UNIVERSITY OF ALBERTA

THE RELATIONSHIP BETWEEN SYMPTOMS OF NAUSEA AND VOMITING DURING EARLY PREGNANCY AND PREGNANCY OUTCOMES

by 

Qiuping Zhou

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled THE RELATIONSHIP BETWEEN SYMPTOMS OF NAUSEA AND VOMITING DURING EARLY PREGNANCY AND PREGNANCY OUTCOMES submitted by QIUPING ZHOU in partial fulfilment of the requirements for the degree of MASTER OF NURSING

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Date: April 14/94.

DEDICATION

To my grandmother:

Mao Quanqin for her unselfish love, caring, and intelligence; for her persistence in pursuing a better life for me; for her continual strong efforts to make me happy; and for always supplying me with an abundance of encouragement and praise for any of my minor achievements. Her unconditional and everlasting pride in me warmed my heart and gave me confidence.

To the hard and bitter life

which I lived when I was a child.

To my dearest husband:

Shenbao Qiu for his love, understanding, constant support, protection, and help; for always encouraging me to achieve my academic goals and appreciating my capacity and efforts.

ABSTRACT

The purposes in this descriptive-correlational investigation were to a) find out whether there is a relationship between symptoms of nausea and vomiting during early pregnancy (NVP) and fetal gender, b) determine whether NVP have an effect on infant birth weight, and c) examine the relationship between demographic characteristics and the severity of NVP. The demographic characteristics of 157 women as well as symptom information were obtained from a previous study. The symptoms were quantified using the Rhodes Index of Nausea and Vomiting during the early stages of pregnancy. The pregnancy outcomes were collected after the women gave birth. Pregnancy outcome information was collected from 103 women.

Women bearing female infants reported longer episodes ($F=4.07$, $p<0.05$) and higher frequencies of nausea ($F=3.78$, $p=0.055$) than those bearing male infants. More female infants ($n=59$) than male infants ($n=46$) were born to the 103 symptomatic women. The ratio of male to female infants was 43.4 to 55.6, this is different from the regional population (50.12 to 49.88). However, since the sample size is small, this difference is not statistically significant. Using infant birth weight as the criteria variable, the stepwise procedure selected three variables explaining 27.7% of the total variance in birth weight. The three variables were length of gestation ($T=3.72$, $p<0.001$), previous parity status (primiparity vs. multiparity) ($T=-3.25$, $p<0.01$), and frequency of vomiting ($T=-2.175$, $p<0.05$). The longer the gestational age, the heavier the infant; multiparous women tend to have shorter gestational age but heavier infants and less vomiting. When the parity status was adjusted to zero, the mean birth weight of male infants was greater than that of female infants ($t_{102}=2.15$, $p<0.05$) in first pregnancy only. Women employed as service workers and menial labourers as well as professionals reported more retching symptoms than did the clerical and secretarial workers ($F_{24,258}=1.67$, $p<0.05$).

The findings suggest that fetal sex does play a role in the degree of NVP and infant birth weight is affected by severe vomiting. It is recommended that this study be replicated with a larger random sample so that these important issues can be further investigated and clarified.

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CHAPTER 1

INTRODUCTION

Nausea and vomiting are very common symptoms in early pregnancy. It has been reported that 70 to 90 percent of all pregnant women experience some degree of the symptoms (Jarnfelt-Samsioe, Samsioe, & Velinder, 1983; Tierson, Olsen, & Hook, 1986). Although numerous theories have been generated to explain the symptoms, the etiology of nausea and vomiting in pregnancy (NVP) remains uncertain (O'Brien & Newton, 1992). Therefore, the symptoms and associated factors are not fully understood and effective ways to relieve or decrease the symptoms have not been found.

Since NVP tends to occur at about the time of peak human chorionic gonadotropin (hCG) concentrations, it has been suggested that symptoms are associated with a rapidly rising serum hCG concentration (Masson, Anthony, & Chau, 1985; Sexena, 1983). It has been hypothesized that the secretion of hCG by the placenta is under fetal endocrine control (Hanning, Curet, Poole, Boehnlein, Kuzma, & Meier, 1989). The endocrine environment in the amniotic fluid is different between male and female fetuses (Bremme, Eneroth, & Nilsson, 1982). Since sex differentiation begins at 7 weeks gestation when NVP tends to begin, there is a possibility that fetal sex may play a role in the prevalence and degree of the symptoms. However, the association between the severity of symptoms and fetal gender has not been fully investigated.

Epidemiological studies have been conducted in the past to explore the relationship between symptoms and a variety of physiological, psychological and cultural variables (Depue, Bernstein, Ross, Judd, & Henderson, 1987; Fairweather, 1968; Jarnfelt-Samsioe et al., 1983; Klebanoff et al., 1985; Tierson et al., 1986; Weigel & Weigel, 1989). However, findings from these studies have been inconsistent. For example, the symptoms were reported to be more severe in multiparous women by some researchers (Jarnfelt-Samsioe, Eriksson, Waldenstrom, & Samsioe, 1985; Petitti, 1986) while others reported that primiparity was associated with more severe symptoms (Depue et al., 1987; Hall, 1943; Kallen, 1987; Klebanoff et al., 1985). Some researchers have found that education was associated with decreased nausea and vomiting (Fairweather, 1965; Klebanoff et al., 1985) while others have reported that symptoms were not associated with education (O'Brien, 1990; Pettiti, 1986).

The way that symptoms have been evaluated may account for some of the discrepancy in the previous studies. Most studies have evaluated symptoms by chart review. This assessment was often based on the care-giver's impression of how the women was feeling when she attended the prenatal service (Klebanoff et al., 1985; Petitti, 1986; Weigel & Weigel, 1989), it could not reflect the symptoms objectively. The incidence and degrees of NVP recorded in different studies have varied considerably depending on the definitions used. For example, the symptoms usually were recorded in two ways. One was

dichotomous recording (i.e., asymptomatic and symptomatic). A woman may be considered symptomatic if she reported nausea alone in one study (Jarnfelt-Samsioe et al., 1983; Jarnfelt-Samsioe et al., 1986) while in another study only if she reported mild or severe vomiting (Depue et al., 1987). It is very difficult to interpret these findings. Another way of recording the symptoms was to assign women to three groups according to whether they experience no symptoms, nausea only, or nausea and vomiting (Weigel & Weigel, 1989). Some researchers have added one more group - the very severe symptoms group (Goodwin, Montoro, Mestman, Pekary, & Hershman, 1992; Mori, Tamaki, Miyai, & Tanizawa, 1988). Those scales only measured the presence of nausea and vomiting and did not reflect the varying degrees of symptoms pregnant women experience. The two methods of recording could not give an accurate evaluation of the duration, distress and frequency of the symptoms the woman experienced. A woman might be assigned to the nausea group for experiencing 10 minutes of nausea per day while another one might be assigned to the same group for experiencing 10 hours of nausea each day. It could be true that a woman in the nausea and vomiting group vomited more than eight times a day while another one in the same group vomited only twice in one week. The above measurements did not differentiate the degree of symptoms.

Another reason for the discrepancy in the findings might be the statistical methods used in these studies. The majority

of the studies have used simple bivariate comparisons in assessing risk of nausea and vomiting (Jarnfelt-Samsioe et al., 1986; Pettiti, 1986). Since numerous factors which relate to nausea and vomiting are highly intercorrelated, most of the previous studies have generally provided insufficient information to assess which factors made significant independent contributions to the relationship. Only two previous studies took into account the interrelationships among variables in their analysis (Klebanoff et al., 1985; Weigel & Weigel, 1988).

Few studies were found that focused on general NVP. Most studies focused on severe NVP, often referred to as hyperemesis gravidarum. However, emesis in pregnancy also calls for attention since nausea and vomiting during pregnancy adversely affects a woman's ability to perform work-related tasks and family and social functions. Symptoms may affect biological status, diet, and health status (Alley, 1984; O'Brien & Naber, 1992; Weigel & Weigel, 1988). It has been demonstrated that absence of early pregnancy-related nausea and vomiting symptoms may indicate an increased risk for fetal loss. Therefore, the presence of NVP may predict favourable pregnancy outcome (Depue et al., 1987; Klebanoff et al., 1985; Weigel & Weigel, 1989). Thus the identification of the factors associated with the incidence of nausea and vomiting has significant practical and clinical implications.

Purpose

The purposes in this descriptive-correlational investigation were to a) find out whether there is a relationship between symptoms of NVP and fetal sex, b) determine whether NVP symptoms have an effect on infant birth weight, and c) examine the relationship between demographic characteristics and the severity of NVP.

Definition of Terms

NVP

Any symptoms of nausea alone or the combination of nausea, retching, and vomiting occurring in the pregnancy, unassociated with other medical conditions coincidental to the pregnancy (e.g., hepatitis, pyelonephritis, influenza, appendicitis, eating disorders such as bulimia, etc.). Symptoms can be mild to moderate (morning sickness) or severe (hyperemesis gravidarum).

Multiparous

Pertaining to a woman who has borne one or more than one children.

Primiparous

Bearing a child for the first time. Primiparity refers to the condition of being primiparous.

Primigravida

A woman being pregnant for the first time.

Nulliparous

A woman who has never given birth to a child.

CHAPTER II

REVIEW OF RELEVANT LITERATURE

The most important consideration in this study is to examine the relationships between symptoms of nausea and/or vomiting/retching during pregnancy and infants' gender, birth weight, and demographic characteristics. Demographic characteristics include maternal age, smoking behaviour, occupation, and parity. Studies that evaluated the etiology of NVP, risk factors related to NVP, and the relationship between NVP and pregnancy outcomes were reviewed. Nursing, medical, and midwifery studies (1934 to present) were found through computer and manual searches.

Three topics are included in this review. 1) the etiology of NVP will be discussed with major findings in the hormone environment during pregnancy including human chorionic gonadotropin (hCG), thyroid hormone, and oestradiol levels being addressed; 2) relationships between NVP and demographic variables, i.e., maternal age, smoking behaviour, parity, occupation will be discussed; and 3) relationships between NVP and pregnancy outcomes including the associations between NVP symptoms and still births, malformation, birth weight, and fetal sex will be addressed.

Overview of NVP

Nausea and vomiting are the most frequent, most characteristic, and probably the most troublesome symptoms of early pregnancy. The incidence of NVP ranges from 69 to 90 percent in all pregnant women. The incidence of vomiting ranges from 46 to 57 percent (Jarnfelt-Samsioe et al. 1883; Weigel & Weigel, 1989; Klebanoff et al. 1985; Petitti, 1986; and Tierson et al. 1986).

The mean week of onset of nausea is 6 to 6.9 weeks of gestation (Jarnfelt-Samsioe et al. 1883; Tierson et al. 1986). In a prospective study conducted by Tierson and associates (1986), nausea was reported in twenty percent of women by the fourth week of gestation. Thereafter, the numbers of women developing symptoms of nausea increased rapidly. By week sixteen, 98 percent of all women who developed nausea (about 86% of the total sample) had begun having symptoms. Some women experienced nausea for only a few weeks. By the twelfth week of gestation, 30 percent of nauseated women stopped having symptoms. By week 15, fifty percent stopped. The number of women with nausea continued to decline, and by the twentieth week of gestation, 75 percent of women stopped having symptoms. A few women continued having nausea throughout their pregnancies (Tierson et al. 1986).

Approximately 92 percent of women who vomit during pregnancy will have symptoms by the twelfth week of gestation (Tierson et al. 1986). Fifty percent of vomiting women will

stop by the fifteenth week, while the mean week of cessation of vomiting is 17.3 weeks (Tierson et al. 1986). Nausea will persist longer among women whose nausea is accompanied by vomiting than those having nausea alone (Tierson et al. 1986). The variance for onset of vomiting is greater than that for nausea (Tierson et al. 1986). Nausea and vomiting in early pregnancy is often referred to as "morning sickness".

Etiology

The etiology of nausea and vomiting in pregnancy remains uncertain although endocrine, allergic and psychosomatic factors have been advanced to explain symptoms (Schoeneck, 1942; Baylis, Leeds & Challacombe, 1982; Atlee, 1934; Chertok, Mondzain & Bonnaud, 1963). Among suggested causal factors, abnormal hormone environment as a possible etiologic agent seems to be the most promising. Hormonal factors associated with NVP included increased levels of human chorionic gonadotropin (hCG), Thyroxine, and Oestrogen. The relationships between each of these factors and NVP symptoms are discussed separately.

HCG: hCG level in pregnancy has been the focus of many studies. It is well documented that hCG concentration increases exponentially during early pregnancy, with a doubling time of 1.7-2 days, reaching peak values by 8-12 weeks of gestation (Brody & Carlstrom, 1965; Kadar, Freedman, & Zacher, 1990; Sexena, 1983). This is the time when nausea and vomiting is most prevalent and severe. Some researchers

have tried to establish the relationship between hCG levels and the symptoms of NVP but there is great discrepancy in the findings. For example, some researchers identified statistically higher hCG levels in patients with nausea alone or nausea with vomiting than in asymptomatic women (Schoeneck, 1942; Masson, Anthony & Chau, 1985; Mori et al. 1988). In one study it was found that severely affected women had statistically higher levels of hCG, with primigravid women having higher hCG concentrations than multigravid women in the same group (mean 41.8+/-4.0 vs 32.2+-2.3, df=35, $P<0.005$) (Kauppila, Huhtaniemi & Ylikorkala, 1979). In another study it was found that mean hCG excretion from 7 to 20 weeks in normal pregnant subjects was significantly higher than for hyperemesis patients (Fairweather, 1965). Other researchers were unable to relate hCG levels to nausea and vomiting symptoms and failed to find obvious differences in hCG levels in hyperemetic compared with nonvomiting women (Souls, Hyges, Carcia, Livergood, Prystowsky, & Alexander, 1980; Depue et al, 1987). It is possible that the reason for discrepancies in findings is partly due to changes in the technology that have led to increasingly sensitive methods of evaluating hCG levels.

Thyroid Function: It is well documented that hCG has a thyroid-stimulating effect (Kaupilla et al, 1979; Mori et al, 1988; Goodwin, Montoro, Mestman, Pekary, & Hershman, 1992). In a study assessing differences in serum hCG concentration in

hyperemesis and control subjects, Goodwin et al (1992) divided subjects into four groups, i.e., no vomiting, some vomiting, hyperemesis and severe hyperemesis (subjects with liver function and electrolyte abnormalities). They found significant differences in hormone concentration in women with severe symptoms. Serum hCG correlated negatively with TSH ($r=-0.48$, $P<0.001$) and positively with free T4 ($r=0.45$, $P<0.001$) across the whole population. The degree of thyroid stimulation varied with the concentration of hCG and correlated with the degree of symptoms. Oestradiol was highest in severely symptomatic women, but did not differ significantly among the other groups. Goodwin and his colleagues presented a hypothesis to explain the relationships among the hormones: hCG stimulates TSH receptor which induces hyperthyroidism; hCG also stimulates hCG receptors, which produce increased oestradiol levels, and increased oestradiol causes vomiting. They argued that hCG is the cause of the thyroid stimulation in women with hyperemesis gravidarum and is closely related to the cause of vomiting. By categorizing 132 women in early pregnancy according to presence or absence of nausea and vomiting (i.e. no symptoms, nausea only, and nausea and vomiting), Mori and associates (1988) studied the relationship among serum Free T4, TSH, hCG and symptoms of nausea and vomiting. They reported that the symptoms of NVP correlated significantly with changes of free T4, TSH, and hCG. Free T4 in all women correlated negatively with their TSH levels ($r=-$

0.439, $p<0.001$) and positively with their hCG levels($r=0.283$, $P<0.002$). These changes were especially obvious in groups with nausea and vomiting. They also found that the mean level of hCG was highest in the group with nausea and vomiting, and intermediate in the group with nausea only. They argued that the thyroid gland is activated in early pregnancy by hCG, and changes in thyroid function may induce NVP symptoms.

