison to those who did not report this stressor (Table 4.17).

4.18.2 Pregnancy-specific Stress

Women who identified concerns about their ability to nurture a child as a pregnancy-specific stressor, were over thrice as likely (AOR: 3.33, 95% CI: [2.08-5.33]) to have chronic stress compared to those who did not (Table 4.17).

Table 4.17 Predictors of Stress, LMKM 2018

Variables	AOR	95% CI	P-value
Constant component through out			
Age in years	0.99	[0.95 - 1.04]	0.810
Ethnicity *(ref: Akan)*			
Ga/Dangme	1.53	[0.80 - 2.95]	0.202
Ewe	1.44	[0.71 - 2.90]	0.312
Other	1.08	[0.49 - 2.39]	0.854
Marital status *(ref: Never married)*			
Married	**1.99**	**[1.07 - 3.69]**	**0.029**
Living together	**2.89**	**[1.61 - 5.17]**	**<0.001**
Divorced/Separated	1.60	[0.47 - 5.45]	0.448
Highest education *(ref: No education)*			
Primary	2.47	[0.84 - 7.29]	0.100
Middle/JSS	1.75	[0.68 - 4.46]	0.244
Secondary	1.33	[0.49 - 3.63]	0.581
Tertiary	1.28	[0.40 - 4.12]	0.680
Currently employed *(ref: Unemployed)*	0.65	[0.39 - 1.08]	0.099
Number of children	1.11	[0.83 - 1.48]	0.500
Number of pregnancies	0.86	[0.66 - 1.12]	0.249
First ANC attendance *(ref: No)*	1.32	[0.74 - 2.34]	0.341
Urban residence *(ref: Rural)*	1.01	[0.66 - 1.54]	0.961
Wealth index *(ref: Poorest)*			
Poorer	0.94	[0.51 - 1.75]	0.849
Middle	0.97	[0.53 - 1.79]	0.920

Richer	0.78	[0.41 - 1.49]	0.449
Richest	1.12	[0.54 - 2.32]	0.764
Financial issues (Stressor) *(ref: No)*	1.51	[0.96 - 2.36]	0.072
Marriage/ relationship issues (Stressor) *(ref: No)*	**1.96**	**[1.23 - 3.13]**	**0.005**
Work related issues (Stressor) *(ref: No)*	1.25	[0.83 - 1.88]	0.293
Environmental issues (Stressor) *(ref: No)*	0.72	[0.35 - 1.50]	0.382
Other issues (Stressor) *(ref: No)*	**2.31**	**[1.01 - 5.30]**	**0.048**
Changes in marriage/ relationship (PS Stressor) *(ref: No)*	1.95	[0.95 - 3.99]	0.069
Future parent-child relation concerns (PS Stressor) *(ref: No)*	1.16	[0.64 - 2.10]	0.627
Ability to nurture, care child concerns (PS Stressor) *(ref: No)*	**3.33**	**[2.08 - 5.33]**	**<0.001**
Other issues (PS Stressor) *(ref: No)*	1.17	[0.70 - 1.96]	0.542

AOR: adjusted odds ratio. CI: confidence interval. ref: reference category. PS: Pregnancy-specific. Bolded p-value statistical significance at $p<0.05$.

4.19 Depression

The odds of depression was about half as probable (AOR: 0.45, 95% CI: [0.26-0.77]) for pregnant women who were married or living with unmarried partners (AOR: 0.57, 95% CI: [0.34-0.94]) when compared to women who had never married. Depression increased by approximately one and a third times higher (AOR: 1.30, 95% CI: [1.02-1.67]) for each increase in the number of pregnancies a woman had had. Also, the odds of depression were about 2 times higher (AOR: 1.94, 95% CI: [1.35-2.78]) for urban residents compared to their rural counterparts. When compared to people in the poorest wealth quintile, depression was about 3 times higher (AOR: 2.70, 95% CI: [1.50-4.86]) for pregnant women in the richest wealth quintile. Women who were concerned about changes in their marriage or relationship as a pregnancy-specific stressor, were two times more likely (AOR: 1.98. 95% CI: [1.12-3.50]) to be depressed compared those pregnant who did not report changes in marriage or relationship as a cause of stress in pregnancy (Table 4.18).

The odds of depression was about 1.8 times more (AOR: 1.78, 95% CI: [1.17-2.20]) for pregnant women whose concerns about their ability to nurture a child was a pregnancy-specific stressor compared to those who did not report this concern. The odds of depression were 75% less (AOR: 025, 95% CI: [0.07-0.86]) for pregnant women who had moderate chronic stress compared to those with low chronic stress. For women who self-reported high stress had over two and a half times higher odds

(AOR: 2.65, 95% CI: [1.57-4.46]) for depression compared to those who reported low stress. The proportional odds of higher depression levels were approximately quadrupled (AOR: 4.39, 95% CI: [2.69-7.16]) and 22 times higher (AOR: 22.54, 95% CI: [10.69-47.50]) respectively for those with high depression related difficulties (Table 4.18).

Table 4.18 Predictors of Depression, LMKM 2018

Variables	AOR	95% CI	P-value
Constant component through out			
Age in years	0.99	[0.95 - 1.03]	0.608
Ethnicity *(ref: Akan)*			
Ga/Dangme	1.12	[0.62 - 2.00]	0.706
Ewe	**2.26**	**[1.21 - 4.23]**	**0.010**
Other	**2.02**	**[1.00 - 4.09]**	**0.049**
Marital status *(ref: Never married)*			
Married	**0.45**	**[0.26 - 0.77]**	**0.003**
Living together	**0.57**	**[0.34 - 0.94]**	**0.027**
Divorced/Separated	0.78	[0.30 - 2.06]	0.619
Number of children	0.79	[0.61 - 1.03]	0.082
Number of pregnancies	**1.30**	**[1.02 - 1.67]**	**0.037**
Ever had pregnancy complication *(ref: No)*	1.22	[0.78 - 1.90]	0.378
Urban residence *(ref: Rural)*	**1.94**	**[1.35 - 2.78]**	**<0.001**
Wealth index *(ref: Poorest)*			
Poorer	1.11	[0.66 - 1.86]	0.704
Middle	1.00	[0.60 - 1.69]	0.988
Richer	1.05	[0.61 - 1.82]	0.850
Richest	**2.70**	**[1.50 - 4.86]**	**0.001**
Marriage/ relationship issues, chronic stressor *(ref: No)*	0.83	[0.56 - 1.24]	0.359
Family issues, chronic stressor *(ref: No)*	1.03	[0.67 - 1.57]	0.902
Fear of childbirth pregnancy specific stressor *(ref: No)*	0.80	[0.52 - 1.25]	0.325
Fear of birth of child with anomaly pregnancy specific stressor *(ref: No)*	0.72	[0.47 - 1.12]	0.143
Changes in marriage/ relationship pregnancy specific stressor *(ref: No)*	**1.98**	**[1.12 - 3.50]**	**0.018**
Future parent-child relation concerns pregnancy specific stressor *(ref: No)*	1.34	[0.83 - 2.16]	0.237
Ability to nurture a child concerns pregnancy specific stressor *(ref: No)*	**1.78**	**[1.17 - 2.71]**	**0.007**
Other causes of stress in pregnancy *(ref: No)*	1.10	[0.62 - 1.94]	0.753
Chronic stress level *(ref: Low)*			
Moderate	**0.25**	**[0.07 - 0.86]**	**0.029**
High	0.61	[0.17 - 2.20]	0.451
Self-reported stress level *(ref: Low)*			
Moderate	0.97	[0.60 - 1.57]	0.901
High	**2.65**	**[1.57 - 4.46]**	**<0.001**
Anxiety-related difficulty *(ref: Low)*			
Moderate	0.65	[0.41 - 1.04]	0.073
High	0.53	[0.27 - 1.02]	0.059
Depression related difficulty *(ref: Low)*			
Moderate	**4.39**	**[2.69 - 7.16]**	**<0.001**
High	**22.54**	**[10.69 - 47.50]**	**<0.001**
(LOW/NO, MILD & MODERATE) VS. SEVERE			
Currently employed *(ref: Unemployed)*	1.04	[0.59 - 1.81]	0.898
Other stressors *(ref: No)*	**0.40**	**[0.17 - 0.92]**	**0.032**
(LOW/NO & MILD) VS. (MODERATE & SEVERE)			
Currently employed *(ref: Unemployed)*	**0.51**	**[0.31 - 0.84]**	**0.008**
Other stressors *(ref: No)*	1.53	[0.62 - 3.80]	0.355
LOW/NO VS. (MILD, MODERATE AND SEVERE)			
Currently employed *(ref: Unemployed)*	0.61	[0.29 - 1.28]	0.193
Other stressors *(ref: No)*	0.65	[0.13 - 3.33]	0.604

AOR: adjusted odds ratio. CI: confidence interval. ref: reference category. Bolded p-value statistical significance at p<0.05.

4.20 Anxiety

The odds of anxiety were approximately half (AOR: 0.49, 95% CI: [0.28-0.87]) for married and those who were living with their partners (AOR: 0.51, 95% CI: [0.30-0.86]) compared to the pregnant women who had never married. The odds of anxiety were decreased by 25% (AOR: 0.74, 95% CI: [0.56-0.98]) for each increase in the number of children a woman had had. For pregnant women who reported fear of birthing a child with a congenital anomaly as a pregnancy-specific stressor, the odds of anxiety were 64% higher (AOR: 1.64, 95% CI: [1.04-2.58]) compared to those who did not report this stressor. Pregnant women who self-reported high stress were three times as likely (AOR: 3.21, 95% CI: [1.81-5.69]) to experience anxiety compared to those who self-reported low stress (Table 4.19). The odds of severe or moderate anxiety versus low/no or mild anxiety was 0.4 times (AOR: 0.43, 95% CI: [0.25-0.74]) for pregnant women who reported financial issues as a chronic stressor compared to those who did not (Table 4.19).

Table 4.19 Predictors of Anxiety, LMKM 2018

Variables	AOR	95% CI	P-value
Constant component throughout			
Age in years	1.03	[0.98 - 1.07]	0.242
Ethnicity *(ref: Akan)*			
Ga/Dangme	**1.96**	**[1.05 - 3.64]**	**0.033**
Ewe	**2.32**	**[1.21 - 4.46]**	**0.011**
Other	**2.45**	**[1.14 - 5.24]**	**0.021**
Marital status *(ref: Never married)*			
Married	**0.49**	**[0.28 - 0.87]**	**0.014**
Living together	**0.51**	**[0.30 - 0.86]**	**0.012**
Divorced/Separated	0.60	[0.22 - 1.65]	0.323
Currently employed *(ref: Unemployed)*	0.83	[0.53 - 1.30]	0.407
Number of children	**0.74**	**[0.56 - 0.98]**	**0.039**
Number of pregnancies	1.27	[0.97 - 1.65]	0.079
Ever had pregnancy complication *(ref: No)*	1.02	[0.64 - 1.64]	0.925
Marital / relationship issues *(ref: No)*	1.08	[0.71 - 1.65]	0.706
Work related issues *(ref: No)*	1.15	[0.78 - 1.69]	0.476
Family issues *(ref: No)*	1.19	[0.76 - 1.87]	0.438
Health issues *(ref: No)*	1.40	[0.80 - 2.46]	0.243
Other issues (*ref: No)*	0.58	[0.25 - 1.37]	0.212
Fear of birth of a child with an anomaly, pregnancy-specific stressor *(ref: No)*	**1.64**	**[1.04 - 2.58]**	**0.032**
Changes in marriage/ relationship, pregnancy specific stressor *(ref: No)*	1.58	[0.87 - 2.87]	0.130
Concerns about future parent-child relationship, pregnancy specific stressor *(ref: No)*	0.92	[0.55 - 1.53]	0.738
Concerns about ability to nurture child, pregnancy specific stressor *(ref: No)*	1.12	[0.72 - 1.73]	0.614
Other *(ref: No)*	0.94	[0.57 - 1.56]	0.811
Chronic stress level *(ref: Low)*			
Moderate	0.64	[0.14 - 2.89]	0.561
High/Severe	1.95	[0.42 - 9.07]	0.394
Self-reported stress level *(ref: Low)*			
Moderate	1.47	[0.85 - 2.54]	0.168
High	**3.21**	**[1.81 - 5.69]**	**<0.001**
Depression related difficulty *(ref: Low)*			
Moderate	1.61	[0.97 - 2.68]	0.068
High	**3.74**	**[1.80 - 7.75]**	**<0.001**
(LOW/NO, MILD & MODERATE) VS. SEVERE DEPRESSION			
Urban residence *(ref: Rural)*	**2.54**	**[1.63 - 3.94]**	**<0.001**
Financial issues *(ref: No)*	0.99	[0.62 - 1.58]	0.973
Anxiety-related difficulty *(ref: Low)*			
Moderate	**2.63**	**[1.55 - 4.45]**	**<0.001**
High	**2.85**	**[1.41 - 5.75]**	**0.003**
(LOW/NO & MILD) VS. (MODERATE & SEVERE)			
Urban residence *(ref: Rural)*	1.11	[0.65 - 1.88]	0.710
Financial issues, chronic stressor *(ref: No)*	**0.43**	**[0.25 - 0.74]**	**0.002**
Anxiety-related difficulty *(ref: Low)*			
Moderate	0.85	[0.43 - 1.68]	0.630
High	**2.85**	**[1.41 - 5.75]**	**0.003**
LOW/NO VS. (MILD, MODERATE AND SEVERE)			
Urban residence (ref: Rural)	0.52	[0.21 - 1.32]	0.167
Financial issues *(ref: No)*	0.51	[0.21 - 1.24]	0.137
Anxiety-related difficulty *(ref: Low)*			
Moderate	**0.15**	**[0.03 - 0.74]**	**0.020**
High	**2.85**	**[1.41 - 5.75]**	**0.003**

COR: crude odds ratio. AOR: adjusted odds ratio. CI: confidence interval. Bolded p-value statistical significance at p<0.05.

CHAPTER FIVE

DISCUSSION

5.0 Summary

There is evidence that maternal stress exposure during pregnancy exerts both immediate and distal effects. This study was conducted in an effort to provide some context-specific data and address unanswered questions particularly those related to chronic stress, depression and anxiety during pregnancy. This chapter presents an in-depth discussion of the study findings as they relate to the study objectives. Moreover, points of intersection and divergence between present stress research and the study findings are discussed.

5.1 Catalogue of Stressors

The first objective of the study was to examine the cause of maternal stress (stressors) in the population of pregnant women studied based on a catalogue distilled from evidence on the subject matter. The significant causes of stress identified in the study population were financial, work/job, marital/relationship, and family issues. Hitherto these causes of stress or stressors amongst pregnant women in LMKM were unknown. In this study almost 70% or participants related that financial issues were a major cause of stress. Other studies across the globe have likewise noted that financial related issues were a source of chronic stress amongst pregnant women (Silveira et al., 2014; Marushka Leanne Silveira, Pekow, Dole, Markenson, & Chasan-Taber, 2013). According to a large population survey in America by the American Psychological Association (APA) on stress, approximately 70% of the participants were stressed out over money within the past month (American Psychological Association, 2015). Similarly, Klein et al., (2016) indicated that majority of pregnant women in Germany reported

income or finances as a major stressor (Klein et al., 2016). Financial stress is a large category and different people may experience versions of it. Also, financial stress tends to be long term and perhaps throughout a person's lifetime, thus exposure may remain long after the pregnancy is over. Therefore, the participants in this study who identified financial issues as a chronic stressor possibly may have experienced this stressor for a lengthy period and may continue after delivery.

The second most significant stressor detailed in the study findings was marital or relationship issues. In the Congo, a study related that marital/ relationship issues as an important source of stress/stressor (Tandu-umba et al., 2014). Similarly, divorce (a subset of marital difficulty) was identified as the main stressor for pregnant women in Kenya, similar to this study in Ghana (Henley et al., 2014). There are many causes of stress in romantic relationships, particularly if there are instances of IPV, role strain, communication or lack thereof, sex and intimacy, the disparity in responsibility-sharing, to name a few (Kim & McKenry, 2002; Willoughby, Hall, & Luczak, 2015). Marriage/relationships are therefore closely linked to psychosocial wellbeing and consequently a key stressor as identified within this group of pregnant women in LMKM.

Work/job-related issues was another significant stressor identified in the study population. This study found that almost half of those currently employed stated that work stress was a major stressor. Work-related stress was examined during pregnancy and similarly acknowledged that it was a major stressor for up to about half of the women studied (Katz, 2012). Majority of the pregnant women interviewed in LMKM were not employed in the formal sector and may experience dimensions of work-related stress such as job insecurity, a high physical work burden, dissatisfaction, and other related work difficulties specific to the non-formal sector. Further studies have addressed the contribution of work/job-related stressors to chronic stress exposure in pregnant women; in all examined studies, job

stress accounted for a large prevalence of chronic stress (≥ 50%), comparable to the results of this present study (Lee et al., 2011; Mutambudzi, Meyer, Warren, & Reisine, 2011; Nakao, 2010).

5.2 Prevalence of Chronic Stress

The next aim of the study was to assess the degree to which situations in a person's life are appraised as stressful using a psychometric scale, the PSS-14 (Cohen et al., 1983). As much as half of the sampled pregnant women in LMKM had high and severe stress. In a study of stress in pregnant women in Ghana, Boakye-Yiadom et al., (2015) indicated a lower prevalence of perceived stress (28%). Possibly, this study conducted in Tamale, a city and regional capital in northern Ghana as compared to peri-urban and largely rural LMKM may account for the difference in perceived stress rates. Studies in Saudi Arabia, India and Nepal, found the prevalence of stress in pregnancy rates also lower than this study's findings (33.4%, 33.3% and 34.2% respectively) (Ahmed et al., 2017; Pais & Pai, 2018; Pantha, 2014). A similar cross-sectional study in India with a similar study population found a lower prevalence (30.9%) of perceived stress in pregnancy (Aneja et al., 2018). Social support has an inverse relationship with perceived stress (Aksoy et al., 2018; Bisetegn et al., 2016). To account for the higher prevalence of high and severe stress amongst pregnant women in LMKM, a lack of social support may be a contributory factor. This finding suggests that women in LMKM may have less robust social support mechanisms and therefore have a higher perception of stress than pregnant women elsewhere.

Aside from a possible lack of social support, daily life hassles could be a major contributor to high stress in LMKM. Early and more recent studies of stress in various settings have arrived at similar conclusions (Kanner et al., 1981; Mcintosh et al., 2010; Tessner et al., 2011). Daily hassles such as parenting and childcare, household tasks, losing an important item or money, household cooking and cleaning tasks, the hassles of public transportation or the lack thereof, extended family responsibilities

and a wide variety of other possibilities. Thus, these daily hassles may significantly contribute to stress in LMKM.

The potential public health implications of these findings are enormous. Chronic stress has been implicated as a critical risk factor for heart disease, heart attacks, hypertension, strokes, and many other cardiovascular diseases (CVD) (An et al., 2015; Vaccarino et al., 2016; Weiß, 2018). From the stressors identified and the substantially high prevalence rates, it can be inferred that without intervention, many pregnant women in LMKM may develop some of these cardiovascular symptoms in the near future. This will place a heavy burden on the healthcare system as the treatment and management of non-communicable diseases such as CVD are chronic and expensive. Apart from heart-related diseases, stress is a risk factor for diabetes (cortisol leads to insulin dysregulation), cancer, migraines, and frequent infections due to immune system dysfunction (Dyer & Rosenfeld, 2011; Juster et al., 2010) Further, chronic stress exacerbates already existing health conditions causing rapid deterioration of health status within the population and create undue burdens on the health system.

The behavioral consequences of stress exposure have substantial public health implications Undesirable behaviors related to chronic stress such as substance abuse or misuse, smoking, alcohol abuse etc. may significantly increase in the community. Also, risky behaviors such as unprotected sex can arise because chronic stress impaired cognitive judgment and decision-making. Consequently, the incidence of HIV and other STDs could then increase, in addition to unintended pregnancies.

5.3 Prevalence of Pregnancy-specific Stressors

Categories of pregnancy-specific stress factors were extracted from the body of evidence to determine if comparable evidence will be gathered in LMKM. Fear of childbirth was identified as a pregnancy-

specific stress category by a majority (61.2%) of the participants. A comparable study in Australia with other groups of pregnant women have identified fear of childbirth as a pregnancy-specific stressor (Fenwick et al., 2013). A multicounty population-based cohort study across six European countries likewise found that fear of childbirth was prevalent and led to increased rates of Cesarean sections (Ryding et al., 2015). Fear of childbirth as a primary pregnancy-specific stressor may be related to some of the socio-cultural interpretations and meaning of pregnancy and also possibly, perceived poor facility birthing experiences as was found in a study in Ghana (Dako-Gyeke et al., 2013). Fear of childbirth has been consistently identified as a type of pregnancy-specific stress (Rondung et al., 2016). Further dimensions related to pathways of acquisition of this fear and behavioral aspects of fear of childbirth could be interrelated subsets of pregnancy-specific stress factors.

An additional dimension of pregnancy-specific stress that was a key finding was concern about the parent-child relationship (34.5%). Indeed, the relationship between a parent-child or mother-child is an important one that is valued across the globe in all cultural and social settings. Similarly, therefore, researchers elsewhere have identified parenting or the parent-child relationship as a potential stressor, thus validating this finding (McStay et al., 2014). Gouveia et al., (2016) after identifying concerns about parent-child relationships as a stressor, reviewed styles of parenting (authoritative, permissive etc.) and their contribution to parenting stress. These factors may be closely associated with this finding in the study population. In a study of low-income women, researchers found likewise that pregnancy-specific stress relating to concerns about the parent-child relationship was a stressor (Raikes & Thompson, 2005).

As detailed in this study's theoretical framework, the experience of chronic stress and pregnancy-specific stress is based on a transactional process or an appraisal of the stressor (Folkman et al., 1986).

The parent-child relationship and stress elicited as a function thereof is transactional in nature, where the parent appraises possible inadequacies as stressors and thus a stress response is elicited. These factors that may be appraised as stressors by the pregnant women in the study may include single parenting, working long hours, lower income, marital/relationship problems etc. Similar research findings as that of this study, have augmented, lent support and build upon an early index of parenting stress that was developed to measure and capture the parent-child relationship as a stressor (Abidin et al., 2013; Cutler et al., 2013; Loyd & Abidin, 1985). This study thus lends to the cogency of the Parenting Stress Index (Cutler et al., 2013; Respler-Herman et al., 2012) that has been validated and used in various settings.

A third significant pregnancy-specific stressor was the fear of giving birth to a child with congenital anomalies. This indeed is a valid concern and stressor as has been equally identified elsewhere. Pinquart (2018) reviewed chronic congenital health conditions in a child and the stress experienced by the mother and found that these were significantly associated (Pinquart, 2018) as has been found in this study. Congenital anomalies of epidemiological importance such as sickle cell disease and spina bifida are relatively common in Ghana (Asare et al., 2018; Nuertey et al., 2017). Knowledge and beliefs related to these congenital anomalies may be an added reason for stress amongst pregnant women as the study identified. Ghanaian researchers have found that women often seek spiritual meanings and explanations to congenital anomalies (Dako-Gyeke et al., 2013; Kpobi & Swartz, 2019). This may be a reason fear of giving birth to a child with a congenital anomaly was identified in the study as a key pregnancy-specific stressor (Treadwell et al., 2015). This fear and ensuing stress experienced may be alleviated or mitigated by antenatal screening for common genetic conditions if clinically warranted (Bäz & Juhasz-Böss, 2019) and increased knowledge about risk factors added to pregnancy schools or antenatal education sessions (Suglo, 2016).

5.4 Predictors of Chronic Stress

The predictors of chronic stress in the sampled group were marital status (married and living together) and the ability to care for, nurture and mother the child as a PSS domain. Marital status as in people with who are married or living with a partner was two times and three times more at risk for chronic stress respectively. All aspects of intimate relationships with spouses or partners are often major predictors of stress as identified in this study. Relationship difficulties with spouses or partners may particularly put pregnant women at a higher risk for chronic stress exposure. For instance, Brock and Lawrence (2011) found that marital discord was directly associated with high levels of chronic stress exposure, with women internalizing symptoms. This is in accord with this study because it was identified that women who upon self-rating of stressors, classified marital issues as a primary stressor, were twice as likely to experience chronic stress.

Family stress of which marital discord may be classified under, plays a significant role in an individual's experience of stress or strain. Very early work presented models and theories to establish and explain the bi-directional relationship between the family related problems and the experience of stress (Hobfoll & Spielberger, 1992; McCubbin et al., 1980). More recent evidence indicate that marriage or living with a significant other is highly interrelated with exposure to stress and thus a strong predictor of chronic stress (Don & Mickelson, 2014; Maroufizadeh et al., 2019; Yazdani et al., 2016).

Societal norms may hold marriage in Ghana in high esteem and perhaps alternatives to relationship conflict resolution, resilience and other positive factors may mitigate or exacerbate exposure to chronic stress amongst the pregnant women. Some women may feel ashamed to seek marital counselling services in an attempt to resolve issues, or they may simply no longer enjoy shared beliefs or moral values with their respective partners and consequently be exposed to chronic stress (J. R. Olson et al.,

2015). Moyer et al., (2015) detailed the influencing effect of strong social networks and relative lack of autonomy for women of reproductive age in northern Ghana. In a similar manner, women in the sampled group may experience chronic stress related to these factors within their intimate relationships (Moyer et al., 2014).

Social support or the lack thereof is a key factor for chronic stress exposure secondary to marital or relationship issues. Comparable studies indicate that social support from spouses or partners particularly for pregnant women is a mitigating factor for stress exposure (Xie et al., 2009). Oppong Asante (2012) confirmed that low social support results in high stress in Ghana, also indicating that in this study, a lack of social support in their families or relationships may be predictive of stress.

The ability to care for, nurture and mother the child is a pregnancy-specific stressor that predicts stress exposure within the sampled group. Concerns about the ability to care for and nurture may be related to parenting stress, individual self-efficacy, or an unplanned/unwanted pregnancy. Comparatively, other literature has indicated that stress related to the future parenting role and transition after birth is a source of significant stress during pregnancy (Guo et al., 2014; Leahy-Warren & McCarthy, 2011; Respler-Herman et al., 2012). This pregnancy-specific predictor of stress exposure, it an area of concern since it may lead to maladaptive parenting followed by poorer child outcomes. To mitigate this, interventions have suggested mindfulness, education courses, pregnancy schools and group therapy (Bondolfi, 2013; Dhillon et al., 2017; Goodman et al., 2014; Gouveia et al., 2016; Guardino et al., 2014).

Concerns about the ability to care for and nurture the child as a predictor of stress during pregnancy may be related to financial ability to care for the child to be born. This may be related to the fact that

the pregnancy may have been unplanned or unintended. Indeed, data suggests that Ghana has a high rate of unintended pregnancies, up to 40% in some findings (Aziato et al., 2016; Eliason et al., 2014; Nyarko, 2019). Of course, an unintended and unwanted pregnancy may lead to a high amount of concern over one's ability to financially care for the unborn child, thereby predisposing them to chronic stress exposure. Of interest is the fact that one predictor of unplanned pregnancy is marital status (Nyarko, 2019). As reviewed earlier, marital status is a predictor of chronic stress during pregnancy, therefore examining the interrelated relationship between unplanned pregnancy, marital status and antenatal stress may reveal important indicators for health professionals.

