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## INTRODUCTION

Yoga is an ancient system of mind-body practices, originating in India, aimed at enhancing health and well-being through the integration of the mind, body and spirit (Pelletier, 1997). Although yoga has been practiced in India for centuries, only in recent decades has the scientific community considered its merits (Engebretson, 2002). Research has established yoga as an effective practice in the treatment of a wide range of conditions, such as anxiety, depression and insomnia (e.g., Khalsa, 2004). Yoga has also been shown to be effective in reducing heart disease (Raub, 2002), hypertension (e.g., Murugesan, Govindarsjulu, & Bera, 2000) and stress (Malathi & Damodaran, 1999), while improving cardiovascular health (Raub, 2002) and general well-being (e.g., Carlson, Speca, Patel, & Goodey, 2004).

Yoga is a complementary therapy utilised by many pregnant women in the West (Teasdale, 1999). However, little is known empirically about the risks and benefits of antenatal yoga on maternal health and well-being (Narendran, Nagarathna, Narendran, Gunasheela, & Nagendra, 2005). Previous research has demonstrated that maternal health and well-being may be positively influenced by mediating factors such as exercise (e.g., Kramer, 2004), social support (e.g., Feldman, Dunkel-Schetter, Sandman, & Wadhwa, 2000), maternal self-efficacy (e.g., Porter & Hsu, 2003), stress-reduction (e.g., Mulder, De Medina et al. 2002) and pain management techniques (e.g., Caton, Corry et al. 2002; Goodman, Mackey et al. 2004). Hatha Yoga naturally combines each of the above mediators of maternal health: as an exercise, a means of stress and pain management (Balaskas, 1994; Ezmerli, 2000) and through its association with enhanced social skills and positive health practices (Telles & Naveen, 1997). Thus, it is hypothesised that the practice of Hatha Yoga would be beneficial to prenatal women and, through its proposed impact on each of the above mediators, would result in positive maternal health and birth outcomes.

The primary aim of this natural history study was to assess the safety and effectiveness of antenatal yoga for first-time mothers in New Zealand. This study investigates how first-time

mothers who participated in yoga performed across a range of antenatal and postnatal measures, during their third trimester of pregnancy and at three months postpartum, when compared with their non-yoga peers. Measures assessed demographic factors, antenatal pain medication preferences and utilisation of pain relief during labour, physical activity levels, complementary therapy utilisation, maternal mood, social networks, maternal self-efficacy, labour experience and birth outcomes. An additional aim of the study was to attempt to predict birth type from the above measures. If yoga was shown to benefit maternal health, the findings of this exploratory study would position us to assess the effectiveness of this popular form of complementary medicine more rigorously in the future. It was anticipated that pregnant women who participated in yoga would: experience fewer signs and symptoms of depression and anxiety before and after delivery; have a preference for low levels of analgesia usage antenatally and utilise less analgesia during labour; engage in more physical activity before and after pregnancy; self-report greater satisfaction with social support, have a greater percentage of natural births and report higher levels of maternal self-efficacy postpartum, when compared with their non-yoga peers. It was also anticipated that a combination of demographic, antenatal and birth measures (i.e., participation in antenatal yoga, levels of complementary therapy utilisation, self-rating of diet, maternal age, and levels of analgesia utilised during labour), would effectively predict the mode of delivery among first-time mothers.

This study draws on research from several different fields, including that of medicine, maternity and paediatrics, complementary and alternative therapies and psychology. As a result, literature for the study is presented in three chapters to illustrate issues relating to childbirth and birth outcomes, factors influencing birth outcomes, and the proposed influence of antenatal yoga on maternal health and well-being. Chapter 1 defines different forms of childbirth, related medical procedures and their prevalence in New Zealand and abroad. Primary birth outcome measures are also defined. Chapter 2 reviews factors associated with positive (i.e., social support, antenatal care, nutrition and physical activity) and negative (i.e., smoking, alcohol, drug use,

maternal stress and anxiety) birth outcomes. In Chapter 3, the history, theory and practice of yoga are introduced, the benefits of yoga highlighted and mechanisms underlying such effects discussed. Finally, antenatal yoga as a concept and practice is introduced and its proposed benefits are outlined in terms of their influence on stress, pain, self-efficacy and social support.

## **CHAPTER 1 :CHILDBIRTH AND BIRTH OUTCOMES**

### **Childbirth Definitions and Prevalence**

Childbirth or parturition refers to the process of labour and delivery of a child after a minimum of 20 weeks' gestation and/or with a birth weight of more than 400 grams, with full-term birth referring to birth at 37 or more weeks' gestation (New Zealand Health Information Services [NZHIS], 2003). The term labour has been defined as “the sequence of actions by which a baby and the afterbirth (placenta) are expelled from the uterus at childbirth” (Ellen, 2007, p. 396). Labour may occur spontaneously or may be induced by artificial means (American College of Obstetricians and Gynaecologists [ACOG], 2001b; Sanchez-Ramos, 2005). According to Ellen (2007), average labour durations may range between 12 hours for first-time mothers to about 8 hours for second and subsequent pregnancies. Current maternity textbooks typically divide the process of labour into three stages (Pullon & Bliss, 2006). The first stage of labour is characterised by a thinning of the cervix, contractions of increasing intensity and frequency and dilation of the cervix to nearly 10cm (Simkin, Whalley, & Keppler, 2001). The second stage of labour is typically marked by achieving cervical dilation of 10cm and strengthening uterine contractions which help push the baby's head through the cervix and into the vagina. At this stage, abdominal contractions and active pushing by the mother help the baby pass through the vaginal opening and the baby is delivered (Ellen, 2007). In cases where the baby's head is unable to pass through the vaginal opening an episiotomy may be performed, with delivery facilitated by the use of forceps or vacuum extraction (further discussed on pages 9 and 10). Finally, the third stage of labour is marked by the delivery of the placenta and membranes (Simkin et al., 2001).

According to national statistics for the year 2008, 64,340 live births were registered to mothers living in New Zealand (Statistics New Zealand, 2009). The greater Auckland region registered the highest number of births (23,110) for this period, accounting for 36% of all registered births. New Zealand women average two births per woman, with the highest fertility

rate occurring in women aged 30-34 years, followed by those aged 25-29 years. While the median age of women giving birth was 30 years, the median age of women giving birth to their first child was 28 years (Statistics New Zealand., 2006). Maternity statistics for the year 2007, show that a majority of mothers who gave birth in New Zealand identified as European (56%), while the proportion of Maori and Pacific Islanders were 20% and 11% respectively (New Zealand Health Information Services, 2009).

Childbirth is commonly categorised as being a normal birth (e.g., spontaneous vaginal birth where medical intervention is minimised), caesarean section (e.g., acute caesarean section performed for clinical reasons and elective caesarean section), or an operative vaginal birth (e.g., vaginal breech birth, or delivery using forceps or vacuum extraction). Of the live births recorded in 2007, 65.4% were via normal delivery, 24.2% were delivered via caesarean section (13.9% emergency and 10.3% elective), and 9.5% were operative births (5.8% vacuum extractions, 3% assisted by the use of forceps and 0.6% vaginal breach) (NZHIS, 2009).

Looking at maternity statistics internationally, National Health Service maternity statistics for the year 2004-2005 show that of the 584,000 hospital deliveries in England, 48% were classified as normal deliveries, 23% were caesarean deliveries (14% emergency and 9% elective) while 11% required instrumental intervention (The Information Centre, 2006). In 2005, caesarean delivery rates in the United States rose to a national high of 30.2% of all deliveries (Hamilton, Martin & Ventura, 2006), while rates of operative vaginal births, i.e., forceps (1.1%) and vacuum extractions 4.1%) (Martin et al., 2006) declined.

A wide range of factors (e.g., demographic, psychosocial, psychological, physical and medical) have been proposed to influence the mode of delivery. Demographic and psychosocial factors cited include maternal age (Jolly, Sebire, Harris, Robinson, & Regan, 2000; Luke & Brown, 2007), the number of previous pregnancies (Gilbert, Nesbitt & Beate, 1999), levels of education (Moran & von Barga, 1982), levels and quality of social support (Moran & von Barga, 1982) and levels and type of physical activity (Bungum, Peaslee, Jackson, & Perez, 2000).

Psychological factors such as maternal anxiety and stress (Cheung, Ip, & Chan, 2006; Lang, Sorrell, Rodgers, & Lebeck, 2006; Sjogren, 1997; Sjogren & Thomassen, 1997) and physical factors such as maternal fatigue and quality of sleep during pregnancy (Lee & Gay, 2004) have also been proposed to influence delivery type. Pre-existing medical conditions (e.g., diabetes, pelvic abnormalities, hypertension, heart diseases and infectious diseases) and conditions which develop during the course of pregnancy (e.g., eclampsia, placenta praevia, malpresentation of the baby) have been associated with complications during labour and delivery, may threaten the life of mother and/or child, prevent a safe vaginal birth, or indicate the need for medical intervention, e.g., caesarean section or operative delivery (Merck Research Laboratories, 2007; Sehdev, 2005; Sewell, 1993).

Having provided a general overview of birth, the following sections further define each mode of delivery as well as medical procedures commonly performed during delivery. Correlates of each are highlighted.

### **“Natural” or “Normal” Childbirth**

A discussion paper by Cosans (2004), which considered the meaning of natural childbirth, concluded that “natural” may refer to “any approach to medicine that makes an effort to incorporate or work with internal processes of the body” (p. 267). “Natural childbirth” may also refer to a number of childbirth methods such as Lamaze, Bradley and home-birth options (Cosans, 2004). From a medical perspective a “normal” delivery may be categorised as a vaginal birth with an absence of obstetric operative interventions, i.e., no surgical intervention, no use of instruments, no induction and no epidural or general anaesthetic (The Information Centre, 2006).

In terms of women’s preferences for different modes of delivery, a number of studies have compared general populations of birthing women wanting a caesarean delivery with those preferring other modes of delivery (Gamble & Creedy, 2001; Geary, Fanagan, & Boylan, 1997; Green, Coupland, & Kitzinger, 1998). Womens’ preference for natural childbirth may be

influenced by their access to information (i.e., how to cope without drugs, delivery positions, monitoring of the baby during labour), viewing birth as a natural event, and having lower levels of state anxiety (Gamble & Creedy, 2001). For example, an Australian study by Gamble and Creedy (2001) examined women's preferences for different modes of delivery and factors influencing their preference. Women in their third trimester (N=310) were recruited and completed a questionnaire which elicited their preferred type of birth, reasons for their preference, childbirth preparations, anxiety levels and concerns, and the influence of their primary caregiver. A vast majority of the women (93.5%) reported a preference for a spontaneous vaginal birth of whom 54.8% wanted no drugs or nitrous oxide only, 38.7% wanted analgesia, and 6.4% reported a preference for a caesarean delivery. Among women with a preference for a vaginal birth with no analgesia or gas only, 53.2% reported their primary reason related to birth being a natural event which they wanted to experience and have control over, while a further 28.2% cited the baby's safety as their primary reason. Women with a preference for vaginal birth with analgesia cited reasons relating to fear of pain, contractions and tearing (39.2%), while also viewing birth as a natural experience which they wanted to experience and have control over (23.3%). Primary reasons cited by women who had a preference for a caesarean delivery related to issues of safety for their baby (40%), doctors' recommendations (25%), and fear of pain, contractions and tearing (20%).

Research has also demonstrated that while a majority of women plan to deliver naturally, a significant proportion will request analgesia during labour (Kannan, Jamison, & Datta, 2001; Ranta, Spalding, Kangas-Saerela, Johela, Hollmen, & Joupilla, 1995). For example, a study by Kannan et al. (2001), which examined the influence of epidural analgesia during labour on maternal satisfaction, found that 48% of women who elected a natural childbirth antenatally subsequently requested epidural analgesia during labour. While epidural analgesia for labour pain was found to be associated with significantly lower levels of reported pain it was also associated with lower levels of satisfaction with the childbirth experience, when compared with those who

did not have epidural analgesia. Similarly, a study by Ranta and colleagues (1995), which assessed the maternal expectations of 1091 Finnish women and their experiences of pain relief options, found that over half (52%) of the women who predicted antenatally that they would not require pain relief during labour, later requested epidural analgesia. In the study, however, dissatisfaction with the childbirth experience was very low, and was associated with instrumental deliveries rather than the use of analgesia.

### **Caesarean Sections**

A caesarean delivery occurs when an incision is made through the abdominal and uterine walls for the purposes of delivery of a foetus (Dorland, 2000). Caesarean deliveries may be acute (e.g., “performed urgently for clinical reasons such as the health of mother or baby once labour has started”) or may be elective (e.g., “performed as a planned procedure before or following the onset of labour when the decision was made before labour”) (NZHIS, 2003, p104).

Historically, indications for caesarean sections have varied significantly over time, with medical practice being influenced by religious, cultural and economic factors, as well as by professional and technological advances (Sewell, 1993). A brief history of caesarean sections collated by Sewell (1993), traces its origins as an operation which attempted to save the life and soul of a foetus whose mother was dead or dying, through advances in caesarean techniques in the 19<sup>th</sup> and 20<sup>th</sup> century, to the present day where caesarean deliveries are commonplace and caesarean rates are at record highs.

In 1985, the World Health Organisation (WHO) reviewed technologies for birth and found that countries with some of the lowest perinatal mortality rates had caesarean section rates of less than 10%. As a result, the WHO recommended that other regions should strive for caesarean rates of no higher than 15% (WHO, 1985). Despite these recommendations, caesarean delivery rates in Western countries have climbed steadily in recent decades and now far exceed recommended rates (Anderson, 2004; Flamm, 2000; Gamble & Creedy, 2000). For example,

recent maternity statistics show caesarean rates of 20% in the United Kingdom (Royal College of Obstetrics and Gynaecology Clinical Effectiveness Support Unit [RCOG], 2001), 22.5% in Canada (Canadian Institute for Health Information [CIHI], 2004), 24.2% in New Zealand (NZHIS, 2009), and 30.2% in the United States (National Centre for Health Statistics [NCHS], 2005). High caesarean rates have been attributed to, in part, an increase in elective caesarean deliveries (Graham et al., 1999; Jackson & Irvine, 1998; Wilkinson, McIlwaine, Boulton-Jones, & Cole, 1998); even though, other commentators have concluded that “the percentage of women requiring a caesarean in the absence of known current or previous obstetric complications appears to be from 0 to 1%” (Gamble & Creedy, 2000, p. 257).

Caesarean delivery may be medically indicated in situations where natural childbirth may pose a significant risk to the mother, baby, or both (Sehdev, 2005). Major indications for a caesarean section include failure for labour to progress, foetal distress, malpresentation (e.g., breech presentation, face presentation, and posterior positions) or a history of previous caesarean deliveries (New Zealand Guidelines Group, 2004). Other factors associated with increased risk of caesarean delivery include advanced maternal age (Panchal, 2001), anxiety and fear of childbirth (Saisto & Halmesmaki, 2003; Saisto, Kaaja, Ylikorkala, & Halmesmaki, 1999), having labour induced (Buist, Brown, & McNamara, 1999; Shetty, Burt, Rice, & Templeton, 2005), negative childbirth experiences (Goodman, Mackey, & Tavakoli, 2004) or complications during a current pregnancy (Jackson & Irvine, 1998; Quinlivan, Petersen, & Nichols, 1999; Wilkinson, McIlwaine, Boulton-Jones, & Cole, 1998). While natural childbirth and caesarean section may be seen as endpoints on the continuum of possible birth experiences, a number of other medical interventions exist, including delivery methods such as operative vaginal births and medical procedures such as episiotomies, inductions and epidural anaesthesia. Each of these interventions is reviewed in brief.

## **Operative Vaginal Birth**

Operative vaginal birth refers to the use of forceps or vacuum extraction to assist with the delivery of a baby, with a Caesarean section being viewed as the surgical alternative (Society of Obstetricians and Gynaecologists of Canada [SOGC], 2005). Use of forceps or vacuum instruments typically occurs while the mother is pushing during contractions, involves the application of either forceps or a vacuum cup to the foetal head and the use of traction to extract the foetus (Wegner & Bernstein, 2007). Indications for operative vaginal deliveries, as recommended by the ACOG, include: prolonged second stage labour, defined as a “lack of continuing progress for 3 hours with regional anaesthesia, or 2 hours without regional anaesthesia”, a “suspicion of immediate or potential foetal compromise”, or “shortening of the second stage for maternal benefit” (ACOG, 2001, p. 70).

## **Episiotomy**

An episiotomy refers to an incision made in the perineum during the second stage of labour to prevent perineal tearing or to facilitate delivery (Pullon & Bliss, 2006). Episiotomies, which have been referred to as “the unkindest cut of all” (Graham, Carroli, Davies, & Medves, 2005, p.219), may be indicated for the health of the foetus (e.g., non-reassuring foetal testing, pre-term delivery and vaginal breech delivery) and/or for the health of the mother (e.g., exhaustion, prolonged second stage or to facilitate an operative birth) (Robinson, Norwitz, Cohen, & Lieberman, 2000). Research has demonstrated that patient characteristics (i.e., age, privately insured, caucasian race), clinical status and physician factors may be associated with episiotomy use, with the strongest predictors of episiotomy being nulliparity (delivery of first child) and operative births (i.e., forcep and vacuum extractions) (Hueston, 1995). Other studies have noted differences in the use of episiotomy based on the training and speciality of the birth attendant; with findings that obstetricians may be twice as likely to perform episiotomy as family physicians

in similar (low-risk vaginal delivery) patients (Allen & Hanson, 2005; Reid, Carroll, Ruderman, & Murray, 1989); who both in turn have been found to have significantly higher rates of episiotomy than midwives (Blanchette, 1995; Hueston, 1995). A number of practices have also been associated with lower rates of episiotomy and/ or laceration (Byrd, Hobbiss, & Tasker, 2005). For example, the practice of antenatal perineal massage has been associated with lower rates of episiotomy and second degree lacerations (Avery & Van Arsdale, 1987); water births have been associated with reduced risk of third degree tearing (among first-time mothers)(Otigbah, Dhanjal, Harmsworth, & Chard, 2000); while women who undertake regular exercise in pregnancy have been found to have fewer third and fourth degree tears in the presence of episiotomy(Klein, Janssen, MacWilliam, Kaczorowski, & Johnson, 1997).

While episiotomy use has been associated with increased risk of perineal lacerations and increased length of hospital stay (Hueston, 1996), and while a growing consensus supports the restrictive use of this procedure (ACOG, 2006; RCOG, 2004; WHO, 2000), there is less consensus as to what may be an optimal episiotomy rate (Graham, Carroli, Davies, & Medves, 2005). Episiotomy rates have been found to vary both within countries and within medical institutions (Graham et al., 2005; RCOG, 2004). Recent maternity statistics illustrate this variation, with episiotomy rates of 9.7% in Sweden (Alran, Sibony, Oury, Luton, & Blot, 2002), 13% in New Zealand (ranging from a high of 22% in Wairarapa to a low of 3.1% in Whanganui; NZHIS, 2007), 13% in England (The Information Centre, 2006), between 30% to 35% in the United States (Katherine, Meera, Rachel, Gerald, & et al., 2005), and estimated rates in excess of 90% in some Central and South American countries (Althabe, Belizan, & Bergel, 2002).

## **Induction**

Induction of labour is a common obstetric practice and refers to “the process whereby uterine contractions are initiated by medical or surgical means before the onset of spontaneous labour” (Tenore, 2003, p. 2123). Induction of labour differs from augmentation of labour in that

the former occurs before the onset of spontaneous labour while the latter occurs “when the progress of labour is deemed inadequate” (Kirby, 2004, p. 148). The ACOG suggests that the “induction of labour is indicated when the benefits to either the mother or foetus outweigh those of continuing the pregnancy” (ACOG, 1996, p. 65). Indications for the induction of labour include maternal medical problems (e.g., pregnancy-induced hypertension, chorioamnionitis, diabetes mellitus), suspected foetal jeopardy (e.g., intrauterine growth restrictions, sporadic non-reassuring foetal heart rate pattern), rupture of membranes for more than 24 hours, oligohydramnios, and post-date pregnancy (beyond 42 weeks) (ACOG, 1996). Conversely, contraindications to labour induction may include placenta praevia, transverse foetal lie, prolapsed umbilical cord, classical uterine incision or active genital herpes infection (ACOG, 1996). Factors predictive of a successful induction include particular maternal (e.g., parity, age, weight and height) and foetal (e.g., gestational age and weight) characteristics, with successful inductions being associated with parous, younger women who are taller with lower weights and foetus with greater gestational age and lower birth weight (Crane, 2006).

Medical induction of labour may occur through non-pharmacologic methods (e.g., stripping the amniotic membranes, artificial rupture of the membranes) or via pharmacologic means (e.g., oxytocin) (ACOG, 1996). Internationally, rates of induction are approximately 20% in England (The Information Centre, 2006) and exceed 20% in the United States and Canada (Health Canada, 2003; Martin et al., 2006). In 2004, the rate of induction in New Zealand was 20.4%, with Maori mothers having the lowest rate of inductions (15.5%) while older mothers (i.e.,  $\geq 40$  years) had the highest rate (32.2%) (NZHIS, 2007).

### **Epidural Analgesia**

Epidural analgesia refers to “a central nerve block technique achieved by injection of a local anaesthetic close to the nerves that transmit pain” (Anim-Somuah et al., 2007, p. 1).

Epidural analgesia is an effective and commonly-used method of relieving pain during labour

which reduces sensation in the lower areas of the body without loss of consciousness (Robinson, 2001). Depending on the amount of analgesia administered, women may still be aware of contractions and while they are able to move following administration they may not be permitted to walk (ACOG, 1993). Epidural analgesia may be administered during labour, once the maternal and foetal status has been evaluated by a physician, a diagnosis of active labour has been established and the mother has requested pain relief (Vincent & Chestnut, 1998). The ACOG, in its published opinion on pain relief during labour, states that “maternal request is a sufficient justification for pain relief during labour” (ACOG, 1993. p. 73). While there is some controversy surrounding the risks and timing of epidural anaesthesia during labour (Chestnut et al., 1994; Wong et al., 2005; Zhang, Yancey, Klebanoff, Schwarz, & Schweitzer, 2001), it is uncommon for analgesia to be requested before cervical dilation of 3 cm (unless labour has been augmented using oxytocin) or for epidural analgesia to be initiated during advanced labour, e.g., cervical dilation exceeding 8 cm (Vincent & Chestnut, 1998). Contraindications to epidural analgesia may include patient refusal, local infection and systemic sepsis, hypovolaemia or active bleeding, anticoagulant therapy, bleeding diathesis and or a lack of adequate staff (e.g., anaesthesiologist) or facilities (Gomar & Fernandez, 2000). In terms of prevalence, it is estimated that 60% of women in the United States request some form of epidural analgesia (e.g., epidural or combined spinal–epidural analgesia) for pain relief during labour (Eltzschig, Lieberman, & Camann, 2003), while in 2004, approximately one-third of women in England had either an epidural, general or spinal anaesthetic administered (The Information Centre, 2006). In 2003, the national rate of epidural administration in New Zealand was 24.2% of all births, with Maori mothers having the lowest epidural rate (13.2%) followed by European mothers (15.9%). Mothers between the ages of 30 and 34 years and mothers who identified as Asian reported the highest rates of epidural administration (26.3% and 32.0% of births, respectively) (NZHIS, 2003).

In summary, childbirth refers to the process of labour and delivery, with primary modes of delivery including vaginal delivery, caesarean section and operative vaginal birth. These modes

of delivery and related procedures (i.e., episiotomy, induction and analgesia) may be associated with positive and negative birth outcomes. The paragraphs which follow define key birth outcome measures (for mother and child) and their correlates.

### **Measuring Birth Outcomes**

Health has been defined by the WHO (1998) as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (p. 39). Conventional indicators of health include mortality, morbidity and life expectancy, while traditional birth outcome measures typically include maternal and neonatal/perinatal mortality and morbidity rates.

#### **Maternal Mortality**

Maternal mortality has been defined by the WHO (2004) as “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes” (p. 3). According to a 2005 WHO report, major causes of maternal death include severe bleeding (25%), bacterial infection (13%), complications from abortions (13%), eclampsia (12%), obstructed labour (8%) and other direct (8%) and indirect causes (20%) (e.g., malaria, anaemia, HIV/AIDS and cardiovascular disease). Of a number of well-established measures of mortality (i.e., maternal mortality ratio, maternal mortality rate and lifetime risk of maternal death), the maternal mortality ratio (MMR) is the most commonly used, and refers to the number of maternal deaths per 100,000 live births over a given time period (WHO, 2004). Globally, it is estimated that less than 1% of maternal deaths occur in developed countries, with estimated MMRs of 4 per 100,000 in European countries such as Austria, 7 per 100,000 in New Zealand, 13 per 100,000 in the United Kingdom, and 17 per 100,000 in the United States (WHO, 2004). In terms of the risks directly associated with childbirth, it is

estimated that between 11% and 17% of maternal deaths occur during childbirth with the majority of maternal deaths (i.e., 50% – 71%) occurring postnatally (WHO, 2005). The risk of maternal death in relation to mode of delivery is reviewed in brief.

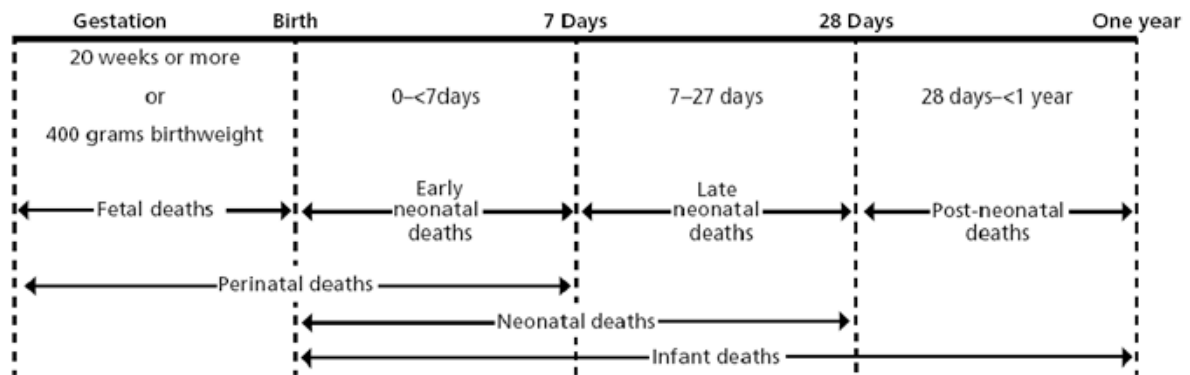
To date, a number of studies have investigated maternal morbidity among women who planned a vaginal birth compared with other modes of delivery (Allen, O'Connell, Liston, & Baskett, 2003; Benedetto et al., 2007; Liu et al., 2007). Liu and colleagues (2007), in a retrospective population-based study of all women who delivered in Canada (excluding Quebec and Manitoba) between 1997 and 2005, compared women who had planned a low-risk caesarean delivery with those who had planned a vaginal delivery at term. They found that those in the planned vaginal delivery group had a mortality rate of 1.8 per 100,000 deliveries; and, while no women died in hospital in the planned caesarean delivery group, women who delivered via emergency caesarean section had an in-hospital mortality rate of 9.7 per 100,000.

While caesarean sections have become safer with advances in surgical techniques, perioperative care and anaesthesia; they are still considered to pose additional risks of maternal mortality or morbidity when compared with vaginal deliveries. Research suggests that maternal mortality may be in the region of two to seven times higher for caesarean than for vaginal delivery (Ecker, 2004; Hall & Bewley, 1999; Wagner, 2000). However, others have argued that this increased risk may reflect a “pre-existing or obstetric disorder that indicated caesarean section rather than the procedure itself” (Benedetto et al., 2007, p. 39). While other modes of delivery such as operative vaginal births (i.e., forceps and vacuum extraction) are not associated with increased risk of maternal mortality per se, indications for operative vaginal births (e.g., maternal and foetal complications) may be associated with an increased risk of mortality (SOGC, 2005).

## Neonatal and Perinatal Mortality

The New Zealand Ministry of Health applies the following definitions of neonatal and perinatal mortality, illustrated in Figure 1, in accordance with the WHO (NZHIS, 2009).

Figure 1. Foetal and infant mortality definitions and time-frames



Source: NZHIS, 2009

Perinatal death is the sum of foetal and neonatal deaths and refers to “death occurring during late pregnancy (at 22 completed weeks gestation and over), during childbirth and up to seven completed days of life” (WHO, 2001, p. 38). Perinatal mortality has been viewed as a good indicator of maternal health and nutrition, as well as reflecting the quality of obstetric and paediatric care (WHO, 2006). Such indicators have been used to improve the health status of mother and child, through allowing health organisations to identify, monitor and address problems (WHO, 2006). The perinatal mortality rate (PNMR) refers to the number of perinatal deaths per 1000 total births and has been considered by the WHO (2006) to be a “direct measure of perinatal health status” as well as “a proxy measure of maternal health status” (p. 38). Stillbirth or foetal death refers to “death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy” (WHO, 2006, p. 6). In contrast, neonatal mortality refers to deaths which occur during the first four weeks of life (WHO, 2006). Neonatal deaths and stillbirths are associated with poor maternal health (e.g., infections) and nutrition, inadequate care during pregnancy, inappropriate management of

complications during pregnancy and delivery, poor hygiene during delivery and the first critical hours after birth and lack of newborn care” (WHO, 2006, p. 2). Low birth weight has also been associated with neonatal death but, rather than a direct cause, it is more likely that pre-term birth and its resulting complications are a primary cause of neonatal mortality (WHO, 2006). Globally, neonatal deaths have been attributed to a number of causes, namely: pre-term birth, which is estimated to account for 28% of all births; followed by severe infection (26%), birth asphyxia (23%), congenital abnormalities (8%), neonatal tetanus (7%), and diseases which result in dehydration (3%; WHO, 2005). The relative contribution which each of these causes has on neonatal death may differ between and within countries; and are dependent on the health of the mother, the prevalence of infections, and the quality of the health care available. For example, New Zealand, Australia and Japan, which have low rates of neonatal mortality, have proportionally higher rates of neonatal mortality attributable to pre-term birth (44%), congenital abnormalities (31%), birth asphyxia (14%) and severe infections (6%), while few or no cases of mortality are attributable to neonatal tetanus or complications from diarrhoea (WHO, 2005).

Globally, it is estimated that over four million babies die each year within the first four weeks of life, with 98% of these deaths occurring in developing countries (Lawn, Cousens, & Zupan, 2005); while over 3.3 million stillbirths are estimated to occur each year (WHO, 2005). Global estimates of perinatal and neonatal mortality rates from the WHO (2005) highlight disparities between the least and most developed regions; with the least developed countries (e.g., middle & western Africa and South-East Asia) having estimated PNMR that are 6 to 8 times higher than those of developed countries. Estimated neonatal mortality (NNMR) and stillbirth rates (SBR) follow a similar trend.

Recent New Zealand perinatal and maternity statistics for 2006 report perinatal mortality rates in New Zealand are comparable with rates reported in Australia and the United Kingdom; New Zealand having a PNMR of 11.6 per 100 births, compared with 12.7 per 1000 births in Victoria, and 10.1 per 1000 in Western Australia, which use similar definitions to New Zealand

(The perinatal and Maternal Mortality Review Committee [PMMRC], 2009). Maternity statistics for the year 2003 show that of the 55,119 babies born in hospital there were 182 (3 per 1000) neonatal deaths and 414 (7 per 1000) stillbirths recorded (New Zealand Health Information Services, 2003). Neonatal deaths were higher among Maori and Pacific babies than in European babies, and were correlated with lower birth weights and gestational age (e.g., less than 2500 grams or less than 37 gestational weeks; NZHIS, 2003).

In terms of the influence of different modes of delivery and obstetric procedures on neonatal mortality, there is ongoing debate about the influence of surgical intervention on maternal and neonatal outcomes (Flamm, 2000; Gamble & Creedy, 2000; Goer, 2001; Lurie, 2005). On the one hand, there is research to support the view that a planned caesarean delivery may “decrease the risk of unexplained stillbirth and neonatal morbidity associated with cord prolapse, chorioamnionitis, foetal heart rate abnormalities and breech presentation when compared with vaginal delivery” (Armson, 2007, citing Hannah et al., 2004 and Visco et al., 2006, p. 475), however, others have challenged this view, citing statistics which show that “the infant mortality rate in the United States for total caesarean deliveries has consistently been approximately 1.5 times that for vaginal deliveries” (MacDorman, 2006, p. 176). Consistent with these statistics, a recent epidemiologic study of 5,800,000 American births (1998-2001) assessed the relationship between caesarean and vaginal births and neonatal mortality in full-term births where there were no known risk factors or indications and found that babies born via caesarean section were 2.9 times more likely to die than those delivered vaginally (MacDorman, Declercq, Menacker, & Malloy, 2006). MacDorman and colleagues (2006) concluded that “the increased risk of neonatal mortality associated with caesarean section in this low intrapartum-risk group of women cannot be explained by a simple review of the causes of death of their infants” and that “the resulting increase in the caesarean section rate may inadvertently be putting a larger population of neonates at risk for neonatal mortality for reasons that remain uncertain” (p. 181).

In addition to spontaneous vaginal births and caesarean deliveries, operative vaginal births have also been associated with increased risk of neonatal mortality and morbidity. For example, a population-based study by Demissie et al. (2004) of singleton live births in the United States compared the risk of neonatal and infant adverse outcomes between vacuum and forceps-assisted deliveries. The authors found that neonatal mortality rates were similar between vacuum and forceps deliveries, with neonatal and infant mortality rates of 3.7 per 10,000 deliveries for unassisted deliveries, 4.7 per 10,000 for deliveries using vacuum extraction and 5.0 per 10,000 for forceps deliveries.

While mortality can be seen as one end along the spectrum of possible birth outcomes, a number of other outcomes are possible. The following sections summarise the literature on maternal and neonatal morbidity and their associations with mode of delivery. Given that mode of delivery is of particular interest to this study, emphasis is placed on research linking mode of delivery to birth outcomes.

### **Maternal Morbidity**

Maternal morbidity has been defined as “any illness or injury caused by, aggravated by, or associated with pregnancy or childbirth” (Kamrul, 2006, p. 7). Given that health may refer to physical, mental and social well-being, a more inclusive definition of maternal morbidity may be “any departure, subjective or objective, from a state of physiological or psychological well-being” (Last, 2001, p. 118). Globally, it is estimated that approximately 15% of pregnant women will experience some complications during pregnancy or delivery that will require emergency obstetric care in a health facility (United Nations Population Fund [UNPF], 2004, citing Maine & McGinn, 1999). As reported by the UNPF (2004), direct causes of maternal morbidity may stem from obstetric complications (i.e., during pregnancy, labour, or postpartum) which result from “interventions, omissions or incorrect treatment” (p. 54), while indirect maternal morbidity may occur due to a pre-existing illness being exacerbated during pregnancy. As highlighted by the

International Classification of Diseases, ICD-10 (WHO, 2002), maternal morbidity may range from short-term morbidity (e.g., haemorrhages, hypertensive disorders during pregnancy, infection, obstetric embolisms) to long-term complications (e.g., fistulas, genital prolapse, infertility, faecal and urinary incontinence) and may range from physiological morbidity to adverse psychological outcomes such as depression (i.e., depression during pregnancy, post-partum depression and post traumatic stress disorder; WHO, 2002). Research, highlighting the influence of mode of birth on maternal morbidity is summarised in Table 1 and is discussed below.

**Maternal morbidity and vaginal deliveries.** While vaginal birth is the most common mode of delivery, with spontaneous vaginal birth being the preferred mode of delivery for the majority of women, it is not without its risks (Allen et al., 2003; Asnat Groutz, 2004). Vaginal delivery has been associated with maternal morbidity such as pelvic floor injury, stress urinary incontinence (SUI), third- and fourth-degree lacerations and increased rates of early postpartum haemorrhaging when compared with women who delivered via caesarean delivery without labour (Allen et al., 2003; Groutz et al., 2004).

**Maternal morbidity and caesarean deliveries.** While caesarean delivery has been associated with lower rates of specific types of maternal morbidity (e.g., pelvic floor trauma and related SUI), when compared with other modes of birth other morbidities are more common (e.g., infection, haemorrhage, uterine tract or bowel injury and thromboembolic disease) and are estimated to be between five and ten times that of spontaneous vaginal birth (Burrows, Meyn, & Weber, 2004; Lobel & DeLuca, 2007, citing Almeida, Nogueira, Candido dos Reis, & Rosa e Silva, 2002; and Murphy, Liebling, Verity, Swingler, & Patel, 2001).