Oestradiol: The concentration of oestradiol increases rapidly during the time that nausea and vomiting tends to occur. Therefore it has been suggested that nausea and vomiting result from the direct and indirect effects of rapidly increasing oestrogen levels (Depue et al, 1987). The supporting evidence for the role of oestrogen in morning sickness comes from several clinical and experimental studies (Jarnfelt-Samsioe et al. 1983; Jarnfelt-Samsioe et al. 1986). Jarnfelt-Samsioe and associates reported that women who could not tolerate oral contraceptives were at increased risk for NVP. Results from epidemiological studies support the hypothesis that oestrogen-related factors such as body weight, parity, and smoking status, correlate with the degrees of NVP (Jarnfelt-Samsioe et al. 1983; Klebanoff et al. 1985). In a sero-epidemiologic study, Depue and his colleagues (1987) found that the oestradiol concentration adjusted for length of gestation was significantly higher in women with severe NVP than in control subjects. Primiparous women have higher circulating and urinary oestrogen levels than multiparous

women and women in their first pregnancies have higher first-trimester oestrogen levels than in subsequent pregnancies (Bernstein, Depue, Ross, Judd, Pike, & Henderson, 1986).

It has been argued that elevated oestrogen levels early in pregnancy is the major cause of hyperemesis gravidarum (Depue et al. 1987). The disappearance of symptoms by the twentieth week in most women is believed to reflect a gradual adjustment to the hormonal environment of pregnancy (Jarnfelt-Samsioe et al. 1986; Weigel & Weigel, 1988).

Hormone Levels in Relation to Fetal Sex: Fetal gender is geneticly determined. Genetic patterns lead to the gonal differentiation, which determines the hormonal environment of the embryo (Speroff, Glass & Kase, 1983). The first sign of gonadal development is in the fifth week and active sex differentiation begins by 6 weeks gestation when the embryo is male (Pelliniemi & Dym, 1980). By the end of 8 weeks, the male fetus starts to synthesize androgens, and the concentration of testosterone begins to increase in testicular tissue, blood, and amniotic fluid. Testosterone levels reach a maximum concentration by the 12 to 18th week of gestation in amniotic fluid (Pelliniemi & Dym, 1980; Speroff et al. 1983). The mechanism of male sex differentiation is not known. It is suggested that hCG is the hormone that triggers sex differentiation (Pelliniemi & Dym, 1980; Speroff et al. 1983).

It is hypothesized that the secretion of hCG by the placenta is under fetal endocrine control (Hanning et al,

1989). There is evidence to support this. First, hCG rises exponentially to peak at 8-10 weeks, then falls and plateaus for the rest of the pregnancy; second, the concentration of hCG in maternal peripheral blood and placental tissues is higher at term in female-bearing pregnancies than in male-bearing pregnancies (Brody & Carlstrom, 1965; Hanning et al, 1989; Wide & Hobson, 1974). Several studies failed to demonstrate any difference in hCG levels between male and female fetuses in first trimester maternal serum (Brody & Carlstrom, 1965; Wide & Hobson, 1974). However, maternal serum hCG is influenced by the sex of the fetus after the 17th week of amenorrhoea. Significantly different values exist for hCG concentration in women pregnant with a female fetus than in those pregnant with a male fetus (Leporrier, Herrou and Leymarie, 1992).

Amniotic fluid hormone levels were investigated in relation to fetal sex (Bremme et al. 1982). Among normal pregnancies (15-21 weeks gestation), sex-related differences were noted in amniotic fluid hCG concentrations with higher values recorded for female fetuses ($t=2.07$, $P=0.043$). Using amniotic hormone levels to diagnose fetal sex, amniotic testosterone levels explained 43 percent of the diagnosis of fetal sex in normal pregnancies. Measurement of hCG levels in amniotic fluid improved the fetal sex diagnosis by 14 percent. Also hCG levels in amniotic fluid correlated with maternal serum concentration of hCG only if the fetus was female. That

might affect hCG levels in first trimester maternal serum. The data of Bremme and associates (1982) demonstrated that normal sexual development in the female fetus was reflected in correlations between amniotic hormones, e.g., prolactin/HPL, prolactin/hCG, alpha-fetoprotein/hCG, and total oestriol/hCG. In normal male fetal pregnancies, these correlations were absent. Endocrine environment is relatively different for male and female fetuses (Bremme et al, 1982), but very few studies have taken fetal sex into account when investigating the hormonal profile.

In a study of steroid hormones in emetic and non-emetic pregnancy, Jarnfelt-Samsioe and associates (1986) studied first trimester serum hormone levels for ninety pregnant women. It was found that the serum concentration of cortisol was significantly lower in the emesis group; the increment in serum testosterone was not as pronounced in the emetic subjects as in the non-emetic group. This finding might suggest gender differences. In this study, the authors found that the sex of the infant was more often male in the non-emetic group than in the population, but the difference was not statistically significant. The mean levels of progesterone were lower in emetic women and significantly lower progesterone values were found in emetic women in gestational week fourteen. In addition, the mean plasma concentration of oestradiol increased almost five times between gestational week nine and gestational week sixteen but no difference was

found between the emesis and non-emesis groups. Jarnfelt-Samsioe and colleagues (1986) also found that in women whose pregnancy ended in spontaneous abortion, oestradiol and progesterone levels were low.

Since the sex differentiation starts at the time when nausea and vomiting tends to occur, there is a possibility that fetal sex may play a role in the occurrence and severity of NVP. Only one study has been found that investigated correlations between peripheral hormone concentration and the severity of nausea and vomiting or the sex of the fetus (Jarnfelt-Samsioe et al. 1986) and no significant results were obtained. As in most studies, the definition of emetic and nonemetic pregnancy was vague. Therefore it is difficult to interpret findings.

NVP and Associated Risk Factors

The relationships between NVP and selected demographic variables such as maternal age, parity, multiple pregnancy, maternal body weight, ethnicity, education and occupation, smoking and alcohol consumption, previous history of emesis in pregnancy, and interbirth interval have been investigated. Each of these variables will be addressed separately.

Maternal Age: Among maternal factors, increased age is associated with decreased nausea and vomiting (Klebanoff et al. 1985; Weigel & Weigel, 1988; Depue et al. 1987; Pettiti, 1986; Kallen, 1987; O'Brien, unpublished). Younger women were at increased risk for severe NVP, i.e., women over 35 years

old had less risk of vomiting than those under 20 years old (Klebanoff et al. 1985; Weigel & Weigel, 1988; Depue et al. 1987; Pettiti, 1986; Kallen, 1987). Pettiti (1986) suggests that women over 35 are less likely than younger women to be nauseated because the absence of nausea is a biologic marker for poor placental function. Jarnfelt-Samsioe and associates (1983) did not support the hypothesis. They found no correlation between nausea and age. In another study, Jarnfelt-Samsioe, Eriksson, Waldenstrom, & Samsioe (1985) found that nausea was not as common in women between 25-29 years of age than in younger and older women.

Parity: Vomiting has been found to be more common among primiparous women, although this has not been consistently confirmed (Hall, 1943; Pettiti, 1986; Jarnfelt-Samsioe et al. 1986). It was reported that primiparous women had an early onset and tended to have more severe symptoms that lasted longer than did multiparous women (Hall, 1943). Kallen (1987) further reported that younger primiparous women had higher rate of hyperemesis gravidarum. Some other studies confirmed that primiparous women were at increased risk for vomiting (Klebanoff et al. 1985; Depue et al. 1987), while findings from two other studies showed the opposite result (Pettiti, 1986; Jarnfelt-Samsioe et al. 1986; O'Brien, unpublished). These investigators reported that women of higher parity tend to be more nauseated than primiparous women.

Multiple Pregnancy: Women with twin pregnancies tend to

be at greater risk for nausea and vomiting and the nausea and vomiting tends to be more severe (Jarnfelt-Samsioe et al. 1983; Klebanoff et al. 1985; Kallen, 1987). Jarnfelt-Samsioe and associates (1983) reported that 7 of 8 women with twin pregnancies complained of nausea, contrasting with 50 percent of women who experienced spontaneous abortions and 80 percent of women who experienced legal abortions. Women with twin pregnancies were at increased risk and this phenomena is usually explained by higher hormone concentrations, especially higher serum hCG concentrations (Kallen, 1987).

Maternal Body Weight: Findings from some studies demonstrated that women who were heavier vomited more often than did controls (Klebanoff et al. 1985; Depue et al. 1987; Behran et al. 1990). This finding supports the hypothesis that oestradiol has an effect on NVP since oestradiol is synthesized in adipose tissue. One research study found no relationship between maternal body mass and NVP (O'Brien, Unpublished).

Ethnicity: Race has been found to have an effect on the occurrence of nausea and vomiting by some researchers (Fairweather, 1968; Klebanoff et al. 1985; Weigel & Weigel, 1988; Behran et al. 1990). Klebanoff and colleagues reported that vomiting was more common among Blacks than Whites. They also reported that age was strongly associated with symptoms experienced by white women but had little effect among Blacks. White primiparas were more likely to vomit than were white

multiparas, while the effect of parity for Blacks was not significant. Fairweather (1968) reported that white, middle class women were more likely to be affected than were black and lower socioeconomic women. Others found no significant correlation between the percentage of women who were nauseated during pregnancy and their race (Pettiti, 1986).

Occupation and Education: It has been reported that vomiting is more common in women with less education (Fairweather, 1965; Klebanoffet et al., 1985). Other studies failed to support this hypothesis (Pettiti, 1986; O'Brien, unpublished). It was reported that housewives tend to have more NVP than employed women (Weigel & Weigel, 1988). Another researcher found that manual or service workers experienced more nausea and vomiting than did clerical or secretarial workers ($F=2.83$, $df_{3, 56}$, $P<0.05$) (O'Brien, unpublished).

Smoking: A negative correlation between nausea and smoking was documented (Little & Hook, 1979; Jarnfelt-Samsioe et al. 1983; Klebanoff et al. 1985). Smokers have significantly less nausea and vomiting than do non-smokers (Little & Hook, 1979; Jarnfelt-Samsioe et al. 1983; Klebanoff et al. 1985; O'Brien, Unpublished). Pre-pregnancy alcohol consumption was also found to be related to decreased risks for nausea and vomiting (Weigel & Weigel, 1988; Little & Hook, 1979). Women who consumed alcohol frequently prior to pregnancy were less likely to experience NVP than those who did not consume alcohol.

Previous History of Emesis in Pregnancy: Previous nausea and vomiting were positively related to nausea and vomiting in subsequent pregnancies (Fairweather, 1968; Klebanoff et al. 1985; Weigel & Weigel, 1988). This finding supports a physiological basis for nausea and vomiting, which may be inherited.

Interbirth Interval: In one study it was reported that the frequency of emesis was higher in women with short inter-gestational intervals (Jarnfelt-Samsioe et al. 1986) while in a multivariate study, Weigel & Weigel (1988) found that inter-pregnancy interval was not associated with nausea and vomiting. Weigel & Weigel (1988) argued that the relationship found between severity of nausea and vomiting and inter-pregnancy interval in other studies was due to the use of inappropriate statistical methods.

Other Factors: Jarnfelt-Samsioe and associates (1983) found a strong correlation between nausea in pregnancy and 'intolerance' to oral contraceptives, as 98 percent of these women experienced nausea. They suggested that oestradiol has an effect on the occurrence of nausea and vomiting during pregnancy. It was also reported that the duration of NVP has a noteworthy tendency to decrease with the number of pregnancies per woman. This was interpreted by Jarnfelt-Samsioe and associates (1983) as an adaptation of hormonal metabolism to the changes induced by pregnancy which resembles the situation experienced by alcoholic abuse or drug

addiction. Arguing that most researchers studying factors associated with nausea and vomiting fail to take into account inter-relationships among the variables, Weigel & Weigel (1988) conducted a multivariate retrospective study with 825 subjects. Doing a factor analysis, they identified three independent factors associated with decreased or increased risks for nausea and vomiting. The first factor accounted for 27.6 percent of the variance and had a high loading on white ethnicity (0.86), a medium loadings of white collar/ professional status (0.52) and consumption of alcohol (0.47). The second factor accounted for 12.6 percent of the common variance and had high loadings on older age (older than 35 years) (0.70) and a history of infertility (0.67). The third factor accounted for 12.2 percent of the variance and identified a high loading on a history of frequent nausea in previous pregnancies (0.68), a medium loading on current housewife status (0.45), and a negative medium loading on the time of first prenatal visit. The three factors accounted for more than 50 percent of the total variance. However, this was the only multivariate study in which these risk factors were identified. No other evidence was found that supports these findings.

NVP and Pregnancy Outcomes

Most epidemiological studies concerning NVP and pregnancy outcomes have been focused on prenatal death and infant malformation. Relatively few studies have been found that

investigated the relationships between NVP and infant sex, birth weight, and length of gestation.

Fetal Mortality, Malformation and Gestational Age: It was demonstrated that women who vomit were at decreased risk for fetal loss and preterm delivery (Klebanoff et al. 1985; Weigel & Weigel, 1989; Depue et al. 1987; Pettiti, 1986). In a meta analysis of previous researches, Weigel and Weigel (1989) investigated 11 studies that explored the relationship between NVP and pregnancy outcomes. They reported that in seven studies with data on spontaneous abortion and its association with NVP, there was an inverse relationship ($P<0.001$ for six of the seven studies). In those studies, findings showed a significantly higher proportion of women with no nausea and vomiting experienced fetal death compared to symptomatic women (Klebanoff et al. 1985; Tierson et al. 1986; Depue et al. 1987). Weigel & Weigel's meta analysis (1989) suggested that a decreased mortality risk associated with NVP is restricted to the first 20 weeks of gestation. In other studies, differences in mortality rate were not noticed (Pettiti, 1986; Kallen, 1987). Since the definition of NVP varied from study to study, it is difficult to assemble the results from different studies. Caution should be payed when conducting and interpreting meta analysis.

In some studies it was reported that vomiting during pregnancy does not increase the risk of having a malformed infant (Fairweather, 1978; Klebanoff et al. 1986; Pettiti,

1986). However, Depue and associates (1987) found an increased incidence of central nervous system and related skeletal malformation in infants of mothers experiencing severe symptoms. Findings from another study of severely ill women also showed a significant increase in congenital malformations (Kallen, 1987). However, the possible teratogenic effects of antiemetics made these retrospective studies difficult to control.

In one study no difference between emetic and non-emetic pregnancies concerning length of gestation was identified (Jarnfelt-Samsioe et al. 1986). Kallen (1987) reported a moderate effect of hyperemesis on the length of gestation, but the effect was restricted to gestational ages of less than 38 weeks. For very short gestational age, this effect did not exist. Klebanoff and associates (1985) found that vomiting was associated with a modest but statistically significant prolongation of gestation, suggesting that the vomiting group were less likely to deliver preterm babies. Tierson and associates (1986) also reported that the length of gestation for non-emetic pregnancies was shorter than that of emetic pregnancies. When estimating length of gestation, Old Chinese people always say "lazy girl, industrious boy". This means that male infants are born earlier than female infants. There is no formal study in the literature concerning the difference of the length of gestation between male and female infants.

Infant Birth Weight: Vomiting did not significantly

affect birth weight (Klebanoff et al. 1985; Fairweather, 1968). In an epidemiological study, Depue and associates (1987) found no difference in birth weight or length of gestation between patients with severe NVP and controls. They also found no significant differences in the frequency of infants born before 35 weeks' gestation or with weights less than 2500 grams. Tierson and associates (1986) reported that a large proportion of low birth weight infants were born to women having no symptoms of NVP. The authors argued that part of the reason for this phenomenon was that women having no symptoms of NVP were more likely to be delivered earlier due to the effect of a high intake of protein food. Increased protein intake causes the maturation of the fetus to be more rapid than normal and therefore, the gestational length is shortened (Tierson et al. 1986).