Furthermore, a study examining the understanding of available counselling services and options for women in the event of an unintended pregnancy, found that as much as 95% of the women interviewed in a large urban area of Ghana (Kumasi) were not aware of adoption as an available option if they so choose (Agbeno et al., 2019). Knowledge of other vital information as part of comprehensive pregnancy counselling services such as contraception in Ghana is often equally limited (Agbeno et al., 2019; Grindlay et al., 2018). As a result, if a woman with an unintended pregnancy is unaware of available options and future unplanned pregnancy preventive options, she might consequently expose herself to higher levels of chronic stress as she ponders over her financial ability to care for an unplanned child.

5.5 Prevalence of Depression

The prevalence of depression amongst pregnant women studied was 37% (moderate, 29.4% and severe, 7.6%) thereby constituting clinically relevant depression as measured by the scale utilized (Kroenke et al., 2010). This finding is contrary to a systematic review consisting of studies from 30 countries that found the prevalence of antenatal depression (depression during pregnancy) to be 9.5% (Falah-Hassani et al., 2017). It is important to note that this study used the PHQ-9 questionnaire, but

this sentinel systematic review included studies that utilized several scales thereby making full comparison challenging. This may account for the reason why the prevalence was higher within this study population than that of this 30-country systematic review.

In an Italian sample of pregnant women, antenatal depression was at a 21.9% prevalence, still lower than that of the pregnant women studied (Giardinelli et al., 2012). In a US population, researchers found amongst pregnant women, a prevalence of 6% for antenatal depression, also indicating a lower prevalence than that of this study population (Ashley et al., 2016). Comparably, a peri-urban study in South Africa found a similar prevalence (39%) of antenatal depression amongst pregnant women (Hartley et al., 2011). This convergence in findings may be related to similar context specific factors that may be related to poverty and food insecurity that may not be the case in other populations. In further support of these findings, a similar population in South Africa also discovered a prevalence of 22% indicating that this sample population may have in common factors associated such as employment, socioeconomic status and perhaps area of residence.

In a large 2014 study in Ghana and Cote d'Ivoire, researchers found a prevalence of antenatal depression of 9.9%, similar to this study population (Weobong et al., 2014b). This study utilized the PHQ-9, thereby the prevalence rates (9.9% severe depression) are very similar to this study population (7.6% severe depression). In a parallel manner, a very early and sentinel study of antenatal depression in Africa by Sawyer et al., (2010) found a prevalence of 11% (Sawyer et al., 2010). Another 2018 study amongst pregnant women in rural Kenya that utilized the PHQ-9 to screen for depression, noted a prevalence (severe depression) of 6.2%; also comparable to the findings here (Green et al., 2018). Although there is not an abundance of evidence on antenatal depression on the African continent and SSA for that matter, this study's findings present comparable in nature. Depression during pregnancy

may be associated with changing levels of hormones or chemicals in the brain, a past history of depression before becoming pregnant and perhaps a genetic predisposition. Other psychosocial factors that could account for these levels of moderate and severe depression may also be related to domestic violence, an unplanned pregnancy, economic disadvantage, lack of social support and stress exposure.

Considerable public health implications arise from a high incidence of depression amongst pregnant women in LMKM. Without intervention or treatment, the progression of depression is disabling. Depression is linked to impairment across multiple areas of functioning (Hyer & Neigh, 2019). Therefore, those who had high and severe probable depression in LMKM may suffer substantial functional impairment causing disability. There are social and economic correlates to depression that may be significant. Functional impairment due to untreated depression amongst pregnant women may render her unable to work, causing economic loss. Still, in Ghana, mental health diagnoses such as depression carries some level of stigma and thus those who suffer from it my experience social isolation.

Antenatal depression is a significant predictor of postpartum depression (Reynolds et al., 2015) and its adverse health outcomes for both mother and baby. Even women with mild depression may still be at risk for postpartum depression. During pregnancy, those who are depressed, may exhibit poor health behavior and thereby place themselves at higher risk for adverse obstetric and birth outcomes. Also, critical to successful motherhood, and care giving for the newborn and child, is the mother's health. Depressed mothers often have children with poorer health outcomes as these mothers are not able to care for their children adequately since they are unwell. In fact, in a study in Ghana, mothers with depression had children with frequent fevers (Guo et al., 2013) These place burdens on the health

system and contribute to important health indicators such as infant and child mortality, stunting and so forth.

5.6 Perceived Stress and Depression

Depression was significantly associated with high chronic stress exposure in this study. Undeniably, in the literature, depression has been closely associated with chronic stress exposure and often presents as a comorbidity; indeed, oftentimes chronic stress may precipitate or exacerbate depression (Pittenger & Duman, 2008). For instance, some early studies have made this association about stress leading to depression (Van Praag, 2004; Wolkowitz et al., 2010). More recent studies have noted that acute and chronic stress exposure leads to recurrent episodes of major depression disorder (Kessler, 2013). Plieger et al., (2015) outlined that the complex relationship between exposure to stressful life events and its high susceptibility to major depressive disorder (Plieger et al., 2015).

At the cellular and molecular levels, stress and depression often have similar neurological mechanisms. Genes and genetic makeup have been postulated as a mediator between the stress response and the neurological pathology of depression (Caspi et al., 2003). High levels of stress and depression as interrelated or significantly associated (such as found in this study population) produce an increased rate of atrophy and loss of neurons in the hippocampus, a vital part of the limbic system responsible for emotional or mood regulation and any disorders thereof (Berk et al., 2013; Bryant et al., 2011; Warner-Schmidt & Duman, 2006). Thus, psychosocial stress factors and the experience of moderate or high levels of depression are highly correlated and may be a significant finding for practice implication.

5.7 Chronic Stressors and Depression

This study sought to catalogue a list of stressors or causes of stress amongst the study population. From the key stressors identified, marital/relationship issues were significantly associated with depression. Denoting that woman who stated that a primary stressor was their marital/relationship issues, were more likely to be depressed than others. Marriage and romantic relationships play a vital role and function within the Ghanaian social and cultural environment. Marital dysfunction across studies in various regions have been closely associated with mood disorders such as depression (Willoughby et al., 2015). Marital or relationship problems are highly influenced and affected by social norms, customs and expectations (Taghani et al., 2019). The women in this study who identified marital or relationship issues as a stressor may have experienced some of these dissatisfaction or dysfunctional domains and consequently were more depressed.

Similarly, a South African cohort of pregnant women who were assessed for psychological wellbeing identified marital dissatisfaction as a significant contributory factor to their mood and emotional regulation (Ndlovu, 2013). Likewise, in Nairobi, Kenya, women with marital problems were more likely to suffer some mood disturbances (Mbunga, 2011). This study also found that marriage at a young age was more likely to lead to marital dissatisfaction (Mbunga, 2011). This finding is key and may provide an explanation to the study findings. Early marriage or child marriage occurs in up to 20% of Ghanaian women (Ahonsi et al., 2019) and thus in the sampled population some women may have had to marry as children (before 15) or very early (before 18). Child or very early marriage lowers the belief that one is in charge or able to control their lives (De Groot et al., 2018). This lack of autonomy may then lead to a higher rate of depression as identified in the study.

A study in the Volta region of Ghana critically critiqued the concept of bride wealth and its constraining effect on women's autonomy (Horne et al., 2013). Based on this paper's findings, bride wealth payment (a practice very common in Ghana) led to women feeling indebted and reinforced normative constrictions on women's autonomy (Horne et al., 2013). It is, therefore, reasonable to imagine that this lack of autonomy in some marriages may led to a higher level of marital discord and subsequently depression as acknowledged in this study. Other psychosocial variables that contribute to marital/relationship problems and depression are IPV (Alhusen et al., 2015), an unintended pregnancy (Eliason et al., 2014) and a lack of male/partner or spouse support (Tavassoli et al., 2018). These listed factors may serve as exploratory/explanatory aspects of this finding.

It is worthy of note that survey participants who stated that financial problems were a major cause of stress or stressor, were not depressed or at a higher risk for depression. The initial hypothesis was that financial problems as a source of chronic stress may subsequently lead to a higher risk for depression. However, in line with the conceptual framework of this study, the Transactional Model of Stress is a cognitive appraisal of a stressor as a threat or non-threatening, followed by s secondary appraisal of resources to cope, after which a stressor may elicit the stress response or a coping/resilience response ((Folkman et al., 1986). Resilience and other coping factors serve as mitigators of the stress response and protect psychological wellbeing. Accordingly, women who identified financial problems as a stressor may have, upon a primary and secondary appraisal, adapted certain coping mechanisms that may mitigate ensuing mental health outcomes such as depression in this instance.

Resilience and adaptive capacity to financial constraints and other stressors have been well studied amongst pregnant women and women in general. In a southwestern China survey of pregnant women, resilience was directly associated with a positive affect (Nie et al., 2017). In a similar study, immigrant

women in Canada had low levels of peri and postpartum depression due to high levels of resilience (Gagnon & Stewart, 2014). In Ghana, resilience has been identified as a buffer or protective mechanism against affective disorders or stress for highly vulnerable women such as mothers with disabilities, widows and female sex workers (Acheampong & Aziato, 2018; Korang-Okrah, 2013; Onyango et al., 2019). Resilience, as a form of coping and a part of the conceptual framework (Folkman et al., 1986) of this study may serve as a mitigating factor against financial stressors and depression.

The tenets of psychology and its role in poverty or financial instability has been studied. Janse (2013) reviewed the mitigating factors related to the psychological response to financial instability or poverty. It was recognized that certain psychological factors such as emotional mindset mediates affective responses amongst people with financial instability (Janse van Rensburg, 2013). Other psychological factors that may provide an explanation for the finding that women who identified financial issues as a stressor were not more likely to be depressed is personality. In a study on personality, psychology and economics, positive personality traits such as malleability and adaptability are directly associated with perceptions of distress or depression secondary to economic challenges (Almlund et al., 2011).

The central variable within the structure of finance and economic livelihood is work or employment. Duffy et al. (2016) propounded a psychology of work theory for people in or near poverty that related that psychological factors serve as mediators or moderators of stress and ensuing affective states (Duffy et al., 2016). One of such factors is hope or aspiration. Lybbert and Wydick (2018) assessed the relationship between hope/aspiration and personal economic development amongst people of little means. The paper found that psychosocial strain related to economic hardship was lessened by personal hope or aspiration (Lybbert & Wydick, 2018).

Adults have to work to make a living, sometimes the income earned thereof is insufficient to cover needs. Consequently, financial instability or poverty may arise. However as detailed certain personality and psychological factors may help a person cope even during times of severe financial difficulty. Within this sample of pregnant women therefore, the above discussed psychological factors may account for the fact that financial stressors did not make women more likely to have depression.

5.8 Pregnancy-specific Stressors and Depression

A specific objective of this study was to review domains of pregnancy-specific stressors as they relate to depression as an outcome. Domains of pregnancy-specific stressors were synthesized from across studies and available material into five distinct categories. All categories of PSS were significantly associated with depression for the surveyed sample. Fear of childbirth, fear of giving birth to a child with congenital abnormalities, concerns about changes in the marriage/relationship, concerns about the mother/child and father/child relationship and ability to care, nurture and mother the child were all significantly associated with depression.

Similar to the findings here, fear of childbirth is closely linked to maternal mental health particularly mood disorders such as depression (Rouhe et al., 2011). A meta-analysis of studies examining fear of childbirth in over 18 countries noted a prevalence of 14% and that it was closely related to higher odds of depression, as found in this study (O'Connell et al., 2017). Specific issues such as fear of pain, labor, duration of labor and the possibility of an unpredictable obstetric emergency may serve as contributing factors to this pregnancy-specific stressor and consequently result in depression. Another study in agreement with this study's findings reported that women were more likely to experience depression during pregnancy if they exhibited fears and had negative beliefs and attitudes towards childbirth (Størksen et al., 2013).

Concerns about the birth of a child with congenital anomalies are a real concern amongst the sample population and led to a higher rate of depression. Undeniably, not many studies in Ghana have explored the mental health effects of women who are screened for and go on to carry babies with common congenital or genetic abnormalities such as sickle cell disease, deafness, blindness, and spina bifida. It is critical to note that in Ghana, there still remains substantial stigma, discrimination, marginalization, disenfranchisement and societal exclusion of persons living with disabilities (Baffoe, 2013; Ganle et al., 2016; Grischow, 2015; Naami, 2015; Opoku et al., 2017). Pregnant women may be very well aware of the possible consequences and difficulties that their child may experience if indeed they are born with a congenital disability. In addition, beliefs, perceptions, and other spiritual connotations surrounding pregnancy, birth and congenital anomalies or disabilities of all forms contribute largely to the experience of this type of stressor and its ensuing depression.

Depression during pregnancy secondary to pregnancy-specific stress may be a direct or indirect consequence of pregnancy intention. Pregnancy intention, principally unplanned, unintended, or unwanted pregnancies may and often do affect a marriage or relationship between the women and their male partners. In Ghana, a secondary analysis of GDHS 2014 data noted that unintended pregnancies have a prevalence of 40% (Nyarko, 2019). Amongst adolescents, this rate is even higher at almost 70% (Ameyaw, 2018). Based on these data, it is reasonable to infer that within the study sample, some of the pregnancies may not have been intended and thus the women may experience stress related to changes in their relationships with partners or spouses resulting in a higher risk for depression. To further support this point, in a qualitative study by Aziato et al., (2016) specified that denial by spouse or partner was particularly high amongst women who had unintended pregnancies leading to a termination of the relationship or very heavy strain (Aziato et al., 2016). Additionally, a new pregnancy introduces changes in a relationship as parents needs to adjust and adapt to either having a first baby or

an additional one. Adjusting to the pending parenting role and its corresponding responsibilities is a factor that may lead to changes in the marriage or relationship and hence lead to a higher rate of depression.

Concerns about one's ability to care for, nurture and mother a child as a pregnancy-specific stressor is directly correlated with maternal self-efficacy. This implies that personal belief in a pregnant woman's ability to carry out necessary behaviors after the birth of her child will mitigate and put into perspective any concerns. Conversely, low self-efficacy pregnant women have intense fears and low coping skills thereby causing depression. This finding corresponds to other literature on self-efficacy and its relationship with ability to care and nurture a child (Toivanen et al., 2018; Byrne et al., 2014; Salomonsson, Berterö, et al., 2013).

5.9 Factors Associated with Depression

Within the sampled population, the factors associated with depression were marital status, employment, area of residence and wealth quintile. Marital status, whether single, in a formal union or an informal union, were cumulatively associated with depression. In support of this finding, a study in Nigeria found that being single and pregnant was a factor associated with antenatal depression (Thompson & Ajayi, 2016). Secondly, in South Africa, single marital status was identified as a factor closely related to antenatal depression (Manikkam & Burns, 2012). Furthermore, in Ethiopia, marital or relationship status was a close factor related to the experience of antenatal depression (Biratu & Haile, 2015). Finally, in a systematic review, marital status was a related factor to antenatal depression (Biaggi et al., 2016). Contradictory findings from a study reviewing married, single and cohabitating pregnant women found that no particular category was more likely to experience depression than the other groups (Akincigil et al., 2010). Other related subdomains such as marital quality and amount of perceived

partner support may be secondary reasons for the study's findings about antenatal depression and marital status. As a matter of fact, partner support is noted as a protective or positive factor that mitigates antenatal depression (Barthel et al., 2016).

Employment, a vital part of livelihood, was associated with antenatal depression within this study population. An Ethiopian study found similarly that employment was a factor associated with antenatal depression (Ayele et al., 2016). This study further explored types of employment during pregnancy that may contribute to depression. These include women who worked as laborers were more likely to experience depression. This may correlate with some of the sampled women in the study population who are engaged in unskilled labor all thorough out their pregnancy. Fall et al., (2012) examined pregnant women who were unemployed, employed or housewives. In disparity with this study's findings, working women had the least risk for depression, closely followed by housewives (Fall et al., 2013). In other words, pregnant women who were employed were less likely to experience depression compared to housewives. In Ghana, it is possible that although women working could have less depression, the type of work may factor into the association with employment. In fact, researchers have piloted an intervention on the burden of heavy lifting work amongst pregnant women in Ghana (Kwegyir-Afful et al., 2018). Thus, the type of employment of pregnant women may not only cause negative obstetric outcomes, but also maternal mental health outcomes as detailed in this study findings.

Nonetheless, modes of employment could afford pregnant women agency and empowerment. Working and an income no matter how limiting may offer women the opportunity to feed, clothe, care for and raise their children to be. Furthermore, during pregnancy, women who may have some income based on their employment status could afford to attend ANC, have a proper diet and other like positive health behaviors. Indeed, employment may be a coping or mediating factor in the experience of antenatal

depression. A factor supporting this assertion is that employment has been identified as a coping factor antenatal by other studies conducted elsewhere (Brittain et al., 2015; Peñacoba-Puente et al., 2013).

Wealth quintile as a proxy measure of socioeconomic status was noted to be associated with depression within the pregnant women sampled. A similar facility-based study of antenatal depression in Nigeria (Thompson & Ajayi, 2016). This team of researchers found that among other factors, the poorest quintile (lowest socioeconomic group) had a significant risk for depression (Thompson & Ajayi, 2016). Likewise, amongst Ethiopian women, those in the lowest quintiles had the highest rates of antenatal depression (Bisetegn et al., 2016). In a community-based study, pregnant women who made 500 Ethiopian birr (18 USD or 104 Ghana Cedis) had higher odds of depression (Tiki et al., 2020). Similarly, pregnant women in this study in lower wealth quintiles may experience higher levels of negative life events and therefore have higher odds of antenatal depression as identified in a recent study (Verbeek et al., 2019a).

5.10 Predictors of Depression

Marital status was identified in this study as a predictor of depression during pregnancy. Indeed, marital status has been identified as a robust predictor of mental health outcomes, both in early and more recent work (Ayalon et al., 2013; Horwitz et al., 1996; Lamb et al., 2003). Also, marriage has been purported to have positive economic (P. Taylor et al., 2010) and physical benefits (England et al., 2001). In LMKM, marital status (married and those living together) was predictive of depression compared to those who had never married. Similar to this finding, a longitudinal study in Korea indicated that marital status was a predictor of depression (Jang et al., 2009). Sandberg et al., (2012) found that amongst married people, marital distress was a significant predictor of depressive symptoms, thereby proffering a contributory factor or explanation (Sandberg et al., 2012). Similarly, a recent 5-year longitudinal

study on marital satisfaction/dissatisfaction and depression, Woods et al., (2019) indicate that for women, marital dissatisfaction predicted depression (Woods et al., 2019). Marital instability and discord have been documented in Ghana (Adofo & Etsey, 2016; Oppong Asante et al., 2014; Takyi, 2001; Takyi & Gyimah, 2007). It may thus be inferred that, in LMKM, for married women and those living with partners, some may experience marital/relationship dissatisfaction or distress that possibly places them at risk for depression.

A sentinel finding in a multi-national (United States, Australia, England and the Netherlands) study by Meyer & Paul (2011) revealed that individuals with early life stress who were more prone to depression experienced a higher amount of marital and relationship challenges (Meyer & Paul, 2011). The psychological implications of early life stressors such as physical abuse, traumatic events, sexual abuse, and extremely difficult economic challenges, if left untreated, have lasting effects (Heim et al., 2008; Kajantie & Räikkönen, 2010; Syed & Nemeroff, 2017). In Ghana, there is a large gap between people who need counselling and other forms of mental healthcare and those who actually receive such care (Lund et al., 2015; Roberts et al., 2014). It is plausible then to infer that woman in LMKM may have experienced some early life stress, and have not received appropriate care or treatment, which then is positively associated with their risk for depression across the lifespan. A scenario then emerges of long-standing psychosocial adversity which likely put many of these women at an increased risk of adverse mental health before getting married/cohabitating and before their pregnancy. Of course, a biopsychosocial approach may be necessary to critically and fully understand all the complexities related to marital status as a predictor of depression.

Each unit increase in the number of pregnancies a woman had had was identified as a predictor of depression. Multiple pregnancies, particularly in rapid succession have been associated with depressive

symptoms and other adverse mental health outcomes. Scott (2016), highlighted that rapid repeat pregnancies (within 12-months of each other) significantly predicted antenatal depression (Scott et al., 2016). Similarly, Conroy et al., (2016) indicate that repeated pregnancies, especially amongst teenagers, resulted in a higher odds for probable depression (Conroy et al., 2016). In Ghana, an unpublished thesis by Amuasi (2018), likewise identified that rapid repeat pregnancy is highly predictive of depression (Amuasi 2018). Of note also is that in 2013, Van Lith found that as much as 8 million women in SSA would prefer to limit their number of pregnancies rather than to space them (Van Lith et al., 2013). In like manner, Cleland et al., (2012) in a Lancet review, identified that women in developing countries desire to have less (limiting) pregnancies (Cleland et al., 2012). Based on these trends, women in SSA and in Ghana by extension generally may want to have fewer children or pregnancies than they presently do (a proxy of unmet contraceptive needs). Thus, unplanned, or unintended pregnancies may place women at additional risk for depression in LMKM. Unintended pregnancies have been documented as predictive of depression (Abajobir et al., 2016; Biaggi et al., 2016; Fellenzer & Cibula, 2014; Weobong et al., 2014b). In Ghana, Weobong et al., (2014) observed that an unintended pregnancy was highly predictive of antenatal depression (Weobong et al., 2014a) Unintended pregnancies often lead to higher rates of abortions and may in tun be a risk factor for depression (Bellieni & Buonocore, 2013; Horvath & Schreiber, 2017; Schwandt et al., 2019). Another point is that already existing depression in an individual may be exacerbated by a new pregnancy and place a woman at higher odds for antenatal depression (Betts et al., 2014; Lefkovics et al., 2014).

In further examining the predictive nature of a high number of pregnancies on depression, it is important to consider women's actions that may contribute to the experience of depressive symptoms. Klutsey & Ankomah (2014), in a study in the Volta region of Ghana (a region that shares boundaries with LMKM), found that women with second pregnancies had a higher rate of induced abortions and that women with

more than 2 pregnancies had almost a 6-fold rate of induced abortions (Klutsey & Ankomah, 2014). Inferring from these findings, more women in LMKM with higher numbers of pregnancies may have sought abortions in the past, or maybe unhappy about their present status and therefore at risk for depression after all associated factors had been controlled for. A factor to consider in the discourse surrounding the number of successive pregnancies and depression amongst women is that perhaps the agency to limit or end childbirth may not entirely rest with them. Cha et al., (2016) theorized that with women, the intention to limit their pregnancies was strongly influenced by paternal opinions and choice (Cha et al., 2016). The implicature then is that for couples with discordant pregnancy intentions, more often than not, the paternal choice or option prevails. Therefore, gender inequalities, shared decision making, and power dynamics play a critical role in determining women's reproductive choices, possibly leading to the manifestation of depressive symptoms during pregnancy (Afriyie & Tarkang, 2019; Bain et al., 2019; Blackstone, 2017; Dehlendorf et al., 2017). These factors may serve explanations for the findings in LMKM.

The richest wealth quintile or group were a predictive correlate for depression as compared to the poorest. In contrast, in another study in the former Brong Ahafo region of Ghana, the poorest quintile were most likely to experience antenatal depression (Weobong et al., 2014b). This implies that other factors may be at play in LMKM. It is probable that the poorest quintiles had minimal expectations and personal aspirations and thus were not prone to much worry and anxiety when compared to the poorest. Objective SES has been conventionally defined by access to material and social dimensions (Howe et al., 2008; Smits & Steendijk, 2015). Consequently, this form of SES is usually operationalized by examining various objective indicators that may ultimately reflect differences in individuals' access to material and social resources (generally into a wealth index as a proxy for SES). Increasingly, subjective SES (an individual's own subjective perception of their economic and social status) has been

associated with psychological wellbeing. For instance, Hoebel et al., (2017) found that subjective individual perceptions of SES were highly predictive of depression, independent of an objective SES assessment (Hoebel et al., 2017). Also, similar to the findings of this study, researchers in Uganda found that objective wealth was not a predictor of depression (Smith et al., 2019). In a large multicountry study in Ghana, Kenya, Norway and the United Kingdom, Ambugo (2014) noted that psychosocial wellbeing is correlated with an individual's subjective perception of their social status (Ambugo, 2014). It may be likely then that in LMKM, pregnant women in the poorest quintiles have placed themselves in on lower ranks in the subjective SES/ social status ladder and maybe somewhat protected from depression. From the emerging body of evidence, subjective perceptions of SES and DSM-IV disorders may be related to psychosocial factors such as social selection, social causation, social trust, and personality traits (Brandt et al., 2015; Piff & Robinson, 2017; Scott et al., 2014). These and other related factors may contribute to the social dynamics between wealth quintiles, socioeconomic status and depression in LMKM.

Certain pregnancy-specific factors may compound depressive symptoms during pregnancy and may place women at a higher risk for depression. Pregnant women in LMKM who cited concerns about their ability to nurture or care for the unborn child, had higher odds of depression. Women in the study may be exposed to chronic social and economic disadvantage and consequently may have a predisposition to depression based on concerns and worries about being able to care for the newborn. Additionally, concerns about changes in the marital/ relationship as a pregnancy-specific stressor was a predictor of depression compared to women no did not identify this stressor. Consistent with this finding, researchers in Pakistan identified marital changes as a predictor of depression (Zahidie & Jamali, 2013). Also, Kastello et al., (2016) indicated that pregnant women who are stressed over changes in their relationship with the addition of a new baby may have secondary exposure to IPV,

putting them at a higher risk for depression (Kastello et al., 2016). In Ghana, Bonful & Anum (2019) show that predictors of depression, similarly, are related to psychosocial variables such as IPV (Bonful & Anum, 2019). Thus, it is plausible to infer that for the women sampled in LMKM, adverse psychosocial variables such as IPV may contribute to their concern about changes in their marriages or relationships with pregnancy and a new baby, thereby increasing their risk for antenatal depression.

5.11 Prevalence of Anxiety

The prevalence of anxiety amongst the sampled group was 13.1% for moderate anxiety and 4.3% for severe anxiety. This finding is supported by a Canadian sample of pregnant women who were examined for antenatal anxiety and found a comparable prevalence rate (15%) (Fairbrother et al., 2016). A facility-based study in an urban population of pregnant women in South Africa however, revealed a higher prevalence of 23% (van Heyningen et al., 2017). A study comparing antenatal anxiety in Nicaragua and the Netherlands revealed disparate prevalence rates of 41% and 15% respectively; making this sample's findings more similar to the rates found in the Netherlands (Verbeek et al., 2019b). In an Italian sample, however, antenatal anxiety was at 20%, whereas in a larger review across studies from various locations, the prevalence was at 9.5% (Falah-Hassani et al., 2017; Giardinelli et al., 2012). From the foregoing, studies have offered a range of prevalence rates for antenatal anxiety, sometimes in contrast to the findings of this study. A reason for some of the disparity noted is that antenatal anxiety is often measured by different scales and thus the prevalence rates may differ based on scale or item utilized to assess or screen.

