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**DETERMINANTS OF MATERNAL ANTENATAL STATE-ANXIETY: ROLE OF
MATERNAL FEELINGS ABOUT THE PREGNANCY**

(Spine Title: Determinants of Maternal Antenatal State-Anxiety)

(Thesis Format: Monograph)

By

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**Graduate Program in
Epidemiology and Biostatistics**

**A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science**

**School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada**

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entitled:

**Determinants of Maternal Antenatal State-Anxiety: Role of Maternal
Feelings about the Pregnancy**

is accepted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

The current state of research into antenatal anxiety is lacking in a comprehensive understanding of determinants. This study aims to expand knowledge in this area, with the two main objectives being to determine potential determinants of maternal antenatal state-anxiety and to identify the pattern of state-anxiety in the second trimester, measured by the abbreviated state version of the State Trait Anxiety Inventory. Data used for this cross-sectional study were obtained from the Prenatal Health Project: a population cohort study of 2357 women in London, Ontario. Our primary hypothesis was that “feelings about the pregnancy” would be a determinant of antenatal state-anxiety. Results from a multiple linear regression analysis revealed that greater stress, feeling unsure/unhappy about the pregnancy and having low self-esteem, low mastery and low social support from one’s partner and family were statistically significant determinants of state-anxiety during the second trimester. In addition, anxiety was found to be inversely related to gestational age. We concluded that how a woman feels about her pregnancy was a predictor of state-anxiety. The findings of this study may facilitate anxiety prevention efforts.

Keywords: *state anxiety, antenatal anxiety, STAI-State, second trimester, feelings about the pregnancy, determinants*

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List of Abbreviations

ART	Assisted Reproductive Technology
CIHR	Canadian Institutes of Health Research
HPA	Hypothalamus-Pituitary-Adrenal-Cortex
IVF	In Vitro Fertilization
MCAR	Missing Completely at Random
PHP	Prenatal Health Project
SD	Standard Deviation
STAI	State Trait Anxiety Inventory
US	United States

CHAPTER 1: BACKGROUND, RATIONALE AND RESEARCH OBJECTIVES

Antenatal anxiety has received considerably less attention than depression in maternal mental health research. Additionally, mental health problems that occur during the antenatal period are far less recognized and studied than those in the postpartum period^{1,2,3,4,5,6,7}. Yet, Health Canada states that anxiety disorders are the most common mental health issue in Canada, affecting one in ten people over the course of their lifetime⁸. Irrespective of this fact, anxiety is frequently unrecognized and subsequently left untreated^{9,10}. This highlights the importance of expanding research to study anxiety.

Pregnancy will likely be experienced at least once during a woman's lifetime. The mean age of onset for many anxiety disorders is in the early 20's, a time when many women are contemplating pregnancy⁷. The transition to becoming a parent may result in major psychological and social changes. These changes may result from new demands and expectations, significant changes in a daily routine, unwanted pregnancy, changes in the relationships between partners, important career decisions and financial and housing issues. These changes have been associated with increased anxiety in pregnancy^{11,12}. The prevalence and severity of anxiety during pregnancy has not been shown to be significantly different from non-pregnant women^{4,13,14}. The prevalence rates of antenatal depression have been reported to be roughly between 7-20%, while the current literature on the prevalence of antenatal anxiety is limited. A study of pregnant women in their second trimester reported that 6.6% of women had antenatal anxiety¹.

Anxiety during pregnancy has several implications for health. Antenatal anxiety exerts its effects not only on the pregnant woman, but on the child as well. Antenatal anxiety has been associated with low birth weight, physical defects, emotional difficulties, and behavioural and cognitive problems in the child³⁴. In addition postpartum depression and anxiety can be prevented antenatally¹⁵.

The lack of research regarding the factors associated with maternal anxiety during pregnancy serves as the rationale for this study. This thesis project will help to contribute knowledge to this lacking area³. Secondly, mental health problems that occur during the antenatal period are far less recognized and studied than those in the postpartum period¹. Thirdly, women suffer from anxiety more than men¹⁶ and lastly, a

great deal of research has been done regarding anxiety and child outcomes, rather than understanding anxiety's effect on the pregnant woman¹⁷.

Prior research studies have reported that anxiety levels tend to decrease during the second trimester, however, there is still importance in examining anxiety during this period. For instance, determining the predictors which cause anxiety in trimester two will help to screen and treat women in order to prevent anxiety from occurring in trimester three when anxiety is elevated. Although the literature states that the second trimester is a time of decreased anxiety there has been literature that demonstrates elevated anxiety during the second trimester when compared to other trimesters in pregnancy. For example anxiety was significantly higher during 12-22 weeks gestation than during 32-40 weeks gestation in one study¹⁸ and state anxiety was significantly higher during the second trimester when compared to the first in another study¹⁹. Furthermore, anxiety and stress during the second trimester has been linked to negative outcomes in the child such as lower scores on intelligence tests¹⁸, impaired cognition¹⁸, impaired language abilities²⁰, ADHD symptoms²¹, externalizing problems²¹ and anxiety in childhood²¹. Stress and anxiety, particularly early on in pregnancy may negatively impact the development of the fetus's brain and may be susceptible to programming²⁰ because important brain structures (such as the hippocampus, amygdala and anterior cingulate cortex²²) are under active growth and neurons have not fully developed¹⁸.

The literature review to follow will outline the need for a study concerning the determinants and pattern of antenatal state-anxiety in the second trimester. The results of this study will help target women who are most at risk of developing anxiety.

1.1 Study Objectives

This thesis research project addresses 2 primary objectives and one secondary objective. A secondary data analysis using data from the Prenatal Health Project (PHP) from women in London, Ontario and a cross-sectional study design was used to address these thesis objectives:

Objective 1: To identify determinants of maternal antenatal state-anxiety in the second trimester of pregnancy as identified from the literature.

- i. To determine whether “feelings about the pregnancy” is a statistically significant predictor of maternal antenatal state-anxiety after controlling for other covariates.
- ii. To examine whether social support, self-esteem and mastery act as moderators of the association between the variable of interest: feelings about the pregnancy and maternal antenatal state-anxiety.

Objective 2: To identify the pattern of maternal state-anxiety in the second trimester of pregnancy.

In addition there is one secondary objective: To identify factors which are associated with women’s feelings about their pregnancy. This secondary objective stems from the results obtained in Objective 1.

1.2 Hypotheses

- i. Women who feel negatively about their pregnancy will have greater state-anxiety in the second trimester.
- ii. Social support, self-esteem and mastery will act as moderators of the association between feelings about the pregnancy and maternal antenatal state-anxiety.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

This chapter will outline a detailed explanation of state anxiety, beginning with definitions and mechanisms. Next, an overview of available literature will be presented regarding the co-occurrence of anxiety and depression, the determinants of antenatal anxiety and subsequently the pattern of anxiety will be outlined. Finally, the limitations identified within the literature will be presented, in which this research project aims to improve upon. It should be noted that the vast majority of research in the area of maternal anxiety focuses on anxiety disorders rather than the construct of state anxiety and, therefore, some of the discussion will be with regards to anxiety disorders.

2.2 Anxiety and State Anxiety

2.2.1 Definitions

The literature has conceptualized anxiety in many ways including viewing it as a stimulus, a response, a trait and a state²³. Spielberger defines anxiety as an “unpleasant emotional state or condition which is characterized by subjective feelings of tension, apprehension, and worry, and activation or arousal of the autonomic nervous system”²⁴. The dimension of state anxiety was first proposed by Cattell and Scheier 50 years ago²⁵. Spielberger distinguishes state from trait anxiety by defining trait anxiety as an individual’s genetic predisposition to experiencing anxiety, and state anxiety as a transitory state that fluctuates over time. State anxiety is affected by the amount of stress affecting an individual and arises when one perceives a particular situation as potentially dangerous or threatening^{24,26}.

2.2.2 Mechanisms

The causes of anxiety are not well known^{9,11,17}. A combination of mental, physical and environmental factors are hypothesized to lead to its occurrence. Anxiety may result before a threat occurs (ie. anticipating the threat), continue after a threat has ended and even without a threat present⁹. Exposure to a stressor activates a stress regulation system; the hypothalamus-pituitary-adrenal-cortex system (HPA) and the sympathetic nervous system-adrenal medulla system become activated²⁷.

Specifically, with regard to antenatal anxiety, it is most highly correlated with external social factors including education, smoking, daily stressors, and obstetric complications²⁸. In addition, further predictors of antenatal anxiety include sociodemographic factors (e.g., being young, single relationship status, low socioeconomic status), intrapersonal (e.g., low self-esteem, increased negative life experiences), social (e.g., marital dissatisfaction, lack of social support), lack of control over the environment, psychiatric history, and pregnancy related factors (e.g., risk status of the pregnancy, previous negative pregnancy experiences, prior abortion)^{4,7,11,15,17,27,29,30}.

2.2.3 Co-occurrence of Anxiety and Depression

There is controversy as to whether anxiety can be differentiated from depression. Some authors argue that anxiety and depression share common mechanisms³¹. In contrast, other researchers have stated that inadequacy in the measures evaluating anxiety and depression, rather than common mechanisms, are to blame for their co-occurrence²³. However anxiety has been shown to be common in the absence of depression³². Due to collinearity between the anxiety and depression measures, depression was excluded from analyses.

2.3 Determinants of Antenatal State-Anxiety

The subsequent section discusses potential determinants of antenatal anxiety as outlined by the current literature. Each predictor is discussed separately.

2.3.1 Feelings About the Pregnancy

A woman's negative feelings about her pregnancy may affect mood and appraisals of stress¹¹. A study by Gurung et al. indicates that feeling positively about the pregnancy is strongly related to lower perceived anxiety at all stages of the pregnancy¹¹. Measuring state anxiety, one study in the United States (US) which recruited women from hospitals and obstetric and gynecology clinics concluded that a lower desire for the pregnancy was associated with higher state anxiety in the first and second trimester³³. One of the few Canadian studies to examine maternal anxiety was done with a community sample of 2,052 women in Ontario. The study measured anxiety with the 20-

item state version of the STAI and found that each source of stress was related to the presence of greater symptoms of anxiety. Among the sources of stress was feeling unsatisfied about the pregnancy³⁴. Additionally, in a sample of 453 women in the US, women with positive attitudes towards pregnancy reported significantly less anxiety¹¹. Lastly, in an Australian study of 147 women, subjects who had low anxiety were less likely to indicate that they had mixed or negative feelings when they found out about their pregnancy³⁵.

2.3.2 Sociodemographic Factors

2.3.2.1 Education

Education plays an important role in health and psychological well-being. Well educated individuals tend to have greater psychological resources, including mastery and social support. Those with higher education also tend to have fewer economic difficulties^{36,37}. A study in Brazil by Faisal-Cury and colleagues which recruited 432 women from private clinics concluded that lower education was associated with greater antenatal state anxiety³⁸. A Canadian study, which recruited pregnant women from different hospitals in Ontario concluded that the presence and intensity of symptoms of anxiety was inversely correlated with education³⁴.

Contrary to these findings, a study by Fatoye et al. concluded that education was not associated with anxiety levels¹⁵. Similar findings were reported by Canals et al. who found that education was not associated with anxiety levels in 96 women recruited from Spain²⁹. The inconsistencies found among these studies may be due to Fatoye and colleagues' failure to control for possible confounding variables and from the small sample size in the study by Canals et al. To sum up, education and its association with is generally consistent in the literature, finding that women with lower education tend to have higher levels of anxiety.

2.3.2.2 Income

Research from a diversity of populations has found associations between lower income and anxiety levels. Low income is often associated with poverty and low educational achievement that may lead to the occurrence of anxiety. The association

between anxiety and income has been generally consistent in the literature. Current research suggests that women who have lower incomes have greater anxiety. For instance, in a prospective study of 1,436 subjects, women who earned less than or equal to \$40,000 (the lowest household income category) reported higher rates of pregnancy-related anxiety compared to women in higher household income categories³⁹. Furthermore, a longitudinal study in Hong Kong which recruited 357 women from an antenatal clinic located in a hospital concluded that women in the middle monthly family income category (20,000 –30,000 Hong Kong dollars, which corresponds to approximately 2,564 –3,046 US dollars) was a protective factor against anxiety¹. In addition, anxiety symptoms were inversely correlated with family income in a study by Glazier and colleagues³⁴. Moreover, women who had above-average incomes, compared to those with below-average incomes, experienced lower state anxiety during the first and second trimester of pregnancy in a US prospective study of 433 women³³.

However, Fatoye et al. did not find significant associations between anxiety and income. They concluded that socioeconomic status was not associated with anxiety scores¹⁵. Again, the reason for the inconsistencies among the studies could be because Fatoye et al. did not control for possible confounding variables in their study. The literature is generally consistent that low income is associated with increased anxiety in pregnancy.

2.3.3 Marital Status

Research findings support the idea that higher levels of anxiety are associated with being single. A great deal of research has been done to understand how marital status affects psychological well-being. Specifically, marriage is associated with a sense of well-being and provides emotional support among partners which is said to decrease the frequency of mental health problems⁴⁰. For instance, Lee et al. concluded that low marital satisfaction was associated with an increased risk of anxiety in the third trimester in a prospective study of 357 women in Hong Kong¹. This is consistent with other research done in this area in which women who were unmarried had higher antenatal state anxiety³⁸. Kalil et al. found that married women – as compared to unmarried women - had lower state anxiety in a prospective study of 433 women. Likewise, unmarried

women (compared to married women) had more stressors during their second trimester, and higher stress intensity during their first and third trimester³³.

However, a study by Glazier et al. while controlling for education, age and income did not reveal any group differences in anxiety between subjects who were married and those who were single³⁴. This study used a different measure of anxiety compared to the studies that had significant results, which may have contributed to the inconsistent findings.

2.3.4 Parity

Competing demands placed on a pregnant woman as a result of caring for her other children may lead to an increase in maternal psychological distress. It is theorized that primiparous women may be less aware of the risks of delivery or the demands of caring for a newborn child and thus have lower levels of distress⁴¹. The association between parity and anxiety is not significant in the majority of studies in the literature. For instance, a meta analysis found that there was no relationship between anxiety symptoms and parity in the majority of studies included³⁰. Similar findings were reported in a Canadian study of 2,052 women which concluded that parity was not related to symptoms of anxiety³⁴. Also, Canals et al. found that parity was not linked to anxiety levels during the course of pregnancy. There were no significant differences between nulliparous and multiparous women in terms of anxiety levels in their study²⁹. Due to the contradictory theory and results, more work is needed to understand the relationship between parity and its effects on anxiety.

2.3.5 Maternal Age

Younger women tend to have higher anxiety during pregnancy. This has been shown consistently in the literature. Younger women may not have developed adequate resources due to their young age and may be adjusting to the demands of different roles⁴². Particularly, in a 2009 prospective study of 1,436 women in the US, high pregnancy-related anxiety was more prevalent in younger women³⁹. Lee and colleagues found an association between younger maternal age and anxiety during the third trimester¹. A study by Da Costa and colleagues recruited 161 women from obstetrician and

gynecologist offices in Montreal. The results of this study concluded that younger women had greater pregnancy-specific stress in the third trimester⁴³. In another study, anxiety symptoms were inversely correlated with age in a sample of Canadian women³⁴. Thus, younger women may be at a higher risk for experiencing anxiety.

2.3.6 Immigration Status

Evidence regarding a possible association between immigration status and levels of anxiety is lacking in the literature. Immigrant women may be susceptible to mental health problems for a variety of reasons including social isolation, financial difficulties, limited employment opportunities and discrimination⁴⁴. Some evidence suggests that one's immigrant status may be associated with higher anxiety during pregnancy. For instance, in an Australian study comprised of 147 women, subjects in the high anxiety group were more likely than those in the moderate or low anxiety groups to be an immigrant³⁵. Contrary to this, a 2004 study in Ontario, controlling for education, age and income did not reveal any group differences in anxiety between subjects who were immigrants and those born in Canada³⁴. The inconsistent results found within these two studies may have resulted from measuring immigrant status differently. For example, in the Canadian study immigrant status was defined as subjects born in Canada vs. subjects not born in Canada, while the study in Australia categorized immigrants as subjects who have lived in Australia for less than ten years. Very little research has been done to comprehend the effect that being an immigrant has on anxiety levels, but some literature suggests that anxiety may be higher in immigrant women.

2.3.7 Prior Abortion/Miscarriage/Stillbirth/Fetal Death

Pregnancy loss can be a tragic, complicated and life altering experience for the woman and her partner⁴⁵. Previous studies have discussed the possibility of high rates of anxiety and depressive symptoms after perinatal loss. However, little is currently known about the consequences of continuous stress on future pregnancies following such a loss⁴⁶. Although, little has been done in this area, the research which does exist tends to find positive associations between previous abortion(s), miscarriage(s), or stillbirth(s) and anxiety. Fetal death, spontaneous abortion and early neonatal deaths cause sudden

interruptions in personal and family life and force new adaptations to an unexpected situation. These prior losses can cause anxiety in subsequent pregnancies.

For instance, a 2009 cross-sectional study of 240 women recruited from two high risk and two low risk prenatal clinics in Brazil concluded that women with a prior fetal loss had greater amounts of anxiety compared to those who experienced no such loss⁴⁶. Furthermore, women who reported a history of prior pregnancy loss had higher rates of anxiety during their subsequent pregnancy compared to women without prior loss⁴⁷.

Findings from research incorporating state-anxiety have shown a lack of consensus. Some studies have noted elevated levels of state-anxiety, while others have not. This could be due to state-anxiety describing general unpleasant emotional arousal rather than pregnancy-related fear which has been found to increase anxiety in women who have had a prior fetal loss^{45,47}.