**Maternal morbidity and caesarean deliveries.** While caesarean delivery has been associated with lower rates of specific types of maternal morbidity (e.g., pelvic floor trauma and related SUI), when compared with other modes of birth other morbidities are more common (e.g., infection, haemorrhage, uterine tract or bowel injury and thromboembolic disease) and are

Table 1

*Prevalence and Risk of Maternal Morbidity According to Mode of Birth*

Maternal Morbidities	Vaginal Delivery Types		Caesarean Delivery Types			References
	SVD	OVD	Obstructed	Elective	Emergency	
Tiredness & exhaustion	69%	67%		66%	76%	
Backache	41%	49%		48%	46%	
Bowel problems	12%	19%		14%	12%	
Haemorrhoids	25%	36%		17%	11%	
Perineal pain	20%	54% OR 4.69*		Nil	2%	(Brown & Lumley, 1998)
Sexual problems	24%	29% OR 2.06*		27%		
Urinary incontinence	11%	18% OR 1.81*	12%	3%	7%	
3 <sup>rd</sup> & 4 <sup>th</sup> degree lacerations	3.2%					(Allen et al., 2003)
Early postpartum haemorrhaging	RR 1.6**	RR 2.5**				
Postpartum depression	18%	21%		22%	25%	(Brown & Lumley, 1998)
Re-admitted to hospital within 8-weeks post partum	2.2%	4.8% OR 2.25*			5.3% OR 2.46*	(Boyce & Todd, 1992)
Extended hospital stays ≥ 6 days	5%			16% (OR 3.26)		(Thompson, Roberts, Currie, & Ellwood, 2002)
Negative outcomes in subsequent pregnancies:						
Frightened about having another baby	10%	25%		26%		(Murphy, Stirrat, & Heron, 2002)
Difficulty conceiving 5-years after first child	16%	28%		30%		
Stillbirth	0.2%			0.4%		(Smith, Pell, & Bobbie, 2003)
Caesarean delivery				89.4%		
Placenta previa				OR 1.59		(Gilliam et al., 2002)

*Note: SVD = Spontaneous Vaginal Delivery. OVD = Operative Vaginal Delivery. OR = Odds Ratio. RR= Relative Risk. \* = compared with SVD. \*\* = Compared with cesarean delivery without labour. \*\*\* = Compared with SVD or OVD*

estimated to be between five and ten times that of spontaneous vaginal birth (Burrows, Meyn, & Weber, 2004; Lobel & DeLuca, 2007, citing Almeida, Nogueira, Candido dos Reis, & Rosa e

Silva, 2002; and Murphy, Liebling, Verity, Swingler, & Patel, 2001). Women who deliver via caesarean section have been found to report more exhaustion, lack of sleep, and bowel problems (Thompson, Roberts, Currie, & Ellwood, 2002), have extended hospital stays (Murphy, Liebling, Verity, Swingler, & Patel, 2001), are more likely to be readmitted to hospital within 8 weeks after the birth (Thompson et al., 2002), and experience more chronic pain following delivery (Nikolajsen, Sorensen, Jensen, & Kehlet, 2004), compared with women who have a spontaneous vaginal birth. Caesarean deliveries have also been associated with increased risk of negative outcomes in subsequent pregnancies, such as increased difficulty conceiving (Jolly, Walker, & Bhabra, 1999; Murphy, Stirrat, & Heron, 2002), stillbirth and miscarriage (Hemminki & Merilainen, 1996; Smith, Pell, & Bobbie, 2003), surgical delivery (Gilliam et al., 2002), obstetric complications such as abruptio placenta and placenta previa (Lydon-Rochelle, Holt, Easterling, & Martin, 2001), and adverse psychological consequences (Clement, 2001; Lobel & DeLuca, 2007) including postpartum depression (Fisher, Astbury, & Smith, 1997; Lydon-Rochelle, Holt, & Martin, 2001). To date, relatively few studies have assessed the influence of modes of delivery on psychological and psychosocial outcomes. A recent review of the literature by Lobel and DeLuca (2007) assessed the psychological consequence of having a caesarean delivery and found that, compared with women who delivered vaginally, “women who deliver by caesarean section have more negative perceptions of their birth experience, themselves, and their infants, exhibit poorer parenting behaviours, and may be at higher risk for postpartum mood disturbance” (p. 2272).

**Maternal morbidity and operative vaginal deliveries.** Operative vaginal deliveries have also been associated with increased risk of maternal and neonatal complications (ACOG, 2001). While vacuum deliveries may be associated with significantly lower risk of maternal injury and fewer caesarean sections when compared with forceps deliveries (Johanson & Menon, 1999; Wen et al., 2001), they can be less effective in achieving a successful vaginal delivery and have been associated with increased short-term neonatal complications (Johanson & Menon, 1999). Maternal complications associated with vacuum deliveries include maternal lacerations (i.e.,

cervical and vaginal), vaginal haematomas and third- and fourth- degree tears (ACOG, 2001; Johanson & Menon, 1999; Wen et al., 2001). Forceps-assisted deliveries have also been associated with increased rates of maternal soft tissue injuries when compared with vacuum deliveries (Johanson & Menon, 1999; Wen et al., 2001), and have been strongly associated with the occurrence of sphincter tears (FitzGerald, Weber, Howden, Cundiff, & Brown, 2007). Long-term maternal outcomes of operative birth may include urinary and faecal incontinence, sexual problems, pelvic organ prolapse and fistula formation (Brown & Lumley, 1998; Sultan, Kamm, Hudson, Thomas, & Bartram, 1993; Wegner & Bernstein, 2007).

**Maternal morbidity and episiotomies.** Related to operative deliveries are procedures such as episiotomies which have also been associated with negative maternal outcomes (e.g., perineal injury and pain, urinary and rectal incontinence, pelvic floor injuries and sexual problems). A systematic review of the maternal outcomes associated with routine versus restrictive use of episiotomy (Hartmann et al., 2005), concluded that the evidence did not support previously-held beliefs that episiotomy offered maternal benefits in some situations (i.e., an episiotomy was easier to repair than the laceration that results when episiotomy is not used), while current evidence suggests that “episiotomy can be considered worse since some proportion of women who would have had lesser injury instead had a surgical incision” (p. 2141). This view is supported by the WHO (1997), who after reviewing the available literature concluded “there is no reliable evidence that liberal or routine use of episiotomy has a beneficial effect, but there is clear evidence that it may cause harm” (p. 28).

### **Neonatal Morbidity**

Neonatal morbidity has been defined as “any illness, disease or disability that occurs to a child during its first 28 days of life” (Bacon et al., 2003, p. 348). Conventional measures of newborn morbidity include low birth weight (e.g., less than 2500 grams), low gestational age/pre-term birth (i.e., delivery of an infant before 37 completed weeks of gestation) or a low Apgar

score (e.g., 5 minute Apgar score < 7) (Verma, Weir, Drummond, & Mitchell, 2005). In addition to the above, other leading causes of morbidity include infections, hypoxia at birth, congenital malformations and obstetric injuries (e.g., fracture, haematoma, visceral trauma). Each of the aforementioned measures of newborn morbidity is reviewed below in brief.

**Birth Weight** refers to the first weight of the baby, usually obtained within one hour of birth and usually measured to the nearest 5 grams (NZHIS, 2003). Low birth weight is defined as a weight of less than 2500g (WHO, 2006a). While birth weight is the outcome of a number of factors (e.g., low gestational age, intrauterine growth retardation, maternal malnutrition), it is one of the most important determinants of newborn survival, growth and development and “a key indicator of the underlying health of a population” (Williams et al., 2000, p. 142). As noted, low birth weight may be influenced by a number of maternal factors, such as genetics (e.g., maternal body size), demographic and psychosocial factors (e.g., younger and older age, smoking, stress, anxiety, high physical workload, maternal education), obstetric risk (e.g., prior history of pre-term birth, spontaneous abortion, stillbirth, cervical incompetence, multiparity), nutritional risk (e.g., foetal nutrition and maternal body weight and nutrition in childhood and adolescence), infection (e.g., viral, respiratory, diarrhoea, malaria, genital and urinary); toxic exposure (e.g., cigarette smoking, alcohol, recreational substance abuse), and antenatal care (e.g., health education) (Williams et al., 2000). In terms of outcomes, low birth weight has been associated with increased risk of foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life (e.g., cardiovascular disease, diabetes and obstructive lung disease) (WHO, 2005).

In terms of the prevalence of low weight births internationally, United Kingdom maternity statistics for the year 2002–2003 show that approximately 6% of births in England were of low weight, i.e., 5% between 1500g and 2499g and 1% under 1500g (The Information Centre, 2006), while the percentage of infants born with low birth weight (< 2500g) in the US was 8.2% in 2005, compared with 6.7% in the mid-1980s (Hamilton, Martin, & Ventura, 2006).

In 2004, the average birth weight of babies born in New Zealand was 3430g. Asian babies had the lowest average birth weight at 3240g, while Pacific Island babies had the highest average birth weight at 3560g. The percentage of New Zealand babies born with low birth weight (< 2500g) in 2004 was 6%, while 1% of babies were born with very low birth weights (< 1500g).

**Gestational age and pre term birth.** In addition to low birth weight, low gestational age/pre-term birth or Apgar score may be considered “proxy measures to report morbidity at birth”. Gestational age is measured (in weeks) from the first day of the woman’s last menstrual cycle to the date of delivery, with a normal pregnancy being approximately 40 weeks (full-term) and a normal pregnancy ranging from 38 to 42 weeks (Ellen, 2007). Pre-term birth refers to birth which occurs at less than 37 weeks gestation, and is generally the result of premature labour and pre-term rupture of the membrane, multiple pregnancy and assisted reproduction, and/or maternal and foetal complications (Tucker & McGuire, 2004). In terms of the incidence of pre-term birth internationally; in the United States, the pre-term birth rate for 2005 was 12.7% (up from 10.6% in 1990), of which 9.1% were late pre-term births (34-36 weeks) and 2% were very premature (less than 32 weeks; Hamilton et al., 2006). In contrast, maternity statistics for England show that approximately 7% of births were pre-term (less than 36 weeks gestation), with 0.9% of these occurring between 28 and 31 weeks and 0.5% occurring before 28 weeks gestation (The Information Centre, 2006). Similar to rates in England, 7.2% of all live births in New Zealand were born pre-term in 2002. Given that very pre-term infants (i.e., those born before 32 weeks gestation) are at increased risk of mortality and morbidity, it has been suggested by some authors that infants born after 32 weeks may experience similar outcomes to infants born full-term (Tucker & McGuire, 2004). Others suggest that even infants delivered late pre-term (34-36 weeks) remain at increased risk of negative outcomes compared with those born later in pregnancy (Wang, Dorer, Fleming, & Catlin, 2004). Negative outcomes associated with pre-term birth may include cerebral palsy, poor cognitive performance and severe visual or hearing impairment (Marlow, 2004).

**Apgar scores** are numeric scores which are used to assess the health of an infant at one and at five minutes after birth (American Academy of Paediatrics [AAP] & American College of Obstetricians and Gynaecologists [ACOG], 2006). The score is calculated by assessing the infant on five criteria (i.e., skin colour, heart rate, reflex irritability, muscle tone and respiration) with each criterion assigned a value between 0 and 2. The Apgar score, which ranges from 0 to 10, is calculated by summing the five criteria values. Scores between 0 and 3 are critically low and indicative of infants requiring resuscitation, scores between 4 and 6 are considered intermediate, while scores of 7 and above are indicative of good to excellent health (AAP & ACOG, 2006; Casey, McIntire, & Leveno, 2001). Of the two scores, the five-minute Apgar score is regarded as a better indicator of neonatal mortality (Casey et al., 2001), but the Apgar is suggested to be inappropriate as a stand-alone measure to establish a diagnosis of asphyxia (AAP & ACOG, 2006). In terms of the prevalence of low Apgar scores, a population-based registry study of one million term births in Sweden between 1988-1997 (Thorngren-Jerneck & Herbst, 2001) investigated the prevalence of low 5-minute Apgar scores (i.e., below 7), the influence of obstetric risk factors on these scores, and the prognosis associated with such scores in terms of infant mortality and morbidity. Thorngren-Jerneck and Herbst (2001) found that of the births analysed 0.76% had low Apgar scores at 5 minutes, with an infant mortality rate of 48 per 1000 and an odds ratio (OR) of 14.4. Obstetric factors associated with a significant risk of a low 5-minute Apgar included vaginal breech delivery, birth weights above 5kg, first-time mothers, greater maternal age, smoking, post-date pregnancy, epidural analgesia, male infant gender, and being born at night. In terms of the long-term risks associated with a low Apgar score at 5 minutes, Thorngren-Jerneck and colleagues calculated an OR of 31.4 for a diagnosis of cerebral palsy, 7.9 for epilepsy and 9.5 for mental retardation. Regarding the influence of mode of delivery on Apgar scores, planned vaginal breech deliveries have been associated with increased risk of morbidity and mortality when compared with planned caesarean deliveries in breech presentations (Hannah et al., 2000), while the “increased risk for a low 5-minute Apgar score in breech presentation,

mainly in vaginal delivery, probably reflects increased risks of both asphyxia and trauma” (Thorngren-Jerneck & Herbst, 2001, p. 69).

**Mode of delivery, obstetric procedure and neonatal morbidity.** The association between mode of delivery, related obstetric procedure, and neonatal morbidity has been addressed by a number of studies. Caesarean delivery has been associated with increased risk of certain forms of neonatal morbidity. For example, research has demonstrated an association between caesarean delivery and significantly higher incidence of persistent pulmonary hypertension of newborns when compared with vaginal deliveries (Levine, Ghai, Barton, & Strom, 2001), and increased respiratory morbidity if a caesarean section occurs before the onset of labour (35.5 per 1000) when compared with caesarean section during labour or vaginal delivery (12.2 and 5.3 per 1000 respectively) (Morrison, Rennie & Milton, 1995). Complications arising during a caesarean delivery may include foetal laceration (Alexander et al., 2006; Asgharnia & Esmailpour, 2005), reported to occur in 1.4% of vertex presentations (Smith, Hernandez, & Wax, 1997) with other neonatal injuries such as cephalohematoma, clavicular fracture, brachial plexus, skull fracture, and facial nerve palsy occurring less frequently (Alexander et al., 2006). Caesarean delivery has also been associated with increased rates of childhood asthma (Bager, Melbye, Rostgaard, Stabell Benn, & Westergaard, 2003; Hakansson & Kallen, 2003) and lower rates of exclusive breastfeeding, significant delays in initiation and establishment of lactation, when compared with women giving birth vaginally (Cakmak & Kuguoglu, 2007; Perez-Rios, Ramos-Valencia, & Ortiz, 2008; Riordan, 2005; Rowe-Murray & Fisher, 2002). Operative vaginal birth has also been associated with increased risk of neonatal complications when compared with spontaneous vaginal (Centers for Disease Control and Prevention, 2004; Hammoud et al., 2005; Mathews, 2004; Royal College of Obstetricians and Gynaecologists, 2006) delivery (ACOG, 2001). When compared with forceps delivery, vacuum extraction has been found to be less effective in achieving a successful vaginal delivery and has been associated with increased short-term neonatal complications (Johanson & Menon, 1999) such as scalp lacerations and bruising,

facial nerve palsy, subaponeurotic haemorrhage, skull fractures, intercranial haemorrhage and retinal haemorrhages (ACOG, 2001). Conversely, forceps-assisted deliveries have been associated with increased risk of facial and cranial injuries when compared with vacuum extraction (Johanson & Menon, 1999; Wen et al., 2001).

In summary, conventional birth outcome measures include maternal and foetal mortality and morbidity as well as the infant's birth weight and Apgar scores. Each of these outcome indicators may be positively or negatively influenced by a number of maternal behaviours and traits. The relative contributions of these influences on birth outcomes are reviewed in the next chapter.

## **CHAPTER 2 : FACTORS INFLUENCING BIRTH OUTCOMES**

Given the potential for negative maternal and neonatal outcomes, research has begun to identify those factors which may contribute to or predict such effects. To date, a number of maternal behaviours (e.g., smoking, consumption of alcohol and partaking in recreational drug use) and maternal traits (e.g., anxiety) have been identified as potential risk factors for adverse maternal and neonatal outcomes. Each of these factors and their relative influence are reviewed in brief, followed by a similar review of maternal behaviours and traits associated with positive outcomes. These reviews lead to the concluding section on the potential effectiveness of antenatal yoga.

### **Factors Associated with Negative Outcomes**

In recent decades a growing body of research suggests that certain maternal behaviours (e.g., consumption of alcohol or tobacco; Parackal et al., 2007), traits (e.g., anxiety) and experiences (e.g., stress; Da Costa, Larouche, Dritsa, & Brender, 1999) may be associated with adverse outcomes for mother and child. The relative influence of each of these factors on birth outcomes is considered below. Relevant research findings are summarised in Table 2, and selected prevalence's are presented in Table 3.

#### **Smoking, Alcohol and Recreational Drug Use**

Recent New Zealand guidelines for healthy pregnant and breastfeeding women recommend abstinence from alcohol, cigarette smoking and use of non-prescription drugs as these may affect the growth and development of the baby (New Zealand Ministry of Health, 2006). These guidelines are similar to those of Australia, Canada and the United States, which recommend abstinence from these maternal behaviours (International Center for Alcohol Policies, 1999; Lumley, Oliver, Chamberlain, & Oakley, 2007). In contrast, the United Kingdom recommends that “women who are trying to become pregnant or are at any stage of pregnancy,

Table 2:

<i>Factors associated with negative birth outcomes</i>		
Author	Design & Sample	Outcomes
<b><i>Maternal Alcohol Consumption</i></b>		
(Henderson et al., 2007)	Systematic review.	At low-moderate levels of consumption, no significant effects of alcohol on miscarriage, stillbirth, prematurity, birth weight, or birth defects
(Kesmodel et al., 2002)	Cohort Study. N= 24,679*	Women consuming $\geq 5$ drinks per week were at increased risk of first trimester spontaneous abortion.
(Kesmodel, Olsen, & Secher, 2001)	Cohort Study. N = 18,228*	Increased risk of pre-term labour, for those drinking $\geq 10$ drinks per week.
(Streissguth et al., 1990)	Longitudinal, prospective, cohort study. N=482 children.	Consumption of $\geq 2$ drinks per day associated with a 7-point decrement in IQ in 7-year-olds. Learning difficulties were associated with binge drinking ( $\geq 5$ drinks)
<b><i>Maternal Smoking: Tobacco &amp; Cannabis</i></b>		
(Higgins, 2002)	Literature Review	Maternal smoking associated with miscarriage, low birthweight, pre-term birth, perinatal death, congenital abnormalities, childhood respiratory and behavioural problems, maternal infertility and cancer, & long term problems for the child.
(Hammoud et al., 2005)	Population-based. N = 170,254*	Smoking was associated with increased rates of intrauterine growth restriction (OR 2.4) & preterm delivery (OR 1.2).
(Magee et al., 2004)	Population based study. N= 79,904*	The RR of low birth weight among smokers was 1.58.
(Ananth et al., 1996)	Prospective cohort study. N = 87,184*	Compared with non-smokers, women who smoked had an increased risk of placental abruption (RR= 2.05) & placenta previa (RR = 1.36).
(Fleming & Blair, 2007)	Review	Prenatal exposure to tobacco smoke is a major risk factor associated with Sudden Infant Death Syndrome (SIDS).
(Fergusson et al., 2002)	Longitudinal study. N= 12,000*	Cannabis use throughout pregnancy associated with small but statistically detectable decrements in birth weight.
<b><i>Maternal Stress &amp; Anxiety</i></b>		
(Copper et al., 1996)	Prospective study. N= 2593*	Stress associated with spontaneous preterm birth & low birth weight with ORs of 1.16 & 1.08, respectively.
(Wadhwa et al., 1993)	Prospective study. N= 90*	Maternal prenatal stress factors significantly associated with infant birth weight & with gestational age at birth.
(Mulder et al., 2002)	Review of literature 1966–2001).	High maternal stress & anxiety associated with increased risk of spontaneous abortion, preterm labour & for having a malformed or growth-retarded baby.
(Koubovec, Geerts, Odendaal, Stein, & Vythilingum, 2005)	Review of literature	Prenatal stress associated with pregnancy complications, developmental, cognitive, and behavioral disorders in offspring.
(Kurki et al., 2000)	Prospective population-based study. N= 623*	Depression & anxiety in early pregnancy associated with risk for subsequent preeclampsia, (ORs=2.5 & 3.2, respectively).
(Ryding et al., 1998)	Case-control study. N= 1,981*	Fear of childbirth during the 3 <sup>rd</sup> trimester of pregnancy may increase the risk of subsequent emergency caesarean section.
(Lang et al., 2006)	Part of a larger prospective study	Anxiety sensitivity during mid-pregnancy predicted maximum pain & sensory affective components of pain during labour

*Note:* \* = Women with singleton pregnancies. FAS = Foetal alcohol syndrome. RR = Relative risk. OR = Odds ratio.

should not drink more than 1 or 2 units of alcohol once or twice a week, and should avoid episodes of intoxication” (United Kingdom Department of Health, 1995, p. 34).

**Maternal consumption of alcohol and fetal outcomes.** As outlined in Table 2, a number of studies have compared low to moderate levels of antenatal alcohol consumption with abstinence from alcohol during pregnancy and found little evidence of adverse effects (e.g., Henderson, Gray, & Brocklehurst, 2007). In contrast, some policy makers hold the view that, given a safe level of alcohol consumption has not been established, it is more prudent to abstain (International Center for Alcohol Policies, 1999). In support of this latter view, there is evidence that alcohol consumption may have adverse consequences on the reproductive system and potentially exert “toxic effects throughout the reproductive process from infertility through miscarriage, aneuploidy, structural congenital anomaly, disordered foetal growth, perinatal death, developmental delay and indeed susceptibility to disease in adult life” (RCOG, 2006, p. 4). The consumption of alcohol during pregnancy has been associated with increased rates of miscarriage and pre-term labour (Kesmodel, Olsen, & Secher, 2001), and low birth weight or growth retardation for infants whose mothers consumed 1-2 drinks daily (Mills, Graubard, Harley, Rhoads, & Berendes, 1984). Research also highlights associations between alcohol consumption during pregnancy and developmental difficulties for children later in life (Streissguth, Barr, & Sampson, 1990), including alcohol-related neurodevelopmental disorders such as foetal alcohol syndrome and foetal alcohol spectrum disorders (Autti-Ramo, 2002). Foetal alcohol syndrome (FAS) refers to a pattern of birth defects found in children whose mothers consumed alcohol during pregnancy, including characteristic pattern of facial anomalies, growth retardation and CNS neurodevelopmental abnormalities. While it is unclear as to what quantity of alcohol needs to be consumed to result in FAS, self-reported rates of alcohol consumption in the region of 10 drinks per week have been associated with a high incidence of FAS (Autti-Ramo, 2000). However, less than 10% of women who consume alcohol during pregnancy have children with

FAS, suggesting that other risk factors, such as genetics, may also play a role (Gemma, Vichi, & Testai, 2007; May et al., 2005).

Table 3

*The prevalence of maternal substance use during pregnancy*

Author	Country	Prevalences
Maternal alcohol consumption during pregnancy		
(CDC, 2004)	US	10% of women consumed some alcohol during pregnancy of whom 1.9% consumed $\geq 7$ drinks per week. 1.9% engaged in binge drinking ( $\geq 4$ drinks on one occasion)
(Goransson, Magnusson, Bergman, Rydberg, & Heilig, 2003)	Sweden	30% drank alcohol regularly during pregnancy, of whom 23% reported drinking once a month or less; 6% consumed alcohol between two to four times a month.
(New Zealand Ministry of Health, 2007)	NZ	82.4% of females (aged 16–39) who had previously consumed alcohol had stopped all alcohol intake during their pregnancies, 13.3% continued to consume alcohol at pre-pregnancy levels
(Parackal, Ferguson, & Harraway, 2007)	NZ	53% of women had consumed some alcohol during pregnancy, of whom 40% had consumed alcohol before discovering they were pregnant but subsequently stopped. 13% continued to drink during pregnancy. Almost one fifth of all women reported binge drinking ( $\geq 4$ drinks on one occasion) at least once during their pregnancy, of whom 17% did so without realising they were pregnant.
Maternal Smoking (Tobacco) during pregnancy		
(Mathews, 2004)	US	Approximately 11.4% of all women giving birth in the United States smoked during pregnancy
(Coleman, 2004)	UK	Almost one quarter of women who smoke, continue to do so during pregnancy, with women who smoke being younger and less educated
	NZ	Self reported smoking prevalence was 19.2% . However, <i>cotinine</i> levels (a metabolite of nicotine) suggest prevalence may be as high as 31.3% for women in the first trimester
(Ford, Tappin, Schluter, & Wild, 1997)	NZ	22.2% reported smoking when they became pregnant of whom 26.8% gave up during the first trimester
Maternal Smoking (Cannabis) during pregnancy		
(Ebrahim & Gfroerer, 2003)	US	Self-reported use during pregnancy for the years 1996 to 1998 in the region of 2.8%
(Fergusson, Horwood, & Northstone, 2002)	UK	5% of mothers (sample of over 12,000 women who were between 18 and 20 weeks' gestation).

The prevalence of alcohol consumption during pregnancy has been assessed by a number of studies, as illustrated in Table 3; which shows that between 10-30% of women consume some alcohol during pregnancy. While a significant proportion of these women consume alcohol unwittingly during pregnancy, a majority stop all alcohol in-take once they know they are pregnant. Of concern for health agencies is a population of women (e.g., approximately 13%) who continue to drink at pre-pregnancy levels (New Zealand Ministry of Health, 2007).

**Smoking outcomes for mother and child.** As highlighted in Table 2, maternal smoking during pregnancy has been associated with adverse outcomes for mother and child in the long and short term (e.g., Higgins, 2002). The dangers of smoking during pregnancy have recently been reiterated by the British Medical Association in Scotland, who report that one in every seven babies born each year in Scotland required some form of special care, primarily due to premature birth and low birth weight (British Medical Association [BMA], 2008). Consistent with this, research has demonstrated an association between smoking during pregnancy and adverse outcomes such as low birth weight (Magee, Hattis, & Kivel, 2004), placental abruption and placenta previa (Ananth, Savitz, & Luther, 1996). Research has also demonstrated that children who are exposed to smoking either during pregnancy, infancy or beyond are at increased risk of Sudden Infant Death Syndrome (SIDS; Flemming and Blair, 2007). For example; a UK review of the evidence linking smoking and sudden infant death syndrome suggested that, between 1984 and 2003, “the prevalence of maternal smoking during pregnancy [rose] amongst SIDS mothers (from 50% to 80%)” (p. 721) with “the proportion of SIDS mothers smoking during pregnancy increasing from 57% to 86%” (p. 724).

As illustrated in Table 3, self-reported prevalence's of maternal smoking during pregnancy range between 11-22% (e.g. Mathews, 2004; McLeod et al., 2003); however, researchers who have utilised objective measures of smoking levels (e.g., cotinine levels) suggests smoking prevalence's may be significantly higher (Ford, Tappin, Schluter, & Wild, 1997). Among women who smoke in New Zealand, factors associated with cessation of during the first

trimester of pregnancy include employment, first pregnancy and nausea during pregnancy, while factors associated with a continuation of smoking past the first trimester included social deprivation, being of Maori ethnicity and having a partner who smoked (McLeod, Pullon, & Cookson, 2003).

**Cannabis use and birth outcomes.** Another maternal behaviour associated with negative birth outcomes is cannabis use; reported to be the most commonly used illicit drug among women of childbearing age in the United States (Ebrahim & Gfroerer, 2003). As highlighted in Table 2, maternal use of cannabis during pregnancy has been associated with lower birth weight in the offspring of heavier cannabis users (Fergusson, Horwood, & Northstone, 2002) and long-term adverse neurobehavioural and cognitive outcomes such as “symptoms of ADHD (inattention, impulsivity), increased externalizing behaviour, decreased general cognitive functioning, and deficits in learning and memory tasks” (p. Huizink et al., 2006, p.24).

In summary, a number of maternal behaviours are associated with adverse outcomes for mother and child. While a vast majority of mothers do not engage knowingly in these behaviours during pregnancy, for those who do, the impact may be both adverse and long-lasting. The section which follows will review maternal traits which have been associated with negative birth outcomes for mother and child.

### **Maternal Stress and Anxiety**

In addition to the aforementioned maternal behaviours, the influence of maternal psychological well-being on birth outcomes has been addressed by a number of studies (Mulder et al., 2002). Many of these studies report an association between antenatal maternal stress, fear and anxiety, and adverse birth outcomes for mother and child.

**Maternal stress.** As outlined in Table 2 above, a growing body of empirical evidence suggests that women who experience high levels of stress during pregnancy are at increased risk

of negative birth outcomes, complications of pregnancy and cognitive and behavioural disorders in offspring.

Broadly speaking, stress may be viewed as an “external load or demand on a biological, social, or psychological system” (Lazarus, 1993, p. 1). Individuals may experience stress in situations where they perceive that they have insufficient personal and social resources to meet the demands of a stressor. Research has demonstrated that when individuals are exposed to a stressor, stress systems in the body (i.e., hypothalamus–pituitary–adrenal cortex system [HPA axis] and sympathetic nervous system) are activated and release a number of hormones (e.g., corticotropin-releasing hormone [CRH], adrenocorticotropin hormone and glucocorticoids) into the blood stream (Chrousos, 1998; Stowell, McGuire, Robles, Glaser, & Kiecolt-Glaser, 2003). Stress may be experienced during significant life events that are perceived as negative (e.g., death of a spouse, divorce, jail term) as well as those that are perceived as positive, (e.g., vacation, marriage and pregnancy; Masuda & Holmes, 1967). Pregnancy is a time associated with both psychological and physiological stress. As summarised by Tiran and Chummun (2004, p.162): “psychological stress, such as fear and anxiety, increases production of several stress hormones, including adrenaline and cortisol, to enable the mother to cope with stress [while] the physical changes which occur as a normal part of pregnancy induce physiological stress”. In addition to daily life stressors, pregnant women may face pregnancy specific stressors such as physical and hormonal changes and pregnancy-specific anxiety (Mulder et al., 2002). While the exact mechanisms mediating the impact of antenatal stress in humans are as yet unknown, influence of the HPA axis and activated hormones (e.g., corticotropin-releasing hormone) has been investigated (for a review see Koubovec et al., 2005; Mulder et al., 2002). In animal studies, “prenatal stress is thought to programme the HPA axis in the developing animal foetus to the extent that irregularities last well into adulthood” (Koubovec et al., 2005, p. 280, citing Weinstock, 2001). Individual differences such as genetic and psychosocial factors (e.g., negative affect, personality traits, coping style, social support and interpersonal relationships) have also

been proposed to mediate stress responses, and may explain why individuals can react differently to identical stressors (Stowell et al., 2003).

**Maternal fear and anxiety.** Other psychological factors which may contribute to maternal stress during pregnancy include maternal fear and anxiety, which have also been associated with negative birth outcomes. Before proceeding further, it is timely to define both fear and anxiety and to highlight how they differ from stress. Firstly, fear has been defined as “an emotional state evoked by the threat of danger and usually characterised by unpleasant subjective experiences as well as physiological (e.g., increased heart rate, blood pressure, sweating) and behavioural changes (e.g., avoidance of fear-inducing object or situation). Fear is often distinguished from anxiety in having a specific object” (Ellen, 2007, p. 266), while anxiety may be viewed as a “generalised pervasive fear” (Ellen, 2007, p. 43). In contrast, “stress” may refer to “any factor that threatens the health of the body or has an adverse effect on its functioning,” such as disease, pain, fear, and anxiety (Ellen, 2007, p. 685). As suggested by Yadin and Thomas (1998, p. 7), “anxiety is very likely the most significant physiological variable giving rise to the stress reaction”, with mounting evidence suggesting a “considerable overlap and crosstalk between brain systems related to anxiety and the systems related to the stress reaction” (p. 73). For example, Yadin and Thomas (1998) argue that limbic system structures, such as the amygdala and lateral septum, play reciprocal roles in the modulation of anxiety and anxiety-mediated stress, with the amygdala playing a role in the expression of both fear and the somatic effects of stress, while the lateral septum appears to moderate anxiety and the effects of stress.

Returning to the field of pregnancy, while there is no single definition of pregnancy-related anxiety, it has been viewed by some as “a construction of different dimensions of anxiety” (Saisto, 2001, p. 13). Other authors propose models of pregnancy-related anxiety that comprise anxiety about being pregnant, childbirth, and hospitalisation (Levin, 1991).

In terms of the prevalence of anxiety and fear during pregnancy; studies have found that up to 80% of women with low-risk pregnancies report some fears relating to childbirth

(Szeverenyi, Poka, Hetey, & Torok, 1998); with the prevalence of moderate fear of childbirth estimated to be in the region of 17%, with severe fear of childbirth being admitted by 6% of women (Areskog, Uddenberg, & Kjessler, 1981).

Factors predisposing women to anxiety during pregnancy and/or fear of childbirth may include demographic (e.g., young maternal age, low education and socioeconomic status), social (e.g., lack of social support, not attending childbirth preparation, and high number of daily stressors), psychological (e.g., problems prior to and during pregnancy, sexual abuse history, and low assertiveness and self esteem), biological (e.g., fear of pain), and factors relating to previous negative childbirth outcomes or experiences (Saisto, 2001). Studies which have assessed women's pregnancy and birth-related fears report that common fears relate to health of the child, requiring an operative delivery, experiencing intolerable pain, death or injury to the mother, and fear of panic, helplessness or losing control (Neuhaus, Scharkus, Hamm, & Bolte, 1994; Ryding, Wijma, Wijma, & Rydhstrom, 1998; Sjogren, 1997; Szeverenyi et al., 1998)

The influence of fear of childbirth and pregnancy-related anxiety on birth outcomes has been addressed by a number of studies. They report an association between antenatal fear of childbirth and increased risk of: emergency caesarean section (Ryding, Wijma, Wijma, & Rydhstrom, 1998), elective caesarean sections (Waldenstrom, Hildingsson, & Ryding, 2006), more severe labour pain and greater need for analgesia (e.g., Alehagen et al., 2005; Lang et al., 2006), maternity blues and puerperal depression (Saisto et al., 2001), and lower gestational age (Wadhwa, Sandman, Porto, Dunkel-Schetter, & Garite, 1993). In terms of the physiological mechanisms by which stress and anxiety may influence birth outcomes, a growing body of literature appears to support "a biopsychosocial model of maternal neuroendocrine responses to stress influencing foetal physiologic characteristics and birth outcomes" (Wadhwa et al., 1993, p. 864). Physiological responses to stress and anxiety may include dysregulation of both the autonomic nervous system and the HPA-Axis during pregnancy, which in turn may contribute to poor birth outcomes (Wadhwa, Culhane, Rauh and Barve, 2001; Wadhwa et al., 1993). For example, elevated pituitary

hormones (e.g., oxytocin and prostaglandins) may result in premature uterine contraction and lead to premature labour (Challis, Matthews, Van Meir and Ramirez, 1995; Lockwood and Kuczynski, 1999). In addition, activation of the HPA-axis may trigger an immunosuppressive response, increasing risk of infection—a risk factor for premature labour (Wadhwa et al., 2001). Furthermore, given that “the foetal nervous system is bathed in the mother's chemical response to the environment” (Sandman, Barron, DeMet, Chicz-DeMet, Rothenberg and Zea, 1990, p. 91), opiate or beta-endorphin elevations in maternal plasma may contribute to deregulation of the foetal nervous system at critical periods of development, thereby increasing the risk of negative neurodevelopmental consequences (Sandman et al., 1990; Wadhwa et al., 1993).

In summary, a number of maternal behaviours (e.g., consumption of alcohol, tobacco or recreational drugs during pregnancy), traits (e.g., anxiety) and experiences (e.g., stress) have been associated with negative birth outcomes. In contrast, the section which follows addresses those factors which have been associated with positive birth outcomes.

### **Factors Associated with Positive Birth Outcomes**

In addition to the wealth of literature addressing factors associated with negative maternal and neonatal outcomes, there is also a growing body of literature focusing on protective factors such as social support, antenatal care, maternal health and well-being and their association with positive birth outcomes. Each of these key factors and their relative influence on birth outcomes are reviewed in brief.

#### **Social Support**

Social support has been defined as the “interpersonal transactions that include one or more of the following: the expression of positive affect of one person toward another; the affirmation or endorsement of another person’s behaviours, perceptions, or expressed views; or the giving of symbolic or material aid to another” (Kahn, 1979, p. 85). However, while there are

many definitions, there has been little consensus among authors as to what may be a precise definition of social support (Cohen, 1992; Hupcey, 1998). A review of the major theoretical definitions of social support (Hupcey, 1998) suggested that definitions most commonly address five broad aspects of support: the type of support provided, recipients' perceptions of support, intentions or behaviours of the provider, reciprocal support and social networks. Rather than develop an "all-encompassing" definition of social support, Cohen (1992) has advocated for the use of three classes of support measures, namely: social networks, perceived social support, and supportive behaviours (p. 109). While acknowledging that social support has numerous definitions and measures, research has established reliable links between better social support and improved health outcomes (Berkman, Glass, Brissette, & Seeman, 2000) such as lower rates of morbidity and mortality (Bert, 2006), particularly among women with suspected coronary disease (Rutledge et al., 2004). Mechanisms hypothesised to mediate the association between social support and diseases have included physiological processes such as changes in cardiovascular, neuroendocrine and immune function (Berkman et al., 2000; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). A recent review of the evidence linking social support to such mechanisms concluded that "consistent with epidemiological evidence, social support appears to be related to more positive "biological profiles" across these disease-relevant systems" (Bert, 2006, p. 377). (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993)

The influence of social support has also been examined, more specifically, in terms of its influence on pregnancy, birth and the postpartum period. For example, better antenatal social support has been correlated with reduced levels of nausea and vomiting in early pregnancy (Chou, Lin, Cooney, Walker, & Riggs, 2003) as well as improved maternal mental well-being during pregnancy (Gjerdingen, Froberg, & Fontaine, 1991). In terms of birth outcomes, social support has been associated with decreases in: maternal physical complications during labour and delivery (Gjerdingen et al., 1991), labour duration (Langer, Campero, Garcia, & Raynoso, 1998; Pascoe, 1993) and better labour progress (Collins et al., 1993). Foetal outcomes which have been

associated with antenatal social support include: higher Apgar scores (Collins et al., 1993), improved foetal growth (Hoffman & Hatch, 1996), increased birth weight (Feldman, Dunkel-Schetter, Sandman, & Wadhwa, 2000) and decreased risk of small-for-gestational-age births (Pryor et al., 2003). Positive maternal outcomes are associated with increased social support and include: improved physical and mental health postpartum; including less postpartum depression (Collins et al., 1993; Gjerdingen et al., 1991); increased frequency of exclusive breastfeeding at one month postpartum (Langer et al., 1998); and increased perception of control over the delivery process (Langer et al., 1998). Conversely, reduced satisfaction with social support has been associated with increased utilisation of avoidant coping and greater depressed mood (Rudnicki, Graham, Habboushe, & Ross, 2001). Furthermore, women with low levels of social support during pregnancy have been found to report poorer health during pregnancy, engage antenatal care later in pregnancy, seek medical help more frequently and be more depressed postnatally (Webster et al., 2000).