A study in Ghana and Cote d'Ivoire examined antenatal anxiety utilizing an identical scale to that used in this study, indicated a prevalence of 11% and 17% respectively for moderate and severe anxiety (Barthel et al., 2016). It is of import to note in this study that as much at 80% of the participants had

consistent low anxiety symptoms (Barthel et al., 2016). As much as 44% of pregnant women in LMKM had mild anxiety symptoms although women were assessed at one point in time, unlike the above study that assessed for antenatal anxiety over several points. The longitudinal course of antenatal anxiety has been studied and shown to increase and decrease over the course of a person's pregnancy. Furthermore, anxiety is a spectrum of intricate psychosocial, social, environmental, and other factors that contribute to varying prevalence rates in Africa. To further support this, early or preliminary studies in West Africa indicated a wide range of prevalence rates for antenatal depression. For instance, Esimai et al., (2008) in Nigeria indicated a 5.8% antenatal anxiety prevalence whereas Adewuya et al., (2006) found as much as 39% prevalence rates (Adewuya et al., 2006; Esimai et al., 2008). Despite these varying prevalence rates, the cost, unmet need for treatment and consequence of perinatal mental health problems such as antenatal anxiety has been detailed across the literature and deserves much needed research and attention in Ghana as well (Apter et al., 2011; Baron et al., 2016; Sawyer et al., 2010). In LMKM, probable anxiety during pregnancy and beyond may result in increased unmet needs for mental health treatment and disability.

5.12 Perceived Stress and Anxiety

Chronic stress was significantly associated with anxiety, implying that all participants who had high levels of stress were more likely to have high anxiety levels as well. The association between antenatal anxiety and chronic stress often present as comorbidities; one as a predictor of the other; or as a significant risk factor across multiple lines of evidence (Bayrampour et al., 2015; George et al., 2013; Giardinelli et al., 2012; Heron et al., 2004; Kang et al., 2016; van Heyningen et al., 2017; Weobong et al., 2015).

In like manner, a large cohort study identified a lifetime risk of generalized anxiety disorder with chronic stress exposure even after the stressor has been eliminated (Pietrzak et al., 2012). The secondary conceptual framework of this study reveals that stress exposure is not only psychological in nature but also physiological where certain neurochemicals or neurohormones lead to behavioral outcomes after the stress response (McEwen & Gianaros, 2010). Furthermore, mental health disorders such as depression and anxiety are intricately linked to a variety of neurological chemicals, the genetic and epigenetic makeup. Shin et al., (2010) examined the relationship between stress and anxiety at the molecular level and revealed the neurological circularity of chemical compounds or hormones for stress and anxiety (Shin & Liberzon, 2010). This study found that the neurohormonal chemicals responsible for stress are simultaneously responsible for anxiety in human physiology and thus may explain the comorbidity often noticed between stress and anxiety. In fact, animal studies that have induced stress in order to predict anxiety models have revealed similar findings (Campos et al., 2013). Gene and environmental interactions additionally play a key role in stress and its significant association with anxiety (Sharma et al., 2016). Likewise, behavioral domains of anxiety such as PTSD, obsessive-compulsive disorder and panic disorder have been associated with chronic stress exposure over time in both human and animal models (Carpenter et al., 2018; Egan et al., 2009).

5.13 Chronic Stressors and Anxiety

The study identified certain causes of stress or stressors that showed a relationship of statistical significance with anxiety. The main stressors were financial and marital issues. Therefore, participants who indicated that their primary stressor was either financial or marital issues were associated with higher anxiety scores. Prasko et al., (2017) closely considered the relationship between anxiety and marital satisfaction and postulated that dissatisfaction in a relationship could lead to anxiety (Prasko et al., 2017). They indicated a reverse relationship where anxiety could rather lead to relationship

dissatisfaction. Also, it has been established that dysfunctional emotions such as depression, anger and anxiety affect marital/relationship adjustment in a negative manner (Filipović et al., 2016). Yet in support of this finding, Yoon and Zinbarg (2007) found that people with anxiety disorders were more likely to enter into marital relationships but were least likely to effectively work through problems that may arise leading to more anxiety or divorce (Yoon & Zinbarg, 2007). From the above, it is possible that women in this study experience marital or relationship challenges due to their anxiety or vice versa causing them to experience both chronic stress and anxiety in a parallel but interrelated manner.

Pregnant women who identified financial issues as a stressor, in turn, experienced higher levels of anxiety. Grable et al., (2015) upon examination indicated that financial anxiety, in fact, led to a physiological response much in line with the secondary conceptual framework of this study (Grable et al., 2015; McEwen, 2007). Financial planning skills, knowledge and judicious use of money, as domains of financial literacy are closely correlated with anxiety (Van Dalen et al., 2017). Women in this sampled group may possibly lack some of these money management skills and therefore categorize financial issues as their major stressor and subsequently expose themselves to higher levels of anxiety. Berry et al., (2018) studied levels of financial literacy and positive financial behaviors such as saving amongst young people in Ghana. They found low levels of financial literacy and positive financial behaviors (Berry et al., 2018). This may indicate that women within this group may face financial issues due to negative financial behaviors such as accumulating higher debt and thus experience higher anxiety (Kaiser & Menkhoff, 2017).

Further to this, Ghana has attempted via government and non-profit initiatives to increase financial or economic empowerment amongst women. Poverty alleviation methods such as microfinancing have been implemented and closely reviewed in the body of evidence (Addai, 2017; Ganle et al., 2015; John-

Engelbert, 2014; Nukpezah & Blankson, 2017). These efforts are and were to support women in gaining financial independence and an ability to control their finances. Indeed, the ability to control one's finances is a moderating or mitigating factor in the experience of anxiety related to financial instability (Gasiorowska, 2014). This may be a mitigating factor in the relationship between financial issues as a self-identified stressor and anxiety.

5.14 Pregnancy specific Stressors and Anxiety

Stressors specific to pregnancy was significantly associated with anxiety in this study. These domains or category of PSS stressors are fear of giving birth to a child with a congenital anomaly, fears about changes in the marital/relationship status, concerns about future mother to child relationship and finally, concerns about the ability to care, nurture and mother-child. As part of the study's specific objectives, these and other categories of PSS were pulled from the evidence on the subject and assessed within the sampled participants to find out which categories were significant to the group. Pregnancy specific stressors are highly correlated with anxiety in studies elsewhere (Guardino & Schetter, 2014). In LMKM, one of the main pregnancy-specific stressors closely associated with anxiety was the fear of giving birth to a child with congenital anomalies.

In Ghana, common congenital conditions such as sickle cell anemia and congenital deafness and blindness occur (Asare et al., 2018; Kusters, 2015; Nuertey et al., 2017). Persons living with these and other forms of disability face difficulties such as abandonment marginalization, stigmatization and discrimination (Baffoe, 2013; Naami, 2015; Opoku et al., 2017). Fear of birthing a baby with a congenital anomaly may thus be related to these above-mentioned factors and consequently lead to anxiety amongst the pregnant women sampled. Furthermore, there are local social, cultural, religious, ethnic and spiritual explanations for congenital abnormalities that may directly or indirectly contribute

to this pregnancy-specific stress and ensuing anxiety (Dako-Gyeke et al., 2013; Kpobi & Swartz, 2019; Manning, 2014).

Concerns about the future mother to child relationship and ability to care, nurture and mother the child were pregnancy-specific stressors that were significantly associated with anxiety. These stressors are legitimate concerns about parenting and self-efficacy related to the parenting or motherhood role. Although some level of anxiety may be helpful or even positive, irrational, constant and uncontrollable worry about these stressors may lead to harm. Parenting or motherhood self-efficacy is a person's belief in their ability to perform the parenting role without undue strain (Wittkowski et al., 2017). Stress and subsequent anxiety may arise from concerns about parental self-efficacy related to the ability to care or nurture a child and the future parent-child relationship. Stress, anxiety and depression have a negative impact on maternal self-efficacy often in the immediate postpartum period where the transition is made from pregnancy into motherhood (Leahy-Warren & McCarthy, 2011). Women in this population may doubt their abilities and consequently expose themselves to anxiety. Also, individual perceptions, cultural and social norms surround motherhood and parenting may serve as a contributing factor as has been identified in other studies (Cheah et al., 2013; Lachman et al., 2016; Wong et al., 2016).

5.14 Predictors of Anxiety

Predictors of anxiety are marital status (married and living with a partner), the number of children and fear of giving birth to a child with a congenital anomaly. These predictors imply that when present, would make a person more vulnerable to antenatal anxiety. Married or living with a partner in this study sample, predicted anxiety exposure similar to other studies elsewhere. For instance, a group of researchers indicated that martial or relationship strain was a risk factor for anxiety (Bayrampour et al., 2015). In a similar research finding, it was indicated that intimate relationship disharmony was a

predictor of antenatal anxiety (Kang et al., 2016). Moreover, a related cross-sectional study in Malawi found that intimate partner dysfunction in the form of IPV was a strong predictor of antenatal anxiety (Stewart et al., 2014). Some of these subdomains of marital or relationship psychosocial factors may support the finding that marital status (married and living together) are predictors of antenatal anxiety.

The number of children or multigravidity was a predictor of antenatal anxiety in the predictor model developed during the analysis of this study. In a similar South African study, multigravida as well as having an unplanned and unwanted baby were predictors of antenatal anxiety (Heyningen et al., 2016b). A team that examined maternal characteristics identified unplanned pregnancy as a strong predictor of antenatal anxiety in congruence with this study (van de Loo et al., 2018). Similarly, in Saudi Arabia, research indicate that unplanned pregnancy is a predictor or risk factors for antenatal anxiety (Alqahtani et al., 2018). In Ghana, the rates of unintended pregnancies are high, often leading to relationship discord, late antenatal care initiation and other psychosocial and affective disorders such as anxiety (Ameyaw, 2018; Eliason et al., 2014; Kotoh & Boah, 2019; Tenkorang, 2019). These and other related factors may contribute directly or indirectly to this study's findings.

5.15 Strengths of the Study

1. This study, to the best of my knowledge, is the first of its kind in Ghana to review chronic stress in pregnancy, pregnancy-specific stress factors and the association of these with depression and anxiety during pregnancy.
2. This study revealed original and valuable insight on chronic stressors and pregnancy-specific stressors such as fear of childbirth, fear of changes in the marriage/relationship and fear of giving birth to a child with congenital anomalies. These fears as captured in the findings, are real to those experiencing them and ought not to be left unaddressed by clinicians. Some of

these factors may have been missed during routine antenatal care; however, these findings present an opportunity for education, counselling, intervention planning and other forms of advocacy.

3. Perinatal anxiety and depression are minimally studied in Ghana and some parts of SSA by extension. The findings herein presented support evidence gathering to inform policy and practice.
4. Some research studies often group anxiety and depression factors as one research outcome. However, this study delineated the two into distinct categories of maternal mental health and utilized scales that distinguished via screening the two phenomena.

5.16 Limitations of the Study

Within the context of a cross-sectional study, this work examined chronic stress during pregnancy and variables of interest, depression and anxiety. Thus, the nature of the study did not allow for a full causal inference as perhaps a prospective or longitudinal cohort research design would. All relationships and associations of significance between chronic stress, depression and anxiety were examined, but a definite assertion that chronic stress causes depression and/or anxiety cannot be made. Likewise, a limitation identified is that the study was facility-based and recruited pregnant women from the ANC, raises the possibility of some selection bias because women with positive health-seeking behaviors generally attend ANC as recommended. Pregnant women in the community, outside the facility ANC were not recruited. These may have included women who seek health services during pregnancy from traditional healers, traditional birth attendants, maternity homes or private hospitals.

The questionnaires utilized in the study were not diagnostic in nature and were only for screening purposes. Thus, all cases identified were probable only. Any diagnostic clinical interviews were beyond

the scope of this work. However, based on the limitations of the screening instruments used, information bias is a possibility. Additionally, although the instruments were widely used and validated in many similar settings including Ghana, this work did not translate the scales into Krobo, the local language in the LMKM due to resource constraints. Stringent measures were adopted during use of the Twi/ Akan versions of two of the scales that had previously been translated by researchers. However, the possibility exists that the tool may have not fully captured certain meanings, perceptions or local idioms that a locally designed, context specific instrument may have identified.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Although significant challenges remain in the definition, establishment and validity of a cross-cultural measurement of stress during pregnancy in SSA, this study revealed that the prevalence was of consequence and cannot be ignored if all aspects of maternal mental wellbeing are to be achieved. The evidence gathered in line with the conceptual framework adopted as the guiding theory for the analysis of chronic stress in pregnancy suggests that chronic stress exposure as an appraisal of the stressor or threat is influenced by several critical factors: marital status, education, employment and socioeconomic status. Categories of self-reported stressors that lead to the perception and experience of stress are primarily financial and marital/relationship related.

Pregnancy-specific stress categories also herein identified that lead to the perception of stress upon appraisal are changes in the partner/marital relationship, concerns about the parent-child relationship and concerns about the ability to care for or nurture the child. Predictors of chronic stress and pregnancy-specific stress as evident from the study findings are marital status (married or living together) and the ability to care for or nurture the child. As hypothesized, chronic stress bears a significant association with antenatal depression and anxiety. Depression is strongly predicted by marital status, number of pregnancies and socioeconomic status. Pregnancy-specific stress factors that are significantly associated with antenatal depression were changes in the marital/relationships and ability to care for or nurture child. Antenatal anxiety, on the other hand, is predicted by marital status

and number of children. Pregnancy-specific stress factors that are predictive of antenatal anxiety is fear of birthing a child with congenital anomalies.

6.2 Recommendations

The findings of this study have important implications for maternal health and wellbeing in Ghana. These recommendations are for individuals, healthcare practice and government policy as they are related to chronic stress amongst pregnant women. The following recommendations are made as appropriate to the Ghanaian setting.

1. This work identified a significant prevalence of chronic stress in pregnant women. Secondly, significant numbers of probable cases for depression and anxiety were found. These findings constitute a key deficiency in present ANC practice where mental health is not afforded sufficient attention and relevance although its prevalence levels are compelling. In order to provide comprehensive care for pregnant women, policy guidelines for mental health assessment are key. It is specifically recommended that a comprehensive healthcare worker- led antenatal and postnatal mental health management policy be drafted to guide clinical practice. This document could include guides on assessment and screening questions, how often assessment should occur, prompt follow up procedures and intervention protocols.
2. Healthcare worker knowledge, capacity and skill are essential to the effective implementation of any policy documents. Insights on the factors associated with and predictors of stress, depression and anxiety were highlighted in this work. It is then recommended that continuing education requirements for health workers include relevant aspects of perinatal mental health, effective assessment of need and risk, implementation of simple early intervention strategies and appropriate referral and knowledge of resources available. These continuing education

programs are existing requirements for license renewals, and thus it is an effective cost-effective way to increase health worker skill and capacity related to stress, depression and anxiety.

3. Pregnancy-specific stressors, in particular, are best addressed during ANC. Women's fears about giving birth to a child with a congenital anomaly and fear of childbirth may be addressed by healthcare workers during pregnancy schools or one-on-one client counselling. To augment any initiatives by health workers, patient education material, behavior change communication and strategically placed images can be utilized in the patient waiting areas and consulting rooms to educate pregnant women on stress reduction and how to seek accurate information to address any fears they may have related to pregnancy.
4. Evidence on the primary sources of stress in the Municipality for pregnant women were financial issues, marital/relationship issues and work-related issues. These psychosocial and social factors that precipitate stress, depression and anxiety may be mitigated by some community programs. Welfare schemes, savings schemes, gender empowerment programs, employment programs, social support groups, women's programs and other similar activities could lessen the burden of financial, marital/relationship and work stress on pregnant women.

6.3 Future Research

The findings of this research suggest some possibilities for future research.

1. Pregnancy outcomes such as low birth weight, small for gestational age and preterm birth are a significant public health issue in Ghana and many other countries in SSA. Research has implicated maternal stress exposure as a significant contributory factor in adverse pregnancy outcomes such, particularly low birth weight and preterm birth. This research has primarily been conducted in developed countries, constituting a crucial disparity in the body of evidence.

Consequently, future research needs to closely examine the association between maternal stress exposure during pregnancy and adverse birth outcomes in Ghana and other SSA.

2. To establish the effectiveness of screening and prevention programs for perinatal stress, depression and anxiety, future research to develop and validate robust and responsive scales could be created for the Ghanaian context. Some research elsewhere have combined local idioms for stress, depression, and anxiety with Western criteria and have developed context- specific tools for screening that are effective. Similar research in Ghana might be helpful.
3. This study did not examine all aspects of chronic stress and pregnancy-specific stress. Future qualitative studies will draw out themes, subthemes and other dynamics of chronic stress. A thorough assessment of actionable drivers and mitigators of chronic stress and how targeted programs and interventions can be developed.
4. The population studied in this research were pregnant women. However, all categories of people are at risk for stress and chronic stress including school children, workers, university students etc. Moreover, very high-risk groups for chronic stress exposure such as women/men in prison or people living in slums have been minimally studied in the literature. Furthermore, the dynamics (nature, intensity, duration) of stress vary over a person's life span. Further research consequently needs to consider these factors and be designed to assess these dynamics across.
5. Chronic stress has an economic cost and an impact on families, health systems and governments. To support national policymaking and resource allocation, future research that elucidates the actual costs of chronic stress may be needed.

REFERENCES

Abajobir, A. A., Maravilla, J. C., Alati, R., & Najman, J. M. (2016). A systematic review and meta-analysis of the association between unintended pregnancy and perinatal depression. *Journal of Affective Disorders, 192,* 56-63. https://doi.org/10.1016/j.jad.2015.12.008

Abidin, R., Flens, J. R., & Austin, W. G. (2013). The parenting stress index. In *Forensic Uses of Clinical Assessment Instruments,* 346-379. https://doi.org/10.4324/9780203726587

Acheampong, A. K., & Aziato, L. (2018). Suicidal ideations and coping strategies of mothers living with physical disabilities: A qualitative exploratory study in Ghana. *BMC Psychiatry, 18*(1), 1-8. https://doi.org/10.1186/s12888-018-1938-x

Adams, S. S., Eberhard-Gran, M., & Eskild, A. (2012). Fear of childbirth and duration of labour: A study of 2206 women with intended vaginal delivery. *BJOG: An International Journal of Obstetrics and Gynaecology, 119*(10), 1238-1246. https://doi.org/10.1111/j.1471-0528.2012.03433.x

Addai, B. (2017). Women Empowerment Through Microfinance: Empirical Evidence from Ghana. *Journal of Finance and Accounting, 5*(1), 1-11. https://doi.org/10.11648/j.jfa.20170501.11

Ademola, A., Boima, V., Odusola, A., Agyekum, F., Nwafor, C., & Salako, B. (2019). Prevalence and determinants of depression among patients with hypertension: A cross-sectional comparison study in Ghana and Nigeria. *Nigerian Journal of Clinical Practice, 22*(4), 558. https://doi.org/10.4103/njcp.njcp_351_18

Adeponle, A., Groleau, D., Kola, L., Kirmayer, L. J., & Gureje, O. (2017). Perinatal depression in Nigeria: Perspectives of women, family caregivers and healthcare providers. *International Journal of Mental Health Systems, 11*(1), 1–13. https://doi.org/10.1186/s13033-017-0134-6

Adewuya, A. O., Atilola, O., Ola, B. A., Coker, O. A., Zachariah, M. P., Olugbile, O., ... & Idris, O. (2018). Current prevalence, comorbidity and associated factors for symptoms of depression and generalised anxiety in the Lagos State Mental Health Survey (LSMHS), Nigeria. *Comprehensive psychiatry, 81,* 60-65.

Adewuya, A. O., Ola, B. A., Aloba, O. O., & Mapayi, B. M. (2006). Anxiety disorders among Nigerian women in late pregnancy: A controlled study. *Archives of Women's Mental Health, 9*(6), 325-328. https://doi.org/10.1007/s00737-006-0157-5

Adofo, P. Y., & Etsey, Y. K. A. (2016). Impact of divorce on adolescent students in Ghana. *Pyrex Journal of Psychology and Counselling, 2*(4), 21-27.

Afifi, M. (2007). Gender Differences in Mental Health. *Singapore Medical Journal, 48*(5), 385. https://doi.org/10.1177/0020764010390431

Afriyie, P., & Tarkang, E. E. (2019). Factors influencing use of modern contraception among married women in Ho west district, Ghana: Descriptive cross-sectional study. *Pan African Medical Journal, 33*. https://doi.org/10.11604/pamj.2019.33.15.17500

Agbeno, E. K., Gbagbo, F. Y., Morhe, E. S. K., Maltima, S. I., & Sarbeng, K. (2019). Pregnancy options counselling in Ghana: A case study of women with unintended pregnancies in Kumasi metropolis, Ghana. *BMC Pregnancy and Childbirth, 19*(1), 446. https://doi.org/10.1186/s12884-019-2598-7/

Ahmed, A. E., Albalawi, A., Alshehri, A., AlBlaihed, R., & Alsalamah, M. A. (2017). Stress and its predictors in pregnant women: a study in Saudi Arabia. *Psychology Research and Behavior Management, 10,* 97. https://doi.org/10.2147/prbm.s131474

Ahonsi, B., Fuseini, K., Nai, D., Goldson, E., Owusu, S., Ndifuna, I., Humes, I., & Tapsoba, P. L. (2019). Child marriage in Ghana: Evidence from a multi-method study. *BMC Women's Health*. https://doi.org/10.1186/s12905-019-0823-1

Airo (Toivanen), R., Korja, R., Saisto, T., Rouhe, H., Muotka, J., & Salmela–Aro, K. (2018). Changes in emotions and personal goals in primiparous pregnant women during group intervention for fear of childbirth. *Journal of Reproductive and Infant Psychology, 19*(1), 1-15. https://doi.org/10.1080/02646838.2018.1462477.

Akincigil, A., Munch, S., & Niemczyk, K. C. (2010). Predictors of maternal depression in the first year postpartum: Marital status and mediating role of relationship quality. *Social Work in Healthcare, 49*(3), 227-244. https://doi.org/10.1080/00981380903213055.

Aksoy Derya, Y., Timur Taşhan, S., Duman, M., & Durgun Ozan, Y. (2018). Turkish adaptation of the pregnancy-related anxiety questionnaire-revised 2: Validity and reliability study in multiparous and primiparous pregnancy. *Midwifery, 62*, 61-68. https://doi.org/10.1016/j.midw.2018.03.006.

Alderdice, F., Henderson, J., Opondo, C., Lobel, M., Quigley, M., & Redshaw, M. (2019). Psychosocial factors that mediate the association between mode of birth and maternal postnatal adjustment: findings from a population-based survey. *BMC women's health*, *19*(1), 42. https://doi.org/10.1186/s12905-019-0738-x

Al-Dubai, S. A. R., Barua, A., Ganasegeran, K., Jadoo, S. A., & Rampal, K. G. (2014). Concurrent validity of the Malay version of Perceived Stress Scale (PSS-10). *ASEAN Journal of Psychiatry, 15*(1), 8-13.

Alhassan, A., Ziblim, A. R., & Muntaka, S. (2014). A survey on depression among infertile women in Ghana. *BMC Women's Health*, *14*(1), 1-6. https://doi.org/10.1186/1472-6874-14-42.

Alhusen, J. L., Frohman, N., & Purcell, G. (2015). Intimate partner violence and suicidal ideation in pregnant women. *Archives of Women's Mental Health*, *18*(4), 573-578. https://doi.org/10.1007/s00737-015-0515-2.

Almadi, T., Cathers, I., Hamdan Mansour, A. M., & Chow, C. M. (2012). An Arabic version of the Perceived Stress Scale: Translation and validation study. *International Journal of Nursing Studies, 49*(1), 84-89. https://doi.org/10.1016/j.ijnurstu.2011.07.012.

Almlund, M., Duckworth, A. L., Heckman, J., & Kautz, T. (2011). Personality psychology and economics. In Handbook of the Economics of Education (Vol. 4, pp. 1-181). Elsevier. https://doi.org/10.1016/B978-0-444-53444-6.00001-8.

Alqahtani, A. H., Al Khedair, K., Al-Jeheiman, R., Al-Turki, H. A., & Al Qahtani, N. H. (2018).

Anxiety and depression during pregnancy in women attending clinics in a University Hospital in Eastern province of Saudi Arabia: Prevalence and associated factors. *International Journal of Women's Health, 10,* 101. https://doi.org/10.2147/IJWH.S153273.

Ambugo, E. A. (2014). Cross-country variation in the sociodemographic factors associated with major depressive episode in Norway, the United Kingdom, Ghana, and Kenya. *Social Science and Medicine, 113,* 154-160. https://doi.org/10.1016/j.socscimed.2014.05.022.

American Psychiatric Association. (2013). DSM V. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. https://doi.org/10.1109/mwc.2007.4300985

American Psychological Association. (2015). Stress in America: Paying with Our Health. Stress in America™ Survey.

American Psychological Association. (2012a) Ethical principles of psychologists and code of conduct. https://doi.org/10.1037/0003-066X.57.12.1060

American Psychological Association. (2012b). Understanding chronic stress.

American Psychological Association [APA]. (2012). The Different Kinds of Stress. *Middle East*. https://doi.org/10.1037/e300842004-001.

Ameyaw, E. K. (2018). Prevalence and correlates of unintended pregnancy in Ghana: Analysis of 2014 Ghana Demographic and Health Survey. *Maternal Health, Neonatology and Perinatology, 4*(1), 17. https://doi.org/10.1186/s40748-018-0085-1.

An, K., Salyer, J., Brown, R. E., Kao, H. F. S., Starkweather, A., & Shim, I. (2015). Salivary Biomarkers of Chronic Psychosocial Stress and CVD Risks: A Systematic Review. *Biological Research for Nursing*, *18*(3), 241–263. https://doi.org/10.1177/1099800415604437.

Andersen, L., Kagee, A., O'Cleirigh, C., Safren, S., & Joska, J. (2015). Understanding the experience and manifestation of depression in people living with HIV/AIDS in South Africa. *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, *27*(1), 59-62. https://doi.org/10.1080/09540121.2014.951306.

Andrade, L. H., Wang, Y. P., Andreoni, S., Silveira, C. M., Alexandrino-Silva, C., Siu, E. R., Nishimura, R., Anthony, J. C., Gattaz, W. F., Kessler, R. C., & Viana, M. C. (2012). Mental disorders in megacities: Findings from the São Paulo megacity mental health survey, Brazil. *PLoS ONE, 7*(2), e31879. https://doi.org/10.1371/journal.pone.0031879.

Aneja, J., Chavan, B. S., Huria, A., Goel, P., Kohli, N., & Chhabra, P. (2018). Perceived stress and its psychological correlates in pregnant women: an Indian study. *International Journal of Culture and Mental Health, 11*(3), 268-279. https://doi.org/10.1080/17542863.2017.1364284.

Angeles, G. (2009). Proxy Variables : Is Principal Component Analysis. *Review of Income and Wealth, 55(1), 128-165*. https://doi.org/10.1111/j.1475-4991.2008.00309.x.

Anokye, R., Acheampong, E., Budu-Ainooson, A., Obeng, E. I., & Akwasi, A. G. (2018). Prevalence of postpartum depression and interventions utilized for its management. *Annals of general psychiatry*, *17*(1), 18. doi.org/10.1186/s12991-018-0188-0.

Apter, G., Devouche, E., & Gratier, M. (2011). Perinatal mental health. *The Journal of nervous and mental disease*, *199*(8), 575-577. https://doi.org/10.1097/NMD.0b013e318225f2f4.