Anxiety is one of the most common psychological responses following a miscarriage⁴⁷. For example, a research study involving 143 women in Germany concluded that state-anxiety levels were higher in pregnant women with a history of more than one miscarriage as compared to women with no prior miscarriage⁴⁷.

With regard to abortion, a cross-sectional study of 156 women in Nigeria concluded that subjects who had previous abortions had higher anxiety scores than those who did not have a history of abortion. The mean anxiety score of those with previous abortions (50.17) was significantly higher than that of subjects with no history of abortion (37.87)¹⁵. Lastly, a 2010 prospective study which included 113 women with a prior miscarriage and 250 women without a prior miscarriage found a significant association between previous miscarriage and state anxiety in the second and third trimester, while controlling for age, current employment status and income⁴⁵.

2.3.8 Prior Caesarean Section

To date, little research has been done with respect to anxiety and its association with prior caesarean section. However, one matched controlled study of 156 Nigerian women recruited from a teaching hospital concluded that the mode of delivery was associated with anxiety. Specifically, women who had previous difficult deliveries

(instrument assisted or caesarean section) had higher mean anxiety scores than those who had typical deliveries¹⁵. Due to the limited research, future research should investigate whether prior cesarean section leads to subsequent anxiety in future pregnancies.

2.3.9 Prior Preterm Birth

Little research has examined the association between prior preterm birth and subsequent anxiety in a future pregnancy. Preterm deliveries lead to a new unexpected situation that may lead to the occurrence of anxiety⁴⁶. For instance, a cross-sectional study in Brazil involving 240 women concluded that pregnant women who had a prior preterm birth had higher anxiety compared to women who did not⁴⁶. The limited research which exists represents the need to study prior preterm birth and its effect on anxiety in future studies.

2.3.10 Stressful Life Events

Negative life events, such as moving to a new city or experiencing a death in the family can be quite stressful and have been associated with an increased risk of premature birth, low birth weight and emotional distress in pregnant women³⁴. One of the most important predictors of antenatal anxiety is current stress affecting the pregnant mother. For instance, a study by Glazier et al. of 2,052 Canadian women revealed that negative life events were associated with higher symptoms of anxiety³⁴. In addition, these findings are similar to other research studies that found that women who had more stressful life events had a greater amount of anxiety^{11,33}. In summary, stressful life events are an important predictor of anxiety during pregnancy.

2.3.11 Assisted Reproductive Technology

Infertility has been shown to lead to anxiety and depression⁴⁸. Women may experience anxiety due to assisted reproductive technology (ART) treatments because they may be apprehensive of pregnancy loss given their previous infertility⁴⁸. Ten to fifty percent of women who undergo infertility and in vitro fertilization (IVF) treatment may develop depressive and anxiety symptoms⁴⁸. However, the majority of research has not demonstrated that the use of ART leads to anxiety in pregnancy. For example, a

prospective study in the US, examining 74 women who underwent IVF and 40 women who did not, found no significant differences between groups on psychological variables; IVF women in the first or second trimester of pregnancy were not more anxious than women who conceived naturally⁴⁸. The findings from Klock & Greenfeld suggest that previously infertile women improve psychologically as they move through pregnancy. This is contrary to current hypotheses that women become more anxious and distressed due to IVF during pregnancy⁴⁸. Lastly, a matched case-control study in Australia, comparing 70 couples who conceived with IVF with 63 matched controls to assess levels of anxiety using the 20 item STAI, concluded that the two groups did not differ in their levels of state or trait anxiety (if the number of treatment cycles was not taken into account)⁴⁹. Although it has been hypothesized that pregnant women may be more anxious due to fear of losing their pregnancy, research results do not support this hypothesis.

2.3.12 Unplanned Pregnancy

Having an unplanned pregnancy may impact a pregnant woman in several different ways including having limited social support from the child's father, exposure to psychosocial stressors, an increase in depressive symptoms, and severely impacting the woman's life satisfaction⁵⁰. An unplanned pregnancy may lead to increased stress and anxiety since women may view life events as having a greater negative effect⁵¹. Having an unplanned pregnancy has been consistently shown to cause anxiety in pregnancy. Specifically, Kalil and colleagues concluded that women who wanted their pregnancy had lower state and trait anxiety during pregnancy³³. In reviews of the literature, Mulder et al. and Jomeen et al. state that having an unwanted pregnancy is associated with increased anxiety during pregnancy^{17,27}. To summarize, the literature states women who have had an unplanned pregnancy are at an increased risk of antenatal anxiety.

2.3.13 Medical Conditions

Little research exists on the relationship between medical conditions and anxiety during pregnancy. Anxiety may be persistent in women dealing with a medical disorder during pregnancy. These women are often excluded from studies involving emotions of pregnant women and thus, little is known regarding their psychological well-

being⁵². A study in London, England involving 60 women with a medical disorder and 60 without found that those with a medical disorder had significantly greater anxiety compared to those without a medical condition⁵². In addition, women who had pregnancy-specific conditions had higher scores on anxiety⁵². Finally, women who had puerperal complications or illness following previous deliveries had higher mean scores in anxiety than those without complications¹⁵.

2.3.14 Smoking

Little is known regarding the mechanisms involved in the association between smoking and anxiety. Several hypotheses exist to attempt to understand this association better. Firstly, smoking may be higher in individuals with anxiety due to the alleged calming effects of smoking and secondly, smoking itself may lead to anxiety by impairing respiration⁵³.

The literature has shown that a history of smoking is associated with high levels of anxiety during the first trimester (OR 2.33, $p < .01$), second trimester (OR 1.87, $p < .05$) and third trimester of pregnancy (OR 1.86, $p < .05$)¹. Further, Macbeth et al. state in a review paper that smoking during pregnancy has been associated with antenatal anxiety²⁸.

However, a prospective study involving 100 women recruited from a hospital in Australia found no associations between smoking and anxiety in the antenatal period when using the STAI and The Mini-Plus International Neuropsychiatric Interview⁵⁴. The null results could be due in part to the small sample size in the study. It's difficult to ascertain the association between smoking and anxiety, but most research states that smoking is associated with increased anxiety.

2.3.15 Social Support

One of the most important predictors of antenatal anxiety is social support. Social support plays a tremendous role in the psychological well-being of a pregnant woman¹¹. The literature is very consistent in demonstrating that low social support during pregnancy is associated with higher antenatal anxiety. Research suggests that depending on the source or provider, social support, can have different benefits to the woman. For

instance, low social support from the baby's father has been associated with emotional distress rather than low social support from friends or family⁵⁵. The support of the baby's father is an important source of social support during pregnancy. It has been shown to predict levels of emotional distress in the pregnant woman¹¹.

Existing data indicates that social support moderates some of the effects of stress on psychological functioning in pregnant women which is consistent with a "stress buffering" hypothesis. This is especially the case for young pregnant women³⁴. A study by Lee et al., revealed that low perceived social support was associated with an increased risk of anxiety during the second trimester¹. In addition, research has demonstrated that the level of perceived social support is inversely related to emotional distress and positively related to self-esteem and life satisfaction during and after pregnancy³⁴. Furthermore, a higher level of social support was correlated with fewer symptoms of anxiety and subjects with high social support from family and friends - as compared to those with low social support - showed a marginally higher correlation between life events and anxiety³⁴. Likewise, perceived support proved to be the most important in distress responses among pregnant women in a US sample assessed during 24 to 34 weeks gestation⁵⁶. Finally, Kalil et al. found that women with emotionally supportive husbands (compared to women with unsupportive husbands), had lower state anxiety in all trimesters³³. To summarize, the literature has shown the beneficial outcomes of increased social support from several different populations.

2.3.16 Self-Esteem

Individuals with low levels of self-esteem are at a greater risk for mental health problems such as depression, substance abuse and anxiety. Self-esteem is protective against mental health problems by buffering the effect of stress which results from negative life events due to thinking positively about oneself⁵⁷. Self-esteem is important for a woman's psychological well-being. Results indicate that high self-esteem is protective against anxiety in pregnancy. For example, Lee et al., in 2007, found that low self-esteem, measured with the Rosenberg Self Esteem Scale, was associated with an increased risk of anxiety during all pregnancy trimesters¹. These authors state that pregnant women with lower levels of self-esteem may be less likely to cope with the

stresses which accompany pregnancy. Self-esteem was found to be a significant predictor of antenatal anxiety in another study which sought to determine the environmental, demographic and personality factors associated with prenatal anxiety. This study included 200 women recruited from three private clinics and two hospitals' obstetric clinics in Turkey⁵⁸. To conclude, high self-esteem is protective against anxiety in pregnancy.

2.3.17 Mastery

Mastery is defined as "the extent to which one regards one's life-chances as being under one's own control". It is conceptually similar to perceived control, locus of control and self-efficacy¹¹. Mastery could influence the appraisal of stress and lead to anxiety. It is a relatively stable tendency of an individual¹¹. Gurung and colleagues found that women with higher mastery reported lower levels of perceived prenatal stress¹¹. In a study utilizing the STAI, of 200 women in Turkey, findings indicate that self-efficacy was a significant predictor of antenatal anxiety⁵⁸. Mastery has been shown in the literature to be an important personal resource for buffering the effects of anxiety during pregnancy.

2.3.18 History of a Mood Disorder

A significant predictor of antenatal anxiety outlined consistently in the literature is having had a history of a mood disorder. A meta analysis by Littleton et al. indicated that women most at risk for anxiety symptoms during pregnancy were women who had a history of mental health problems³⁰. Also, a cross sectional study of 806 women receiving prenatal, postpartum, infant, gynaecologic or contraceptive care from four university clinics in the US, found that a history of either depression or anxiety was a significant predictor of state anxiety levels².

2.4 Pattern of Anxiety in Pregnancy

The following discussion regarding the pattern of anxiety in pregnancy has been separated by state anxiety, general anxiety and anxiety disorders. This was done since much of the literature discusses the pattern of anxiety as it relates to various anxiety constructs in pregnancy.

2.4.1 State Anxiety

Several studies have used the state version of the STAI to assess the pattern of anxiety during pregnancy. Pregnant women are at a higher risk of developing anxiety during the first and the third trimesters than during the second¹⁵. In a longitudinal study involving 137 subjects during pregnancy in the US, women reported feeling notably more anxious from 28 to 38 weeks on the STAI state scale⁴¹. Elevated anxiety levels (STAI-State equal to or greater than 45) were higher in the first and third trimesters and lower in the second trimester¹². The pattern of anxiety followed a U-shaped curve in pregnancy which is consistent with previous literature, in that anxiety is high during the first trimester, decreases during the second trimester and increases once again during the third trimester¹².

2.4.2 General Anxiety

A number of studies have used general anxiety measures (ie. assessing the general emotion of anxiety as opposed to distinguishing between trait or state anxiety) to assess the pattern of anxiety during pregnancy. The prevalence of antenatal anxiety in a sample of 357 women in Hong Kong was observed to be a U-shaped curve; decreasing from the first trimester to second trimester and then increasing again in the third trimester¹. In this study the prevalence of antenatal anxiety was 36.3% (95% CI 33.7–38.9%) during the first trimester, 32.3% (95% CI 29.7–34.9%) during the second trimester and increased once more to 35.8% (95% CI 33.2–38.4%) during the third trimester. Furthermore, antenatal anxiety was the lowest during approximately 24 weeks gestational age¹. Therefore, the pattern of general anxiety in the literature has been represented by a U-shaped pattern.

2.4.3 Anxiety Disorders

Several studies have assessed the pattern of anxiety disorders during pregnancy. Perinatal mood and anxiety disorders affect an estimated 20% of women during pregnancy³⁹. Specifically, anxiety disorders account for 6.6% to 16.8%³⁹. A 2010 study which included 309 women in Turkey concluded that prevalence rates of mood and

anxiety disorders was 5.4% and 15.5% in the first trimester, 4.6% and 7.6% in the second trimester and 13.3% and 24.2% in the third trimester, respectively⁶.

2.5 Summary and Integration of the Current Literature

Determinants of antenatal anxiety identified from the literature included sociodemographic factors, pregnancy and medical conditions, psychosocial stress variables and personal resource variables. As discussed previously in section 2.4, the pattern of anxiety during pregnancy most resembles a U-shaped curve; anxiety levels are elevated in the first and third trimesters and are lowest in the second trimester.

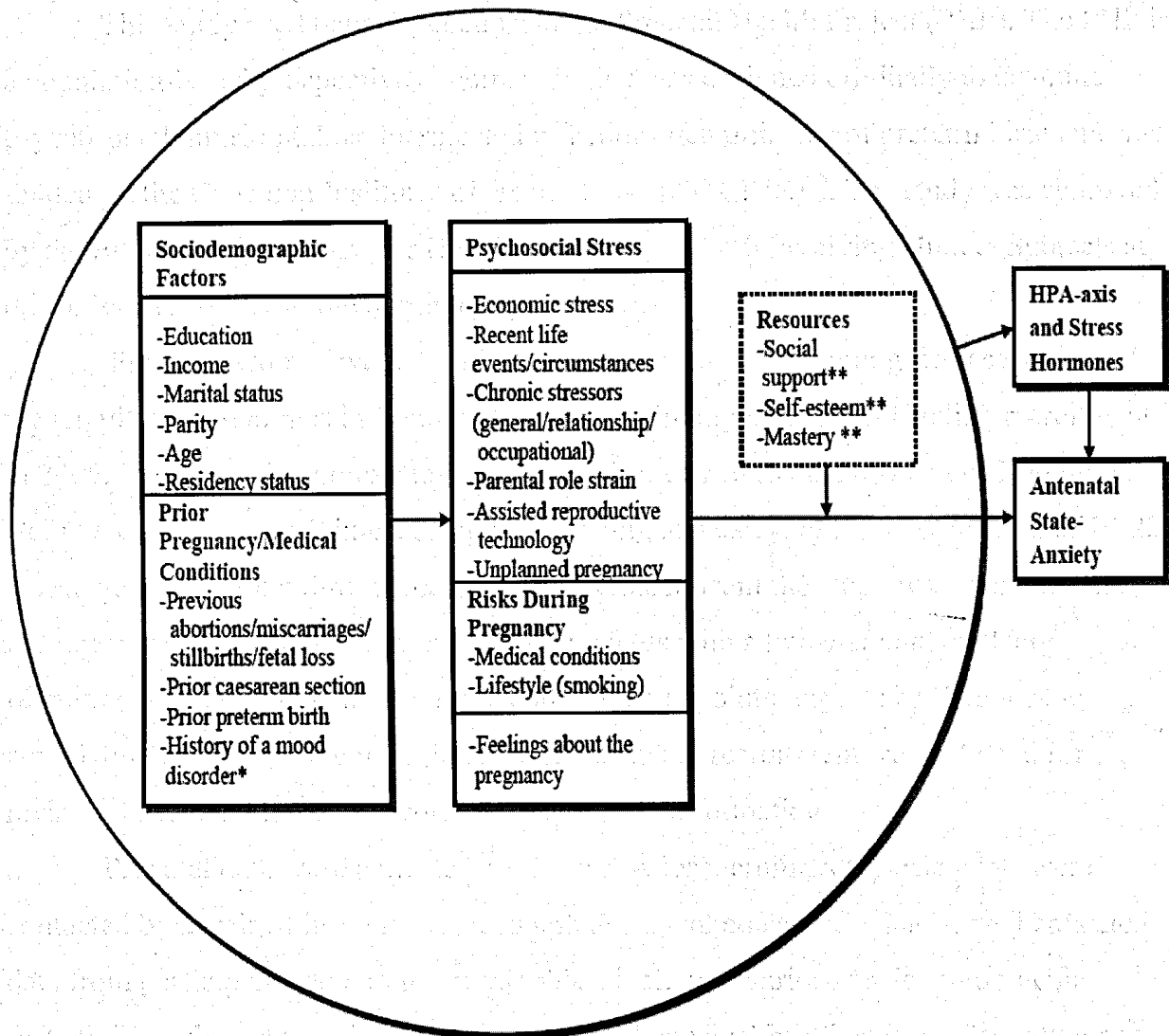
A conceptual model was constructed for antenatal state-anxiety (Figure 2.1) based on the review of the literature. The model outlines the potential determinants of state-anxiety during pregnancy arranged according to the temporal sequence of the variables. The sociodemographic factors and prior pregnancy/medical conditions are presented in the first box of the model. The sociodemographic factors include education, income, marital status, parity, maternal age and residency status, while the pregnancy/medical conditions include previous obstetric complications, previous abortion/miscarriage/stillbirth/fetal loss, prior caesarean section and prior preterm birth. The psychosocial stress variables are presented in the middle box of the model. These determinants include economic stress, recent life events/circumstances, chronic stressors (general/relationship/occupational), parental role strain, assisted reproductive technology and unplanned pregnancy. Outlined in the same box are determinants dealing with risks during pregnancy that include medical conditions, lifestyle (smoking) and feelings about the pregnancy. Potential moderators are represented by a dotted box outlined to the far right of the conceptual model and include social-support, self-esteem and mastery. The determinants of state-anxiety are surrounded by a circle to indicate that these variables may lead to the activation of the HPA-axis and the release of stress hormones that lead to state-anxiety.

The available research encompassing maternal antenatal state-anxiety is limited. Many studies discuss anxiety disorders during pregnancy, but little work has been done to assess state anxiety in the antenatal period. Also, numerous studies have limited sample sizes which may lead to unreliable results resulting from a lack of power. Furthermore, a

limited amount of research has been done in a Canadian context. To our knowledge this is the first study to assess state antenatal anxiety using the 12 item abbreviated state version of the STAI in a Canadian population.