The relative influence of different aspects of social support (i.e., amount of support received, quality of support received and network resources) on birth outcomes (e.g., birth weight, Apgar score, labour progress and postpartum depression) has also been investigated. For example, a prospective study by Collins et al. (1993), found different aspects of social support to be associated with different outcomes. In the study, more support was associated with improved labour progression and higher Apgar scores, better quality support was associated with higher Apgar scores and lower levels of postpartum depression, and larger social networks were associated with increased birth weight. Research by Gjerdingen et al., (1991) suggested that “the importance of various types of support changes with the changing needs of women as they move from pregnancy to labour and delivery, and then to the postpartum period” (p. 370). For example, the authors found that emotional and tangible social support provided during pregnancy was associated with better maternal mental health antenatally; support and information received at antenatal classes was associated with improved maternal outcomes during labour and

delivery (e.g., reduced incidence of physical complications), and postpartum (e.g., improved mental and physical health); and support during labour and deliveries was associated with reduced incidence of complications during childbirth and less postpartum depression.

### **Antenatal Care**

According to the WHO (2007), “antenatal care constitutes screening for health and socioeconomic conditions likely to increase the possibility of specific adverse pregnancy outcomes, providing therapeutic interventions known to be effective and educating pregnant women about planning for safe birth, emergencies during pregnancy and how to deal with them” (p. 1). There is growing consensus that “the focus of antenatal care interventions should be on improving maternal health, this being both an end in itself and necessary for improving the health and survival of infants” (Abou-Zahr & Wardlaw, 2003, p. 1). Mounting evidence suggests that antenatal care offers a protective influence, reducing the risk of prematurity and low birth weight and protecting against perinatal morbidity and mortality (Herbst, Mercer, Beazley, Meyer, & Carr, 2003; Vintzileos, Ananth, Smulian, Scorza, & Knuppel, 2002). The WHO currently views antenatal care as an opportunity to inform women and their families of the influence of maternal health (e.g., nutrition, tetanus immunisation, treatment of anaemia and infections) on foetal growth and development, the risks associated with labour and delivery, the benefits of skilled health care providers assisting delivery, and the importance of birth spacing (Abou-Zahr & Wardlaw, 2003). In terms of the content of antenatal care, the WHO recommends that activities performed during the course of antenatal care should determine maternal weight and height, gestational age and uterine height; blood pressure, STIs and tetanus, haemoglobin levels, and breech presentation. It should also encourage the consumption of folic acid and provide recommendations for delivery, lactation and contraception (Villar et al., 2001). The benefits of initiating antenatal care early in pregnancy have been attributed in part to the benefits offered by screening (e.g., Down’s syndrome and neural tube defects), which takes place during the first

trimester or early in the second trimester (Chamberlain & Morgan, 2002; Kupek, Petrou, Vause, & Maresh, 2002). Late initiation of antenatal care has been associated with negative outcomes, characterised by low birth weight, premature birth and infant mortality (Gortmaker, 1979; Kupek et al., 2002; Quick, Greenlick, & Roghmann, 1981; Rowe & Garcia, 2003; Ryan, Sweeney, & Solala, 1980). Late enrolment for antenatal care may be influenced by socio-demographic (e.g., young maternal age, non-Caucasian ethnic origin, low income, high parity, low level of education, low socio-economic status, and unmarried status), psycho-social (e.g., unrecognised pregnancy symptoms or unwanted pregnancy), and external factors (e.g., lack of health insurance, difficulties with childcare and transport) (Kupek et al., 2002; Low et al., 2005; Rowe & Garcia, 2003).

Globally, women's utilisation of antenatal care is measured by the WHO using "antenatal care coverage" (ACC), an indicator of access to and use of health care during pregnancy. ACC is defined as the "percentage of women who used antenatal care provided by skilled health personnel for reasons related to pregnancy at least once during pregnancy, as a percentage of live births in a given time period" (WHO, 2007, p. 1). ACC rates for industrialised countries have been estimated to be in the region of 98%, reducing to 86% in developing countries, excluding China, and falling to 54% in South Asia countries (Abou-Zahr & Wardlaw, 2003).

Antenatal care in New Zealand is an integral part of maternity care and is provided by a Lead Maternity Carer (LMC). A LMC is "an authorised practitioner who is a general practitioner with a Diploma of Obstetrics (or equivalent, as determined by the New Zealand College of General Practitioners); a midwife or an obstetrician who has been selected by the women to provide her lead maternity care" (NZHIS, 2003, p. 106). LMCs are responsible for providing and co-ordinating maternity care throughout pregnancy, labour and birth and postpartum (Health Funding Authority, 2000). In New Zealand, maternity care (including antenatal care) is free for women who are New Zealand citizens, who have permanent residency, or who hold a work permit for two or more year's duration. However, charges may apply for private or specialist maternity services (e.g., private obstetrician, private hospital, non-routine scans or laboratory

tests) (New Zealand Ministry of Health, 2002). The Ministry of Health recommends that women register with their chosen LMC by the fourteenth week of pregnancy to maximise the benefits of screening. The number of antenatal visits a woman may receive is generally based on the needs of the individual and the assessment of risk (Chamberlain & Morgan, 2002). Consistent with conservative practice in countries such as the UK, antenatal visits in New Zealand generally occur every 4-6 weeks in the first 28 weeks, then fortnightly until the 36<sup>th</sup> week and weekly until the commencement of labour, particularly for first-time mothers (Chamberlain & Morgan, 2002; Low et al., 2005). In 2003, approximately 93% of mothers registered with at least one LMC, while 7% of mothers did not register with a LMC to provide them with maternity care (New Zealand Health Information Services, 2003). A recent study by Low and colleagues (2005), which investigated antenatal care attendance by pacific island mothers living in New Zealand, found that, from a cohort of 1365 mothers interviewed, over 99% attended antenatal care at least once.

### **Nutrition and Gestational Weight Gain**

Mounting evidence suggests that good nutritional intake during pregnancy enables optimal gestational weight gain (GWG) and is associated with good maternal health and positive birth outcomes (Fowles, 2004). Conversely, poor maternal nutrition has been associated with low infant birth weight, young gestational age and greater length of hospital stay (Paauw, Bierling, Cook, & Davis, 2005). While many healthcare professionals and expectant mothers are aware of the importance of good nutrition during pregnancy, they may be unaware of specific nutritional guidelines for pregnant women or how best to achieve them (Vause, Martz, Richard, & Gramlich, 2006). For example, rather than doubling calorific intake with the aim of “eating for two”, guidelines suggest that a pregnant woman of average body weight should not require additional calories until her second trimester of pregnancy, when her daily calorie intake should be increased by 340 calories, and increased by 452 calories in the third trimester (Vause et al.,

2006, citing Health Canada, 2005; National Health and Medical Research Council & Ministry of Health, 2006).

GWG has been viewed as having three components: the products of conception (i.e., the foetus, placenta, and amniotic fluid); maternal tissues (i.e., uterus, mammary, and blood); and maternal fat reserves (National Research Council & Institute of Medicine, 2007). Alternately GWG may be viewed as comprising water (65%), fat reserves (30%) and proteins (5%) (National Research Council & Institute of Medicine, 2007, citing Butte, Ellis, Wong, Hopkinson, & Smith, 2003; Hytten & Chamberlain, 1980; Kopp-Hoolihan, van Loan, Wong, & King, 1999). GWG has been found to correlate with infant birth weight (Rode et al., 2007), with increases in birth weight in both term and pre-term infants associated with decreases in perinatal and neonatal mortality (Lederman, 2001). In terms of the optimum GWG for maternal and foetal health, the Institute of Medicine (IOM, 1990) has issued recommended weight gain ranges based on women's pre-pregnancy body mass index (BMI). For example, the IOM "recommends that women of normal pre-pregnancy weight for height (i.e., BMI = 19.8 to 26) carrying a single foetus aim for a weight gain of between 11.5 kg and 16 kg" (p. 11). Research has demonstrated that inadequate gestational weight gain (GWG) is associated with increased risk of negative consequences for both mother and child (New Zealand Ministry of Health, 2006; Vause et al., 2006). Mounting evidence supports the link between lower than recommended GWG and increased risk of pre-term birth (Carmichael & Abrams, 1997; Hickey, Cliver, McNeal, Hoffman, & Goldenberg, 1996; Siega-Riz, Adair, & Hobel, 1994) and low birth weight (Abrams, Altman, & Pickett, 2000). Excessive GWG has been associated with increased risk of large infants (e.g., > 4000 grams, termed macrosomia), who are at increased risk of birth injury (Abrams et al., 2000) and are more likely to be delivered via caesarean section (Weiss et al., 2004), particularly if maternal weight gain exceeded 16 kg (Johnson, Longmate, & Frentzen, 1992). According to the ACOG committee opinion on obesity in pregnancy (2005), obese women (i.e. BMI of 30 or greater) are at increased risk of several adverse perinatal outcomes such as aesthetic and perioperative complications (i.e.,

excessive blood loss, operative time greater, wound infection and endometriosis), and increased risk of gestational hypertension, pre-eclampsia, and gestational diabetes when compared with women who have a BMI of less than 30 (Weiss et al., 2004). Given rising rates of obesity in many Western countries (ACOG, 2005), of concern for health authorities is that high GWG may lead to weight retention postpartum (Thorsdottir & Birgisdottir, 1998) and in the longer term (Rooney & Schaubert, 2002).

Given the potential for adverse outcomes stemming from poor nutritional intake and inadequate or excessive GWG, adherence to nutritional guidelines for pregnant women, in collaboration with a healthcare provider, may help optimise maternal health and birth outcomes (World Health Organization & UNICEF, 2004). In terms of specific nutritional requirements for pregnant women, there is a general consensus that women should consume food and/or dietary supplements to ensure they maintain adequate levels of: folic acid (to prevent neural tube defects in offspring); iron (accumulated by bone marrow, foetus and placenta and reduces the risk of premature delivery and low birth weight); calcium (required to maintain maternal bone integrity, skeletal development of the foetus and production of breast milk); vitamin D (helps with the absorption of calcium); other essential nutrients (e.g., selenium, zinc and magnesium); and other essential fatty acids (Gunderson & Erica, 2003; Vause et al., 2006). Research suggests that daily consumption of antenatal vitamins (commenced 1 month prior to conception) should ensure adequate levels of folic acid, iron and other essential nutrients (Scholl et al., 1997). In terms of calcium, antenatal vitamins may not provide sufficient calcium, so women are encouraged to consume the equivalent of 3 to 4 servings of milk or milk products, which should also provide sufficient vitamin D (Olafsdottir, Skuladottir, Thorsdottir, Hauksson, & Steingrimsdottir, 2006). In addition, a recent study of the relationship between maternal serum levels of vitamin D and the prevalence of primary caesarean section, found that Vitamin D deficiency to be associated with increased odds of primary caesarean section (Merewood, Mehta, Chen, Bauchner, & Holick, 2009).

## **Physical Activity**

Physical activity is commonly defined as “any bodily movement produced by skeletal muscles that results in energy expenditure”, while exercise has been viewed as “a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness” (Caspersen, Powell, & Christenson, 1985, p. 126). The WHO defines physical activity in its broadest sense as referring to “the entire spectrum of bodily movements resulting in energy expenditure that each person can undertake in daily life, ranging from normal active living conditions to intentional moderate physical activities, physical exercises, physical fitness and training sessions and sport for all activities, especially leisure and recreational sports” (WHO, 1998, p. 9). Regular physical activity is considered a major component in the prevention of chronic diseases, through reducing the risk of heart disease, stroke, type 2 diabetes, cancer (i.e., breast and colon) and facilitating social interaction (World Health Organisation, 2003).

A growing body of literature suggests that healthy and well-nourished women can safely participate in most forms of physical activity during pregnancy (Sternfeld, 1997). Research suggests that participation in physical activity during pregnancy may reduce the risks of gestational diabetes mellitus (Dye, Knox, Artal, Aubry, & Wojtowycz, 1997; Solomon et al., 1997) and pre-eclampsia (Sorensen et al., 2003), help prevent excess maternal weight gain (Clapp & Capeless, 1990; Clapp & Little, 1995), improve physical fitness and body image (Kramer, 2004), ease labour and delivery (Hatch, Levin, Shu, & Susser, 1998), reduce symptoms of depression (Nordhagen & Sundgot-Borgen, 2002) and anxiety (Da Costa, Rippen, Dritsa, & Ring, 2003; Goodwin, Astbury, & McMeeken, 2000), and promote psychological well-being (Carr, 2001; Lox & Treasure, 2000).

The New Zealand Hillary Commission recommendations for exercising during pregnancy are consistent with those of The American College of Obstetricians and Gynaecologists

(ACOG), who recommend “30 minutes or more of moderate exercise a day on most, if not all, days of the week” for women with low-risk pregnancies (ACOG, 2002, p. 79). Furthermore, research also suggests that even previously sedentary women in uncomplicated pregnancies may engage in aerobic and strength-conditioning exercises but should commence at a level of “15 minutes of continuous exercise three times a week, increasing gradually to 30-minute sessions four times a week” (Davies et al., 2003, p. 335). Moderate-intensity exercises which are recommended during pregnancy include walking, swimming, low-impact aerobics, yoga and exercise programmes specifically designed for pregnant women (ACOG, 2003). Activities which pregnant women are advised to avoid include water-skiing, contact sports, strenuous anaerobic exercise and activities that may affect the oxygen supply to the baby (e.g., scuba diving) or involve changes in pressure or high altitudes (e.g., mountain climbing) (Sport and Recreation New Zealand, 2006). Furthermore, medical conditions where exercise may be contraindicated for women during pregnancy include pregnancy-induced hypertension, pre-term rupture of the membranes, pre-term labour during a previous or current pregnancy, an incompetent cervix or persistent second or third trimester bleeding, and intrauterine foetal growth retardation (ACOG, 2003).

As the benefits of exercising during pregnancy are actively promoted by healthcare providers in Western countries, increasing numbers of women have come to participate in regular physical activity (Morris & Johnson, 2005). Many women enter pregnancy with existing exercise regimes (SPARC, 2003), while other women see pregnancy as an opportunity to introduce more health-conscious activities into their lifestyles (Davies, Wolfe, Motola & MacKinnon, 2003). One such activity that has received notable attention in recent years is yoga, which has become popular in Western cultures as a means of exercise and fitness (Raub, 2002). The practice of yoga has been associated with improved mental and physical well-being, and has been recommended as a low-impact exercise for women during pregnancy (Sport and Recreation New Zealand, 2006). The practice of yoga during pregnancy is believed to assist women in maintaining good

health during pregnancy and in their preparations for labour, birth and the postpartum period (Sparrowe & Walden, 2002). However, evidence to support these claims is currently lacking which is the motivation for this study. Before examining the proposed influence of yoga on maternal health and well-being, a more general review of yoga and its health benefits is warranted.

## CHAPTER 3 : YOGA AND ITS INFLUENCE ON HEALTH

### Yoga: An Overview

According to Eastern philosophy, health may be viewed as “a state of complete equilibrium of body, mind and spirit” characterised by “forgetfulness of physical and mental consciousness” (Iyengar, 1979, p. 41). Yoga is an ancient system of mind-body practices originating in India aimed at enhancing health and well-being through the integration of the mind, body and spirit (Pelletier, 1997). The origin of the term “yoga” has been linked to the Sanskrit root “yujir” meaning “to unite or connect” (Joshi, 1965, p. 53), or, alternatively, is derived from the Sanskrit root “yuj” meaning “to bind, join, attach and yoke, to direct and concentrate one’s attention on, to use and apply” (Iyengar, 2001, p. 1). Stone seals discovered in the Indus Valley, depicting figures in yoga postures, suggest that yoga was practised around 3000 BC (Flood, 1996). The history of yoga is commonly divided into four periods: the Vedic, Pre-Classical, Classical and Post-Classical Periods (Sparrowe, 2003).

The Vedic period was marked by *The Vedas* (i.e., *Rig-Veda*, *Sama-Veda*, *Yajur-Veda*, and *Atharva-Veda*), ancient scriptures which were orally transmitted, with the earliest portions of the text being written between 1500 BC and 1200 BC (Flood, 1996; Hirianna, 2000). The word yoga was first mentioned in the *Rig-Veda*, the oldest portion of the text (Feuerstein, 2002).

The pre-classical yoga period was marked by the creation of ancient texts such as the *Upanishads* scriptures, part of the Vedas (Murthy, 1994), and the *Bhagavad-Gita* (c. 500 BC) the oldest known yoga scripture (Strauss, 2005). One of the *Upanishads*, the *Kathopanishad*, describes yoga as: “When the senses are stilled, when the mind is at rest, when the intellect wavers not – then, say the wise, is reached the highest stage. This steady control of the senses and mind has been defined as yoga” (Iyengar, 2001, p. 2). The *Bhagavad-Gita* has been viewed as “the most

important authority on yoga philosophy” and proposes yoga as “a deliverance from contact with pain and sorrow” (Iyengar, 2001, p. 1).

The classical yoga period was marked by the creation of Patanjali’s *Yoga Sutra* (c. 200 BC to AD 200) which is “considered the master text for classical yoga” (Strauss, 2005, p. 3). Patanjali’s *Yoga Sutra* outlines eight steps of the yoga system which are arranged in hierarchal order: Yama (restraint); Niyama (discipline); Asanas (physical postures); Pranayama (regulation of life-force/breath); Pratyahara (sense withdrawal); Dharana (concentration); Dhyana (meditation); and Samadhi (unity or ecstasy) (Malhotra, 2001). According to Malhotra (2001), “the first five steps are called the external steps because they aim to help the individual to gain control of one’s attitude, body, breathing, emotions, and sense organs. The last three are called the internal steps because they assist the individual to take charge of all mental modifications arising from inner and outer sources” (p. 9). Patanjali held a dualistic view of existence, with the co-existence of purusha (male, formless, all-present and all-knowing invisible consciousness) and prakriti (female, visible and nature incarnate) (Sparrowe, 2003). According to Sparrowe (2003), Patanjali’s *Yoga Sutra* and his eight-limbed path reflected yoga practices during the classical period and were an integral part of yoga systems which followed. Raja Yoga (Raja meaning king), one of six orthodox schools of Hindu philosophy, is also referred to as Astanga (eight-limbed) Yoga, as it reflects the eight limbs of yoga as outlined in the *Yoga Sutras*. Raja Yoga is associated with a complete mastery of the mind. As summarised by Iyengar (2001), “Mind is the king of the senses. One who has conquered his mind, senses, passions, thoughts and reason is a king among men. He is fit for Raja Yoga, the royal union with the Universal Spirit” (p. 4). Iyengar further clarified the relationship between Raja Yoga and Hatha Yoga, saying: “As a mountaineer needs ladders, ropes and crampons as well as physical fitness and discipline to climb the icy peaks of the Himalayas, so does the yoga aspirant need the knowledge and discipline of the Hatha Yoga of Swatmarama to reach the heights of Raja Yoga dealt with by Patanjali” (p. 4).

Post-classical yoga has been defined as “an appreciation of the present moment” with the post-classical yoga period being defined by an abundance of literature, and the emergence of Tantra and Hatha Yoga (Govindji, 2006, p. 15). Modern yoga was introduced to the West (e.g., United States and England) by Swami Vivekananda in the 1890s (Govindji, 2006). By the beginning of the 20<sup>th</sup> century, the practice of yoga asanas had gained popularity. Hatha Yoga was credited with physical health benefits, and yoga research institutes were established in India and in the United States (Sparrowe, 2003). While yoga and other complementary and alternative therapies have Eastern philosophical origins (e.g., Indian or Vedic cultures), their popularity and practice in the West reflects a growing holistic health movement (Engebretson, 2002). In the West, it is popular for yoga to be practised as a physical exercise, and as such yogic practices may overlook holistic ideals (e.g., integrating mind, body and spirit), in favour of practices which focus primarily on the body (Clay, Lloyd, Walker, Sharp, & Pankey, 2005). From a cultural perspective, the Western reductive approach to yogic practices may seem at odds with Eastern holistic ideals. Despite this, research which has assessed the influence of singular elements of yoga (e.g., exercise, relaxation, breathing or meditation) has found them to be associated with positive health benefits (Engebretson, 2002).

### **Hatha Yoga**

The focus of this study is on Hatha Yoga, one of the six main branches of yoga (i.e., Hatha, Bhakti, Raja, Jnana, Karma and Tantra) and the most popular branch of yoga practised in the West (Taylor, 2003). The origins of Hatha Yoga have been traced back to as early as the 10<sup>th</sup> or 11<sup>th</sup> century, although the only surviving Hatha Yoga text, the *Hatha Yoga Pradipika*, was written by Yogi Swatmarama in the 15<sup>th</sup> Century (Wikipedia, 2007). While traditional Hatha Yoga practice includes *Yama* (moral restraint), *Niyama* (set of behaviour or observances), *Asana* (postures), *Pranayama* (suspension or regulation of breath) and *Dhyana* (Meditation) (Wikipedia, 2007), Western interpretation of yoga may place greater emphasis on *asanas* and *pranayama*, while

being partially or even thoroughly neglectful of *dhyana*, the spiritual element (Engebretson, 2002). Several Hatha Yoga teaching styles have developed, including Astanga, Iyengar, Integral, Bikram, Kripaulu and Kundalini Yoga (Collins, 1998). B.F.S. Iyengar, a yoga guru who developed his own style of Hatha Yoga (i.e., Iyengar Yoga), wrote that experience led him to conclude that “for an ordinary man or woman in any community of the world, the way to achieve a quiet mind is to work with determination on two of the eight stages of yoga mentioned by Patanjali, namely, *asana* and *pranayama*” (Iyengar, 2001, p. 8). These two stages are briefly described, with reference to Iyengar’s, *Light on Yoga*, which is also known as the bible of modern yoga.

*Asanas*, or yoga postures, are the third limb of Patanjali’s *Yoga Sutra*, and are proposed to bring “steadiness, health and lightness of limb”, increase “agility, balance, endurance and great vitality”, help “secure a fine physique, which is strong and elastic without being muscle-bound”, “keep the body free from disease”, “exercise every muscle, nerve and gland in the body”, “reduce fatigue and calm the nerves”, and “train and discipline the mind” (Iyengar, 2001, p. 20). Iyengar suggests that through the practice of asanas, health is achieved, which he defines as the “equilibrium of body, mind and spirit”, and “forgetfulness of physical and mental consciousness” (p. 21). Each asana is proposed to offer specific effects or benefits. For example, standing postures may help focus the mind, tone the leg muscles, open the hips, and given a sense of balance and poise. Seated poses may facilitate the practice of pranayama, improve posture and open the hips. The practice of inversion ananas may improve blood circulation and digestion and reduce the effects of gravity on the body, while ananas involving twists are proposed to increase strength and flexibility in the abdomen, back and spine and improve the functioning of internal organs through increased blood circulation (Bailey, 2004; Iyengar, 2001). Specific asanas, or a combination of asanas, may be prescribed by yoga practitioners for specific complaints or conditions such as arthritis, asthma, backache, high and low blood pressure, diabetes, epilepsy, fatigue, headache, conditions involving kidneys, liver, spleen, lungs, and labour pain (Iyengar, 2001).

*Pranayama*, the fourth limb of the Yoga Sutra, refers to the science of breath (Iyengar, 2001). It is composed of the words *Prana*, meaning “breath, respiration, life, vitality, wind, energy or strength” and *Ayama*, meaning “length, expansion, stretching or restraint”. The practice of pranayama involves control of all aspects of breathing such as inhalation, exhalation, and brief suspension of breath (Iyengar, 2001. p. 445). Iyengar suggests that when “the yogi masters the science of breath and by the regulation and control of breath; he controls the mind and stills its constant movement” (p. 24). Recent research has also highlighted an association between the practice of pranayama and significant levels of muscle activity (Petrofsky, Cuneo, Dial, & Morris, 2005). While yoga has been promoted as a good means of stretching muscles associated with improved muscle power, dexterity, visual perception (Raghuraj & Telles, 1997) and reaction time (Madanmohan et al., 1993), a recent study aimed to quantify muscle use during yoga through the use of an electromyogram (Petrofsky et al., 2005). Petrofsky and colleagues, measured muscle activity in the abdomen (i.e., rectus abdominis and external oblique muscles) during a seated pranayama practice as well as muscle activity associated with abdominal crunches. They found that “while muscle activity during this yoga breathing exercise was comparable to that seen during the performance of abdominal crunches, the longer duration of the breathing exercises increased the total work on the abdominal muscles up to 5 times greater than the work during crunches” (Petrofsky et al., 2005, p. 501). The authors concluded that activities such as yoga may prove invaluable for those wishing to increase their muscle strength and dexterity, and may be particularly important for those wishing to build core stability, such as women during and after their pregnancy.

While there are no published studies on the prevalence of Hatha Yoga practice per se, one study suggests that, in 1998, 15 million American adults had practised yoga at least once in their lifetime, while 7.4 million had practised yoga during the previous year (Saper et al., 2004). The same study reported that from a representative sample of 2055 English-speaking adults in the United States, respondents who had practised yoga at least once in their life time were more

likely to be female, college-educated, urban dwellers, than those who had not. Respondents who practised yoga in the previous year reported using yoga for wellness (64%), health conditions (48%) and for back or neck pain (21%).

In 2008, an annual “Yoga in America” survey found that of a representative sample of 5,050 respondents, 6.9% of adults in the United States were currently practising yoga; of whom a vast majority were women (72.2%), college-educated (71.4%) or had postgraduate qualifications (27%) (Yoga Journal, 2008). The survey also highlighted that 28.4% of survey respondents had practised yoga for less than one year, 21.4% had practised between one and two years, and over 50% had practised yoga for two or more years. A majority of those practising yoga were aged between 35 and 54 years (41%), followed closely by those in the 18- to 34-year age range (40.6%).

### **Health Benefits of Yoga**

To date, yoga has been shown to be an effective practice for treating a wide range of conditions, such as anxiety (Netz & Lidor, 2003; Shannahoff-Khalsa, 2004; Woolery, Myers, Sternlieb, & Zeltzer, 2004), depression (Netz & Lidor, 2003; Shannahoff-Khalsa, 2004; Woolery et al., 2004), obsessive compulsive disorder (Shannahoff-Khalsa & Beckett, 1996), substance use disorders (Telles & Naveen, 1997), and insomnia (Cohen, Warneke, Fauladi, Rodriguez, & Chaoul-Reich, 2004; Khalsa, 2003; Shaffer, 1997). Yoga has also been shown to be effective in treating asthma (Singh, Wisniewski, Britton, & Tattersfield, 1990), and migraines (Latha & Kaliappan, 1992); reducing heart disease (Raub, 2002), hypertension (Murugesan, Govindarsjulu, & Bera, 2000; Selvamurthy et al., 1998), stress (Malathi & Damodaran, 1999) and seizure frequency (Panjwani, Gupta, Singh, Selvamurthy, & Rai, 1995); while improving cardiovascular health (Raub, 2002) and general well-being (Carlson, Specia, Patel, & Goodey, 2004; Malathi & Damodaran, 1999). Stage 2 clinical trials investigating the influence of yoga on attention in aging in individuals with multiple sclerosis have been completed and results are awaited (National Centre for Complementary and Alternative Medicine [NCCAM], 2008).

In terms of the mechanisms underlying the practice of yoga and associated health benefits, research suggests that yoga may: mediate the influence of stress hormones (Mager, Pratap, Leavitt, Hanifin, & Brainard, 2003); improve symptoms associated with anxiety, depression and epilepsy by increasing GABA levels (Streeter et al., 2007); activate alpha rhythms which may enhance immunity (via increased natural killer cell activity); and improve mental health (Kamei, Toriumi, Kimura, & Kimura, 2001). For example, a recent study by Streeter and colleagues (2007) investigated the association between individual yoga sessions among experienced yoga practitioners and brain gamma-aminobutyric acid (GABA) levels. Given that previous research had demonstrated associations between yoga practice and improvements in conditions associated with low levels of GABA (e.g., anxiety, depression and epilepsy), and which responded well to pharmacological agents which increased GABA levels; the authors hypothesised that the practice of yoga would be associated with increased levels of brain GABA levels.

To test this hypothesis they recruited a sample of 8 yoga practitioners and 11 control participants. Yoga practitioners practised yoga for 60 minutes while those in the control group participated in a reading session. The authors reported a 27% increase in GABA levels in those in the yoga practitioner group, while no change was recorded in the reading control group. The authors recommended that practice of yoga, and other mind-body practices, be investigated as a treatment for conditions with low GABA levels (Streeter et al., 2007).

Other research has contributed to a growing body of scientific evidence supporting the link between mind and body. For example, a study by Kamei et al., (2001) investigated the influence of yoga practice on the immune system and brain activity of a group of eight yoga instructors with several years' practice experience. The authors proposed that there was "a reciprocal relationship between mind and body [where] physiologic exercises affect the mental/emotional state, and the mental/emotional state affects the physiology" (p. 141). Furthermore they hypothesised that "proficiency in yoga is considered to induce physiological changes based on these relationships, thus contributing to human health, especially the

maintenance and promotion of immunocompetence” (p. 141). Outcome measures in this study included natural killer (NK) cell activity and changes in brain activity/rhythms measured using an electroencephalograph (EEG). NK cell activity has been defined as “an in-vitro correlate of cellular immune function important in host resistance to viral illness” (Cover & Irwin, 1994, p. 217) and has been found to be reduced in patients with major depression and individuals experiencing severe life stress (Irwin et al., 1990). On the day of the study, participants were fitted with a catheter for the drawing of blood samples to measure NK activity at a later stage (Kamei et al., 2001). Twenty minutes following the catheter insertion the participants rested for a period of 10 minutes, followed by the practice of asana, pranayama and meditation. A series of asanas were practised for 15 minutes, followed by 15 minutes of pranayama practice with the eyes closed, and 20 minutes of meditation involving the use of a mantra. A total of four blood samples were taken from each participant, immediately following the rest period, asana practice, pranayama practice and meditation. Kamei et al., (2000) authors found the practice of asana, pranayama and meditation to be associated with increased alpha wave activity (characterised by a relaxed, alert state of consciousness). In terms of NK activity, while there were no changes noted following the practice of asana and meditation, the practice of pranayama was associated with increases in NK activity which was positively correlated with increased alpha frequencies. The authors concluded that the practice of pranayama was associated with a neuroimmunological effect, which may be mediated through a number of mechanisms. The first mechanism included “the stimulation of the respiratory center located in the upper 1/3 of the pons, resulting in the release of a neurotransmitter”, while the second possible mechanism related to the “markedly changed blood O<sub>2</sub> levels, caused by extraordinary changes in ventilation, [which] stimulate the release of a neurotransmitter” (p. 145).

## Yoga and Pregnancy

Yoga is a complementary therapy increasingly utilised by pregnant women in the West (Teasdale, 1999). However, little is known empirically about the risks and benefits of antenatal yoga on maternal health and well-being (Narendran, Nagarathna, Narendran, Gunasheela, & Nagendra, 2005). In recent years, a number of American studies (Gibson & Powrie, 2001; Ranzini, Allen, & Yu-Ling, 2001) have reported that between 13% and 30% of women use some form of complementary medicine or therapy (CMT) during pregnancy. Commonly cited reasons for CMT use include lowering gastro-intestinal problems, anxiety, nausea/vomiting, and urinary tract problems (Ranzini et al., 2001). Generally speaking, antenatal yoga refers to yoga which has been adapted to ensure the safety and comfort of pregnant women. For example, adaptations are aimed to accommodate women's growing abdomen, ensuring the uterus is not compressed (Pizer, 2007). In particular, asanas which involve abdominal work (e.g., boat pose) are not recommended, nor are postures which involve lying on the back for extended periods after the first trimester (Pizer, 2007). Such poses may lower the mother's blood pressure, reduce blood flow to the placenta, decrease oxygen supply to the baby and reduce the foetal heart rate (Pullon & Bliss, 2006). Exercise recommendations for pregnancy also caution against activities which may overheat the baby, meaning the practice of Bikram or "Hot" yoga is not recommended (Sport and Recreation New Zealand, 2006).

Yoga has been posited as a natural way to relieve the stress and discomfort associated with pregnancy (Balaskas, 1994; Ezmerli, 2000). It is thought to facilitate pregnancy and labour through improving strength and flexibility achieved through the practice of *asana*; reducing or alleviating fatigue, back-pain, digestion and headaches; while facilitating labour and delivery through the use of *pranayama* (Sparrowe & Walden, 2002). The following section identifies various aspects of health that may be compromised during pregnancy for which yoga may be beneficial.

One way in which yoga might be beneficial during pregnancy is through reducing the risks associated with pregnancy and related health concerns. In terms of the health risks associated with pregnancy, research has demonstrated that pregnancy may place even previously healthy women at increased risk of complications such as gestational hypertension (Hermida et al., 2000), gestational diabetes (Young, Kuehl, Sulak, & Allen, 2000), changes in body temperature (Beinder, Huch, & Huch, 1990; Clapp, 1991; Olsson & Nilsson-Wikmar, 2004), excess weight gain (Rooney & Schaubert, 2002), discomfort and pain (e.g., lower back) (Olsson & Nilsson-Wikmar, 2004), nausea/vomiting (Chou, Lin, Cooney, Walker, & Riggs, 2003; Jewell & Young, 2003), fatigue (Chou et al., 2003), anxiety (Da Costa, Larouche, Dritsa, & Brender, 1999; Mulder et al., 2002) depression (McGill, Burrows, Holland, Langer, & Sweet, 1995) and stress (Soderquist, Wijma, & Wijma, 2001).

Research has also demonstrated that maternal health and well-being can be positively influenced by factors such as exercise (Bell & O'Neill, 1994; Kramer, 2004), a healthy diet (Williams, 1999), social support (Feldman, Dunkel-Schetter, Sandman, & Wadhwa, 2000), improved maternal self-efficacy (Gross, Conrad, Fogg, & Wothke, 1994; Porter & Hsu, 2003; Teti & Gelfand, 1991; Teti, O'Connell, & Reiner, 1996) and stress management (Lobel, CeVincent, Kamier, & Meyer, 2000; Mulder et al., 2002) techniques. The practice of yoga is believed to promote health and well-being through the integration of mind, body and spirit (Pelletier, 1997). Hatha Yoga naturally combines each of the above mediators of maternal health, including exercise, stress and pain management (Balaskas, 1994; Ezmerli, 2000), self-efficacy (Sharma, 2007), social support (Schell, 1994), positive health practices (Telles & Naveen, 1997) and enhanced quality of life (Reibel, Greeson, Brainard, & Rosenzweig, 2001).

The paragraphs which follow present the literature linking each of the above mediators of maternal health and well-being to the practice of Hatha Yoga. Where available, literature on yoga and pregnancy are presented. However, due to a lack of research in this area, the effectiveness of yoga on other patient groups is presented.

## **Pregnancy Stress and Yoga**

A recent study investigating the physiological and psychological effects of yoga practice found that cortisol, a hormone linked to stress, is significantly reduced in people who practice yoga, even in those who practice a single one-hour session (Mager et al., 2003). In a within-subjects designed experiment, Mager et al., (2003) attempt to test whether a single set of classical yoga practices or 7 days of continuous yoga practice could lower plasma cortisol levels in inexperienced yoga practitioners. They recruited healthy males and females with a mean age of 27.6 years who were deemed “yoga naïve” to participate in this eight-day study. On the first day participants took part in a control session where they sat quietly, read or wrote for 50 minutes and blood samples were collected immediately before and after (11 a.m. to 11.50 a.m.). On days 2 and 8, participants were led through yoga practices for 50 minutes (11 a.m. to 11.50 a.m.), with blood samples taken immediately before and after the sessions. Similarly, on days 3 to 7, participants were led through yoga practices for 50 minutes (from 5.30 p.m. to 6.20 p.m.) but without taking blood samples. Analysis indicated decreased plasma levels which were statistically significant on yoga practice days but not on control days. The authors concluded that classical yoga practices were associated with significantly lower plasma cortisol levels after one day’s yoga practice as well as after one week’s yoga practice (Mager et al., 2003). Such findings have helped establish the mediating influence of yoga practice on hormonal secretion of cortisol from the adrenal gland which increases during times of stress.

Other researchers have compared stress management techniques based on principles of cognitive behavioural therapy with a Kundalini Yoga Programme (a form of Hatha Yoga) and found both to be beneficial stress management techniques (Granath, Ingvarsson, von Thiele, & Lundberg, 2006). In this study, the authors recruited 33 employees (26 women and 7 men) from a large Swedish company and randomly assigned them into four groups (2 groups for each intervention). Each group received 10 training sessions with group leaders over a four-month

period. Outcome measures included psychological (e.g., self-rated stress and stress behaviour, anger, exhaustion, quality of life) and physiological measures (e.g., blood pressure, heart rate, urinary catecholamines, salivary cortisol) taken before and after the interventions. While no significant differences were found between the programmes both programmes resulted in a significant reduction of virtually all stress-related subjective and physiological variables (Granath et al., 2006).