Arroll, B., Goodyear-Smith, F., Crengle, S., Gunn, J., Kerse, N., Fishman, T., Falloon, K., & Hatcher, S. (2010). Validation of PHQ-2 and PHQ-9 to screen for major depression in the primary care population. *Annals of Family Medicine*. https://doi.org/10.1370/afm.1139

Aryeetey, R., Lartey, A., Marquis, G. S., Nti, H., Colecraft, E., & Brown, P. (2017). Prevalence and predictors of overweight and obesity among school-aged children in urban Ghana. *BMC obesity*, *4*(1), 1-8. https://doi.org/10.1186/s40608-017-0174-0.

Asare, E. V., Wilson, I., Benneh-Akwasi Kuma, A. A., Dei-Adomakoh, Y., Sey, F., & Olayemi, E. (2018). Burden of sickle cell disease in Ghana: the Korle-Bu Experience. *Advances in hematology*, *2018*. https://doi.org/10.1155/2018/6161270.

Ashley, J. M., Harper, B. D., Arms-Chavez, C. J., & LoBello, S. G. (2016). Estimated prevalence of antenatal depression in the US population. *Archives of Women's Mental Health*. https://doi.org/10.1007/s00737-015-0593-1

Atwoli, L., Stein, D. J., Koenen, K. C., & McLaughlin, K. A. (2015). Epidemiology of posttraumatic stress disorder: prevalence, correlates and consequences. *Current opinion in psychiatry*, *28*(4), 307–311. https://doi.org/10.1097/YCO.0000000000000167

Austin, M.-P., & Priest, S. R. (2005). Clinical issues in perinatal mental health: new developments in the detection and treatment of perinatal mood and anxiety disorders. *Acta Psychiatrica Scandinavica*, *112*(2), 97-104. https://doi.org/10.1111/j.1600-0447.2005.00549.x.

Austin, M. P., & Lumley, J. (2003). Antenatal screening for postnatal depression: A systematic review. *Acta Psychiatrica Scandinavica*, *107*(1), 10-17. https://doi.org/10.1034/j.1600-0447.2003.02024.x.

Averill, J. R. (1973). Personal control over aversive stimuli and its relationship to stress. *Psychological Bulletin*, *80*(4), 286. https://doi.org/10.1037/h0034845.

Ayalon, L., Shiovitz-Ezra, S., & Palgi, Y. (2013). Associations of loneliness in older married men and women. *Aging and Mental Health*, *17*(1), 33-39. https://doi.org/10.1080/13607863.2012.702725.

Ayano, G., Tesfaw, G., & Shumet, S. (2019). Prevalence and determinants of antenatal depression in Ethiopia: A systematic review and meta-analysis. *PLoS ONE*, *14*(2), e0211764. https://doi.org/10.1371/journal.pone.0211764.

Ayele, T. A., Azale, T., Alemu, K., Abdissa, Z., Mulat, H., & Fekadu, A. (2016). Prevalence and Associated Factors of Antenatal Depression among Women Attending Antenatal Care Service at Gondar University Hospital, Northwest Ethiopia. *PLoS ONE*, *11*(5), e0155125. https://doi.org/10.1371/journal.pone.0155125.

Aziato, L., Hindin, M. J., Maya, E. T., Manu, A., Amuasi, S. A., Lawerh, R. M., & Ankomah, A. (2016). Adolescents' Responses to an Unintended Pregnancy in Ghana: A Qualitative Study. *Journal of Pediatric and Adolescent Gynecology*, *29*(6), 653-658. https://doi.org/10.1016/j.jpag.2016.06.005.

Babaev, O., Piletti Chatain, C., & Krueger-Burg, D. (2018). Inhibition in the amygdala anxiety circuitry. *Experimental and Molecular Medicine, 50*(4), 1-16. https://doi.org/10.1038/s12276-018-0063-8.

Babenko, O., Kovalchuk, I., & Metz, G. A. S. (2015). Stress-induced perinatal and transgenerational epigenetic programming of brain development and mental health. In *Neuroscience and Biobehavioral Reviews, 48,* 70-91. https://doi.org/10.1016/j.neubiorev.2014.11.013.

Baffoe, M. (2013). Stigma, Discrimination & Marginalization: Gateways to Oppression of Persons with Disabilities in Ghana, West Africa. *Journal of Educational and Social Research, 3*(1), 187-187. https://doi.org/10.5901/jesr.2013.v3n1p187.

Bain, L. E., Zweekhorst, M. B. M., Amoakoh-Coleman, M., Muftugil-Yalcin, S., Omolade, A. I. O., Becquet, R., & De Cock Buning, T. (2019). To keep or not to keep? Decision making in adolescent pregnancies in Jamestown, Ghana. *PLoS ONE, 14*(9). https://doi.org/10.1371/journal.pone.0221789.

Baron, E. C., Hanlon, C., Mall, S., Honikman, S., Breuer, E., Kathree, T., Luitel, N. P., Nakku, J., Lund, C., Medhin, G., Patel, V., Petersen, I., Shrivastava, S., & Tomlinson, M. (2016). Maternal mental health in primary care in five low- and middle-income countries: A situational analysis. *BMC Health Services Research, 16*(1), 53. https://doi.org/10.1186/s12913-016-1291-z.

Barthel, D., Barkmann, C., Ehrhardt, S., & Bindt, C. (2014). Psychometric properties of the 7-item Generalized Anxiety Disorder scale in antepartum women from Ghana and Côte d'Ivoire. *Journal of Affective Disorders, 169,* 203-211. https://doi.org/10.1016/j.jad.2014.08.004.

Barthel, D., Barkmann, C., Ehrhardt, S., Schoppen, S., Bindt, C., & International CDS Study Group. (2015). Screening for depression in pregnant women from Côte d′ Ivoire and Ghana: Psychometric properties of the Patient Health Questionnaire-9. *Journal of affective disorders, 187,* 232-240. https://doi.org/10.1016/j.jad.2015.06.042.

Barthel, D., Kriston, L., Barkmann, C., Appiah-Poku, J., Te Bonle, M., Doris, K. Y. E., ... & Fordjour, D. (2016). Longitudinal course of ante-and postpartum generalized anxiety symptoms and associated factors in West-African women from Ghana and Côte d'Ivoire. *Journal of affective disorders, 197,* 125-133. https://doi.org/10.1016/j.jad.2016.03.014.

Bayrampour, H., McDonald, S., & Tough, S. (2015). Risk factors of transient and persistent anxiety during pregnancy. *Midwifery, 31*(6), 582-589. https://doi.org/10.1016/j.midw.2015.02.009.

Bäz, E., & Juhasz-Böss, I. (2019). Prenatal diagnosis. *Medizinische Monatsschrift fur Pharmazeuten*. https://doi.org/10.3329/bjog.v31i2.34211.

Bech, P., Bille, J., Møller, S. B., Hellström, L. C., & Østergaard, S. D. (2014). Psychometric validation of the Hopkins Symptom Checklist (SCL-90) subscales for depression, anxiety, and interpersonal sensitivity. *Journal of Affective Disorders, 160,* 98-103.

Beck, A. T. (1961). A systematic investigation of depression. *Comprehensive Psychiatry, 2*(3), 163-170. https://doi.org/10.1016/S0010-440X(61)80020-5.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An Inventory for Measuring Clinical Anxiety: Psychometric Properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893. https://doi.org/10.1037/0022-006X.56.6.893.

Becker, M., Weinberger, T., Chandy, A., & Schmukler, S. (2016). Depression During Pregnancy and Postpartum. *Current Psychiatry Reports*, *18*(3), 32. https://doi.org/10.1007/s11920-016-0664-7.

Beijers, R., Buitelaar, J.K. & de Weerth, C. Mechanisms underlying the effects of prenatal psychosocial stress on child outcomes: beyond the HPA axis. *Eur Child Adolesc Psychiatry* **23,** 943–956 (2014). https://doi.org/10.1007/s00787-014-0566-3

Beijers, C., Verbeek, T., Van Pampus, M. G., Meijer, J. L., Burger, H., & Bockting, C. L. H. (2015). Cognitive behavioral therapy for treatment of antenatal anxiety and depressive symptoms: A randomized controlled trial. *Arch Womens Ment Health, 18,* 269–408. https://doi.org/10.1007/s00737-014-0488-6.

Bellieni, C. V., & Buonocore, G. (2013). Abortion and subsequent mental health: Review of the literature. In *Psychiatry and Clinical Neurosciences, 67*(5), 301-310. https://doi.org/10.1111/pcn.12067.

Belvederi Murri, M., Prestia, D., Mondelli, V., Pariante, C., Patti, S., Olivieri, B., Arzani, C., Masotti, M., Respino, M., Antonioli, M., Vassallo, L., Serafini, G., Perna, G., Pompili, M., & Amore, M. (2016). The HPA axis in bipolar disorder: Systematic review and meta-analysis. *Psychoneuroendocrinology*, *63*, 327-342. https://doi.org/10.1016/j.psyneuen.2015.10.014.

Berk, M., Williams, L. J., Jacka, F. N., O'Neil, A., Pasco, J. A., Moylan, S., Allen, N. B., Stuart, A. L., Hayley, A. C., Byrne, M. L., & Maes, M. (2013). So, depression is an inflammatory disease, but where does the inflammation come from? *BMC Medicine*, *11*(1), 1-16. https://doi.org/10.1186/1741-7015-11-200.

Bernell S and Howard SW (2016) Use Your Words Carefully: What Is a Chronic Disease? *Front. Public Health* 4:159. doi: 10.3389/fpubh.2016.00159

Berry, J., Karlan, D., & Pradhan, M. (2018). The Impact of Financial Education for Youth in Ghana. *World Development*, *102*, 71-89. https://doi.org/10.1016/j.worlddev.2017.09.011.

Betts, K. S., Williams, G. M., Najman, J. M., & Alati, R. (2014). Maternal depressive, anxious, and stress symptoms during pregnancy predict internalizing problems in adolescence. *Depression and Anxiety*, *31*(1), 9-18. https://doi.org/10.1002/da.22210.

Beydoun, H., & Saftlas, A. F. (2008). Physical and mental health outcomes of prenatal maternal stress in human and animal studies: A review of recent evidence. *Paediatric and Perinatal Epidemiology*, *22*(5), 438–466. https://doi.org/10.1111/j.1365-3016.2008.00951.x.

Biaggi, A., Conroy, S., Pawlby, S., & Pariante, C. M. (2016). Identifying the women at risk of antenatal anxiety and depression: A systematic review. *Journal of Affective Disorders*, *191*, 62-77. https://doi.org/10.1016/j.jad.2015.11.014.

Binder, E. B., & Nemeroff, C. B. (2010). The CRF system, stress, depression and anxietyinsights from human genetic studies. *Molecular Psychiatry*, *15*(6), 574-588. https://doi.org/10.1038/mp.2009.141.

Bindt, C., Appiah-Poku, J., Te Bonle, M., Schoppen, S., Feldt, T., Barkmann, C., Koffi, M., Baum, J., Nguah, S. B., Tagbor, H., Guo, N., N'Goran, E., & Ehrhardt, S. (2012). Antepartum Depression and Anxiety Associated with Disability in African Women: Cross-Sectional Results from the CDS Study in Ghana and Côte d'Ivoire. *PLoS ONE*, *7*(10), e48396. https://doi.org/10.1371/journal.pone.0048396.

Bindt, C., Guo, N., Te Bonle, M., Appiah-Poku, J., Hinz, R., Barthel, D., Schoppen, S., Feldt, T., Barkmann, C., Koffi, M., Loag, W., Nguah, S. B., Eberhardt, K. A., Tagbor, H., N'Goran, E., & Ehrhardt, S. (2013). No association between antenatal common mental disorders in low-obstetric risk women and adverse birth outcomes in their offspring: Results from the CDS study in Ghana and Côte D'Ivoire. *PLoS ONE*, *8*(11), 1–9. https://doi.org/10.1371/journal.pone.0080711.

Biratu, A., & Haile, D. (2015). Prevalence of antenatal depression and associated factors among pregnant women in Addis Ababa, Ethiopia: A cross-sectional study. *Reproductive Health*, *12*(1), 99. https://doi.org/10.1186/s12978-015-0092-x.

Bisetegn, T. A., Mihretie, G., & Muche, T. (2016). Prevalence and predictors of depression among pregnant women in debretabor town, northwest Ethiopia. *PLoS ONE*, *11*(9), e0161108. https://doi.org/10.1371/journal.pone.0161108.

Blackstone, S. R. (2017). Women's empowerment, household status and contraception use in Ghana. *Journal of Biosocial Science*, *49*(4), 423-34. https://doi.org/10.1017/S0021932016000377.

Boakye-Yiadom A., S., S., J., D., P., D., & A., A. (2015). Perceived stress and anxiety among Ghanaian pregnant women. *Journal of Medical and Biomedical Sciences*, *4*(2), 29–37. http://www.ajol.info/index.php/jmbs/article/download/127723/117251%5Cnhttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed17&NEWS=N&AN=607356309.

Boateng, S., & Poku, K. O. (2019). Accessing finance among women-owned small businesses: evidence from lower Manya Krobo municipality, Ghana. *Journal of Global Entrepreneurship Research*, *9*(1), 5.

Bolarinwa, O. A. (2015). Principles and methods of validity and reliability testing of questionnaires used in social and health science research. *Nigerian Postgraduate Medical Journal*, *22*(4), 195.

Bondolfi, G. (2013). 2993–Is mindfullness an evidence-based treatment? *European Psychiatry*, *28*(S1), 1-1.

Bonful, H. A., & Anum, A. (2019). Sociodemographic correlates of depressive symptoms: a cross-sectional analytic study among healthy urban Ghanaian women. *BMC public health*, *19*(1), 50.

Bosu, W. K. (2015). An overview of the nutrition transition in West Africa: implications for non-communicable diseases. *Proceedings of the nutrition society*, *74*(4), 466-477.

Bougie, E., Arim, R. G., Kohen, D. E., & Findlay, L. C. (2016). Validation of the 10-item Kessler psychological distress scale (K10) in the 2012 Aboriginal Peoples Survey. *Health reports*, *27*(1), 3-11.

Brandt, M. J., Wetherell, G., & Henry, P. J. (2015). Changes in income predict change in social trust: A longitudinal analysis. *Political Psychology*, *36*(6), 761-768.

Brebner, J. (2001). Personality and stress coping. *Personality and individual differences*, *31*(3), 317-327.

Brittain, K., Myer, L., Koen, N., Koopowitz, S., Donald, K. A., Barnett, W., ... & Stein, D. J. (2015). Risk factors for antenatal depression and associations with infant birth outcomes: results from a S outh a frican birth cohort study. *Paediatric and perinatal epidemiology*, *29*(6), 505-514.

Brown, G. W., & Harris, T. (Eds.). (2012). *Social origins of depression: A study of psychiatric disorder in women* (Vol. 2). Routledge.

Bruce, M. A., Griffith, D. M., & Thorpe, R. J., Jr (2015). Social Determinants of Men's Health Disparities. *Family & community health*, *38*(4), 281–283. https://doi.org/10.1097/FCH.0000000000000083

Brummelte, S., & Galea, L. A. (2010). Depression during pregnancy and postpartum: contribution of stress and ovarian hormones. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *34*(5), 766-776.

Brunton, P. J. (2013). Effects of maternal exposure to social stress during pregnancy: consequences for mother and offspring. Reproduction *146*, 175–189.

Bryant, R. A., Friedman, M. J., Spiegel, D., Ursano, R., & Strain, J. (2011). A review of acute stress disorder in DSM-5. *Focus*, *9*(3), 335-350.

Burger, H., Bockting, C. L., Beijers, C., Verbeek, T., Stant, A. D., Ormel, J., ... & Meijer, J. (2015). Pregnancy Outcomes After a Maternity Intervention for Stressful Emotions (PROMISES): A Randomised Controlled Trial. In *Perinatal Programming of Neurodevelopment* (pp. 443-459). Springer, New York, NY.

Busfield, J. (2010). Gender and mental health. In *The Palgrave Handbook of Gender and Healthcare* (pp. 172-188). Palgrave Macmillan, London.

Buss, C., Davis, E. P., Hobel, C. J., & Sandman, C. A. (2011). Maternal pregnancy-specific anxiety is associated with child executive function at 6–9 years age. *Stress*, *14*(6), 665-676.

Byrne, J., Hauck, Y., Fisher, C., Bayes, S., & Schutze, R. (2014). Effectiveness of a mindfulness-based childbirth education pilot study on maternal self-efficacy and fear of childbirth. *Journal of midwifery & women's health*, *59*(2), 192-197.

Campos, A. C., Fogaça, M. V., Aguiar, D. C., & Guimaraes, F. S. (2013). Animal models of anxiety disorders and stress. *Brazilian Journal of Psychiatry*, *35*, 101-111.

Cannon, W. B. (1929). Organization for physiological homeostasis. *Physiological reviews*, *9*(3), 399-431.

Cannon, W. B., Lissak, K. (1939). Evidence of adrenaline in adrenergic

neurons. https://doi.org/10.1152/ajplegacy.1939.125.4.765

Cantalupo, N., Martin, L. V., Pak, K., & Shin, S. (2006). Domestic violence in Ghana: The open secret. *Georgetown Journal of Gender and Law*, *7*, 531.

Carpenter, J. K., Andrews, L. A., Witcraft, S. M., Powers, M. B., Smits, J. A., & Hofmann, S. G. (2018). Cognitive behavioral therapy for anxiety and related disorders: A meta-analysis of randomized placebo-controlled trials. *Depression and anxiety*, *35*(6), 502-514.

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., & Poulton, R. (2003). Influence of life stress on depression: moderation by a polymorphism in the 5-HTT gene. *Science*, *301*(5631), 386-389.

Couto, T. C., Brancaglion, M. Y. M., Cardoso, M. N., Protzner, A. B., Garcia, F. D., Nicolato, R., ... & Corrêa, H. (2015). What is the best tool for screening antenatal depression? *Journal of Affective Disorders*, *178*, 12-17.

Cha, S., Chapman, D. A., Wan, W., Burton, C. W., & Masho, S. W. (2016). Discordant pregnancy intentions in couples and rapid repeat pregnancy. *American journal of obstetrics and gynecology*, *214*(4), 494-e1.

Cheah, C. S., Leung, C. Y., & Zhou, N. (2013). Understanding "tiger parenting" through the perceptions of Chinese immigrant mothers: Can Chinese and US parenting coexist?. *Asian American journal of psychology*, *4*(1), 30.

Chen, L. W., Sun, D., Davis, S. L., Haswell, C. C., Dennis, E. L., Swanson, C. A., ... & Thompson, P. (2018). Smaller hippocampal CA1 subfield volume in posttraumatic stress disorder. *Depression and anxiety*, *35*(11), 1018-1029.

Chen, M. J., Grobman, W. A., & Gollan, J. K. (2011). Borders AEB. *The use of psychosocial stress scales in preterm birth research. AJOG*, *205*, 402-434.

Chidarikire, S., Cross, M., Skinner, I., & Cleary, M. (2018). Treatments for people living with schizophrenia in Sub-Saharan Africa: an adapted realist review. *International Nursing Review*, *65*(1), 78-92.

Chisholm, D., Sweeny, K., Sheehan, P., Rasmussen, B., Smit, F., Cuijpers, P., & Saxena, S. (2016). Scaling-up treatment of depression and anxiety: a global return on investment analysis. *The Lancet Psychiatry*, *3*(5), 415-424.

Cholera, R., Gaynes, B. N., Pence, B. W., Bassett, J., Qangule, N., Macphail, C., ... & Miller, W. C. (2014). Validity of the patient health questionnaire-9 to screen for depression in a high-HIV burden primary healthcare clinic in Johannesburg, South Africa. *Journal of affective disorders*, *167*, 160-166.

Chorwe-Sungani, G., & Chipps, J. (2017). A systematic review of screening instruments for depression for use in antenatal services in low resource settings. *BMC psychiatry*, *17*(1), 112.

Chorwe-Sungani, G., & Chipps, J. (2018). A cross-sectional study of depression among women attending antenatal clinics in Blantyre district, Malawi. *South African Journal of Psychiatry*, *24*(1).

Chrousos, G. P. (2009). Stress and disorders of the stress system. *Nature reviews endocrinology*, *5*(7), 374.

Cipresso, P., & Immekus, J. C. (2017). Back to the future of quantitative psychology and measurement: psychometrics in the twenty-first century. *Frontiers in Psychology*, *8*, 2099.

Cleland, J., Conde-Agudelo, A., Peterson, H., Ross, J., & Tsui, A. (2012). Family Planning 2, Contraception and Health. *Lancet*, *380*(9837), 149-156.

Clow, A., Hamer, M. (2010) The iceberg of social disadvantage and chronic stress: implications for public health. *Neuroscience & Biobehavioral Reviews.* 35 (1), p. 1. https://doi.org/10.1016/j.neubiorev.2010.03.002

Cochrane, R., & Robertson, A. (1973). The life events inventory: a measure of the relative severity of psycho-social stressors. *Journal of Psychosomatic Research*.

Cohen, J. (1992). A power primer. *Psychological bulletin*, *112*(1), 155.

Cohen, S., Kamarck, T., & Mermelstein, R. (1994). Perceived stress scale. *Measuring stress: A guide for health and social scientists*, *10*, 1-2.

Cohen S, Kessler, R.C., Gordon, L.U., (1995) : Measuring Stress : A Guide for Health and Social Scientists . New York, Oxford University Press , 1995 .

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*, 385-396.

Collins, D. (2003). Pretesting survey instruments: an overview of cognitive methods. *Quality of life research*, *12*(3), 229-238.

Conroy, K. N., Engelhart, T. G., Martins, Y., Huntington, N. L., Snyder, A. F., Coletti, K. D., & Cox, J. E. (2016). The enigma of rapid repeat pregnancy: a qualitative study of teen mothers. *Journal of Pediatric and Adolescent Gynecology*, *29*(3), 312-317.

Contrada, R., & Baum, A. (Eds.). (2010). *The handbook of stress science: Biology, psychology, and health*. Springer Publishing Company.

Cooper, S. (2016). "How I Floated on Gentle Webs of Being": Psychiatrists Stories About the Mental Health Treatment Gap in Africa. *Culture, Medicine, and Psychiatry*, *40*(3), 307-337.

Cooper, S. J. (2008). From Claude Bernard to Walter Cannon. Emergence of the concept of homeostasis. *Appetite*, *51*(3), 419-427.

Cougle, J. R., Resnick, H., & Kilpatrick, D. G. (2009). PTSD, depression, and their comorbidity in relation to suicidality: cross-sectional and prospective analyses of a national probability sample of women. *Depression and Anxiety*, *26*(12), 1151-1157.

Crum, A. J., Salovey, P., & Achor, S. (2013). Rethinking stress: The role of mindsets in determining the stress response. *Journal of personality and social psychology*, *104*(4), 716.

Cryan, J. F., & Kaupmann, K. (2005). Don't worry 'B'happy! a role for GABAB receptors in anxiety

and depression. *Trends in pharmacological sciences*, *26*(1), 36-43.

Cuijpers, P., Auerbach, R. P., Benjet, C., Bruffaerts, R., Ebert, D., Karyotaki, E., & Kessler, R. C. (2019). Introduction to the special issue: The WHO World Mental Health International College Student (WMH-ICS) initiative. *International journal of methods in psychiatric research*, *28*(2), e1762.

Cuijpers, P., Geraedts, A. S., van Oppen, P., Andersson, G., Markowitz, J. C., & van Straten, A. (2011). Interpersonal psychotherapy for depression: a meta-analysis. *American Journal of Psychiatry*, *168*(6), 581-592.

Cuijpers, P., Sijbrandij, M., Koole, S., Huibers, M., Berking, M., & Andersson, G. (2014). Psychological treatment of generalized anxiety disorder: a meta-analysis. *Clinical psychology review*, *34*(2), 130-140.

Cuijpers, P., van Straten, A., Warmerdam, L., & Andersson, G. (2009). Psychotherapy versus the combination of psychotherapy and pharmacotherapy in the treatment of depression: a meta-analysis. *Depression and anxiety*, *26*(3), 279-288.

Cutler, B., Gagné, J. L., & Reitman, D. (2013). Parenting Stress Index (PSI). In *Encyclopedia of Psychology and Law*.

Dako-Gyeke, P., Aikins, M., Aryeetey, R., Mccough, L., & Adongo, P. B. (2013). The influence of socio-cultural interpretations of pregnancy threats on health-seeking behavior among pregnant women in urban Accra, Ghana. *BMC pregnancy and childbirth*, *13*(1), 211.

Dao-Tran, T. H., Anderson, D., & Seib, C. (2017). The Vietnamese version of the Perceived Stress Scale (PSS-10): Translation equivalence and psychometric properties among older women. *BMC psychiatry*, *17*(1), 1-7.

Davis, K., Pearlstein, T., Stuart, S., O'Hara, M., & Zlotnick, C. (2013). Analysis of brief screening tools for the detection of postpartum depression: comparisons of the PRAMS 6-item instrument, PHQ-9, and structured interviews. *Archives of women's mental health*, *16*(4), 271-277.

de Groot, R., Kuunyem, M. Y., & Palermo, T. (2018). Child marriage and associated outcomes in northern Ghana: a cross-sectional study. *BMC public health*, *18*(1), 1-12.

Dear, B. F., Titov, N., Sunderland, M., McMillan, D., Anderson, T., Lorian, C., & Robinson, E. (2011). Psychometric comparison of the generalized anxiety disorder scale-7 and the Penn State Worry Questionnaire for measuring response during treatment of generalised anxiety disorder. *Cognitive behaviour therapy*, *40*(3), 216-227.

Dehlendorf, C., Grumbach, K., Schmittdiel, J. A., & Steinauer, J. (2017). Shared decision making in contraceptive counseling. *Contraception*, *95*(5), 452-455.

Deichmann, U. (2016). Epigenetics: The origins and evolution of a fashionable topic. *Developmental biology*, *416*(1), 249-254.

DeMartini, J., Patel, G., & Fancher, T. L. (2019). Generalized anxiety disorder. *Annals of internal medicine*, *170*(7), ITC49-ITC64.

Denollet, J., Rombouts, H., Gillebert, T. C., Brutsaert, D. L., Sys, S. U., & Stroobant, N. (1996).

Personality as independent predictor of long-term mortality in patients with coronary heart disease. *The Lancet*, *347*(8999), 417-421.

Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behavioral science*, *19*(1), 1-15.

Dewey, K. G. (2017). Heterogeneity in response to nutrition interventions during the first 1000 days: evidence from randomized controlled trials using lipid-based nutrient supplements for mothers and infants. *Annals of Nutrition & Metabolism*. (Vol. 71, pp. 12-12). Allschwilerstrasse 10, Ch-4009 Basel, Switzerland: Karger.

Dhillon, A., Sparkes, E., & Duarte, R. V. (2017). Mindfulness-based interventions during pregnancy: a systematic review and meta-analysis. *Mindfulness*, *8*(6), 1421-1437.

Ding, X. X., Wu, Y. L., Xu, S. J., Zhu, R. P., Jia, X. M., Zhang, S. F., ... & Tao, F. B. (2014). Maternal anxiety during pregnancy and adverse birth outcomes: a systematic review and meta-analysis of prospective cohort studies. *Journal of affective disorders*, *159*, 103-110.

Dikmen-Yildiz, P., Ayers, S., & Phillips, L. (2017). Depression, anxiety, PTSD and comorbidity in perinatal women in Turkey: A longitudinal population-based study. *Midwifery*, *55*, 29-37.

Doku, P. N., Dotse, J. E., & Mensah, K. A. (2015). Perceived social support disparities among children affected by HIV/AIDS in Ghana: a cross-sectional survey. *BMC Public Health*, *15*(1), 538.