In another study, it was found that maternal age and social group had no significant effect on the birth weight (Kariniemi & Rosti 1988). The significant independent variables that accounted for variation in birth weight were identified as gestational age at birth, infant sex, maternal smoking, and parity (Kariniemi & Rosti 1988). Behrman and associates (1990) also reported a positive relationship between birth weight and length of gestation.

Alcohol and tobacco use were frequently associated with decreased infant birth weight. It was reported that alcohol consumption affects female birth weight, while maternal

smoking affects the birth weight of both sexes (Kariniemi & Rosti, 1988). The effect of smoking on decreased birth weight was also documented by several other researchers (Little & Hook, 1979; Weigel & Weigel, 1988). Women who do not work outside the home were reported to have higher infant birthweight and placental weight (Weigel & Weigel, 1989). Weigel & Weigel (1989) divided 873 women with singleton pregnancies into three ordered categories: neither nausea nor vomiting; nausea but no vomiting; nausea and vomiting. The length of gestation, birthweight, body length at birth, head circumference, one and five minute Apgar scores, placental weight, and other variables were evaluated. Researchers found that with increasing maternal age, there was an increase in birth weight and five minute Apgar scores. In a registry study conducted in Sweden, Kallen (1987) reported a moderate effect of severe NVP on birthweight if the birthweight was less than 2500 grams. For very low birthweight (less than 1,000 grams) this effect was not demonstrated.

Infant Sex: Few studies were found that investigated the relationship between the symptoms of NVP and the infants' gender. Kallen (1987) conducted a retrospective study using a sample of 3068 women with hyperemesis gravidarum. Forty-seven percent of the infants were males and fifty-three percent were females, this was statistically different (chi-square=29, $P<0.001$) from the reported incidence in the general population (male infants 51%). This finding was supported by a study

conducted by Hsu and Witter (1993). Among 66 pregnant women with severe hyperemesis gravidarum, 44 female fetuses and 22 male fetuses were identified ($P<0.01$). These findings support the hypothesis that fetal androgen could counteract the effect of oestrogen on emesis (Jarnfelt-Samsioe et al. 1985).

In a post-pregnancy survey of a cohort of 7767 pregnancies, Pettiti (1986) reported that the percentage of women nauseated during pregnancy was 70.1 for those who delivered a boy and 73.3 for those who delivered a girl. However, the difference was not statistically significant. The author argued that although the exact physiologic mechanism for nausea of pregnancy is unknown, levels of hCG, oestrogen, and progesterone are profoundly altered during pregnancy. Any of these changes could explain NVP. In another study, the sex of the newborn, and infant and placental weight had no correlation with emesis gravidarum (Jarnfelt-Samsioe et al. 1986). The author did notice that the sex of the infant was more often male in the non-emetic group than in the general population, but again, the difference was not statistically significant. In a similar study O'Brien has found that the symptoms of vomiting were more severe if the infant was female ($t=-2.21$, 62 df, $P<0.03$) (O'Brien, 1990).

Summary

Studies investigating NVP defined the symptoms using nominal measures, such as no nausea and vomiting, nausea only, nausea and vomiting, hyperemesis (Mori et al. 1988; Goodwin et

al, 1992). They really measured the presence of NVP rather than the varying degrees of symptoms. Since NVP is almost a universal but variate symptom, nominal measures cannot be considered sensitive. Ordinal or continuum scales are needed to increase the measurement sensitivity.

Although many factors have been associated with NVP, many of these relationships have not been supported in further studies. The etiology of NVP suggests that infant gender may have an effect on NVP symptoms, but few epidemiological studies have examined the relationship between the varying degrees of symptoms and infant gender. Do women bearing female infants experience more severe NVP than those bearing male infants? Do the symptoms affect birth weight? What are the characteristics of the relationships between demographic variables and symptoms of NVP? The purpose of this study is to examine these questions.

Hypothesis

To address the purposes, the following hypothesis were tested:

1. Women bearing female infants will experience more severe NVP symptoms than those bearing male infants.
2. There will be a relationship between the NVP symptoms and specific demographic variables.
    2a. There will be a relationship between the NVP symptoms and maternal age.
    2b. There will be a relationship between the NVP symptoms and cigarette smoking.

2c. There will be a relationship between the NVP symptoms and the occupation.

2d. There will be a relationship between the NVP symptoms and parity.

3. There will be a relationship between the NVP symptoms and the birth weight of the infant.

CHAPTER III

RESEARCH METHODS

Design of the Study

A descriptive-correlational research design was employed to conduct this study. The purpose was to identify factors associated with NVP and the relationships among them.

Sample Characteristics and Sampling Procedure

The sample for this study was those who had already enroled in a clinical trial that was designed to evaluate the efficacy of P6 acupressure in treating symptoms of nausea and vomiting during early pregnancy (P6 clinical trial) (O'Brien, Relyea & Teraem, 1992). The group consisted of 161 volunteers who reported that they were experiencing NVP. They were recruited through advertisements placed in community newspapers and through posters placed in the offices of health care providers. In addition, municipal news services publicized the study. Participants were recruited from all areas of Edmonton as well as from surrounding rural areas. Subjects were enroled from April 1991 to March 1993.

Those who met the following criteria were included in the P6 clinical trial. Volunteers: a) had not used acupressure in the past; b) were experiencing nausea and vomiting during pregnancy; c) were older than 16 years of age; d) were able to understand the purpose of the study, e) were able to sign a written , informed consent. Subjects were assigned to one of

the three groups (i.e., intervention, placebo, or control) through a process of blocked randomization.

Of the 161 participants, three withdrew initially when they learned that they were in the control group. One subject's demographic data was missing. Five subjects did not evaluate their symptoms for first two days for various reasons. A total of 153 subjects completed the questionnaires which were used to quantify the symptoms for the first two days of the seven day trial.

Of the 153 women who finished the clinical trial, two women miscarried. The expected birth date for two of the women was later than November 1, 1993. Therefore 149 women were eligible to participate in this study.

Instrument

The Rhodes Inventory of Nausea and Vomiting (Rhodes INV) (Appendix 1) is an eight item, Likert type, pencil and paper instrument that measures "the individual components of nausea, vomiting, retching, and associated distress" (Rhodes, 1990; P. 888). The questionnaire measures duration, frequency, and distress associated with nausea; frequency, amount, and distress associated with vomiting; and, frequency and distress associated with retching. The overall score for the Rhodes INV scale ranges from 8 to 40. The minimum score that can be attained is 8 while 40 implies the most serious symptoms. In the Rhodes INV, three items, question 4, 5 and 7 are related to nausea and the range of scores for this subscale is 3-15.

Three items, questions 1, 3, and 6 are concerned with vomiting and the range of scores for the subscale is 3-15. Two items, question 2 and 8 address retching and the range for this subscale is 2-10.

Validity

Construct validity for the Rhodes INV was established by factor analysis. The authors of the Rhodes INV reported that three factors were extracted using factor analysis, i.e., nausea, vomiting, and retching factors (Rhodes, Watson & Johnson, 1984; Rhodes, 1990). Another researcher identified only two factors accounting for 84 percent of the common variance in her study (O'Brien, 1990). The first factor is a 5 item vomiting and retching factor. The second factor is a 3-item nausea factor identical to Rhodes' nausea factor.

Construct validity was also established by conducting an independent sample t-test between scores for 75 pregnant women and for 27 non-pregnant women of child bearing age who served as the control group. The pregnant women had much higher mean scores on the instrument as a whole ($t_{101}=4.3$, $P<0.0001$) and on each of the two subscales ($P<0.0001$) (O'Brien, 1990).

Concurrent validity was evaluated by correlating the subject's rating of her symptoms with the rating recorded by her care giver. The care giver's rating was determined by chart review. The subject was assigned a score of 0 to 3 according to the varying degrees of her symptoms. The correlation between the Rhodes INV and the provider rating was

moderate ($r=0.50$, $p < 0.0002$) (O'Brien, 1991).

Reliability:

The author of the Rhodes INV reported initial reliability greater than 0.90 in 11 of 12 administrations of this instrument (Rhodes, 1990). In a separate study, the Rhodes INV was administrated to 102 pregnant subjects and non pregnant controls in a pilot study, the overall Cronbach's alpha coefficients was 0.88. Internal consistency for the nausea and vomiting subscale was 0.90 and 0.88 respectively (O'Brien, 1991).

Overall, the validity and reliability were acceptable. The Rhodes INV is copyrighted and copies were purchased and used for the P6 clinical trial.

The **Pregnancy Outcome Questionnaire (POQ)** was developed for this study to gather pregnancy outcome information, i.e., sex, birth weight, length of gestation (Appendix 2).

This questionnaire with nine items was developed by the researcher and was mailed to subjects to gather information about pregnancy outcomes. Most questions in the questionnaire are concrete questions about infant weight and gender. The content validity of the tool was established by asking two experts in maternal newborn education and practice to review it.

Procedure

The data for this study incorporated selected data that

had been collected in the original P6 clinical trial and the data collected by this researcher.

Data Obtained from the P6 Clinical Trial

Demographic data was collected at the time subjects were recruited into the P6 clinical trial. Each participant was asked to fill out a demographic information sheet (Appendix 3). Demographic variables that were thought to affect the degree of nausea and vomiting were collected (O'Brien, 1990). This data included gestational age at time of initial admission, maternal age, occupation, working status, smoking behaviour, previous pregnancy loss, gravida, and parity status. Gestational age was calculated using the date of admission and the date of first day of the last menstrual period. Occupational status was determined using the Four Factor Index of Social Status (Hollingshead, 1975).

The symptoms of NVP were evaluated when the subject was enroled into the P6 clinical trial and for six days following her admission. Nausea and vomiting information collected before the treatment/placebo was introduced were utilized in this study. The prevalence of nausea and vomiting/retching symptoms was obtained using the Rhodes Inventory of Nausea and Vomiting (Rhodes INV). Prevalence is operationalized as the presence and degrees of nausea and vomiting at the time the subject was completing the Rhodes INV and for 12 hours prior to that time. The Rhodes INV was colour coded for each day of the study and each participant was asked to evaluate her

symptoms using this instrument on the admission day and twice daily for the duration of the study. The P6 clinical trial study lasted for 7 days, Admission day, day 2 through day 7. The treatment/ placebo was introduced on the morning of day 3. Symptom information gathered on admission day and day 2 served as baseline data.

In this study, symptom information on admission day, day 2 morning, and day 2 evening was used to evaluate the prevalence and degrees of nausea and vomiting/retching.

Data Collected in This Study

The Pregnancy Outcomes Questionnaire was used to collect information about pregnancy outcomes. The questionnaire was mailed to the subjects selected from the P6 Clinical trial study with an accompanying cover letter from Dr. O'Brien, principal investigator in the clinical trial (Appendix 4) The letter discussed consent, confidentiality and the expected date of return of the questionnaire. The phone numbers of Dr. O'Brien and the researcher were included. If subjects did not respond to the questionnaire within three weeks, a reminder letter (appendix 5) and another questionnaire were sent. It was assumed that subjects who did not respond after that mailing did not want to participate. If the pregnancy was known to end in abortion or fetal death, the woman was not contacted.

To ensure accuracy in data collection, the subject's previous code number was included on the bottom of the

questionnaire. The pregnancy outcomes included length of gestation, infant sex, birth weight, time NVP started, time NVP stopped, baby's condition at birth, medications taken during pregnancy, and the birth condition.

Methods of Data Analysis

SPSS for windows was the statistical program that was used to analyze the data. Factor analysis was performed to establish construct validity of Rhodes INV. Cronbach's alpha was used to evaluate inter-item reliability and test-retest reliability.

The distribution of demographic variables, i.e., gestational age at admission to the study, maternal age, occupation, work held outside home, smoking behaviour, gravid and parity status, previous abortions, sexes and birth weight of the previous children, and NVP symptoms associated with previous pregnancies was described. Symptoms that were quantified using the Rhodes INV were presented. The pregnancy outcome information was also described using descriptive statistics.

The associations among variables were tested using bi-serial and Pearson product moment correlation formulas. Following the correlational study, further analysis was carried out using Multivariate Analysis of Variance (MANOVA), Analysis of Variance (ANOVA), and Chi-square. Stepwise regression procedures were carried out to evaluate the predictability of independent variables for explaining infant

birth weight.

In the present study, questions concerning duration, frequency, and distress from nausea, frequency and distress from retching, frequency, amount and distress from vomiting were examined separately and concurrently. For statistical tests, the level of significance was set at alpha=0.10 for MANOVA, alpha=0.05 for the rest of the tests. One tailed results were used in interpreting the relationship between infant sex and symptoms. The rest of the relationships were obtained using two tailed values.

CHAPTER IV

RESULTS

The findings from this study will be reported in two sections: (a) the response rate to the Pregnancy Outcomes Questionnaire and (b) the results of the study.

The Response Rate to the Pregnancy Outcome Questionnaire

Pregnancy Outcome Questionnaires were sent to 149 women. One hundred and three women (69.1%) returned the completed questionnaire to the researcher. Two women returned the blank questionnaires and declined to participate (1.34%). Twenty two questionnaires (15%) were returned because the women had moved and could not be reached. The total number of women who received questionnaires was 127. Therefore the actual participation rate was 81.1 percent.

The high response rate was anticipated because of the subjects previously demonstrated interest and participation in P6 Clinical Trial.

Table 4.1
Response Rate to the Pregnancy Outcome Questionnaire

SENT	RETURNS		NO REPLY	MOVED	TOTAL
	Completed	declined			
149	103	2	22	22	149
	69.1%	1.34%	14.8%	14.8%	100%

Results

The information presented in this chapter is divided into four sections. In the first section a description of the sample is provided. In the second section, an examination of the instrument including validity and reliability is discussed. Thirdly, a summary of the important correlations are presented, and finally a comparative analysis including discussion of the results from Chi-square, Multivariate Analysis of Variance (MANOVA), and Analysis of Variance (ANOVA) is presented. Variables were assigned scores and the scores for each rating scale were then used for statistical analysis.

Description of the Sample

Demographic variables of the original 157 women in the P6 clinical study

The frequencies and/or means and standard deviations of the 157 women who finished the demographic information sheet are as follows (see Table 4.2).

Maternal Age: Ranged from 18 to 43 years old, with a mean of 29.57 years. Two women (1.3%) were younger than 20 years old, 141 women (89.8%) were from 20 to 35 years old, and 14 (8.9%) women were 36 to 43 years old.

Gestational Age: When admitted to the P6 study, the gestational age ranged from 32 to 165 days, with a mean of 70.55 days. One hundred and twenty one women (78.6%) were less than or equal to 12 weeks of gestation (84 days) on admission

to the P6 study. The gestational age for 33 women (21.4%) ranged from 12 to 24 weeks (85 to 165 days).

Smoking behaviour: Twenty one of the 157 women (13.4%) were smokers; 136 (86.6%) did not smoke.

Occupation: One hundred women (63.7%) filled out an occupation. Among them, 10% were menial labours, unskilled or semiskilled workers, and small business owners; 25% were clerical and sale's workers; 47% were technicians, semi professionals or minor professionals; 18% were administrators, executives, or professionals.

Work outside home: Eighty six women (54.8%) worked outside home at the time they enroled in the P6 study; while 71 (45.2%) worked in the home (housewives).

Gravida: Ranging from 1 to 8 with a mean of 2.71. Thirty women (19.1%) did not experience a previous pregnancy before, while the rest of them had one or more previous pregnancies.