The rationale to focus this study primarily on how a woman feels about her pregnancy stems from a number of reasons. First, the literature examining the association between maternal feelings about the pregnancy and anxiety is an under researched area in maternal mental health. This study will be one of the first to look at feelings about the pregnancy as a possible predictor of antenatal state-anxiety. Second, the literature has shown that women who feel less favorably about their pregnancy are less likely to seek adequate prenatal care^{59,60,61,62} and be at an increased risk of having a low birth weight baby^{63,64}. In light of the potential importance of this variable, the central hypothesis of this thesis will be to determine whether maternal feelings about the pregnancy are associated with state anxiety in the second trimester. Studying the importance of this variable may lead to improvement in not only the pregnant woman's well-being, but that of her child as well.

Figure 2.1: Conceptual Model for Antenatal State-Anxiety Based on the Literature Review



*Note: History of a mood disorder was not measured

** Social support, self-esteem, and mastery represent potential moderators

CHAPTER 3: METHODS

3.1 Data Source: The Prenatal Health Project

This study used data obtained from the Prenatal Health Project (PHP). The PHP is a population-based prospective cohort study that was designed originally to examine psychosocial, nutritional, endocrine and infectious determinants of preterm birth and was funded by the Canadian Institutes of Health Research (CIHR)⁶⁵. The study was approved by the Ethics Review Board for Health Sciences Research Involving Human Subjects at the University of Western Ontario (Appendix A).

Pregnant women were recruited using convenience sampling from seven out of the ten ultrasound clinics in London, Ontario, beginning in 2002 and ending recruitment in 2005. In order to be eligible to participate, women had to be a resident of Middlesex County, over the age of sixteen, English speaking and carrying a singleton fetus of 10-22 weeks gestation at the time of recruitment. Excluded from the study were women who did not speak English or who were carrying a fetus with a known anomaly. Upon recruitment and obtainment of written consent, an appointment was booked for the completion of a telephone interview. Also, consent at recruitment was obtained for review of perinatal hospital records to obtain birth information.

Prenatal data were collected as follows. After recruitment, participants were contacted by a trained interviewer to complete a telephone survey. The survey collected data from participants on a range of variables, including various sociodemographic factors, lifestyle factors, dietary intake questions, medical health status information and social and emotional well being information. These are described in further detail in the sections to follow. The answers were recorded by the interviewer on a Scantron form. Scanned answers were uploaded into an Access database developed for the study. Data were ultimately transferred to a SAS data file.

Perinatal data were abstracted from hospital records. Trained medical record technicians abstracted the birth information using a perinatal abstraction sheet. Data obtained from the hospital records included information on current and previous pregnancy conditions along with various delivery information. In order to capture prior cesarean section, prior fetal loss and prior preterm live birth data, perinatal abstraction sheets were used. These variables supplemented similar variables from the Prenatal

Survey except for prior caesarean section which was solely obtained from perinatal hospital records data.

The Prenatal Health Project (PHP) cohort consisted of 2357 women who completed the Prenatal Survey. A total of 2357 women also had perinatal hospital record information. Figure 3.1 presents how this sample was obtained. A total of 3656 women were approached to participate in the PHP study. Of these, 75.14% (n=2761) women agreed to participate. A total of 2421 women completed the telephone survey. However, 38 women were excluded due to insufficient follow up perinatal data, because of miscarriage, abortion, neonatal death or loss to follow-up. Additionally, 26 women completed the Prenatal Survey twice, once for each separate pregnancy. To ensure statistical independence in the data, a randomly-chosen survey from each of these 26 pairs was removed.

3.2 Study Design and Inclusion of Study Variables of Interest

Study variables were selected from the PHP based on the review of the literature and subsequent development of the conceptual model. Variables included in the present study and their coding are discussed in detail beginning in section 3.2.1. The original format of the survey questions from the PHP and the re-coding of variables are presented in Table 3.1.

3.2.1 Anxiety: STAI-State

In order to measure the outcome of state anxiety, the 12 item abbreviated state version of the State Trait Anxiety Inventory (STAI) was used⁶⁶. The STAI-State scale asks subjects to rate how they have been feeling during the past week, with regard to intensity, to assess the transitory condition of state anxiety, using a four-point Likert scale. The responses include: "very much so", "moderately so", "somewhat" and "not at all". Higher values on the scale indicate higher levels of state anxiety.

The state version of the STAI has established adequate concurrent and construct validity⁶⁶. Internal consistency coefficients range from 0.82 to 0.92 for the STAI measure⁴³. The STAI-State scale demonstrated good internal consistency in this study (Cronbach's alpha= 0.82).

Very few studies have examined the validity of the STAI in pregnancy. However, one study concluded that the STAI is a valid tool in measuring anxiety during pregnancy⁶⁷. Moreover, Correia & Linhares conducted a systematic review of published studies between 1998-2003 on maternal anxiety in the prenatal and postnatal period and stated that the STAI was used in a little over half (52%) of studies included in their review⁶⁸. For analysis, the STAI-State scale was standardized and kept continuous.

3.2.2 Feelings about the Pregnancy

The variable of interest, feelings about the pregnancy, was assessed by asking women how they felt when first learning that they were pregnant. Women had four possible response options: happy, unsure, unhappy and other. If a woman stated "other", she was asked to specify how she felt by providing a qualitative response.

The variable was re-coded into three possible categories: happy, unsure/unhappy and other. The response options "unsure" and "unhappy" were combined since the sample size was very small for women who responded "unhappy" (n=14, 0.70%). Many women who responded "other" (n=375, 18.84%) were re-coded where possible into "happy" (n=212) or "unsure/unhappy" (n=34) based on their qualitative responses. The remainder of the "other" (n=129) responses included women who could not be re-coded into either "happy" or "unsure/unhappy" (refer to Appendix C, Table C1, for women's "other" responses).

3.2.3 Education

The highest level of education achieved by a woman was measured using eight potential response options: elementary school, some high school, completed high school, some college or university, college diploma, university degree, trade school, or other.

Education was re-categorized into women who did not complete high school, completed high school and more than high school. This classification was chosen based on research that demonstrates that economic hardship which leads to stress is highest among individuals who did not finish high school, followed by those who did and lowest among those with a college degree or more³⁷.

3.2.4 Income

Income was assessed by asking women what the total income was from all members of their household before taxes from the previous year. This question was posed as a series of consecutive response options as illustrated in Appendix B, beginning with whether the total income was $< \$30,000$ or $\geq \$30,000$, then to select further narrower categories. Participants also had the option of stating no income, don't know, or refuse to answer. Income was assessed in this manner since providing further response options allows for better response rates because questions regarding income may be considered sensitive or intrusive by subjects⁶⁹.

Income was re-categorized as $< \$30,000$, $\geq \$30,000$ or don't know/refused to answer. This variable has been re-coded in this manner since it is close to the 2005 low-income cut-offs published by Statistics Canada in Ontario of \$27,386 to \$33,251 for a household with three or four family members⁷⁰.

3.2.5 Marital Status

Marital status was obtained by asking women to respond using five response options: married, common-law, single/never married, separated/divorced and widowed. No women in the sample were widowed and as such, this category was removed.

Although the separated/divorced category contained a small sample of women ($n=30$, 1.50%), this category remained separated from the single/never married category since the literature suggests the separation of the two categories because the groups share different sociodemographic characteristics, diversity and depression rates⁷¹ and because the separated/divorced category represented the highest mean STAI-State score (Table 4.1).

3.2.6 Parity

Parity is defined as the number of live births a woman has had to date, excluding fetal deaths, stillbirths and miscarriages. In the event of twins, each birth is counted separately⁷². Parity was obtained from survey data in which women had provided the year for each previous pregnancy and stated whether the birth was a live birth, stillbirth, miscarriage or abortion.

Parity was dichotomized as 0 or ≥ 1 for analysis. This categorization was chosen since women who have had previous children tend to report higher levels of psychological distress during pregnancy⁴¹. All women with one or more previous pregnancies were considered as one group since the literature does not differentiate between women with greater pregnancies as being more prone to anxiety, but rather the presence of any child as indicative of higher anxiety scores.

3.2.7 Immigration Status

In order to measure immigration status, two questions were used from the Prenatal Survey. The first asked respondents what country they were born in and, if they answered "other", they responded to a second question which asked the year that they came to Canada. The year given in the second question was used to estimate the respondent's respective residency length at the time of completing the Prenatal Survey. This was done by subtracting the date in which respondents completed the Prenatal Survey from the date in which women arrived to Canada.

Immigration status was categorized as lifetime (born in Canada), ≥ 11 years, 6-10 years and ≤ 5 years. This classification was chosen based on a study of 119 women in Montreal which found that women who lived in Canada for less than five years were at an increased risk for antenatal depression⁷³. The remainder of the coding was adopted from Harley et al.⁴⁰.

3.2.8 Prior Adverse Pregnancy Conditions

In order to capture prior adverse pregnancy conditions, several questions were used. At the time of the prenatal survey, women reported if any previous pregnancies ended in a livebirth, stillbirth, miscarriage or abortion. Information on previous fetal or neonatal death was collected from perinatal data available from hospital records.

A "prior fetal loss" category was created that includes prior miscarriages, abortions, stillbirths and fetal/neonatal loss. Women were categorized as having a prior fetal loss vs. woman who have not. It was created in this manner due to the inability to separate miscarriages and abortions.

Prior caesarean section was measured using perinatal data from hospital records. The variable was coded as binary: no prior caesarean section vs. prior caesarean section.

Prior preterm birth (gestational weeks <37 weeks) was assessed by asking women to list the year of any previous pregnancies that occurred, along with the gestational age in weeks. Gestational age was used to determine whether a pregnant woman had a previous preterm birth of <37 weeks. The variable was dichotomized into women with no prior preterm live birth vs. women who had a prior preterm live birth.

3.2.9 Assisted Reproductive Technology

Information on the use of ART was obtained by asking women whether they used any technology to assist them with their current pregnancy. Assisted reproductive technology was broadly defined in order to encompass any artificial effort to improve fertility.

The variable was dichotomized as: women who conceived without ART vs women who conceived using ART (refer to Appendix C, Table C2, for assisted reproductive technologies used by subjects).

3.2.10 Medical Condition(s)

Medical conditions were measured by asking women to indicate whether they currently had or have ever had particular medical conditions such as responding either “yes” or “no” to having heart disease, high blood pressure or diabetes before pregnancy, high blood pressure or diabetes during pregnancy or asthma. Subjects could also indicate that they had “other medical conditions” and list a qualitative response.

Medical condition(s) was coded as women with no prior/existing medical condition(s) vs women with a prior/existing medical condition(s). A list of all medical condition(s) is available in Appendix C. Existing vs prior medical conditions could not be distinguished and had to be combined into “existing/prior medical conditions” due to the way the subjects were asked the question.

3.2.11 Smoking Status

In order to capture smoking status, three questions were used. The first question asked women if they ever smoked, with women providing a response of either “yes” or “no”, the second question asked women how many cigarettes they smoked during pregnancy and the third question asked women how many cigarettes they smoked before they were pregnant.

Smoking status was coded as a three level categorical variable. The first category included women who never smoked, followed by women who smoked before pregnancy and the final category included women who smoked before pregnancy and continued to do so during pregnancy. In order to capture women who never smoked, women were asked the question “have you ever smoked?”. Women who responded with “no” were coded as “never smokers”. To capture women who smoked before, but not during pregnancy, women were asked the question “how many cigarettes did you smoke each day before you were pregnant?” and “how many cigarettes do you typically smoke each day now?”. Women who responded with any numeric value in the first question and did not provide a numeric response for the second question were coded as women who smoked before pregnancy, but not during. Lastly, women who provided any numeric response for the previous two questions were categorized as women who smoked before pregnancy and continued to do so during pregnancy.

3.2.12 Planned Pregnancy

Women were asked if their current pregnancy was planned, using a yes or no response. This dichotomous response was used for analysis.

3.2.13 Self-Esteem

Maternal self-esteem was measured using the six item short-form version of the Rosenberg Self-Esteem Scale⁷⁴. The scale measures how positively an individual feels about themselves. Higher scores on this scale were coded to indicate greater self-esteem. Pregnant woman’s responses were scored using a five point Likert scale: strongly agree, mildly agree, neither agree or disagree, mildly disagree and strongly disagree. One question was reverse scored (e.g., “All in all, I’m inclined to feel that I’m a failure”). The

Rosenberg Self-Esteem Scale demonstrated good internal consistency in this study (Cronbach's alpha= 0.84)^{75,76}.

3.2.14 Maternal Age

Age was obtained by asking women to self-report their date of birth. In order to acquire the age of the woman during the time of completing the STAI-State scale, women's age was subtracted from the date in which the Prenatal Survey was completed. Maternal age was rounded to the nearest whole number and kept continuous for analysis.

3.2.15 Stress

Stressful experiences during pregnancy were assessed using seven different measures of stress. These scales included: Stressful Life Events, Family Strain, Relationship Strain, General Strain, Occupational Strain, Caregiver Strain and Economic Strain^{77,78,79,80,81,82,83}.

Stressful Life Events were assessed using several established life event scales^{77,78,79,80}. Participants were asked to specify whether certain negative events have occurred to them, using a response of "yes", "no", or "not applicable". A total of 40 questions were asked to assess negative life events over the previous 12-month period. An example includes, "were there serious arguments with other household members?". Of the 40 questions asked, ten of the items asked respondents to indicate whether the event occurred to a husband/partner, a child, themselves, or that no such event occurred. An example of such a question was, "did anyone drop out of school?". In addition, of the 40 questions asked, nine items asked women to indicate whether the event happened to them, a husband/partner, a child, a relative/friend or that no such event occurred. An example of such a question was, "was there a serious accident or injury?".

Chronic strain was assessed using 29 items taken from Wheaton's original 51-item scale. Several areas of chronic strain were measured including general or ambient strain, family strain, relationship strain and occupational strain⁸². Responses were based on a 4 point Likert scale which included, "not true", "somewhat true", "very true" and "not applicable". The General Strain scale demonstrated poor internal consistency in the current study (Cronbach's alpha= 0.43). Next, the Family Strain scale demonstrated good

internal consistency in the current study (Cronbach's alpha= 0.74). Furthermore, the Relationship Strain scale demonstrated good internal consistency in the current study (Cronbach's alpha= 0.77) and occupational Strain scale demonstrated good internal consistency in the current study (Cronbach's alpha= 0.74). The Caregiver strain scale was measured using a 7-item scale developed from Pearlin et al.⁸³. Participants indicated on a 5 point Likert scale how they felt regarding each question, as either: "completely", "quite a bit", "somewhat", "not at all", or "not applicable". An example from the caregiver strain scale includes, "I have more things to do than I can handle". The remaining two questions of the scale refer to children, thus for women who do not have children they were assigned values of 0 before summing the subscore. The Caregiver Strain scale demonstrated good internal consistency in the current study (Cronbach's alpha= 0.74). Economic strain was measured using a 10-item scale developed by Avison⁸¹. Responders were asked to state whether certain financial expenses such as housing or food were hard to meet on a 5 point Likert scale including, "very difficult", "somewhat difficult", "not very difficult", "not at all difficult" and "not applicable". Economic Strain scale demonstrated good internal consistency in the current study (Cronbach's alpha= 0.85).

Higher scores indicate greater stress for these measures. Each of the seven stress subscale scores was totaled then each subscale was standardized prior to summing each together. The composite sum was also standardized which provided a final score for overall stress experienced during pregnancy. The stress scales were combined to form an overall stress score for easier interpretability because the main objective was not to determine types of stress which have an effect on anxiety, but rather the combined effect of stress leading to greater anxiety⁷⁷.

3.2.16 Social Support: Family, Friends, and Husband/Partner

Maternal social support was obtained from three social support scales developed by Turner and Marino⁸⁴. The social support scales include support from a husband or partner which contains 7-items, social support from family which contains 8 items and lastly, social support from friends which contains 8 items. All three social support scales were based on a five point Likert scale which included: "strongly agree", "agree", "neither agree nor disagree", "disagree" and "strongly disagree". Higher scores were

coded to indicate greater social support. Women who were not in a relationship and subsequently did not receive social support from a partner/husband received a score of 0. The social support scales from the husband or partner, from family and from friends demonstrated good internal consistency in this study (Cronbach's alpha= 0.87, 0.94, 0.94, respectively).

Each of the three social support scales were summed separately and then standardized and kept continuous for analysis. These scales were separated because research on social support during pregnancy states that, depending on the source or provider of the social support, it can have different benefits to the woman^{11,55}.

3.2.17 Mastery

Mastery was measured using the Pearlin & Schooler Mastery Scale^{85,86}, which contains 7 items. Higher scores indicate higher levels of mastery. The scale measures the degree to which individuals feel that they are in control of the forces that affect their lives. The Mastery Scale demonstrated good internal consistency in this study (Cronbach's alpha= 0.76). Mastery was kept continuous and standardized for statistical analysis.

3.2.18 Gestational Age

Three methods were used to obtain gestational age: mid-trimester ultrasound record, subject's self-reported last menstrual period and abstracted from the delivery chart. Estimates obtained from these three measures were compared to determine if they agreed to within one week. For estimates that agreed to within one week, the gestational age recorded on the delivery chart was used.

Gestational age in the second trimester (14-26 weeks)⁸⁷ was derived by subtracting the gestational age in weeks by the date the subject completed the Prenatal Survey. Gestational age was rounded to the nearest whole number and kept continuous for analysis.

3.3 Statistical Analyses

3.3.1 Initial Data Handling

Exploratory univariate analyses were used to detect implausible or missing values among the predictor variables. Original data records were used to check these items for accuracy and incorrect values were corrected to correspond with the answers recorded on the Prenatal Survey.