Similarly, a study of healthy women who practised Hatha Yoga exercises found that yoga practice was associated with enhanced coping skills in dealing with stress, greater life satisfaction and lower excitability, aggressiveness, emotionality and somatic complaints, when compared with controls (Schell, 1994). According to Schell (1994), the practice of Hatha Yoga is a popular way to manage stress in Western countries. Schell investigated the physiological and psychological effects associated with yoga practice among a group of 25 healthy women aged between 22 and 55 years. Twelve of the participants were experienced yoga practitioners, while 13 volunteers had no prior experience of relaxation exercises were used as controls. In this study, those in the yoga group participated in an experimental session where a cannula needle (for blood samples) was inserted into their forearm, 90 minutes prior to commencing yoga exercises. Heart rate and blood pressure were recorded. The experimental session took place over a period of three hours (2 p.m. to 5 p.m.), with blood samples taken every 30 minutes. Yoga practice consisted of 30 minutes of asana practice (eight asanas), followed by 20 minutes of pranayama practice (i.e., fast superficial breathing and slow rhythmic breathing), and 10 minutes of meditation. The control group read a newspaper in a comfortable position for the duration of the experiment. Outcome measures were physiological (e.g., heart rate, blood pressure, cortisol, prolactin and growth hormones) and psychological measures as assessed by three questionnaires: The Freiburger Personality Inventory, the Stress Coping Questionnaire and the Adjective Check List. Results indicated that while there were no significant differences between the yoga and control group on endocrine measures or blood pressure; those in the yoga group had significant decreases in heart rate, significantly higher

scores in terms of life satisfaction, high spirits and extravertedness, and significantly lower scores on personality factors (e.g., aggression) and somatic complaints when compared with controls (Schell, 1994).

Pregnancy is a time associated with both psychological and physiological stress (Tiran & Chummun, 2004). In addition to the stresses of modern life, pregnant women, particularly those who are having their first child, may be exposed to additional stresses such as fear of labour (Soderquist et al., 2001). As previously discussed, a growing body of empirical evidence suggests that women who experience high levels of stress during pregnancy are at increased risk of pre-term birth, low birth weight or growth-restricted babies (Copper et al., 1996), as well as pregnancy complications such as pre-eclampsia (Kurki et al., 2000). Mechanisms which have been proposed to mediate the influence of antenatal stress include the HPA axis and activated hormones such as corticotropin-releasing hormone (see Koubovec et al., 2005; Mulder et al., 2002). Antenatal exposure to excess glucocorticoids has been associated with increased risk of poor physical (i.e., cardiovascular, metabolic and neuroendocrine disorders) and psychological health (e.g., cognitive and behavioural disorders and potential psychopathology) in later life (Huizink, Mulder, & Buitelaar, 2004; Koubovec et al., 2005; Seckl, 2001).

Yoga has been posited as a natural way to relieve stress during pregnancy (Balaskas, 1994; Ezmerli, 2000). While research on the influence of antenatal yoga on pregnancy and birth outcomes has been scarce, a recent Indian study investigated the hypothesis that stress management using an integrated approach of yoga therapy (IAYT) would be associated with improved pregnancy outcomes when compared with standard obstetric management (Narendran et al., 2005). IAYT refers to “the application of yoga practices to promote health (as defined by the WHO) and in disease states” and is proposed to reduce stress through the practice of asanas, pranayama and meditation/chanting techniques (Narendran et al., 2005, p. 238). In this prospective, matched, observational study, the authors recruited a total of 335 women, of whom 169 were in the yoga group and 166 were in the control group. Women were matched in terms of

age, parity, body weight, and Doppler velocimetry scores of umbilical and uterine arteries. Women in the yoga group practised asanas (i.e., while standing, sitting, lying prone or lying supine), pranayama (i.e., conscious prolongation of inhalation, breath retention and exhalation), and meditation (i.e., listening to breath or repeating a mantra or word) for one hour per day from the date of enrolment in the study. Those in the control group participated in 30 minutes of walking twice daily. Compliance of activities in both groups was ensured through activity diaries and frequent telephone calls. Outcome measures included gestational age at birth, mode of delivery, intrauterine growth retardation and obstetric complications (e.g., pregnancy-induced hypertension). Narendran et al., (2005) found that, compared with those in the control group, those in the yoga group had a significantly higher number of babies with birth weights of 2500 grams or more, had significantly lower rates of pre-term labour, and had lower rates of complications (i.e., isolated intrauterine growth retardation (IUGR), pregnancy-induced hypertension (PIH) or PIH with associated IUGR). Most importantly, this study is the first known study to demonstrate that the practice of IATY during pregnancy is safe (Narendran et al., 2005). However, it is important to note the practice IATY as described in the study, is likely to differ significantly from the practice of antenatal or Hatha Yoga in Western countries. As previously note, Western interpretations of Hatha Yoga commonly neglect the practice of meditation, an integral element of IATY. Furthermore, while the practice of IATY for an hour a day is commendable, such frequency of practice is less common in New Zealand. For example, in New Zealand, it is not uncommon for yoga novices to practice antenatal yoga one a week in a class setting, which may or may not be followed up with individual practice. The generalisability of the aforementioned findings is limited by the studies exclusion of women who were: 35 years or older, who previously practiced yoga, or who had experienced complications during their current or previous pregnancy. In addition, findings may also be limited to the demographic characteristics of the sample population, women from middle to upper class socioeconomic strata who received specialist care from an obstetrician or gynaecologist. While Narendran and

colleagues' primary aim was to assess the relationship between the practice of IAYT and pregnancy outcomes, their outcome measures failed to assess instrumental modes of birth, Apgar scores, or other variables (e.g., induction of labour or use of analgesia during labour) strongly correlated with birth outcomes. Thus, while Narendran et al., (2005), have taken an important first step in establishing the safety of IATY during pregnancy, it is equally important that other studies assess the safety and effectiveness of antenatal Hatha Yoga as practiced in Western countries.

### **Pregnancy, Pain and Pain Management**

Some of the unique experiences which women may face during pregnancy relate to pain and pain management. For example, pregnancy-related backache can have a significant impact on women's daily activities, with incidences of gestational back pain (GBP) ranging from 40% to 90% (Wang, 2003). Furthermore, "labour has been described as one of the most intense forms of pain that can be experienced, and represents both a physiological and psychological challenge for women" (Cyna, McAuliffe, & Andrew, 2004; citing Melzack, 1984; Smith, Collins, Cyna, & Crowther, 2006). Antenatally, labour pain may be a source of fear and apprehension, which may contribute to women's perceptions of pain, and in turn may affect their labour and birth experience (Smith, Collins, Cyna, & Crowther, 2006). As previously discussed, research has demonstrated an association between fear of childbirth and pregnancy-related anxiety and between negative pregnancy and birth outcomes, such as increased risk of emergency caesarean section (Ryding et al., 1998), elective caesarean section (Waldenstrom & Irestedt, 2006), more severe labour pain and greater need for analgesia (Alehagen et al., 2005; Lang et al., 2006; Saisto, 2001; Saisto et al., 1999), maternity blues and puerperal depression (Saisto et al., 2001), and lower gestational age (Wadhwa et al., 1993). Factors which may mediate the aforementioned pregnancy and birth outcomes are discussed in brief.

Firstly, there is a natural link between fear of childbirth and antenatal stress. Therefore, factors which have been proposed to mediate a stress response (e.g., the influence of the HPA axis and stress hormones) may also mediate antenatal anxiety. Secondly, the influence of fear of labour on birth outcomes may be mediated via women's preference for particular modes of delivery. For example, as highlighted in a study by Gamble and Creedy (2001), 20% of women who had a preference for a caesarean delivery cited their primary reason as relating to fear of pain, contractions and tearing. Furthermore, fear of labour has also been associated with an increased need for analgesia (Saisto, 2001), which in turn has been implicated in negative birth outcomes. For example, epidural analgesia has been associated with lower levels of satisfaction with the childbirth experience (Kannan et al., 2001), and increased rates of instrumental delivery (Ranta et al., 1995). Additionally, epidural analgesia (or may not) have a negative impact on breast-feeding in the first 24 hours after birth (Baumgarder, Muehl, Fischer, & Pribbenow, 2003; Radzysimski, 2003) when compared with women who do not have epidural analgesia. In terms of the effects of maternal analgesia on the foetus and newborn, a review of the literature by Littleford (2004) concluded that "as yet, there is no one test that clearly separates effects on the foetus/newborn, if any, of maternally-administered medication during labour and delivery, although newer technologies show some promise" (p. 591). Another factor which may mediate the influence of fear of birth and labour pain on birth outcomes is self-efficacy. For example, a study by Lowe (2000) investigated the relationship between self-efficacy for labour and childbirth fears among a sample of 280 healthy nulliparous women during their third trimester of pregnancy. Lowe found that women with high levels of fear were characterised by having "significantly higher learned helplessness, chance health locus of control and powerful others health locus of control, and significantly lower self-esteem and generalized self-efficacy" (p. 219). Higher self-efficacy has been associated with lower pain ratings in chronic pain patients (Chong, Cogan, Randolph, & Racz, 2001). Findings from a study conducted by Arnstein, Caudill, Mandle, Norris, and Beasley, (1999) suggest that "the lack of belief in one's own ability to manage pain,

cope and function despite persistent pain, is a significant predictor of the extent to which individuals with chronic pain become disabled and/or depressed” (p. 483).

The influence of self-efficacy on self-reported labour pain and use of analgesia has been assessed in a study by Stockman and Altmaier (2001). In this study, self-efficacy scores were ascertained through participants’ (N = 43) self-reported confidence in performing behavioural tasks involved in labour and delivery (e.g., doing breathing exercises) and in overcoming potential barriers (e.g., non-supportive partner). Participants were required to provide certainty ratings (1-10 scale) for both task and barrier items, with average certainty rating resulting in a “strength of self-efficacy score”. Pain was measured using a visual analogue scale (VAS) and the McGill Pain Questionnaire (MPQ). As described by Stockman and colleagues, “the MPQ consists of 20 categories of verbal descriptions of pain including words from three descriptive classes (sensory, affective, and evaluative) and one miscellaneous class.” (p. 163). Results indicated that while lower levels of pain were associated with higher self-efficacy, analgesia usage was not influenced. In addition, self-efficacy measures were found to be predictive of affective, evaluative, and miscellaneous categories of the pain rating index of MPQ. As a result, the authors concluded that while “all women experienced similar sensory aspects of pain during labour and delivery [...] women with higher self-efficacy perceived pain differently. In other words, the emotional and cognitive aspects of pain were less painful for women with higher self-efficacy” (p. 165). As discussed, further in the self-efficacy section (refer to p. 67), the practice of yoga has been associated with improved self-efficacy. Therefore, it may be hypothesised that the practice of yoga may also reduce women’s fear of labour as self-efficacy is increased.

In terms of labour pain and pregnancy related back pain, it has been hypothesised that mind-body interventions like yoga may help reduce pain by providing physical and mental relaxation (i.e., through stretching and relaxing muscles) and by providing a distraction from pain and tension (i.e., through meditation and breathing practices; Vickers & Zollman, 1999). Yoga has been documented as an effective treatment in easing chronic pain such as low back pain and

carpal tunnel syndrome (Gaur, 2001, 2002). In a prospective open study by Gaur (2002), 18 chronic pain patients were recruited (i.e., 11 lower back pain, two carpal tunnel syndrome, and one each migraine, dermatomyositis, hip pain, neck pain and osteoarthritis). Over the course of four weeks, participants attended three 90-minute sessions of yoga per week and completed weekly questionnaires each week to assess pain intensity, mood, functional status, domestic, social and occupational productivity and medication usage. Findings included a significant decrease in measures of mood disorder, pain severity and medication usage. The authors concluded that yoga improves coping and self-management in chronic pain patients and, according to Gaur, “yoga heals by combining transcendental meditation with a variety of isometric exercises. The combination of the two leads to increased self-awareness which can increase resistance to disease” (Gaur, 2002).

Other research has specifically assessed the influence of Iyengar Yoga on chronic lower back pain and found promising results. For example, Williams et al., (2005), conducted a randomised control study of 60 participants with a history of lower back pain (i.e.,  $11.2 \pm 1.54$  years), 48% of whom used pain medication, and assigned them to either an Iyengar Yoga therapy group or an educational control group for 16-weeks. Both groups received 16 weekly newsletters on back care and attended two one-hour lectures on occupational/physical therapy for chronic lower back pain. In addition, those in the yoga group attended a 90-minute Iyengar Yoga class weekly for 16-weeks and were encouraged to practice at home for 30-minutes, 5-days per week. The yoga intervention consisted of 29 asanas which included supine, seated, standing, forward bends, twists, and inversions. The authors posited “that Iyengar Yoga therapy would progressively rehabilitate LBP by addressing imbalances in the musculoskeletal system that affect spinal alignment and posture” (Williams et al., 2005, p. 108). Outcome measures assessed included functional disability (Pain disability Index); clinical pain (McGill pain Questionnaire); fear of movement (Tampa Scale of Kinesiophobia); pain attitudes (Survey of Pain Attitudes); coping strategies (Coping Strategies Questionnaire-Revised); self-efficacy (Back Pain Self-Efficacy

Scale); range of motion (Saunders Digital Inclinometer); pain medication usage (telephone-screening interview); and adherence to yoga practice (weekly self-report of frequency and duration of practice at home). Of the 60 participants enrolled, 42 completed the study. While significant differences were not found between groups in terms of psychological or behavioural outcomes, those in the yoga intervention group had significant reductions in pain intensity (64%), functional disability (77%) and pain medication usage (88%) following intervention and at 3-month follow-up assessments. Based on these findings the authors concluded that “a majority of self-referred persons with mild chronic low back pain will comply with and report improvement on medical and functional pain-related outcomes from Iyengar Yoga therapy” (Williams et al., 2005, p. 107).

In terms of the management of labour pain, pharmaceutical interventions are well documented, while complementary alternatives have also proven beneficial (Smith et al., 2006). Complementary methods of pain relief such as yoga are growing in popularity and are thought to reflect a growing desire by many women to avoid pharmacological or invasive methods of pain relief during labour (Bennett & Brown, 1999). In addition to providing non-invasive and safe methods of pain relief, use of complementary and alternative treatments may empower women by giving them greater control over their pain relief and allow them more active participation during childbirth (Wang, 2003). Recent review studies have addressed the efficacy of complementary and alternative therapies in managing labour pain (Smith et al., 2006; Tournaire & Theau-Yonneau, 2007). Smith and colleagues highlighted that “mind-body interventions such as relaxation, meditation, visualisation and breathing are commonly used for labour (and) together may have a calming effect and provide a distraction from pain and tension” (Smith et al., 2006, p. 2; citing Vickers & Zollman, 1999). Tournaire and Theau-Yonneau (2007) suggested that yoga offers a “special training of breathing” and “according to professionals who use this technique for delivery, yoga shortens the duration of labour, decreases pain and reduces the need for

analgesia medication” (p. 4). However, no studies could be found by the authors to substantiate these claims.

Although presently there appears to be no scientific evidence to support anecdotal claims that yoga techniques are beneficial during labour, there is some evidence to support the use of psychoprophylactic methods involving breathing practice for pain management. For example, a study conducted by Yildirim and Sahuin (2004) investigated the effect of breathing techniques and massage administered by a nurse on women’s pain perceptions during labour. In this study, 40 women (75% primiparous and between 38-42 weeks gestation) were assigned to either an experimental or control group. Those in the experimental group received information about labour, breathing techniques and massage at the start of their labour, were accompanied by a study investigator during labour, and received massage from a nurse who encouraged them to use breathing techniques, change their positions and to relax. Women who were in the control group received standard obstetric care (Yildirim & Sahuin, 2004). Findings from this study suggest that nursing support and education about breathing and massage was effective in reducing women’s pain perceptions resulting in greater maternal satisfaction with the birthing experience.

### **Maternal Self-Efficacy**

Self-efficacy has been defined as “people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave” (Bandura, 1994, p. 2). According to self-efficacy theory and related research, acquiring new skills is facilitated by self-efficacy beliefs (Bandura, 1982). Self-efficacy expectancy refers to the “personal conviction that one can successfully perform required behaviours in a given situation” (Lowe, 1993, p. 141). In the case of birth and labour, self-efficacy information may be found in prior coping experiences of childbirth or pain, observing others who have managed to cope, verbal encouragement from influential mentors such as midwife or childbirth educator, and somatic

reactions (e.g., nausea and panic) triggered by autonomic arousal (e.g., increased heart rate/respiration) (Lowe, 1991). Consistent with the above, research has established that attending childbirth classes may result in increased confidence related to knowledge of practical skills (Walker & Erdman, 1984), which in turn has been associated with reports of less painful childbirths among first-time mothers (Crowe & Baeyer, 1989). Similarly, a recent prospective study assessed the self-efficacy of thirty-seven women who attended Lamaze classes - in terms of use of pain coping strategies taught in the class as well as the importance and likely influence of using these strategies (Larsen, O'Hara, Brewer, & Wenzel, 2001). It found that, while higher levels of self-efficacy were associated with lower levels of pain in both early and active labour, it did not account for variance in women's transitional labour pain. As previously discussed, increased self-efficacy has also been associated with decreased fear of birth (Lowe, 2000), which in turn may mediate women's experience and tolerance of labour pain (Stockman & Altmaier, 2001). Other studies have investigated the role of self-efficacy in terms of women's birth expectation, pain control, and mode of delivery. For example, an early study by Manning and Wright (1983) examined the influence of self-efficacy and outcome expectancies and the persistence of pain control during childbirth. In this study of 52 first-time mothers, the authors assessed women's self-efficacy judgements prior to labour and later assessed the quantity and timing of analgesia use during labour. The authors found that use of pain medication and length of time without analgesia were negatively correlated with both self-efficacy expectancy and with outcome expectancy. Other studies have assessed the influence of self-efficacy on women's birth choice (Dilks & Beal, 1997). In this study, the participants were a group of 74 women who were currently pregnant with their first child following a previous caesarean delivery, and had the option of either a vaginal delivery or an elective caesarean for their current pregnancy. The authors found that women who chose caesarean delivery did not score highly on a measure of self-efficacy, and advocated education to help increase their self-efficacy and help them choose between available birth options (Dilks & Beal, 1997).

As the above research suggests, high levels of maternal self-efficacy may be associated with lower level of pain during labour, decreased medication/ analgesia use during labour, and increased preference for a vaginal delivery among women who previously delivered via caesarean. In the postpartum period, high maternal self-efficacy beliefs have been associated with specific positive parenting practices such as responsive, stimulating and non-putative caretaking, active maternal coping orientations, and fewer maternally perceived child behaviour problems (Coleman & Karraker, 2003). Conversely, low maternal self-efficacy has been found to correlate with increased maternal depression, behaviour problems in children, maternal perceptions of child difficulty, a passive coping style in the parental role and high levels of stress (Coleman & Karraker, 2003; Teti & Gelfand, 1991).

Previous research has shown that mind-body exercises such as yoga can improve an individual's self-efficacy, increase their long-term adherence to healthy behaviours and improve personal stress management skills (La Forge, 1997). It was hypothesized that yoga practice produced "a temporary self-contemplative mental state" (La Forge, 1997, p. 53) and that it is this internal focus which differentiates yoga from conventional body-centred exercises such as aerobics. Consistent with this, Sharma (2007) investigated the influence of yoga practice on self-efficacy through use of a yoga-based behavioural intervention for smoking cessation based on social cognitive theory. Twenty-one participants were randomly assigned to either the yoga intervention or an existing self-help programme for a period of six months. The yoga intervention consisted of asanas (30 minutes), relaxation (10 minutes), pranayama (10 minutes) and meditation (10–15 minutes). The control group receive a self-help guide to smoking cessation. According to Sharma (2006, p. 5), "the construct of self-efficacy is modified by teaching the participants each technique in small steps, role modelling, giving verbal persuasion, and ensuring mastery. Self-control is modified by allowing participants to set goals". A 23-item instrument was utilised to measure self-efficacy for quitting, self-control for quitting, self-reported daily consumption of cigarettes, self-efficacy for yoga, and past week performance of

yoga behaviours. Outcomes included a significant improvement in self-control for quitting and performance of yoga behaviours in the yoga Intervention group compared with controls (Sharma, 2007). While these findings are promising it is important to note that only 7 (33.3%) participants completed the study protocol.

While existing research has established the importance of maternal self-efficacy during pregnancy and in the postpartum period, and while the practice of yoga has been associated with increased self-efficacy and improved adherence to healthy behaviours, to date there is little empirical evidence for the use of antenatal yoga practice to enhance maternal self-efficacy during pregnancy and in the postpartum period.

### **Social Support and Maternal Health**

As previously established, the importance of social support during pregnancy and birth is well documented. Increased levels of quality social support are associated with improved mental and physical health during pregnancy (Chou et al., 2003; Gjerdingen et al., 1991), a reduction in labour and delivery complications and in labour duration (Collins et al., 1993; Gjerdingen et al., 1991; Langer et al., 1998; Pascoe, 1993), and improved birth outcomes (Collins et al., 1993; Feldman et al., 2000; Hoffman & Hatch, 1996; Pryor et al., 2003). As highlighted by the WHO (1998), participation in physical activity may help build self-esteem, confidence and social integration. Previous research has demonstrated that the practice of yoga and mindfulness-based stress reduction techniques may result in greater social functioning and enhanced quality of life (Reibel et al., 2001). Furthermore, a study of the effects of Hatha Yoga exercises in healthy women found that women who participated in yoga scored higher on measures of high spirits and extravertedness (Schell, 1994).

While there is little empirical evidence to directly link the practice of antenatal yoga to the social support per se, antenatal yoga classes may provide a relaxing environment where pregnant women are in the company of their peers and have an opportunity to extend their social network.

Furthermore, attending antenatal yoga classes may also result in the provision of informational support, which may be associated with numerous benefits. For example, Feldman et al., (2000) proposed that “the provision of emotional, informational, and material resources may mitigate the physical and psychological strains associated with pregnancy” (p. 715). Information provided by antenatal yoga classes may include practical skills relating to relaxation and breathing, which women practise during classes and may utilise during their pregnancy and later during labour. Equipped with such skills, women may develop a greater sense of self-efficacy and to use them.

To summarise, maternal health and well-being have been linked to stress management, pain management, social support, exercise and maternal self-efficacy. That is, women who have high levels of social support and self-efficacy, who exercise, and who are able to cope effectively with pain and stress, experience better physical and mental health before, during and after birth. In turn, foetal outcomes are significantly influenced by the health and well-being of the mother during pregnancy and the postpartum period. Hatha Yoga is proposed as one method by which women may target each of these factors in order to increase the likelihood of better maternal and foetal health and well-being.

### **Purpose**

While yoga has become a complementary therapy increasingly utilised by many pregnant women in the West, little is known empirically about the risks and benefits of antenatal yoga on maternal health and well-being. Thus, this study attempts to address this knowledge gap by assessing the effectiveness and safety of antenatal yoga for first-time mothers in New Zealand. Specifically, this study investigated how first-time mothers who participated in yoga performed across measures of maternal mood, social support, maternal mental health, physical well-being and birth outcomes when compared with first-time mothers who did not participate in yoga. An additional aim of the study is to attempt to predict birth type from the above measures. If yoga is shown to benefit maternal health, the findings of this exploratory study may position us to assess

the effectiveness of this popular form of complementary medicine more rigorously in the future with pregnant women. It was anticipated that pregnant women who participated in yoga would: experience fewer signs and symptoms of depression and anxiety before and after delivery; have a preference for low levels of analgesia usage antenatally and utilise less analgesia during labour; engage in more physical activity before and after pregnancy; self-report greater satisfaction with social support; have a greater percentage of natural births and report higher levels of maternal self-efficacy postpartum, when compared with their non-yoga peers. It was also anticipated that a combination of demographic, antenatal and birth measures (i.e., participation in antenatal yoga, levels of complementary therapy utilisation, self-rating of diet, maternal age, and levels of analgesia utilised during labour), would effectively predict mode of delivery (i.e., namely, natural childbirth as compared with medically-indicated delivery) among first-time mothers.

## CHAPTER 4 : METHOD

### Participants

A priori power analysis was conducted and indicated that 34 participants were needed in each group (Yoga/Non-Yoga) to have 80% power for detecting a medium to large sized effect when statistical significance was set at .05. A total of 71 participants were included in this study. Participation was open to any woman who lived in the Auckland region, who was at least 28 weeks pregnant with her first child, was at least 16 years of age and who spoke English fluently. Of the 71 participants, 34 met criteria for inclusion in the yoga group. That is, they participated in at least six sessions of yoga during the course of their pregnancy. The remaining 37 participants were included in the non-yoga group. All participants received usual antenatal care offered by the public health system. Table 4 presents demographic information for each of the two groups.

Table 4

*Demographic Information between Groups at Initial Assessment (Time 1)*

	Yoga Group (n=34)		Non-Yoga Group (n=37)	
	Mean	SD	Mean	SD
Weeks pregnant	32.09	3.26	32.99	3.20
Years education	16.34	2.80	15.97	2.44
Age (years)	33.81	4.61	29.70	4.87
Number of pregnancies	1.44	0.89	1.41	0.76

As can be seen in Table 4, the two groups were similar in terms of the timing of the initial assessment (Time 1) which occurred within participants' third trimester of pregnancy. Education levels were also similar between the two groups, as were the total number of pregnancies (i.e., current pregnancy and previous miscarriages, still births, and abortions). The two groups did differ slightly in terms of age, with those in the yoga groups being an average of four years older. A one-way Anova was conducted to determine if the two groups differed significantly on any of the factors included in Table 4, with no significant differences found ( $p > .05$ ).

Table 5 presents further demographic information for categorical variables for the two study groups. For analysis purposes, participants occupations were later categorised by the

Table 5

*Number and Frequency (%) of Participants within Demographic Categories by Group.*

	Yoga Group (n=34)		Non-Yoga Group (n=37)	
Occupation Prior to Birth				
Professional	19	(55.9%)	16	(43.2%)
Skilled	7	(20.6%)	8	(21.6%)
Semi-skilled	6	(17.6%)	12	(33.4%)
Unskilled	1	(2.9%)	1	(2.7%)
Unemployed	1	(2.9%)	-	
Work Status Prior to Birth				
Full time	16	(45.5%)	20	(54.1%)
Part-Time	8	(24.2%)	6	(16.2%)
Maternity Leave	5	(14.7%)	10	(29.7%)
Not Working	5	(14.7%)	1	(2.7%)
Work categories collapsed				
Full time & Part-time	24	(70.6%)	26	(70.3%)
Maternity Leave & Not Working	10	(29.4%)	11	(29.7%)
Work Status Following Birth				
Full time	5	(14.7%)	3	(8.1%)
Part-Time	4	(11.8%)	11	(29.7%)
Maternity Leave	9	(26.5%)	7	(18.9%)
Not Working	15	(44.1%)	13	(35.1%)
Missing data	1	(2.9%)	3	(8.1%)
Work categories collapsed				
Full time & Part-time	9	(26.5%)	14	(37.8%)
Maternity Leave & Not Working	24	(70.6%)	20	(54.1%)
Missing data	1	(2.9%)	3	(8.1%)
Marital Status			1	
Single	2	(5.9%)	29	(78.4%)
Married	24	(70.6%)	7	(18.9%)
Defacto	8	(23.5%)		
Ethnicity				
Pakeha / New Zealander	29	(85.3%)	28	(75.7%)
Euro Other	3	(8.8%)	3	(8.1%)
Maori / PI	2	(5.9%)	5	(13.5%)
Asian	-	(0%)	1	(2.7%)
Lead Maternity Carer (LMC)				
Midwife	27	(79.4%)	26	(70.3%)
OBGYN	5	(14.7%)	9	(24.3%)
GP	2	(5.9%)	2	(5.4%)
Midwife & GP (Standard care)	29	(85.3%)	28	(75.7%)
OBGYN (Specialist care)	5	(14.7%)	9	(24.3%)

*Note. Pakeha refers to New Zealand European ancestry, while PI refers to Pacific Island ethnicity (e.g., Fijian, Tongan, and Samoan).*

researcher as professional (e.g., teacher, nurse), skilled (e.g., office manager, yoga instructor), semi-skilled (e.g., accounts clerk, receptionist), unskilled (e.g., retail assistant) or unemployed.

To determine if the two groups differed significantly on any of the above categorical variables, non-parametric tests were used. Mann-Whitney U tests indicated that the two groups did not differ significantly ( $p > .05$ ) on any of the variables presented in Table 5.

While not significant, differences between the two groups did exist. Those in the yoga group had a higher percentage of defacto relationships, a greater percentage of women who identified as Pakeha / European New Zealanders, occupied a greater percentage of professional employment roles prior to birth, were engaged in more full time employment, and a greater percentage reported not working or being on maternity leave at the follow-up. Those in the non-yoga group had a higher percentage of married women, had a higher percentage of women who identified as Maori / Pacific Island or Asian, were engaged in more semi-skilled work and more part-time work, and postnatally they engaged in more full or part-time employment.

## Measures

### Demographic Assessment Form (See Appendix 1).

The Demographic Assessment Form for both the initial (Time 1) and follow-up assessments (Time 2) was developed by the researcher to gather general information about each participant in the study. The Form recorded the name and contact details for each participant and addressed demographic domains of maternal age, employment status (i.e., full-time, part-time, on maternity leave and not-working), occupation, years of education, marital status (i.e., single, married, defacto relationship, separated, divorced, widowed), ethnicity (i.e., Pakeha, Maori, Pacific Islander, Asian, European, African, North American, South American, Multicultural, Other), parity (i.e., number of stillbirths &/or miscarriages), prescription and non prescription drugs (i.e., marijuana / hash, tranquilizers, sleeping pills, stimulants, hallucinogens, injected drugs, solvents), alcohol and tobacco use, their primary care provider (i.e., General Practitioner [GP],

Obstetrician or Gynaecologist [OB-GYN], Midwife, Homeopath, Naturopath, Other) and a self-report ratings of participants diet and wellness which used Likert scales ranging from 1 (Poor) to 10 (Excellent). Variables on the Form completed postnatally included employment status, substance use (as above), who delivered their child, and self-report ratings of diet and wellness.

### **Pain Medication Preference Scale (See Appendix 2)**

This self-report scale was adapted from a scale originally created by Simkin (1989) to assess a pregnant woman's preferences regarding the use of pain medication during labour. The original scale includes eleven items that are rated on a Likert scale which ranges from +10 "You want to feel nothing, you desire anaesthesia before labour begins" to -10 "You want no medication whatsoever, even for caesarean delivery". Located beside each scale number are their corresponding meanings. The top five are positive numbers which decrease in order (e.g., +10, +9, +7, +5, +3) and represent a gradual decline in the desire to use pain medication. A neutral point on the scale, represented by the number zero, indicates "No preference". Scale numbers below zero (e.g., -3, -5, -7, -9, -10) indicate the increasing desire to avoid pain medication. At initial assessment the adapted scale instructed women to choose the number which best reflects their anticipated desire for pain medication during labour, while at follow-up assessment the scale instructed women to choose the number which best reflects their actual birth experience (e.g., +10 "I felt nothing, I had anaesthesia before labour began"). For women who had medical intervention requiring analgesia during labour (e.g., cesarean), rating were based on analgesia usage before the medical intervention. In this study the Pain Medication preference Scale (PMPS) was used to generate two scores, one antenatally at initial assessment and one postnatally at follow-up assessment, which ranged from -10 to +10 and which reflected anticipated desire for pain medication during labour and actual birth experience respectively. The adapted version of the scale differs from Simkin's original (1989) only in the language used to explain each scale number, with this using the second person language (i.e., "You want to feel nothing") while the

original utilised third person language (i.e., “She wants to feel nothing”). Additionally, the original version was designed to collect women’s pain medication preferences prior to labour, while the adapted version was also utilised postpartum to assess actual pain medication utilised. The PMPS has been published in books (Simkin, 1989), handbooks (Amis & Green, 2007), journals (Hodnett, 1996) (Amis & Green, 2007) and as an online resource (Simkin, 2007) for utilisation by both health professionals and parents-to-be. While the PMPS has not previously been used as a research tool to elicit women’s pain medications preferences antenatally or to reflect their actual birth experience, a number of journal articles have advocated the use of the PMPS as a “a quick and easy method of initiating an informed discussion” about women’s preferences regarding use of pain medication (Hodnett, 1996, p. 259). It has also been recommended as a method of “ascertaining preferences about pharmacologic pain relief” (Hodnett, 2002, p.170) to enable caregivers to help women achieve their desires.

### **Canada Fitness Survey Questionnaire – Modified Version (See Appendix 3)**

The Canadian Fitness Survey Questionnaire (CFSQ; Canada Fitness Survey, 1983) was adapted from the Minnesota Leisure Time Physical Activity Questionnaire (MLTPAQ) (Taylor et al., 1978) by The Canadian Fitness and Lifestyle Research Institute (CFLRI), as part of a nationally representative study to determine physical recreation habits, physical fitness, and health status of Canadians between the ages of 7 and 97 years (Canada Fitness Survey, 1983). In its assessment of physical activity, the original CFSQ assessed the frequency, intensity and duration (i.e., months when activity was done, number of occasions in last 12 months, average number of minutes per occasion) across thirty named activities which may occur during leisure time, in the home, at work, or at school (Canada Fitness Survey, 1983). In the present study, the physical activity portion of the CFSQ was modified, substituting activities more popular in Canada (i.e., Baseball, softball, ice hockey, curling) with activities popular in New Zealand which were not included in the original CFSQ (i.e., cricket, netball and rugby). Furthermore, additional mind-

body exercises (i.e., Tai'Chi, Pilates) were added as were activities specific to mothers, such as breastfeeding and childcare, as these activities are common during pregnancy and are not included in the original CFSQ. The revised version of the CFSQ used in this study had a total of thirty activities, and took between five and ten minutes to complete depending on the number of activities women participated in. Unlike the original CFSQ, which assessed physical activity during the past week, the past month and the past year, the current study assessed the frequency, intensity and duration of the thirty activities during the course of each participant's pregnancy and up until their follow-up assessment three months postpartum. Scores reported in the study reflect the total number of activities women participated in during the course of their pregnancy, the average number of sessions each activity was engaged in per week during the course of their pregnancy, and the average duration of each session (i.e., 15 minutes or less, 16 to 30, 31 to 60 or 61 or more). The CSFQ has been widely used within Canada and exhibits good overall reliability and consistency ( $r = .98$ ; Weller & Corey, 1998), as does the MLTPAQ from which it was adapted ( $r = .79$  to  $.88$ ; Folsom, Jacobs, Capersen, Gomez-Marin, & Kundsén, 1986).

#### **Complementary Therapies Measure – Revised (See Appendix 4)**

This self-report measure of complementary therapy use was developed by Crocetti, Crotti, Feltrin, Ponton, Geddes, & Buiatti (1998) to assess the use of complementary therapies by breast cancer patients attending conventional treatment. It consists of a list of 14 alternative complementary practices and techniques, specifically: acupuncture, homeopathy, manual healing methods, therapeutic touch, herbalism, diet (all types), naturopathy, energy healing, psychotherapy, iridology, mind-bodies therapies, relaxation techniques, folk remedies and spiritual healing. Each of these was identified by Crocetti et al (1998) through a review of the literature on complementary therapy use. To date, no studies have assessed the validity or reliability of the original complementary therapies measure. For the purposes of this study, the original measure was expanded by the researcher to include other complementary therapies (i.e.,

acupressure, antenatal classes, aromatherapy, biofeedback, hypnosis) and dietary supplements (both in diet and in supplement form) identified in the literature as utilised by women during pregnancy and childbirth (For a comprehensive review see Tiran & Mack, 2000). The revised measure consisted of a list of 20 alternative complementary practices and techniques and 27 dietary supplements, with the option for participants to list other therapies or supplements not included. For both the alternative complementary practices and techniques list, and dietary supplements list, participants ticked yes or no for use of each item. In terms of scoring, one point was allocated to each therapy or supplement used which were then summed to give an overall score. The revised version of the complementary therapies measure adapted for this study took an average of five minutes to complete.

### **Profile of Mood States (POMS; See Appendix 5)**

The Profile of Mood States (POMS; McNair, Lorr & Droppleman, 1981) is a widely used self-report inventory of mood states which presents respondents with 65 affect adjectives (e.g., sad) which are to be rated on a 5-point scale, from “Not at all” to “Extremely” based on how well each item describes their mood during the past week, including today. The inventory, which takes approximately 10 minutes to complete, yields 6 subscales, including 5 negative mood states and 1 positive mood state. A total score of mood disturbance may also be calculated. The 5 negative mood state subscales are: tension-anxiety (i.e., subjective state and somatic experience of anxiety); depression-dejection (i.e., feelings of inadequacy, isolation, guilt, futility, sadness); anger-hostility (i.e., overt hostility and irritability); fatigue-inertia (i.e., feelings of weariness); and confusion-bewilderment (i.e., efficiency and clarity of thinking). The single positive mood state subscale is vigour-activity (i.e., well-being, enthusiasm, liveliness, energy, optimism). Subscale scores are calculated by summing the responses for the adjectives defining the factor. The psychometric properties are sound and the scale has been found to produce scores reflective of available normative data sets when used in New Zealand (Barker-Collo, 2003). Internal

consistencies (Cronbach's Alpha) for individual subscales are as follows: fatigue-inertia (.90), vigour-activity (.83), tension-anxiety (.79), depression-dejection (.95), anger-hostility (.93), and confusion-bewilderment (.74) (Barker-Collo, 2003). In terms of pregnancy, the POMS has been used to assess mood states in numerous studies which may be found in a comprehensive bibliography of research using the POMS between 1964 and 2002 (McNair, Heuchert, & Shilony, 2003). Recent studies which have utilised the POMS to assess mood have investigated antepartum depressive symptoms during high risk pregnancies (Maloni, 2005), assessed the influence of planned and unplanned pregnancy on women's psychological well-being (Grussu, Quatraro, & Nasta, 2005) and have explored associations between serum testosterone levels and maternal peripartum mood states (Hohlgeschwandtner, Husslein, Klier, & Ulm, 2001).