Parity: Forty-six women (29.5%) had no completed pregnancy previously, while 111 women (70.5%) had one or more previous completed pregnancies. The parity ranged from zero to 5. Fifty seven (36.3%) had one child, 38 (24.2%) had two, 14 (8.9%) had three, and 2 women had five children.

Previous spontaneous abortion: The majority of women (n=107, 68.2%) did not experience any previous spontaneous abortion, while the rest (n=50, 30.8%) had one or more previous abortions.

Sex of the first child: Of the 111 multiparous women, the

first births of fifty-four women (48.6%) were females, fifty-eight women's first child/children was/were male(s) (54 had single birth, two women had male twins).

Birth weight of the first child: For the 111 multiparous women, the mean birth weight of their first child was 119.42 ounces (7 lbs and 7 OZ). The lowest birth weight was 47 ounces (2 lbs and 15 OZ) while the highest birth weight 155 ounces (9 lbs and 11 OZ).

NVP associated with first child/children: One hundred women (90.1%) reported that they had some NVP associated with their first children.

Summary of the demographic variables from the original and the final samples is presented in Table 4.2.

Demographic variables of the Sample of 103 women

Outcome data for 103 women included in this study were evaluated. The demographic variables for this group of women follow:

Maternal Age: The mean of age was 29.95, with a minimum of 18, maximum of 43. The distribution was similar to the original sample.

Gestation age. The gestational age on admission to the P6 study ranged from 32 to 160 days with a mean of 71 days.

Smoking behaviour. Of women who returned the pregnancy outcome questionnaire, only 7 (4.2%) were smokers.

Occupation. Thirty (29.1%) of the 103 women were housewives and 73 (70.9%) of them had an occupation. The mode

of the women who had an occupation were clerical/ secretarial workers (22 women, 30.6%).

Table 4.2
Demographic characteristics of the original and final sample

Variable	Mean	SD	Minimum	Maximum	N
Maternal age	29.57	4.54	18	43	157
AGE final	29.95	4.47	18	43	102
Gestational age	70.55	24.77	32	165	154
GA final	70.93	24.75	32	160	100
Prev SP Abortion	.52	.93	0	5	157
SAB final	.58	.95	0	5	102
Gravida	2.71	1.39	1	8	157
GR final	2.68	1.41	1	8	102
Parity	1.18	1.03	0	5	157
PARA final	1.12	1.04	0	5	102
Occupation	6.07	1.72	1	9	100
OCCUP final	6.21	1.50	1	9	73
WGT1	119.42	17.22	47	155	106
WGT1 final	120.59	16.98	87	155	66

AGE final -maternal age of the 103 women who returned the completed POQ.
Gestational age - days of pregnancy when admitted to the P6 study.
GA final - gestational age of the 103 women who returned the completed POQ.
Prev SP Abortion - previous spontaneous abortions.
SAB final - previous spontaneous abortions for the 103 women who returned the completed POQ.
GR final - gravida of the 103 women who returned the completed POQ.
PARA final - parity of the 103 women who returned the completed POQ.
OCCUP final - occupation of the 103 women who returned the completed POQ.
WGT1 - birth weight of the first child of the multiparous women.
WGT1 final -birth weight of the first child of the multiparous women in the final sample group (n=103).

Work Outside Home. The majority of women (64, 62.7%) worked outside home when they participated in the P6 Clinical Trial.

Gravida. ranged from 1 to 8 with a mean of 2.68. Twenty-five (24.5%) of the women had no previous pregnancy.

Parity. Thirty-four women (33.3%) had no previous live birth, while the rest of them had 1 to 5 live births.

Spontaneous Abortion. The majority of women (66, 64.7%) had no previous spontaneous abortion while the rest (33, 35.3%) had at least one abortion.

Sex of the first child: Sixty eight women (65.4%) were multiparous. Thirty three (48.5%) of their first children were male, 34 were female, while one women had twin males.

Birth weight of the first child: The average birth weight of the first child born to the multiparous women in this group was 120.59 ounces. The range was from 87 to 155 ounces.

NVP associated with the first child: Of the 68 multiparous women in this group, 62 (91.2%) reported some NVP associated with their first child.

Description of NVP symptoms of the 157 women

The eight items in the Rhodes INV were divided into three subscales, i.e., nausea subscale (item 4, 5, and 7), vomiting subscale (item 1, 3, and 6), and retching subscale (item 2 and 8). The distributions and means of the three subscales are described as follows:

Nausea Subscale: The mean values of each participant's reported Rhodes INV nausea subscale ranged from 1.44 to 5.0 with a mean of 3.44. Twenty-seven percent of the sample had a mean below 3.0. Fifty-three percent had a mean between 3 to 4. About 19.7 percent of the sample had a mean greater than 4. Since the lowest value of each subscale is one, the data

indicated that in the two-day study period, every woman reported some nausea symptoms.

Retching Subscale: Twenty-eight women (18.7%) reported not experiencing any symptoms from retching in the two days. Ninety-three women (62%) reported a mean between 1.17 to 2.5. Only 29 people (19.3%) reported a mean greater than 2.5. The mean score for the total sample was 1.94.

Vomiting Subscale: Sixty women (43.6%) did not experience any vomiting symptoms in the two days. Sixty-seven women (45%) reported a mean score ranging from 1.11 to 2.5. Only 17 (11.4%) reported a mean score greater than 2.5. The average of all the means was 1.56.

The Rhodes Nausea, Vomiting and Retching Overall: The mean value of Rhodes INV overall for the 148 women who finished the three measurements was 2.35. The scores ranged from 1.21 to 4.92. Forty-one women (27.7%) reported a mean below 2. Ninety-five (64.2%) reported a mean ranging from 2 to 3 and twelve women (8.1%) reported a mean greater than 3. The data indicated that every participant experienced some symptoms related to nausea, vomiting and retching.

The mean, standard deviation and range of the Rhodes INV overall as well as the three subscales from both the original and the final samples are summarized in Table 4.3.

Table 4.3
Summary of the Rhodes INV subscales and overall

Variable	Mean	Std Dev	Minimum	Maximum	N
NVP OVERALL	2.35	.57	1.21	4.92	148
NVP final	2.33	.52	1.21	3.75	99
NAUSEA	3.41	.74	1.44	5.00	152
nausea final	3.44	.72	1.56	5.00	102
RETCHING	1.94	.81	1.00	5.00	150
retching final	1.90	.77	1.00	4.77	101
VOMITING	1.56	.68	1.00	4.78	149
vomiting final	1.50	.62	1.00	3.22	100

final - the 103 women who returned the completed POQ.

Description of NVP symptoms of the 103 women

As showed in Table 4.3, the mean, standard deviation, and range of the scores of the subjects in this study were similar to those in the original sample. The mean for Rhodes INV overall was 2.33, for nausea subscale was 3.44, for retching subscale was 1.90 and 1.50 for vomiting subscale. The distribution of the symptom scores in this study were similar to those of the original sample.

Description of the pregnancy outcome variables

Length of gestation in weeks. Of the 103 births, 1 occurred in the 34th week, 1 in the 35th week, 2 in the 36th week, and 7 in 37 weeks. The gestational length was less than 38 weeks for 10.7 percent of the sample. The rest of the women were between 38 and 46 weeks of gestation when the baby was born. Of these, one birth occurred in the 43rd week and one was reported by the subject as occurring in the 46th week.

Gender of the infants: There were 101 singleton births

and two twin births. Of the 101 singleton births, 45 were male, 56 were female. Of the two twin births, one resulted in two females and one resulted in one male and one female. Therefore, the 103 births resulted in 105 infants, 46 were male and 59 were female (Table 4.4).

Table 4.4
Frequency distribution of infant gender

Category	Frequency	Percent	Cum percent
male	45	43.7	43.7
female	56	54.4	98.1
two females	1	1	99
one male and one female	1	1	100
Total	103	100	100

Birth weight of the infants: The mean birth weight of the 105 infants was 123.83 ounces (7 lbs and 11 OZ). The minimum birth weight was 76 ounces (4 Ibs and 12 OZ), the maximum was 162 ounces (10 Ibs and 2 OZ).

Time NVP started: Thirty-one women (30.7%) responding to the questionnaire reported that the symptoms started within one month after the last menstrual period, 61 (60.4%) reported that the symptoms started between one and two months, only 8 women (7.9%) said the symptoms started between 2 to 3 months following the first day of the last menstrual period.

Time NVP stopped: Due to the enrolment criteria, all women had some periods of nausea with or without vomiting during their pregnancy. Of the 101 women responding to this question, 11 (10.9%) reported that symptoms stopped in the

third month, 33 (32.7%) in the fourth month, 18 (17.8%) in the fifth month, 12 (11.9%) in the 6th month, 4 (4.0%) in the seventh and the eighth month, and 23 (22.8%) had the symptoms until the birth.

Duration of NVP: Eight women (7.8%) had symptoms for only one month, fifty-two (50.1%) had symptoms for two or three months, twenty-one women (20.6%) had symptoms that lasted for four to six months, fourteen (13.7%) had symptoms for seven months, and six (5.9%) had symptoms for eight months.

Infant health problems: When asked whether there were any problems with the baby's health at birth, the majority reported no problem (n=82, 80.4%). There was one still-born male baby. The rest of the twenty women reported one or more problems and they included: one baby with respiratory problems, 4 with jaundice, 1 with placental insufficiency, 2 with colic, 2 with congenital problems, 2 with premature labour, 1 with meconium, and 5 with other problems.

Baby's birth: Of the 102 women who responded to this item, 64 (62.7) experienced a natural birth, 11 (10.8%) a forcep birth, 8 (7.8%) a vacuum extraction, 12 (11.8%) a caesarian section, and 7 (6.9%) an induced labour.

The pregnancy outcome variables are summarized in Table 4.5.

Table 4.5
Summary of pregnancy outcome variables

	Mean	SD	Min	Max
length (weeks)	39.83	1.75	34	46
start (month)	1.75	0.61	1	3
stop (month)	5.58	2.12	3	9
duration of NVP (months)	3.77	2.19	1	8
birth weight (ounces)	123.83	15.35	76	162

Examination of the Rhodes INV

Validity of the instrument:

Construct validity of the Rhodes Inventory of Nausea and Vomiting (Rhodes INV) was assessed to determine whether question items would fall into the categories established earlier in the literature review. Findings from the literature review indicated that either two or three subscales were extracted - nausea, vomiting, and retching subscales (Rhodes, Watson, and Johnson, 1984) or nausea and vomiting/retching subscales (O'Brien, 1990).

According to Kerlinger (1973), factor analysis can be used to determine a number of underlying concepts among many measures. In this study, factor analysis was used to determine whether those eight items fell into the two or three categories that had been established by other researchers.

Description of the eight item scores of the Rhodes INV:

The scores for each question from the three measurements were added up to a single value, i.e., q1 equals day1 question1 plus day2 morning question1 plus day2 evening question1; q2 equals day1 question2 plus day2 morning question2 plus day2 evening question2, and so on. The mean, standard deviation, and range of scores from the eight items are summarized in Table 4.6. The frequency distribution of the scores from the 8 items are summarized in Table 4.7a to Table 4.7c. For each question, 3 indicates the least symptom while 15 indicates the most severe symptom.

Table 4.6
Description of the eight items in Rhodes INV

Variable	Mean	Std Dev	Minimum	Maximum
Q1-frequency of vomiting	4.44	1.89	3	13
Q3-distress from vomiting	4.95	2.39	3	15
Q6-amount of vomiting	4.62	2.18	3	15
Q4-duration of nausea	11.37	2.61	3	15
Q5-distress from nausea	8.79	2.10	4	15
Q7-frequency of nausea	10.53	2.74	4	15
Q2-distress from retching	6.22	2.60	3	15
Q8-frequency of retching	5.44	2.58	3	15

Table 4.7a
Distribution of Rhodes INV vomiting items

	Q1-frequency vomit			Q3-distress vomit			Q6-amount vomit		
	freq	%	cum%	freq	%	cum%	freq	%	cum%
3	71	46.6	46.7	69	45.4	45.4	74	49.3	49.3
4	26	17.1	63.8	12	7.9	53.3	17	11.3	60.7
5	17	11.2	75.0	15	9.9	63.2	17	11.3	72.0
6	17	11.2	86.2	24	15.8	78.9	15	10.0	82.0
7	9	5.9	92.1	11	7.2	86.2	7	4.7	93.3
8	8	5.3	97.4	6	3.9	90.1			
9				6	3.9	94.0	5	3.3	96.7
10	2	1.3	98.7	4	2.6	96.7	2	1.3	98.0
11	1	0.7	99.3	3	2.0	98.7	2	1.3	99.3
12				1	0.7	99.3			
13	1	0.7	100						
15				1	0.7	100	1	0.7	100

fre - frequency
% - percent
cum% - cumulative percent

Table 4.7b
Distribution of Rhodes INV nausea items

	Q4-duration nausea			Q5-distress nausea			Q7-frequency nausea		
	freq	%	cum%	freq	%	cum%	freq	%	cum%
3	1	0.7	0.7						
4	1	0.7	1.3	1	0.7	0.7	1	0.7	0.7
5				4	2.6	3.3	4	2.6	3.3
6	5	3.3	4.6	15	9.9	13.2	6	3.9	7.2
7	6	3.9	8.5	25	16.4	29.6	11	7.2	14.5
8	11	7.2	15.7	27	17.8	47.4	16	10.5	25.0
9	15	9.8	25.5	29	19.1	66.4	18	11.8	36.8
10	11	7.2	32.7	16	10.5	77.0	20	13.2	50.0
11	17	11.1	43.8	21	13.8	90.8	16	10.5	60.5
12	31	20.3	64.1	9	5.9	96.7	24	15.8	76.3
13	20	13.1	77.1	1	0.7	97.4	11	7.2	83.6
14	17	11.1	88.2	2	1.3	98.7	8	5.3	88.8
15	18	11.8	100	2	1.3	100	17	11.2	100

Table 4.7c
Distribution of Rhodes INV retching items

	Q2-distress retching			Q8-frequency retching		
	freq	%	cum%	freq	%	cum%
3	31	20.5	20.5	41	27.0	27.0
4	20	13.2	33.8	31	20.4	47.4
5	15	9.9	43.7	19	12.5	59.9
6	14	9.3	53.0	23	15.1	75.0
7	23	15.2	68.2	11	7.2	82.2
8	19	12.6	80.8	6	3.9	86.2
9	12	7.9	88.7	9	5.9	92.1
10	7	4.6	93.4	2	1.3	93.4
11	7	4.6	98.0	5	3.3	96.7
12	2	1.3	99.3	2	1.3	98.0
13				2	1.3	99.3
15	1	0.7	100	1	0.7	100

Factorial analysis of Rhodes INV:

Using listwise deletion of missing values and principal components analysis, when the criterion for selecting the number of factors as the number of eigenvalues greater than 1 was used, two factors were extracted explaining 74.7 percent of the total variance. However, when examining the results, it showed that the third factor accounted for 11.4 percent of the variance. Including the third factor (eigenvalue=0.91), the three factors accounted for 86 percent of the total variance. There was a clear separation between factor 3 and factor 4 (Table 4.8).

Table 4.8
Eigenvalues of Factors extracted

Factor	Eigenvalue	Percent of variance	Cum percent
1	4.06	50.8	50.8
2	1.91	23.9	74.7
3	0.91	11.4	86.0
	0.43	5.4	91.4

An oblique rotation was performed. The pattern matrix (Table 4.9) showed that factor 1 was a vomiting cluster, with the three items concerning vomiting loaded high on it (0.942, 0.858, 0.944). It accounted for 32.74 percent of the total variance. The second factor was a nausea factor, with the items concerning nausea loaded high on it (0.936, 0.765, 0.834). It accounted for 29.81 percent of the total variance. Factor 3 concerned retching, with question 2 and 8

loaded high on this factor (0.851, 0.980). It accounted for 21.05 percent of the total variance.