Don, B. P., & Mickelson, K. D. (2014). Relationship satisfaction trajectories across the transition to parenthood among low-risk parents. *Journal of Marriage and Family*, *76*(3), 677-692.

Donkor, E. S., Naab, F., & Kussiwaah, D. Y. (2017). "I am anxious and desperate": psychological experiences of women with infertility in The Greater Accra Region, Ghana. *Fertility research and practice*, *3*(1), 6.

Doris, S. F., Thompson, D. R., Yu, C. M., Pedersen, S. S., & Denollet, J. (2010). Validating the Type D personality construct in Chinese patients with coronary heart disease. *Journal of psychosomatic research*, *69*(2), 111-118.

Duffy, R. D., Blustein, D. L., Diemer, M. A., & Autin, K. L. (2016). The psychology of working theory. *Journal of Counseling Psychology*, *63*(2), 127.

Dunkel Schetter, C. (2010). Psychological science on pregnancy: stress processes, biopsychosocial models, and emerging research issues. *Annual review of psychology*, *62*, 531-558.

Duthie, L., & Reynolds, R. M. (2013). Changes in the maternal hypothalamic-pituitary-adrenal axis in pregnancy and postpartum: influences on maternal and fetal outcomes. *Neuroendocrinology*, *98*(2), 106-115.

Dyer, J. S., & Rosenfeld, C. R. (2011). Metabolic imprinting by prenatal, perinatal, and postnatal overnutrition: a review. In *Seminars in reproductive medicine* (Vol. 29, No. 03, pp. 266-276).

Edmond, K. M., Newton, S., Shannon, C., O'Leary, M., Hurt, L., Thomas, G., ... & Bahl, R. (2015). Effect of early neonatal vitamin A supplementation on mortality during infancy in Ghana (Neovita): a randomised, double-blind, placebo-controlled trial. *The Lancet*, *385*(9975), 1315-

1323.

Egan, R. J., Bergner, C. L., Hart, P. C., Cachat, J. M., Canavello, P. R., Elegante, M. F., ... & Mohnot, S. (2009). Understanding behavioral and physiological phenotypes of stress and anxiety in zebrafish. *Behavioural brain research*, *205*(1), 38-44.

Eide, K. T., Morken, N. H., & Bærøe, K. (2019). Maternal reasons for requesting planned cesarean section in Norway: a qualitative study. *BMC pregnancy and childbirth*, *19*(1), 102.

Eke, A. C., Saccone, G., & Berghella, V. (2016). Selective serotonin reuptake inhibitor (SSRI) use during pregnancy and risk of preterm birth: a systematic review and meta-analysis. *BJOG: An International Journal of Obstetrics & Gynaecology*, *123*(12), 1900-1907.

Eliason, S., Baiden, F., Yankey, B. A., & Awusabo–Asare, K. (2014). Determinants of unintended pregnancies in rural Ghana. *BMC pregnancy and childbirth*, *14*(1), 261.

England, P. L. J., & Gallagher, M. (2001). The case for marriage: Why married people are happier, healthier, and better off financially. *Contemporary Sociology*, *30*(6), 564.

Escribà-Agüir, V., Royo-Marqués, M., Artazcoz, L., Romito, P., & Ruiz-Pérez, I. (2013). Longitudinal study of depression and health status in pregnant women: incidence, course and predictive factors. *European archives of psychiatry and clinical neuroscience*, *263*(2), 143-151.

Esimai, O. A., Fatoye, F. O., Quiah, A. G., Vidal, O. E., & Momoh, R. M. (2008). Antepartum anxiety and depressive symptoms: A study of Nigerian women during the three trimesters of pregnancy. *Journal of Obstetrics and Gynaecology*, *28*(2), 202-203.

Evans, G. W., & English, K. (2002). The environment of poverty: Multiple stressor exposure, psychophysiological stress, and socioemotional adjustment. *Child development*, *73*(4), 1238-1248.

Faa, G., Manchia, M., Pintus, R., Gerosa, C., Marcialis, M. A., & Fanos, V. (2016). Fetal programming of neuropsychiatric disorders. *Birth Defects Research Part C: Embryo Today: Reviews*, *108*(3), 207-223.

Fairbrother, N., Janssen, P., Antony, M. M., Tucker, E., & Young, A. H. (2016). Perinatal anxiety disorder prevalence and incidence. *Journal of Affective Disorders*.

Faisal-Cury, A., & Menezes, P. R. (2012). Antenatal depression strongly predicts postnatal depression in primary healthcare. *Revista Brasileira de Psiquiatria*, *34*(4), 446-450.

Falah-Hassani, K., Shiri, R., & Dennis, C. L. (2017). The prevalence of antenatal and postnatal co-morbid anxiety and depression: a meta-analysis. *Psychological medicine*, *47*(12), 2041.

Fall, A., Goulet, L., & Vézina, M. (2013). Comparative study of major depressive symptoms among pregnant women by employment status. *Springerplus*, *2*(1), 201.

Faramarzi, M., Amiri, F. N., & Rezaee, R. (2016). Relationship of coping ways and anxiety with pregnancy specific-stress. *Pakistan journal of medical sciences*, *32*(6), 1364.

Feduccia, A. A., Holland, J., & Mithoefer, M. C. (2018). Progress and promise for the MDMA drug development program. *Psychopharmacology*, *235*(2), 561-571.

Fellenzer, J. L., & Cibula, D. A. (2014). Intendedness of pregnancy and other predictive factors for symptoms of prenatal depression in a population-based study. *Maternal and child health journal*, *18*(10), 2426-2436.

Fenwick, J., Gamble, J., Creedy, D. K., Buist, A., Turkstra, E., Sneddon, A., ... & Toohill, J. (2013). Study protocol for reducing childbirth fear: a midwife-led psycho-education intervention. *BMC Pregnancy and Childbirth*, *13*(1), 1-9.

Filipović, S., Vukosavljević-Gvozden, T., & Opačić, G. (2016). Irrational beliefs, dysfunctional emotions, and marital adjustment: A structural model. *Journal of Family Issues*, *37*(16), 2333-2350.

Fink, G. (2009). Stress: definition and history. *Stress science: neuroendocrinology*, 3-9.

Fink, G. (2016). Stress: Concepts, definition and history. Florey Institute of Neuroscience and Mental Health

Fisher, J., Mello, M. C. D., Patel, V., Rahman, A., Tran, T., Holton, S., & Holmes, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: a systematic review. *Bulletin of the World Health Organization*, *90*, 139-149.

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., & Gruen, R. J. (1986). Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *Journal of personality and social psychology*, *50*(5), 992.

Friedman, H. S., & Booth-Kewley, S. (1987). Personality, type A behavior, and coronary heart disease: the role of emotional expression. *Journal of Personality and Social Psychology*, *53*(4), 783.

Fuglenes, D., Aas, E., Botten, G., Øian, P., & Kristiansen, I. S. (2011). Why do some pregnant women prefer cesarean? The influence of parity, delivery experiences, and fear. *American journal of obstetrics and gynecology*, *205*(1), 45-e1.

Gadanya, M. A., Abulfathi, A. A., & Ahmad, F. A. (2018). Anxiety and depression in pregnancy: prevalence and associated risk factors among pregnant women attending antenatal clinic in Aminu Kano Teaching Hospital Kano, Nigeria. *Annals of African Medical Research*, *1*(1).

Gagnon, A. J., & Stewart, D. E. (2014). Resilience in international migrant women following violence associated with pregnancy. *Archives of women's mental health*, *17*(4), 303-310.

Gagnon, S. A., & Wagner, A. D. (2016). Acute stress and episodic memory retrieval: neurobiological mechanisms and behavioral consequences. *Annals of the New York Academy of Sciences*, *1369*(1), 55-75.

Ganle, J. K., Afriyie, K., & Segbefia, A. Y. (2015). Microcredit: Empowerment and disempowerment of rural women in Ghana. *World Development*, *66*, 335-345.

Ganle, J. K., Otupiri, E., Obeng, B., Edusie, A. K., Ankomah, A., & Adanu, R. (2016). Challenges women with disability face in accessing and using maternal healthcare services in Ghana: a qualitative study. *PloS one*, *11*(6), e0158361.

Garcia, J., Hromi-Fiedler, A., Mazur, R. E., Marquis, G., Sellen, D., Lartey, A., & Pérez-Escamilla, R. (2013). Persistent household food insecurity, HIV, and maternal stress in peri-urban Ghana. *BMC Public Health*, *13*(1), 215.

Garthus-Niegel, S., von Soest, T., Vollrath, M. E., & Eberhard-Gran, M. (2013). The impact of subjective birth experiences on post-traumatic stress symptoms: a longitudinal study. *Archives of women's mental health*, *16*(1), 1-10.

Gartlehner, G., Wagner, G., Matyas, N., Titscher, V., Greimel, J., Lux, L., ... & Lohr, K. N. (2017). Pharmacological and non-pharmacological treatments for major depressive disorder: review of systematic reviews. *BMJ open*, *7*(6), e014912.

Gasiorowska, A. (2014). The relationship between objective and subjective wealth is moderated by financial control and mediated by money anxiety. *Journal of Economic Psychology*, *43*, 64-74.

Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry*, *3*(10), 973-982.

Gentile, S. (2017). Untreated depression during pregnancy: Short-and long-term effects in offspring. A systematic review. *Neuroscience*, *342*, 154-166.

George, A., Luz, R. F., De Tychey, C., Thilly, N., & Spitz, E. (2013). Anxiety symptoms and coping strategies in the perinatal period. *BMC pregnancy and childbirth*, *13*(1), 233.

Ghana AIDS Commission. (2016). *Summary of the 2013 HIV Sentinel Survey Report*. Ghanaids.Gov.Gh.

Ghana Statistical Service. (2013). *2010 Population & Housing Census - National Analytical Report*.

Ghana Statistical Service. (2014a). 2010 Population and Housing Census, District Analytical Report. *Ghana Statistial Service*. https://doi.org/10.1371/journal.pone.0104053

Ghana Statistical Service. (2014b). Ghana Demographic and Health Survey. *Studies in Family Planning*, *21*(1), 1–5. https://doi.org/10.1007/s13398-014-0173-7.2.

Giardinelli, L., Innocenti, A., Benni, L., Stefanini, M. C., Lino, G., Lunardi, C., ... & Faravelli, C. (2012). Depression and anxiety in perinatal period: prevalence and risk factors in an Italian sample. *Archives of women's mental health*, *15*(1), 21-30.

Giurgescu, C., Kavanaugh, K., Norr, K. F., Dancy, B. L., Twigg, N., McFarlin, B. L., Engeland, C. G., Hennessy, M. D., & White-Traut, R. C. (2013). Stressors, resources, and stress responses in pregnant African American women: a mixed-methods pilot study. *The Journal of perinatal & neonatal nursing*, *27*(1), 81–96. https://doi.org/10.1097/JPN.0b013e31828363c3

Gladstone, G. L., Parker, G. B., Mitchell, P. B., Malhi, G. S., Wilhelm, K. A., & Austin, M. P. (2005). A Brief Measure of Worry Severity (BMWS): Personality and clinical correlates of severe worriers. *Journal of Anxiety Disorders*, *19*(8), 877-892.

Glover, V., O'Connor, T. G., & O'Donnell, K. (2010). Prenatal stress and the programming of the HPA axis. *Neuroscience and Biobehavioral Reviews*, *35*(1), 17–22.

Gold, K. J., Spangenberg, K., Wobil, P., & Schwenk, T. L. (2013). Depression and risk factors for depression among mothers of sick infants in Kumasi, Ghana. *International Journal of Gynecology & Obstetrics*, *120*(3), 228-231.

Goldstein, D. S., & Kopin, I. J. (2007). Evolution of concepts of stress. *Stress*, *10*(2), 109-120.

Goodman, J. H., Guarino, A., Chenausky, K., Klein, L., Prager, J., Petersen, R., ... & Freeman, M. (2014). CALM Pregnancy: results of a pilot study of mindfulness-based cognitive therapy for perinatal anxiety. *Archives of women's mental health*, *17*(5), 373-387.

Gouda, H. N., Charlson, F., Sorsdahl, K., Ahmadzada, S., Ferrari, A. J., Erskine, H., ... & Mayosi, B. M. (2019). Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. *The Lancet Global Health*, *7*(10), e1375-e1387.

Gouveia, M. J., Carona, C., Canavarro, M. C., & Moreira, H. (2016). Self-compassion and dispositional mindfulness are associated with parenting styles and parenting stress: The mediating role of mindful parenting. *Mindfulness*, *7*(3), 700-712.

Grable, J., Heo, W., & Rabbani, A. (2015). Financial anxiety, physiological arousal, and planning intention. *Journal of Financial Therapy*, *5*(2).

Graignic-Philippe, R., Dayan, J., Chokron, S., Jacquet, A. Y., & Tordjman, S. (2014). Effects of prenatal stress on fetal and child development: a critical literature review. *Neuroscience & biobehavioral reviews*, *43*, 137-162.

Green, E. P., Tuli, H., Kwobah, E., Menya, D., Chesire, I., & Schmidt, C. (2018). Developing and validating a perinatal depression screening tool in Kenya blending Western criteria with local idioms: A mixed methods study. *Journal of Affective Disorders*, *228*, 49-59.

Grindlay, K., Dako-Gyeke, P., Ngo, T. D., Eva, G., Gobah, L., Reiger, S. T., ... & Blanchard, K. (2018). Contraceptive use and unintended pregnancy among young women and men in Accra, Ghana. *PloS one*, *13*(8), e0201663.

Grischow, J. D. (2015). 'I nearly lost my work': chance encounters, legal empowerment and the struggle for disability rights in Ghana. *Disability & Society*, *30*(1), 101-113.

Guardino, C. M., Dunkel Schetter, C., Bower, J. E., Lu, M. C., & Smalley, S. L. (2014). Randomised controlled pilot trial of mindfulness training for stress reduction during pregnancy. *Psychology & health*, *29*(3), 334-349.

Guardino, C. M., & Schetter, C. D. (2014). Understanding Pregnancy Anxiety: Concepts, Correlates, and Consequences. *Zero to three*, *34*(4), 12-21.

Guo, N., Bindt, C., Te Bonle, M., Appiah-Poku, J., Hinz, R., Barthel, D., ... & Schlüter, L. (2013). Association of antepartum and postpartum depression in Ghanaian and Ivorian women with febrile illness in their offspring: a prospective birth cohort study. *American journal of epidemiology*, *178*(9), 1394-1402.

Guo, N., Bindt, C., Te Bonle, M., Appiah-Poku, J., Tomori, C., Hinz, R., ... & Koffi, M. (2014). Mental health related determinants of parenting stress among urban mothers of young children–results from a birth-cohort study in Ghana and Côte d'Ivoire. *BMC psychiatry*, *14*(1), 156.

Gyamfi, E., Okyere, P., Enoch, A., & Appiah-Brempong, E. (2017). Prevalence of, and barriers to the disclosure of HIV status to infected children and adolescents in a district of Ghana. *BMC international health and human rights*, *17*(1), 1-8.

Halbreich, U. (2005). The association between pregnancy processes, preterm delivery, low birth weight, and postpartum depressions—the need for interdisciplinary integration. *American journal of obstetrics and gynecology*, *193*(4), 1312-1322.

Hamilton, M. (1960). Arating scale for depression. Journal of Neurology. *Neurosurgery, and Psychiatry*, *23*, 5642.

Hammen, C., Kim, E. Y., Eberhart, N. K., & Brennan, P. A. (2009). Chronic and acute stress and the prediction of major depression in women. *Depression and anxiety*, *26*(8), 718-723.

Hanington, L., Heron, J., Stein, A., & Ramchandani, P. (2012). Parental depression and child outcomes–is marital conflict the missing link? *Child: care, health and development*, *38*(4), 520-529.

Harmsen, R., Helms-Lorenz, M., Maulana, R., & van Veen, K. (2018). The relationship between beginning teachers' stress causes, stress responses, teaching behaviour and attrition. *Teachers and Teaching*, *24*(6), 626-643.

Harris, A., & Seckl, J. (2011). Glucocorticoids, prenatal stress and the programming of disease. *Hormones and Behavior*, *59*(3), 279–289.

Hartley, M., Tomlinson, M., Greco, E., Comulada, W. S., Stewart, J., Le Roux, I., ... & Rotheram-Borus, M. J. (2011). Depressed mood in pregnancy: prevalence and correlates in two Cape Town peri-urban settlements. *Reproductive health*, *8*(1), 9.

Harville, E. W., Savitz, D. A., Dole, N., Herring, A. H., & Thorp, J. M. (2009). Stress questionnaires and stress biomarkers during pregnancy. *Journal of women's health*, *18*(9), 1425-1433.

Harville, E. W., Xiong, X., & Buekens, P. (2009). Hurricane Katrina and perinatal health. *Birth*, *36*(4), 325-331.

Harville, E., Xiong, X., & Buekens, P. (2010). Disasters and Perinatal Health: A Systematic Review. *Obstetrics & Gynecology Survey*, *65*(11), 713–728.

Hasanjanzadeh, P., & Faramarzi, M. (2017). Relationship between maternal general and specific-pregnancy stress, anxiety, and depression symptoms and pregnancy outcome. *Journal of Clinical and Diagnostic Research*, *11*(4), VC04–VC07.

Hasler, G. (2010). Pathophysiology of depression: do we have any solid evidence of interest to clinicians? *World Psychiatry*, *9*(3), 155.

Hayes, R. M., Wu, P., Shelton, R. C., Cooper, W. O., Dupont, W. D., Mitchel, E., & Hartert, T. V. (2012). Maternal antidepressant use and adverse outcomes: a cohort study of 228,876 pregnancies. *American journal of obstetrics and gynecology*, *207*(1), 49-e1.

Heim, C., Newport, D. J., Mletzko, T., Miller, A. H., & Nemeroff, C. B. (2008). The link between childhood trauma and depression: insights from HPA axis studies in humans. *Psychoneuroendocrinology*, *33*(6), 693-710.

Hellerstein, S., Feldman, S., & Duan, T. (2016). Survey of obstetric care and cesarean delivery rates in Shanghai, China. *Birth*, *43*(3), 193-199.

Hellhammer, D. H., Stone, A. A., Hellhammer, J., & Broderick, J. (2010). Measuring stress. *Encyclopedia of behavioral neuroscience*, *2*, 186-191.

Henley, P., Lowthers, M., Koren, G., Fedha, P. T., Russell, E., VanUum, S., Arya, S., Darnell, R., Creed, I. F., Trick, C. G., & Bend, J. R. (2014). Cultural and socio-economic conditions as factors contributing to chronic stress in sub-Saharan African communities. *Canadian Journal of Physiology and Pharmacology*, *92*(9), 725–732.

Herbison, C. E., Allen, K., Robinson, M., Newnham, J., & Pennell, C. (2017). The impact of life stress on adult depression and anxiety is dependent on gender and timing of exposure. *Development and Psychopathology*, *29*(4), 1443-1454.

Heron, J., O'Connor, T. G., Evans, J., Golding, J., Glover, V., & ALSPAC Study Team. (2004). The course of anxiety and depression through pregnancy and the postpartum in a community sample. *Journal of affective disorders*, *80*(1), 65-73.

Heyningen, T. Van, Myer, L., Onah, M., Tomlinson, M., Field, S., & Honikman, S. (2016a). Antenatal depression and adversity in urban South Africa. *Journal of Affective Disorders*, *203*, 121–129.

Hicken, M. L., Hedwig, L., Morenoff, J., House, J.S., Williams, D. R., (2014) Racial/Ethnic Disparities in Hypertension Prevalence: Reconsidering the Role of Chronic Stress. *American Journal of Public Health* 104, no. 1 pp. 117-123. https://doi.org/10.2105/AJPH.2013.301395

Hobel, C. J. (2004). Stress and preterm birth. *Clinical obstetrics and gynecology*, *47*(4), 856-880.

Hobel, C . J., Goldstein, A., & Barrett, E. S. (2008). Psychosocial s t r e s s and pregnancy outcome. *Clinical obstetrics and gynecology*, *51*(2), 333-348.

Hobfoll, S. E., & Spielberger, C. D. (1992). Family stress: Integrating theory and measurement. *Journal of family psychology*, *6*(2), 99.

Hoebel, J., Maske, U. E., Zeeb, H., & Lampert, T. (2017). Social inequalities and depressive symptoms in adults: the role of objective and subjective socioeconomic status. *PloS one*, *12*(1), e0169764.

Hofmann, S. G., Asmundson, G. J. G., & Beck, A. T. (2013). The Science of Cognitive Therapy. *Behavior Therapy*, 44(2),199-212.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of psychosomatic research*.

Hong, J. Y., Lim, J., Carvalho, F., Cho, J. Y., Vaidyanathan, B., Yu, S., ... & Medzhitov, R. (2020).

Long-Term Programming of CD8 T Cell Immunity by Perinatal Exposure to Glucocorticoids. *Cell, 180*(5), 847-861.

Horne, C., Dodoo, F. N. A., & Dodoo, N. D. (2013). The shadow of indebtedness: Bridewealth and norms constraining female reproductive autonomy. *American Sociological Review*, *78*(3), 503-520.

Horvath, S., & Schreiber, C. A. (2017). Unintended pregnancy, induced abortion, and mental health. *Current psychiatry reports*, *19*(11), 77.

Horwitz, A. V., White, H. R., & Howell-White, S. (1996). Becoming married and mental health: A longitudinal study of a cohort of young adults. *Journal of Marriage and the Family*, 895-907.

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (Vol. 398). John Wiley & Sons.

Howard, L. M., Molyneaux, E., Dennis, C. L., Rochat, T., Stein, A., & Milgrom, J. (2014). Non-psychotic mental disorders in the perinatal period. *The Lancet*, *384*(9956), 1775–1788.

Howard, L. M., Oram, S., Galley, H., Trevillion, K., & Feder, G. (2013). Domestic violence and perinatal mental disorders: a systematic review and meta-analysis. *PLoS Med*, *10*(5), e1001452.

Howe, L. D., Hargreaves, J. R., & Huttly, S. R. (2008). Issues in the construction of wealth indices for the measurement of socio-economic position in low-income countries. *Emerging themes in epidemiology*, *5*(1), 3.

Huizink, A. C., Menting, B., De Moor, M. H. M., Verhage, M. L., Kunseler, F. C., Schuengel, C., & Oosterman, M. (2017). From prenatal anxiety to parenting stress: a longitudinal study. *Archives of Women's Mental Health*, *20*(5).

Hyer, M. M., & Neigh, G. N. (2019). Depression in Women. In *Neurobiology of Depression* (pp. 425-440). Academic Press.

Ibrahim, S. M., & Lobel, M. (2020). Conceptualization, measurement, and effects of pregnancy-specific stress: Review of research using the original and revised Prenatal Distress Questionnaire. *Journal of behavioral medicine*, *43*(1), 16-33.

Insaf, T. Z., Fortner, R. T., Pekow, P., Dole, N., Markenson, G., & Chasan-Taber, L. (2011). Prenatal stress, anxiety, and depressive symptoms as predictors of intention to breastfeed among Hispanic women. *Journal of Women's Health*, *20*(8), 1183-1192.

Iovino, M., Messana, T., De Pergola, G., Iovino, E., Dicuonzo, F., Guastamacchia, E., ... & Triggiani, V. (2018). The role of neurohypophyseal hormones vasopressin and oxytocin in neuropsychiatric disorders. *Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders)*, *18*(4), 341-347.

Jang, S. N., Kawachi, I., Chang, J., Boo, K., Shin, H. G., Lee, H., & Cho, S. I. (2009). Marital status, gender, and depression: analysis of the baseline survey of the Korean Longitudinal Study of Ageing (KLoSA). *Social science & medicine*, *69*(11), 1608-1615.

Janse van Rensburg, J. (2013). The psychology of poverty. *Verbum et Ecclesia*, *34*(1), 10-11.

Jarero, I., & Artigas, L. (2018). AIP model-based acute trauma and ongoing traumatic stress theoretical conceptualization. *Iberoamerican Journal of Psychotraumatology and Dissociation*, *10*(1), 1-7.

Jesulola, E., Micalos, P., & Baguley, I. J. (2018). Understanding the pathophysiology of depression: From monoamines to the neurogenesis hypothesis model-are we there yet? *Behavioural brain research*, *341*, 79-90.

Juster, R. P., Marin, M. F., Sindi, S., Nair, N. P. V., Ng, Y. K., Pruessner, J. C., & Lupien, S. J. (2011). Allostatic load associations to acute, 3-year and 6-year prospective depressive symptoms in healthy older adults. *Physiology and Behavior*, *104*(2), 360–364.

Juster, R. P., McEwen, B. S., & Lupien, S. J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience & Biobehavioral Reviews*, *35*(1), 2-16.

Kader Maideen, S. F., Sidik, S. M., Rampal, L., & Mukhtar, F. (2014). Prevalence, associated factors and predictors of depression among adults in the community of Selangor, Malaysia. *PloS one*, *9*(4), e95395.

Kaiser, T., & Menkhoff, L. (2017). *Does financial education impact financial literacy and financial behavior, and if so, when?* The World Bank.

Kajantie, E., & Räikkönen, K. (2010a). Early life predictors of the physiological stress response later in life. *Neuroscience and Biobehavioral Reviews*, *35*(1), 23–32.

Kammerer, M., Taylor, A., & Glover, V. (2006). The HPA axis and perinatal depression: a hypothesis. *Archives of women's mental health*, *9*(4), 187-196.

Kang, Y. T., Yao, Y., Dou, J., Guo, X., Li, S. Y., Zhao, C. N., ... & Li, B. (2016). Prevalence and risk factors of maternal anxiety in late pregnancy in China. *International journal of environmental research and public health*, *13*(5), 468.

Kanner, A. D., Coyne, J. C., Schaefer, C., & Lazarus, R. S. (1981). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of behavioral medicine*, *4*(1), 1-39.

Kastello, J. C., Jacobsen, K. H., Gaffney, K. F., Kodadek, M. P., Sharps, P. W., & Bullock, L. C. (2016). Predictors of depression symptoms among low-income women exposed to perinatal intimate partner violence (IPV). *Community mental health journal*, *52*(6), 683-690.

Kathree, T., Selohilwe, O. M., Bhana, A., & Petersen, I. (2014). Perceptions of postnatal depression and healthcare needs in a South African sample: the "mental" in maternal healthcare. *BMC Women's Health*, *14*(1), 140.

Katz, V. L. (2012). Work and work-related stress in pregnancy. *Clinical obstetrics and gynecology*, *55*(3), 765-773.

Kendler, K. S., Gardner, C. O., & Prescott, C. A. (2002). Toward a comprehensive developmental model for major depression in women. *American Journal of Psychiatry*, *159*(7), 1133-1145.

Kesmodel, U. S. (2018). Cross-sectional studies–what are they good for?. *Acta obstetricia et gynecologica Scandinavica*, *97*(4), 388-393.

Kessler, R. C. (2003). The effects of stressful life events on depression. *Annual review of psychology*, *48*(1), 191-214.

Khan, A., Faucett, J., Lichtenberg, P., Kirsch, I., & Brown, W. A. (2012). A systematic review of comparative efficacy of treatments and controls for depression. *PloS one*, *7*(7), e41778.

Kim, E. J., Pellman, B., & Kim, J. J. (2015). Stress effects on the hippocampus: a critical review. *Learning & memory*, *22*(9), 411-416.