Missing data were handled using pairwise deletion. Cases were excluded from a particular calculation involving variables with missing data⁸⁸. This approach to missing data was utilized since only a small number of missing values for the majority of variables (<5%) were present in this study⁸⁹. However, one particular variable, Assisted Reproductive Technologies (ART), had a high degree of item non-response (missing n=576). For this reason all missing responses were handled using single imputation in order to replace missing values with reasonable ones. Single imputation was utilized since the number of subjects stating they used ART in pregnancy was quite low (n=90) compared to those who had not (n=1382). It was very likely that interviewers did not take note of subject's responses due to the low prevalence of ART use in the sample. Imputation was used to avoid discarding observations which may lead to a loss of power that would have resulted from an extremely limited sample size⁹⁰. It is important to note the key assumption of imputation, in that missing completely at random (MCAR) must be present. MCAR was likely satisfied if it resulted due to random failure of the interviewers to record ART responses (due to the limited number of women who used ART; n=90). However, this assumption cannot be confirmed and it could be the case that subjects felt this question to be sensitive, although this is unlikely to be the case^{91,92}.

3.3.2 Univariable Analyses

The twenty potential predictors of antenatal state-anxiety were examined initially in univariable analyses for Objective 1. Specifically, descriptive analyses involving T-tests were used for binary predictor variables and General Linear Models were used for categorical predictor variables to examine associations between each specific predictor

and the outcome. As well, simple linear regression was conducted with each predictor alone with the outcome in order to examine the crude relationship.

For the Secondary Objective, Chi-Square tests were used to examine potential correlates of feelings about the pregnancy.

3.3.3 Multivariable Analyses

For Objectives 1 and 2, variables which had a p-value of ≤ 0.2 were included in the multiple linear regression model(s) and entered in blocks according to the hypothesized causal model (Figure 2.1). Variables that had univariable significance at $p \leq 0.2$ were chosen for inclusion in the multivariable model based on guidelines for predictive model building⁹³. This significance level is large enough to allow important variables entry into the multivariable model without being too stringent⁹⁴.

At each stage, the model was trimmed by backward elimination with a p-value set at $p \leq 0.2$ for the first two models. Statistical significance for the final model was set at $p < 0.05$. Since feelings about the pregnancy was the variable of interest in Objective 1 and gestational age was the variable of interest in Objective 2, both variables were included in all three models of the multiple linear regression.

The first multivariable regression model included the first block of sociodemographic factors that were statistically significant in the univariable analyses and included education, income, marital status, maternal age, prior fetal loss, prior preterm live birth and feelings about the pregnancy.

The second multivariable regression model included sociodemographic factors which remained statistically significant in the first model, along with the second block of variables according to the conceptual model including stress, planned pregnancy, prior/existing medical conditions, smoking status and feelings about the pregnancy.

The final multivariable regression model included variables that were statistically significant in the second model, along with the third block of variables according to the conceptual model including self-esteem, mastery, social support from family, friends, husband/partner and feelings about the pregnancy.

For the Secondary Objective, since the outcome of interest was a nominal variable, multinomial logistic regression was used. Given that this objective was descriptive in nature, a conceptual model was not developed and variables were entered into the multinomial logistic regression if they achieved a significance of $p \leq 0.2$ in the univariable analysis. Backward elimination was used to trim the model.

Figure 3.1 Flow Diagram of Participants Recruited in the Prenatal Health Project

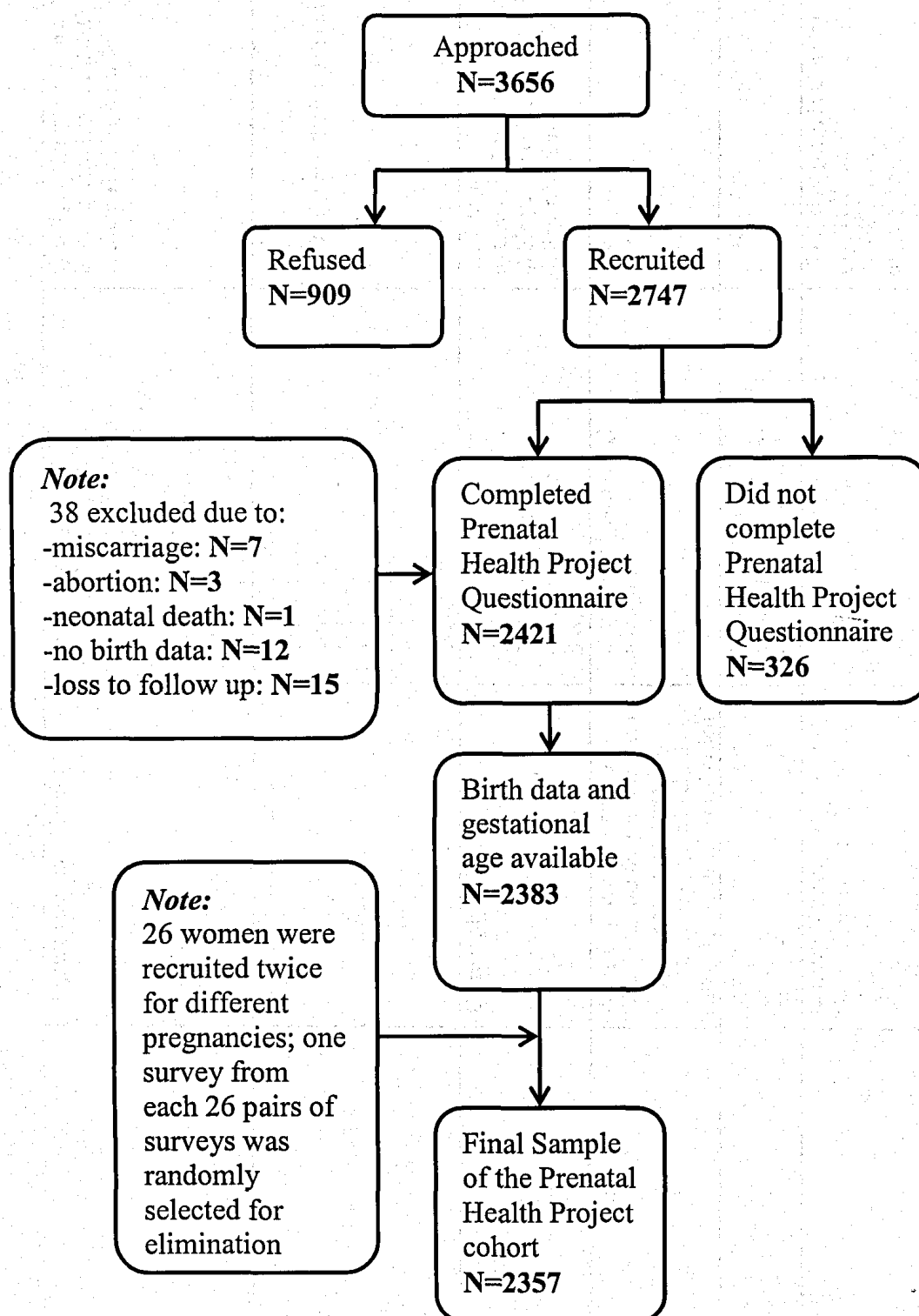


Table 3.1: Original Format and Recoding of Predictor Variables from PHP Data

In Literature	Available in Dataset	Original Format of Variables	How Variable will be Used in Analyses
Sociodemographic Factors			
Education	Highest educational level	1=Elementary school 2=Some high school 3=Completed high school 4=Some college or university 5=College diploma 6=University degree 7=Trade school 8=Other	a) Did Not Complete High School b) Completed High School Only c) More Than High School
Income	Annual household income	0=refused to answer 1=less than 10k 2=10k-15k 3=15k-20k 4=20k-30k 5=30k-40k 6=40k-60k 7=60k-80k	a) <30k b) ≥30k c) Don't know/Refused to answer
Marital Status	Current Marital Status	1=Married 2=Common-law 3=Single/Never Married 4=Separated/Divorced 5=Widowed	a) Married b) Common Law c) Single/Never Married d) Separated/Divorced
Parity	Parity (previous live births) "Please tell me the year that each of your previous pregnancies ended, and if it was a livebirth, stillbirth, miscarriage or abortion."	Continuous Responses (1 through 8)	a) 0 b) ≥1
Age	Age	Womans' date of birth at prenatal survey completion	Continuous
Residency Status	Country of Birth "What Country Were You Born In?" Years In Canada "What Year Did You Come To Canada?"	1=Canada 0=Other Applicable Year Given	a) Lifetime (born in Canada) b) ≥ 11 Years c) 6-10 Years d) ≤ 5 years

Table 3.1 *continued*

Prior Adverse Pregnancy Conditions	Prior miscarriages, abortions, stillbirths, and fetal/neonatal loss	Numeric Responses	Prior Fetal Loss: a) 0 b) ≥ 1
	Previous Fetal/Neonatal Loss	0=No 1=Yes	
	Previous Pregnancies Prior Caesarean Section	0=No 1=Yes	a) No Prior Caesarean Section b) Prior Caesarean Section
	Prior Preterm Birth	0=No 1=Yes	a) No Prior Preterm Live Birth b) Prior Preterm Live Birth
Assisted Reproductive Technology	Technology Used "Did You Use Any Technology To Assist You With This Pregnancy?..."	0=No 1=Yes	a) Conceived without ART b) Conceived with ART
Feelings About the Pregnancy	Feelings About the Pregnancy "How did you feel upon learning that you were pregnant?"	1=Happy 2=Unsure 3=Unhappy 4=Other	a) Happy b) Unsure/Unhappy c) Other
Medical Conditions	Prior/Existing Health Conditions and Other Health Conditions "I am going to read a list of health conditions. For each, please say 'yes' if you currently have the condition or have had the condition in the past. If you do not have, or have never had the condition please respond with 'no'. Do you have, or have you ever had:"	Heart Disease, Or Cardiovascular Disease: 0=No 1=Yes High Blood Pressure <u>Before</u> Pregnancy: 0=No 1=Yes Diabetes <u>Before</u> Pregnancy: 0=No 1=Yes Asthma: 0=No 1=Yes Heart Murmur: 0=No 1=Yes Thyroid Condition: 0=No 1=Yes High Blood Pressure <u>During</u> Pregnancy: 0=No 1=Yes Diabetes <u>During</u> Pregnancy: 0=No 1=Yes	a) No Prior/Existing Medical Conditions b) Prior/Existing Medical Conditions
Smoking	Smoking Status "Have you ever smoked?" "How many cigarettes do you typically smoke each day now?" "How many cigarettes did you smoke each day before you were pregnant?"	0=No 1=Yes Numeric Responses Numeric Responses	a) Never Smokers b) Smoked Before Pregnancy, but not During c) Smoked Before and During Pregnancy

Table 3.1 continued

Planned Pregnancy	Planned Pregnancy "Was your current pregnancy planned?"	0=No 1=Yes	a) Unplanned b) Planned
Self-Esteem/Mastery	Self-Esteem/Mastery Scale	1=Strongly agree 2=Mildly agree 3=Neither agree or disagree 4=Mildly disagree 5=Strongly disagree	Continuous (Standardized)
Negative Life Experiences/Daily Stressors	Stressful Life Events	1=You 2=Husband/Partner 3=Not Very Difficult 4=Child	Standardized Sum Score
	Chronic Strain (Economic Strain)	1=Very difficult 2=Somewhat Difficult 3=Not Very Difficult 4=Not At All Difficult 9=Not Applicable	Standardized Sum Score
	Chronic strain (Caregiver Strain)	1=Completely 2=Quite a bit 3=Somewhat 4=Not at all 9=Not applicable	Standardized Sum Score
	Chronic Strain (General/ Relationship/Occupational and Family Strain)	1=Not true 2=Somewhat true 3=Very true 4=Not applicable	Standardized Sum Score
Social Support	Social Support (Husband/Partner, Family, and Friends)	1=Strongly agree 2=Agree 3=Neither Agree Or Disagree 4=Disagree 5=Strongly Disagree	Standardized Sum Score for Each Social Support Measure (Husband/Partner, Family and Friends)
History of a Mood Disorder	---	---	---

CHAPTER 4: RESULTS

4.1. Study Sample

For this thesis study, a cross-sectional segment of data was utilized from PHP data. Women were included in the analysis if they completed the STAI-State measure and were in their second trimester. Of the 2357 participants in the PHP cohort, 355 (15.06%) women were in their first trimester and 3 (0.13%) were in the third trimester. These women were excluded in order to leave a more homogenous group of women. Furthermore, 7 women did not complete the STAI-State scale and thus, were excluded from analyses. After these exclusion criteria, the total sample size for this thesis project was 1992 women.

The demographic characteristics of the sample are presented in Table 4.1. This sample represents a population of well educated, mainly married, relatively affluent women. As summarized in this table, the mean age of the women in the sample was approximately 30 years old (standard deviation [SD] 5.0). Close to equal numbers of women were either nulliparous (49.95%) or primiparous/multiparous (50.05%). The majority of women had an annual income equal to or greater than \$30,000 Canadian dollars (82.44%), while approximately 11% of women had an annual income of less than \$30,000 Canadian dollars. 82.29% of the sample had more than a high school education. The majority of women were married (76.34%). Finally, more than half (71.51%) of women had planned their pregnancy.

The variable of primary interest was "feelings about the pregnancy". Close to 83% of women stated that they were happy upon learning that they were pregnant, 10.80% of women stated they were unhappy/unsure about their pregnancy and 6.48% said they felt "other" when asked how they felt upon learning they were pregnant.

The mean STAI-State score was 20.9 (SD 5.6). However, as mentioned this variable was standardized and kept continuous for the analysis, but for descriptive purposes the raw score is presented here.

4.2 Results Pertaining to Objective One: Associations with STAI-State Score in the Second Trimester

This section presents the results as they pertain to the first objective of this thesis: to determine risk factors associated with maternal antenatal state-anxiety. Particularly, “feelings about the pregnancy” is hypothesized to be a determinant of maternal antenatal state anxiety after controlling for other potential covariates. All statistical analyses were performed using SAS 9.2 software for Windows⁹⁵.

4.2.1 Univariable Analyses

Table 4.2 presents the univariable associations between potential predictor variables and STAI-State scores. Table 4.3 presents the results of linear regression models predicting the standardized STAI-State score with each hypothesized predictor variable. This table corresponds with Table 4.2 (Appendix E outlines regression coefficients for linear regression models predicting raw STAI-State score).

Variables that had univariable association only with STAI-State scores according to linear regression models at $p \leq 0.2$, included education, income, marital status, prior fetal loss, prior preterm live birth, prior/existing medical conditions, smoking status, planned pregnancy and, lastly, social support from friends.

With regard to education, STAI-State scores for women who did not complete high school were 0.22 SD higher compared to women who had more than a high school education. Women who completed high school only, had a higher SD of 0.16 in their STAI-State scores compared to women with more than a high school education.

Subjects who had less than a \$30,000 annual income had a notably higher SD of 0.34 in their STAI-State score compared to women who had an annual income of $\geq \$30,000$. Women who refused or did not know their annual income had a 0.13 SD higher STAI-State score compared to women with an annual income greater or equal to \$30,000.

Women who were separated/divorced had a particularly higher SD of 0.30 in their STAI-State score, when compared to women who were married. STAI-State scores for women who were in a common law relationship were 0.19 SD higher compared to

married women. Lastly, STAI-State scores for women who were single/never married were 0.19 SD higher compared to married women.

STAI-State scores for women with a prior fetal loss were 0.16 SD higher compared to women without a fetal loss. Subjects with a prior preterm live birth had higher anxiety. Specifically, pregnant women with a prior preterm live birth had a 0.15 SD higher anxiety score compared to women without a prior preterm live birth.

STAI-State scores for women with prior/existing medical conditions were 0.18 SD higher compared to women without a prior/existing medical condition.

With respect to smoking status, STAI scores for women who smoked before pregnancy, but not during, were 0.26 SD higher compared to women who were never smokers. Furthermore, anxiety scores for women who smoked before pregnancy, and continued to do so during, were 0.32 SD higher compared to women who were never smokers.

Those who did not plan their pregnancy had a statistically significant higher SD of 0.42 in their anxiety score compared to women who planned their pregnancy.

Younger women may be more predisposed to anxiety than older women according to a negative Pearson correlation coefficient observed between maternal age and STAI-State score.

The last variable that had a univariable association only with STAI-State scores was social support from friends. Specifically, a negative Pearson correlation coefficient was observed between social support from friends and STAI-State score, suggesting that STAI-State scores decrease with increased social support from friends.

In the univariable regression models assessing the relationship between potential predictor variables and STAI-State scores, four variables, including parity ($p=0.45$), prior caesarean section ($p=0.36$), immigration status ($p=0.86$) and assisted reproductive technology ($p=0.76$) were not found to be statistically significant with anxiety during pregnancy and subsequently were not included in the multivariable models.

4.2.2 Multivariable Analyses: Predictors of Antenatal State-Anxiety

Table 4.4 presents the results of the multiple linear regression models. The total sample size of the final multiple linear regression included 1,767 women. Variables retained in the final multivariable model included feelings about the pregnancy, current stress, social support from the family, social support from the husband/partner, self-esteem and mastery.