#### **Social Network Index (See Appendix 6)**

Social network diversity, that is the number of social relationships in which the respondent regularly participates, was assessed using the Social Network Index (SNI; Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). The SNI is a self-report, pen-and-paper measure of social support which assesses participation in 12 types of social relationship. Social relationships listed include those with a spouse, parent, parents-in-law, children, other close family members, close neighbours, friends, workmates, schoolmates, fellow volunteers (e.g., charity or community work), members of groups without religious affiliations (e.g., social, recreational or professional group), and members of religious groups (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). Respondents are instructed to specify (i.e., yes or no) for each relationship whether they have spoken (in person or by phone) to someone in that relationship at least once in the previous two weeks. The index takes less than five minutes to complete. Scoring of the index involves assigning one point for each type of relationship participated in by the respondent, with a maximum total score of 12 points. Studies which have utilised the Social Network Index include Cohen et al.'s (1997) study of the influence of social networks on susceptibility to the common

cold, for which the SNI was originally developed. To date, no studies have specifically assessed the validity or reliability of the SNI. However, the authors of a study which investigated the influence of social support and social-ecological resources on lifestyle intervention effects for type 2 diabetes (Barrera, Toobert, Angell, Glasgow, & MacKinnon, 2006) reported a 6-month test-retest reliability of 0.42 for the SNI in their control group. A study by Hopper (2003), who utilised the SNI to assess the social support construct with a group of cancer patients, reported a Cronbach's alpha coefficient of 0.72 for the SNI.

### **Maternal Self-Efficacy Scale (See Appendix 7)**

The Maternal Self-Efficacy Scale (MSES) was developed by Teti and Gelfand (1991) to inquire about self-efficacy beliefs in parenting domains specific to mothers with infants less than 12 months of age. It consists of nine items or tasks (e.g., soothing the child, maintaining joint attention and interaction with the child, and performing daily routine tasks) which are presented in the form of a question (e.g., When your baby is upset, grizzly, or crying, how good are you at soothing him or her?) to which participants respond using a four-point Likert scale which ranges from 1 (Not good at all) to 4 (Very good). A tenth item inquires about the participant's general sense of self-efficacy as a mother, is also rated on the same 1 to 4 scale. The measure yields a total score which is derived through summing each of the ten items. Scores may range from 10 to 40, with higher scores indicative of stronger self-efficacy. To date, no normative data has been published for this scale. The MSES has been found to have an adequate internal reliability (Cronbach's alpha = 0.79) (Teti, Hess, & O'Connell, 2005). The MSES has previously been adapted by LaRoche, Turner and Kalick (1995) to match the developmental age of toddlers in a study of the relationship between toddler's behavioural difficulties, mother's depression, mother's self-efficacy and mother's levels of social support. Given the very young age of infants in the current study it was decided to administer only nine of the ten items, omitting a question relating to getting the baby to "show-off" to others.

### **Labour and Delivery Questionnaire - Modified (See Appendix 8)**

The original Labour and Delivery Questionnaire created by Amis and Green (2007) recorded women's personal details (e.g., name, date of birth, birth weight, length and sex), details relating to labour (e.g., type of birth, induction, labour duration, and analgesia) and their birth experience (e.g., positive/ negative aspects of birth experience, emotions, aspects they would like to change, and recommendations for other expectant mothers). For the purposes of this study, the original version of this questionnaire was modified to create an interview-based survey of pregnancy complication and labour and delivery outcomes. The modified version utilised questions from the original questionnaire while adding additional questions relating to complications during pregnancy, the prescription of medications, bedrest or hospitalisation during pregnancy, women's experience of labour from early to active labour, and Apgar scores at 1 and 5 minutes. During the interview women were invited to tell their birth story from the commencement of labour through to delivery, while the researcher completed the questionnaire where possible. Questions not already been answered by the information provided by women were then specifically asked. A majority of questions were factual (e.g., yes/no, measurements, durations) while remaining questions were open-ended and were recorded verbatim by the researcher. The adapted version of the labour and delivery questionnaire took between 30 to 40 minutes to complete.

### **Procedures**

Ethical approval for this study was granted by the University of Auckland Human Subjects Ethics Committee (UAHSEC). Individuals who worked for agencies in contact with first-time mothers (e.g., yoga centers, Plunkett, Midwives) were identified and contacted via telephone. Meetings were held to ascertain their willingness to act as facilitators in the distribution of information to potential participants. Of the 25 contacted 23 agreed to act in this capacity. Those who agreed to distribute information about the study were antenatal yoga class instructors (7), antenatal class instructors (7), midwives (5), administrators of online notice board

utilised by first-time mothers (3) and the organisers of an annual Auckland parent and child exposition (1). Via each of these contacts, potential participants were given access to a participant information flyer (Appendix A) which outlined: what the study was about, who the investigators were, who was invited to participate, what participation involved, eligibility criteria, what participants would receive if they participated (i.e., \$30 on completion of the follow up assessment) and who they should contact if they were interested in participating. In addition to the above, a number of potential participants heard about the study through word of mouth and requested copies of flyers from the researcher via email. Once participants had initiated contact with the researcher they were screened for eligibility and an appointment was made with each to conduct the baseline assessment. Recruitment continued until a target sample size of at least 34 yoga and 34 control participants was reached. A total of 75 potential participants contacted the researcher to register interest in participating in the study, of whom 71 consented to participate and were included in the sample.

The researcher arranged to meet each participant for the purposes of conducting the initial assessment once the participant was at least 28 weeks into their pregnancy. Participants were asked to nominate a location that was convenient for them to meet the researcher (i.e., a café (n = 19), their home (n = 45) or workplace (n = 7)). To ensure that assessments were consistent across locations and to maintain confidentiality in public settings where possible, the researcher and participants sat in more private areas, away from others, and questionnaires were designed to ensure participants could complete them unaided if required, thereby reducing personal information being overheard. To ensure all participants received similar instructions across locations, written instructions were printed at the top of each measure to clearly outline how each measure was to be completed. Participants were told prior to assessment that the initial assessment would take approximately 40 minutes. Prior to commencing the initial assessment the researcher read through the participant information sheet (PIS) with the participant (Appendix 9), ensured the participant met the eligibility criteria, and ensured they understood what participation

entailed. The PIS outlined the study in brief including eligibility criteria, benefits, risks and safety issues related to participation, what participation involved, who the researcher was and their contact details, and issues relating to confidentiality and ethics approval information. Participants were given a copy of the PIS to take away with them. Once the content of the participant information sheet had been outlined, participants were given an opportunity to sign a consent form (Appendix 10). By signing the consent form participants consented to participate in the study which would involve two assessments, the first to take place when they were at least 28 weeks pregnant and a follow-up to take place once their baby was at least 3 months old.

Once written consent was obtained, the initial assessment commenced with completion of the following questionnaires: Demographic Assessment Form, PMPS, CFS (modified), CTM (modified), POMS and the SNI. As noted previously, initial assessments took place in a location nominated by the participant and lasted approximately 40 minutes. When participants' babies were estimated to be at least 3 months old (based on original estimated arrival dates), participants were contacted by email or telephone to schedule a follow-up assessment. Those participants who requested that the follow-up assessment take place in their home (N=25) were notified that the follow-up assessment would take up to 90 minutes. The majority (N=46) of participants agreed for follow-up questionnaires to be posted to them. Participants who were posted follow-up questionnaires were invited to contact the researcher via phone or email if they had any questions or concerns at any stage when completing the questionnaires. The researcher contacted all participants within two weeks of the questionnaires being posted to ensure they had received the questionnaire and to answer any questions or concerns. The follow-up assessment involved completion of a Follow-up Demographic Assessment Form, PMPS, Labour and Delivery Information Scale, CFS (modified), CTM (modified), POMS, SNI, and a MSES. All participants (i.e., those who met with the researcher face-to-face and those who received questionnaires in the mail) were given an opportunity to relay their birth story verbally; thus when face-to-face meetings were not possible, women were invited to write down their birth story or relay their

story to the researcher over the phone. Once the follow-up assessment was completed, participants who had nominated to receive \$30 were asked for their bank account details, as payment was made directly into their bank account by the University of Auckland. Participants who had nominated for payment to be paid to a charity were reminded that their nominated charity would receive a donation on their behalf. In addition, all participants received either a pair of booties or a gift voucher to the value of \$10 as a gift for their baby. Once all data was collected it was scored according to standardised procedures and all the data was entered into SPSS<sup>14.0</sup> data file for analysis.

## **CHAPTER 5 : RESULTS**

The results of this study are presented in five sections. Section one details preliminary analysis including: (1) inspection of the data set, (2) management of missing data, and (3) testing assumptions related to analyses performed (e.g., ANOVA), namely, normality, linearity and homogeneity of variance-covariance matrices. Section two describes the sample's performance across measures, including means, standard deviations and, where appropriate, frequencies. The third section provides comparisons between the two groups in relation to hypotheses made about maternal mental health, social support, birth outcomes, and maternal self-efficacy. One-way ANOVAs were conducted to determine if the yoga and non-yoga groups differed significantly antenatally at Time 1 (T1; >28 weeks gestation) and postnatally at Time 2 (T2; 3 months postpartum) on measures of antenatal and postnatal mood and levels of social supports, maternal health and physical well being, pain medication preferences; birth outcomes and feelings of maternal self-efficacy. To determine if there were significant changes in the above measures over time and whether these changes differed between the two groups, a series of repeated measures within subjects' ANOVAs were conducted. The fourth section utilises correlational analysis to highlight interrelationships between antenatal and postnatal factors that were associated with various birth outcomes; as well as interrelationships between antenatal factors, birth factors and maternal outcomes. Finally, section five utilises logistic regression to determine whether antenatal variables examined in this study contribute to the prediction of medical versus natural childbirth (i.e., no obstetric operative interventions), and vaginal (including operative vaginal birth) versus caesarean delivery.

### **Section 1: Preliminary Analyses**

Preliminary analysis included inspection of the dataset to check for accuracy of data input and management of missing data, and analysis of testing assumptions (i.e., normality, linearity, and homogeneity of variance-covariance).

## **Inspection of the Dataset**

The accuracy of the dataset was ensured through checking the original data against the data entered into SPSS and examination of univariate descriptive statistics (e.g., minimum and maximum values) which fell within acceptable ranges. Means and standard deviations were also found to be plausible. Inspection of the dataset revealed a minimum amount of missing data, which was managed using a variety of methods recommended by Tabachnick and Fidell (2001). One case which had a significant amount of missing data was deleted from the dataset. Three cases which were missing postnatal data were included in both the initial description of the sample and for antenatal data analysis, but were excluded from all further analysis. Finally, nine cases were missing between one and two items on the 65-item POMS, and were managed using a mean substitution method. The mean substitution method may be used to estimate missing values where “means are calculated from available data and used to replace missing data prior to analysis” (Tabachnick & Fidell, 2001, p.62). For the purposes of replacing missing items on the POMS, missing ratings were replaced with the mean rating. Thus, if a participant was missing an item which loaded on the tension scale, the mean score obtained across remaining tension scale items was substituted for the missing value. Following mean substitutions, POMS subscales and total mood disturbance scores were recalculated to incorporate the mean substitutions.

## **Testing Assumptions**

The assumption of multivariate normality underlies all parametric tests utilised in this study. Skewness and kurtosis are two components of normality, with the former referring to the symmetry of the distribution, and the latter referring to the peakedness of a distribution. In a normal distribution “the values of skewness and kurtosis are zero” (Tabachnick & Fidell, 2001, p.73). However, while skewness and kurtosis highlight deviations from normality, they address only a single feature of non-normality each. Thus, it is considered prudent to assess whether the distribution as a whole deviates from a comparable normal distribution (Field, 2005). The

Kolmogorov-Smirnov and Shapiro-Wilk tests may be used to compare scores in a sample to a normally distributed set of scores with the same mean and standard deviations (Field, 2005). If these tests are found to be significant ( $p < .05$ ), then the distribution is significantly different from a normal distribution and parametric tests should not be used due to breaching the assumption of normality. In such cases, non-parametric tests may be used or raw data may be transformed to increase its normality (Field, 2005). The Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted using the aforementioned criteria for all variables presented in Table 3, namely: POMS scores including subscores (ante/ postnatally); maternal self-efficacy; self-reported wellness and diet (ante/ postnatally); use of alternative therapies and dietary supplements; average weekly physical activity antenatally; complications; hospitalisation; prescribed bedrest; prescribed hospitalisation; pain medication preferences; type of birth; labour duration; gestational age; birth weight; analgesia use; and Apgar scores at one and five minutes. Of these variables, the vigour subscale of the POMS (ante/postnatally), use of dietary supplements, and birth weight were all found to have distributions that did not differ significantly from a normal distribution ( $p > .05$ ). All other variables tested breached the normality assumption ( $p < .05$ ). While non-normality of variables may be addressed via a number of transformation methods (Tabachnick & Fidell, 2001), given the large number of transformations that would be required, alongside the wish to maintain interpretability, the decision was made not to transform the data, and to treat the findings with caution.

Linearity refers to the assumptions that “there is a straight line relationship between two variables” (Tabachnick & Fidell, 2001, p.77). A number of analyses (e.g., regression and correlation) rely on the assumption of linearity, which may be assessed through the inspection of bivariate scatterplots. Scatterplots were created for bivariate combinations of all variables listed in Table 6, and no evidence of non-linearity was found.

Table 6

*Between group comparisons across measures*

Measure	Yoga					Non-Yoga				
	Time 1		Time 2		%	Time 1		Time 2		%
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Maternal Mental Health										
POMS (Z scores)										
Tension	-1.28	0.09	-1.30	0.09	---	-1.25	0.13	-1.31	0.09	---
Depression	-0.86	0.05	-0.85	0.06	---	-0.86	0.05	-0.86	0.05	---
Anger	-0.99	0.09	-0.99	0.07	---	-1.01	0.06	-1.00	0.08	---
Vigour	-2.60	0.10	-2.63	0.12	---	-2.61	0.12	-2.66	0.08	---
Fatigue	-1.20	0.14	-1.20	0.12	---	-1.14	0.13	-1.20	0.15	---
Confusion	-1.15	0.14	-1.20	0.12	---	-1.14	0.12	-1.22	0.10	---
TMD	-0.61	0.01	-0.61	0.01	---	-0.61	0.01	-0.61	0.01	---
Maternal Self-efficacy	---	---	3.71	0.46	---	---	---	3.59	0.50	---
Maternal Health & Well-being										
Self-reported Wellness <sup>a</sup>	8.19	1.24	7.75	1.43	---	8.31	0.99	7.75	1.29	---
Social Network Scale	7.61	2.04	8.15	1.86	---	8.08	1.72	8.64	1.63	---
Alternative Therapies	4.97	3.04	---	---	---	3.24	1.96	---	---	---
Dietary Supplements	8.38	4.07	---	---	---	8.15	3.88	---	---	---
Self-reported Diet <sup>a</sup>	8.06	1.18	7.40	1.41	---	7.56	1.08	6.88	1.33	---
Canadian Fitness Survey <sup>c</sup>	521	302	---	---	---	398	295	---	---	---
Complications	---	---	---	---	15.6	---	---	---	---	33.3
Hospitalisation	---	---	---	---	12.1	---	---	---	---	27.3
Prescribed medication	---	---	---	---	21.2	---	---	---	---	33.3
Prescribed bedrest	---	---	---	---	6.1	---	---	---	---	24.2
Pain Medication Preferences	3.43	1.70	---	---	---	4.76	2.14	---	---	---
Birth Outcomes										
Natural birth	---	---	---	---	61.8	---	---	---	---	51.5
Operative birth	---	---	---	---	11.8	---	---	---	---	21.2
Caesarean section	---	---	---	---	26.5	---	---	---	---	27.3
Labour duration - hours <sup>b</sup>	---	---	18.84	21.43	---	---	---	16.06	10.0	---
Analgesia usage	---	---	4.37	2.67	---	---	---	5.19	2.41	---
Gestational Age – weeks	---	---	40.32	1.11	---	---	---	39.77	1.75	---
Apgar - One minute	---	---	8.71	0.80	---	---	---	8.69	1.00	---
Apgar - Five minutes	---	---	9.64	0.49	---	---	---	9.78	0.42	---
Birth weight (lbs)	---	---	7.67	0.80	---	---	---	7.60	1.31	---

Note: --- indicates this date was not collected or was not relevant. **a** indicates scores could range from 1 to 10 where 10 indicates best possible self rated well-being and diet. **b** excludes deliveries via caesarean section. **c** indicates average weekly physical activity antenatally.

## Section 2: Overall Performance Across Measures

Means, standard deviations and, where appropriate, frequencies were generated across measures and are presented in Table 6. For the POMS, z-scores, comparing performance to that of a normal adult female population (Nyenhuis, Yamamoto, Luchetta, Terrien, & Parmentier, 1999), are presented.

As can be seen in Table 6, the two groups performed similarly in terms of maternal mental health as measured by the POMS antenatally (Time 1) and postnatally (Time 2). On measures of maternal health and well-being, the two groups also reported similar mean levels of wellness antenatally and postnatally and reported similar utilisation of dietary supplements antenatally. While those in the yoga group reported slightly smaller social networks (antenatally and postnatally), they rated their diet as slightly better, utilised a greater number of alternative therapies and engaged in more physical activities during the course of their pregnancy than those in the non-yoga group. In addition, those in the yoga group, on average, experienced fewer complications, had fewer hospitalisations and were prescribed less medication and bedrest than those in the non-yoga group. In terms of preference for, and actual utilisation of, pain medication during labour, those in the yoga group had a preference for less pain medication and utilised less medication during their labours than those in the non-yoga group. In the yoga-group there were a higher percentage of natural births, and conversely fewer caesarean and operative births than in the non-yoga group. The groups also differed in terms of the duration of labour. Excluding participants who delivered via caesarean section, those in the yoga group were found to have longer mean labour durations. However this may be explained by two very long labours (>70 hours) among those in the yoga group. Both of these labours was associated with greater gestational age (i.e., 41 weeks) and birth weights that were heavier than the mean for the group as a whole ( $M=7.64\text{lbs}$ ,  $SD=1.07$ ), at 8.40lbs and 9lbs respectively. In addition, both women had a desire for minimum analgesia. While one woman received gas during labour and delivered via an

operative vaginal birth, the second failed to progress, had labour augmented with Pitocin and received an epidural. Finally, in terms of child outcomes, there were no notable differences between groups in terms of Apgar scores at one or five minutes. However, those in the yoga group delivered babies that were slightly heavier and at older gestational age.

### **Section 3: Between Group Comparisons**

The primary aim of this study was to compare those who participated in antenatal yoga to those who did not participate in antenatal yoga in terms of: ante and postnatal mood and levels of social supports; maternal health and physical well being; pain medication preferences; birth outcomes for mother and child; and feelings of maternal self-efficacy. In addition to examining these differences, this section examines whether change over time is significant for these measures and whether any change differed between the two groups.

#### **Maternal Mood and Levels of Social Support**

To examine mood and levels of social support, a one-way ANOVA was conducted to compare those who participated in antenatal yoga to those who did not participate in antenatal yoga across subscales of the POMS and the SNI total scores at Time 1 and Time 2. No significant differences were found between the two groups in terms of the amount of social support as measured by the SNI, or in terms of mood as measured by the POMS subscales at either time period ( $p > .05$ ).

To determine if there were significant changes in women's reported mood and social support from Time 1 to Time 2, and whether these differed between the two groups, a series of repeated measures within subjects' ANOVAs was conducted with yoga versus non-yoga as the grouping variable and POMS scales and the SNI total score as dependent variables. Significant differences were found between Time 1 and Time 2 for the whole sample on POMS scales for tension ( $F(1) = 8.221, p = .006$ ), vigour ( $F(1) = 5.205, p = .025$ ), and confusion ( $F(1) = 14.710$ ,

$p = .000$ ), as well as on the Social Network Index ( $F(1) = 7.536, p = .008$ ), with a decrease in tension and an increase in vigour, confusion and social support between Time 1 and Time 2. None of these significant differences was impacted by group membership ( $p > .05$ ).

### **Maternal Health and Physical Well-Being**

A one-way ANOVA was conducted to determine if the yoga and non-yoga groups differed significantly antenatally (Time 1) and postnatally (Time 2) on measures of: physical well-being; use of alternative therapies and physical activity (i.e., Self-reported wellness and diet, CTM - complementary practices, CTM - dietary supplements, and average weekly physical activity as measured by the CFS). Results of this analysis suggest that the two groups did differ significantly on antenatal measures of self-reported diet antenatally (Time 1) ( $F(1, 64) = 4.085, p = .047$ ) and use of complementary practices during pregnancy ( $F(1, 64) = 9.502, p = .003$ ). As can be seen in Table 3, the yoga group had a significantly higher mean score than the non-yoga group, indicating those in the yoga group reported having a better diet and reported using more complementary therapies. None of the other comparisons reached significance ( $p > .05$ ).

To determine if there were significant changes on the above variables from Time 1 to Time 2, and whether these changes differed between the two groups, a series of repeated measures within subjects' ANOVA was conducted with yoga versus non-yoga as the grouping variable and self-reported measures of wellness and diet as dependent variables. Significant differences were found between Time 1 and Time 2 measures of self-reported rating of diet ( $F(1, 69) = 20.694, p = .00$ ) and self-reported rating of wellness ( $F(1, 69) = 5.077, p = .027$ ), with both declining over time. Neither difference was impacted by group membership ( $p > .05$ ).

### **Pain Medication Preferences**

To examine pain medication preferences antenatally and analgesia utilisation during labour, a one-way ANOVA was conducted to compare those who participated in antenatal yoga to those who did not participate in antenatal yoga on the Pain Medication Preference measures at

Time 1 and Time 2. The results of the analysis indicated that the two groups differed significantly on antenatal pain medication preference, ( $F(1, 66) = 8.424, p = .005$ ), but did not differ significantly on postnatal reports of actual analgesia used ( $p > .05$ ). As can be seen in Table 3, the yoga group reported a preference for significantly less analgesia antenatally and, though not significant, used less analgesia during labour.

To determine if there were significant changes in women's preference for pain medication at Time 1 and reported use of analgesia utilised during labour at Time 2, and whether these differed between the two groups, a series of repeated measures within subjects' ANOVA was conducted with yoga versus non-yoga as the grouping variable and Pain Medication Preference measures from Time 1 and Time 2 as dependent variables. Significant differences were found between Time 1 and Time 2 measures of the Pain Medication Preference Scale ( $F(1, 66) = 4.991, p = .029$ ), with actual analgesia use during labour being higher than women's pain medication preference antenatally. This difference was not impacted by group membership ( $p > .05$ ).

### **Birth Outcomes and Maternal Self-Efficacy**

Given that birth outcomes were, for the most part, measured as categorical variables, non-parametric analyses were employed. A Mann-Whitney U test was run to examine between group differences in terms of pregnancy complications, enforced bedrest, prescribed medications during pregnancy, required hospitalisation during the pregnancy and birth type (i.e., natural, surgical, instrumental).

This analysis revealed that the two groups differed significantly in terms of the need for episiotomy ( $U = 292.500, p = .000$ ), and in terms of the need for enforced bedrest prior to the birth ( $U = 445.5, p = .041$ ). Examining the means for the two groups (See Table 3) revealed that those in the yoga group were less likely to be prescribed bedrest prior to birth and had fewer episiotomies than those in the non-yoga group. None of the other comparisons were significant ( $p > .05$ ). A Mann-Whitney U test was also run to examine between group differences on levels

of maternal self-efficacy at Time 2. However, consistent the reported means for both groups in Table 3, no significant differences were found ( $p > .05$ ).

Several birth outcomes (i.e., Apgar scores, gestational age, birth weight and duration of labour) were measured as continuous variables, and a one-way ANOVA was conducted to compare those who participated in antenatal yoga to those who did not participate in antenatal yoga across the above outcome measures at Time 2. While the means suggest no notable differences between groups in terms of Apgar scores at one and at five minutes, the yoga group delivered slightly heavier babies at older gestational age, however these between-group differences were not significant ( $p > .05$ ).

In summary, several significant differences were found between groups on measures of self-reported diet, use of complementary practices, antenatal pain medication preference, episiotomies and enforced bedrest. Those in the yoga group reported their diet as better, used a greater number of complimentary therapies, had a preference for significantly less analgesia, and were less likely to be prescribed bedrest or to need an episiotomy when compared with those in the non-yoga group. The two groups did not differ significantly on antenatal measures of social support, wellness, mood, size of social network, analgesia utilised during labour, on postnatal measure of maternal self-efficacy, Apgar scores and gestational age.

#### **Section 4: Factors Related to Better Outcomes**

Of interest here were antenatal and postnatal factors linked to birth outcomes. Birth outcomes of interest were birth type (i.e., natural, instrumental and caesarean), labour duration, and the overall well-being of the child at birth (i.e., gestational age, Apgar score, and birth weight). The association between antenatal and postnatal factors and the aforementioned birth outcomes were assessed using bivariate two tailed correlational analysis with  $\alpha$  set to .05. The following examines each of these factors in turn.

### **Interrelationship: Antenatal Factors Related to Better Birth Outcomes**

Firstly, the interrelationships between factors assessed antenatally were examined in terms of their relationship with birth outcomes. Antenatal factors of interest were: demographic characteristics; choice of lead maternity carer; maternal pain medication preferences; self-reported well-being and diet; use of complementary therapies and dietary supplements; physical activity; participation in antenatal yoga; maternal mental health; and complications, hospitalization, and medications prescribed during pregnancy. Birth outcomes of interest were: type of birth; labour duration; gestational age; birth weight; and Apgar scores.

Firstly, in terms of significant interrelations between antenatal factors and birth type, correlational analysis highlighted that self-reported diet was significantly correlated with type of birth ( $r = -.26, p=.037$ ) suggesting that women who rated their diet as good antenatally were more likely to experience a natural birth than those who were less satisfied with the quality of their diet.

In terms of the interrelationship between the aforementioned antenatal factors and the duration of labour, the analysis which follows excludes ( $N=18$ ) cases where birth type was caesarean section. Labour duration was found to be significantly correlated with use of complementary practices ( $r = .44, p=.002$ ) and with occupational type ( $r = .42, p=.003$ ) and was significantly and negatively correlated with choice of lead maternity carer ( $r = -.31, p=.003$ ). These findings indicate that women who reported using greater numbers of complementary practices were more likely to experience a longer labour duration. Participants who were employed in semi/unskilled occupations ( $M = 24.70, SD = 16.84$ ) were more likely to experience longer labours when compared with those in professional/skilled occupations ( $M = 13.83, SD = 15.53$ ). Furthermore, those who chose a midwife or a GP for their lead maternity carer were on average more likely to experience longer labours ( $M = 19.28, SD = 17.55$ ) than those who chose a specialist (e.g., OBGYN) ( $M = 8.90, SD = 8.19$ ).

Correlational analysis also highlighted a number of interrelationships between antenatal factors, birth weight and Apgar scores. Birth weight was significantly correlated with utilization of complementary practices ( $r = .37$ ,  $p=.002$ ) and consumption of dietary supplements ( $r = .28$ ,  $p=.022$ ); indicating that utilization of greater numbers of therapeutic practice and dietary supplements was associated with heavier birth weights. Birth weight was also found to be correlated with labour duration ( $r = .41$ ,  $p=.001$ ), indicating that increased birth weight was associated with longer labour duration. The one minute Apgar score was also found to be significantly associated with consumptions of dietary supplements ( $r = .33$ ,  $p=.011$ ), while the five minute Apgar score was found to be significantly associated with work status ( $r = .30$ ,  $p=.024$ ) and antenatal anger scores on the POMS ( $r = -.35$ ,  $p=.008$ ). Thus, higher Apgar scores at one minutes were associated with higher consumption of dietary supplements during pregnancy, while higher Apgar scores at five minutes were associated with lower anger/hostility antenatally and with mothers who worked part or full time ( $M = 9.79$ ,  $SD = .41$ ) than those not working or on maternity leave ( $M = 9.50$ ,  $SD = .51$ ). None of the antenatal variables assessed were found to be significantly correlated with gestational age ( $p>.05$ ).

In summary, several antenatal factors were found to be significantly correlated with birth outcomes, namely: self-reported diet, use of complimentary therapies, employment profession, and choice of lead maternity carer. Having a midwife/GP as lead maternity carer was associated with increased likelihood of experiencing a natural birth, while longer labour durations were associated with greater use of complimentary therapies, being employed in a semi/unskilled profession and choosing a midwife / GP as lead maternity carer. Heavier birth weights were associated with a greater use of therapeutic practice and dietary supplements and longer labour durations. Finally, higher one minute Apgar scores were associated with higher consumption of dietary supplements during pregnancy, while higher five minute Apgar scores were associated with lower anger/hostility and working part or full time antenatally.

### **Interrelationship: Factors Related to Better Maternal Outcomes**

The interrelationships between antenatal and birth factors and maternal outcomes are examined. Antenatal factors of interest are as listed previously, while birth factors of interest were: induction of labour; labour duration; use of analgesia; type of birth; tearing and episiotomy; gestational age, birth weight and Apgar scores. Maternal outcomes of interest were: maternal mental health; social support; maternal self-efficacy and self-reported well-being and diet.

Correlational analysis highlighted the following interrelationships between antenatal factors and maternal outcomes. Maternal self-efficacy was found to be significantly correlated with pain medication preference ( $r = -.31, p=.009$ ), the amount of yoga practised ( $r = .24, p=.047$ ), and the amount of fatigue reported on the POMS ( $r = -.26, p=.031$ ), suggesting that higher levels of maternal self-efficacy were associated with a preference for less analgesia, more frequent yoga practice and lower levels of fatigue antenatally. Social support was significantly correlated with self-reported wellness ( $r = .33, p=.004$ ), self-reported diet ( $r = .24, p=.05$ ), the amount of physical activity ( $r = .30, p=.047$ ), and the level of vigour reported antenatally ( $r = .28, p=.020$ ). These results suggest that higher levels of social support postnatally were associated with higher levels of self-reported wellness and better diet, as well as greater levels of activity and vigour antenatally. In addition, self-reported wellness and diet postnatally were found to be correlated with self-reported wellness and diet antenatally ( $r = .27, p=.05$  and  $r = .37, p=.01$  respectively).

In terms of maternal mental health postnatally, the following subscale of the POMS were associated with a number of antenatal and birth factors presented in Table 7. As can be seen in Table 7, higher levels of tension postnatally were associated with: choosing an Obstetrician or specialist as a lead maternity carer ( $M = -1.35, SD = .07$ ) compared with choosing a midwife or GP as a lead maternity carer ( $M = -1.29, SD = .09$ ); lower self-reported wellness; as well as higher levels of tension, depression, anger, confusion, fatigue, confusion and mood disturbance antenatally. The depression subscale was also found to be significantly correlated with several

POMS subscales, with higher levels of depression postnatally associated with higher levels of tension, anger, fatigue, confusion and greater mood disturbance antenatally. Similarly, elevated levels of anger postnatally were associated with elevated tension, anger, fatigue, confusion and greater mood disturbance antenatally. The vigour subscale of the POMS was found to be significantly correlated with a number of factors antenatally. Greater vigour postnatally was associated with more frequent practice of yoga, less medication prescribed during pregnancy and greater levels of vigour antenatally. Higher levels of confusion postnatally were associated with better self-reported diet, greater use of complementary therapies, as well as higher levels of depression, fatigue, confusion and greater mood disturbance antenatally. Finally, greater fatigue postnatally was associated with lower levels of self-reported wellness, as well as higher levels of tension, fatigue, confusion and total mood disturbance antenatally.

Birth factors found to be significantly correlated with maternal mental health postnatally are also presented in Table 7 and suggest that women who reported greater confusion three months postpartum were more likely to experience longer labours, and give birth to heavier babies of greater gestational age. Additionally, women who gave birth to heavier babies also reported greater depression and overall mood disturbance three months postpartum than women who had children with lower birth weight.

### **Interrelationship Between Birth Factors**

The interrelationships between birth factors of interest (i.e., induction of labour; labour duration; level of analgesia utilised; type of birth; tearing and episiotomy; gestational age, birth weight and Apgar scores) were examined. Birth type was found to be significantly correlated with labour duration ( $r = .26, p = .041$ ), analgesia usage during labour ( $r = .39, p = .001$ ), and tearing ( $r = -.50, p = .000$ ), indicating that births requiring less medical intervention (i.e., natural birth) were associated with shorter labour duration, less analgesia usage during labour and were more likely to experience tearing.

Table 7

*Antenatal and birth factors associated with maternal mental health postnatally*

<b>Postnatal Profile of Mood States</b>						
	Tension r	Depression r	Anger r	Vigour r	Confusion r	Fatigue r
<b>Antenatal Factors</b>						
Maternal age at birth	---	-.24 <sup>x</sup>	-.26 <sup>x</sup>	---	---	---
Level of education	---	---	---	---	---	---
Number of pregnancies	---	---	---	---	---	---
Occupational category <sup>a</sup>	.32 <sup>xx</sup>	.29 <sup>x</sup>	.41 <sup>xx</sup>	---	---	.37 <sup>xx</sup>
Work Status <sup>a</sup>	---	.28 <sup>x</sup>	---	---	---	---
Self Reported Wellness	-.26 <sup>x</sup>	---	---	---	-.24 <sup>x</sup>	-.72 <sup>x</sup>
Dietary Supplements	---	---	---	---	-.27 <sup>x</sup>	---
Complementary Therapies	---	---	---	---	.24 <sup>x</sup>	---
Lead Maternity Carer <sup>a</sup>	-.35 <sup>xx</sup>	---	---	---	---	---
Physical Activity	---	---	---	---	---	---
Yoga Practice - # weeks	---	---	---	.29 <sup>x</sup>	---	---
Prescribed Medication <sup>a</sup>	---	---	---	---	---	---
Prescribed bedrest <sup>a</sup>	---	---	---	---	---	---
Hospitalisation <sup>a</sup>	---	---	---	---	---	---
Complications <sup>a</sup>	---	---	---	---	---	---
POMS - Tension	.33 <sup>xx</sup>	.35 <sup>xx</sup>	.24 <sup>x</sup>	---	---	.27 <sup>x</sup>
POMS - Depression	.35 <sup>xx</sup>	.28 <sup>x</sup>	---	---	.31 <sup>xx</sup>	---
POMS - Anger	.35 <sup>xx</sup>	.35 <sup>xx</sup>	.36 <sup>xx</sup>	---	---	---
POMS - Vigour	---	---	---	.25 <sup>x</sup>	---	---
POMS - Confusion	.39 <sup>xxx</sup>	.31 <sup>xx</sup>	.29 <sup>x</sup>	---	.33 <sup>xx</sup>	.23 <sup>x</sup>
POMS - Fatigue	.34 <sup>xx</sup>	.37 <sup>xx</sup>	.28 <sup>x</sup>	---	.43 <sup>xxx</sup>	.34 <sup>xx</sup>
POMS - TMD	.32 <sup>xx</sup>	.329 <sup>x</sup>	.33 <sup>xx</sup>	---	.35 <sup>xx</sup>	.42 <sup>xxx</sup>
<b>Birth Factors</b>						
Birth Type	---	---	---	---	---	---
Labour Duration	---	---	---	---	.25 <sup>x</sup>	---
Birth weight (lbs)	---	.254 <sup>x</sup>	---	---	.32 <sup>xx</sup>	---
Gestational Age	---	---	---	---	.28 <sup>x</sup>	---
Apgar at 1 minute	---	---	---	---	---	---
Apgar at 5 minutes	---	---	---	---	---	---

--- p>.05. <sup>x</sup> p<.05. <sup>xx</sup> p<.01. <sup>xxx</sup> p<.001. <sup>a</sup> indicates categorical variables where spearman's rho was used.

Other significant associations were found between gestational age, use of analgesia ( $r = -.29$ ,  $p = .020$ ) and birth weight ( $r = .57$ ,  $p = .000$ ), suggesting that greater gestational age was associated with the utilisation of less analgesia during labour and heavier birth weights. In addition, birth weight was found to be significantly correlated with the duration of labour, ( $r = .40$ ,  $p = .001$ ), indicating that longer labours were associated with heavier birth weights. In terms of the association between Apgar scores and other birth variables, the Apgar at 1 minute was significantly correlated with tearing ( $r = -.31$ ,  $p = .022$ ), with higher 1 minute Apgar scores associated with less tearing. No significant associations were found between Apgar scores at 5 minutes.

### Section 5: The Prediction of Medical versus Natural Childbirth

In order to determine whether the variables examined in this study contribute to the prediction of medical versus natural childbirth a logistic regression was conducted with birth type (medical = caesarean or using instruments; natural = no medical instruments/surgery) as the dependent variable and the following as independent variables: participation in antenatal yoga, levels of complementary therapy utilisation, self-rating of diet, maternal age, and level of analgesia utilised during labour. These particular variables were chosen for analysis as research suggests they may influence birth outcomes, while the utilisation of complimentary therapies and the practice of antenatal yoga were also included as these may naturally combine factors associated with good maternal health (e.g., exercise, stress and pain management).

The results of this analysis indicate that natural versus medical childbirth methods was significantly predicted ( $X^2(5) = 13.171$ ,  $p = .022$ ,  $R^2 = 0.178$ ). In looking at the findings, only one variable approached significance, and this was levels of analgesia utilised during labour ( $\beta = -.250$ ,  $p = .030$ ). This finding suggests that of the variables examined, levels of analgesia utilised during labour significantly predicted natural versus medical delivery.

In order to determine whether the above was influenced by the inclusion of instrumental deliveries, the prediction of vaginal versus caesarean childbirth was then examined using logistic regression with birth type (i.e., vaginal or caesarean) as the dependent variable and the following as independent variables: participation in antenatal yoga, levels of complementary therapy utilisation, self-rating of diet, maternal age, and level of analgesia utilised during labour.