Kim, H. K., & McKenry, P. C. (2002). The relationship between marriage and psychological well-being A longitudinal analysis. *Journal of family Issues*, *23*(8), 885-911.

Kim, Y. J., van Rooij, S. J., Ely, T. D., Fani, N., Ressler, K. J., Jovanovic, T., & Stevens, J. S. (2019). Association between posttraumatic stress disorder severity and amygdala habituation to fearful stimuli. *Depression and anxiety*, *36*(7), 647-658.

Klein, E. M., Brähler, E., Dreier, M., Reinecke, L., Müller, K. W., Schmutzer, G., ... & Beutel, M. E. (2016). The German version of the Perceived Stress Scale–psychometric characteristics in a representative German community sample. *BMC psychiatry*, *16*(1), 159.

Klengel, T., Mehta, D., Anacker, C., Rex-Haffner, M., Pruessner, J. C., Pariante, C. M., ... & Nemeroff, C. B. (2013). Allele-specific FKBP5 DNA demethylation mediates gene–childhood trauma interactions. *Nature neuroscience*, *16*(1), 33-41.

Klutsey, E. E., & Ankomah, A. (2014). Factors associated with induced abortion at selected hospitals in the Volta Region, Ghana. *International journal of women's health*, *6*, 809.

Korang-Okrah, R. (2012). *Risk and resilience: Ghanaian (Akan) widows and property rights* (Doctoral dissertation, University of Illinois at Urbana-Champaign).

Koren, G., & Nordeng, H. (2012). Antidepressant use during pregnancy: the benefit risk ratio. *American journal of obstetrics and gynecology*, *207*(3), 157-163.

Korte, S. M., Koolhaas, J. M., Wingfield, J. C., & McEwen, B. S. (2005). The Darwinian concept of stress: Benefits of allostasis and costs of allostatic load and the trade-offs in health and disease. *Neuroscience and Biobehavioral Reviews*, *29*(1 SPEC. ISS.), 3–38.

Kotoh, A. M., & Boah, M. (2019). "No visible signs of pregnancy, no sickness, no antenatal care": Initiation of antenatal care in a rural district in Northern Ghana. *BMC public health*, *19*(1), 1094.

Kpobi, L., & Swartz, L. (2019). Ghanaian traditional and faith healers' explanatory models of intellectual disability. *Journal of Applied Research in Intellectual Disabilities*, *32*(1), 43-50.

Kramer, M. S., Lydon, J., Goulet, L., Kahn, S., Dahhou, M., Platt, R. W., ... & Séguin, L. (2013). Maternal stress/distress, hormonal pathways and spontaneous preterm birth. *Paediatric and perinatal epidemiology*, *27*(3), 237-246.

Krause, M., Gutsmiedl, K., Bighelli, I., Schneider-Thoma, J., Chaimani, A., & Leucht, S. (2019).

Efficacy and tolerability of pharmacological and non-pharmacological interventions in older patients with major depressive disorder: A systematic review, pairwise and network meta- analysis. *European Neuropsychopharmacology*, *29*(9), 1003-1022.

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613.

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *General hospital psychiatry*, *32*(4), 345-359.

Kudielka, B. M., & Wüst, S. (2010). Human models in acute and chronic stress: assessing determinants of individual hypothalamus–pituitary–adrenal axis activity and reactivity. *Stress*, *13*(1), 1-14.

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

Kuhlman, K. R., Vargas, I., Geiss, E. G., & Lopez-Duran, N. L. (2015). Age of Trauma Onset and HPA Axis Dysregulation Among Trauma-Exposed Youth. *Journal of Traumatic Stress*, *28*(6), 572-579.

Kupper, N., & Denollet, J. (2007). Type D personality as a prognostic factor in heart disease: assessment and mediating mechanisms. *Journal of personality assessment*, *89*(3), 265-276.

Kusters, A. (2015). Peasants, Warriors, and the Streams: Language Games and Etiologies of Deafness in Adamorobe, Ghana. *Medical anthropology quarterly*, *29*(3), 418-436.

Kwegyir-Afful, E., Verbeek, J., Aziato, L., Seffah, J. D., & Räsänen, K. (2018). A Liftless intervention to prevent preterm birth and low Birthweight among pregnant Ghanaian women: protocol of a stepped-wedge cluster randomized controlled trial. *JMIR research protocols*, *7*(8), e10095.

Kyei, J. J., Dueck, A., Indart, M. J., & Nyarko, N. Y. (2014). Supernatural belief systems, mental health and perceptions of mental disorders in Ghana. *International Journal of Culture and Mental Health*, *7*(2), 137-151.

Laar, A.K., Lartey, M. Y., Ankomah, A., Okyerefo, M. P. K., Ampah, E. A., Letsa, D. P., Nortey, P. A., & Kwara, A. (2018). Food elimination, food substitution, and nutrient supplementation among ARV-exposed HIV-positive persons in southern Ghana. *Journal of Health, Population and Nutrition*, *37*(1).

Laar, Amos K., Grant, F. E., Addo, Y., Soyiri, I., Nkansah, B., Abugri, J., Laar, A. S., Ampofo, W. K., Tuakli, J. M., & Quakyi, I. A. (2013). Predictors of fetal anemia and cord blood malaria parasitemia among newborns of HIV-positive mothers. *BMC Research Notes*, *6*(1), 1.

Lachman, J. M., Sherr, L. T., Cluver, L., Ward, C. L., Hutchings, J., & Gardner, F. (2016). Integrating evidence and context to develop a parenting program for low-income families in South Africa. *Journal of Child and Family Studies*, *25*(7), 2337-2352.

Lamb, K. A., Lee, G. R., & DeMaris, A. (2003). Union formation and depression: Selection and relationship effects. *Journal of Marriage and Family*, *65*(4), 953-962.

Lambert, W. W., & Lazarus, R. S. (1970). Psychological Stress and the Coping Process. *The American Journal of Psychology*, 634-637.

Langan, R. C., & Goodbred, A. J. (2016). Identification and management of peripartum depression. *American family physician*, *93*(10), 852-858.

Latendresse, G. (2009). The interaction between chronic stress and pregnancy: preterm birth from a biobehavioral perspective. *Journal of midwifery & women's health*, *54*(1), 8-17.

Law, R. (2011). Interpersonal psychotherapy for depression. *Advances in psychiatric treatment*, *17*(1), 23-31.

Lawrence, D. J. (2007). The four principles of biomedical ethics: a foundation for current bioethical debate. *Journal of Chiropractic Humanities*, *14*, 34-40.

Lazarus, R. S. (1966). *Psychological stress and the coping process*. McGrawHill series in psychology. https://doi.org/10.2307/1420698

Leahy-Warren, P., & McCarthy, G. (2011). Maternal parental self-efficacy in the postpartum period. *Midwifery*, *27*(6), 802-810.

Lecic-Tosevski, D., Vukovic, O., & Stepanovic, J. (2011). Stress and personality. *Psychiatriki*, *22*(4), 290-297.

Lee, B. E., Ha, M., Park, H., Hong, Y. C., Kim, Y., Kim, Y. J., & Ha, E. H. (2011). Psychosocial work stress during pregnancy and birthweight. *Paediatric and perinatal epidemiology*, *25*(3), 246-254.

Lee, R. S., Tamashiro, K. L., Yang, X., Purcell, R. H., Harvey, A., Willour, V. L., ... & Potash, J. B. (2010). Chronic corticosterone exposure increases expression and decreases deoxyribonucleic acid methylation of Fkbp5 in mice. *Endocrinology*, *151*(9), 4332-4343.

Lefkovics, E., Baji, I., & Rigó, J. (2014). Impact of maternal depression on pregnancies and on early attachment. *Infant mental health journal*, *35*(4), 354-365.

Leigh, B., & Milgrom, J. (2007). Acceptability of antenatal screening for depression in routine antenatal care. *Australian Journal of Advanced Nursing, The*, *24*(3), 14.

Lemma, S., Gelaye, B., Berhane, Y., Worku, A., & Williams, M. A. (2012). Sleep quality and its psychological correlates among university students in Ethiopia: a cross-sectional study. *BMC psychiatry*, *12*(1), 237.

Leung, D. Y., Lam, T. H., & Chan, S. S. (2010). Three versions of Perceived Stress Scale: validation in a sample of Chinese cardiac patients who smoke. *BMC public health*, *10*(1), 513.

Liou, S. R., Wang, P., & Cheng, C. Y. (2014). Longitudinal study of perinatal maternal stress, depressive symptoms and anxiety. *Midwifery*, *30*(6), 795-801.

Lloyd-Sherlock, P., Agrawal, S., Amoakoh-Coleman, M., Adom, S., Adjetey-Sorsey, E., Rocco, I., & Minicuci, N. (2019). Old age and depression in Ghana: assessing and addressing diagnosis and treatment gaps. *Global health action*, *12*(1), 1678282.

Lobel, M. (1994). Conceptualizations, measurement, and effects of prenatal maternal stress on birth outcomes. *Journal of behavioral medicine*, *17*(3), 225-272.

Lobel, M., Cannella, D. L., Graham, J. E., DeVincent, C., Schneider, J., & Meyer, B. A. (2008). Pregnancy-specific stress, prenatal health behaviors, and birth outcomes. *Health psychology*, *27*(5), 604.

Locke, A., Kirst, N., & Shultz, C. G. (2015). Diagnosis and management of generalized anxiety disorder and panic disorder in adults. *American Family Physician*, *91*(9), 617-624.

Logan, J. G., & Barksdale, D. J. (2008). Allostasis and allostatic load: expanding the discourse on stress and cardiovascular disease. *Journal of clinical nursing*, *17*(7b), 201-208.

Lommatzsch, M., Hornych, K., Zingler, C., Schuff-Werner, P., Höppner, J., & Virchow, J. C. (2006). Maternal serum concentrations of BDNF and depression in the perinatal period. *Psychoneuroendocrinology*, *31*(3), 388-394.

Loyd, B. H., & Abidin, R. R. (1985). Revision of the parenting stress index. *Journal of Pediatric Psychology*, *10*(2), 169-177.

Lu, S., Gao, W., Huang, M., Li, L., & Xu, Y. (2016). In search of the HPA axis activity in unipolar depression patients with childhood trauma: Combined cortisol awakening response and dexamethasone suppression test. *Journal of psychiatric research*, *78*, 24-30.

Lund, C., Alem, A., Schneider, M., Hanlon, C., Ahrens, J., Bandawe, C., ... & Cowan, F. (2015). Generating evidence to narrow the treatment gap for mental disorders in sub-Saharan Africa: rationale, overview and methods of AFFIRM. *Epidemiology and psychiatric sciences*, *24*(3), 233-240.

Lupien, S. J., & Seguin, F. (2013). How to measure stress in humans. *Centre for Studies in Human Stress*.

Lybbert, T. J., & Wydick, B. (2018). Poverty, aspirations, and the economics of hope. *Economic Development and Cultural Change*, *66*(4), 709-753.

Maccari, S., Krugers, H. J., Morley-Fletcher, S., Szyf, M., & Brunton, P. J. (2014). The consequences of early-life adversity: neurobiological, behavioural and epigenetic adaptations. *Journal of neuroendocrinology*, *26*(10), 707-723.

Majodina, M. Z., & Johnson, F. A. (1983). Standardized assessment of depressive disorders (SADD) in Ghana. *The British Journal of Psychiatry*, *143*(5), 442-446.

Malone, C. D., Bhowmick, A., & Wachholtz, A. B. (2015). Migraine: treatments, comorbidities, and quality of life, in the USA. *Journal of pain research*, *8*, 537–547. https://doi.org/10.2147/JPR.S88207

Malta, L. A., McDonald, S. W., Hegadoren, K. M., Weller, C. A., & Tough, S. C. (2012). Influence of interpersonal violence on maternal anxiety, depression, stress and parenting morale in the early postpartum: a community-based pregnancy cohort study. *BMC pregnancy and childbirth*, *12*(1), 153.

Manikkam, L., & Burns, J. K. (2012). Antenatal depression and its risk factors: an urban prevalence study in KwaZulu-Natal. *South African Medical Journal*, *102*(12), 940-944.

Manning, L. K. (2014). Enduring as lived experience: exploring the essence of spiritual resilience for women in late life. *Journal of religion and health*, *53*(2), 352-362.

Marin, M. F., Lord, C., Andrews, J., Juster, R. P., Sindi, S., Arsenault-Lapierre, G., ... & Lupien, S. J. (2011). Chronic stress, cognitive functioning and mental health. *Neurobiology of learning and memory*, *96*(4), 583-595.

Maroufizadeh, S., Hosseini, M., Foroushani, A. R., Omani-Samani, R., & Amini, P. (2019). The relationship between perceived stress and marital satisfaction in couples with infertility: actor-partner interdependence model. *International journal of fertility & sterility*, *13*(1), 66.

Mastorakos, G., & Ilias, I. (2003). Maternal and fetal hypothalamic-pituitary-adrenal axes during pregnancy and postpartum. *Annals of the New York Academy of Sciences*, *997*(1), 136-149.

Mbunga, J. M. (2011). An exploratory study of marital satisfaction of forty couples at the Africa Inland Church, Jericho, Nairobi, with the view to inform premarital counseling practices in Kenya. (Doctoal dissertation) Asbury Theological Seminary.

McCubbin, H. I., Joy, C. B., Cauble, A. E., Comeau, J. K., Patterson, J. M., & Needle, R. H. (1980). Family stress and coping: A decade review. *Journal of Marriage and the Family*, 855-871.

McDonagh, M. S., Matthews, A., Phillipi, C., Romm, J., Peterson, K., Thakurta, S., & Guise, J. M. (2014). Depression drug treatment outcomes in pregnancy and the postpartum period: a systematic review and meta-analysis. *Obstetrics & Gynecology*, *124*(3), 526-534.

McEwen, B. S. (2003). Mood disorders and allostatic load. *Biological Psychiatry*, *54*(3), 200–207.

McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological reviews*, *87*(3), 873-904.

McEwen, B. S., Eiland, L., Hunter, R. G., & Miller, M. M. (2012). Stress and anxiety: structural plasticity and epigenetic regulation as a consequence of stress. *Neuropharmacology*, *62*(1), 3-12.

McEwen, B. S., & Gianaros, P. J. (2010). Central role of the brain in stress and adaptation: links to socioeconomic status, health, and disease. *Annals of the New York Academy of Sciences*, *1186*, 190.

McEwen, B. S., & Wingfield, J. C. (2010). What is in a name? Integrating homeostasis, allostasis and stress. *Hormones and Behavior*, *57*(2), 105–111.

McIntosh, E., Gillanders, D., & Rodgers, S. (2010). Rumination, goal linking, daily hassles and life events in major depression. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice*, *17*(1), 33-43.

McStay, R. L., Dissanayake, C., Scheeren, A., Koot, H. M., & Begeer, S. (2014). Parenting stress and autism: The role of age, autism severity, quality of life and problem behaviour of children and adolescents with autism. *Autism*, *18*(5), 502-510.

Melville, J. L., Gavin, A., Guo, Y., Fan, M. Y., & Katon, W. J. (2010). Depressive disorders during pregnancy: prevalence and risk factors in a large urban sample. *Obstetrics and gynecology*, *116*(5), 1064.

Menard, S. (2011). Standards for standardized logistic regression coefficients. *Social Forces*, *89*(4), 1409-1428.

Meyer, D., & Paul, R. (2011). A cross-national examination of marriage and early life stressors as correlates of depression, anxiety, and stress. *The Family Journal*, *19*(3), 274-280.

Miller, A. H., & Raison, C. L. (2016). The role of inflammation in depression: from evolutionary imperative to modern treatment target. *Nature reviews immunology*, *16*(1), 22.

American Psychological Association. (2011). Stress: The different kinds of stress. *Retrieved from American Psychological Association website: http://www. apa. org/helpcenter/stress-kinds. aspx.*

Millsap, R. E., & Maydeu-Olivares, A. (2012). *The SAGE handbook of quantitative methods in psychology*. Sage Publications.

Miracle, V. A. (2016). The Belmont Report: The triple crown of research ethics. *Dimensions of Critical Care Nursing*, *35*(4), 223-228.

Miyazaki, M., Benson-Martin, J. J., Stein, D. J., & Hollander, E. (2016). Anxiety disorders. *Encyclopedia of Neuroscience*, 493-497

Mogre, V., Dery, M., & Gaa, P. K. (2016). Knowledge, attitudes and determinants of exclusive breastfeeding practice among Ghanaian rural lactating mothers. *International breastfeeding journal*, *11*(1), 12.

Möhler, H. (2012). The GABA system in anxiety and depression and its therapeutic potential. *Neuropharmacology*, *62*(1), 42-53.

Molenaar, N. M., Brouwer, M. E., Bockting, C. L., Bonsel, G. J., van der Veere, C. N., Torij, H. W., ... & Lambregtse-van den Berg, M. P. (2016). Stop or go? Preventive cognitive therapy with guided tapering of antidepressants during pregnancy: study protocol of a pragmatic multicentre non-inferiority randomized controlled trial. *BMC psychiatry*, *16*(1), 72.

Montgomery, S., & Åsberg, M. (1979). A New Depression Scale Designed to be Sensitive to Change. *British Journal of Psychiatry, 134*(4), 382-389. doi:10.1192/bjp.134.4.382

Morrison, B., & Ludington-Hoe, S. (2012). Interruptions toBreastfeeding Dyads in an DRP Unit. *MCN: The American Journal of Maternal/Child Nursing*, *37*(1), 36-41.

Morrison, S., Shenassa, E. D., Mendola, P., Wu, T., & Schoendorf, K. (2013). Allostatic load may not be associated with chronic stress in pregnant women, NHANES 1999-2006. *Annals of Epidemiology*, *23*(5), 294–297.

Moyer, C. A., Adongo, P. B., Aborigo, R. A., Hodgson, A., Engmann, C. M., & DeVries, R. (2014). "It's up to the woman's people": how social factors influence facility-based delivery in Rural Northern Ghana. *Maternal and child health journal*, *18*(1), 109-119.

Murray, D., & Cox, J. L. (1990). Screening for depression during pregnancy with the Edinburgh Depression Scale (EDDS). *Journal of reproductive and infant psychology*, *8*(2), 99-107.

Mutumba, M., Bauermeister, J. A., Musiime, V., Byaruhanga, J., Francis, K., Snow, R. C., & Tsai, A. C. (2015). Psychosocial challenges and strategies for coping with HIV among adolescents in Uganda: a qualitative study. *AIDS patient care and STDs*, *29*(2), 86-94.

Mutambudzi, M., Meyer, J. D., Warren, N., & Reisine, S. (2011). Effects of psychosocial characteristics of work on pregnancy outcomes: a critical review. *Women & health*, *51*(3), 279-297.

Muzik, M., & Borovska, S. (2010). Perinatal depression: implications for child mental health. *Mental Health in Family Medicine*, *7*(4), 239.

Muzik, M., Marcus, S. M., Flynn, H., & Rosenblum, K. L. (2010). Depression during pregnancy: detection, comorbidity and treatment. *Asia-Pacific Psychiatry*, *2*(1), 7-18.

Myrtek, M. (2001). Meta-analyses of prospective studies on coronary heart disease, type A personality, and hostility. *International journal of cardiology*, *79*(2-3), 245-251.

Naab, F., Brown, R., & Heidrich, S. (2013). Psychosocial health of infertile Ghanaian women and their infertility beliefs. *Journal of Nursing Scholarship*, *45*(2), 132-140.

Naami, A. (2015). Disability, gender, and employment relationships in Africa: The case of Ghana. *African Journal of Disability*, *4*(1).

Nabeshima, T., & Kim, H. C. (2013). Involvement of genetic and environmental factors in the onset of depression. *Experimental neurobiology*, *22*(4), 235-243.

Nakao, M. (2010). Work-related stress and psychosomatic medicine. *BioPsychoSocial medicine*, *4*(1),4.

Nartey, V. K., Nanor, J. N., & Klake, R. K. (2012). Effects of Quarry Activities on some Selected Communities in the Lower Manya Krobo District of the Eastern Region of Ghana. *Atmospheric and Climate Sciences*, *3*(2), 1-11.

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1978). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. [Bethesda, Md.]: The Commission.

Erhabor, S. I., & Ndlovu, N. J. (2013). How happy are married people? Psychological indicators of marital satisfaction of married men and women in Gauteng Province, South Africa. *Gender and Behaviour*, *11*(2), 5486-5498.

Nie, C., Dai, Q., Zhao, R., Dong, Y., Chen, Y., & Ren, H. (2017). The impact of resilience on psychological outcomes in women with threatened premature labor and spouses: a cross-sectional study in Southwest China. *Health and Quality of Life Outcomes*, *15*(1), 26.

Nielsen, M. G., Ørnbøl, E., Vestergaard, M., Bech, P., Larsen, F. B., Lasgaard, M., & Christensen, K. S. (2016). The construct validity of the Perceived Stress Scale. *Journal of PsychosomaticResearch*, *84*, 22–30.

Noble, D. (2008). Claude Bernard, the first systems biologist, and the future of physiology. *Experimental physiology*, *93*(1), 16-26.

Nuertey, B., Gumanga, S., Kolbila, D., Malechi, H., Asilfi, A., & Konsosa, M. (2017). External structural congenital anomalies diagnosed at birth in Tamale Teaching Hospital. *Postgrad Med J Ghana*, *6*(1), 5.

Nukpezah, J. A., & Blankson, C. (2017). Microfinance intervention in poverty reduction: A study of women farmer-entrepreneurs in rural Ghana. *Journal of African Business*, *18*(4), 457-475.

Nyarko, S. H. (2019). Unintended pregnancy among pregnant women in Ghana: prevalence and predictors. *Journal of pregnancy*, *2019*.

O'Connell, M. A., Leahy-Warren, P., Khashan, A. S., Kenny, L. C., & O'Neill, S. M. (2017). Worldwide prevalence of tocophobia in pregnant women: systematic review and meta-analysis. *Acta obstetricia et gynecologica Scandinavica*, *96*(8), 907-920.

Ofori-Asenso, R., Agyeman, A. A., Laar, A., & Boateng, D. (2016). Overweight and obesity epidemic in Ghana—a systematic review and meta-analysis. *BMC public health*, *16*(1), 1239.

Ola, B., Crabb, J., Tayo, A., Ware, S. H. G., Dhar, A., & Krishnadas, R. (2011). Factors associated with antenatal mental disorder in West Africa: A cross-sectional survey. *BMC pregnancy and childbirth*, *11*(1), 90.

Olson, D., Severson, E., Verstraeten, B., Ng, J., McCreary, J., & Metz, G. (2015). Allostatic Load and Preterm Birth. *International Journal of Molecular Sciences*, *16*(12), 29856–29874.

Olson, J. R., Marshall, J. P., Goddard, H. W., & Schramm, D. G. (2015). Shared religious beliefs, prayer, and forgiveness as predictors of marital satisfaction. *Family Relations*, *64*(4), 519-533.

Onyango, M. A., Adu-Sarkodie, Y., Adjei, R. O., Agyarko-Poku, T., Kopelman, C. H., Green, K., ... & Beard, J. (2019). Love, power, resilience and vulnerability: Relationship dynamics between female sex workers in Ghana and their intimate partners. *Culture, Health & Sexuality*, *21*(1), 31-45.

Opoku-Acheampong, A., Kretchy, I. A., Acheampong, F., Afrane, B. A., Ashong, S., Tamakloe, B., & Nyarko, A. K. (2017). Perceived stress and quality of life of pharmacy students in University of Ghana. *BMC research notes*, *10*(1), 115.

Opoku, M. P., Alupo, B. A., Gyamfi, N., Odame, L., Mprah, W. K., Torgbenu, E. L., & Eric, B. (2017). The family and disability in Ghana: highlighting gaps in achieving social inclusion. *Disability, CBR & Inclusive Development*, *28*(4), 41-59.

Oppong Asante, K., Osafo, J., & Nyamekye, G. K. (2014). An exploratory study of factors contributing to divorce among married couples in Accra, Ghana: A qualitative approach. *Journal of Divorce & Remarriage*, *55*(1), 16-32.

Osuch, E., & Marais, A. (2017). The pharmacological management of depression-update 2017. *SA Pharmaceutical Journal*, *84*(2), 36–45.

Otte, C. (2011). Cognitive behavioral therapy in anxiety disorders: current state of the evidence. *Dialogues in clinical neuroscience*, *13*(4), 413.

Owusu, A. E. S., & Agbemafle, I. (2016). Determinants of domestic violence against women in Ghana. *BMC public health*, *16*(1), 1-9.

Pacak, K., & Palkovits, M. (2001). Stressor specificity of central neuroendocrine responses: implications for stress-related disorders. *Endocrine reviews*, *22*(4), 502-548.

Pacak, K., Palkovits, M., Kopin, I. J., & Goldstein, D. S. (1995). Stress-induced norepinephrine release in the hypothalamic paraventricular nucleus and pituitary-adrenocortical and sympathoadrenal activity: in vivo microdialysis studies. *Frontiers in neuroendocrinology*, *16*(2), 89-150.

Pais, M., & Pai, M. V. (2018). Stress among pregnant women: a systematic review. *J Clin Diagn Res*, *12*(5), LE01-LE04.

Palazidou, E. (2012). The neurobiology of depression. *British medical bulletin*, *101*(1), 127-145.

Pantha, S., Hayes, B., Yadav, B. K., Sharma, P., Shrestha, A., & Gartoulla, P. (2014). Prevalence of stress among pregnant women attending antenatal care in a tertiary maternity hospital in Kathmandu. *J Women's Healthcare*, *3*(5), 183.

Park, H. J., & Friston, K. (2013). Structural and functional brain networks: from connections to cognition. *Science*, *342*(6158).

Patel, B. B., Gurmeet, P., Sinalkar, D. R., Pandya, K. H., Mahen, A., & Singh, N. (2016). A study on knowledge and practices of antenatal care among pregnant women attending antenatal clinic at a Tertiary Care Hospital of Pune, Maharashtra. *Medical Journal of Dr. DY Patil University*, *9*(3), 354.

Paykel, E. S. (1997). The interview for recent life events. *Psychological medicine*, *27*(2), 301-310.

Pechtel, P., & Pizzagalli, D. A. (2011). Effects of early life stress on cognitive and affective function: an integrated review of human literature. *Psychopharmacology*, *214*(1), 55-70.

Peñacoba-Puente, C., Carmona-Monge, F. J., Marín-Morales, D., & Naber, K. (2013). Coping strategies of Spanish pregnant women and their impact on anxiety and depression. *Research in nursing & health*, *36*(1), 54-64.

Pereira, A. T., Bos, S. C., Marques, M., Maia, B. R., Soares, M. J., Valente, J., Gomes, A. A., MacEdo, A., & De Azevedo, M. H. P. (2011). The postpartum depression screening scale: Is it valid to screen for antenatal depression? *Archives of Women's Mental Health*.

Petraglia, F., Serour, G., Chapron, C., (2013). The Changing Prevalence of Infertility. *International Journal of Gynecology & Obstetrics*, 123: S4-S8. https://doi.org/10.1016/j.ijgo.2013.09.005

Pietrzak, R. H., Goldstein, R. B., Southwick, S. M., & Grant, B. F. (2012). Psychiatric comorbidity of full and partial posttraumatic stress disorder among older adults in the United States: results from wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. *The American Journal of Geriatric Psychiatry*, *20*(5), 380-390.