Based on the results from the final multiple regression model assessing potential predictors of antenatal state-anxiety, as predicted we conclude that how a woman feels about her pregnancy contributes to antenatal anxiety. STAI-State scores for women who felt unsure/unhappy about their pregnancy were 0.74 SD higher compared to women who felt happy about their pregnancy ($p < 0.0001$). Women who stated they felt "other" about their pregnancy had a 0.25 SD higher anxiety score when compared to women who felt happy ($p = 0.0139$). A one SD increase in a woman's current stress score is associated with a 0.15 SD higher state anxiety score in the second trimester ($p < 0.0001$). Thus, STAI-State scores increase with increased stress. Women receiving greater social support from their family reported feeling significantly less anxious. Specifically, a one SD increase in social support from the family is associated with a 0.044 SD decrease in anxiety ($p = 0.029$). With respect to social support from the husband/partner, anxiety scores decrease with increased social support. Particularly, a one SD increase in social support from the husband/partner leads to a 0.033 decrease in STAI-State scores ($p = 0.0051$). Self-esteem was a significant predictor of anxiety during pregnancy. For every one SD increase in self-esteem there was a 0.42 decrease in STAI-State scores, indicating that higher self-esteem is protective against high levels of anxiety ($p < 0.0001$). The final statistically significant predictor of state anxiety to remain in the final multiple regression model was mastery. For every one SD increase in mastery, there was a 0.27 SD decrease in STAI-State scores ($p < 0.0001$), meaning that high self-mastery is protective against high levels of anxiety.

4.2.3 Assessing Effect Measure Modification

Table 4.5 describes the interaction terms used in the multiple linear regression model along with their associated beta coefficients and p-values. The results indicated

that social support (from husband/partner and from family), self-esteem and mastery did not moderate the association between the respective predictor variable and state anxiety at a significance level of $p < 0.05$, which is contrary to what was hypothesized and suggested in the literature^{17,56,96,97}.

4.3 Results Pertaining to Objective Two: Pattern of Antenatal State-Anxiety

Objective 2 of this thesis was to assess the pattern of antenatal state-anxiety in the second trimester. Gestational age ranged from 14-26 weeks amongst the women. The mean gestational age of the women was 18.9 weeks (SD 2.4).

Gestational age was considered in the regression models reported above and demonstrated to have a linear relationship. In the univariable analysis, a Pearson correlation was conducted and a negative value of -0.02 was obtained with a p-value of 0.0024. This suggests that STAI-State scores decrease with increased gestational age in the second trimester. In a multiple regression model, gestational age remained statistically significant and was retained in the final model and thus, results indicate that after controlling for potential confounders, anxiety scores decrease with increased gestational age. Specifically, for every week increase in gestational age there was a 0.088 SD decrease in anxiety ($p = 0.046$) during the second trimester.

4.4 Regression Diagnostics

Several key regression diagnostics were completed to ensure that the assumptions of the statistical tests were met. Presented below are key diagnostics completed.

4.4.1 Residuals

The distribution of the STAI-State outcome measure did not follow a normal distribution and thus, did not meet the linearity assumption for linear regression. In order to test whether this assumption was met, the residuals in the multiple linear regression model were assessed to determine if they were normally distributed. The residuals were approximately normally distributed which satisfies the assumption of linearity for the regression models (refer to Appendix D Figure D1 and D2 for the distribution of the STAI-State scale and the distribution of residuals).

To ensure that collinearity was not present among the variables, all variables included in the multivariable linear regression were assessed for collinearity. The Variance Inflation Factor values did not reach levels of above 10, which most researchers use to identify variables that are likely to be collinear⁹⁸. All variables had Variance Inflation Factors of <3.5.

4.5 Results Pertaining to the Secondary Objective: Factors Associated With Feelings About the Pregnancy

The results in the following sections pertain to the Secondary Objective of this thesis project which is to understand the factors which affect how a woman feels about her pregnancy. The discussion to follow will begin with results from univariable analyses and then results from the multinomial logistic regression model.

4.5.1 Univariable Analysis

Table 4.6 presents the univariable associations using Chi-Square tests to determine whether a relationship exists between variables. The results indicate that there is a statistically significant relationship ($p \leq 0.2$) between education, income, marital status, prior/existing medical conditions, smoking, planned pregnancy, maternal age and feelings about the pregnancy.

There was no statistically significant relationship between parity, immigration status, prior fetal loss, prior caesarean section, prior preterm live birth and feelings about the pregnancy.

4.5.2 Multinomial Logistic Regression

Table 4.7 presents the results of the multinomial logistic regression, which identifies factors associated with how a woman feels about her pregnancy. These results indicate that planned pregnancy and marital status are associated with how a woman feels about her pregnancy. Specifically, with regard to a planned pregnancy, women who did not plan their pregnancy relative to women who did plan their pregnancy were 13.39 times more likely to feel unsure/unhappy about their pregnancy than happy about their pregnancy ($p < 0.0001$). These women were also 7.36 times more likely to feel "other" about their pregnancy than happy ($p < 0.0001$). Lastly, with respect to marital status,

women who were single/never married relative to women who were married were 1.42 times more likely to feel unsure/unhappy about their pregnancy than to feel happy ($p=0.0001$). These women were also 1.34 times more likely to state they felt "other" about their pregnancy than to feel happy ($p=0.0044$).

4.6 Summary

Results relating to Objective 1 for this thesis indicate that feeling unsure or unhappy about the pregnancy, having greater stress, lacking social support from the family and from the husband/partner, low self-esteem and low mastery were statistically significant predictors of maternal state-anxiety during the second trimester. With regard to the main hypothesis of this thesis project, we conclude that how a woman feels about her pregnancy was indeed a statistically significant predictor of antenatal state-anxiety after controlling for other potential covariates. Pregnant women who felt unsure or unhappy about their pregnancy had greater state-anxiety compared to pregnant women who felt happy about their pregnancy.

Results pertaining to Objective 2, pattern of antenatal state-anxiety, revealed that state-anxiety decreases throughout trimester two in a multiple regression model.

Lastly, results from the Secondary Objective revealed that factors associated with feeling unsure/unhappy about the pregnancy included women who did not plan their pregnancy and women who were single/never married. Factors associated with women reporting feeling "other" about their pregnancy included women who did not plan their pregnancy and single/never married subjects.

Table 4.1: Demographic Characteristics of the Sample (n=1992)

Maternal Characteristics (Categorical)	Frequency (%)
Sociodemographic Factors	
Education (n=1988)	
<i>Did Not Complete High School</i>	109 (5.48%)
<i>Completed High School Only</i>	243 (12.22%)
<i>More Than High School</i>	1636 (82.29%)
Income (n=1993)	
<i><30,000</i>	217 (10.89%)
<i>≥30,000</i>	1643 (82.44%)
<i>Don't Know/Refused</i>	132 (6.23%)
Marital Status (n=1991)	
<i>Married</i>	1520 (76.34%)
<i>Common Law</i>	311 (15.62%)
<i>Single/Never Married</i>	130 (6.53%)
<i>Separated/Divorced</i>	30 (1.51%)
Parity (n=1992)	
<i>0</i>	995 (49.95%)
<i>≥1</i>	997 (50.05%)
Residency Status (n=1976)	
<i>Lifetime (born in Canada)</i>	1680 (85.02%)
<i>≥ 11 Years</i>	153 (7.74%)
<i>6-10 Years</i>	43 (2.18%)
<i>≤ 5 years</i>	100 (5.06%)
Prior Pregnancy Conditions	
Prior Fetal Loss* (n=1992)	
<i>0</i>	1366 (68.57%)
<i>≥1</i>	626 (31.43%)
Prior Caesarean Section (n=1927)	
<i>No Prior Caesarean Section</i>	1740 (90.30%)
<i>Prior Caesarean Section</i>	187 (9.70%)
Prior Preterm Live Birth (n=1992)	
<i>No Prior Preterm Live Birth</i>	1894 (95.08%)
<i>Prior Preterm Live Birth</i>	98 (4.92%)
Assisted Reproductive Technology (ART) (n=1992)	
<i>Conceived without ART</i>	1894 (95.08%)
<i>Conceived with ART</i>	98 (4.92%)
Feelings About the Pregnancy (n=1991)	
<i>Happy</i>	1647 (82.72%)
<i>Unhappy/Unsure</i>	215 (10.80%)
<i>Other</i>	129 (6.48%)
Medical Conditions**	
Prior/Existing Medical Conditions (n=1992)	
<i>No Prior/Existing Medical Conditions</i>	1178 (59.14%)
<i>Prior/Existing Medical Conditions</i>	814 (40.86%)

Smoking Status (n=1973)	
<i>Never Smokers</i>	1492 (75.62%)
<i>Smoked Before Pregnancy, but not During</i>	271 (13.74%)
<i>Smoked Before and During Pregnancy</i>	210 (10.64%)
Planned Pregnancy (n=1990)	
<i>No</i>	567 (28.49%)
<i>Yes</i>	1423 (71.51%)
Maternal Characteristics (Continuous)	MEAN (SD)
Maternal Age (n=1992)	29.5 (5.0)
Gestational Age (n=1992)	18.9 (2.4)
Current Stress (n=1886)	0 (1) (standardized)
Social Support-Family (n=1992)	0 (1) (standardized)
Social Support-Friends (n=1988)	0 (1) (standardized)
Social Support-Husband (n=1992)	0 (1) (standardized)
Self-Esteem (n=1947)	0 (1) (standardized)
Mastery (n=1876)	0 (1) (standardized)
State Anxiety (n=1992)	0 (1) (standardized)
State Anxiety (raw) (n=1992)	20.9 (5.6)

*Includes stillbirths, miscarriages, abortions and fetal/neonatal loss

**Prior/Existing medical conditions include high blood pressure, diabetes, asthma, thyroid conditions, heart murmur, pregnancy induced hypertension, gestational diabetes, previous gestational diabetes, pre-eclampsia and women who listed they had an "other" medical condition

Table 4.2: Univariable Associations with STAI-State Score (n=1992)

Variable	Frequency (%)	Mean Antenatal STAI-State (SD)	Min	Max	p-value
Maternal Characteristics (Categorical)					
Sociodemographic Factors					
Education (n=1988)					
<i>Did Not Complete High School</i>	109 (5.48%)	24.2 (6.0)	12.0	43.0	<0.0001 ^a
<i>Completed High School Only</i>	243 (12.22%)	22.2 (6.4)	12.0	40.0	
<i>More Than High School</i>	1636 (82.29%)	20.4 (5.4)	12.0	44.0	
Income (n=1993)					
<i><30,000</i>	217 (10.89%)	24.1 (6.6)	12.0	44.0	<0.0001 ^a
<i>≥30,000</i>	1643 (82.44%)	20.3 (5.3)	12.0	43.0	
<i>Don't Know/Refused</i>	132 (6.23%)	22.5 (6.4)	12.0	41.0	
Marital Status (n=1991)					
<i>Married</i>	1520 (76.34%)	20.2 (5.2)	12.0	41.0	<0.0001 ^a
<i>Common Law</i>	311 (15.62%)	22.4 (6.0)	12.0	41.0	
<i>Single/Never Married</i>	130 (6.53%)	23.5 (6.3)	12.0	43.0	
<i>Separated/Divorced</i>	30 (1.51%)	27.0 (8.5)	12.0	44.0	
Parity (n=1992)					
<i>0</i>	995 (49.95%)	21.0 (5.7)	12.0	43.0	0.4517 ^b
<i>≥1</i>	997 (50.05%)	20.8 (5.6)	12.0	44.0	
Residency Status (n=1976)					
<i>Born in Canada</i>	1680 (85.02%)	20.8 (5.6)	12.0	44.0	0.8626 ^a
<i>≥11 Years</i>	153 (7.74%)	20.9 (5.9)	12.0	38.0	
<i>6-10 Years</i>	43 (2.18%)	20.8 (6.4)	12.0	38.0	
<i>≤ 5 years</i>	100 (5.06%)	21.3 (5.3)	12.0	36.0	
Prior Pregnancy Conditions					
Prior Fetal Loss (n=1992)					
<i>0</i>	1366 (68.57%)	20.6 (5.5)	12.0	44.0	0.0007 ^b
<i>≥1</i>	626 (31.43%)	21.5 (5.8)	12.0	43.0	
Prior Caesarean Section (n=1927)					
<i>No Prior Caesarean Section</i>	1740 (90.30%)	20.8 (5.6)	12.0	44.0	0.3600 ^b
<i>Prior Caesarean Section</i>	187 (9.70%)	21.2 (5.7)	12.0	40.0	
Prior Preterm Live Birth (n=1992)					
<i>No Prior Preterm Live Birth</i>	1894 (95.08%)	20.8 (5.6)	12.0	44.0	0.1526 ^b
<i>Prior Preterm Live Birth</i>	98 (4.92%)	21.7 (6.0)	12.0	38.0	
Assisted Reproductive Technology (ART) (n=1992)					
<i>Conceived without ART</i>	1902 (95.48%)	20.9 (5.7)	12.0	44.0	0.7597 ^b
<i>Conceived with ART</i>	90 (4.52%)	21.0 (5.6)	12.0	38.0	
Feelings About the Pregnancy (n=1991)					
<i>Happy</i>	1647 (82.72%)	20.3 (5.3)	12.0	41.0	<0.0001 ^a
<i>Unsure/Unhappy</i>	215 (10.80%)	24.3 (6.1)	12.0	44.0	
<i>Other</i>	129 (6.48%)	22.8 (6.2)	12.0	43.0	
Medical Conditions					
Prior/Existing Medical Conditions (n=1992)					
<i>No Prior/Existing Medical Conditions</i>	1178 (59.14%)	20.5 (5.3)	12.0	41.0	0.0001 ^b
<i>Prior/Existing Medical Conditions</i>	814 (40.86%)	21.5 (6.1)	12.0	44.0	

Smoking Status (n=1973)					
<i>Never Smokers</i>	1492 (75.62%)	20.3 (5.3)	12.0	44.0	<0.0001 ^b
<i>Smoked Before Pregnancy, but not During</i>	271 (13.74%)	21.8 (6.1)	12.0	43.0	
<i>Smoked Before and During Pregnancy</i>	210 (10.64%)	23.9 (6.4)	12.0	41.0	
Planned Pregnancy (n=1990)					
<i>No</i>	567 (28.49%)	22.6 (6.2)	12.0	44.0	<0.0001 ^b
<i>Yes</i>	1423 (71.51%)	20.2 (5.3)	12.0	40.0	
Maternal Characteristics (Continuous)	Pearson Correlation Coefficient (p-value)				
Maternal Age (n=1992)	-0.12 (<0.0001)				
Stress (n=1886)	0.55 (<0.0001)				
Social Support-Family (n=1992)	-0.29 (<0.0001)				
Social Support-Friends (n=1988)	-0.30 (<0.0001)				
Social Support-Husband/Partner (n=1992)	-0.20 (<0.0001)				
Self-Esteem (n=1947)	-0.49 (<0.0001)				
Mastery (n=1876)	-0.52 (<0.0001)				
Gestational Age (n=1992)	-0.072 (0.0012)				

a General Linear Model (GLM)

b T-test

Table 4.3: Regression Coefficients for Linear Regression Models Predicting Standardized STAI-State Score (n=1992)

Variable	Beta (p-value)	95% Confidence Limits
Sociodemographic Factors		
Education (n=1992)¹		
<i>Did Not Complete High School</i>	0.22 (<0.0001)	0.160, 0.287
<i>Completed High School Only</i>	0.16 (<0.0001)	0.089, 0.222
<i>More Than High School</i>	[reference]	
Income (n=1992)		
<i><30,000</i>	0.34 (<0.0001)	0.268, 0.406
<i>≥30,000</i>	[reference]	
<i>Don't Know/Refused</i>	0.13 (<0.0001)	0.072, 0.187
Marital Status (n=1992)		
<i>Married</i>	[reference]	
<i>Common Law</i>	0.19 (<0.0001)	0.132, 0.251
<i>Single/Never Married</i>	0.19 (<0.0001)	0.137, 0.253
<i>Separated/Divorced</i>	0.30 (<0.0001)	0.212, 0.388
Parity (n=1992)		
<i>0</i>	-0.034 (0.4517)	-0.122, 0.054
<i>≥1</i>	[reference]	
Residency Status (n=1992)		
<i>Born in Canada</i>	[reference]	
<i>≥11 Years</i>	0.0040 (0.8900)	-0.051, 0.059
<i>6-10 Years</i>	-0.0052 (0.9467)	-0.157, 0.146
<i>≤ 5 years</i>	0.087 (0.3987)	-0.115, 0.289
Prior Pregnancy Conditions		
Prior Fetal Loss (n=1992)		
<i>0</i>	[reference]	
<i>≥1</i>	0.16 (0.0007)	0.068, 0.257
Prior Caesarean Section (n=1927)		
<i>No Prior Caesarean Section</i>	[reference]	
<i>Prior Caesarean Section</i>	0.070 (0.3600)	-0.080, 0.221
Prior Preterm Live Birth (n=1992)		
<i>No Prior Preterm Live Birth</i>	[reference]	
<i>Prior Preterm Live Birth</i>	0.15 (0.1526)	-0.055, 0.351
Assisted Reproductive Technology (ART) (n=1992)		
<i>Conceived without ART</i>	[reference]	
<i>Conceived with ART</i>	0.033 (0.7597)	-0.179, 0.225
Feelings About the Pregnancy (n=1992)		
<i>Happy</i>	[reference]	
<i>Unsure/Unhappy</i>	0.35 (<0.0001)	0.284, 0.422
<i>Other</i>	0.11 (<0.0001)	0.069, 0.156
Medical Conditions		
Prior/Existing Medical Conditions (n=1992)		