The results of this analysis indicate that vaginal versus caesarean delivery was significantly predicted ( $X^2(5) = 23.748, p = >.001, R^2 = 0.298$ ). In looking at the findings, three variables reached significance, namely: level of analgesia utilised during labour ( $\beta = -.434, p = .005$ ), self-reported diet, ( $\beta = .888, p = .012$ ), and maternal age ( $\beta = -.215, p = .033$ ). This finding suggests that of the variables examined, level of analgesia utilised during labour, self-reported diet and maternal age significantly predicted vaginal versus caesarean delivery.

## CHAPTER 6 : DISCUSSION

The primary aim of this study was to assess the effectiveness and safety of antenatal yoga for first-time mothers in New Zealand. The study investigated how first-time mothers who participated in yoga performed across a range of measures in terms of maternal mood, social support, maternal mental health, physical well-being and birth outcomes when compared with first-time mothers who did not participate in yoga. An additional aim was to attempt to predict birth type from the above measures. The results of this study should be interpreted within the context of characteristics of the sample, who were first-time mothers from the Auckland region of New Zealand. A typical yoga participant was a 34 years old Pakeha (i.e., European) New Zealander, who was married, had over 16 years education, was working antenatally either full or part-time in a professional or skilled position, and had chosen a midwife to be their lead maternity carer. In contrast, a typical participant in the non-yoga group was a 30 year old Pakeha New Zealander who was married, who had almost 16 years education, worked either full or part-time in a professional, skilled or semi-skilled position, and had chosen a midwife to be their lead maternity carer. Thus, generalisability to non-Pakeha individuals, who have lower levels of education and who are younger than 30 years of age may not be appropriate. On reflecting on the participant sample as a whole, for the most part participants in both groups were remarkably healthy and active, and as a result it could be argued that potential benefits afforded by participating in antenatal yoga would be comparatively small. It is also important to acknowledge that because this study had a non-randomised group allocation; it is possible that factors other than women's participation in antenatal yoga are responsible for differences between the two groups. Furthermore, given the poverty of research regarding the effectiveness of antenatal yoga on maternal health and wellbeing and the potential for smaller differences between the groups to be missed due to small sample size and a potential lack of power, it was decided that both

significant non-significant findings would be discussed as a means of encouraging debate and additional research in this field.

### **Effectiveness of Antenatal Yoga**

In comparing first-time mothers who participated in antenatal yoga and their non-yoga peers, several significant differences were found between the groups on measures of self-reported diet, use of complementary practices, antenatal pain medication preference, rate of episiotomy and enforced bedrest. Those in the yoga group reported their diet as better, used a greater number of complimentary therapies, had a preference for significantly less analgesia, and were less likely to be prescribed bedrest or require an episiotomy. In addition, while not statistically significant, women who participated in antenatal yoga had a higher percentage of natural births, experienced fewer complications and hospitalisations, were prescribed less medication antenatally and utilized less analgesia during labour. Furthermore, while not reaching statistical significance, yoga participants experienced longer mean labour durations, delivered babies that were slightly heavier, at older gestational age and engaged in more physical activity antenatally when compared with their non-yoga peers. While the two groups performed similarly on mean measures of maternal mental health and self-reported wellness ante and postnatally, utilisation of dietary supplements antenatally, and Apgar scores at 1 and at 5 minutes; those in the yoga group reported slightly smaller social networks ante and postnatally.

The finding that first-time mothers who participated in antenatal yoga experienced better health and wellbeing antenatally, as indicated by significantly greater utilisation of alternative therapies and greater self-reported satisfaction with diet, is in keeping with research demonstrating associations between the practice of yoga and improved self-efficacy, long term adherence to healthy behaviours (La Forge, 1997), as well as improved self-control for quitting unhealthy behaviours such as smoking (Sharma, 2007).

That the practice of antenatal yoga was associated with significantly less prescribed bedrest and (while not statistically significant) fewer complications, hospitalization and less prescribed medication, is also consistent with literature suggesting that positive maternal health and positive birth outcomes are associated with good maternal nutritional intake during pregnancy (Fowles, 2004), good maternal mental health (e.g., reduced anxiety and stress; Da Costa et al., 1999), participation in physical activity during pregnancy and cessation of unhealthy behaviours such as smoking and alcohol consumption (Parackal et al., 2007). Given the current study found the practice of yoga to be associated with greater satisfaction with diet and greater levels of physical activity (albeit a non-significant finding); and previous research has demonstrated associations between yoga practice and greater adherence to healthy behaviours (La Forge, 1997; Sharma, 2007); it is possible that the practice of yoga positively influences health via direct (e.g., physical activity) as well as indirect (e.g., improved nutritional intake) means. While it may be anticipated that women who practiced antenatal yoga and utilize a greater number of complementary therapies, would also utilize a greater number of dietary supplements antenatally when compared with their non-yoga peers; no significant differences were found between the groups on dietary supplement usage. This may be explained in part by the fact that dietary supplements, unlike many complementary therapies, may be considered mainstream; particularly given the now widespread dissemination of literature which advocates the consumption of folic acid and other vitamins and minerals to optimise the health of mother and child (Mahomed, 2000; Scholl, 2005; Viteri & Berger, 2005).

Similarly, the preference of yoga participants for significantly less analgesia antenatally and (while not-statistically significant) utilisation of less analgesia during labour when compared with their non-yoga peers, is consistent with previous research. Such research suggests that high maternal self-efficacy, linked with the practice of yoga (La Forge, 1997), is associated with lower analgesia usage during labour (Manning & Wright, 1983) and increased preference for vaginal delivery among women who previously delivered via caesarean (Dilks & Beal, 1997). In addition,

research suggests that fear of childbirth and pregnancy-related anxiety (associated with greater labour pain and need for analgesia; Alehagen et al., 2005; Lang et al., 2006; Saisto, 2001; Saisto et al., 1999), may be mediated by self-efficacy; with high self-efficacy being associated with lower pain ratings in chronic pain patients (Chong et al., 2001). Thus, it may be hypothesised that yoga may result in reduced analgesia usage during labour, mediated by increased maternal self-efficacy and less fear of labour.

The finding that first-time mothers who participated in antenatal yoga were significantly less likely to require an episiotomy has not been reported previously. Previous research suggests that exercise may mitigate the potential for severe trauma induced by episiotomy (Klein et al., 1997), and complementary practices such as antenatal perineal massage and water births have been found to lower incidences of severe laceration and episiotomy. Thus, given the association between the practice of antenatal yoga and increased complementary therapy usage, it is possible that a combination of yoga practice (as a means of exercise) and increased utilization of potentially beneficial complementary practices may result in favorable maternal outcomes (i.e., reduced risk of laceration and episiotomy).

While not statistically significant, yoga participants had a higher percentage of natural births, a finding correlated with a preference for less pain medication and utilization of less analgesia during labour. As previously hypothesized, the practice of yoga – potentially mediated by increased maternal self-efficacy and a reduction of women's fear of labour, may result in reduced analgesia usage during labour and thereby increasing chances of a natural birth. High maternal self-efficacy and reduced labour-related anxiety have been associated with increased preference for natural birth (Dilks & Beal, 1997). The practice of yoga has been proposed to reduce labour pain through physical and mental relaxation - achieved through stretching and relaxing muscles, and to provide distraction from pain and tension - through meditation and breathing practices (Vickers & Zollman, 1999). No direct evidence for this was obtained during this study and further investigation is needed. In addition, anecdotal evidence suggests that Yogic

breathing techniques may help shorten labour duration (Tournaire & Theau-Yonneau, 2007), but these claims are yet to be substantiated by scientific research. Existing literature has found associations between natural birth and a number of demographic and psychosocial factors, including reduced maternal age (Jolly et al., 2000; Luke & Brown, 2007), higher levels of education (Moran & von Bargen, 1982), and regular participation in physical activity during the first two trimesters of pregnancy (Bungum et al., 2000). Given this literature, it is interesting to note that those in the yoga group were on average four years older than those in the non-yoga group, and yet had a higher likelihood of natural birth. Advanced maternal age, particularly between the ages of 35 to 40 years, has frequently been associated with increased risk of operative vaginal delivery (1.5 times), elective Caesarean section (1.77 times) or emergency Caesarean section (1.59 times) when compared with younger women (Jolly et al., 2000). Thus, this finding suggests that the practice of antenatal yoga may reduce some of the additional risks associated with increased maternal age. Further investigation with a larger sample and with a wider age range of participants would provide added support to this possibility. Participation in regular exercise, evident in both groups in this study, has been found to ease labour and delivery (Hatch et al., 1998), while women who prepare for natural childbirth through the utilisation of natural techniques such as deep breathing, have been found to be better educated (Moran & von Bargen, 1982). Indeed, in the current study, a majority (56%) of those in the yoga group had a tertiary education, while just under one third of those in the non-yoga group had tertiary qualifications. Thus, it is possible that better education increases the likelihood of participation in antenatal yoga.

Another birth outcome, labour duration, also differed between the two groups, with those in the yoga group having longer mean labour durations. However, this difference failed to reach significance and, as previously discussed, labour duration measures included two yoga participants who had very long labours - possibly the result of delivering heavier babies. The labour duration measure also excluded caesarean deliveries, which were more prevalent among

women in the non-yoga group. In addition, recent research has found the practice of antenatal yoga to be associated with a significantly higher number of babies with birth weights of 2500 grams (5.5 lbs) or more (Narendran et al., 2005). In this study, mean birth weights were slightly higher among the yoga group; however this difference did not reach significance. Birth weight, an important determinant of newborn health and development, has been associated with antenatal social support (Feldman et al., 2000), good maternal nutrition with adequate levels of recommended vitamins and minerals (Fowles, 2004), younger maternal age (Jolly et al., 2000), and reduced anxiety and stress (Copper et al., 1996). As discussed, yoga participants in this study reported greater satisfaction with their diet compared with those in the non-yoga group, and similar levels of maternal mood and consumption of dietary supplements. They also had older maternal age. Given that advanced maternal age is a risk factor for lower birth weight, it is possible that the practice of antenatal yoga may offer additional protection against lower birth weight for first-time mothers who are older.

In terms of findings which highlighted similarities between the two groups on measures of maternal mental health and self-reported wellness ante and postnatally, there were both expected and unexpected findings. Given that a number of studies have found yoga to be an effective practice for treating mood disorders such as anxiety and depression (Netz & Lidor, 2003; Shannahoff-Khalsa, 2004; Woolery et al., 2004), it was anticipated that first-time mothers participating in yoga may experience enhanced mood during pregnancy and in the postpartum period when compared with first-time mothers not participating in antenatal yoga. No significant differences were found between the groups in terms of reported mood as measured by the POMS subscales at either time period. One explanation for the disparity between this finding and the existing literature is that prior research assessing the influence of yoga on mood has assessed samples of psychiatric populations (Shannahoff-Khalsa, 2004), mildly depressed college students (Woolery et al., 2004) and middle-aged women (Netz & Lidor, 2003). Since the current study of first-time mothers used a non-clinical sample, it may be anticipated that any changes in mood

resulting from the practice of yoga may be modest at best. In addition, research also suggests that participation in physical activity during pregnancy may help reduce symptoms of anxiety (Da Costa et al., 2003; Goodwin et al., 2000) and depression (Nordhagen & Sundgot-Borgen, 2002) as well as promoting psychological well-being (Carr, 2001; Lox & Treasure, 2000). Given that the current sample as a whole engaged in levels of physical activity which met, and in many instances exceeded, recommended activity guidelines during pregnancy, it is possible that the entire group benefited psychologically thereby reducing differences in reported mood between the groups. Indeed, this hypothesis is consistent with findings from Netz and Lidor (2003), who reported improved mood among middle-aged women who participated in a single session of either an aerobic activity such as swimming or mindful low-exertion activities such as yoga. There were also no significant differences between groups in terms of self-reported wellness, use of dietary supplements, or average weekly physical activity. However, as previously mentioned both groups engaged in relatively high levels of activity and as a result may have enjoyed comparable physical and mental health benefits which lead to similar self-reported wellness.

In terms of levels of maternal self-efficacy postpartum, no significant differences were found between groups. However, mean self-efficacy scores were found to be slightly higher among those in the yoga groups when compared with those in the non-yoga group. The practice of yoga has been proposed to improve self-efficacy and long term adherence to healthy behaviours (La Forge, 1997; Sharma, 2007), while high levels of maternal self-efficacy have been associated with reduced labour related anxiety and increased preference for natural birth (Dilks & Beal, 1997), as well as decreased medication/ analgesia use during labour (Manning & Wright, 1983). While it is hypothesised that the practice of antenatal yoga may be mediated by increased maternal self-efficacy and lead to reduced analgesia usage and lower levels of maternal anxiety, further research is warranted.

As a significant marker of infant health, the 1 and 5 minute Apgar score did not differ significantly between groups in this study. Research suggests that a number of obstetric factors,

such as vaginal breech delivery, first-time mothers, greater maternal age, and epidural analgesia, are associated with a 5 minute Apgar scores less than 7 (Thorngren-Jerneck & Herbst, 2001). While those in the yoga group utilised less analgesia during labour, and experienced a greater number of natural births, they experienced a slightly lower score at 5 minutes when compared with those in the non-yoga group. It is possible that this slightly lower 5 minute Apgar score may have been influenced by the older age of participants in the yoga group. Despite this, Apgar scores for both groups were highly favourable, with the average 5 minute Apgar score for both groups exceeding 9.6.

Significant differences were found for the sample as a whole between antenatal and postnatal measures of social network (with participants' social networks increasing postnatally). However, no significant difference was found between the two groups at either time period. Furthermore, while not statistically significant, inspection of the mean scores on the social network scale show that those in the yoga group reported slightly smaller social networks both ante and postnatally. While it was anticipated that the two groups may differ in terms of social support, with those in the yoga group potentially reporting larger social networks, the existing findings may be explained in part by the high levels of physical activity engaged by the sample as a whole. That is, the high levels of physical activity in both groups (associated with increased self-esteem, confidence and social integration; WHO, 1998), may have made the additional contribution of yoga practice (associated with greater social functioning and extravertedness; Reibel et al., 2001), less likely to be detected using the Social Network Index (Cohen et al., 1997). The two groups reported different types of social networks, with those in the yoga-group reporting greater contact with close family members other than parents, friends, schoolmates, volunteer groups, and groups without religious affiliation, while those in the non-yoga group reported greater contact with parents, parents' in-law, children, work colleagues, and religious groups. Thus, given that the Social Network Index assesses the number of social relationships in which a respondent has participated in the previous two weeks, rather than assessing the quality

or satisfaction with social supports available, it is unknown if differences existed between the two groups in terms of satisfaction with, or the quality of the social support available, and further investigation is warranted. In hindsight, use of a social support satisfaction measure, such as The Support Behaviour Inventory developed by Brown, (1986), may have provided additional information regarding satisfaction with support from “partners” and “others” support, which may have highlighted additional differences between the two groups.

### **Predicting Birth Type**

An additional aim of this study was to determine if birth type could be predicted from a range of demographic, antenatal and birth measures (i.e., participation in antenatal yoga, levels of complementary therapy utilisation, self-rating of diet, maternal age, and levels of analgesia utilised during labour). Firstly, in terms of predicting vaginal versus caesarean delivery, three variables were significant predictors of this outcome, namely, level of analgesia utilised during labour, self-reported diet and maternal age. This finding is in keep with research linking each of these variables to a variety of birth outcomes. For example, there is a substantial body of research which highlights the association between utilisation of epidural analgesia during labour and negative birth outcomes such as, prolonged labour (in itself is an indicator for operative delivery), increased risk of operative vaginal deliveries (Howell, 2000; Lieberman & O'Donoghue, 2002), and increased risk of caesarean deliveries compared with other forms of analgesia (Lieberman et al., 1996). In addition, research suggest that women with a high “willingness to accept intervention” are at increased risks of having an operative or instrumental birth (compared with women who had low scores (Green & Baston, 2007). While the association between epidural analgesia and instrumental vaginal deliveries and long labours is well established, the causal nature of the association between epidural analgesia and caesarean delivery remains open to debate (Lieberman et al., 1996) According to some researchers there is currently insufficient evidence to determine whether epidural does or does not tend to increase the risk of caesarean delivery

(Lieberman & O'Donoghue, 2002). It should also be noted here, that although the statistical methodology used in this indicates 'prediction', the causal direction of these relationships has not been established.

The finding that self-reported diet was predictive of vaginal versus caesarean delivery is consistent with research linking good nutritional intake during pregnancy, optimal gestational weight gain (GWG), good maternal health and positive birth outcomes (e.g., infant birth weight, young gestational age, and perinatal health; Fowles, 2004). In terms of the association between maternal nutrition and birth type, research has demonstrated that excessive GWG may be associated with increased risk of large infants, who in turn are more likely to be delivered to be delivered via caesarean section (Weiss et al., 2004). Literature also suggests that many pregnancy complications (e.g., abruption, toxemia, and prematurity) which result in cesarean sections, may be prevented with good maternal nutrition, which "can help [women] feel empowered and significantly increase her chances of having a vaginal birth" (Frye, 1992, p. 22). In addition, some studies have found that Vitamin D deficiency may be associated with increased odds of primary caesarean section (Merewood, Mehta, Chen, Bauchner, & Holick, 2009).

A final predictor of vaginal versus caesarean delivery was maternal age, a finding which again is consistent with a wealth of evidence linking advanced maternal age and increased rates of caesarean sections (Heffner, Elkin, & Fretts, 2003; Jolly, Sebire, Harris, Robinson, & Regan, 2000; Luke & Brown, 2007).

Again, in the prediction of natural versus medical (e.g., caesarean and instrumental deliveries), levels of analgesia utilised during labour significantly predicted natural versus medical delivery. However, in this instance, neither self-reported diet nor maternal age significantly predicted this outcome. It is notable that the inclusion of instrumental deliveries in this analysis highlighted only one variable predictive of medical versus natural birth. However, two of these variables (e.g., antenatal yoga and levels of complementary therapy utilisation) also failed to significantly predict vaginal versus caesarean childbirth (excluding instrumental deliveries). One

potential explanation is that analysis of vaginal versus caesarean birth offered a greater distinction between the groups, with this distinction being somewhat diluted when instrumental deliveries were excluded. Furthermore, while neither the practice of antenatal yoga nor levels of complementary therapy utilisation were predictive of vaginal versus caesarean or natural versus medical births; the practice of antenatal yoga was associated with: a preference for less pain medication, utilisation of less analgesia during labour, a higher percentage of natural births (fewer caesarean and operative births), slightly better self-reports of diet, greater utilisation of alternative therapies than their non-yoga peers. In addition, women who practiced antenatal yoga experienced fewer complications, had fewer hospitalisations and were prescribed less medication and bedrest than those in the non-yoga group. Thus, while not statistically significant in the current study, it is likely that the practice of yoga is associated with better birth outcomes; however the exact mechanisms through which this may be achieved is currently unknown and further exploration is warranted.

### **Clinical Implications**

While yoga has become a complementary therapy increasingly utilised by many pregnant women in the West, little is known empirically about the risks and benefits of antenatal yoga on maternal health and well-being. This study attempted to address this knowledge gap by assessing the effectiveness of antenatal yoga for first-time mothers, thereby contributing to the currently sparse literature regarding the effectiveness and safety of antenatal yoga for this population. The study found the practice of yoga to be associated with a number of benefits, most notably: lower rates of episiotomy, less prescribed bedrest antenatally, a preference for significantly less analgesia antenatally and utilization of a greater number of complementary therapies. In addition, while not statistically significant, those in the yoga group: had a higher percentage of natural births; experienced fewer complications and hospitalizations; were prescribed less medication antenatally and utilized less analgesia during labour. Also of interest, albeit not significant, yoga participants

experienced longer mean labour durations; delivered babies that were slightly heavier and at older gestational age; engaged in more physical activity antenatally, and performed similarly to their non yoga peers in terms of Apgar scores at 1 and at 5 minutes. Thus, based on findings from the study, the practice of antenatal yoga by first-time mothers in Auckland was found to be safe and associated with a number of benefits. However; before the practice of yoga can be recommended, a larger randomized control study is warranted.

Findings in the study are similar to those of Narendran et al. (2005), who found that an integrated approach of yoga therapy to be a safe practice during pregnancy, associated with heavier birth weights and lower rates of complications during pregnancy. However, the findings of the current study are generalisable to primarily Pakeha/European individuals who have high levels of education and are over the age of 30 years. Similarly, the findings from Narendran and colleagues (2005) may be limited to women of middle to upper class socioeconomic strata, who received specialist care from an obstetrician or gynaecologist, and who practice the integrated approach of yoga therapy (IAYT) one hour daily. Thus, for the findings of these studies to be generalisable to more diverse populations a multi-centre, international randomised controlled study is warranted. Such an investigation could assess the effectiveness of yoga on pregnancy and labour and delivery in first-time mothers as compared with another low-impact aerobic treatment group of pregnant walkers, and a conventional care control group of first-time mothers without a prescribed exercise assignment.

### **Strengths and Weaknesses**

A key strength of this study is that, through assessing the influence of antenatal yoga on birth outcomes for first-time mothers from Auckland, we greatly enhance our understanding of the potential benefits and risks of antenatal yoga on maternal health and well-being. This, in turn, may allow further research to assess the effectiveness of this popular form of complementary therapy more rigorously. An additional strength is the large amount of data which was collected.

In addition to assessing the frequency and intensity of antenatal yoga engaged in by first-time mothers, a wide range of antenatal and postnatal factors thought to potentially influence outcome were also assessed (i.e., maternal mood, social support, maternal mental health, physical well-being and birth outcomes). Thus, as a result, not only do results of this study highlight the potential effectiveness and safety of antenatal yoga for first-time mothers in New Zealand, they also provide a good snapshot of which activities and practices women may engage in during pregnancy and the potential influence of these activities/practices on birth outcomes.

Primary weaknesses of this research include the non-random assignment of participants to yoga and non-yoga groups. The natural history study design was chosen due to the current lack of empirical data on the safety and effectiveness of antenatal yoga. This design was deemed necessary for ethical reasons because it seemed unethical to assign participants to yoga/non-yoga groups when its safety and effectiveness had yet to be established. Furthermore, health interventions of any kind are an attempt to alter the natural history of individuals. Therefore, documenting the natural history of populations is often necessary to provide a benchmark for researchers and clinicians. Thus, there are a number of advantages associated with use of the natural history design, including its suitability in circumstances where it would be unethical to manipulate variables, while findings from natural history studies may be generalised to larger and more general populations, such as antenatal mothers in New Zealand. However, a primary disadvantage of the study design includes difficulty in assigning causality.

As highlighted above, another potential weakness of the study is that findings are only generalisable to first-time mothers who are of Pakeha/European ethnic origin, are over the age of 30 and have achieved a high level of education. However, it may also be argued that this profile is consistent with patterns and prevalence of adult yoga use in countries such the United States, where compared to their non-yoga peers, those who practiced yoga were more likely to be female, college-educated, urban dwellers, and who were more than twice as likely to be between the ages of 34 and 53 and were more than five times more likely to have used at least one other

type of complimentary or alternative therapy during their lifetime (Saper et al., 2004; Yoga Journal, 2008). Antenatal yoga classes may be less accessible outside of urban centres, with urban areas potentially attracting a greater percentage of educated females who are open to participating in research. It is therefore important that future research expands on findings from this current study by investigating the effectiveness of antenatal yoga among women from a broader ethnic and sociodemographic mix who may reside outside of the main urban centres. With this in mind, recruitment of a more diverse sample could have been achieved through ensuring dissemination of information about the study extended beyond urban centres to a greater number of lead maternity carers and community centres where yoga and other antenatal groups are held.

Finally, in terms of outcome measures, while a strength of this study was the large amount of data which measures collected, use of personality measures, such as The Freiburger Personality Inventory utilised in other yoga studies (e.g., Schell, 1994) would have been beneficial in highlighting potential differences between the group. Furthermore, while the current study did measure women's antenatal preference for and level of analgesia utilised during labour, it may have been beneficial to have included a measure of pain intensity using either a visual analogue scale or the McGill Pain Questionnaire (Melzack, 1975). It may also be argued that the wording of Pain Medication Preference Scale utilised in the study may have introduced a social desirability bias towards the negative end of the scale; particularly points 5 and 7 where the baby's benefit is brought into the statements. On reflection, it may have been prudent to rephrase such statements to reduce this potential bias.

## **Conclusion**

This study of the influence of antenatal yoga among first-time mothers in the Auckland region of New Zealand found the practice of antenatal yoga to be safe and associated with a number of benefits, namely: lower episiotomy rates, less prescribed bedrest, a preference for significantly less analgesia and utilisation of a greater number of complimentary therapies.

However, before the practice of antenatal yoga can be recommended, a larger randomized control study is warranted. Future research in this area should also investigate the influence and practice of antenatal yoga among women from socially and ethnically diverse populations, including those who reside outside of main urban centres.

*Appendix 1: Demographic Assessment Form*

Demographic Contact Form

Staff Code: \_\_\_\_\_ Client Birthday: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Intake date: \_\_\_\_/\_\_\_\_/\_\_\_\_ ID Letters: \_\_\_\_\_

1. Last name: \_\_\_\_\_ First name: \_\_\_\_\_  
2. Familiar Name: \_\_\_\_\_  
3. Date of birth: \_\_\_\_\_  
4. Address: \_\_\_\_\_ City: \_\_\_\_\_  
5. Home Phone Number: \_\_\_\_\_ Work Phone Number: \_\_\_\_\_ ext: \_\_\_\_\_  
6. Best times to be contacted: \_\_\_\_\_  
7. OK to mail to above address? Yes No  
8. OK to call home phone number? Yes No  
9. OK to leave message on home phone? Yes No  
10. OK to call work phone number? Yes No  
Long Term Contact (relative or friend not living with you)  
Last name: \_\_\_\_\_ First name: \_\_\_\_\_  
Address: \_\_\_\_\_ City: \_\_\_\_\_  
Phone Number: \_\_\_\_\_  
Relationship to long-term contact: \_\_\_\_\_  
Is long-term contact aware of your participation in this study? Yes No  
If we cannot reach you at your contact number or address, can we contact this person in order to try to reach you at your new address or phone number? Yes No

11. Are you currently employed? Full-time Part-time Not-working  
12. What is your current occupation (if not working, what was prior occupation)? \_\_\_\_\_  
13. What is the highest grade you have completed in school? \_\_\_\_\_ years  
14. Can you read and write in English? Yes No

15. What is your marital status?  
a. single  
b. married  
c. common law marriage  
d. separated  
e. divorced  
f. widowed  
g. Other

16. How would you identify your ethnic heritage?  
a. Pakeha  
b. Maori  
c. Pacific Islander  
d. Asian  
e. European  
f. African  
g. North American  
h. South American  
g. Multicultural  
Other: \_\_\_\_\_

17. Number of biological children: \_\_\_\_\_ Age(s) in years: \_\_\_\_\_  
18. Are you currently pregnant? DK No Yes If yes, # of weeks: \_\_\_\_\_  
19. Including this pregnancy, how many pregnancies have you had in your life? \_\_\_\_\_  
20. Have you ever experienced a miscarriage? DK No Yes If yes, when? \_\_\_\_\_  
21. Have you ever experienced a stillbirth? DK No Yes If yes, when? \_\_\_\_\_  
22. Have you ever experienced an abortion? DK No Yes If yes, how many? \_\_\_\_\_

23. About how often have you been drinking alcohol this month?  
\_\_\_\_ More than once a day \_\_\_\_ 1-3 times a month  
\_\_\_\_ 4-7 times a week \_\_\_\_ Less than once a month  
\_\_\_\_ 1-3 times a week \_\_\_\_ I haven't been drinking alcohol (Skip next question)

24. About how many drinks do you usually have at a time (one drink equals one pint-12 ounces- of beer, one small glass of wine, or one shot of liquor):  
\_\_\_\_ One \_\_\_\_ Six or seven  
\_\_\_\_ Two or three \_\_\_\_ Eight or more

\_\_\_Four or five

25. Which of the following best describes your experience with tobacco this month?

___I haven't ever smoked	I currently smoke:	I stopped smoking:
	___occasionally	___recently
	___less than 1/2 pack per day	___over a year ago
	___about a pack daily	
	___two or more packs daily	
	___a pipe or cigar occasionally	
	___a pipe or cigar daily	

26. Have you taken any drugs or medications in the past month?

Yes No DK

If yes, on how many days this month have you taken them? \_\_\_\_\_

27. If yes, what type(s) of drugs have you taken this month:

Marijuana or hash	Yes	No	DK
tranquillizers such as Valium, Xanax, or Ativan?	Yes	No	DK
sleeping pills in the past month?	Yes	No	DK
pain killers such as Codeine, Percodan, or Morphine?	Yes	No	DK
stimulants (uppers) such as Ritalin, speed, Dexedrine, amphetamines, meth?	Yes	No	DK
hallucinogens such as LSD, PCP, or Ecstasy in the past month?	Yes	No	DK
injection drugs such as heroin?	Yes	No	DK
solvents such as glue, paint thinner, or gasoline?	Yes	No	DK

28. On a scale from 1 (poor) to 10 (excellent), how would you rate your diet? \_\_\_\_\_

29. Is your primary care provider a:

GP  
OB-GYN  
Midwife  
Homeopath  
Naturopath  
Other

### Post-Natal Demographic Follow-up Form

Staff Code: \_\_\_\_\_ Client Birthday: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Intake date: \_\_\_\_/\_\_\_\_/\_\_\_\_ ID Letters: \_\_\_\_\_

11. Are you currently employed?      Full-time      Part-time      Not-working

12. If you did return to work, when did you return to work after the birth of your child? \_\_\_\_\_ weeks

23. About how often have you been drinking alcohol this month?  
     \_\_\_ More than once a day      \_\_\_ 1-3 times a month  
     \_\_\_ 4-7 times a week      \_\_\_ Less than once a month  
     \_\_\_ 1-3 times a week      \_\_\_ I haven't been drinking alcohol (Skip next question)

24. About how many drinks do you usually have at a time (one drink equals one pint-12 ounces- of beer, one small glass of wine, or one shot of liquor):  
     \_\_\_ One      \_\_\_ Six or seven  
     \_\_\_ Two or three      \_\_\_ Eight or more  
     \_\_\_ Four or five

25. Which of the following best describes your experience with tobacco this month?  
     \_\_\_ I haven't ever smoked      I currently smoke:      I stopped smoking:  
   \_\_\_ occasionally      \_\_\_ recently  
   \_\_\_ less tha 1/2 pack per day      \_\_\_ over a year ago  
   \_\_\_ about a pack daily  
   \_\_\_ two or more packs daily  
   \_\_\_ a pipe or cigar occasionally  
   \_\_\_ a pipe or cigar daily

26. Have you taken any drugs or medications in the past month?      Yes      No      DK  
 If yes, on how many days this month have you taken them? \_\_\_\_\_

27. If yes, what type(s) of drugs have you taken this month:

Marijuana or hash	Yes	No	DK
tranquillizers such as Valium, Xanax, or Ativan?	Yes	No	DK
sleping pills in the past month?	Yes	No	DK
pain killers such as Codeine, Percodan, or Morphine?	Yes	No	DK
stimulants (uppers) such as ritalin, speed, Dexedrine, amphetamines, meth?	Yes	No	DK
hallucinogens such as LSD, PCP, or Extasy in the past month?	Yes	No	DK
injection drugs such as heroin?	Yes	No	DK
solvents such as glue, paint thinner, or gasoline?	Yes	No	DK

28A. On a scale from 1 (poor) to 10 (excellent), how would you rate your diet? \_\_\_\_\_

28B. On a scale from 1 (poor) to 10 (excellent), how would you rate your overall wellness? \_\_\_\_\_

29. Who delivered your child?

GP
OB-GYN
Midwife
Homeopath
Naturopath
Other

**Appendix 2: Pain Medication Preference Scale**

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**Pain Medications Preference Scale**

Please circle your preference regarding the use of pain medication in labour. Choose the number that best matches your feelings.

<i>Preference</i>	<i>What It Means</i>
+10	You want to feel nothing. You desire anesthesia before labour begins.
+9	You have a fear of pain. You are concerned that you will not be able to cope. You feel dependent on staff for pain relief.
+7	You have a definite desire for anesthesia as soon in labour as the doctor allows for it, or before labour becomes painful.
+5	You desire epidural anesthesia in active labour (4-5cm). You are willing to cope until then, perhaps with narcotic medication.
+3	You desire to use some pain medication, but want as little as possible. You plan to use self-help comfort measures for part of labour.
0	No preference.
-3	You prefer that pain medications are avoided, but want medication as soon as you request it in labour.
-5	You have a strong preference to avoid pain medications, mainly for the benefit to baby & labour progress. You will accept medications for a difficult or long labour.
-7	You have a very strong desire for natural childbirth, for sense of personal gratification as well as to benefit baby and labour progress. You will be disappointed if you use medications.
-9	You want medications to be denied by staff, even if you ask for them.
-10	You want no medication whatsoever, even for cesarean delivery.

**Antenatal Pain Medications Scale**

Please circle your use of pain medication in labour. Choose the number that best matches your what happened during your labour and delivery.

<i>Preference</i>	<i>What It Means</i>
+10	I felt nothing. I had anesthesia before labour began.
+9	I had a fear of pain. I was concerned that I would not be able to cope. I felt dependent on staff for pain relief.
+7	I used anesthesia as soon in labour as the doctor allowed for it, or before labour became painful.
+5	I had an epidural anesthesia in active labour (4-5cm). I was willing to cope until then, perhaps with narcotic medication.
+3	I desired to use some pain medication, but took as little as possible. I used self-help comfort measures for part of labour.
-3	I preferred to avoid pain medications, but took medication when I requested them in labour.
-5	I strongly avoided pain medications, mainly for the benefit to baby & labour progress. I accepted medications only when labour became extremely difficult or long.
-7	I had a very strong desire for natural childbirth, for sense of personal gratification as well as to benefit baby and labour progress. I was disappointed when I used any medication, including gas.
-8	I had staff deny me medications, even if I asked for them.
-9	I did not request for any medications and did not use any medications during labour or delivery.
-10	I had no medication whatsoever, even for my cesarean delivery.

Appendix 3: Canada Fitness Survey Questionnaire

Canadian Fitness Survey-modified (1983)  
Physical Activities Check-List

Please review the following list of physical activities. Please identify the physical activities you have been involved with during your pregnancy (or since your last assessment):

Activity	If yes, average # of times per week		Average minutes per occasion
<b>Yoga</b>	Yes	No	
Type(s) of yoga, if known (Antenatal, Hatha, Ashtanga, etc...)	Yes	No	
Group	Yes	No	1-2 3-4 5 or more times For how many weeks?
Individual	Yes	No	1-2 3-4 5 or more times For how many weeks?
Antenatal group	Yes	No	1-2 3-4 5 or more times For how many weeks?
			1-2 3-4 5 or more times
<b>Tai'Chi</b>	Yes	No	
Group	Yes	No	1-2 3-4 5 or more times For how many weeks?
Individual	Yes	No	1-2 3-4 5 or more times For how many weeks?
<b>Pilates</b>	Yes	No	
Group	Yes	No	1-2 3-4 5 or more times For how many weeks?
Individual	Yes	No	1-2 3-4 5 or more times For how many weeks?
<b>Aerobics</b>	Yes	No	
For how many weeks?			1-2 3-4 5 or more times
<b>Basketball</b>	Yes	No	
For how many weeks?			1-2 3-4 5 or more times
<b>Biking</b>	Yes	No	
For how many weeks?			1-2 3-4 5 or more times

Physical Activities Check-List (continued):

<b>Breastfeeding</b> For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Child Care:</b> (dressing, holding, carrying) For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Cricket</b> For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Dancing</b> For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Gardening</b> (spading, planting, digging, weeding) For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Golfing</b> Carry/Pull Clubs	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Ride Golf Cart</b> For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more
<b>Horse Riding</b> For how many weeks?	Yes _____	No _____	1-2____3-4____5 or more times	15 or less____16-30____31-60____61 or more

Physical Activities Check-List (continued):

<b>Housework:</b>				
<b>Light:</b> Yes	No	1-2	3-4	5 or more times
(wash dishes, prepare meals, iron, vacuum, make beds, dust)				15 or less 16-30 31-60 61 or more
<b>Heavy:</b> Yes	No	1-2	3-4	5 or more times
(wash & wax floors, mow lawns, paint)				15 or less 16-30 31-60 61 or more
For how many weeks?				
<b>Ice Skating</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Jogging</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Netball</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Push-up/Sit-up</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Racquetball</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Roller Skating</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Rugby</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more
<b>Running</b> Yes	No	1-2	3-4	5 or more times
For how many weeks?				15 or less 16-30 31-60 61 or more

**Physical Activities Check-List (continued):**

<b>Snow Skiing</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____
<b>Stair Stepping</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____
<b>Swimming</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or Yes _____
<b>Tennis</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____
<b>Walking</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____
<b>Water skiing</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____
<b>Weight Training</b> For how many weeks?	Yes _____	No _____	1-2 _____	3-4 _____	5 or more times _____	15 or less _____	16-30 _____	31-60 _____	61 or more _____

*This questionnaire was modified for New Zealand from the Canadian Health Survey Checklist.*

**Appendix 4: Complementary Therapies Measure – Revised**

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**Complementary Therapies Measure**

*Many of us engage in activities and services to help ourselves, especially during pregnancy. Since becoming pregnant (or since your last visit), have you used any of the following services or supplements (please check all that apply)?*

Acupuncture	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Acupressure	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Antenatal Classes	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Aromatherapy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Biofeedback	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Chiropractic	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Colonic Irrigation	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Dance/Movement Therapy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Energy healing	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Electrochemical Current	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Folk remedies	<input type="checkbox"/> No	<input type="checkbox"/> Yes: What kind? _____ How often? _____
Guided Imagery or Relaxation Therapy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Homeopathy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Hypnosis	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Iridology	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Massage therapy/ Therapeutic Touch	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Music Therapy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Psychotherapy	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Qi Kong	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Spiritual healing or Prayer	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Other	<input type="checkbox"/> No	<input type="checkbox"/> Yes: What kind? _____ How often? _____

Have you taken any of these dietary supplements since becoming pregnant  
(or since your last visit)?