The communality ranged from 0.72 to 0.90 (Table 4.9). It indicated that 72 to 90 percent of the variance of each item could be reproduced by the three selected factors.

Table 4.9
Pattern Matrix

	Factor 1	Factor 2	Factor 3	communality
Q1-frequenc vomiting	.951 *	.000	.014	.892
Q2-distress retching	.145	.018	.851 *	.884
Q3-distress vomiting	.890 *	-.031	-.104	.884
Q4-duration nausea	.000	.962 *	.106	.870
Q5-distress nausea	.070	.812 *	-.044	.719
Q6-amount vomiting	.960 *	.036	.047	.894
Q7-frequenc nausea	-.062	.896 *	-.094	.837
Q8-frequenc retching	-.068	.010	.980 *	.901
sum of squares	2.6193	2.3861	1.6839	
Accountability	32.74%	29.81%	21.05%	

The factor correlation matrix (Table 4.10) showed that the vomiting factor and the nausea factor had a correlation of 0.245, the vomiting and the retching factor had a correlation of 0.518, and the retching and the nausea factor had a correlation near 0.325. This is reasonable that all the three concepts are correlated. Using the Pearson product moment correlation, a significant relationship between nausea and vomiting (Table 4.10a) ($r=0.248$, $P=0.002$), a significant relationship between nausea and retching ($r=0.347$, $P<0.001$), and a significant relationship between retching and vomiting ($r=0.561$, $P<0.001$) were demonstrated.

Table 4.10
Factor Correlation Matrix

	Factor1	Factor2	Factor3
Factor1-vomiting	1.00		
Factor2-nausea	0.24	1.00	
Factor3-retching	0.52	0.32	1.00

Table 4.10a
Correlations between Rhodes INV overall and subscales

	Vomiting	Nausea	Retching	NVP overall
Vomiting	1.0000	r=.248 n=149 p.002	r=.561 n=148 p<.001	r=.7481 n=148 p<.001
Nausea		1.0000	r=.347 n=150 p<.001	r=.777 n=148 p<.001
Retching			1.0000	r=.786 n=148 p<.001

NVP overall - Rhodes INV Overall (the sum of the eight items in the Rhodes INV).

Further factor analyses using scores from the first, second, and third measurement separately extracted the same factors and resulted in a similar factor loading matrix.

Reliability of the Instrument:

Adding up all the eight items in the Rhodes INV (Rhodes INV Overall), the test-retest reliability was 0.77 over the two day periods, with 150 cases and three different measurements.

The internal consistency (Cronbach) between the Rhodes INV nausea items (Q4, Q5, Q7) in the first measurement was 0.806, in the second measurement was 0.848, and 0.835 in the third measurement. It indicated that the duration, distress

and frequency of nausea are highly correlated. The three questions can therefore be analyzed together as a nausea subscale. The test-retest reliability of the nausea subscale (adding up the three nausea items) over the three measurements was 0.73.

The internal consistency for the vomiting items (Q1, Q3 and Q6) were 0.909, 0.912, and 0.863 respectively. The test-retest reliability of the subscale (three vomiting items together) was 0.75, with 149 cases and three measurements.

The internal consistency for retching items (Q2 and Q8) in the first measurement was 0.817, in the second measurement was 0.754, and 0.812 in the third measurement. The test-retest reliability over the study period was 0.81, with 150 cases and three measurements.

Both the internal consistency and test-retest reliabilities were high. To get further understanding of the instrument, the test-retest reliability for each item in the Rhodes INV questionnaire was also performed. The reliabilities were 0.70, 0.73, 0.66. 0.73, 0.71, 0.69, 0.73, and 0.84 respectively. Question 1, 3, and 6 concern frequency, distress, and amount of vomiting; question 2 and 8 concern distress and frequency of retching; question 4, 5, and 7 concern duration, distress and frequency of nausea. The results indicated that the symptoms over time were consistent for each item.

Results of the Correlational Analysis

Both bi-serial and Pearson product moment correlation formulas were employed to analyze data.

Correlations between demographic variables:

Correlations between selected demographic characteristics, including maternal age, gestational age, occupation, work outside home, parity, smoking behaviour, and previous spontaneous abortion were explored. The important correlations are summarized in Table 4.11.

Table 4.11
Correlations between Demographic Variables

	cig	gesage	occup	outjob	gravida	para1	para2	sab
age	.128 n=154 p.11	-.083 n=157 p.307	.218 n=100 p.029 *	-.09 n=157 p.256	.342 n=157 p.000 *	.335 n=157 p.000 *	-.298 n=157 p.000 *	.157 n=157 p.05 @
cig	1.000	.020 n=154 p.803	.035 n=100 p.725	-.169 n=157 p.034 *	-.027 n=157 p.734	.0135 n=157 p.867	-.041 n=157 p.614	-.024 n=157 p.770
outjob			.092 n=100 p.362	1.000	.133 n=157 p.097	.203 n=157 p.011 *	-.180 n=157 p.024 *	-.078 n=157 p.334
gravida					1.000	.782 n=157 p.000 *	-.561 n=157 p.000 *	.696 n=157 p.000 *
para1						1.000	-.724 n=157 p.000 *	.157 n=157 p.05 @
para2							1.000	-.079 n=157 p.324

Age - maternal age. Cig - smoking behaviour.
Gestage - gestational age. Occup - occupational grouping (four groups).
Outjob -work outside home. Sab - previous spontaneous abortion.
Para1 - previous live births.
para2 - previous parity status, i.e., primiparous vs multiparous.

* - significant at P<0.05, two tailed.
@ - approaching significant.

Maternal age correlated positively with occupational grouping ($r=0.218$, $P=0.029$), gravida ($r=0.342$, $p<0.001$), and parity (number of previous live births) ($r=0.335$, $P<0.001$). Maternal age was associated with previous parity status ($r=-0.298$, $p<0.001$) with the direction that multiparous women tended to be older than primiparous women. The relationship between age and previous spontaneous abortions was approaching significant ($r=0.157$, $P=0.05$).

Smoking habits related to whether a subject works outside home or not ($r=-0.169$, $P=0.034$). Women who work in the home were more likely to smoke than women who were employed outside home.

Working outside of the home had a significant relationship with number of previous live births ($r=0.203$, $P=0.011$) and previous parity status ($r=-0.180$, $p=0.024$). Women with children tended to work in the home.

Gravida correlated with number of previous live births ($r=0.782$, $p<0.001$) and previous spontaneous abortions ($r=0.696$, $p<0.001$). The relationship between the number of previous live births and the number of previous spontaneous abortions was approaching significant ($r=0.157$, $p=0.05$).

Correlations between demographic variables and pregnancy outcomes:

Relationships between demographic variables and pregnancy outcomes are summarized in Table 4.12. The length of gestation correlated with parity status ($r=-0.213$, $p=0.031$). Primiparous

women tended to have longer gestation, which is a normal finding with a first pregnancy. There is a relationship between infant birth weight and number of previous live births (r=0.205, p=0.04) and parity status (r=0.238, p=0.02). primiparous women tended to have smaller infants.

Table 4.12
Correlations between Demographic Variables and Pregnancy Outcomes

	age	cig	occup	outjob	para1	para2	sab
length	-.11 n=102 p.272	-.094 n=102 p.347	.101 n=73 p.394	.043 n=102 p.667	-.103 n=102 p.304	-.213 n=103 p.031 *	.044 n=102 p.660
sex	.024 n=102 p.808	-.069 n=102 p.489	.042 n=73 p.722	.0389 n=102 p.698	.126 n=102 p.207	-.070 n=103 p.481	-.139 n=102 p.163
sexnew	.008 n=102 p.937	-.085 n=102 p.396	.069 n=73 p.560	.0312 n=102 p.755	.120 n=102 p.228	-.048 n=103 p.632	-.125 n=102 p.211
wgt	.093 n=100 p.36	.059 n=100 p.559	-.031 n=72 p.799	.075 n=100 p.460	.205 n=100 p.041 *	.238 n=101 p.017 *	.058 n=100 p.567
durat	.118 n=100 p.241	.011 n=100 p.912	.180 n=72 p.131	-.026 n=100 p.800	.090 n=100 p.373	.016 n=101 p.878	.054 n=100 p.593

len - length of gestation.
sex - infant gender, divided to male, female, and twins.
sexnew - infant gender coded as male and female with twins in the female group.
wgt - infant birth weight.
durat - duration of NVP symptoms.

Correlations between symptoms and demographic variables

The correlations between symptoms and selected demographic variables were explored using each item in Rhodes INV, the three subscales and the Rhodes INV overall. The important relationships were summarized in Table 4.13 and Table 4.14.

Table 4.13
Correlations between each question in Rhodes INV and selected demographic variables

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
age	-.065 n=152 p.425	.019 n=151 p.821	-.019 n=152 p.819	.043 n=152 p.597	-.083 n=151 p.313	-.072 n=149 p.382	.001 n=151 p.994	.005 n=151 p.953
cig	.004 n=152 p.961	.04 n=151 p.628	.009 n=152 p.909	.014 n=152 p.861	.03 n=151 p.715	.075 n=149 p.365	.012 n=151 p.889	.096 n=151 p.241
gesage	.010 n=149 p.906	.031 n=148 p.709	.024 n=149 p.774	-.067 n=149 p.415	-.096 n=148 p.245	.105 n=146 p.208	-.128 n=148 p.121	.010 n=148 p.904
occup	.009 n=96 p.337	-.028 n=96 p.786	.066 n=96 p.524	-.003 n=96 p.975	-.092 n=95 p.377	.063 n=95 p.545	-.087 n=95 p.403	.061 n=95 p.558
outjob	.046 n=152 p.571	-.066 n=151 p.42	.057 n=152 p.49	.026 n=152 p.755	-.069 n=151 p.397	.079 n=149 p.34	-.056 n=151 p.494	.015 n=151 p.854
Para1	-.087 n=152 p.287	.034 n=151 p.682	-.13 n=152 p.112	.164 n=152 p.043 *	-.018 n=151 p.827	-.072 n=149 p.384	.094 n=151 p.254	.021 n=151 p.80
Para2	.094 n=152 p.252	.06 n=151 p.464	.208 n=152 p.010 *	-.104 n=152 p.203	-.087 n=151 p.289	.154 n=149 p.061	-.079 n=151 p.334	.066 n=151 p.419

Q1, Q3, Q6 - frequency, distress, and amount of vomiting.
Q2, Q8 - distress and frequency of retching.
Q4, Q5, Q7 - duration, distress, and frequency of nausea.

Table 4.14
Correlations between Rhodes INV subscales and demographic variables

	age	cig	gesage	occup	outjob	para1	para2	sab
nn	-.009 n=151 p.914	.016 n=151 p.844	-.109 n=148 p.188	-.066 n=95 p.526	-.036 n=151 p.662	.098 n=151 p.231	-.047 n=151 p.568	.01 n=151 p.907
rr	.018 n=150 p.828	.078 n=150 p.344	.026 n=147 p.756	-.049 n=95 p.943	-.031 n=150 p.710	.028 n=150 p.733	.072 n=150 p.379	-.029 n=150 p.723
vv	-.05 n=149 p.515	.034 n=149 p.681	.047 n=146 p.577	.077 n=95 p.457	.071 n=149 p.393	-.10 n=149 p.227	.166 n=149 p.042 *	-.107 n=149 p.195
nvp	-.021 n=148 p.797	.053 n=148 p.524	-.023 n=145 p.785	-.012 n=95 p.910	.001 n=148 p.993	.015 n=148 p.857	.078 n=148 p.344	-.053 n=148 p.522

nn - nausea subscale, sum of the Rhodes INV Q4, Q5 and Q7.
rr - retching subscale, sum of the Rhodes INV Q2 and Q8.
vv - vomiting subscale, sum of the Rhodes INV Q1, Q3 and Q6.
nvp - Rhodes INV overall.

The number of previous live birth correlated with the duration of nausea (Q4) ($r=0.164$, $p=0.043$). The more the previous live births, the more likely the women experienced a longer duration of the nausea. Multiparous women reported significantly less distress associated with vomiting than primiparous women ($r=0.208$, $P=0.01$) (Table 4.13). This may be related to the increased oestrogen level in primiparous women.

Correlating the Rhodes INV subscales with demographic variables indicated that the vomiting subscale was correlated with previous parity status ($r=0.166$, $p=0.042$). The direction was that primiparous women reported more severe vomiting than multiparous women.

Correlations between symptoms and pregnancy outcomes

The relationships between symptom scores and pregnancy outcome variables were explored using each question in Rhodes INV, the three subscales and symptoms overall. The important relationships are summarized in Table 4.15 and Table 4.16.

Table 4.15
Correlations between each question in Rhodes INV and pregnancy outcomes

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
sex (one tailed)	.070 n=102 p.244	.143 n=101 p.078	.123 n=102 p.104	.234 n=102 p.009*	.115 n=102 p.125	.160 n=100 p.056	.216 n=102 p.015*	.098 n=102 p.163
sexnew (one tailed)	.034 n=102 p.368	.154 n=101 p.062	.102 n=102 p.153	.197 n=102 p.024*	.061 n=102 p.272	.148 n=100 p.072	.188 n=102 p.03*	.119 n=102 p.116
durnvp	.235 n=100 p.019*	.232 n=99 p.021*	.221 n=100 p.027*	.132 n=100 p.189	.199 n=100 p.047*	.249 n=98 p.013*	.132 n=100 p.191	.143 n=100 p.156
bhlth	-.048 n=101 p.634	-.053 n=100 p.602	-.073 n=101 p.47	.031 n=101 p.757	.161 n=101 p.107	-.049 n=99 p.633	.04 n=101 p.691	-.041 n=101 p.683
wgt	-.217 n=100 p.03 *	-.024 n=99 p.817	-.201 n=100 p.045*	-.135 n=100 p.18	-.181 n=100 p.072	-.214 n=98 p.035*	-.113 n=100 p.261	-.063 n=100 p.537

bhlth - infant health at birth.

Table 4.16
Correlations between Rhodes INV subscales and Pregnancy Outcomes

	length	sex	sexnew	wgt	durat	bhlth
nn	-.075 n=102 p.454	.215 n=102 p.015 *#	.173 n=102 p.041 *#	-.154 n=100 p.125	.166 n=100 p.098	.078 n=101 p.441
rr	.001 n=101 p.991	.123 n=101 p.110	.140 n=101 p.082	-.032 n=99 p.752	.227 n=100 p.023 *	-.048 n=100 p.635
vv	.02 n=100 p.848	.130 n=100 p.098	.108 n=100 p.143	-.220 n=98 p.029 *	.269 n=99 p.007 *	-.063 n=99 p.539
nvp	-.03 n=99 p.763	.218 n=99 p.015 *#	.191 n=99 p.029 *#	-.192 n=97 p.059	.289 n=98 p.004 *	-.005 n=98 p.965
len		-.037 n=103 0.711	-.032 n=103 p.746	.315 n=101 p.001 *	-.042 n=102 p.675	-.283 n=102 p.004 *
wgt		-.106 n=101 p.290	-.095 n=101 p.346		-.131 n=101 p.192	-.16 n=101 p.11
durat		.043 n=101 p.666	.072 n=101 p.476			.281 n=102 p.004 *

*# - significant, one tailed.

Correlations between frequency, distress and amount of vomiting and pregnancy outcomes:

The frequency, distress and amount of vomiting were associated with duration of NVP symptoms (r=0.235, p=0.019; r=0.221, p=0.027; and r=0.249, p=0.013) and birth weight (r=-0.217, p=0.03; r=-0.201, p=0.045; and r=-0.214, p=0.035) (Table 4.15). The more severe the vomiting, the longer the duration of NVP during pregnancy. The relationship between vomiting and birth weight was negative. The more severe the vomiting, the less the birth weight.