<i>No Prior/Existing Medical Conditions</i>	[reference]	
<i>Prior/Existing Medical Conditions</i>	0.18 (<0.0001)	0.091, 0.269
Smoking Status (n=1992)		
<i>Never Smokers</i>	[reference]	
<i>Smoked Before Pregnancy, but not During</i>	0.26 (<0.0001)	0.133, 0.386
<i>Smoked Before and During Pregnancy</i>	0.32 (<0.0001)	0.249, 0.391
Planned Pregnancy (n=1990)		
<i>No</i>	0.42 (<0.0001)	0.320, 0.511
<i>Yes</i>	[reference]	
Maternal Characteristics (Continuous)		
Maternal Age (n=1992)	-0.025 (<0.0001)	-0.033, -0.016
Gestational Age (n=1992)	-0.030 (0.0012)	-0.048, -0.012
Stress (n=1883)	0.54 (<0.0001)	0.507, 0.582
Social Support-Family (n=1989)	-0.29 (<0.0001)	-0.336, -0.252
Social Support-Friends (n=1984)	-0.30 (<0.0001)	-0.343, -0.259
Social Support-Husband/Partner (n=1992)	-0.20 (<0.0001)	-0.244, -0.158
Self-Esteem (n=1947)	-0.49 (<0.0001)	-0.526, -0.449
Mastery (n=1876)	-0.52 (<0.0001)	-0.563, -0.486

¹ reference group for dummy variables in regression models (for categorical variables)

Table 4.4: Regression Coefficients for Multivariable Regression Models Predicting Change in STAI-State Score in the Second Trimester

Variable	Beta (p-value)		
	Model 1 (N=1992) R ² =0.1161 Adj R ² =0.1112	Model 2 (N=1881) R ² =0.3214 Adj R ² =0.3193	Model 3 (N=1767) R ² =0.4256 Adj R ² =0.4230
Sociodemographic Factors			
Education			
<i>Did Not Complete High School</i>	0.66 (0.0007)	0.70 (<0.0001)	-----
<i>Completed High School Only</i>	0.46 (0.0168)	0.31 (0.0621)	-----
<i>More Than High School¹</i>	[reference]	[reference]	-----
Income			
<i><30,000</i>	1.1 (<0.0001)	-----	-----
<i>≥30,000¹</i>	[reference]	-----	-----
<i>Don't Know/Refused</i>	0.25 (0.1364)	-----	-----
Marital Status			
<i>Married¹</i>	[reference]	-----	-----
<i>Common Law</i>	0.38 (0.0338)	-----	-----
<i>Single/Never Married</i>	0.23 (0.2040)	-----	-----
<i>Separated/Divorced</i>	1.15 (<0.0001)	-----	-----
Prior Fetal Loss			
<i>0</i>	[reference]	-----	-----
<i>≥1</i>	0.62 (0.0169)	-----	-----
Feelings About the Pregnancy			
<i>Happy¹</i>	[reference]	[reference]	[reference]
<i>Unsure/Unhappy</i>	1.5 (<0.0001)	0.81 (<0.0001)	0.74 (<0.0001)*
<i>Other</i>	0.43 (0.0006)	0.22 (0.0444)	0.25 (0.0139)*
Gestational Age <i>(continuous)</i>	-0.14 (0.0053)	-0.12 (0.0055)	-0.088 (0.0359)*
Current Stress <i>(continuous-standardized)</i>	-----	0.23 (<0.0001)	0.15 (<0.0001)*
Social Support-Family <i>(continuous-standardized)</i>	-----	-----	-0.044 (0.0291)*
Social Support-Husband <i>(continuous-standardized)</i>	-----	-----	-0.033 (0.0051)*
Self-Esteem <i>(continuous-standardized)</i>	-----	-----	-0.42 (<0.0001)*
Mastery <i>(continuous-standardized)</i>	-----	-----	-0.27 (<0.0001)*

¹ reference group for dummy variables in regression models (for categorical variables)

*statistically significant (p<0.05)

NOTE: Variables with univariable significance at p<0.2 are included in multivariable analyses

NOTE: Feelings about the pregnancy retained in all models since it is the variable of interest

NOTE: Variables which did not enter the model are not included in this table. These include: maternal age, prior preterm birth, smoking status, planned pregnancy, prior/existing medical conditions, and social support from friends

Table 4.5: Test for Effect Measure Modification in the Association Between Predictors and Maternal Antenatal State-Anxiety

Interaction Term	Adjusted	
	Beta	P-Value
Feelings about the pregnancy*mastery	-0.0027	0.5541
Feelings about the pregnancy*self-esteem	0.031	0.6681
Feelings about the pregnancy*social support (family)	0.039	0.1872
Feelings about the pregnancy*social support (husband)	0.0088	0.6215

Significance set at $p < 0.05$

NOTE: regression coefficients of interaction terms with social support, mastery, self-esteem and feelings about the pregnancy in multiple regression models

Table 4.6: Univariable Associations with Feelings About The Pregnancy

Variable	Feelings About the Pregnancy			p-value
	Happy (%)	Unsure/Unhappy (%)	Other (%)	
Maternal Characteristics (Categorical)				
Sociodemographic Factors				
Education (n=1992)				
<i>Did Not Complete High School</i>	69 (63.30%)	28 (25.69%)	12 (11.01%)	<0.0001 ^a
<i>Completed High School Only</i>	186 (76.23%)	32 (13.11%)	26 (10.66%)	
<i>More Than High School</i>	1393 (84.99%)	155 (9.46%)	91 (5.55%)	
Income (n=1997)				
<i><30,000</i>	144 (65.75%)	49 (22.37%)	26 (11.87%)	<0.0001 ^a
<i>≥30,000</i>	1415 (86.02%)	137 (8.33%)	93 (5.65%)	
<i>Don't Know/Refused</i>	92 (69.17%)	29 (21.80%)	12 (9.02%)	
Marital Status (n=1996)				
<i>Married</i>	1350 (88.52%)	105 (6.89%)	70 (4.59%)	<0.0001 ^a
<i>Common Law</i>	220 (70.74%)	56 (18.01%)	35 (11.25%)	
<i>Single/Never Married</i>	63 (48.46%)	46 (35.38%)	21 (16.15%)	
<i>Separated/Divorced</i>	17 (56.67%)	8 (26.67%)	5 (16.67%)	
Parity (n=1997)				
<i>0</i>	819 (82.31%)	109 (10.95%)	67 (6.73%)	0.9101 ^a
<i>≥1</i>	832 (83.03%)	106 (10.58%)	64 (6.39%)	
Residency Status (n=1980)				
<i>Born in Canada</i>	1387 (82.46%)	183 (10.88%)	112 (6.66%)	0.8791 ^a
<i>≥11 Years</i>	129 (85.31%)	16 (10.46%)	8 (5.23%)	
<i>6-10 Years</i>	37 (84.09%)	3 (6.82%)	4 (9.09%)	
<i>≤ 5 years</i>	83 (82.18%)	13 (12.87%)	5 (4.95%)	
Prior Pregnancy Conditions				
Prior Fetal Loss (n=1996)				
<i>0</i>	1142 (83.42%)	138 (10.08%)	89 (6.50%)	0.3234 ^a
<i>≥1</i>	508 (81.02%)	77 (12.88%)	42 (6.70%)	
Prior Caesarean Section (n=1930)				
<i>No Prior Caesarean Section</i>	1432 (82.20%)	193 (11.08%)	117 (6.72%)	0.2659 ^a
<i>Prior Caesarean Section</i>	163 (86.70%)	17 (9.04%)	8 (4.26%)	
Prior Preterm Live Birth (n=1997)				
<i>No Prior Preterm Live Birth</i>	1571 (82.73%)	202 (10.64%)	126 (6.64%)	0.6234 ^a
<i>Prior Preterm Live Birth</i>	80 (81.63%)	13 (13.27%)	5 (5.10%)	
Medical Conditions				
Prior/Existing Medical Conditions (n=1997)				
<i>No Prior/Existing Medical Conditions</i>	995 (84.18%)	119 (10.07%)	68 (5.75%)	0.0829 ^a
<i>Prior/Existing Medical Conditions</i>	656 (80.49%)	96 (11.78%)	63 (7.73%)	
Smoking Status (n=1978)				
<i>Never Smokers</i>	1304 (87.17%)	120 (8.02%)	72 (4.81%)	<0.0001 ^a
<i>Smoked Before Pregnancy, but not During</i>	194 (71.32%)	48 (17.65%)	30 (11.03%)	
<i>Smoked Before and During Pregnancy</i>	140 (66.67%)	43 (20.48%)	27 (12.86%)	

Planned Pregnancy (n=1995)									
<i>No</i>	311 (54.56%)			170 (29.82%)			89 (15.61%)		
<i>Yes</i>	1339 (93.96%)			44 (3.09%)			42 (2.95%)		
Maternal Characteristics (continuous)	Happy			Unsure/Unhappy			Other		
Maternal Age (n=1997)	N	%	Mean	N	%	Mean	N	%	Mean
	1651	82.67%	30.00	215	10.77%	27.73	131	6.56%	28.15

a Chi-Square Test

Table 4.7: Multinomial Logistic Regression: Factors Associated With Feelings About The Pregnancy

Variable	Feelings About the Pregnancy (Reference group: Happy Women) N=1995			
	Unsure/ Unhappy OR (95% Wald CI)	P-value	Other OR (95% Wald CI)	P-value
Marital Status				
<i>Married</i>	[reference]			
<i>Common Law</i>	1.10 (0.90, 1.34)	0.3704	1.16 (0.92, 1.47)	0.2108
<i>Single/Never Married</i>	1.42 (1.21, 1.66)	0.0001*	1.34 (1.10, 1.63)	0.0044*
<i>Separated/Divorced</i>	1.21 (0.96, 1.54)	0.1104	1.25 (0.95, 1.64)	0.1068
Planned Pregnancy				
<i>No</i>	13.39 (9.15, 19.60)	<0.0001*	7.36 (4.81, 11.60)	<0.0001*
<i>Yes</i>	[reference]		[reference]	

Note: Reference category is women who were happy about their pregnancy

Note: Variables that did not reach a significance level of $p < 0.2$ in univariable analyses were not included in the multinomial regression analyses

* $p < 0.05$

CHAPTER 5: DISCUSSION

This study sought to address two specific objectives regarding antenatal state-anxiety. The first objective was to identify determinants of maternal antenatal state-anxiety while controlling for possible confounders and the second objective was to identify the pattern of maternal state-anxiety in trimester two by gestational age. The final multiple linear regression model, used to address these objectives, explained 42% (adjusted R^2) of the variability of STAI-State score in the sample (Table 4.4). A Secondary Objective was to determine the factors influencing how a woman feels about her pregnancy. The findings from this thesis project will contribute to an enhanced understanding of women's anxiety during pregnancy.

5.1 Determinants of Maternal State-Anxiety

5.1.1 Main Results from the Final Multiple Regression Model

Women who felt unsure or unhappy about their pregnancy had higher levels of anxiety during pregnancy compared to women who felt happy about their pregnancy. This finding is consistent with our hypothesis and consistent in the literature. For example, Gurung et al. found that women who felt positively about their pregnancy had lower state-anxiety. They suggested that women who feel positively about their pregnancy are more likely to be able to attenuate the effect of stress which subsequently may lead to improved mental health¹¹. Additionally, our findings are similar to that of other previous research^{33,34,35}.

In our sample, women with greater stress as assessed by combining seven different measures of stress (stressful life events, family strain, relationship strain, general strain, occupational strain, caregiver strain and economic strain) had higher state-anxiety during pregnancy. These results are consistent with the literature. Utilizing the STAI scale, Kalil et al. concluded that women with fewer stressors, compared to women with more stressors, had lower state-anxiety. In addition, Gurung et al. concluded that women with a greater amount of stressful life events had a greater amount of anxiety^{11,33}.

Our findings that low social support is associated with increased levels of anxiety during pregnancy is consistent with the current literature^{1,33,34}. Gurung et al. suggest that the provider of social support would have different effects on emotional outcomes, which

proved to be the case in this study. Social support from family and from the husband/partner proved to be significant predictors of state-anxiety whereas social support from friends did not¹¹. Supportive relationships during pregnancy are believed to benefit pregnant women's psychological health because supporters can provide affirmation, comfort, or affection⁵⁵. Furthermore, social support may reduce the stressfulness of pregnancy, providing women with a "stress-buffering" effect⁵⁵.

Low self-esteem in our sample was a statistically significant predictor of state-anxiety. Our results regarding self-esteem are consistent with previous literature^{1,58}. For example, Lee et al. reported that low self-esteem was associated with an increased risk for anxiety during all three trimesters of pregnancy¹. Self-esteem may protect against the effects of anxiety by buffering the effects of stress¹⁷. Furthermore, Lee et al. suggest that women who have low self-esteem do not have the capabilities to overcome the many stressors they may face and as a result are more prone to anxiety¹.

With respect to mastery, our results are similar to what has been reported in the current literature. For example, Gurung et al. concluded that women who have higher mastery have lower anxiety during pregnancy¹¹. Having low mastery may lead to increased anxiety during pregnancy due to the fact that distress arises when an individual's primary appraisals of threat exceed secondary appraisals (including personal resources available such as social support or mastery). Thus, mastery may influence the appraisal of stress⁶⁷.

5.1.2 Results from the Secondary Objective: Factors Associated with Feelings About the Pregnancy

Results of the multinomial logistic regression indicated that an unplanned pregnancy and being single/never married was associated with a woman feeling less favorable toward her pregnancy. The results obtained from this study are comparable to past research, although limited. For instance, Gurung et al. concluded through correlational analyses that women who were married had significantly greater positive attitudes toward pregnancy¹¹. One study addressed the factors associated with pregnancy attitudes among pregnant adolescent women. Women who were presently in a

relationship had a lesser amount of negative pregnancy attitudes when compared to women who were not in a relationship⁹⁹.

5.1.3 Factors Not Found to Have Significant Multivariable Associations

Four anticipated relationships did not prove to be statistically significant at a level of $p \leq 0.2$ in the univariable analyses with STAI-State scores. These variables included parity, prior caesarean section, immigration status and ART use.

A current theory regarding the relationship between parity and anxiety suggests that multiparous women may have higher levels of anxiety during pregnancy since they have more demands placed on them due to having larger families⁴¹. Our results indicated that the direction of the association between parity and anxiety follows the current hypothesized theory, although the association was insignificant. However, other research has found that parity does not seem to be associated with an increase in anxiety during pregnancy^{29,34}. This was consistent in this study; parity was not a significant determinant of state-anxiety in the univariable analyses. However, Dipietro et al. found that parity was associated with anxiety in their study⁴¹. Some explanation of the differences between studies could be due to when anxiety was measured. Dipietro et al. measured anxiety with the STAI later in pregnancy, between 28 to 38 weeks gestation.

The literature on ART use and anxiety during pregnancy has theorized that women who have undergone ART may be more anxious in pregnancy due to a fear of pregnancy loss⁴⁸. However, this has not been shown consistently within the literature. Our finding that ART use did not increase a woman's anxiety during pregnancy, is consistent with those reported by Klock & Greenfeld⁴⁸, in which women who conceived via IVF did not prove to be more anxious compared to those who conceived naturally. Perhaps, women who undergo ART are less anxious during pregnancy due to wanting and expecting the pregnancy for probably some time. Also, results in this study may have been insignificant due to the way ART was measured. Possibly measuring a past history of infertility may be more likely to cause anxiety in future pregnancies.

Little research has been done regarding the association between immigration status and anxiety levels in pregnancy. It is therefore difficult to speculate whether the null results found in the univariable analyses were to be expected. However, one

explanation leading to the insignificant results may have been due to the methodological problems in previous research including using different definitions of immigrant status such as country of origin, mother language spoken or language spoken at home that makes it difficult to compare results among studies⁷³.

Finally, our finding that women with a prior caesarean section do not have higher levels of anxiety during pregnancy in the univariable analyses is not consistent with a study by Fatoye et al.¹⁵. However, these researchers did not control for confounding variables. Also, women were recruited if they were in their 36th week of gestation or greater and may not be comparable to the women in this sample who were between 14-26 weeks gestation. Furthermore, a prior caesarean section may not increase levels of anxiety for it may not have been a traumatic experience to cause anxiety in subsequent pregnancies. More research is needed due to the limited studies assessing prior caesarean section and anxiety levels in subsequent pregnancies.

Education, income and marital status, while significant in the univariable analyses with STAI-State scores, did not remain statistically significant when entered into the multivariable regression models. This is a contrary to findings from current literature. These findings may suggest possible confounding or mediation. Stress may have acted as a possible mediator in the association between income and anxiety and also between marital status and anxiety in the second model. Furthermore, the association between education and anxiety may have been confounded by the addition of the resource variables in the third model.

In order to test for possible effect measure modification, interaction terms (between feelings about the pregnancy with mastery, self-esteem, social support from family, and social support from a husband/partner) were added to the final model of the multiple linear regression. Since feelings about the pregnancy was the variable of interest, the interaction terms were analyzed using this particular variable. No interaction effects were found in the present study. Social support, self-esteem and mastery were not moderators of the association between feelings about the pregnancy and maternal state-anxiety in the second trimester. This was contrary to what was expected. One possible explanation may be differences across measures utilized in previous research that make certain measures less or more likely to be amenable to moderating effects. However, our

results are similar to those reported by Gurung et al. who tested for moderation between social support and attitudes about the pregnancy and between mastery and attitudes about the pregnancy. None of the interaction terms were found to be significant in their study¹¹.

5.2 Pattern of State-Anxiety by in the Second Trimester

With regard to Objective 2, results illustrate that state-anxiety decreases throughout the second trimester in a multiple regression model. The pattern of anxiety throughout pregnancy has largely been characterized as a U-shaped curve in the literature with lowest levels occurring in the second trimester^{1,12,15,43}. One reason why anxiety may be lowest in the second trimester, as Teixeira et al. explain, may be due to the second trimester being a period of higher stability after the initial adaptation in the first trimester and prior to the stress of anticipating the birth of the child in the third trimester¹². Also, women's worries tend to decrease in mid-pregnancy¹⁷. Our study is among the first to look at the temporal trend within trimester two and we have illustrated that this is consistent with the current literature.