Bilberry/ blueberry	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Black Cohosh	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Castor oil	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Chapparral	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Cinnamon	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Comfrey	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Coriander	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Curry	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
DHEA	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Echinacea	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Ephedra/ ma huang	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Garlic	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Ginger	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Ginko Biloba	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Ginseng/ Ginsana	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Goldenseal	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Green Tea	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Hawthorn	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Herbal Tea	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
		Type(s): _____
Kava Kava	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Licorice	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Ma Huang	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Milk Thistle	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Peony	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Primrose Oil	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Raspberry Leaf Tea	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Saw Palmetto	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
Senna	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____
St. John's Wort	<input type="checkbox"/> No	<input type="checkbox"/> Yes: How often? _____

## Appendix 5: Profile of Mood States

Participant ID \_\_\_\_\_  
Participant Initials \_\_\_\_\_  
Date \_\_\_\_\_

### Profile of Mood States (POMS)

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in one square under the answer to the right, which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.

1. Friendly	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
2. Tense	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
3. Angry	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
4. Worn Out	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
5. Unhappy	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
6. Clearheaded	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
7. Lively	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
8. Confused	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
9. Sorry	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
10. Shaky	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
11. Listless	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
12. Peeved	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
13. Considerate	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
14. Sad	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
15. Active	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
16. On edge	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
17. Grouchy	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
18. Blue	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
19. Energetic	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
20. Panicky	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
21. Hopeless	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
22. Relaxed	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
23. Unworthy	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
24. Spiteful	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
25. Sympathetic	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
26. Uneasy	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
27. Restless	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
28. Unable to concentrate	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
29. Fatigued	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
30. Helpful	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
31. Annoyed	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
32. Discouraged	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
33. Resentful	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
34. Nervous	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
35. Lonely	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
36. Miserable	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
37. Muddled	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
38. Cheerful	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely

39. Bitter	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
40. Exhausted	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
41. Anxious	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
42. Ready to fight	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
43. Good natured	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
44. Gloomy	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
45. Desperate	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
46. Sluggish	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
47. Rebellious	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
48. Helpless	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
49. Weary	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
50. Bewildered	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
51. Alert	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
52. Deceived	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
53. Furious	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
54. Efficient	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
55. Trusting	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
56. Full of pep	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
57. Bad-tempered	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
58. Worthless	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
59. Forgetful	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
60. Carefree	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
61. Terrified	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
62. Guilty	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
63. Vigorous	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
64. Uncertain	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely
65. Bushed	<input type="checkbox"/> Not at all	<input type="checkbox"/> A little	<input type="checkbox"/> Moderately	<input type="checkbox"/> Quite a bit	<input type="checkbox"/> Extremely

**Appendix 6: Social Network Index**

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**Social Network Scale**  
(Cohen, Underwood, & Gottlieb, 2000)

Below are various kinds of social relationships. For each kind of relationship, please indicate whether you have spoken (in person or by phone) to someone in that relationship **at least once in the last two weeks**.

- |   |    |     |
|---|----|-----|
| 1. A spouse or partner.....   | NO | YES |
| 2. A parent.....  | NO | YES |
| 3. A parent-in-law.....   | NO | YES |
| 4. Child.....   | NO | YES |
| 5. Another close family member.....   | NO | YES |
| 6. A close neighbour .....  | NO | YES |
| 7. A friend.....  | NO | YES |
| 8. A workmate.....  | NO | YES |
| 9. A schoolmate .....   | NO | YES |
| 10. A fellow volunteer (e.g., charity or community work).....   | NO | YES |
| 11. A member of a group without religious affiliations<br>(e.g., social, recreational or professional group)..... | NO | YES |
| 12. A member of a religious group.....  | NO | YES |
| 13. Another first time mother.....  | NO | YES |
| 14. A healthcare provider (GP, midwife, etc).....   | NO | YES |

### Appendix 7: Maternal Self-Efficacy Scale

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#### Maternal Self-Efficacy Questionnaire

Teti and Gelfand (1985)

We want to ask you some questions about yourself and your baby. We are trying to get a general idea of how you usually handle different situations with your baby. We realize that no one is always effective or always ineffective. We all do better in some situations than in others. So I would like to have you think about some situations that all mothers encounter.

#### SOOTHABILITY

1. When your baby is upset, grizzly, or crying, how good are you at soothing him or her?

1	2	3	4
not good at all	not good enough	good enough	very good

#### UNDERSTANDING WHAT YOUR BABY WANTS

2. How good are you at understanding what your baby wants or needs? For example, do you know when your baby needs to be changed or wants to be fed?

1	2	3	4
I do not understand my baby	I understand my baby some of the time	I understand my baby most of the time	I understand my baby most of the time

#### BABY'S UNDERSTANDING OF MOTHER'S WISHES

3. How good are you at making your baby understand what you want him/her to do? For example, if you want your baby to feed or play quietly, how good are you at making him or her do that?

1	2	3	4
not good at all	not good enough	good enough	very good

#### MAINTAINING JOINT ATTENTION/INTERACTION

4. How good are you at getting your baby to pay attention to you? For example, when you want your baby to look at you, how good are you at making him or her to do it?

1	2	3	4
not good at all	not good enough	good enough	very good

#### POSITIVE RESPONSE TO AFFECTION

5. How good are you at getting your baby to have fun with you? For example, how good are you at getting your baby to smile and laugh with you?

1	2	3	4
not good at all	not good enough	good enough	very good

KNOWLEDGE OF ACTIVITIES THAT THE BABY ENJOYS

6. How good are you at knowing what activities your baby will enjoy? For example, how good are you at knowing what games and toys your baby will like to play with?

1	2	3	4
not good at all	not good enough	good enough	very good

ABILITY TO DISENGAGE

7. How good are you at keeping your baby occupied when you need to do housework? For example, how good are you at finding things for the baby when you need to do the dishes?

1	2	3	4
not good at all	not good enough	good enough	very good

DAILY ROUTINE

8. How good do you feel you are in feeding, changing, and bathing your baby?

1	2	3	4
not good at all	not good enough	good enough	very good

GLOBAL MEASURE OF EFFICACY IN MOTHERING

In general, how good a mother do you feel you are?

1	2	3	4
not good at all	not good enough	good enough	very good

***Appendix 8: Labour and Delivery Questionnaire – Modified***

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Participant initials: \_\_\_\_\_  
Participant number: \_\_\_\_\_  
Date: \_\_\_\_\_

**Labour and Delivery Questionnaire**

*All of us have unique experiences during the labour and delivery of our children. The following questions are aimed at trying to capture your recent pregnancy and childbirth experience.*

1. Baby's birthdate (d/mo/yr): \_\_\_\_\_
2. At how many weeks gestation  
did you deliver your child? \_\_\_\_\_ weeks
3. Weight \_\_\_\_\_ lbs.
4. Length \_\_\_\_\_ cms
5. Sex \_\_\_\_\_ M \_\_\_\_\_ F
6. Was a doctor, midwife, or both present at the birth?: Dr \_\_\_\_\_ M \_\_\_\_\_ B \_\_\_\_\_
7. Location of birth: Hospital \_\_\_\_\_ Birthing Center \_\_\_\_\_  
Home \_\_\_\_\_ Other (specify) \_\_\_\_\_
8. Dates of antenatal classes attended (if any): \_\_\_\_\_
9. Number of classes mother attended: \_\_\_\_\_
10. Number of classes partner attended: \_\_\_\_\_
11. How much time did you practice each week? \_\_\_\_\_ minutes
12. Any complications during your pregnancy? Y \_\_\_ N \_\_\_
13. If yes, please specify (hospitalization, hemorrhage,  
diabetes) \_\_\_\_\_
14. Were you prescribed any medications during pregnancy? Y \_\_\_ N \_\_\_
15. If yes, what medications? \_\_\_\_\_
16. Were you prescribed bedrest during your pregnancy? Y \_\_\_ N \_\_\_
17. If yes, at what week? \_\_\_\_\_
18. Were you hospitalized during your pregnancy? Y \_\_\_ N \_\_\_
19. If yes, for what reason? \_\_\_\_\_

**Labour and Birth Experience**

20. . Type of birth: Vaginal \_\_\_\_\_ Cesarean \_\_\_\_\_
21. . Was this a normal, full-term uncomplicated pregnancy? Y \_\_\_ N \_\_\_
22. If no, please explain why (e.g., baby breech position,  
cord prolapse, etc): \_\_\_\_\_
23. If the birth was by cesarean, when were you told that a cesarean  
would have to be done? \_\_\_\_\_
24. Was labour induced? Y \_\_\_ N \_\_\_

- If yes,      25. by medication to soften/ripen the cervix      Y\_\_ N\_\_  
                  26. and/or Pitocin      Y\_\_ N\_\_  
                  27. and/or castor oil      Y\_\_ N\_\_  
                  28. and/or by rupturing your membranes      Y\_\_ N\_\_

29. If membranes were ruptured, at approximately how many centimeters dilation did this occur: \_\_\_\_\_ cm

30. If labour was induced, what was the reason given for induction?  
 \_\_\_\_\_  
 \_\_\_\_\_

31. How did you know your labour had begun?  
 \_\_\_\_\_  
 \_\_\_\_\_

32. How would you describe your labour experience (from early labour to active labour)?  
 \_\_\_\_\_  
 \_\_\_\_\_

33. How long did you labour at home? \_\_\_\_\_ hours  
 34. What was the approximate length of labour? \_\_\_\_\_ hours  
 35. Time spent pushing? \_\_\_\_\_ minutes  
 36. How many hours were you in the hospital/birthing center before birth? \_\_\_\_\_ hours  
 37. What medications were given during pushing (if any)?  
 \_\_\_\_\_

38. How did you feel about these medications?  
 \_\_\_\_\_

39. Location of Birth:

Birthing room\_\_ Delivery room\_\_  
 ER\_\_ Home\_\_ Other\_\_

40. What position were you in when delivering your baby

(e.g., squat, lying on side, etc...)? \_\_\_\_\_

41. Did you use a birthing pool? Yes\_\_ No\_\_

42. Describe how you pushed. \_\_\_\_\_

43. Did you have an episiotomy (that is, an incision between vagina and anus)? Yes\_\_ No\_\_

44. Any tears to the perineum? Yes\_\_ No\_\_

45. Were forceps or a vacuum extractor used? Yes\_\_ No\_\_

46. If yes, what was the reason?  
 \_\_\_\_\_

47. Who was with you during labour? \_\_\_\_\_

48. Who was with you during birth? \_\_\_\_\_

Describe briefly the type of guidance and support that you received from the following people.

Rate the quality of their support from 1 (poor) to 10 (excellent):

49. Doctor/Midwife \_\_\_\_\_  
50. Nursing Staff \_\_\_\_\_  
51. Labour partner \_\_\_\_\_  
52. Duola \_\_\_\_\_  
53. Family \_\_\_\_\_  
54. Friends \_\_\_\_\_

55. Were you able to hold your baby immediately after birth? Yes\_\_ No\_\_

56. If yes, for how long? \_\_\_\_\_ minutes

57. Describe your feelings at ~~that~~ time?  
\_\_\_\_\_

58. Did you have rooming-in \_\_\_\_\_ Yes\_\_ No\_\_  
(that is, the baby lived in the same room with you following delivery)?

59. If rooming-in was not available, were  
you able to access your baby for frequent feedings? Yes\_\_ No\_\_

60. How are you feeding your baby? Breast\_\_ Formula\_\_ Both\_\_  
If breast feeding how did/do you feel about it?

61. How would you describe your baby after delivery (drowsy, alert,  
etc..)? \_\_\_\_\_

62. What was your baby's Apgar score after 1 minute (if known)? \_\_\_\_(1-10)

63. What was your baby's Apgar score after 5 minutes (if known)? \_\_\_\_(1-10)

64. If the baby is a boy, did you have him circumcised? Yes\_\_ No\_\_

## Appendix 9: Participant Information Sheet

DEPARTMENT OF PSYCHOLOGY



THE UNIVERSITY OF AUCKLAND  
FACULTY OF SCIENCE

Human Sciences Building  
Level 6, 10 Symonds Street  
Auckland, New Zealand  
Telephone 64 9 373 7599 ext. 88557  
Facsimile 64 9 373 7450

### PARTICIPANT INFORMATION SHEET

The University of Auckland  
Private Bag 92019  
Auckland, New Zealand

#### The influence of antenatal yoga on maternal health

Dear Participant:

Dr. Jackie Summers and colleagues are conducting a research study to look at the effect and safety of antenatal yoga on the experience of pregnancy and childbirth in first time mothers. This study will compare the experiences of first time mothers who participate in antenatal yoga to those who do not. This study aims to gain an understanding of the things you do to keep yourself healthy during and after pregnancy. You may be asked some initial screening questions regarding your background and health behaviors that may influence your pregnancy (namely, age, education, ethnic background, marital status, household income, reproductive history, current alcohol and drug use-including prescription drugs-, and information about your primary care provider for your pregnancy). During the study, you may be asked additional questions regarding your exercise activities, nutrition, mood, and social support, as well as questions about your personal experiences of pregnancy, childbirth, and mothering.

#### Study Information

- Participants in this study will be at least 12 weeks pregnant as first time mothers. All participants will be fluent in English and be at least 16 years of age.
- Study assessments will take place either at the University of Auckland or your own home. You will be free to choose the location that is most convenient for you.
- Study participation involves three separate assessments: a first assessment at intake, a second assessment after 7 months of pregnancy, and a final assessment within two months of childbirth. Each assessment will take approximately 60-90 minutes and a brief screening assessment at intake will take approximately 20-30 minutes. In total, the study will require approximately five hours of your time.
- Taking part in this study will not cost you anything. As a participant, you will be reimbursed \$10 for each completed assessment that totals \$30 for the entire study. If you would prefer not to receive any money for your participation, we are happy to make a donation to Plunkett on your behalf.
- You will not be obligated to answer any oral or written question that you do not want to and you can stop an assessment at any time. The study is interested in understanding your feelings and experience of pregnancy and childbirth. This will provide insights into the whole experience of pregnancy and childbirth from the perspective of first time mothers.

#### Benefits, Risks, Safety

- Talking about one's experiences in a supportive environment can sometimes be beneficial for people going through pregnancy and childbirth. The results of this

study may help you understand how other first time mothers experience pregnancy and childbirth and the types of decisions they make in the process.

- Indirect benefits may arise, in that a better understanding of the personal experience of first time mothers can inform the health care field about the needs and first-hand experiences of this special group of women.
- Possibly, responding to a series of study questions may cause some fatigue or distress. If so, you can stop the assessment at any time in order to take a break. Also, you have the choice not to answer any question that you are not comfortable responding to. The researchers are all trained psychologists or clinical psychologists in training and we are happy to discuss your response to the assessments and provide any referrals, if needed.

#### **Participation**

- Your participation is entirely voluntary (your choice). You do not have to take part in this study, and if you choose not to take part, you will still receive your usual healthcare.
- If you do agree to take part, you are free to withdraw from the study at any time, without giving a reason and this will in no way affect your future healthcare.
- Participation in this study will be stopped should any harmful effects appear or if any health professionals (including research team members) feel it is not in your best interest to continue.

#### **General**

- Your GP will not be informed of your participation in the study. However, you will be able to discuss the results with your health care professional if you wish.
- At the end of the study, you may discuss the outcomes of the study with the researchers &/or receive a copy of results &/or attend a community meeting at which study outcomes will be presented.

#### **Research Team Members**

- This study is being carried out by Dr. Jackie Summers, Dr. Suzanne Barker-Collo, and Dr. Linda Cameron, all lecturers at the University of Auckland Department of Psychology as well as Ms. Sharon Moore who is a doctoral student in Clinical Psychology. If you have any questions or wish to know more about the study, please contact Dr. Summers by phone or e-mail at 373-7599 ext 83794 or [j.summers@auckland.ac.nz](mailto:j.summers@auckland.ac.nz). Otherwise, contact Dr. Barker-Collo at 373-7599 ext 88517 or [s.barker-collo@auckland.ac.nz](mailto:s.barker-collo@auckland.ac.nz). Alternatively, Dr. Cameron can be contacted at 373-7599 ext 86869 or at [l.cameron@auckland.ac.nz](mailto:l.cameron@auckland.ac.nz). And finally, Ms. Sharon Moore can be reached at 373-7599 ext 84990 or electronically at [sharondee007@hotmail.com](mailto:sharondee007@hotmail.com).
- All members of the research team can be reached by mail at: Dept of Psychology, University of Auckland, Private Bag 92019, Auckland, New Zealand.

#### **Confidentiality**

- No material that may personally identify you will be used in any of the reports on this study. Personal identifying information will not be on any research forms, except for

the intake screening form. The intake screening form will be kept under lock and key in the office of Dr. Jackie Summers at all times.

- Upon acceptance into this study, you will be assigned a random number. Study assessment forms will be identified with a combination of this random number and the three initials of your name. All data will be kept strictly confidential and your privacy protected. At the completion of the study, all records will be locked away in a filing cabinet in Dr. Summers' office for up to 7 years after which time they will be shredded.

#### **Study Outcomes**

- A copy of the final report will be forwarded to all participants who request it. Additionally, a community meeting will be hosted to present study outcomes. Participants and their family members will be invited to attend the meeting if they choose to.
- A report on the research may be submitted for publication for appropriate academic publications. However, in order to protect your privacy, none of your personal identifying information will be used in any publications related to this research.

Thank you very much for considering the possibility of participating in this research. If wish to know or think you may like to participate in this study, please contact any member of the research team. We look forward to the possibility of working with you in order to learn more about the unique experiences of first time mothers during pregnancy and childbirth.

Best wishes,

Jackie Summers, PhD

Suzanne Barker-Collo, PhD

Linda Cameron, PhD

Sharon Moore, M.A.

Department of Psychology  
The University of Auckland  
Private Bag 92019  
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The Head of Department is:

Dr. Dianne McCarthy  
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Private Bag 92019  
Auckland, New Zealand  
Ph: 373-7599 extn 88555

For any queries regarding ethical concerns, please contact:  
The Chair, The University of Auckland Human Subjects Ethics Committee, the  
University of Auckland, Research Office-Office of the Vice Chancellor, Private Bag  
92109, Auckland. Ph: 373-7599 extn 87830.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN SUBJECTS ETHICS  
COMMITTEE on July 30, 2003 for a period of 3 years, from 30/07/03. Reference  
2003/063.

*Appendix 10: Participant Consent Form*

DEPARTMENT OF PSYCHOLOGY



THE UNIVERSITY OF AUCKLAND  
FACULTY OF SCIENCE

Human Sciences Building  
Level 6, 10 Symonds Street  
Auckland, New Zealand  
Telephone 64 9 373 7599 ext. 88557  
Facsimile 64 9 373 7450

The University of Auckland  
Private Bag 92019  
Auckland, New Zealand

**CONSENT FORM**

**Title of Project:** The influence of antenatal yoga on the maternal health

**Researchers:** Jackie Summers, PhD, Suzanne Barker-Collo, PhD, Linda Cameron, PhD, and Ms. Sharon Moore, M.A.

I have been given and have understood an explanation of this research project that involves participating in three assessments that consist of a series of interview questions and questionnaires. I understand that the first assessment will occur antenatally and the final assessment will occur after three months following childbirth. I have had an opportunity to ask questions and have them answered to my satisfaction.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw any information traceable to me and/or stop participation at any time without giving a reason for up to 30 days following an assessment. I understand that my participation in this study is confidential and that any material that could identify me personally will not be used in any reports on this study.

I agree to receive \$15 for each assessment. Yes No

If no, please specify which charitable organization (if any) you would like your participant fee donated. \_\_\_\_\_

I would like a summary of the research findings from the study forwarded to me once a final report is completed. Yes No

I agree to participate in this study.

Signed: \_\_\_\_\_

Name (please print clearly): \_\_\_\_\_

Date: \_\_\_\_\_

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN SUBJECTS' COMMITTEE on July 30, 2003 for a period of 3 years, from 30/07/03  
Reference: 2003/063.

*Appendix A: Participant Information Flyer*

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# **First-time Mother?**

## **Research Participants Wanted!**

What?

**Study for women who are pregnant as first time mothers**

Who are the study investigators?

**Sharon Moore BSc (hons), Drs. Jackie Summers, Linda Cameron, and Suzanne Barker-Collo of the University of Auckland, Department of Psychology.**

Who is invited to participate?

**Any women who is at least 7 months pregnant as a first time mother.**

What is involved in participation?

**Two assessments: One after the 7th month of pregnancy and one 3 months following the birth of your baby. Assessments will focus on what you do to keep yourself healthy during and after pregnancy. Questions will include a brief interview and questionnaires on mood, exercise (such as yoga, walking, gardening, etc...), labour and delivery, and your general health and well-being.**

What will I get if I participate?

**You will be compensated \$30 for participating in this study at the completion of your second assessment. You will also be invited to a community presentation on study outcomes at the completion of the study.**

Who do I contact if I am interested in participating?

**Sharon Moore (mob) 021-1458-399 or email: [yogastudy@hotmail.com](mailto:yogastudy@hotmail.com)**

## REFERENCES:

- Abou-Zahr, C. L., & Wardlaw, T. M. (2003). *Antenatal care in developing countries: promise, achievements, and missed opportunities*. Geneva: World Health Organisation, UNICEF.
- Abrams, B., Altman, S. L., & Pickett, K. E. (2000). Pregnancy weight gain: still controversial. *Am J Clin Nutr*, 71(5), 1233S-1241.
- Alehagen, S., Wijma, B., Lundberg, U., & Wijma, K. (2005). Fear, pain and stress hormones during childbirth. *Journal of Psychosomatic Obstetrics & Gynecology*, 26(3), 153-165.
- Alexander, J. M., Leveno, K. J., Hauth, J., Landon, M. B., Thom, E., Spong, C. Y., et al. (2006). Fetal injury associated with cesarean delivery. *Obstetrics and Gynecology*, 108(4), 885-890.
- Allen, R. E., & Hanson, R. W., Jr. (2005). Episiotomy in Low-Risk Vaginal Deliveries. *The Journal of the American Board of Family Practice*, 18(1), 8-12.
- Allen, V. M., O'Connell, C. M., Liston, R. M., & Baskett, T. F. (2003). Maternal morbidity associated with cesarean delivery without labor compared with spontaneous onset of labor at term. *Obstetrics & Gynecology*, 102(3), 477-482.
- Almeida, E. C. S., Nogueira, A. A., Candido dos Reis, F. J., & Rosa e Silva, J. C. (2002). Cesarean section as a cause of chronic pelvic pain. *International Journal of Gynecology & Obstetrics*, 79(2), 101-104.
- Alran, S., Sibony, O., Oury, J.-F., Luton, D., & Blot, P. (2002). Differences in management and results in term-delivery in nine European referral hospitals: descriptive study. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 103(1), 4-13.
- Althabe, F., Belizan, J. M., & Bergel, E. (2002). Episiotomy rates in primiparous women in Latin America: hospital based descriptive study. *BMJ*, 324(7343), 945-946.
- American Academy of Pediatrics, C. o. F. a. N., & American College of Obstetricians and Gynecologists, a. C. o. O. P. (2006). The Apgar Score. *Pediatrics*, 117(4), 1444-1447.

- American College of Obstetricians and Gynecologists, A. (1993). Pain relief during labor :  
ACOG committee opinion: Committee on obstetrics: Maternal and fetal medicine  
number 118 -- January 1993. *International Journal of Gynecology & Obstetrics*, 42(1), 73.
- American College of Obstetricians and Gynecologists, A. (1996). Induction of labor. *International  
Journal of Gynecology & Obstetrics*, 53(1), 65-72.
- American College of Obstetricians and Gynecologists, A. (2001a). ACOG practice bulletin  
Operative Vaginal Delivery. *International Journal of Gynecology & Obstetrics*, 74(1), 69-76.
- American College of Obstetricians and Gynecologists, A. (2001). *Evaluation of cesarean delivery*.  
Washington, DC: ACOG.
- American College of Obstetricians and Gynecologists, A. (2001b). Labour induction. *ACOG  
Education Pamphlet AP154* Retrieved 15th May, 2007, from  
[http://www.acog.org/publications/patient\\_education/bp154.cfm](http://www.acog.org/publications/patient_education/bp154.cfm)
- American College of Obstetricians and Gynecologists, A. (2003). Exercise during pregnancy.  
*ACOG Education Pamphlet AP119* Retrieved 5th July, 2007, from  
[http://www.acog.org/publications/patient\\_education/bp119.cfm](http://www.acog.org/publications/patient_education/bp119.cfm)
- American College of Obstetricians and Gynecologists, A. (2005). ACOG Committee Opinion  
#315: Obesity in Pregnancy. *Obstet Gynecol*, 106(3), 671-675.
- American College of Obstetricians and Gynecologists, A. (2006). ACOG Practice Bulletin No.  
71: Episiotomy. *Obstetrics & Gynecology*, 107(4), 956-962.
- American College of Obstetricians and Gynecologists, Opinion, No. 267. (2002). Exercise during  
pregnancy and the postpartum period. *Obstetrics and gynecology*, 99, 171-173.
- Amis, D., & Green, J. (2007). *Prepared childbirth the family way* (Sixth Edition ed.). Plano, Texas: The  
Family Way Publications, Inc.
- Ananth, C. V., Savitz, D. A., & Luther, E. R. (1996). Maternal cigarette smoking as a risk factor  
for placental abruption, placenta previa, and uterine bleeding in pregnancy. *American  
Journal of Epidemiology*, 144(9), 881-889.

- Anim-Somuah, M., Smyth, R., & Howell, C. (2007). Epidural versus non-epidural or no analgesia in labour. [Systematic Review]. *Cochrane Database of Systematic Reviews*, 2.
- Armson, B. A. (2007). Is planned cesarean childbirth a safe alternative? *CMAJ*, 176(4), 475-476.
- Arnstein, P., Caudill, M., Mandle, C. L., Norris, A., & Beasley, R. (1999). Self efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. *Pain*, 80(3), 483-491.
- Asgharnia, M., & Esmailpour, N. (2005). Fetal laceration injury during cesarean delivery. *Journal of Research in Medical Sciences*, 10(6), 391-394.
- Autti-Ramo, I. (2000). Twelve year follow-up of children exposed to alcohol in utero. *Developmental Medicine and Child Neurology*, 42(6), 406-411.
- Avery, M. D., & Van Arsdale, L. (1987). Perineal massage Effect on the incidence of episiotomy and laceration in a nulliparous population. *Journal of nurse-midwifery*, 32(3), 181-184.
- Bacon, J., T., D., Donner, L., Ginsburg, L., Katherine, W., Medeves, J., et al. (2003). *Executive report of the Ontario maternity care expert panel: Emerging crisis, emerging solutions. Appendix J – Glossary and Key Concepts*. Ontario: Ontario Women's Health Council.
- Bager, P., Melbye, M., Rostgaard, K., Stabell Benn, C., & Westergaard, T. (2003). Mode of delivery and risk of allergic rhinitis and asthma. *Journal of Allergy and Clinical Immunology*, 111(1), 51-56.
- Bailey, L. (2004). Yoga. In S. Loue & M. Sajatovic (Eds.), *Encyclopaedia of Women's Health* (pp. 689-690): Springer US.
- Balaskas, J. (1994). *Preparing for Birth with Yoga: Exercises for Pregnancy and Childbirth*: Element Books Ltd.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122-147.
- Barker-Collo, S. (2003). Culture and validity of the Profile of Mood States in a New Zealand student sample. *Journal of cultural diversity and ethnic minority psychology*, 9(2), 185-196.

- Barrera, M., Jr., Toobert, D. J., Angell, K. L., Glasgow, R. E., & MacKinnon, D. P. (2006). Social Support and Social-ecological Resources as Mediators of Lifestyle Intervention Effects for Type 2 Diabetes. *J Health Psychol*, 11(3), 483-495.
- Baumgardner, D. J., Muehl, P., Fischer, M., & Pribbenow, B. (2003). Effect of Labor Epidural Anaesthesia on Breast-Feeding of Healthy Full-Term Newborns Delivered Vaginally. *Journal of the American Board of Family Practice*, 16(1), 7-13.
- Beinder, E., Huch, A., & Huch, R. (1990). Peripheral skin temperature and microcirculatory reactivity during pregnancy. A study with thermography. *Journal of Perinatal Medicine*, 118(5), 383-390.
- Bell, R., & O'Neill, M. (1994). Exercise and pregnancy: a review. *Birth*, 21(2), 85-95.
- Benedetto, C., Marozio, L., Prandi, G., Roccia, A., Blefari, S., & Fabris, C. (2007). Short-term maternal and neonatal outcomes by mode of delivery: A case-controlled study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 135(1), 35-40.
- Bennett, V. R., & Brown, L. K. (1999). *Myles textbook for midwives* (13th ed.). London: Churchill Livingstone.
- Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, 51(6), 843-857.
- Bert, N. U. (2006). Social Support and Health: A Review of Physiological Processes Potentially Underlying Links to Disease Outcomes. *Journal of Behavioral Medicine*, 29(4), 377-387.
- Blanchette, H. (1995). Comparison of obstetric outcome of a primary-care access clinic staffed by certified nurse-midwives and a private practice group of obstetricians in the same community. *American Journal of Obstetrics and Gynecology*, 172(6), 1864-1871.
- Boyce, P. M., & Todd, A. L. (1992). Increased risk of postnatal depression after emergency caesarean section. *The Medical Journal of Australia*, 157(3), 172-174.

British Medical Association [BMA]. (2008). BMA Scotland Briefing: Getting the best start in life.

Retrieved 12th November, 2008, from

[http://www.bma.org.uk/health\\_promotion\\_ethics/child\\_health/gettingbeststartinlife.jsp?page=1](http://www.bma.org.uk/health_promotion_ethics/child_health/gettingbeststartinlife.jsp?page=1)

Brown, M. A. (1986). Social support during pregnancy: A unidimensional or multidimensional construct? *Nursing Research*, 35, 4-9.

Brown, S., & Lumley, J. (1998). Maternal health after childbirth: results of an Australian population based survey. *British Journal of Obstetrics & Gynaecology*, 105(2), 156-161.

Buist, R., Brown, J., & McNamara, T. (1999). For whom is the Caesarean section rate high? *New Zealand Medical Journal*, 112(1101), 469-471.

Bungum, T. J., Peaslee, D. L., Jackson, A. W., & Perez, M. A. (2000). Exercise During Pregnancy and Type of Delivery in Nulliparae *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 29(3), 258-264.

Burrows, L. J., Meyn, L. A., & Weber, A. M. (2004). Maternal Morbidity Associated With Vaginal Versus Cesarean Delivery. *Obstet Gynecol*, 103(5), 907-912.

Butte, N. F., Ellis, K. J., Wong, W. W., Hopkinson, J. M., & Smith, E. O. (2003). Composition of gestational weight gain impacts maternal fat retention and infant birth weight. *American Journal of Obstetrics and Gynecology*, 189(5), 1423-1432.

Byrd, L. M., Hobbiss, J., & Tasker, M. (2005). Is it possible to predict or prevent third degree tears? *Colorectal Disease*, 7(4), 311-318.

Cakmak, H., & Kuguoglu, S. (2007). Comparison of the breastfeeding patterns of mothers who delivered their babies per vagina and via cesarean section: an observational study using the LATCH breastfeeding charting system. [Comparative Study]. *International Journal of Nursing Studies*, 44(7), 1128-1137.

Canada Fitness Survey. (1983). *Fitness and Lifestyle in Canada*. Ottawa.

- Canadian Institute for Health Information (CIHI) (2004). Giving Birth in Canada: Providers of Maternity and Infant Care. *Journal*, 53. Retrieved from [http://secure.cihi.ca/cihiweb/products/GBC2004\\_report\\_ENG.pdf](http://secure.cihi.ca/cihiweb/products/GBC2004_report_ENG.pdf)
- Carlson, L. E., Specia, M., Patel, K. D., & Goodey, E. (2004). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. *Psychoneuroendocrinology*, 29, 448-474.
- Carmichael, S. L., & Abrams, B. (1997). A critical review of the relationship between gestational weight gain and preterm delivery. *Obstet Gynecol*, 89(5), 865-873.
- Carr, H. (2001). *Physical activity and health*. Hillary Commission for Sport, Fitness and Leisure.
- Casey, B. M., McIntire, D. D., & Leveno, K. J. (2001). The Continuing Value of the Apgar Score for the Assessment of Newborn Infants. *N Engl J Med*, 344(7), 467-471.
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126-131.
- Caton, D., Corry, M. P., Frigoletto, F. D., Hopkins, D. P., Lieberman, E., Mayberry, L., et al. (2002). The nature and management of labor pain: Executive summary. *American Journal of Obstetrics and Gynecology*, 186(5), S1-S15.
- Centers for Disease Control and Prevention, C. (2004). Alcohol Consumption Among Women Who Are Pregnant or Who Might Become Pregnant --- United States, 2002. *Morbidity and Mortality Weekly Report*, 53(50), 1178-1181.
- Challis, J. R., Matthews, S. G., Van Meir, C., & Ramirez, M. M. (1995). Current topic: The placental corticotrophin-releasing hormone–adrenocorticotrophin axis. *Placenta*, 6(16), 481–502.
- Chamberlain, G., & Morgan, M. (2002). Normal antenatal management. In G. Chamberlain & M. Morgan (Eds.), *ABC of Antenatal Care* (Vol. 4th, pp. 9 - 16). London: BMJ Books.

- Chestnut, D. H., McGrath, M. J., Vincent, R. D., Penning, D. H., Choi, W. W., Bates, J. N., et al. (1994). Does early administration of epidural analgesia affect obstetric outcome in nulliparous women who are in spontaneous labor? *Anesthesiology*, 80(6), 1201-1208.
- Cheung, W., Ip, W. Y., & Chan, D. (2006). Maternal anxiety and feelings of control during labour: A study of Chinese first-time pregnant women. *Midwifery*.
- Chong, G. S., Cogan, D., Randolph, P., & Racz, G. (2001). Chronic Pain and Self-efficacy: The Effects of Age, Sex, and Chronicity. *Pain Practice*, 1, 338-343.
- Chou, F. H., Lin, L. L., Cooney, A. T., Walker, L. O., & Riggs, M. W. (2003). Psychosocial factors related to nausea, vomiting, and fatigue in early pregnancy. *Journal of Nursing Scholarship*, 35(2).
- Chrousos, G. P. (1998). Stressors, Stress, and Neuroendocrine Integration of the Adaptive Response: The 1997 Hans Selye Memorial Lecture. *Annals of the New York Academy of Sciences*, 851(1), 311-335.
- Clapp, J. (1991). The changing thermal responses to endurance exercise during pregnancy. *American Journal of Obstetrics and Gynaecology*, 165, 1684-1689.
- Clapp, J., & Little, K. (1995). The interaction between regular exercise and selected aspects of women's health. *American Journal of Obstetrics and Gynecology*, 173(1), 2-9.
- Clapp, J. F., & Capeless, E. L. (1990). Neonatal morphometrics after endurance exercise during pregnancy. *American Journal of Obstetrics & Gynecology*, 163(1), 1805-1811.
- Clay, C. C., Lloyd, L. K., Walker, J. L., Sharp, K. P., & Pankey, R. B. (2005). The metabolic cost of hatha yoga. *Journal of Strength & Conditioning Research*, 19(3), 604-610.
- Clement, S. (2001). Psychological aspects of caesarean section. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 15(1), 109-126.
- Cohen, L., Warneke, C., Fauladi, R. T., Rodriguez, M. A., & Chaoul-Reich, A. (2004). Psychological adjustment and sleep quality in a randomized trial of the effects of a Tibetan yoga intervention in patients with lymphoma. *Cancer*, 100(10), 2253-2260.

- Cohen, S. (1992). Stress, social support and disorder. In H. Veiel & U. Baumann (Eds.), *The meaning and measurement of social support*. New York: Hemisphere Press.
- Cohen, S., Doyle, W. J., Skoner, D. P., Rabin, B. S., & Gwaltney, J. M. (1997). Social ties and susceptibility to the common cold. *Journal of the American Medical Association*, 277(24), 1940-1944.
- Coleman, P. K., & Karraker, K. H. (2003). Maternal self-efficacy beliefs, competence in parenting, and toddlers' behavior and developmental status. *Infant Mental health Journal*, 24(2), 126-148.
- Coleman, T. (2004). ABC of smoking cessation: Special groups of smokers. *British Medical Journal*, 328(7439), 575-577.
- Collins, C. (1998). Yoga: Intuition, Preventive Medicine, and Treatment  
doi:10.1111/j.1552-6909.1998.tb02623.x. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, 27(5), 563-568.
- Collins, N. L., Dunkel-Schetter, C., Lobel, M., & Scrimshaw, S. C. M. (1993). Social Support in Pregnancy: Psychosocial Correlates of Birth Outcomes and Postpartum Depression. *Journal of Personality & Social Psychology*, 65(6), 1243-1258.
- Copper, R. L., Goldenberg, R. L., Das, A., Elder, N., Swain, M., Norman, G., et al. (1996). Obstetrics: The preterm prediction study: Maternal stress is associated with spontaneous preterm birth at less than thirty-five weeks' gestation. *American Journal of Obstetrics & Gynecology*, 175(5), 1286-1292.
- Cosans, C. (2004). The meaning of natural childbirth. *Perspectives in Biology & Medicine*, 47(2), 266-272.
- Cover, H., & Irwin, M. (1994). Immunity and Depression: Insomnia, retardation and reduction of natural killer cell activity. *Journal of Behavioral Medicine*, 17(2), 217-223.
- Crane, J. M. G. (2006). Factors predicting labor induction success: a critical analysis. *Clinical Obstetrics & Gynecology*, 49(3), 573-584.