Correlations between duration, distress and frequency of nausea and pregnancy outcomes:

There was a relationship between duration of nausea (q4), frequency of nausea (q7) and fetal sex. Women bearing female fetuses tended to experience a longer episode of nausea (r=0.197, p=0.024, one-tailed) and a higher frequency of nausea episodes each day (r=0.188, p=0.03, one-tailed) (Table 4.15). Distress from nausea (Rhodes INV q5) was associated with the duration of NVP symptoms (r=0.199, p=0.047). The more severe the distress from nausea, the longer the symptoms lasted during pregnancy (Table 4.15).

The relationship between infant sex and the nausea subscale (Table 4.16) was significant (r=0.215, p=0.015 and r=0.173, p=0.041, one-tailed). The twin group experienced the most severe nausea. Women bearing female infants experienced more severe nausea than those bearing male infants.

Correlations between distress and frequency of retching and pregnancy outcomes:

There was a relationship between distress from retching (Rhodes INV q2) and the duration of symptoms ($r=0.232$, $p=0.021$). The more severe the distress from retching, the longer the symptoms lasted. A significant relationship between frequency of retching and pregnancy outcome variables was not found in this study.

Correlations between Rhodes INV overall and pregnancy outcomes:

The relationship between infant sex and the Rhodes INV overall was statistically significant ($r=0.191$, $p=0.029$, one-tailed). Women bearing twins had more severe symptoms than those bearing single infants, and women bearing female infants had more severe overall symptoms than those bearing male infants. The negative relationship between Rhodes INV overall and infants' birth weight was approaching significance ($r=-0.192$, $p=0.059$). The more severe the Rhodes INV symptoms, the less the infant birth weight. A positive significant correlation was found between the Rhodes INV overall and the duration of NVP symptoms during pregnancy ($r=0.289$, $p=0.004$). Women who reported severe symptoms during the study period reported longer duration of NVP during the entire pregnancy.

Correlations among pregnancy outcome variables:

The length of gestation at birth was positively associated with infant birth weight ($r=0.315$, $p=0.001$) and

negatively associated with the baby's health at birth (r=-0.283, p=0.004). The shorter the length of gestation, the more likely that the baby had problems after birth.

There was a relationship between the duration of NVP and the baby's health at birth (r=0.281, p=0.004). The longer the NVP lasted, the more likely the baby was to have some problems after birth.

Results of the Comparative Study

Multivariate Analysis of Variance (MANOVA), Analysis of Variance (ANOVA), independent t-test, stepwise regression and Chi-square methods were used to test the relationships found in the correlational study.

The first analysis conducted was to test the relationship between the symptoms and infant gender. It was noticed that a relationship existed between gender and nausea from the correlational study. The Chi-square test, MANOVA and ANOVA were carried out to test the relationship.

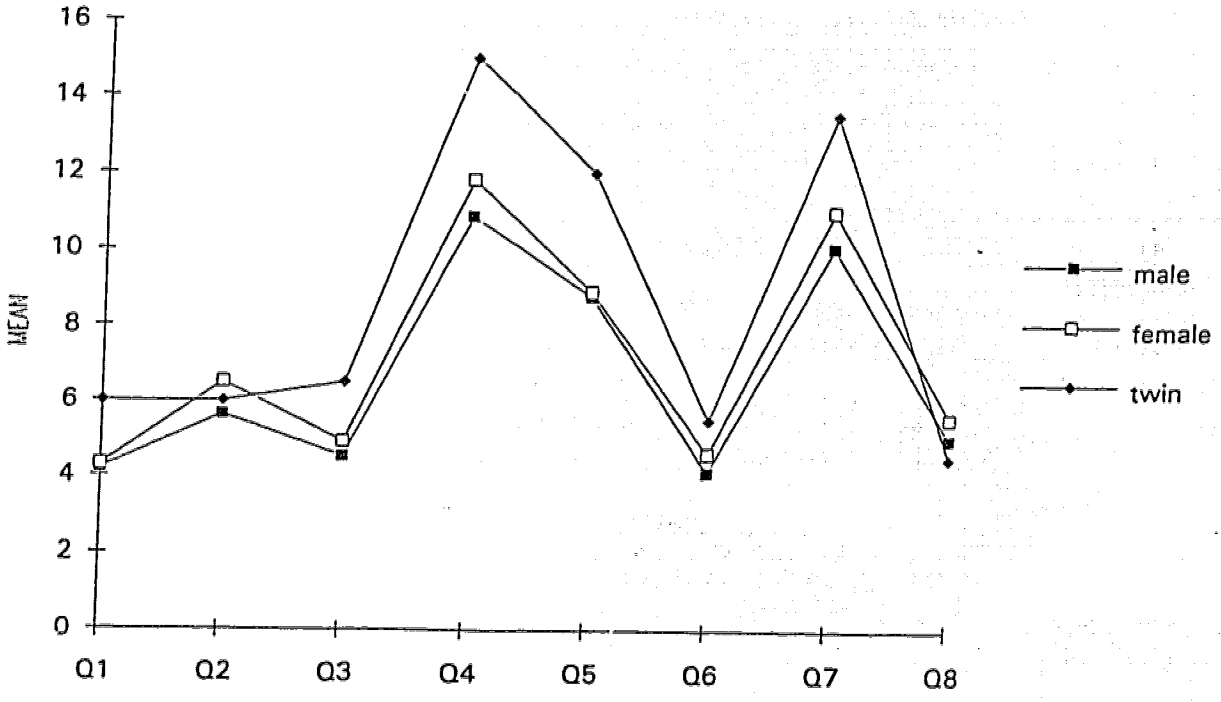
Forty six male and 59 female infants were born to the 103 women (two pregnancies resulted in twin births, 3 female and 1 male were born to the two mothers), the ratio of male to female infants was 43.4 to 55.6. In Edmonton city at the same time period, the ratio of male to female infants was 50.12 to 49.88 (Vital Statistics Alberta). The ratio of male and female infants in this study was different from the population. However, since the sample size was small, the result was not statistically significant (chi-square=1.67, p=0.196).

With gender being divided as male, female, and twins, the mean for each item is summarized in Table 4.17 and Chart 1.

Table 4.17
Mean for each item of Rhodes INV in the gender groups

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
male	4.20	5.64	4.53	10.87	8.78	4.11	10.07	5.02
female	4.29	6.50	4.92	11.81	8.90	4.60	11.00	5.56
twin	6.00	6.00	6.50	15.00	12.00	5.50	13.50	4.50

Chart 1
Mean for each item of Rhodes INV in the gender groups



The mean symptom scores for the twin group were the highest for both nausea and vomiting questions, while for retching questions, the female group had the highest mean. For all the questions, the male group had the lowest mean. However, it should be noted that the sample size was very small for the twin group (n=2).

MANOVA showed that the difference among the three groups was approaching significant ($F_{16,180}$=1.494, p=0.106). The follow up F-test indicated that significant or approaching significant differences existed in nausea items, i.e., duration of nausea (F=3.55, p=0.03), distress from nausea (F=2.58, p=0.08), and frequency of nausea (F=2.79, p=0.07). Further analysis was undertaken using LSD to explore which groups were different. The results showed that the twin group had a significantly longer duration of nausea than the male group (Q4), and the difference between the twin group and the female group was approaching significance (p=0.069). The difference between male and female groups was approaching significance in this item (F=3.18, p=0.078). The results showed that women bearing twins suffered a longer episode of nausea during the study period than women with either a male or a female singleton fetuses, and women with a female fetuses had a longer episode of nausea than those with a male fetuses.

It was also shown through the LSD analysis that women bearing twins suffered more from distress associated with nausea than the groups bearing male (P<0.01) and female

infants ($P<0.05$) (q5). The difference between male and female group was not significant. Although the difference among the three groups in regard to frequency of nausea was approaching significance, no two groups were significantly different at the 0.05 level.

Using the nausea subscale as dependent variable, one way ANOVA indicated that the three groups were different ($F_{2, 99}=3.446$, $p=0.036$). The LSD test showed that the women bearing twins suffered significantly more severe nausea than those bearing male or female infants. Women bearing female infants had higher mean score than those bearing male infants, but the difference was not significant ($p=0.133$).

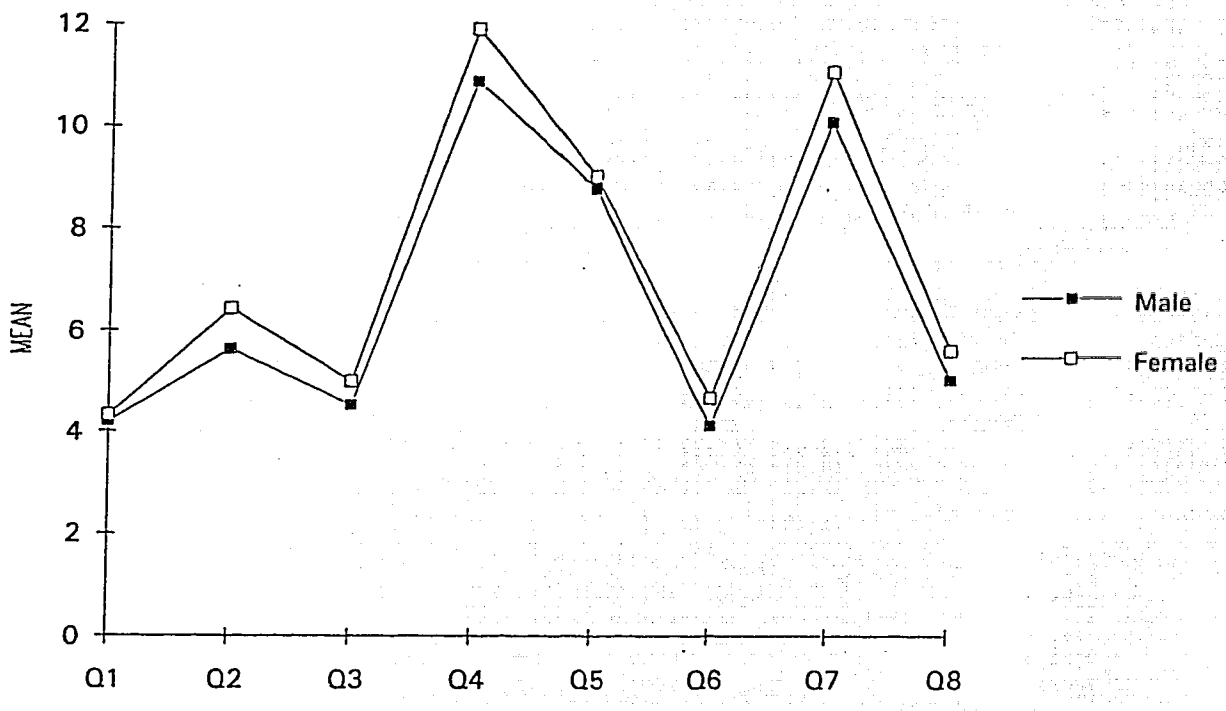
Since there were only two women in the twin pregnancy group, it is very hard to draw any conclusion. In the literature, it has been suggested that women bearing twin females as well as male/female pairs had similar nausea and vomiting symptoms with women bearing singleton female infants. So the twin group was added to the female group to further analyze the data.

The mean for each item for male and female group was summarized in Table 4.17a and Chart 2. It was shown that female group had a higher mean in all of the eight items.

Table 4.17a
Mean for each item of Rhodes INV in the two groups

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Male	4.2	5.64	4.53	10.87	8.78	4.11	10.07	5.02
Female	4.32	6.43	5.00	11.89	9.02	4.67	11.05	5.60

Chart 2
Mean for each item of Rhodes INV in the two groups



Dividing sex as male and female, with twins in the female group, one way ANOVA showed that women bearing female infants had significantly longer episodes of nausea (q4) during the study period than those bearing male infants ($F=4.067$, $P=0.047$). The difference in regard to frequency of nausea (q7) was approaching significant ($F=3.78$, $P=0.055$). Women bearing female infants tended to have more episodes of nausea than those bearing male infants. The Rhodes INV overall was approaching significant ($F_{1,97}=3.68$, $P=0.058$). Women who later gave birth to female infants tended to have more severe

overall symptoms than those who gave birth to male infants. However, the differences in respect to retching and vomiting were not significant ($F_{1,99}=1.98$, $p=0.16$ and $F_{1,98}=1.15$, $p=0.29$).

The second analysis was undertaken to test the relationships between nausea, retching, vomiting, Rhodes INV overall and selected demographic variables. It was shown that relationships existed between maternal age, parity, and occupational grouping.

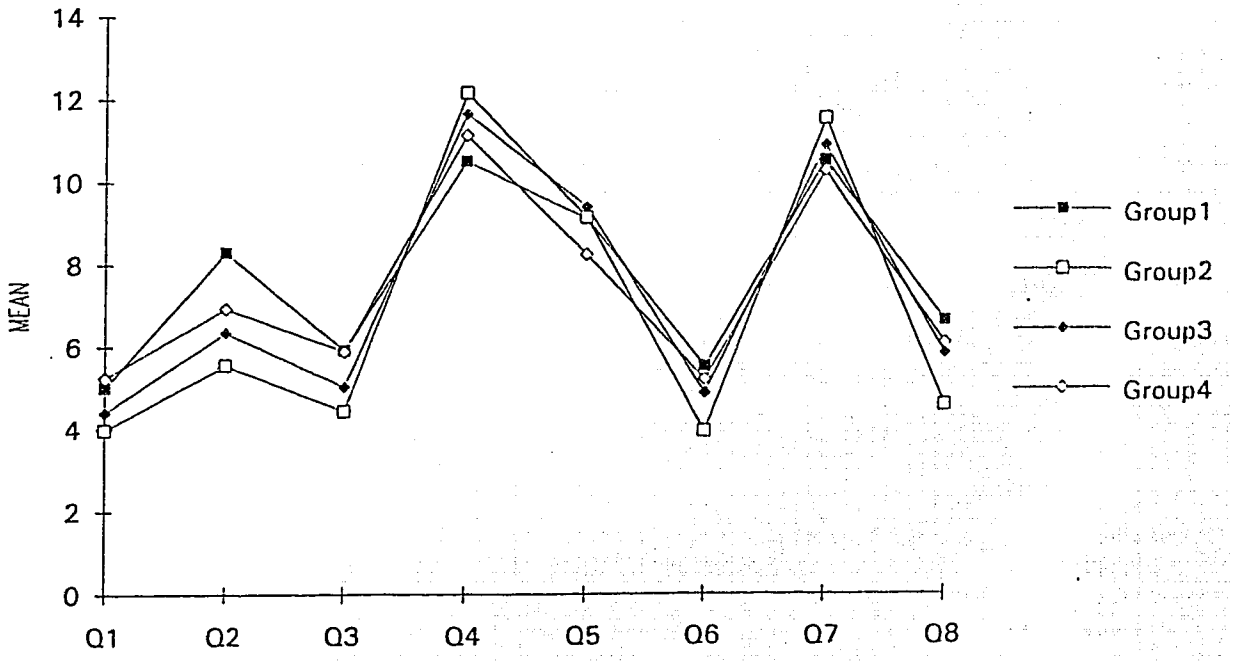
a. Occupation. Occupational grouping was defined by the Four Factor Index of Social Status (Hollingshead, 1975). For the 100 women who were employed outside the home when they enroled in the P6 study, the means for the four occupational groups are summarized in Table 4.18 and Chart 3.

Table 4.18
Mean for each item of Rhodes INV in the four occupational groups

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Group1	5.00	8.30	5.90	10.50	9.10	5.50	10.50	6.60
Group2	3.96	5.54	4.42	12.13	9.13	3.92	11.50	4.54
Group3	4.39	6.34	5.02	11.64	9.39	4.84	10.86	5.80
Group4	5.24	6.94	5.88	11.12	8.24	5.18	10.24	6.06

Group1 - refers to menial or service workers (n=10).
Group2 - refers to secretarial and clerical workers (n=25).
Group3 - refers to minor professionals, i.e., technicians, nurses and teachers (n=47).
group4 - refers to administrative and professional workers (n=18).