5.3 Contributions and Strengths of the Study

This thesis project sought to augment the limited research that currently exists regarding anxiety during pregnancy. Particularly, we addressed key objectives including predictors of antenatal state-anxiety and understanding the pattern of state-anxiety in the second trimester.

There were many methodological strengths to this thesis project. This study focused on "feelings about the pregnancy" which is an under researched predictor of anxiety in pregnancy. The PHP project had a large population-based cohort of 2,357 women of which 1992 were in trimester two and completed the STAI-State measure. This study was therefore able to produce generalizable findings which allowed for detection of relationships among variables because of the large sample size. Our choice to restrict the study to subjects in the second trimester allowed for a homogenous group of women to be assessed. The PHP incorporated a wide range of demographic, social and psychological factors which allowed for many predictors to be utilized and also allowed us to control for possible confounding among variables.

The STAI-State measure is the most widely used self report scale to analyze anxiety and has been widely validated with proven psychometric properties. The STAI-State is a well validated screening tool and our estimates are likely to be valid. It should be noted that the STAI-State measure identifies women who are at a greater risk of developing elevated symptoms of anxiety, but it is not a clinical diagnostic tool and therefore, is unable to diagnose an anxiety disorder. Furthermore, the decision to standardize the STAI allowed for the relative magnitude of effects to be measured. According to Cohen's effect sizes, a 0.20 SD change would be considered a small effect, a 0.50 SD change is considered a medium effect and a 0.80 SD change is considered a large effect. For example, results indicated that STAI-State scores for women who felt unsure/unhappy about their pregnancy were 0.74 SD higher compared to happy women. According to Cohen's effect size this would suggest a moderate to high practical significance¹⁰³.

There are several limitations in this thesis research project which should be noted when interpreting results. By utilizing a secondary data set, there were some predictor variables which could not be included. For instance, a past history of anxiety or a mood disorder was not measured in the data source. The literature states this to be a significant predictor in determining anxiety levels. Similarly, trait anxiety, the second common construct of anxiety, which defines one's genetic predisposition to anxiety was not be measured. This limits our ability to distinguish between periodic or persistent anxiety levels. However, the PHP allowed for the majority of the predictors identified in the literature to be analyzed. A minor measurement issue that should be noted results from combining miscarriages and abortions into "prior fetal loss" due to the inability of separating these two experiences. Miscarriages, stillbirths and abortions may present different experiences to the pregnant women and affect anxiety levels differently based on the experience. Future research should tease out these fetal losses to determine whether anxiety is higher among those with a previous stillbirth, miscarriage or abortion.

Some selection bias may have been present; one could speculate that women who volunteered to participate in the PHP may be more content and involved with their pregnancy. Even more important, the potential for recall bias must be acknowledged. Women's retrospective recall of their feelings upon learning they were pregnant was

reported at the time their antenatal anxiety was measured. It is possible that current state anxiety may influence the recall of prior feelings. Thus, the relationship between “feelings” and later STAI could be over-estimated¹⁰⁰. Furthermore, research has demonstrated the possibility that reporting feelings retrospectively may lead to more positive feelings being reported as time passes¹⁰⁰. Finally, social desirability bias may have been present. Women may be less likely to state that they felt “unhappy” or “unsure” when learning they were pregnant when completing the telephone interview.

The use of life event scales to measure the occurrence of stress during pregnancy has been disputed by researchers. They argue that major events do not occur often enough in order to properly assess their effects during the relatively short time frame of pregnancy. However, stress occurring from major life events may be additive and continue to affect one’s mental health well into the future^{34,43}.

In interpreting these results it is important to note that this study encompassed a cross-sectional study design and, as such, causation cannot be proven for observed associations.

5.4 Conclusions and Future Directions

The results of this thesis research project contribute to a deeper understanding of the determinants and pattern of state-anxiety in the second trimester. It has highlighted important predictors for state-anxiety particularly feelings about the pregnancy. Other important predictors included social support (from family and husband/partner), self-esteem, mastery and current stress. There is a need for additional research focused on anxiety in the antenatal period. By revealing additional information on determinants and the pattern of antenatal anxiety, this research contributes knowledge aiming to help women improve their mental health during pregnancy. The need to treat pregnant women for mental health issues is essential. For example, Lee et al. state that 14.1% of pregnant women had one or more mental health disorders, but just 5.5% were receiving treatment¹. Therefore, interventions to minimize the effects of anxiety during pregnancy are crucial.

Identifying women with antenatal anxiety can be quite difficult. First, depressive disorders have similar somatic symptoms to that of anxiety and secondly, somatic complaints are commonly found in pregnancy, such as changes in appetite and fatigue,

which can make it difficult to identify when anxiety is present. By identifying important determinants of anxiety in this study, along with the pattern of anxiety, intervention strategies can be catered to women who are at a greater risk. We speculate that this will improve their livelihood, prevent their anxiety from intensifying and prevent negative birth outcomes in the child.

Future directions for this area of research should incorporate a prospective or longitudinal study design to better understand how anxiety and the various predictor variables interact and change over pregnancy. Specifically, prenatal anxiety research should begin before, during and after pregnancy to better allow for an in-depth investigation into the determinants which are associated with anxiety^{7,101}. Much of the research in the literature is based on measuring anxiety at one point in time, but this single evaluation may not fully explain the changes of anxiety during the course of pregnancy³⁴.

Although previous studies have shown that anxiety levels tend to decrease during the second trimester, there is still importance in a detailed investigation of trimester two anxiety. For instance, determining the predictors which cause anxiety in trimester two will help identify women most at risk in order to prevent anxiety from recurring or continuing in the third trimester.

Our findings lead to the policy recommendations that intervention strategies be focused on women with lower social support from their family and from their husband/partner, those who are suspected to have lower self-esteem and mastery and those who have high stress. A new emphasis from our study is that women who feel unhappy/unsure about their pregnancy may be important targets for support and for preventive and therapeutic strategies. Interventions for anxiety during pregnancy include counseling, stress management and breathing exercises¹⁰². Targeting women most at risk for antenatal anxiety will improve their well-being and that of the child as well.

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APPENDICES

APPENDIX A

Ethics Approval for the Prenatal Health Project



The UNIVERSITY of WESTERN ONTARIO

Research Ethics Office - Dental Sciences Building, London, ON, Canada N6A 5C1
Telephone: (519) 861-3036 Fax: (519) 850-2466 E-mail: ethics@uwo.ca

REVIEW BOARD FOR HEALTH SCIENCES RESEARCH INVOLVING HUMAN SUBJECTS (ELL BOARD)
CERTIFICATION OF APPROVAL OF HUMAN RESEARCH

ALL HEALTH SCIENCES RESEARCH INVOLVING HUMAN SUBJECTS AT THE UNIVERSITY OF WESTERN ONTARIO
OPERATES IN ACCORDANCE WITH AND CONFORMS TO THE TRI-COUNCIL POLICY STATEMENT
(ETHICAL CONDUCT FOR RESEARCH INVOLVING HUMANS)

2000-2001 REVIEW BOARD MEMBERSHIP

- 1) Dr. P.G.R. Harding, (Chair) (Obstetrics, Gynaecology)
- 2) Ms. S. Hoddinott, Director of Research Services (Epidemiology)
- 3) St. Joseph's Health Centre Representative ()
- 4) Dr. R. McManus, London Health Sciences Centre - Victoria Campus Representative (Endocrinology Metabolism)
- 5) London Health Sciences Centre - University Campus Representative
- 6) Dr. L. Heller, Office of the President Representative (French)
- 7) Ms. S. Agranove, Office of the President Representative (Community)
- 8) Ms. S. Fincher-Stoll, Office of the President Representative (Legal)
- 9) Dr. D. Freeman, Faculty of Medicine Dentistry Representative (Clinical)
- 10) Dr. G. Woodbury, Faculty of Medicine Dentistry Representative (Basic)(Epidemiology)
- 11) Dr. G. McCarthy, School of Dentistry Representative (Oral Biology)
- 12) Ms. D. Travis, Faculty of Health Sciences Representative, (Nursing)
- 13) Dr. D. Jonker, London Regional Cancer Centre Representative, (Oncology)
- 14) Ms. N. Pus, London Clinical Research Association Representative (Nursing)
- 15) Dr. M. Gibson, Research Institutes Representative (Psychology)

Alternates are appointed for each member.

THE REVIEW BOARD HAS EXAMINED THE RESEARCH PROJECT ENTITLED:

Prediction of Preterm Birth

REVIEW NO: 08253E

AS SUBMITTED BY: Dr. M.K. Campbell - Epidemiology & Biostatistics, University of Western Ontario

AND CONSIDERS IT TO BE ACCEPTABLE ON ETHICAL GROUNDS FOR RESEARCH INVOLVING HUMAN SUBJECTS UNDER CONDITIONS OF THE UNIVERSITY'S POLICY ON RESEARCH INVOLVING HUMAN SUBJECTS.

APPROVAL DATE: April 26, 2001 (UWO Protocol, Letter of Information & Consent)

AGENCY CIHR

AGENCY TITLE:

P. Harding, Chair

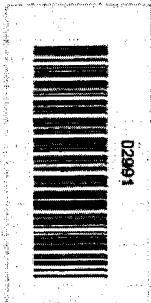
c.c. Hospital Administration

APPENDIX B

Relevant Sections from the Prenatal Health Project Questionnaire

Thank you for providing us with some information about your lifestyle. It is important for us to know something about your financial situation. I realize these are extremely personal matters and I wish to assure you again that your responses will be kept strictly confidential.

PARTICIPANTS MAY DECLINE TO RESPOND TO THIS QUESTION AS THEY FEEL IT IS TOO INVASIVE. YOU MAY NEED TO PROMPT SOME RESPONDENTS AS TO SOURCES OF INCOME. WE ARE INTERESTED IN ALL SOURCES INCLUDING MOTHER'S ALLOWANCE, WELFARE, DISABILITY, UNEMPLOYMENT INSURANCE, PENSION, STUDENT LOANS, LOTTERY WINNINGS, INHERITANCE.



29. What is your best estimate of the total income of all members of your household from all sources before taxes and deductions for the past year. By total income I mean total gross income from paid employment, government assistance, student loans or inheritance.
Was the total household income:

<input type="radio"/> Less than \$30,000	<input type="radio"/> Less than \$15,000 <input type="radio"/> Greater than or equal to \$15,000	<input type="radio"/> Less than \$10,000 <input type="radio"/> \$10,000 to \$14,999 <input type="radio"/> \$15,000 to \$19,999 <input type="radio"/> \$20,000 to \$29,999 <input type="radio"/> \$30,000 to \$39,999 <input type="radio"/> \$40,000 to \$59,999 <input type="radio"/> \$60,000 to \$79,999 <input type="radio"/> \$80,000 or more
<input type="radio"/> Greater than or equal to \$30,000	<input type="radio"/> Less than \$60,000 <input type="radio"/> Greater than or equal to \$60,000	

NO INCOME
 DON'T KNOW
 REFUSE TO ANSWER

30. When you think of your financial situation overall, how difficult would you say it is to meet each of the following commitments? (Please refer to the column labelled A from your response option table.)

Would you say that _____ tend(s) to be very difficult, somewhat difficult, not very difficult, or not at all difficult.

	Very difficult	Somewhat difficult	Not very difficult	Not at all difficult	Not applicable
Housing	1	2	3	4	
Food	1	2	3	4	
Children's clothing	1	2	3	4	5
Personal expenses	1	2	3	4	
Transportation	1	2	3	4	
Child care or babysitting	1	2	3	4	5
Child's recreational activities	1	2	3	4	5
Medical expenses	1	2	3	4	
Dental expenses	1	2	3	4	
Optical expenses	1	2	3	4	

Is there any other commitment that is difficult to meet financially? Yes No

(Please specify)

Thank you for telling me about your financial commitments. Now I would like to know a little bit about your energy level and the time it takes to do things on most days. (Please refer to column B in your response option table.)

APPENDIX C
CATEGORICAL VARIABLES: RAW FREQUENCIES

Table C1: Subjects Who Responded With “Other” When Asked How They Felt About Finding out That They Were Pregnant

<u>Response</u>	<u>Frequency (%)</u>
A bit stressed	1 (0.8%)
Anxious	1 (0.8%)
Initially scared, then happy	1 (0.8%)
Nervous	7 (5.6%)
Nervous and worried	1 (0.8%)
Overwhelmed	1 (0.8%)
Scared	17 (13.6%)
Scared (to tell parents)	1 (0.8%)
Shocked	47 (37.6%)
Shocked and Scared	3 (2.4%)
Shocked, but okay, because trust it's a good thing	1 (0.8%)
State of Shock	1 (0.8%)
Stressed	5 (4.0%)
Stressful	1 (0.8%)
Stunned	1 (0.8%)
Surprised	28 (22.4%)
Surprised and shocked	4 (3.2%)
Surprised, it happened so quickly	1 (0.8%)
Surprised-Old thought they were menopausal	1 (0.8%)
Very Scared	1 (0.8%)
Very Stressed	1 (0.8%)
	Total: 125

Responses listed in alphabetical order

Note: Frequency does not add up to 129 since 5 subjects stated they felt “other” when learning they were pregnant, but did specify the feeling

Table C2: Assisted Reproductive Technologies Used by Subjects

<u>Responses</u>	<u>Frequency (%)</u>
Chromafine	2 (2.53%)
Clomafed (seraphine) with insemination, Gonal-F	1 (1.27%)
Clomasin	1 (1.27%)
Clomephene	1 (1.27%)
Clomephene, femara, IUI	1 (1.27%)
Clomid	24 (30.38%)
Clomid, IUI	1 (1.27%)
Clomid, Pregnot	1 (1.27%)
Clomid/medformin	1 (1.27%)
Clomiphene-citrate, also progesterone	1 (1.27%)
Dostinex	1 (1.27%)
Femara	1 (1.27%)
Femera, repronex, insemination	1 (1.27%)
Fertility clinic, one dose of fertility pills	1 (1.27%)
Fertility drugs	5 (6.33%)
First used Clomiphene, then intrauterine insemination	1 (1.27%)
Hormone suppository	1 (1.27%)
Insemination and fertility drugs (clomid and purogone)	1 (1.27%)
Intrauterine Insemination	2 (2.53%)
Invitro fertilization	4 (5.06%)
Invitro fertilization and fertility drugs	1 (1.27%)
IUI	9 (11.39%)
IUI and fertility drugs, ephemera	1 (1.27%)
IUI and ovulation stimulating drugs	1 (1.27%)
IUI injection	1 (1.27%)
IUI, drugs	1 (1.27%)
IUI, Femara	1 (1.27%)
IVF maximum allowed, Flare program	1 (1.27%)
IVF, Prometrium, Synarel, Gonal-F	1 (1.27%)
Medication (coomiphene) in combination with antioicial insemination	1 (1.27%)
Omifin-ovulation stimulation drug	1 (1.27%)
Ovulating Stimulation Intrauterine Drugs	2 (2.53%)
Ovulation stimulating drugs-metaformin	1 (1.27%)
Progesterone	1 (1.27%)

Puregon	2 (2.53%)
Serophene	1 (1.27%)
Uterine insemination, fertility drug semara	1 (1.27%)
	Total: 79

Responses listed in alphabetical order

Note: Although there were 90 women who used ART to get pregnant, eleven women did not specify what they used

Table C3: Prior/Existing Medical Conditions

<u>Response</u>	<u>Frequency (%)</u>
High Blood Pressure Before Pregnancy (n=1992)	
No	1943 (97.54%)
Yes	49 (2.46%)
High Blood Pressure During Pregnancy (n=1984)	
No	1824 (91.96%)
Yes	160 (8.06%)
Diabetes Before Pregnancy (n=1992)	
No	1969 (98.85%)
Yes	23 (1.15%)
Diabetes During Pregnancy (n=1992)	
No	1929 (96.84%)
Yes	63 (3.16%)
Asthma (n=1985)	
No	1687 (84.99%)
Yes	298 (15.01%)
Gestational Diabetes* (n=1992)	
No	1969 (98.85%)
Yes	23 (1.15%)

*Question obtained from perinatal charts

Table C3: Other Medical Conditions Specified by Subjects

<u>Response</u>	<u>Secondary Conditions Listed (if applicable)</u>	<u>Frequency (%)</u>
Acid Reflux		2 (0.58%)
Acne		1 (0.29%)
ADHD		1 (0.29%)
Anemia		10 (2.91%)
Anemia	Breast Cancer Removed	1 (0.29%)
Anemia	Hypoglycemia	1 (0.29%)
Anemia	Neuropathy	1 (0.29%)
Anemia	Rheumatoid Arthritis	1 (0.29%)
Anemia	Vitamin B12 Deficiency	1 (0.29%)
Angina		1 (0.29%)
Anxiety		2 (0.58%)
Anxiety Attacks		1 (0.29%)
Anxiety Disorder		2 (0.58%)
Arthritis		2 (0.58%)
Asthma		2 (0.58%)
Autoimmune Disease		1 (0.29%)
Back Problem		1 (0.29%)
Bell's Palsy		1 (0.29%)
Bi-Polar Disorder		2 (0.58%)
Bleeding in Low Lying Placenta	Backpain	1 (0.29%)
Blood Cot		1 (0.29%)