Piff, P. K., & Robinson, A. R. (2017). Social class and prosocial behavior: Current evidence, caveats, and questions. *Current opinion in psychology*, *18*, 6-10.

Pigott, H. E., Leventhal, A. M., Alter, G. S., & Boren, J. J. (2010). Efficacy and effectiveness of antidepressants: current status of research. *Psychotherapy and psychosomatics*, *79*(5), 267-279.

Pinquart, M. (2018). Parenting stress in caregivers of children with chronic physical condition A meta-analysis. *Stress and Health*, *34*(2), 197-207.

Pittenger, C., & Duman, R. S. (2008). Stress, depression, and neuroplasticity: a convergence of mechanisms. *Neuropsychopharmacology*, *33*(1), 88-109.

Plieger, T., Melchers, M., Montag, C., Meermann, R., & Reuter, M. (2015). Life stress as potential risk factor for depression and burnout. *Burnout Research*, *2*(1), 19-24.

Pool, M. S., Otupiri, E., Owusu-Dabo, E., De Jonge, A., & Agyemang, C. (2014). Physical violence during pregnancy and pregnancy outcomes in Ghana. *BMC pregnancy and childbirth*, *14*(1), 1-8.

Porter, R. J., & Gallagher, P. (2006). Abnormalities of the HPA axis in affective disorders: clinical subtypes and potential treatments. *Acta Neuropsychiatrica*, *18*(5), 193-209.

Kasalova, P., Prasko, J., Holubová, M., Vrbova, K., Zmeskalova, D., Slepecky, M., & Grambal, A. (2017). Anxiety disorders and marital satisfaction. *Neuroendocrinology Letters*, *38*(8), 555-564.

Provenzi, L., Giorda, R., Beri, S., & Montirosso, R. (2016). SLC6A4 methylation as an epigenetic marker of life adversity exposures in humans: a systematic review of literature. *Neuroscience & Biobehavioral Reviews*, *71*, 7-20.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement*, *1*(3), 385-401.

Radoš Nakić, S., Tadinac, M., & Herman, R. (2018). Anxiety during pregnancy and postpartum: course, predictors and comorbidity with postpartum depression. *Acta Clinica Croatica*, *57*(1.), 39-51.

Radtke, K. M., Ruf, M., Gunter, H. M., Dohrmann, K., Schauer, M., Meyer, A., & Elbert, T. (2011). Transgenerational impact of intimate partner violence on methylation in the promoter of the glucocorticoid receptor. *Translational psychiatry*, *1*(7), e21-e21.

Raikes, H. A., & Thompson, R. A. (2005). Efficacy and social support as predictors of parenting stress among families in poverty. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *26*(3), 177-190.

Rallis, S., Skouteris, H., McCabe, M., & Milgrom, J. (2014). The transition to motherhood: towards a broader understanding of perinatal distress. *Women and Birth*, *27*(1), 68-71.

Ramakrishnan, A., Spangenberg, K., & Gold, K. J. (2013). Perceptions of perinatal depression training among primary care providers and obstetricians in Kumasi, Ghana. *Contraception*, *88*(2), 314.

Raskin, M., Easterbrooks, M. A., Lamoreau, R. S., Kotake, C., & Goldberg, J. (2016). Depression trajectories of antenatally depressed and nondepressed young mothers: implications for child socioemotional development. *Women's Health Issues*, *26*(3), 344-350.

Read, U. M., & Doku, V. C. K. (2012). Mental health research in Ghana: a literature review. *Ghana Medical Journal*, *46*(2), 29-38.

Rehm, J., & Shield, K. D. (2019). Global burden of disease and the impact of mental and addictive disorders. *Current psychiatry reports*, *21*(2), 10.

Remes, O., Brayne, C., Van Der Linde, R., & Lafortune, L. (2016). A systematic review of reviews on the prevalence of anxiety disorders in adult populations. *Brain and behavior*, *6*(7), e00497.

Respler-Herman, M., Mowder, B. A., Yasik, A. E., & Shamah, R. (2012). Parenting Beliefs, Parental Stress, and Social Support Relationships. *Journal of Child and Family Studies*.

Reynolds, R. M., Pesonen, A. K., O'reilly, J. R., Tuovinen, S., Lahti, M., Kajantie, E., ... & Räikkönen, K. (2015). Maternal depressive symptoms throughout pregnancy are associated with increased placental glucocorticoid sensitivity. *Psychological Medicine*, *45*(10), 2023.

Rincel, M., Lepinay, A. L., Delage, P., Fioramonti, J., Theodorou, V. S., Laye, S., & Darnaudery, M. (2016). Maternal high-fat diet prevents developmental programming by early-life stress. *Translational psychiatry*, *6*(11), e966-e966.

Roberts, L., Hales R., Yudofsky, S., (2019). The American Psychiatric Association Publishing Textbook of Psychiatry. Seventh edition. | Washington, D.C.: American Psychiatric Association Publishing, [2019]

Roberts, M., Mogan, C., & Asare, J. B. (2014). An overview of Ghana's mental health system: results from an assessment using the World Health Organization's Assessment Instrument for Mental Health Systems (WHO-AIMS). *International Journal of Mental Health Systems*, *8*(1), 16.

Rochat, T. J., Tomlinson, M., Bärnighausen, T., Newell, M. L., & Stein, A. (2011). The prevalence and clinical presentation of antenatal depression in rural South Africa. *Journal of affective disorders*, *135*(1-3), 362-373.

Rondung, E., Thomtén, J., & Sundin, Ö. (2016). Psychological perspectives on fear of childbirth. *Journal of anxiety disorders*, *44*, 80-91.

Rook, G. A., Lowry, C. A., & Raison, C. L. (2013). Microbial 'Old Friends', immunoregulation and stress resilience. *Evolution, medicine, and public health*, *2013*(1), 46-64.

Rouhe, H., Salmela-Aro, K., Gissler, M., Halmesmäki, E., & Saisto, T. (2011). Mental health problems common in women with fear of childbirth. *BJOG: An International Journal of Obstetrics & Gynaecology*, *118*(9), 1104-1111.

Rubertsson, C., Hellström, J., Cross, M., & Sydsjö, G. (2014). Anxiety in early pregnancy: prevalence and contributing factors. *Archives of women's mental health*, *17*(3), 221-228.

Rubinchik, S. M., Kablinger, A. S., & Gardner, J. S. (2005). Medications for panic disorder and generalized anxiety disorder during pregnancy. *Primary care companion to the Journal of clinical psychiatry*, *7*(3), 100.

Rutstein, S. O., & Staveteig, S. (2014). Making the Demographic and Health Surveys Wealth Index comparable. Paper Presented at the 27th IUSSP International Population Conference, 26-31August 2013, BEXCO, Busan, Korea

Ryding, E. L., Lukasse, M., Parys, A. S. V., Wangel, A. M., Karro, H., Kristjansdottir, H., ... & Bidens Group. (2015). Fear of childbirth and risk of cesarean delivery: a cohort study in six European countries. *Birth*, *42*(1), 48-55.

Salomonsson, B., Berterö, C., & Alehagen, S. (2013). Self-efficacy in pregnant women with severe fear of childbirth. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, *42*(2), 191-202.

Sandberg, J. G., Yorgason, J. B., Miller, R. B., & Hill, E. J. (2012). Family-to-work spillover in Singapore: Marital distress, physical and mental health, and work satisfaction. *Family Relations*, *61*(1), 1-15.

Sandi, C. (2013). Stress and cognition. *Wiley Interdisciplinary Reviews: Cognitive Science*, *4*(3), 245-261.

Sapolsky, R. M. (1990). Stress in the wild. *Scientific American*, *262*(1), 116-123.

Sarris, J., O'Neil, A., Coulson, C. E., Schweitzer, I., & Berk, M. (2014). Lifestyle medicine for depression. *BMC psychiatry*, *14*(1), 1-13.

Sasaki, A., De Vega, W. C., St-Cyr, S., Pan, P., & McGowan, P. O. (2013). Perinatal high fat diet alters glucocorticoid signaling and anxiety behavior in adulthood. *Neuroscience*, *240*, 1-12.

Saveanu, R. V., & Nemeroff, C. B. (2012). Etiology of depression: genetic and environmental factors. *Psychiatric Clinics*, *35*(1), 51-71.

Sawyer, A., Ayers, S., & Smith, H. (2010). Pre- and postnatal psychological wellbeing in Africa: A systematic review. *Journal of Affective Disorders*, *123*(1–3), 17–29.

Schmitt, A., Malchow, B., Hasan, A., & Fallkai, P. (2014). The impact of environmental factors in severe psychiatric disorders. *Frontiers in neuroscience*, *8*, 19.

Schwabe, L., Joëls, M., Roozendaal, B., Wolf, O. T., & Oitzl, M. S. (2012). Stress effects on memory: an update and integration. *Neuroscience & Biobehavioral Reviews*, *36*(7), 1740-1749.

Scorza, P., Owusu-Agyei, S., Asampong, E., & Wainberg, M. L. (2015). The expression of perinatal depression in rural Ghana. *International journal of culture and mental health*, *8*(4), 370-381.

Scott, S., Ashby, B., & John-Larkin, C. S. (2016). One is Enough: Decreasing Repeat Pregnancy Rates in Adolescent Mothers with Mental Health Symptoms. *Journal of Pediatric and Adolescent Gynecology*, *29*(2), 167.

Seddoh, J. E. (2014). The impact of Plan Ghanas microfinance scheme on poverty reduction among women in Lower Manya Krobo. *Journal of African Studies and Development*, *6*(8), 132-139.

Sedgwick, P. (2014). Cross sectional studies: advantages and disadvantages. *Bmj*, *348*.

Sefogah, P. E., Samba, A., Mumuni, K., & Kudzi, W. (2020). Prevalence and key predictors of perinatal depression among postpartum women in Ghana. *International Journal of Gynecology & Obstetrics*, *149*(2), 203-210.

Segal, M., Richter-Levin, G., & Maggio, N. (2010). Stress-induced dynamic routing of hippocampal connectivity: A hypothesis. *Hippocampus*, *20*(12), 1332-1338.

Seib, C., Whiteside, E., Humphreys, J., Lee, K., Thomas, P., Chopin, L., ... & Anderson, D. (2014). A longitudinal study of the impact of chronic psychological stress on health-related quality of life and clinical biomarkers: protocol for the Australian Healthy Aging of Women Study. *BMC public health*, *14*(1), 1-8.

Seligman, M. E. (1975). On depression, development, and death. *San Fracisco: Freeman*. Selye, H. (1936). A syndrome produced by diverse nocuous agents. *Nature*, *138*(3479), 32-32.

Selye, H. (1957). Participation of the adrenals in the production of renal and cardiac lesions by cold. *Canadian Medical Association journal*, *77*(12), 1114–1117.

Selye H. (1976). Forty years of stress research: principal remaining problems and misconceptions. *Canadian Medical Association journal*, *115*(1), 53–56.

Shadrina, M., Bondarenko, E. A., & Slominsky, P. A. (2018). Genetics factors in major depression disease. *Frontiers in psychiatry*, *9*, 334

Sharma, S., Powers, A., Bradley, B., & Ressler, K. J. (2016). Gene× environment determinants of stress-and anxiety-related disorders. *Annual review of psychology*, *67*, 239-261.

Sher, L. (2005). Type D personality: the heart, stress, and cortisol. *Qjm*, *98*(5), 323-329.

Shin, L. M., & Liberzon, I. (2010). The neurocircuitry of fear, stress, and anxiety disorders. *Neuropsychopharmacology*, *35*(1), 169-191.

Sidebottom, A. C., Harrison, P. A., Godecker, A., & Kim, H. (2012). Validation of the Patient Health Questionnaire (PHQ)-9 for prenatal depression screening. *Archives of women's mental health*, *15*(5), 367-374.

Sie, S. D., Wennink, J. M. B., Van Driel, J. J., te Winkel, A. G. W., Boer, K., Casteelen, G., & van Weissenbruch, M. M. (2012). Maternal use of SSRIs, SNRIs and NaSSAs: practical recommendations during pregnancy and lactation. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, *97*(6), F472-F476.

Silveira, M. L., Whitcomb, B. W., Pekow, P., Braun, B., Markenson, G., Dole, N., ... & Chasan-Taber, L. (2014). Perceived psychosocial stress and glucose intolerance among pregnant Hispanic women. *Diabetes & metabolism*, *40*(6), 466-475.

Sipsma, H., Ofori-Atta, A., Canavan, M., Osei-Akoto, I., Udry, C., & Bradley, E. H. (2013). Poor mental health in Ghana: who is at risk? *BMC public health*, *13*(1), 288.

Siqueira Reis, R., Ferreira Hino, A. A., & Romélio Rodriguez Añez, C. (2010). Perceived stress scale: reliability and validity study in Brazil. *Journal of health psychology*, *15*(1), 107-114.

Smith, M. L., Kakuhikire, B., Baguma, C., Rasmussen, J. D., Perkins, J. M., Cooper-Vince, C., ... & Tsai, A. C. (2019). Relative wealth, subjective social status, and their associations with depression: Cross-sectional, population-based study in rural Uganda. *SSM-population health*, *8*, 100448.

Smits, J . , & Steendijk, R. (2015). The international wealth index (IWI). Social Indicators *Research*, *122*(1), 65-85.

Snyder, J. S., Soumier, A., Brewer, M., Pickel, J., & Cameron, H. A. (2011). Adult hippocampal neurogenesis buffers stress responses and depressive behaviour. *Nature*, *476*(7361), 458-461.

Solivan, A. E., Xiong, X., Harville, E. W., & Buekens, P. (2015). Measurement of perceived stress among pregnant women: A comparison of two different instruments. *Maternal and child health journal*, *19*(9), 1910-1915.

Somerville, S., Dedman, K., Hagan, R., Oxnam, E., Wettinger, M., Byrne, S., ... & Page, A. C. (2014). The perinatal anxiety screening scale: development and preliminary validation. *Archives of women's mental health*, *17*(5), 443-454.

Sperner-Unterweger, B., Kohl, C., & Fuchs, D. (2014). Immune changes and neurotransmitters: possible interactions in depression? *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *48*, 268-276.

Shahid, A., Wilkinson, K., Marcu, S., & Shapiro, C. M. (2011). State-Trait Anxiety Inventory (STAI). In *STOP, THAT and One Hundred Other Sleep Scales* (pp. 367-368). Springer, New York, NY.

Spielberger, C. D. (1970). Manual for the state-trait anxiety inventory (Self-evaluation questionnare). *Consulting Psychogyists Press*.

Spinhoven, P. H., Ormel, J., Sloekers, P. P. A., Kempen, G. I. J. M., Speckens, A. E. M., & Van Hemert, A. M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychological medicine*, *27*(2), 363-370.

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.

Staneva, A., Bogossian, F., Pritchard, M., & Wittkowski, A. (2015). The effects of maternal depression, anxiety, and perceived stress during pregnancy on preterm birth: A systematic review. *Women and Birth*, *28*(3), 179-193.

Staniute, M., Brozaitiene, J., Burkauskas, J., Kazukauskiene, N., Mickuviene, N., & Bunevicius, R. (2015). Type D personality, mental distress, social support and health-related quality of life in coronary artery disease patients with heart failure: a longitudinal observational study. *Health and quality of life outcomes*, *13*(1), 1.

Starcevic, V. (2014). The reappraisal of benzodiazepines in the treatment of anxiety and related disorders. *Expert review of neurotherapeutics*, *14*(11), 1275-1286.

Stewart, C., & Henshaw, C. (2002). Midwives and perinatal mental health. *British journal of midwifery*, *10*(2), 117-121.

Stewart, R. C., Umar, E., Tomenson, B., & Creed, F. (2014). A cross-sectional study of antenatal depression and associated factors in Malawi. *Archives of women's mental health*, *17*(2), 145-154.

Størksen, H. T., Garthus-Niegel, S., Vangen, S., & Eberhard-Gran, M. (2013). The impact of previous birth experiences on maternal fear of childbirth. *Acta obstetricia et gynecologica Scandinavica*, *92*(3), 318-324.

Stuart, S., & Koleva, H. (2014). Psychological treatments for perinatal depression. *Best practice & research Clinical obstetrics & gynaecology*, *28*(1), 61-70.

Suglo, S., & Siakwa, M. (2016). Knowledge and practices on birth preparedness among expectant mothers seeking antenatal care at the Tamale Teaching Hospital, Ghana. *International Journal of Research*, *8*(1), 2307-2083.

Sweetland, A. C., Belkin, G. S., & Verdeli, H. (2014). Measuring depression and anxiety in Sub-Saharan Africa. *Depression and anxiety*, *31*(3), 223-232.

Syed, S. A., & Nemeroff, C. B. (2017). Early life stress, mood, and anxiety disorders. *Chronic Stress*, *1*, 2470547017694461.

Tabong, P. T. N., & Adongo, P. B. (2013). Understanding the social meaning of infertility and childbearing: a qualitative study of the perception of childbearing and childlessness in Northern Ghana. *PloS one*, *8*(1), e54429.

Taghani, R., Ashrafizaveh, A., Soodkhori, M. G., Azmoude, E., & Tatari, M. (2019). Marital satisfaction and its associated factors at reproductive age women referred to health centers. *Journal of Education and Health Promotion*, *8*.

Taherdoost, H. (2016). Validity and reliability of the research instrument; how to test the validation of a questionnaire/survey in a research. *How to Test the Validation of a Questionnaire/Survey in a Research (August 10, 2016)*.

Takyi, B. K. (2001). Marital instability in an African society: Exploring the factors that influence divorce processes in Ghana. *Sociological focus*, *34*(1), 77-96.

Takyi, B. K., & Gyimah, S. O. (2007). Matrilineal family ties and marital dissolution in Ghana. *Journal of Family Issues*, *28*(5), 682-705.

Tandu-Umba, B., Dedetemo, D. K., & Mananga, G. L. (2014). Maternal stress and pregnancy outcomes. *Open Journal of Obstetrics and Gynecology*, *2014*.

Tavassoli, A., Ahmadian, M., Abu Samah, A., Latiff, L. A., & Taheri, N. (2018). A survey on men's awareness of premenstrual syndrome and marital satisfaction in married women in Tehran, Iran. *The Open Public Health Journal*, *11*(1).

Taylor, P., Fry, R., Cohn, D., Wang, W., Velasco, G., & Dockterman, D. (2010). Women, Men and the New Economics of Marriage. *Pew Research Center*. https://doi.org/202.419.4372.

Taylor, S. E. (2012). Social Support: A Review. In *the Oxford Handbook of Health Psychology*. https://doi.org/10.1093/oxfordhb/9780195342819.013.0009.

Tefera, T. B., Erena, A. N., Kuti, K. A., & Hussen, M. A. (2015). Perinatal depression and associated factors among reproductive aged group women at Goba and Robe Town of Bale Zone, Oromia Region, Southeast Ethiopia. *Maternal health, neonatology and perinatology*, *1*(1), 12.

Tenkorang, E. Y. (2019). Explaining the links between child marriage and intimate partner violence: Evidence from Ghana. *Child Abuse & Neglect*, *89*, 48-57.

Tenkorang, E. Y., Owusu, A. Y., & Laar, A. K. (2017). Housing and health outcomes of persons living with HIV/AIDS (PLWHAs) in the Lower Manya Krobo District, Ghana. *Journal of Healthcare for the Poor and Underserved*, *28*(1), 191-215.

Tessner, K. D., Mittal, V., & Walker, E. F. (2011). Longitudinal study of stressful life events and daily stressors among adolescents at high risk for psychotic disorders. *Schizophrenia bulletin*, *37*(2), 432-441.

Thompson, K. S., & Fox, J. E. (2010). Post-partum depression: A comprehensive approach to evaluation and treatment. *Mental Health in Family Medicine*, *7*(4), 249.

Thompson, O., & Ajayi, I. O. (2016). Prevalence of Antenatal Depression and Associated Risk Factors among Pregnant Women Attending Antenatal Clinics in Abeokuta North Local Government Area, Nigeria. *Depression Research and Treatment*. https://doi.org/10.1155/2016/4518979.

Tiki, T., Taye, K., & Duko, B. (2020). Prevalence and factors associated with depression among pregnant mothers in the West Shoa zone, Ethiopia: a community-based cross-sectional study. *Annals of General Psychiatry*, *19*, 1-7.

Tofoli, S. M. D. C., Baes, C. V. W., Martins, C. M. S., & Juruena, M. (2011). Early life stress, HPA axis, and depression. *Psychology & Neuroscience*, *4*(2), 229-234.

Treadwell, M. J., Anie, K. A., Grant, A. M., Ofori-Acquah, S. F., & Ohene-Frempong, K. (2015). Using formative research to develop a counselor training program for newborn screening in Ghana. *Journal of genetic counseling*, *24*(2), 267-277.

Tsai, A. C., Scott, J. A., Hung, K. J., Zhu, J. Q., Matthews, L. T., Psaros, C., & Tomlinson, M. (2013). Reliability and validity of instruments for assessing perinatal depression in African settings: systematic review and meta-analysis. *PloS one*, *8*(12), e82521.

Tsigos, C., & Chrousos, G. P. (2002). Hypothalamic–pituitary–adrenal axis, neuroendocrine factors and stress. *Journal of psychosomatic research*, *53*(4), 865-871.

Turney, K. (2011). Chronic and proximate depression among mothers: Implications for child well-being. *Journal of Marriage and Family*, *73*(1), 149-163.

Twum-Danso, N. A., Dasoberi, I. N., Amenga-Etego, I. A., Adondiwo, A., Kanyoke, E., Boadu, R. O., ... & Sagoe-Moses, I. (2014). Using quality improvement methods to test and scale up a new national policy on early post-natal care in Ghana. *Health policy and planning*, *29*(5), 622-632.

Ugwu, E. O., Olibe, A. O., Obi, S. N., & Ugwu, A. O. (2014). Determinants of compliance to iron supplementation among pregnant women in Enugu, Southeastern Nigeria. *Nigerian journal of clinical practice*, *17*(5), 608-612.

Vaccarino, V., Mayer, E., & Bremner, J. D. (2016). Stress and health. *Posttraumatic Stress Disorder*, 361-386.

Vaiserman, A. M. (2015). Epigenetic programming by early-life stress: Evidence from human populations. *Developmental Dynamics*, *244*(3), 254-265.

Van Dalen, H. P., Henkens, K., & Hershey, D. A. (2017). Why do older adults avoid seeking financial advice? Adviser anxiety in the Netherlands. *Ageing & Society*, *37*(6), 1268-1290.

van de Loo, K. F., Vlenterie, R., Nikkels, S. J., Merkus, P. J., Roukema, J., Verhaak, C. M., ... & van Gelder, M. M. (2018). Depression and anxiety during pregnancy: The influence of maternal characteristics. *Birth*, *45*(4), 478-489.

Van Der Linden, E. L., Browne, J. L., Vissers, K. M., Antwi, E., Agyepong, I. A., Grobbee, D. E., & Klipstein-Grobusch, K. (2016). Maternal body mass index and adverse pregnancy outcomes: A ghanaian cohort study. *Obesity*, *24*(1), 215-222.

van Heyningen, T., Honikman, S., Myer, L., Onah, M. N., Field, S., & Tomlinson, M. (2017). Prevalence and predictors of anxiety disorders amongst low-income pregnant women in urban South Africa: a cross-sectional study. *Archives of women's mental health*, *20*(6), 765-775.

Van Lith, L. M., Yahner, M., & Bakamjian, L. (2013). Women's growing desire to limit births in sub-Saharan Africa: meeting the challenge. *Global Health: Science and Practice*, *1*(1), 97-107.

Van Praag, H. M. (2004). Can stress cause depression? *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *28*(5), 891-907.

Verbeek, T., Bockting, C. L., Beijers, C., Meijer, J. L., van Pampus, M. G., & Burger, H. (2019). Low socioeconomic status increases effects of negative life events on antenatal anxiety and depression. *Women and Birth*, *32*(1), e138-e143.

Verbeek, T., Bockting, C. L., Beijers, C., Meijer, J. L., van Pampus, M. G., & Burger, H. (2019). Low socioeconomic status increases effects of negative life events on antenatal anxiety and depression. *Women and Birth*, *32*(1), e138-e143.

Vinci, M. C. (2011). Sensing the environment: epigenetic regulation of gene expression. *Phys. Chem. Biophys. S*, *3*, 2161-0398.

Vollrath, M. (2001). Personality and stress. *Scandinavian Journal of Psychology*, *42*(4), 335-347.

von Ehr, J., & von Versen-Höynck, F. (2016). Implications of maternal conditions and pregnancy course on offspring's medical problems in adult life. *Archives of gynecology and obstetrics*, *294*(4), 673-679.

Vyas, S., & Kumaranayake, L. (2006). Constructing socio-economic status indices: how to use principal components analysis. *Health policy and planning*, *21*(6), 459-468.

Wagner, G., Schultes, M. T., Titscher, V., Teufer, B., Klerings, I., & Gartlehner, G. (2018). Efficacy and safety of levomilnacipran, vilazodone and vortioxetine compared with other second-generation antidepressants for major depressive disorder in adults: A systematic review and network meta-analysis. *Journal of Affective Disorders*, *228*, 1-12.

Warner-Schmidt, J. L., & Duman, R. S. (2006). Hippocampal neurogenesis: opposing effects of stress. and antidepressant treatment. *Hippocampus*, *16*(3), 239-249.

Wei, L. K., & Au, A. (2017). Computational Epigenetics. In *Handbook of Epigenetics* (pp. 167-190). Academic Press.

Weiß, E. E. (2018). The Handbook of Stress and Health: A Guide to Research and Practice. *Management Revue*, *29*(1), 108-111.

Weobong, B., Soremekun, S., Ten Asbroek, A. H., Amenga-Etego, S., Danso, S., Owusu-Agyei, S., Prince, M., & Kirkwood, B. R. (2014a). Prevalence and determinants of antenatal depression among pregnant women in a predominantly rural population in Ghana: The DON population-based study. *Journal of Affective Disorders*, *165*, 1–7.

Weobong, B., Soremekun, S., Ten Asbroek, A. H., Amenga-Etego, S., Danso, S., Owusu-Agyei, S., ... & Kirkwood, B. R. (2014). Prevalence and determinants of antenatal depression among pregnant women in a predominantly rural population in Ghana: The DON population-based study. *Journal of affective disorders*, *165*, 1-7.

Weobong, B., Ten Asbroek, A. H., Soremekun, S., Danso, S., Owusu-Agyei, S., Prince, M., & Kirkwood, B. R. (2015). Determinants of postnatal depression in rural Ghana: findings from the Don population-based cohort study. *Depression and anxiety*, *32*(2), 108-119.

Werner, F. M., & Covenas, R. (2010). Classical neurotransmitters and neuropeptides involved in major depression: a review. *International Journal of Neuroscience*, *120*(7), 455-470.

Wilfley, D. E., & Shore, A. L. (2015). Interpersonal Psychotherapy. In *International Encyclopedia of the Social & Behavioral Sciences: Second Edition*. https://doi.org/10.1016/B978-0-08-097086-8.21065-9

Williams, R. (2006). *Generalized ordered logit / partial proportional odds models for ordinal dependent variables*. *1*, 58–82.

Williams, R. (2016). Understanding and interpreting generalized ordered logit models. *The Journal of Mathematical Sociology*, *40*(1), 7-20.