Chart 3
Mean for each item of Rhodes INV in the four occupational groups



Using the eight items in the Rhodes INV as the dependent variable, the MANOVA procedure demonstrated that the differences among the occupational groups were significant ($F_{24,258}$=1.67, p=0.028). Univariate F-test indicated that distress from retching (q2) was significant (F=2.8, p=0.044). The LSD was carried out to determine which groups were different. It was found that group1 vs group2, group4 vs group2 concerning distress from retching were significant ($F_{3,92}$=2.81, p=0.044). Women employed as service workers and professionals reported more distress from retching than

secretarial and clerical workers.

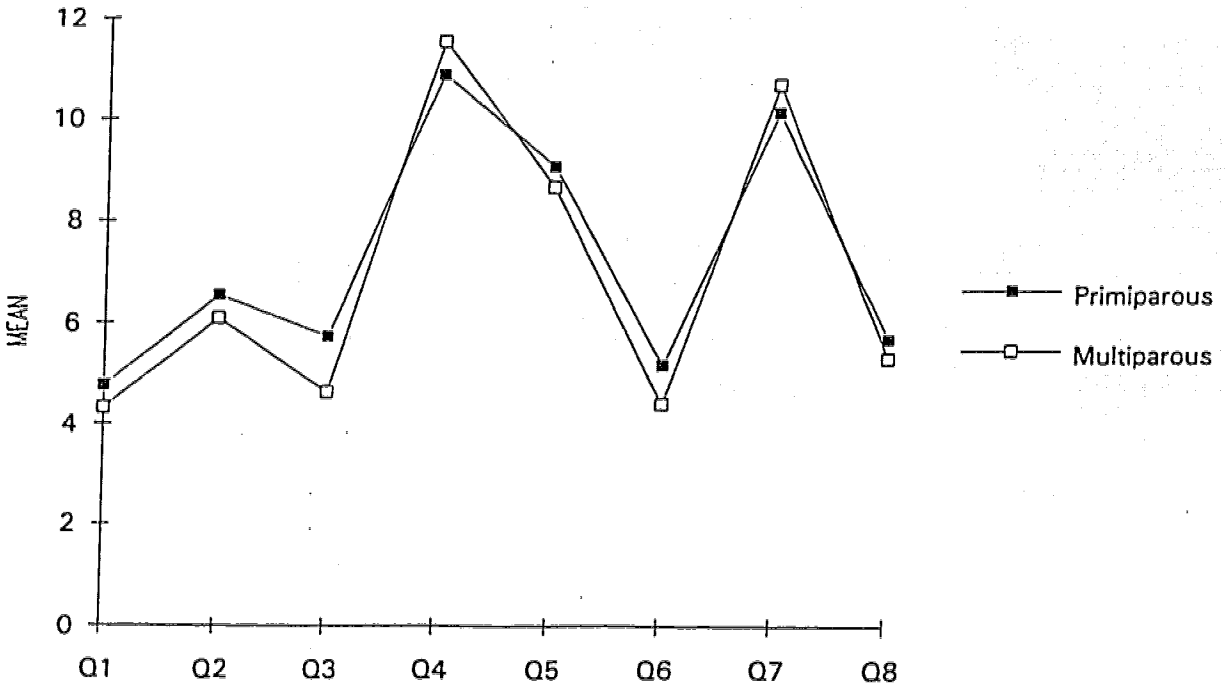
When holding an outside home job was used as the independent variable, the MANOVA showed that the difference between women who worked outside the home and those who worked in the home was not significant ($F_{8,139}$=0.89, p=0.524).

b. Parity. Parity was recoded as primiparous and multiparous. The mean of each item in Rhodes INV is summarized in Table 4.19 and Chart 4. It was shown that the primiparous women had a higher mean on all the vomiting and retching items.

Table 4.19
Mean for each item of Rhodes INV in the two parity groups

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
primiparous	4.76	6.55	5.74	10.90	9.07	5.17	10.14	5.69
Multiparous	4.33	6.09	4.63	11.56	8.66	4.40	10.69	5.31

Chart 4
Mean for each item of Rhodes INV in the two parity groups



MANOVA was carried out using the eight items in Rhodes INV as dependent variables. The difference between primiparous and multiparous women was significant ($F_{8,139}$=2.20, p=0.031). Univariate F-test showed that a difference existed in regard to distress from vomiting (q3) (F=6.58, p=0.011). Primiparous women reported more distress than multiparous women. The difference between the two groups in regard to amount of vomiting (Q6) was approaching significant (F=3.80, p=0.053), with primiparous women reporting vomiting larger amounts than multiparous women.

Using each of the three subscales as dependent variable, one way ANOVA was carried out to compare the two groups. The only difference found was the vomiting subscale ($F_{1,147}$=4.19, p=0.043). Primiparous women experienced more severe symptoms of vomiting than multiparous women.

The third analysis carried out was to test the relationships between infant birth weight and NVP symptoms.

Two way ANOVA using gender and previous parity status (0 vs >0) showed that birth weight was affected by previous parity status ($F_{2,97}$=5.57, p=0.02), but not affected by the infant gender (p=0.28). The mean birth weight of infants born to the primiparous women was 118.5 ounces, while the mean weight was 126.3 ounces for the multiparous group. The interaction effect between gender and parity in regard to birth weight was not significant.

Multiple regression procedure was carried out to

determine the best prediction model for birth weight. Using listwise deletion of missing values, the stepwise procedure selected three predictor variables and predicted 27.7 percent ($R=0.526$) of the total variance in birth weight ($F_{3,67}=8.56$, $p=0.0001$). The three variables were length of gestation ($T=3.72$, $p=0.0004$), previous parity status (multiparous=1, primiparous=2) ($T=-3.25$, $p=0.0018$), and frequency of vomiting (Q1) ($T=-2.175$, $p=0.033$). The multiple regression equation is:

Birth weight = 16.3 + 3.3 (length of gestation) - 11.3 (parity[1]) - 2.2 (frequency of vomiting).

The plot of residual showed that the residuals were randomly distributed around zero. The goodness of fit for the regression model was acceptable.

It is noticed that length of gestation in weeks was affected by the parity status ($t_{101}=-2.19$, $p=0.031$). The primiparous women had longer gestations than multiparous women. There was an interaction effect between length of gestation and previous parity status. The longer the gestation, the heavier the infant. Multiparous women have a shorter gestation but a heavier baby. The stepwise multiple regression analysis demonstrated that after the length of gestation was removed, parity status was still significantly correlated to infant birth weight.

Frequency of vomiting does affect infant birth weight.

Parity: multiparity=1, primiparity=2.

The higher the frequency of vomiting, the less the infant birth weight. Primiparity correlated to increased frequency of vomiting and decreased birth weight.

An independent t-test was carried out to test whether the birth weight was the same between gender in regard to the previous first child born to this group of women. The mean difference between the two groups was 7.13 ounce and it was statistically significant ($t_{102}=2.15$, $p=0.034$). It indicated that when parity status was zero, the mean birth weight of male infants was greater than that of female infants. This relationship did not exist for either the second or third child.

Summary

In this chapter, distributions of the samples in regard to demographic variables, symptoms and pregnancy outcome variables were described. The relationships among those variables were explored using correlational analysis. Significant relationships were further tested using multivariate analysis.

It was found that gender was related to nausea symptoms with the direction that women bearing female infants experienced more severe nausea than those bearing male infants.

There was a relationship between birth weight and vomiting symptoms. The more severe the vomiting, the less the birth weight. Stepwise regression indicated that infant birth

weight was affected by length of gestation, previous parity status, and frequency of vomiting.

Primiparous women experienced more severe vomiting symptoms than multiparous women. Menial and service workers and professionals experienced more severe retching symptoms than clerical and secretarial workers.

CHAPTER V

DISCUSSIONS AND RECOMMENDATIONS

Nausea and vomiting have been reported as symptoms of pregnancy for almost 4000 years (Fairweather, 1968). Symptom ranges from just a feeling of nausea in the morning to nausea and vomiting which continues all day and in extreme cases requires hospital admission and treatment. The most commonly suggested cause is hormonal alterations such as the high levels of circulating oestrogen and hCG in the first trimester. However, during the 19th and early 20th century, psychological reasons have been advanced to explain severe NVP. Suggestions of maladjustment have been made about women with persistent severe sickness where no other cause can be found.

The purpose of this study was to assess the relationships between 1) demographic characteristics, 2) pregnancy outcomes and NVP. The Rhodes INV, an instrument developed to quantify the symptoms of nausea and vomiting was used and a questionnaire was developed by the researcher to collect pregnancy outcome data. In earlier reviewed studies, nausea and vomiting have rarely been treated as separate symptoms. Most often if vomiting occurs, then nausea is considered to be severe. This study was able to analyze the symptoms separately and concurrently since the Rhodes INV quantifies frequency, duration and distress of nausea, frequency, amount and

distress of vomiting, and frequency and distress of retching. The responses from the pregnant women indicated that they differentiated between those experiences. Since the subjects were asked to recall their symptoms every 12 hours and continue to do so for several days, the symptom report was more accurate than either chart review or later memory recall. In addition, subjects in the P6 study were asked to write in a diary during the study period. This assisted their recall of symptoms when they filled out the Rhodes INV.

The data of NVP symptoms were obtained from a previous quasi-experimental study. The Pregnancy Outcome Questionnaire was distributed to people who had participated in this study. An actual response rate of 81.1 percent was achieved.

Discussions

The women who participated in this study were mostly Caucasian. The average age of the sample was almost 30 years old. Most women (79%) were in the first trimester of pregnancy when their NVP symptoms were evaluated; the rest were in their second trimester. Only 13.4 percent of the sample were smokers, fewer than the ratio of 27 percent reported in the general population (Klebanoff et al., 1985). About 55 percent of the sample worked outside of the home at the time when the symptoms were evaluated. Of the 100 women who reported their occupation, 47 percent were minor-professionals (i.e., nurses, technicians, and teachers), 18 percent were administrators and professionals, and only 10 percent were menial and service

workers. The majority of participants (81%) had experienced at least one previous pregnancy. Forty-six women had no completed previous pregnancy, while the majority (n=111) had reported at least one live birth before. Of the 111 multiparous women, 51.4 percent had previously give birth to males in their first birth while 48.6 percent had give birth to females. The mean birth weight of their first children was 119 ounces (7 pounds and 7 ounces). About 90 percent of the multiparous women reported some NVP during their pregnancy. Thirty-one percent of the sample experienced one or more previous spontaneous abortions prior to participating in the P6 study.

One hundred and three women completed and returned the "Pregnancy Outcome Questionnaire". The rate at which the women participated indicated the group's understanding and support of research. Most women wrote comments on the back of the questionnaire reporting their personal experiences with efforts to control NVP. Some of them made suggestions about how to reduce discomfort associated with NVP.

Of the 103 births, one primigravida gave birth to a full term (41 weeks) still-born male. The mother was a 19 years old nonsmoker who worked in the home. Examination of the NVP scores showed that she reported moderate nausea and retching, without vomiting during the two day measurements.

One male infant had respiratory problems at birth and was severely jaundiced within a few days. Examination of the data showed that the mother was 36 years old with two older

children. She reported severe NVP during the study period and symptoms lasted until the birth of her son. She took gravol frequently during the early part of her pregnancy.

Another male baby was born at 36 weeks gestation and suffered from respiratory problems and was put on a ventilator. Examination of the data showed that the mother was a multiparous nonsmoker who worked in the home. She reported moderate to severe nausea during the study period without vomiting and retching. Her nausea lasted until the birth of the child.

One male baby born at 34 weeks of gestation weighing 2160 grams and suffered from multiple problems including Downs syndrome, congenital hypotonic, and myotonic dystrophy. Examination of the data indicated that the mother took gravol for severe nausea till 19 weeks gestation. She was hypertensive and was hospitalized at 33 weeks. She was 31 years old with one healthy son in the home. She reported no vomiting and retching during the study period but had severe nausea. Her nausea stopped at 16 weeks gestation.

Two female infants were born at 35 and 36 weeks of gestation without complications. One mother reported severe nausea in combination with moderate retching without vomiting. The other reported mild nausea and occasional vomiting (she experienced vomiting in only one 12 hour measurement on the 7 day period).

It was noticed that all the infants with severe

complications were males. Three of the four mothers reported moderate to severe nausea but no vomiting. These findings support other researchers' suggestions that absence of vomiting in pregnancy is associated with unfavourable outcomes (Klebanoff et al., 1985; Tierson et al., 1986). Nausea alone does not decrease the risk of infant complications.

The length of gestation was normally distributed with the mode at 40 weeks. The peak time for NVP symptoms to start was two months after the last menstrual period. One third of the women reported that NVP started in the first month of pregnancy. Only a very small portion of the subjects reported symptoms starting in the third month. The findings agree with those reported by Tierson and associates (1986). It suggested that if a woman does not experience NVP within three months of the last menstrual period, she will be less likely to have symptoms during her pregnancy.

The mode for cessation of symptoms was the fourth month of pregnancy. The majority of women reported that the symptoms stopped by the sixth month of pregnancy. Slightly under one quarter (23%) of the women had the symptoms until the birth of the child.

More female infants (n=59) than male infants (n=46) were born to this group of women. Since it was hypothesized that women bearing female infants would report more severe symptoms than those bearing male infants, and since enrolment was restricted to participants who experienced NVP, more female

infants were expected. However, since the sample size was small, the difference in the male/female ratio was not statistically significant. Two researchers reported that when the study population was restricted to women with very severe symptoms (hyperemesis), the ratio of male to female infants was statistically significant with more females born to the hyperemetic women (Kallen, 1987; Hsu & Witter, 1993). In this study, although not significant, the excess of girls among infants born to this group of women support the suggestion that fetal gender may have an effect on NVP.

Women bearing female twins and female infants reported more severe nausea symptoms than those bearing male infants. This finding was supported in a previous study that examined whether fetal-sex had an effect on hCG concentration in singleton and twin pregnancies (Steier, Myking, and Ulstaein, 1989). Steier and associates reported that pregnant women carrying singleton female fetuses or twin female-female, female-male fetuses have higher hCG levels than women carrying male fetuses. Since hCG was the hormone most often reported in relation to the degree of NVP, this finding supports the notion that women bearing female infants have higher hCG levels than those bearing male infants.

The hypothesis that increased age is associated with decreased nausea and vomiting is not supported in this study. The reason might be that age was on a continuum ranging from 18 to 43. In previous studies, most researchers treated age as

less than 20 years, 20 to 34, and older than 35. Since the participants were included in this study only if NVP was experienced, older women who did not experience NVP would not be included. Therefore no conclusions can be made about the relationship between NVP and maternal age from this study.

No relationship between smoking and NVP was found in this study. The ratio of nonsmokers to smokers in the sample was less than is found in the general population. Previously it has been reported that smokers had significantly less NVP than non-smokers (Little & Hook, 1979; Klebanoff et al., 1985). It is also possible that smokers who experienced little or no NVP felt less bothered by the symptoms so they did not volunteer to participate in the P6 study.

The occupation of women was found to be related to their symptoms. It was found that service workers as well as professionals reported more severe retching than clerical workers. The reason for service workers experiencing more severe retching might be that most of them work in environments over which they have little control. Some people worked in the fast food industry where they could not avoid the smell and sight of food. The smell and sight of certain foods in pregnant women trigger NVP and in particular retching. It is hypothesized by the researcher that professionals may have had less control over their environment. They had to deal with daily stress and had less chance to rest during work hours.