Borderline Diabetes		1 (0.29%)
Bowel Obstruction		1 (0.29%)
Brain Aneurysm		1 (0.29%)
Brain Aneurysm		1 (0.29%)
Breathing Problems at Night		1 (0.29%)
Broke Arm		1 (0.29%)
Broken Knee		1 (0.29%)
Broken Leg	Kidney Stones, Viral Meningitis	1 (0.29%)
Bronchial Spasms		1 (0.29%)
Bronchitis		5 (1.45%)
Bronchitis	Yeast Infection	1 (0.29%)
Carpal Tunnel Syndrome		2 (0.58%)
Carrier for Hemophilia		1 (0.29%)
Celiac Disease	Floating Kidney	1 (0.29%)
Celiac Disease		2 (0.58%)
Cervical Cancer		1 (0.29%)
Chlamydia		1 (0.29%)
Chronic Bladder Infection		1 (0.29%)
Chronic Fatigue Syndrome		1 (0.29%)
Chronic Nasal Stuffiness		1 (0.29%)
Coagulant Problem		1 (0.29%)
Colitis	Back surgery	1 (0.29%)
Colitis	Gall Bladder Removed	1 (0.29%)

Crohn's Disease		4 (1.16%)
Cyst		1 (0.29%)
Cystinuria		1 (0.29%)
Deep Vein Thrombosis		1 (0.29%)
Depression		19 (5.52%)
Depression	Anxiety	1 (0.29%)
Depression	Interstitial Cystitis, Yeast Infection	1 (0.29%)
Depression	Strep B	1 (0.29%)
Depression	Stress Disorder, Panic Disorder	1 (0.29%)
Depression	Stress Related Illness	1 (0.29%)
Diabetes		4 (1.16%)
Dialysis Dependent		1 (0.29%)
Disc Problems	One Kidney	1 (0.29%)
Dizziness	Decreased Blood Pressure	1 (0.29%)
Dry Skin		1 (0.29%)
Eating Disorder		1 (0.29%)
Eczema		6 (1.74%)
Eczema	Allergies	1 (0.29%)
Eczema	Anemia	1 (0.29%)
Eczema	Back Pain	1 (0.29%)
Edema		1 (0.29%)
Endocrine Disease Hypophosphatasia		1 (0.29%)

Endometriosis		6 (1.74%)
Endometriosis	Gall Bladder Problems	1 (0.29%)
Endometriosis	Irritable Bowel Syndrome	1 (0.29%)
Endometriosis	Knee Surgery, Spondylitis, Spondylothesis	1 (0.29%)
Endometriosis	Migraines	1 (0.29%)
Epilepsy		6 (1.74%)
Factor 5 Clotting Disorder		1 (0.29%)
Factor 5 Clotting Disorder	Donated One Kidney	1 (0.29%)
Fetal Alcohol Syndrome		1 (0.29%)
Fibroids		2 (0.58%)
Fibromyalgia		4 (1.16%)
Fibromyalgia	Genetic Disc Disease	1 (0.29%)
Gall Bladder Attack		1 (0.29%)
Gall Bladder Disease		1 (0.29%)
Gall Bladder Removed		2 (0.58%)
Gall Bladder Removed	Blood Sugar Drops, Migraines	1 (0.29%)
Gall Bladder Removed	Irritable Bowel Syndrome	1 (0.29%)
Gall Bladder Stones		1 (0.29%)
Gastroesophageal Reflux Disease		2 (0.58%)
Gastroesophageal Reflux Disease	Kidney Transplant, Fibromyalgia	1 (0.29%)
Gastroesophageal Reflux Disease	Painful Menstruation	1 (0.29%)

Genital Herpes	Chronic Inflammatory Demyelinating Polyneuropathy	1 (0.29%)
Glucose Intolerance		2 (0.58%)
Grave's Disease		1 (0.29%)
Heart Murmur	Bilateral Patellofemoral Syndrome	1 (0.29%)
Heart Palpitations		2 (0.58%)
Heart Surgery		2 (0.58%)
Heartburn		1 (0.29%)
HELLP Syndrome		1 (0.29%)
HELLP Syndrome	Knee Injury	1 (0.29%)
Hepatitis A		2 (0.58%)
Hepatitis B		1 (0.29%)
Hepatitis C	Irritable Bowel Syndrome	1 (0.29%)
Hepatitis C	Upper Respiratory Tract Infections, GERD, Fibromyalgia, Kidney Transplant	1 (0.29%)
Hernia		2 (0.58%)
Herpes		1 (0.29%)
High Cholesterol		5 (1.45%)
High Cholesterol	Acid Reflux	1 (0.29%)
High Prolactin Level		1 (0.29%)
HIV		1 (0.29%)
Hives		1 (0.29%)

Hypoglycemia		9 (2.62%)
Hypoglycemia	Yeast Infection	1 (0.29%)
Hypothyroidism		1 (0.29%)
Intracranial Hypertension		1 (0.29%)
Irritable Bowel Syndrome		1 (0.29%)
Irritable Bowel Syndrome	Migraines	1 (0.29%)
Kidney Condition		1 (0.29%)
Kidney Stones		5 (1.45%)
Knee Injury		1 (0.29%)
Lactose Intolerant		1 (0.29%)
Low B12	Curve in Spine	1 (0.29%)
Low Blood Pressure		5 (1.45%)
Low Blood Sugar		1 (0.29%)
Low Hemoglobin		2 (0.58%)
Low Lying Placenta		1 (0.29%)
Low Platelet Count		1 (0.29%)
Lupus		3 (0.87%)
Migraines		22 (6.40%)
Migraines	Severe Menstrual Cramps	1 (0.29%)
Mono		1 (0.29%)
Mood Disorder		1 (0.29%)
Mood Disorder	Anxiety, Learning Disability	1 (0.29%)
Multiple Sclerosis		2 (0.58%)
Myasthenia Gravis		1 (0.29%)

Nephritis		1 (0.29%)
Neuropathologic Disorder		1 (0.29%)
One Kidney		1 (0.29%)
Osgood-Schlatter Disease		1 (0.29%)
Osteoporoses		1 (0.29%)
Ovarian Cysts		1 (0.29%)
Overweight		1 (0.29%)
Peptic Ulcers	Infertility	1 (0.29%)
Pericarditas		1 (0.29%)
Pituitary Tumor		1 (0.29%)
Placenta Previa		2 (0.58%)
Placenta Previa	Appendicitis	1 (0.29%)
Placenta Previa	Fibroids	1 (0.29%)
Polycystic Kidney Disease		1 (0.29%)
Polycystic Ovarian Disease		11 (3.20%)
Postpartum Depression		1 (0.29%)
Pre-Cancerous Cells of Cervix		1 (0.29%)
Predisposition for Blood Clots		1 (0.29%)
Problem With Kidney		2 (0.58%)
Problems with heart (unsure exactly what the problem is)		1 (0.29%)
Prolactinoma		1 (0.29%)
Proliferative Retinopathy		1 (0.29%)
Prothrombin Gene Mutation		1 (0.29%)

Psoriasis		1 (0.29%)
Psoriasis		8 (2.33%)
Renal Problems		1 (0.29%)
Rosea		2 (0.58%)
Scoliosis		4 (1.16%)
Seizure Disorder		1 (0.29%)
Sensitive Stomach		1 (0.29%)
Shortness of Breath		1 (0.29%)
Sickle Cell Trait		2 (0.58%)
Sinusitis		1 (0.29%)
Skin Cancer		1 (0.29%)
Spotting		1 (0.29%)
Stressed		1 (0.29%)
Stroke		1 (0.29%)
Supraventricular Tachycardia		1 (0.29%)
Symphysis Pubis Inflammation		1 (0.29%)
Tachycardia	Rheumatoid Arthritis	1 (0.29%)
Thalassemia Anemia		1 (0.29%)
Thomson's disease (myotonia congenital)		1 (0.29%)
Thyroid Problem		1 (0.29%)
Toxemia		2 (0.58%)
Toxemia	Ovarian Cysts	1 (0.29%)

Toxemia	Pre-eclampsia	1 (0.29%)
Ulcer		1 (0.29%)
Ulcerative Colitis		4 (1.16%)
Ulcerative Proctitis		1 (0.29%)
Urinary Tract Infection		1 (0.29%)
Urticaria		1 (0.29%)
Vaginal Eczema		1 (0.29%)
Vaginitis		1 (0.29%)
Varicose Veins		3 (0.87%)
Vision Loss		1 (0.29%)
Vitiligo		1 (0.29%)
Von Willebrand	Yeast Infection	1 (0.29%)
White Coat Syndrome		1 (0.29%)
Yeast Infection		8 (2.33%)
Yeast Infection	Kidney Damage (Infection)	1 (0.29%)
		Total: 344

*Conditions listed in alphabetical order

*Subjects who listed more than one condition are represented in the "response" and "secondary conditions listed"

*A total of 350 women specified having an "other medical condition". Three women were excluded from the analysis due to not stating their condition, not having the condition and being investigated for a condition

*Total does not add up to 350 since 6 were missing

APPENDIX D REGRESSION DIAGNOSTICS

Figure D1: Distribution of STAI-State Measure

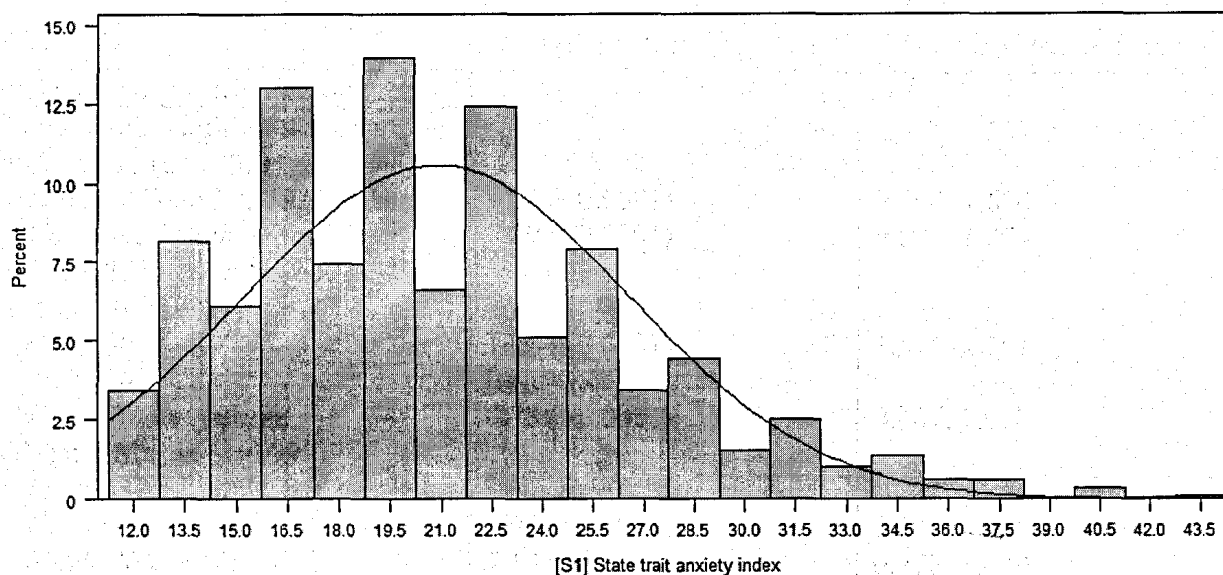
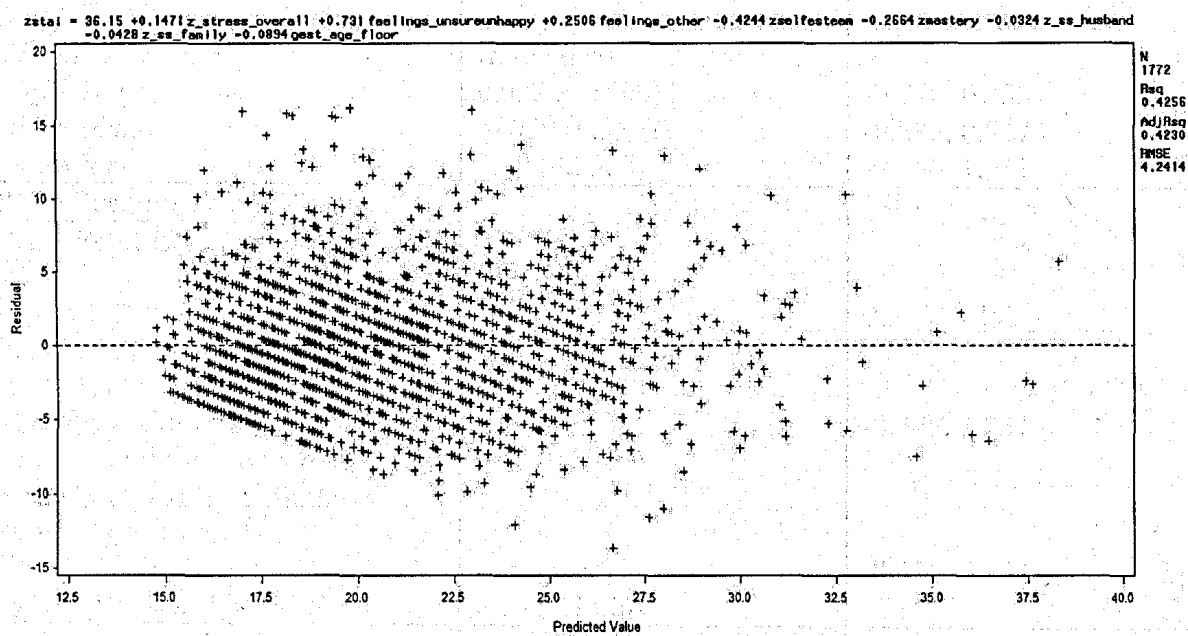


Figure D2: Distribution of Residuals from the Final Multiple Regression Model



APPENDIX E
Regression Coefficients for Linear Regression Models
Predicting Raw STAI Score

Table E1: Regression Coefficients for Linear Regression Models Predicting Raw STAI Score (n=1992)

Variable	Beta (p-value)	95% Confidence Limits
Sociodemographic Factors		
Sociodemographic Factors		
Education (n=1992)		
<i>Did Not Complete High School</i>	1.26 (<0.0001)	0.904, 1.624
<i>Completed High School Only</i>	0.89 (<0.0001)	0.504, 1.254
<i>More Than High School¹</i>	[reference]	
Income (n=1992)		
<i><30,000</i>	1.90 (<0.0001)	1.511, 2.291
<i>≥30,000¹</i>	[reference]	
<i>Don't Know/Refused</i>	0.73 (<0.0001)	0.407, 1.058
Marital Status (n=1992)		
<i>Married¹</i>	[reference]	
<i>Common Law</i>	1.08 (<0.0001)	0.748, 1.419
<i>Single/Never Married</i>	1.10 (<0.0001)	0.772, 1.429
<i>Separated/Divorced</i>	1.69 (<0.0001)	1.198, 2.192
Parity (n=1992)		
<i>0</i>	-0.19 (0.4517)	-0.687, 0.306
<i>≥1</i>	[reference]	
Residency Status (n=1992)		
<i>Born in Canada¹</i>	[reference]	
<i>≥11 Years</i>	0.022 (0.8900)	-0.290, 0.333
<i>6-10 Years</i>	-0.029 (0.9467)	-0.885, 0.827
<i>≤ 5 years</i>	0.49 (0.3987)	-0.650, 1.631
Prior Pregnancy Conditions		
Prior Fetal Loss (n=1992)		
<i>0</i>	[reference]	
<i>≥1</i>	0.92 (0.0007)	0.386, 1.452
Prior Caesarean Section (n=1927)		
<i>No Prior Caesarean Section</i>	[reference]	
<i>Prior Caesarean Section</i>	0.40 (0.3600)	-0.349, 1.231
Prior Preterm Live Birth (n=1992)		
<i>No Prior Preterm Live Birth</i>	[reference]	
<i>Prior Preterm Live Birth</i>	0.84 (0.1526)	-0.310, 0.153
Assisted Reproductive Technology (ART) (n=1992)		
<i>Conceived without ART</i>	[reference]	
<i>Conceived with ART</i>	0.19 (0.7597)	-1.009, 1.382
Feelings About the Pregnancy (n=1992)		

<i>Happy¹</i>	[reference]	
<i>Unsure/Unhappy</i>	2.0 (<0.0001)	1.606, 2.387
<i>Other</i>	0.64 (<0.0001)	0.391, 0.883
Medical Conditions		
Prior/Existing Medical Conditions (n=1992)		
<i>No Prior/Existing Medical Conditions</i>	[reference]	
<i>Prior/Existing Medical Conditions</i>	1.02 (<0.0001)	0.514, 1.520
Smoking During Pregnancy (n=1992)		
<i>Never Smokers¹</i>	[reference]	
<i>Smoked Before Pregnancy, but not During</i>	1.46 (<0.0001)	0.747, 2.179
<i>Smoked Before and During Pregnancy</i>	1.81 (<0.0001)	1.409, 2.208
Planned Pregnancy (n=1990)		
<i>No</i>	1.80 (<0.0001)	1.807, 2.888
<i>Yes</i>	[reference]	
Maternal Characteristics (Continuous)		
Maternal Age (n=1992)	-0.139 (<0.0001)	-0.188, -0.090
Gestational Age (n=1992)	-0.171 (0.0012)	-0.274, -0.068
Stress (n=1883)	3.07 (<0.0001)	2.863, 3.286
Social Support-Family (n=1989)	-1.66 (<0.0001)	-1.897, -1.423
Social Support-Friends (n=1984)	-1.70 (<0.0001)	-1.936, -1.462
Social Support-Husband/Partner (n=1992)	-1.14 (<0.0001)	-1.380, -0.893
Self-Esteem (n=1947)	-2.75 (<0.0001)	-2.973, -2.534
Mastery (n=1876)	-2.96 (<0.0001)	-3.182, -2.747

¹reference group for dummy variables in regression models (for categorical variables)