Willoughby, B. J., Hall, S. S., & Luczak, H. P. (2015). Marital paradigms: A conceptual framework for marital attitudes, values, and beliefs. *Journal of Family Issues*, *36*(2), 188-211.

Wingenfeld, K., & Wolf, O. T. (2011). HPA axis alterations in mental disorders: impact on memory and its relevance for therapeutic interventions. *CNS neuroscience & therapeutics*, *17*(6), 714-722.

Wittkowski, A., Garrett, C., Calam, R., & Weisberg, D. (2017). Self-report measures of parental self-efficacy: A systematic review of the current literature. *Journal of child and family studies*, *26*(11), 2960-2978.

Wolkowitz, O. M., Epel, E. S., Reus, V. I., & Mellon, S. H. (2010). Depression gets old fast: do stress and depression accelerate cell aging? *Depression and anxiety*, *27*(4), 327-338.

Wong, O., Nguyen, T., Thomas, N., Thomson-Salo, F., Handrinos, D., & Judd, F. (2016). Perinatal mental health: Fathers–the (mostly) forgotten parent. *Asia-Pacific Psychiatry*, *8*(4), 247-255.

Woods, S. B., Priest, J. B., Signs, T. L., & Maier, C. A. (2019). In sickness and in health: the longitudinal associations between marital dissatisfaction, depression and spousal health. *Journal of Family Therapy*, *41*(1), 102-125.

Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., & Harris, M. G. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *Journal of affective disorders*, *219*, 86-92.

Woolhouse, H., Mercuri, K., Judd, F., & Brown, S. J. (2014). Antenatal mindfulness intervention to reduce depression, anxiety and stress: a pilot randomised controlled trial of the MindBabyBody program in an Australian tertiary maternity hospital. *BMC pregnancy and childbirth*, *14*(1), 369.

World Health Organization. (2014). Social determinants of mental health. https://doi.org/10.3109/09540261.2014.928270.

World Health Organization. (2017). Depression and other common mental disorders: global health estimates. *World Health Organization*. https://doi.org/CC BY-NC-SA 3.0 IGO

Xie, R. H., He, G., Koszycki, D., Walker, M., & Wen, S. W. (2009). Prenatal social support, postnatal social support, and postpartum depression. *Annals of epidemiology*, *19*(9), 637-643.

Yang, X., Ewald, E. R., Huo, Y., Tamashiro, K. L., Salvatori, R., Sawa, A., ... & Lee, R. S. (2012). Glucocorticoid-induced loss of DNA methylation in non-neuronal cells and potential involvement of DNMT1 in epigenetic regulation of Fkbp5. *Biochemical and biophysical research communications*, *420*(3), 570-575.

Yazdani, F., Kazemi, A., Fooladi, M. M., & Samani, H. R. O. (2016). The relations between marital quality, social support, social acceptance and coping strategies among the infertile Iranian couples. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *200*, 58-62.

Yeh, Y. C., Lai, G. J., Lin, C. F., Lin, C. W., & Sun, H. C. (2015). How stress influences creativity in game-based situations: Analysis of stress hormones, negative emotions, and working memory. *Computers & Education*, *81*, 143-153.

Yesavage, J. A. (1988). Geriatric depression scale. *Psychopharmacol Bull*, *24*(4), 709-711.

Yonkers, K. A., Wisner, K. L., Stewart, D. E., Oberlander, T. F., Dell, D. L., Stotland, N., ... &

Lockwood, C. (2009). The management of depression during pregnancy: a report from the American Psychiatric Association and the American College of Obstetricians and Gynecologists. *General hospital psychiatry*, *31*(5), 403-413.

Yoon, K. L., & Zinbarg, R. E. (2007). Generalized anxiety disorder and entry into marriage or a marriage-like relationship. *Journal of anxiety disorders*, *21*(7), 955-965.

Yu, R., Branje, S.J.T., Keijsers, L., Meeus, W. (2010). Personality types and development of adolescents' conflict with friends. *European Journal of Personality*. 2010;28(2):156-167. doi:10.1002/per.1913

Zahidie, A., & Jamali, T. (2013). An overview of the predictors of depression among adult Pakistani women. *Journal of the College of Physicians and Surgeons Pakistan*, *23*(8), 574.

Zincir, S. B. (2016). Generalized anxiety disorder. In *Psychiatric Disorders during the Postpartum Period in Light of Current Advances*. https://doi.org/10.7326/0003-4819-159-11-201312030-01006

APPENDICES

Appendix I: Demographic Questionnaire, Socioeconomic Assessment and Catalogue of Stress

A. Background and Characteristics

1. What is your age? .....
2. What is your ethnic group?

Akan.....Ga/Dangme.....Ewe.....Guan.....Other.....

3. What is your religious background?

Christian.....Islam.....Traditional/Spiritualist.....No Religion.....Other.....

4. What is your marital status?

Never married.....Married.....Living together.....Divorced/Separated.....Widow.....

5. What is highest level of education?

No Education.....Primary.....Middle/JSS.....Secondary.....

6. Are you currently employed? Yes……No….. If so, what do you do? .....
7. What is your place of residence?

Rural.....Urban.....

8. How many living children do you have? .....
9. How many times have you been pregnant? .....
10. Have you experienced any complications during past pregnancies?

Yes..... No.....

11. Is this your first ANC visit?.....If not, how many have you had? _____
12. How many months is your pregnancy? Gestational age.....
13. Do you plan to give birth in this facility?.....If not, then where?

B. Socioeconomic Status Assessment

1	Does your household have:	YES, NO Electricity Radio Television Refrigerator Freezer Mobile Telephone Non-mobile Telephone Computer Fan Bicycle Motorbike Car Electric generator	
2	Type of floor	Earth/Sand/Mud Dung floor Wood/Palm/Bamboo Polished/ Parquet Cement floor Vinyl floor Terrazzo Ceramic tiles Carpet floor Other	
3	Source of water supply	In-residence tap/pipe In-compound tap/pipe Out-of-compound tap/pipe Covered well Open well Covered spring. River/stream/pond	
4	Sanitation Facility	No facility/bush Traditional Pit latrine with slab Ventilated Improved Pit latrine (KVIP) Flush toilet	
5	What type of fuel does your household normally use for cooking?	Firewood Saw Dust Charcoal Kerosene LP Gas Electricity Other	

C. Catalogue of Stress

A. What are the usual causes of stress in your life? (**DO NOT PROMPT**)
   a. .....
   b. .....
   c. .....
   d. .....
   e. .....

B. What are the usual causes of stress in your life? (**PROMPT)**
   a. Financial issues
   b. Marital/Relationship issues
   c. Work or job-related issues
   d. Family issues
   e. Health issues
   f. Social support
   g. Neighborhood/environment/living conditions
   h. Other (specify).....

C. What are the usual causes of stress since you have been pregnant? **(DO NOT PROMPT)**
   a. ……
   b. ……
   c. ……
   d. ……
   e. ……

D. What are the usual causes of stress since you have been pregnant? (**PROMPT)**
   a. Fear of childbirth
   b. Fear of giving birth to a child with abnormalities/deformities
   c. Changes in the marital/relationship
   d. Concerns about future mother-child and/or father-child relationship
   e. Concerns about ability to care, nurture and mother child.

E. State and rate the topmost source of stress:
   Stressor.....
      a. Slight stress
      b. Average
      c. Above average
      d. Severe stress

Appendix II: The Perceived Stress Scale (14 Items) - Cohen et al, 1983

1. In the last month, how often have you been upset because of something that happened unexpectedly?

2. In the last month, how often have you felt that you were unable to control important things in your life?

3. In the last month, how often have you felt nervous and "stressed"?

4. In the last month, how often have you dealt successfully with irritating life hassles?

5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?

6. In the last month, how often have you felt confident about your ability to handle your personal problems?

7. In the last month, how often have you felt that things were going your way?

8. In the last month, how often have you found that you could not cope with all the things that you had to do?

9. In the last month, how often have you been able to control irritations in your life?

10. In the last month, how often have you felt that you were on top of things?

11. In the last month, how often have you been angered because of things that happened that were outside of your control?

12. In the last month, how often have you found yourself thinking about things that you have to accomplish?

13. In the last month, how often have you been able to control the way you spend your time?

14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

[0=never; 1=almost never; 2=sometimes; 3=fairly often; 4=very often]

Appendix III: Patient Health Questionnaire (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several Days	More than half the days	Nearly Every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling asleep or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself- or that you are a failure or have let yourself or family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite-being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself in some way	0	1	2	3

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of the things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Appendix IV: Generalized Anxiety Disorder-7

Over the last 2 weeks, have you felt bothered by any of these things?	Not a t all	Several Days	More than half the days	Nearly Every day
1. Feeling nervous, anxious, or on edge?	0	1	2	3
2. Not being able to stop or control worrying?	0	1	2	3
3. Worrying too much about different things?	0	1	2	3
4. Trouble relaxing?	0	1	2	3
5. Being so restless that it is hard to sit still?	0	1	2	3
6. Becoming easily annoyed or irritable?	0	1	2	3
7. Feeling afraid as if something awful might happen?	0	1	2	3

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of the things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Appendix V: Patient Health Questionnaire (PHQ-9) TWI Version

Instructions

Nnawɔtwe mmienu a ɛtwam yi, nneɛma a ɛdidi soɔ yi bi aha w'adwene anaa? Mmuaeɛ an aka asɛmmisa no ho nie:

a. Amma saa koraa
b. Nna bebree nanso ɛnnuru nnawɔtwe
c. ɛboro nnawɔtwe baako
d. ɛkame ayɛ sɛ da biara

Tie mmuaeɛ no bio:

a. Amma saa koraa
b. Nna bebree nanso ɛnnuru nnawɔtwe
c. ɛboro nnawɔtwe baako
d. ɛkame ayɛ sɛ da biara

Nsɛmmisa (questions)

Afei tie nsɛmmisa no.

1. Woannya anigyeɛ anaa ahomka wɔ nneɛma a woreyɛ mu.
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

2. Awerɛhoɔ kaa wo anaa w'anidasoɔ sããyɛ.
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

3. Na wontumi nna anaa woda nso a ɛnkyɛ na w'ani ate.
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

4. Nnawɔtwe mmienu a ɛtwaa mu yi wo tee nka sɛ woabrɛ anaa w'ahoɔden so ate.
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

5. Nnawɔtwe mmienu a ɛtwaa mu yi w'anom ato anaa wodidi maa no boroo so.
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

6. Nnawɔtwe mmienu a ɛtwaa mu yi w'ani angye, wodii abooboo anaa ɛyɛɛ wo sɛ wadi wo hop anaa w'abusua huamɔ.
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

7. Nnawɔtwe mmienu a ɛtwaa mu yin a ɛyɛ den sɛ w'adwene bɛwɔ nneɛma bi a woreyɛ bi te sɛ worekenkan koowa krataa anaasɛ worehwɛ kasafoni.
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

8. Nnawɔtwe mmienu a ɛtwaa mu yi obi ama wahu sɛ wo kasa anaa wo nanteɛ ayɛ nyaa anaa wo home te a wontumi ntena faako
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

9. Nnawɔtwe mmienu a ɛtwaa mu yi adwene bi sii wo tirim sɛ wo yam an anka wonte ase anaa adwene bi sii wo tirim sɛ di wo hop dɛm
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

Yɛ da wo ase pii.

Appendix VI: Generalized Anxiety Disorder Questionnaire (GAD-7) TWI Version

Instructions

Nnawɔtwe mmienu a ɛtwaa mu yi nneɛma a ɛdidi soɔ yi bi aha w'adwene anaa?

Mmuaeɛ a ɛka asɛmmisa no ho nie:

a. Amma saa koraa
b. Nna bebree nanso ɛnnuru nnawɔtwe
c. ɛboro nnawɔtwe baako
d. ɛkame ayɛ sɛ da biara

Tie mmuaeɛ no bio:

a. Amma saa koraa
b. Nna bebree nanso ɛnnuru nnawɔtwe
c. ɛboro nnawɔtwe baako
d. ɛkame ayɛ sɛ da biara

Nsɛmmisa (questions)

Afei tie nsɛmmisa no

1. Nnawɔtwe mmienu a ɛtwaa mu yi ɛhu bi hyɛɛ wo so?
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

2. Nnawɔtwe mmienu a ɛtwaa mu yi adwendwen bi hyɛɛ wo so anaa adwendwen bi baa wo so a na woyɛ wo hop hwee a ɛnyɛ yie.
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

3. Nnawɔtwe mmienu a ɛtwaa mu yi nneɛma ahodoɔ bi wɔ hɔ a aha w'adwene pii
   a. Amma saa koraa
   b. Nna bebree nanso ɛnnuru nnawɔtwe
   c. ɛboro nnawɔtwe baako
   d. ɛkame ayɛ sɛ da biara

4. Nnawɔtwe mmienu a ɛtwaa mu yi na ɛyɛ den sɛ wo bo bɛtɔ wo yam anaa na ɛyɛ den sɛ wobɛdwodwo wo ho
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

5. Nnawɔtwe mmienu a ɛtwaa mu yi na wontumi ntena faako kom
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

6. Nnawɔtwe mmienu a ɛtwaa mu yi ɛnkyɛ na wo bo afu anaa na wo bo fu ntɛntɛm
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

7. Nnawɔtwe mmienu a ɛtwaa mu yin a wosuro sɛ biribi bɔne bi bɛte wo.
    a. Amma saa koraa
    b. Nna bebree nanso ɛnnuru nnawɔtwe
    c. ɛboro nnawɔtwe baako
    d. ɛkame ayɛ sɛ da biara

Yɛ da wo ase pii.

Appendix VII: Participant Information Sheet and Consent Form

Primary Investigator: Demi Priscilla Letsa, PhD Candidate, School of Public Health, University of Ghana, Legon.

Study Title: *Chronic Stress in Pregnancy: Implications on Maternal Mental Health Outcomes in Lower Manya Krobo District, Ghana.*

General Information about Research

Good morning/afternoon. I am Demi Letsa, a graduate student at the School of Public Health, University of Ghana.

I invite you to take part in a research project entitled: Chronic Stress in Pregnancy: implications on maternal mental health in the Lower Manya Krobo District of Ghana.

You will be interviewed by myself or one of the members of the research team. The interviewer will be recording and taking detailed notes during the interview. It will involve individual interviews based on questionnaires. We will, however, want to get your consent for participating in the study, so what you are about to hear is part of the process of informed consent.

This is a graduate student research study. This process will give you a basic idea of what the research is about and what your participation will involve. Your right to withdraw from the study at any time will also be described to you.

What is the purpose of this research?

This research project is designed to gather information to better understand how stress affects women during pregnancy. It will also gather information on what stressors pregnant women face and how it may affect their mental health, especially if it is chronic. We will also explore

if chronic stress experienced during pregnancy affects the maternal depression and anxiety outcomes.

Who can participate in the research?

Pregnant women seeking care at the Antenatal Clinic of the hospital.

You may not participate in the research if you:

- Have physical or mental complications that affect your ability to undergo a verbal interview
- Are not able to speak English, Twi, Ga, or Krobo.

What is the approximate number of participants involved?

You will be one of approximately 600 people being interviewed for this research.

What will be done if I take part in this research?

You will be interviewed by the researcher (graduate student) or one of the members of the research team. The interviewer will record and take detailed notes. If you do not consent to being audio recorded, please inform the interviewer and they will take field notes of what you share with us. Alternatively, the interviewer may request your verbal consent to use any information you share with us during the interview. In this event, your verbal consent will be recorded on a mobile phone.

What is the expected duration of my participation?

Each interview will last between 45 minutes to an hour.

What is the duration of this research?

The duration of this research is: 9 months.

How will my privacy and the confidentiality of my research records be protected?

The confidentiality of your data will be maintained by keeping identities and research records anonymous, storing data securely and making it accessible to investigators only, and removing

identifiers and using a pseudonym to protect your identity. You have the option of not being quoted, even anonymously, in the study and subsequent publications.

What are the possible discomforts and risks of participation?

Although there are no known discomforts and risks associated with this research, it is always possible that you may experience discomfort when addressing sensitive issues that may arise during the interviews. However, the primary researcher and the research team has taken reasonable safeguards to minimize potential but unknown risks.

If you experience psychological distress or other discomforts as a result of your participation in this study, please contact any of the primary investigator listed above. Please note that you are free to not respond to any of the questions posed by the researchers.

You may also choose to pause or stop the interview at any time, and your data will be discarded and not used in the study.

How long will my data be kept by the researchers?

In accordance with Local Research Data Management Policy and the University of Ghana, the research data will be retained for 5 years in case the original data set needs to be referred to in the future.

What is the compensation for any injury?

No injuries are anticipated. In the highly unlikely event of an injury, no compensation will be given.

Will there be reimbursement for participation?

There will no reimbursement for your participation.

What are the possible benefits to me and others?

There is no guaranteed direct benefit in this research study. But you may indirectly benefit by knowing that the knowledge gained from this research will provide independent data on the role of stress on mental health outcomes amongst pregnant women.

Can I refuse to participate in this research?

Yes, you can, your participation in this project is voluntary. You may withdraw and discontinue participation for any reason, at any time, without penalty.

Contact for Additional Information

Investigator:

Demi Priscilla Abena Letsa, PhD Candidate, Department of Population, Family and Reproductive Health School of Public Health College of Health Sciences University of Ghana Box LG 13 Legon

Telephone: 0203798400

Email: dapletsa@st.ug.edu.gh

Your rights as a Participant

This research has been reviewed and approved by the Ethical Review Committee of the Ghana Health Service. If you have any questions about your rights as a research participant, you can contact the IRB Office between the hours of 8am-5pm through the Cell Phone +233507041223 or the landline +233 0302 681109 or email addresses: Hannah.Frimpong@ghsmail.org.

Appendix VIII: Minor Assent Form

Chronic Stress in Pregnancy: Implications on Maternal mental Health outcomes in Lower Manya Krobo Municipality, GHANA

Introduction

My name is Demi Letsa, and I am from the University of Ghana, School of Public Health. I am conducting a research study entitled Chronic Stress in Pregnancy: Implications on Maternal Mental Health Outcomes in Lower Manya Krobo Municipality, Ghana as part of my PhD studies. I am asking you to take part in this research study because I am trying to learn more about what happens when a pregnant woman experiences a large amount of stress.

What is the purpose of this research?

This research project is designed to gather information to better understand how stress affects women during pregnancy. It will also gather information on what stressors pregnant women face and how it may affect their mental health, especially if it is chronic. We will also explore if chronic stress experienced during pregnancy affects the maternal depression and anxiety outcomes.

General Information

If you agree to be in this study, you will be asked to provide information about yourself, perception of stress by answering questions from a survey. The survey will only commence once you have had the information regarding the study read to you and your issues of concern and questions have been addressed satisfactorily.

Possible Benefits

There will be no direct benefit to you. Your participation in this study will result helping us understand better the role of chronic stress on a mother's mental health during the time she is pregnant. This is intended to assist us in understanding how to make services better suited to the various needs of women.

Possible Risks and Discomforts

However, there are no associated health risks to you from participation in this study. You may however be asked certain questions that may require personal information from you. In the even that you feel that the questions are too personal you have every right to draw my attention to your discomfort.

Voluntary Participation and Right to Leave the Research

You can stop participating at any time if you feel uncomfortable and do not wish to proceed further with the study. The decision is entirely yours.

Confidentiality

Your information will be kept confidential. You will be given a participant ID so your name will not be disclosed. No one will be able to know how you responded to the questions and your information will be anonymous.

Additional Information

You may ask me any further questions about this study to clarify issues that may be of particular concern to you.

Your rights as a Participant

Please talk about this study with your parents/guardians before you decide whether or not to participate. I will also ask permission from your parents/guardians before you are enrolled into the study. Even if your parents/guardians say "yes" you can still decide not to participate.

Contact Information

This research has been reviewed and approved by the Ghana Health Services Ethics Review Committee. If you have any questions about your rights as a research participant you can Hannah Frimpong at GHS-ERC on 0507-041223, email: hannahfrimpong@ghsmail.org.

Child Assent

This assent form which describes the benefits, risks and procedures for the research titled *Chronic Stress in Pregnancy: Implications on Maternal Mental Health in Lower Manya Krobo Municipality, Ghana* has been read and or explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I consent voluntarily to participate as a subject in this study and understand that I have the right to withdraw from the study at any time without it affecting my further medical care.

Participant ID:…… Researcher's Name:…….....

Signature/Thumbprint……Researcher's Signature: …….

Date: ……..……Date: ……

Appendix IX: Minor Parental Consent/Assent Form

Chronic Stress in Pregnancy: Implications on Maternal mental Health outcomes in Lower Manya Krobo Municipality, GHANA

Introduction

My name is Demi Letsa, and I am from the University of Ghana, School of Public Health. I am conducting a research study entitled Chronic Stress in Pregnancy: Implications on Maternal Mental Health Outcomes in Lower Manya Krobo Municipality, Ghana as part of my PhD studies. I am asking you to take part in this research study because I am trying to learn more about what happens when a pregnant woman experiences a large amount of stress.

What is the purpose of this research?

This research project is designed to gather information to better understand how stress affects women during pregnancy. It will also gather information on what stressors pregnant women face and how it may affect their mental health, especially if it is chronic. We will also explore if chronic stress experienced during pregnancy affects the maternal depression and anxiety outcomes.

General Information

If you agree to be in this study, you will be asked to provide information about yourself, perception of stress by answering questions from a survey. The survey will only commence once you have had the information regarding the study read to you and your issues of concern and questions have been addressed satisfactorily.

Possible Benefits

There will be no direct benefit to you. Your participation in this study will result helping us understand better the role of chronic stress on a mother's mental health during the time she is

pregnant. This is intended to assist us in understanding how to make services better suited to the various needs of women.

Possible Risks and Discomforts

However, there are no associated health risks to you from participation in this study. You may however be asked certain questions that may require personal information from you. In the even that you feel that the questions are too personal you have every right to draw my attention to your discomfort.

Voluntary Participation and Right to Leave the Research

You can stop participating at any time if you feel uncomfortable and do not wish to proceed further with the study. The decision is entirely yours.

Confidentiality

Your information will be kept confidential. You will be given a participant ID so your name will not be disclosed. No one will be able to know how you responded to the questions and your information will be anonymous.

Additional Information

You may ask me any further questions about this study to clarify issues that may be of particular concern to you.

Your rights as a Participant

Please talk about this study with your parents/guardians before you decide whether or not to participate. I will also ask permission from your parents/guardians before you are enrolled into the study. Even if your parents/guardians say “yes” you can still decide not to participate.

Contact Information

This research has been reviewed and approved by the Ghana Health Services Ethics Review Committee. If you have any questions about your rights as a research participant you can Hannah Frimpong at GHS-ERC on 0507-041223, email: hannahfrimpong@ghsmail.org.

Parental Consent/Assent for Minors

This assent form which describes the benefits, risks and procedures for the research titled *Chronic Stress in Pregnancy: Implications on Maternal Mental Health in Lower Manya Krobo Municipality, Ghana* has been read and or explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I consent voluntarily as a ***parent and/or legal guardian*** for the stated minor to participate as a subject in this study and understand that I have the right to withdraw from the study at any time without in any way it affecting further medical care.

Participant ID: Researcher's Name:…...

Signature/Thumbprint……. Researcher's Signature: …

Date: ……..…… Date: …….

Contacts for Additional Information

Investigator at:

Demi Priscilla Abena Letsa, Ph. D Candidate, Department of Population, Family and Reproductive Health School of Public Health College of Health Sciences University of Ghana Box LG 13 Legon

Telephone: 0203798400

Email: dapletsa@st.ug.edu.gh

Appendix IX: Ethical Approval Letter

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com

MyRef. GHS/RDD/ERC/Admin/App/820
Your Ref. No.

26th October, 2017

Demi Priscilla Abena Letsa
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 012/09/17**
Project Title	Chronic Stress in Pregnancy: Implications on Maternal Mental Health and Pregnancy Outcomes in Lower Manya Krobo Municipality, Ghana
Approval Date	19th October, 2017
Expiry Date	18th October, 2018
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Appendix X: Generalized Ordered Logistic Regression Model (Wald's Test)

Test of proportional odds assumption using the generalized ordered logistic regression model's constraints approach for the overall model

	Wald's test for proportional odds assumption		
Model	**Degree of freedom**	**Chi-square**	**P-value**
Chronic stress	35	0	1.000
Depression	52	68.27	0.0645
Anxiety	56	51.51	0.6454

Appendix XI: Test of Proportional Odds

Test of proportional odds assumption using the generalized ordered logistic regression model's constraints approach for the individual factors

	P-values		
	Chronic	**Depression**	**Anxiety**
Age in years	0.1801	0.6854	0.1233
Ethnicity *(ref: Akan)*			
Ga/Dangme	0.9832	0.5389	0.1215
Ewe	0.9430	0.5341	0.6879
Other	0.9951	0.0976	0.1031
Marital status *(ref: Never married)*			
Married	0.0889	0.0792	0.6545
Living together	0.9994	0.2992	0.2102
Divorced/Separated	0.9996	0.9487	0.7126
Highest education *(ref: No education)*			
Primary	0.9999	-	-
Middle/JSS	0.9996	-	-
Secondary	0.9998	-	-
Tertiary	0.9928	-	-
Currently employed *(ref: Unemployed)*	1.0000	**0.0487**	0.7066
Number of children	0.9985	0.5518	0.2720
Number of pregnancies	0.9983	0.1463	0.4339
First ANC attendance *(ref: No)*			
Ever had pregnancy complication *(ref: No)*	0.9926	0.7158	0.9791
Urban residence *(ref: Rural)*	0.9996	0.4243	**0.0021**
Wealth index *(ref: Poorest)*			
Poorer	0.9994	0.1110	-
Middle	0.6349	0.2031	-
Richer	0.1931	0.1151	-
Richest	0.9514	0.1110	-
Financial issues *(ref: No)*	0.2148	-	**0.0210**
Marriage/ relationship issues*(ref: No)*	0.9996	0.0670	0.1272
Work related issues *(ref: No)*	0.9889	-	0.6353
Family issues *(ref: No)*		0.1667	0.0995
Environmental issues *(ref: No)*	0.0620	-	-
Health issues *(ref: No)*	-	-	0.7732
Other issues *(ref: No)*	0.9999	**0.0091**	0.2682
Fear of childbirth causes stress in pregnancy *(ref: No)*	-	0.3350	-
Fear of birth deformed child causes stress in pregnancy *(ref: No)*	-	0.0527	0.2804
Changes in marriage/ relationship causes stress in pregnancy *(ref: No)*	0.9997	0.8531	0.4970
Future parent-child relation concerns cause stress in pregnancy *(ref: No)*	0.4837	0.0992	0.1138
Concerns about ability to nurture a child causes stress in pregnancy *(ref: No)*	0.9807	0.1099	0.7638
Other causes stress in pregnancy *(ref: No)*	0.8669	0.1188	0.3086
Chronic stress level *(ref: Low)*			
Moderate	-	0.9956	0.8648
High	-	0.1307	0.6515
Self-reported stress rating *(ref: Low)*			
Moderate	0.9988	0.1508	0.7806
High	0.9991	0.1588	0.2710
Anxiety related difficulty *(ref: Low)*			
Moderate	0.0673	0.9276	**0.0001**
High	0.9996	0.2643	0.5370
Characteristics			
Depression related difficulty *(ref: Low)*			
Moderate	0.9990	0.1664	0.0900
High	0.9992	0.3430	0.0766