Education was not evaluated in this study. The report that vomiting was more common in women with less education (Fairweather, 1965; Klebanoff et al., 1985) was probably related to the fact that less educated women tended to work as service and menial labours.

The hypothesis that housewives tend to have more NVP than employed women was not supported in this study. No differences between women who worked out of the home and those who worked in the home was found.

The effect of parity on NVP resembles findings in other studies. Multiparous women experienced less vomiting than primiparous women. It has been documented that primiparous women have higher circulation concentration of hCG than do multiparous women (Kauppila et al., 1979). It has also been reported that primiparous women have higher circulating and urinary oestrogen levels than multiparous women (Depue et al., 1987) and that women in their first pregnancies have higher oestrogen levels than in subsequent pregnancies (Bernstein et al., 1986). The finding that primiparous women suffered more from vomiting supports hormonal hypotheses.

Women experiencing twin pregnancies suffered severe NVP and these findings are supported in previous studies. This effect is usually explained by higher hormone concentrations, especially hCG. Although some authors could not verify it (Soul et al, 1980; Depue et al, 1987), increased hCG levels during emetic pregnancies have been described (Schoeneck,

1942; Masson et al, 1985).

In contrast to many previous studies, this study demonstrated that increased frequency of vomiting was associated with decreased infant birth weight. Because there is a relationship between vomiting and duration of NVP, it seems reasonable that women who vomited frequently and for a longer time during pregnancy would eat less. This might affect the nutrition of the fetus in later pregnancy. A similar result was reported by Kallen (1987). He reported that in a group of hyperemetic women, a moderate effect of NVP on birth weight was demonstrated if the birth weight was less than 2500 grams. However, for birth weight less than 1000 grams, the effect disappeared. In the present study, the smallest birth weight was greater than 2000 grams. Therefore there is no evidence to support the finding that for the very low birth weight infants, the effect of vomiting on birth weight does not exist.

This study supports previous reports that birth weight is associated with parity and length of gestation, but the relationships between birth weight and infant gender and maternal smoking were not demonstrated. However, frequency of vomiting was predictive of infant birth weight. The finding that parity was associated with birth weight supports a previous study that the infant birth weight of primiparous women is significantly lower than that of multiparous women after 32 weeks (Bulter and Albertan, 1969).

In the stepwise regression equation, three variables made significant independent contributions to the variance in birth weight. The relationships among the three variables are interesting. Increased length of gestation related to increased birth weight, while primiparity tended to have increased length of gestation but decreased birth weight. Meanwhile, primiparity related to increased frequency of vomiting, and increased frequency of vomiting related to low birth weight.

Although a regression model is established in this study, only 27.7 percent of the variance in birth weight could be predicted. The remaining 72.3% of the variance was unexplained by the three selected variables. Other variables that significantly affect infant birth weight were not identified in this study.

It was reported that the birth weight of male infants is greater than that of female infants (Yadav, 1988). This relationship was not found in this study. However, when comparing the birth weight between the gender of first babies of women who previously had one or more children, the mean birth weight of male infants was greater than that of female infants.

The length of gestation and infant health at birth was correlated. This finding is reasonable because the shorter the gestational age, the less mature the infant, and the more likely that the infant will have health problems.

Another interesting finding was that the duration of nausea and vomiting during the entire pregnancy correlated with the severity of vomiting. This agrees with Tierson and associates' (1986) finding that women whose nausea is accompanied by vomiting have a longer period of nausea than those having nausea alone.

It has been reported that NVP is related to slightly longer gestational length (Klebanoff et al. 1985). In this study, no relationship was found. However, the data showed that for those who had a gestational length of less than 36 weeks, the vomiting symptoms were reported less frequently. It is possible that if the sample was larger, there might be a significant relationship between vomiting and length of gestation.

In conclusion, nausea and vomiting during pregnancy is a common event. Vomiting was more severe among primiparous women. Menial and service workers and professionals suffered more from retching than clerical and secretarial workers. The most severe nausea was reported by women bearing twin pregnancies. Women bearing female infants suffered more from nausea than those bearing male infants. The severity of vomiting does relate to infant birth weight. Also, birth weight was affected by the length of gestation and parity status.

Implications for Clinical Practice, Research and Education

At present, there is little information on the

relationship between NVP and pregnancy outcome, especially between symptoms and infant gender and/or birth weight. The information available on NVP and pregnancy outcomes is inconsistent and sometimes contradictory. A more accurate measurement of symptoms, associated factors and risk factors will provide information for health workers who care for pregnant women.

It was quite common for NVP to last for the entire pregnancy (23%) in this study of symptomatic women. The assurance from health workers that NVP will stop within three months may lead to disappointment and frustration in pregnant women. It is also important to assure pregnant women that NVP is associated with positive outcomes. This knowledge may help them adapt to the discomfort caused by NVP.

The significance of predicting infant birth weight is to identify mothers who are more likely to have low birth weight infants or infants with higher risk because the association between perinatal mortality and low birth weight is well documented. The risk of mortality increases 30 to 35 times for infants weighing less than 2500 grams (Yadav, 1983).

Previous information about the measurement of NVP included occurrence, not severity of symptoms. Studies that measure degrees of NVP for several days as detailed as in this study were not found.

This study provides some rationale for further large scale multivariate research that identifies factors and

pregnancy outcomes which relate to nausea and vomiting in early pregnancy. For example, findings from this study support the hypothesis that fetal gender plays a role in the occurrence and degree of NVP. However, whether the difference in NVP is caused by the female fetal effect on hCG concentration or by other mechanisms needs further investigation. Sensitive measures of NVP symptoms, accurate measures of hormone levels in early pregnancy, and reliable measurement of pregnancy outcomes will increase the understanding of this phenomena and contribute to effective ways of managing symptoms.

The increased understanding of symptoms and related factors will provide health educators with more comprehensive information for teaching students about pregnancy.

Limitations

This study sample was composed of predominantly white, English speaking and middle-class individuals. The symptoms and pregnancy outcomes might not be reflected similarly in a different sample. Because the participation was based on interest in the study, the sample might be biased. For example, the women may have more severe symptoms than the general population of pregnant women. The findings from this study can only be generalized to a similar population, i.e., women who experience nausea and vomiting in their pregnancy.

It should be noted that statistical significance does not necessarily mean clinical significance and a strong

relationship between dependent and independent variables. Except for the strong relationships of the length of gestation and parity on birth weight, the rest of the relationships were of moderate magnitude.

Although a predictive model was established, the study only suggests associations and does not imply causal relationships. Causal relationships in this study were not investigated.

Since criteria for inclusion involved only women who experienced nausea and vomiting in their early pregnancy, it is impossible to assess the incidence of NVP from this study. When comparing results with previous studies, it should be remembered that earlier studies included both women with NVP and those without symptoms. In this study, every woman reported some symptoms.

Recommendations for Future Research

A large scale study consisting of 300 randomly selected pregnant women from the population with or without nausea and vomiting during the first trimester of pregnancy is recommended. The demographic variables need to include maternal age, gestational age, smoking behaviour, education, occupation, working outside of the home, parity, and maternal weight, height, and body mass. The nutrition of the women and history of previous pregnancies also needs to be evaluated. Detailed pregnancy outcomes would be collected after the women give birth. That way, relationships will be more thorough, and

some of the weak to moderate relationships could be identified. A hormonal study is needed to further investigate the etiology of NVP, thereby effective measures to comfort women with NVP can be found.

A causal model of birth weight needs to be established to identify the variables which affect infant birth weight. With such a model, effective interventions to increase the birth weight can be initiated leading to promoted family health.

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APPENDICES

APPENDIX 1

The Rhodes Inventory of Nausea and Vomiting

APPENDIX 1

Day 1

RHODES INV-FORM 2

APPENDIX 2

The Pregnancy Outcome Questionnaire

PREGNANCY OUTCOME QUESTIONNAIRE
FOR
the Relationship Between Symptoms of Nausea and Vomiting
During Early Pregnancy and Pregnancy Outcomes

****

1. How many weeks did your pregnancy last?

Less than 36wks _____

36wks _____

37wks _____

38wks _____

39wks _____

40wks _____

41wks _____

42wks _____

More than 42wks _____

If less than 36wks, How many weeks? _____

If more than 42 wks, How many weeks? _____

2. Gender of your baby

Male _____

Female _____

Twins Both are male _____

Both are female _____

1 male and 1 female _____

3. What was your baby's birth weight(s)?
(in pounds or/and kilograms)

4. Can you recall when your morning sickness started?

Within 1 month from the last menstrual period _____

Between 1-2month from the last menstrual period _____

Between 2-3month from the last menstrual period _____

After 3 month from the last menstrual period _____

5. At what time of pregnancy did your morning sickness stop?

6. Was your baby healthy when he/she was born?

Yes _____

No _____

Describe any problems.

7. Did you take any medications or vitamins during your pregnancy?

Yes _____

No _____

List medication(s) and/or vitamin(s) that you took during your pregnancy. Include how often, how long you took them and the dosage.

8. Describe your baby's birth

Normal _____

Forceps _____

Vacuum extraction _____

Caesarian section _____

Other _____

Describe any complications that you experienced during or after the birth.

9. Do you remember anything else that you would be willing to share with us?

APPENDIX 3

Demographic Data Form

Demographic Data Form

Subject Number_____

1. Date_____.

2. Date of Last Normal Menstrual Period_____.

3. Age_____.

4. Occupation_____.

5. Do you work outside the home?_____.If so, what type of work do you do?_____.

6. Do you smoke?____.If so, how many cigarettes do you smoke a day?____.

7. Have you had a 'miscarriage' prior to this pregnancy?_____.If so, give dates_____.

8. Please fill in information about previous pregnancies.

Birth date	Sex and weight of infant	Nausea/vomiting during pregnancy	Complications during pregnancy /birth

APPENDIX 4

Cover Letter to Participants

July 20, 1993

Dear ***:

I want to thank you for taking part in the 'morning sickness' study. We very much value your time and help with our study. We finished collecting data and we are now studying that data. We will send a copy of the study results to you as soon as possible.

Since we measured your morning sickness early in your pregnancy, we want to know more about how you have felt since that time. We also would like to know more about the birth of your baby. Qiuping Zhou is a graduate student in the Faculty of Nursing. She has been one of our assistants since we began this study. She is conducting a study for her master's thesis. She would like to study the effect of morning sickness on the birth of your baby. The title of her study is "The Relationship Between the Severity of Nausea and Vomiting During Early Pregnancy and Pregnancy Outcomes". She would like to know if your baby's gender affects morning sickness and if morning sickness affected your baby's birth weight. She also wants to know the length of your pregnancy. The information from her study may help us to understand more about morning sickness. It also may help us to make women more comfortable.

If you would be willing to be part of this study, please fill out the enclosed questionnaire. The questionnaire takes about 5 to 10 minutes to complete. Please return the questionnaire in the enclosed stamped envelope.

If you do not wish to be in this study, please return the blank questionnaire to us in the stamped envelope. This will let Qiuping know that you do not wish to take part.

We gave you the same code number that you had when you were in the morning sickness study. Qiuping will use the code number to match what you told us in the morning sickness study to this study. Qiuping will not be given that information unless you complete the questionnaire so she will not be able to access to your name or address. Only the investigators in the morning sickness study have access to that information.

You will not be harmed by taking part in this study. You will not benefit directly from being in this study. The results of the study may help nurses and midwives understand more about morning sickness. This could improve the care they give to others.

We will not use your name in any report of the study. Only your code number when you took part in the morning sickness study will appear on the form. We will keep the questionnaire which you return to us in a locked file and will destroy it seven years after the end of the study. We will type what you write in the questionnaire and keep that in a

locked file. The information may be used for another study in the future, if the person doing the study gets approval from the proper ethical review committee.

We may publish or present information about this study. If we do this, we will not use your name or any material that may identify you.

If you have any questions, please call me at 492-8232. As well as being the primary investigator in the morning sickness study, I am Qiuping's thesis supervisor. You also may call Qiuping at 439-2308. If you have any concerns, please call us at 492-6206 or call Joyce Relyea (co-investigator in the morning sickness study) at 492-5929. Thank you for thinking about taking part in Qiuping's study.

Sincerely,

Beverley O'Brien, RN, DNS
Assistant Professor

Addresses:

Beverley O'Brien
Assistant Professor
Faculty of Nursing
University of Alberta
Edmonton, T6G 2G3

Qiuping Zhou
Graduate Student
Faculty of Nursing
University of Alberta
Edmonton, T6G 2G3

APPENDIX 5

Reminder Letter to Participants

Sep. 14, 1993

Dear ***

Thank you very much for participating in the 'morning sickness' study. I sent you a letter regarding Qiuping Zhou's 'The Severity of Nausea and Vomiting During Early Pregnancy and Pregnancy outcomes' study at the end of July. This is a follow up to the 'morning sickness study'.

I wonder if you would like to take part in this study. If you do and just misplaced the questionnaire, I have enclosed another one. Please fill it out and return to me. If you do not want to participate, please send back the blank questionnaire. If you have already sent the questionnaire out, please disregard this letter and enclosed questionnaire.

If you have any questions, please call me at 492-8232. As well as being the primary investigator in the morning sickness study, I am Qiuping's thesis supervisor. You also may call Qiuping at 439-2308. If you have any concerns, please call us at 492-6206 or call Joyce Relyea (co-investigator in the morning sickness study) at 492-5929. Thank you for thinking about taking part in Qiuping's study.

Sincerely,

Beverley O'Brien, RN, DNS
Assistant Professor

Addresses:

Beverley O'Brien
Assistant Professor
Faculty of Nursing
University of Alberta
Edmonton, T6G 2G3

Qiuping Zhou
Graduate Student
Faculty of Nursing
University of Alberta
Edmonton, T6G 2G3

APPENDIX 6

Student/Faculty Agreement for Use of Shared Data

Student/Faculty Agreement for Use of Shared Data

Ownership of Data:

Questionnaires returned following distribution of the letter of explanation by Beverley O'Brien will become the property of the graduate student, Qiuping Zhou. In addition, as participants return completed questionnaires, thus indication their willingness to participate in the study, Qiuping Zhou will be given access to corresponding demographic information sheets and nausea scores for day 1 and 2 of the "P6 acupressure Clinical Trial". Subsequent inquiry regarding the use of the questionnaires for other research proposes will require the written consent of Qiuping Zhou. Following the study, the demographic information sheets and nausea scores will remain the property of the investigators who conducted the clinical trial i.e., Beverley O'Brien and Joyce Relyea.

Guidelines for Publications and Presentations of the Proposed Research:

a) **Publications**

First Author

Qiuping zhou will be first author of any article(s) using data obtained through use of the questionnaires. The article(s) may also include findings from the demographic information sheets and nausea scores (Day 1 & Day 2) of the "P6 Acupressure Clinical Trial".

Co-authors

Beverley O'Brien and Joyce Relyea will be co-authors of any article(s) that includes findings from the demographic information sheets and nausea scores. Other individuals who participate in the research may be acknowledged in article(s) where appropriate.

Time Lines for Submission

The time line for submission of an article will be one year from completion of the research study (thesis). if Qiuping Zhou does not do so within one year, the right to submission will be transmitted to beverley O'Brien or Joyce relyea.

b) **Presentations**

The time line for submission of an abstract to present findings (oral or poster) at a suitable conference will be one year from completion of the research study (thesis). If Qiuping Zhou does not do so within one year, the right to submission will be transferred to Joyce Relyea or Beverley O'brien.

This agreement has been reviewed by Qiuping Zhou (graduate student) and Beverley O'brien (Thesis Co-supervisor and principle Investigator of "P6 Acupressure Clinical trial") and is hereby endorsed by the undersigned.

Qiuping Zhou	(Date)
Beverley O'Brien	(date)