- Crocetti, E., Crotti, N., Feltrin, A., Ponton, P., Geddes, M., & Buiatti, E. (1998). The use of complementary therapies by breast cancer patients attending conventional treatment. *European Journal of Cancer*, 34(3), 324-328.
- Crowe, K., & Baeyer, C. (1989). Predictors of a Positive Childbirth Experience. *Birth*, 16(2), 59-63.
- Cyna, A. M., McAuliffe, G. L., & Andrew, M. I. (2004). Hypnosis for pain relief in labour and childbirth: a systematic review. *Br. J. Anaesth.*, 93(4), 505-511.
- Da Costa, D., Larouche, J., Dritsa, M., & Brender, W. (1999). Variations in stress levels over the course of pregnancy: factors associated with elevated hassles, state anxiety and pregnancy-specific stress. *Journal of Psychosomatic Research*, 47(6), 609-621.
- Da Costa, D., Rippen, N., Dritsa, M., & Ring, A. (2003). Self-reported leisure time physical activity during pregnancy and relationship to psychological well-being. *Journal of Psychosomatic Obstetrics & Gynecology*, 24, 111-119.
- Davey Smith, G., Hypponen, E., Power, C., & Lawlor, D. A. (2007). Offspring Birth Weight and Parental Mortality: Prospective Observational Study and Meta-Analysis. *Am. J. Epidemiol.*, kwm054.
- Davies, G. A., Wolfe, L. A., Mottola, M. F., MacKinnon, C., SOGC, & Committee., S. C. P. O. (2003). Joint SOGC/CSEP clinical practice guideline: exercise in pregnancy and the postpartum period. *Canadian Journal of Applied Physiology*, 28(3), 330-341.
- Demissie, K., Rhoads, G. G., Smulian, J. C., Balasubramanian, B. A., Gandhi, K., Joseph, K. S., et al. (2004). Operative vaginal delivery and neonatal and infant adverse outcomes: population based retrospective analysis. *BMJ*, 329(7456), 24-.
- Dilks, F. M., & Beal, J. A. (1997). Role of self-efficacy in birth choice. *Journal of Perinatal & Neonatal Nursing*, 11(1), 1-9.
- Dorland, W. A. (2000). Dorland's illustrated medical dictionary In W. B. Saunders (Ed.) (30th ed.). London: W. B. Saunders.

- Dye, T. D., Knox, K. L., Artal, R., Aubry, R. H., & Wojtowycz, M. A. (1997). Physical activity, obesity, and diabetes in pregnancy. *American Journal of Epidemiology*, 146(11).
- Ebrahim, S. H., & Gfroerer, J. (2003). Pregnancy-related substance use in the United States during 1996-1998. *Obstetrics & Gynecology*, 101(2), 374-379.
- Ecker, J. L. (2004). Once a pregnancy, always a cesarean? Rationale and feasibility of a randomized controlled trial. *American Journal of Obstetrics and Gynecology*, 190(2), 314-318.
- Ellen, E. S. (2007). Oxford concise colour medical dictionary (4th ed.). New York Oxford University Press.
- Eltzschig, H. K., Lieberman, E. S., & Camann, W. R. (2003). Regional Anesthesia and Analgesia for Labor and Delivery. *N Engl J Med*, 348(4), 319-332.
- Engebretson, J. (2002). Culture and complementary therapies. *Complementary Therapies in Nursing and Midwifery*, 8(4), 177-184.
- Ezmerli, N. M. (2000). Exercise in pregnancy. *Primary Care Update for OB/GYNs*, 7(6).
- Feldman, P., Dunkel-Schetter, C., Sandman, C. A., & Wadhwa, P. (2000). Maternal social support predicts birth weight and fetal growth in human pregnancy. *Psychosomatic Medicine*, 62(5), 715-725.
- Fergusson, D. M., Horwood, L. J., & Northstone, K. (2002). Maternal use of cannabis and pregnancy outcome. *BJOG: An International Journal of Obstetrics and Gynaecology*, 109(1), 21-27.
- Feuerstein, G. (2002). *The yoga tradition: its history, literature, philosophy and practise*. Delhi: Motilal Banarsidass
- Field, A. P. (2005). *Discovering statistics using SPSS for Windows* (2nd ed.). London: Sage.
- Fisher, J., Astbury, J., & Smith, A. (1997). Adverse psychological impact of operative obstetric interventions: A prospective longitudinal study. *Aust NZ J Psychiatry*, 31, 728-738.
- FitzGerald, M., Weber, A., Howden, N., Cundiff, G., & Brown, M. (2007). Risk Factors for Anal Sphincter Tear During Vaginal Delivery. *Obstetrics & Gynecology*, 109(1), 29-34.

- Flamm, B. L. (2000). Cesarean section: a worldwide epidemic? *Birth*, 27(2), 139-140.
- Fleming, P., & Blair, P. S. (2007). Sudden Infant Death Syndrome and parental smoking. *Early Human Development*, 83(11), 721-725.
- Flood, G. (1996). *An Introduction to Hinduism* New York: Cambridge University Press.
- Folsom, A. R., Jacobs, D. R., Caspersen, C. J., Gomez-Marin, O., & Knudsen, J. (1986). Test-retest reliability of the Minnesota Leisure Time Physical Activity Questionnaire. *Journal of Chronic Diseases*, 39(7), 505-511.
- Ford, R., Tappin, D., Schluter, P., & Wild, C. (1997). Smoking during pregnancy: how reliable are maternal self reports in New Zealand? *J Epidemiol Community Health*, 51(3), 246-251.
- Fowles, E. R. (2004). Prenatal Nutrition and Birth Outcomes. *JOGNN - Journal of Obstetric, Gynecologic, & Neonatal Nursing*, 33, 809-822.
- Gamble, J. A., & Creedy, D. K. (2000). Women's request for a cesarean section: a critique of the literature.[see comment]. *Birth*, 27(4), 256-263.
- Gamble, J. A., & Creedy, D. K. (2001). Women's Preference for a Cesarean Section: Incidence and Associated Factors. *Birth*, 28, 101-110.
- Gaur, S. D. (2001). *Chronic Pain and Yoga: A Study* Paper presented at the American Psychiatric Association Annual Meeting.
- Gaur, S. D. (2002, 2002). Yoga For Your Pain. Retrieved 19th July, 2007, from <http://www.wchstv.com/newsroom/healthyforlife/1863.shtml#transcript>
- Geary, M., Fanagan, M., & Boylan, P. (1997). Maternal satisfaction with management in labour and preference for mode of delivery. *Journal of Perinatal Medicine*, 25(5), 433-439.
- Gemma, S., Vichi, S., & Testai, E. (2007). Metabolic and genetic factors contributing to alcohol induced effects and fetal alcohol syndrome. *Neuroscience & Biobehavioral Reviews*, 31(2), 221-229.
- Gibson, P. S., & Powrie, R. (2001). Herbal and alternative medicine use during pregnancy: a cross sectional survey. *Obstetrics and Gynecology*, 97(4), 45S.

- Gilbert, W. M., Nesbitt, T. S., & Danielsen, B. (1999). Childbearing beyond age 40: pregnancy outcome in 24,032 cases. *Obstetrics & Gynecology*, 93(1), 9-14.
- Gilliam, M., Rosenberg, D., & Davis, F. (2002). The likelihood of placenta previa with greater number of cesarean deliveries and higher parity. *Obstetrics & Gynecology*, 99(6), 976-980.
- Gjerdingen, D. K., Froberg, D. G., & Fontaine, P. (1991). The effects of social support on women's health during pregnancy, labor and delivery, and the postpartum period. [Review]. *Family Medicine*, 23(5), 370-375.
- Goer, H. (2001). The case against elective cesarean section. *Journal of Perinatal & Neonatal Nursing*, 15(3), 23-38.
- Gomar, C., & Fernandez, C. (2000). Epidural analgesia-anaesthesia in obstetrics. *European Journal of Anaesthesiology*, 17(9), 542.
- Goodman, P., Mackey, M. C., & Tavakoli, A. S. (2004). Factors related to childbirth satisfaction. *Journal of Advanced Nursing*, 46(2), 212-219.
- Goodwin, A., Astbury, J., & McMeeken, J. (2000). Body image and psychological well-being in pregnancy. A comparison of exercisers and non-exercisers. *Australian & New Zealand Journal of Obstetrics & Gynaecology*, 40(4), 442-447.
- Goransson, M., Magnusson, A., Bergman, H., Rydberg, U., & Heilig, M. (2003). Fetus at risk: prevalence of alcohol consumption during pregnancy estimated with a simple screening method in Swedish antenatal clinics. *Addiction*, 98(11), 1513-1520.
- Gortmaker, S. L. (1979). The effect of prenatal care upon the health of the newborn. . *American Journal of Public Health*, 69, 653-660.
- Govindji. (2006). *Yoga: The body the mind and the devine* (1st ed.). India: Dee Bee Info Publications.
- Graham, Carroli, G., Davies, C., & Medves, J. M. (2005). Episiotomy Rates Around the World: An Update. *Birth*, 32(3), 219-223.

- Graham, W. J., Hundley, V., McCheyne, A. L., Hall, M. H., Gurney, E., & Milne, J. (1999). An investigation of women's involvement in the decision to deliver by caesarean section. *BJOG: An International Journal of Obstetrics and Gynaecology*, 106(3), 213-220.
- Granath, J., Ingvarsson, S., von Thiele, U., & Lundberg, U. (2006). Stress management: a randomized study of cognitive behavioural therapy and yoga. *Cognitive Behaviour Therapy*, 35(1), 3-10.
- Green, J. M., Coupland, V. A., & Kitzinger, J. V. (1998). *Great Expectations: A Prospective Study of Women's Expectations and Experiences of Childbirth*. Cheshire, England: Books for Midwives Press.
- Gross, D., Conrad, B., Fogg, L., & Wothke, W. (1994). A longitudinal model of maternal self-efficacy, depression, and difficult temperament during toddlerhood. *Research in Nursing and Health*, 17, 207-215.
- Groutz, A., Rimon, E., Peled, S., Gold, R., Pauzner, D., Lessing, J. B., et al. (2004). Cesarean section: Does it really prevent the development of postpartum stress urinary incontinence? a prospective study of 363 women one year after their first delivery. *Neurourology and Urodynamics*, 23(1), 2-6.
- Grussu, P., Quatraro, R. M., & Nasta, M. T. (2005). Profile of Mood States and parental attitudes in motherhood: comparing women with planned and unplanned pregnancies. *Birth*, 32(2), 107-114.
- Gunderson, E. P., & Abrams, B. (2000). Epidemiology of gestational weight gain and body weight changes after pregnancy. *Epidemiologic Reviews*, 22(2), 261-274.
- Hakansson, S., & Kallen, K. (2003). Caesarean section increases the risk of hospital care in childhood for asthma and gastroenteritis. *Clinical & Experimental Allergy*, 33(6), 757-764.
- Hall, M., & Bewley, S. (1999). Maternal mortality and mode of delivery. *Lancet*, 354, 776-776.
- Hamilton, B. E., Martin, J. A., & Ventura, S. J. (2006). *Births: Preliminary Data for 2005*: Health E-Stats.

- Hammoud, A. O., Bujold, E., Sorokin, Y., Schild, C., Krapp, M., & Baumann, P. (2005). Smoking in pregnancy revisited: Findings from a large population-based study. *American Journal of Obstetrics and Gynecology*, 192(6), 1856-1862.
- Hannah, M. E., Hannah, W. J., Hewson, S. A., Hodnett, E. D., Saigal, S., & Willan, A. R. (2000). Planned caesarean section versus planned vaginal birth for breech presentation at term: A randomised multicentre trial. Term Breech Trial Collaborative Group. *Lancet*, 356, 1375–1383.
- Hannah, M. E., Whyte, H., Hannah, W. J., Hewson, S., Amankwah, K., Cheng, M., et al. (2004). Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: The international randomized Term Breech Trial. *American Journal of Obstetrics and Gynecology*, 191(3), 917-927.
- Hartmann, K., Viswanathan, M., Palmieri, R., Gartlehner, G., Thorp, J., Jr., & Lohr, K. N. (2005). Outcomes of Routine Episiotomy: A Systematic Review. *JAMA*, 293(17), 2141-2148.
- Hatch, M. C., Levin, B., Shu, X. O., & Susser, M. (1998). Maternal leisure-time exercise and timely delivery. *American Journal of Public Health*, 88(10), 1528-1533.
- Health Canada. (2005). Dietary reference intake (pp. 13).
- Hemminki, E., & Merilainen, J. (1996). Long-term effects of cesarean sections: Ectopic pregnancies and placental problems. *American Journal of Obstetrics and Gynecology*, 174(5), 1569-1574.
- Henderson, J., Gray, R., & Brocklehurst, P. (2007). Systematic review of effects of low-moderate prenatal alcohol exposure on pregnancy outcome. *BJOG: An International Journal of Obstetrics & Gynaecology*, 114(3), 243-252.
- Herbst, M. A., Mercer, B. M., Beazley, D., Meyer, N., & Carr, T. (2003). Relationship of prenatal care and perinatal morbidity in low-birth-weight infants. *American Journal of Obstetrics & Gynecology*, 189(4), 930-933.

- Hermida, R. C., Ayala, D. E., Mojon, A., Fernandez, J. R., Alonso, I., Silva, I., et al. (2000). Blood pressure patterns in normal pregnancy, gestational hypertension, and preeclampsia. *Hypertension*, 36(2), 149-158.
- Hickey, C. A., Cliver, S. P., McNeal, S. F., Hoffman, H. J., & Goldenberg, R. L. (1996). Prenatal weight gain patterns and birth weight among non-obese black and white women. *Obstet Gynecol*, 88(4), 490-496.
- Higgins, S. (2002). Smoking in pregnancy. *Current Opinion in Obstetrics & Gynecology*, 14(2), 145-151.
- Hiriyanna, M. (2000). *The essentials of Indian philosophy*. Delhi: Motilal Banarsidass
- Hodnett, E. (1996). Nursing support of the labouring women. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 25, 257-264.
- Hodnett, E. D. (2002). Pain and women's satisfaction with the experience of childbirth: A systematic review. *American Journal of Obstetrics and Gynecology*, 186(5), S160-S172.
- Hoffman, S., & Hatch, M. C. (1996). Stress, social support and pregnancy outcome: a reassessment based on recent research. *Paediatric and Perinatal Epidemiology*, 10(4), 380-405.
- Hohlagschwandtner, M., Husslein, P., Klier, C., & Ulm, B. (2001). Correlation between serum testosterone levels and peripartal mood states. . *Acta Obstetricia et Gynecologica Scandinavica*, 80, 326–330.
- Hopper, M. A. (2003). *A study of the social support construct with a group of cancer patients*. Ball State University, Muncie, Indiana.
- Howell, C. J. (2000). Epidural versus non-epidural analgesia for pain relief in labour.[update in Cochrane Database Syst Rev. 2005;(4):CD000331; PMID: 16235275]. *Cochrane Database of Systematic Reviews*(2), CD000331.
- Hueston, W. J. (1995). Site-to-Site Variation in the Factors Affecting Cesarean Section Rates. *Archives of Family Medicine*, 4(4), 346-351.

- Huizink, A. C., & Mulder, E. J. H. (2006). Maternal smoking, drinking or cannabis use during pregnancy and neurobehavioral and cognitive functioning in human offspring. *Neuroscience & Biobehavioral Reviews*, 30(1), 24-41.
- Huizink, A. C., Mulder, E. J. H., & Buitelaar, J. K. (2004). Prenatal Stress and Risk for Psychopathology: Specific Effects or Induction of General Susceptibility? *Psychological Bulletin*, 130(1), 115-142.
- Hupcey, J. E. (1998). Clarifying the social support theory-research linkage. *Journal of Advanced Nursing*, 27(6), 1231-1241.
- Hyttén, F., & Chamberlain, G. (1980). *Clinical Physiology in Obstetrics*. Oxford, England.: Blackwell Scientific Publications.
- Institute of Medicine. (1990). *Nutrition during Pregnancy, weight gain and nutrient supplements*. Washington, DC.: National Academy Press.
- International Center for Alcohol Policies, I. (1999). *Government policies on alcohol and pregnancy*. Washington: ICAP.
- Irwin, M., Patterson, T., Smith, T. L., Caldwell, C., Brown, S. A., Gillin, J. C., et al. (1990). Reduction of immune function in life stress and depression. *Biological Psychiatry*, 27(1), 22-30.
- Iyengar, B. F. S. (1979). *Light on Yoga: The bible of modern yoga, its philosophy and practice*. New York: Schocken Books Inc.
- Iyengar, B. F. S. (2001). *Light on Yoga*. UK: Thorsons.
- Jackson, N., & Irvine, L. M. (1998). The influence of maternal request on the elective caesarean section rate. *Journal of Obstetrics and Gynaecology*, 18, 115-120.
- Johanson, R. B., & Menon, V. (1999). Vacuum extraction versus forceps for assisted vaginal delivery. *Cochrane Database of Systematic Reviews*, 1999(2).
- Johnson, J. W., Longmate, J. A., & Frentzen, B. (1992). Excessive maternal weight and pregnancy outcome. *American Journal of Obstetrics & Gynecology*, 167(2), 353-370.

- Jolly, J., Walker, J., & Bhabra, K. (1999). Subsequent obstetric performance related to primary mode of delivery. *BJOG: An International Journal of Obstetrics and Gynaecology*, 106(3), 227-232.
- Jolly, M., Sebire, N., Harris, J., Robinson, S., & Regan, L. (2000). The risks associated with pregnancy in women aged 35 years or older. *Hum. Reprod.*, 15(11), 2433-2437.
- Joshi, K. S. (1965). On the meaning of yoga. *Philosophy East and West*, 15(1), 53-64.
- Kahn, R. L. (1979). Aging and social support. In M. W. Riley (Ed.), *Aging from birth to death: Interdisciplinary perspectives* (pp. 77-91). Boulder, CO: Westview press.
- Kamei, T., Toriumi, Y., Kimura, H., & Kimura, K. (2001). Correlation between alpha rhythms and natural killer cell activity during yogic respiratory exercise. *Stress and Health*, 17, 141-145.
- Kamrul, I. M. (2006). *The costs of maternal - newborn illness and mortality*. World Health Organisation.
- Kannan, S., Jamison, R. N., & Datta, S. (2001). Maternal satisfaction and pain control in women electing natural childbirth. *Regional Anesthesia and Pain Medicine*, 26(5).
- Katherine, H., Meera, V., Rachel, P., Gerald, G., & et al. (2005). Outcomes of Routine Episiotomy: A Systematic Review. *JAMA*, 293(17), 2141.
- Kesmodel, U., Olsen, S. F., & Secher, N. J. (2001). Does alcohol increase the risk of preterm delivery? *Ugeskrift For Laeger*, 163(34), 4578-4582.
- Kesmodel, U., Wisborg, K., Olsen, S. F., Brink Henriksen, T., & Jorgen Secher, N. (2002). Moderate alcohol intake in pregnancy and the risk of spontaneous abortion. *Alcohol Alcohol*, 37(1), 87-92.
- Khalsa, S. B. (2004). Yoga as a therapeutic intervention: a bibliometric analysis of published research studies. [Review] [181 refs]. *Indian Journal of Physiology & Pharmacology*. 48(3):269-85, 2004 Jul.
- Kirby, R. S. (2004). Trends in labor induction in the United States: is it true that what goes up must come down? *Birth*, 31(2), 148-151.

- Klein, M. C., Janssen, P. A., MacWilliam, L., Kaczorowski, J., & Johnson, B. (1997). Determinants of vaginal-perineal integrity and pelvic floor functioning in childbirth. *American Journal of Obstetrics & Gynecology*, 176(2), 403-410.
- Kopp-Hoolihan, L. E., van Loan, M. D., Wong, W. W., & King, J. C. (1999). Fat mass deposition during pregnancy using a four-component model. *J Appl Physiol*, 87(1), 196-202.
- Koubovec, D., Geerts, L., Odendaal, H. J., Stein, D. J., & Vythilingum, B. (2005). Effects of psychological stress on fetal development and pregnancy outcome. *Current Psychiatry Reports*, 7(4), 274-280.
- Kramer, M. S. (1987). Determinants of low birth weight: Methodological assessment and meta-analysis. *Bulletin of the World Health Organisation*, 65(5), 663-737.
- Kramer, M. S. (2004). Aerobic exercise for women during pregnancy (Cochrane Review). In *The Cochrane Library*. Chichester, UK.: John Wiley & Sons, Ltd.
- Kupek, E., Petrou, S., Vause, S., & Maresh, M. (2002). Clinical, provider and sociodemographic predictors of late initiation of antenatal care in England and Wales. *BJOG: An International Journal of Obstetrics and Gynaecology*, 109(3), 265-273.
- Kurki, T., Hiilesmaa, V., Raitasalo, R., Mattila, H., & Ylikorkala, O. (2000). Depression and anxiety in early pregnancy and risk for preeclampsia. *Obstetrics & Gynecology*, 95(4), 487-490.
- La Forge, R. (1997). Mind-body fitness: encouraging prospects for primary and secondary prevention. *Journal of Cardiovascular Nursing*, 11(3), 53-65.
- La Roche, M. J., Turner, C., & Kalick, S. M. (1995). Latina Mothers and Their Toddlers' Behavioral Difficulties. *Hispanic Journal of Behavioral Sciences*, 17(3), 375-384.
- Lang, A. J., Sorrell, J. T., Rodgers, C. S., & Lebeck, M. M. (2006). Anxiety sensitivity as a predictor of labor pain. *European Journal of Pain*, 10(3), 263-270.

- Langer, A., Campero, L., Garcia, C., & Raynoso, S. (1998). Effects of psychosocial support during labour and childbirth on breastfeeding, medical interventions, and mothers' wellbeing in a Mexican public hospital: a randomised clinical trial. *British Journal of Obstetrics and Gynaecology*, 105(10), 1056-1063.
- Larsen, K. E., O'Hara, M. W., Brewer, K. K., & Wenzel, A. (2001). A prospective study of self-efficacy expectancies and labour pain *Journal of Reproductive and Infant Psychology*, 19(3), 203-214.
- Last, J. M. (2001). A Dictionary of Epidemiology, *A Dictionary of Epidemiology* (3rd ed.). New York: Oxford University Press.
- Latha, & Kaliappan, K. V. (1992). Efficacy of yoga therapy in the management of headaches. *Journal of Indian Psychology*, 10, 41-47.
- Lawn, J. E., Cousens, S., & Zupan, J. (2005). Neonatal survival 1: 4 million neonatal deaths: when? Where? Why? *The Lancet*, 365(9462), 891.
- Lazarus, R. S. (1993). From psychological stress to the emotions: a history of changing outlooks. *Annual Review of Psychology*, 44, 1-22.
- Lederman, R. P. (1984). *Psychosocial adaptation in pregnancy*. Englewood Cliffs (NJ): Prentice-Hall.
- Lee, K. A., & Gay, C. L. (2004). Sleep in late pregnancy predicts length of labor and type of delivery. *Sleep in late pregnancy predicts length of labor and type of delivery*, 191(6), 2041-2046.
- Levin, J. S. (1991). The factor structure of the pregnancy anxiety scale. *Journal of Health and Social Behaviour*, 32, 368-381.
- Lieberman, E., & O'Donoghue, C. (2002). Unintended effects of epidural analgesia during labor: a systematic review.[see comment]. *American Journal of Obstetrics & Gynecology*, 186(5 Suppl Nature), S31-68.
- Liu, S., Liston, R. M., Joseph, K. S., Heaman, M., Sauve, R., Kramer, M. S., et al. (2007). Maternal mortality and severe morbidity associated with low-risk planned cesarean delivery versus planned vaginal delivery at term. *CMAJ*, 176(4), 455-460.

- Lobel, M., CeVincent, C., Kamier, A., & Meyer, B. (2000). The impact of prenatal maternal stress and optimistic disposition on birth outcomes in medically high risk women. *Health Psychology, 19*(6), 544-553.
- Lobel, M., & DeLuca, R. S. (2007). Psychosocial sequelae of cesarean delivery: Review and analysis of their causes and implications. *Social Science & Medicine, 64*(11), 2272-2284.
- Low, P., Paterson, J., Wouldes, T., Carter, S., Williams, M. S., & Percival, T. (2005). Factors affecting antenatal care attendance by mothers of Pacific infants living in New Zealand. *The New Zealand Medical Journal, 118*(1216).
- Lowe, N. K. (1991). Maternal Confidence in coping with labor A Self-Efficacy Concept. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 20*(6), 457-463.
- Lowe, N. K. (1993). Maternal confidence for labor: development of the Childbirth Self-Efficacy Inventory. *Research in Nursing and Health, 16*(2), 141-149.
- Lowe, N. K. (2000). Self-efficacy for labor and childbirth fears in nulliparous pregnant women. *Journal of Psychosomatic Obstetrics and Gynaecology, 21*(4), 219-224.
- Lox, C. L., & Treasure, D. C. (2000). Changes in Feeling States Following Aquatic Exercise During Pregnancy. *Journal of Applied Social Psychology, 30*(3), 518-527.
- Luke, B., & Brown, M. B. (2007). Elevated risks of pregnancy complications and adverse outcomes with increasing maternal age. *Hum. Reprod.*, del522.
- Lumley, J., Oliver, S. S., Chamberlain, C., & Oakley, L. (2007). Interventions for promoting smoking cessation during pregnancy. [Systematic Review]. *Cochrane Database of Systematic Reviews, 2*.
- Lurie, S. (2005). The changing motives of cesarean section: from the ancient world to the twenty-first century. *Archives of Gynecology & Obstetrics, 271*(4), 281-285.
- Lydon-Rochelle, M., Holt, V. L., Easterling, T. R., & Martin, D. P. (2001). First-birth cesarean and placental abruption or previa at second birth. *Obstetrics & Gynecology, 97*(5, Part 1), 765-769.

- Lydon-Rochelle, M., Holt, V. L., & Martin, D. P. (2001). Delivery method and self-reported postpartum general health status among primiparous women. *Paediatric and Perinatal Epidemiology*, 15(3), 232-240.
- MacDorman, M. F., Declercq, E., Menacker, F., & Malloy, M. H. (2006). Infant and Neonatal Mortality for Primary Cesarean and Vaginal Births to Women with "No Indicated Risk", United States, 1998 - 2001 Birth Cohorts. *Birth: Issues in Perinatal Care*, 33(3), 175-182.
- Madanmohan, Thombre, D. P., Balakumar, B., Nambinarayanan, T. K., Thakur, S., Krishnamurthy, N., et al. (1993). Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Indian Journal of Physiology and Pharmacology*, 36, 229-233.
- Magee, B. D., Hattis, D., & Kivel, N. M. (2004). Role of Smoking in Low Birth Weight. *Journal of Reproductive Medicine for the Obstetrician and Gynecologist*, 49(1), 23-27.
- Mager, J., Pratap, V., Leavitt, B., Hanifin, J., & Brainard, G. (2003, June 19–22, 2003 ). *The influence of classical yoga practices on plasma cortisol levels*. Paper presented at the ENDO 2003: The 85th Annual Meeting of The Endocrine Society Philadelphia.
- Mahomed, K. (2000). Iron and folate supplementation in pregnancy. *Cochrane Database of Systematic Reviews*(2).
- Malathi, A., & Damodaran, A. (1999). Stress due to exams in medical students--role of yoga. *Indian Journal of Physiology and Pharmacology*, 43(2), 218-224.
- Malhotra, A. K. (2001). *An introduction to yoga philosophy: an annotated translation of the yoga sutras*. England: Ashgate publishing limited.
- Maloni, J. A., Park, S., Anthony, M. K., & Musil, C. M. (2005). Measurement of antepartum depressive symptoms during high-risk pregnancy. *Research in Nursing & Health*, 28(1), 16-26.
- Manning, M. M., & Wright, T. L. (1983). Self-efficacy expectancies, outcome expectancies, and the persistence of pain control in childbirth. *Journal of Personality & Social Psychology*, 45(2), 421-431.

- Marlow, N. (2004). Neurocognitive outcome after very preterm birth. *Arch. Dis. Child. Fetal Neonatal Ed.*, 89(3), F224-228.
- Martin, J. A., Hamilton, B. E., Sutton, P. D., Ventura, S. J., Menacker, F., & Kimeyer, S. (2006). *Births: Final data for 2004. National vital statistics reports; vol 55 no 1*. Hyattsville, MD: National Center for Health Statistics.
- Masuda, M., & Holmes, T. H. (1967). The social readjustment rating scale: A cross-cultural study of Japanese and Americans. *Journal of Psychosomatic Research*, 11(2), 227-237.
- Mathews, T. J. (2004). Smoking During Pregnancy - United States, 1990--2002. *Journal*, 53(39), 911-915
- McGill, H., Burrows, V. L., Holland, L. A., Langer, H. J., & Sweet, M. A. (1995). Postnatal depression: a Christchurch study. *New Zealand Medical Journal*, 108(999), 162-165.
- McLeod, D., Pullon, S., & Cookson, T. (2003). Factors that influence changes in smoking behaviour during pregnancy. *The New Zealand Medical Journal*, 116(1173).
- McNair, Heuchert, J. W., & Shilony, E. (2003). Research with the Profile of Mood States (POMS) 1964–2002: A comprehensive bibliography, Available from [https://www.mhs.com/ecom/\(clvqbgnhf3pczx55bxurp4fg\)/TechBrochures/POMS%20Bibliography.pdf](https://www.mhs.com/ecom/(clvqbgnhf3pczx55bxurp4fg)/TechBrochures/POMS%20Bibliography.pdf)
- McNair, P., Lorr, M., & Droppleman, L. (1981). *POMS Manual* (2nd ed.). San Diego: Educational and Industrial testing Service.
- Melzack, R. (1975). The McGill Pain Questionnaire: Major properties and scoring methods. *Pain*, 1: 277-299.
- Melzack, R. (1984). The myth of painless childbirth (The John J. Bonica Lecture). *Pain*, 19(4), 321-337.
- Merck Research Laboratories (2007). The Merck Manuals. In R. S. Porter & J. L. Kaplan (Eds.), Online Medical library (Vol. Home Edition for Patients and Caregivers, Available from <http://www.merck.com/mmhe/index.html>

- Merewood, A., Mehta, S. D., Chen, T. C., Bauchner, H., & Holick, M. F. (2009). Association between Vitamin D Deficiency and Primary Cesarean Section. *J Clin Endocrinol Metab*, 94(3), 940-945.
- Mills, J. L., Graubard, B. I., Harley, E. E., Rhoads, G. G., & Berendes, H. W. (1984). Maternal alcohol consumption and birth weight. How much drinking during pregnancy is safe? *JAMA*, 252(14), 1875-1879.
- Moran, J. D., 3rd, & von Barga, N. (1982). Attitudinal and demographic factors influencing mothers' choice of childbirth procedures. *American Journal of Obstetrics & Gynecology*, 142(7), 846-850.
- Morris, S. N., & Johnson, N. R. (2005). Exercise during pregnancy: a critical appraisal of the literature. *The Journal of Reproductive Medicine*, 50(3), 181-188.
- Morrison, J. J., Rennie, J. M., & Milton, P. J. (1995). Neonatal respiratory morbidity and mode of delivery at term: influence of timing of elective caesarean section. *BJOG: An International Journal of Obstetrics and Gynaecology*, 102(2), 101-106.
- Morton, S. C., Williams, M. S., Keeler, E. B., Gambone, J. C., & Kahn, K. L. (1994). Effect of epidural analgesia for labor on the cesarean delivery rate. *Obstet Gynecol*, 83(6), 1045-1052.
- Mulder, E. J., De Medina, P. G., Huizink, A. C., Van de Bergh, B. R., Buitelaar, J. K., & Visser, G. H. (2002). Prenatal maternal stress: effects on pregnancy and the (unborn) child. *Early Human Development*, 70, 3-14.
- Murphy, D. J., Liebling, R. E., Verity, L., Swingle, R., & Patel, R. (2001). Early maternal and neonatal morbidity associated with operative delivery in second stage of labour: a cohort study. *The Lancet*, 358(9289), 1203-1207.
- Murphy, D. J., Stirrat, G. M., & Heron, J. (2002). The relationship between Caesarean section and subfertility in a population-based sample of 14 541 pregnancies. *Hum. Reprod.*, 17(7), 1914-1917.

- Murugesan, R., Govindarsjulu, N., & Bera, T. K. (2000). Effect of selected yogic practices on the management of hypertension. *Indian Journal of Physiology and Pharmacology*, 44, 207-210.
- Narendran, S., Nagarathna, R., Narendran, V., Gunasheela, S., & Nagendra, H. R. (2005). Efficacy of yoga on pregnancy outcome. *Journal of Alternative & Complementary Medicine*, 11(2), 237-244.
- National Center for Complementary and Alternative Medicine (NCCAM). (2008). Yoga: Effect on Attention in Aging & Multiple Sclerosis. Retrieved 14th November, 2008, from <http://www.clinicaltrials.gov/ct2/show/NCT00010998>
- National Center for Health Statistics (NCHS) (2005). Births: Preliminary Data for 2005. *Journal*. Retrieved from <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/prelimbirths05/prelimbirths05.htm>
- National Health and Medical Research Council, & Ministry of Health. (2006). *Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes*. Canberra Wellington: NHMRC, Ministry of Health,.
- National Research Council, & Institute of Medicine. (2007). *Influence of Pregnancy Weight on Maternal and Child Health. Workshop Report*. Washington, DC.: The National Academies Press.
- Netz, Y., & Lidor, R. (2003). Mood alterations in mindful versus aerobic exercise modes. *Journal of Psychology*, 137(5), 405-419.
- Neuhaus, W., Scharkus, S., Hamm, W., & Bolte, A. (1994). Prenatal expectations and fears in pregnant women. *Journal of Perinatal Medicine*, 22, 409-414.
- New Zealand Guidelines Group. (2004). *Care of women with breech presentations or previous caesarean births*. Wellington.
- New Zealand Health Information Service. (2007). *Fetal and Infant Deaths 2003 & 2004*. Wellington: Ministry of Health.

- New Zealand Health Information Services. (2003). *Report on maternity: Maternal and newborn information 2003*.
- New Zealand Health Information Services. (2009). Infant and perinatal mortality in 2004, 2005 and 2006. Retrieved 6 August, 2009, from <http://www.nzhis.govt.nz/moh.nsf/indexns/stats-infant-perinatal-mort-04-06?Open>
- New Zealand Health Information Services. (2006). *Maternity 2003: A Snapshot*.
- New Zealand Ministry of Health. (2002). *A guide to pregnancy and childbirth in New Zealand*. Wellington: Ministry of Health.
- New Zealand Ministry of Health. (2006). *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper*. Wellington: Ministry of Health.
- New Zealand Ministry of Health. (2007). *Alcohol Use in New Zealand: Analysis of the 2004 New Zealand Health Behaviours Survey – Alcohol Use*. . Wellington: Ministry of Health.
- Nikolajsen, L., Sorensen, H. C., Jensen, T. S., & Kehlet, H. (2004). Chronic pain following Caesarean section. *Acta Anaesthesiologica Scandinavica*, 48(1), 111-116.
- Nordhagen, I. H., & Sundgot-Borgen, J. (2002). Physical activity among pregnant women in relation to pregnancy-related complaints and symptoms of depression. *Tidsskrift for Den Norske Laegeforening*, 122(5), 470-474.
- Nyenhuis, D. L., Yamamoto, C., Luchetta, T., Terrien, A., & Parmentier, A. (1999). Adult and geriatric normative data and validation of the Profile of Mood States. *Journal of Clinical Psychology*, 55, 79–86.
- Olafsdottir, A. S., Skuladottir, G. V., Thorsdottir, I., Hauksson, A., & Steingrimsdottir, L. (2006). Maternal diet in early and late pregnancy in relation to weight gain. *International Journal of Obesity*, 30(3), 492-499.
- Olsson, C., & Nilsson-Wikmar, L. (2004). Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstetricia et Gynecologica Scandinavica*, 83(4), 351-357.

- Otigbah, C. M., Dhanjal, M. K., Harmsworth, G., & Chard, T. (2000). A retrospective comparison of water births and conventional vaginal deliveries. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 91(1), 15-20.
- Paauw, J. D., Bierling, S., Cook, C. R., & Davis, A. T. (2005). Hyperemesis Gravidarum and Fetal Outcome. *JPEN J Parenter Enteral Nutr*, 29(2), 93-96.
- Panchal, S. (2001). Considerations for the Parturient with Advanced Maternal Age: A Current Review. *Journal, Summer 2001*. Retrieved from [http://www.soap.org/media/newsletters/summer2001/current\\_review.htm](http://www.soap.org/media/newsletters/summer2001/current_review.htm)
- Panjwani, U., Gupta, H. L., Singh, S. H., Selvamurthy, W., & Rai, U. C. (1995). Effect of Sahaja yoga practice on stress management in patients with epilepsy. *Indian Journal of Physiology and Pharmacology*, 39, 111-116.
- Parackal, S., Ferguson, E., & Harraway, J. (2007). Alcohol and tobacco consumption among 6-24-months post-partum New Zealand women. *Maternal & Child Nutrition*, 3(1), 40-51.
- Pascoe, J. M. (1993). Social support during labor and duration of labor: a community-based study. *Public Health Nursing*, 10(2), 97-99.
- Pelletier, K. (1997). Current trends in the integration and reimbursement of complementary and alternative medicine. *American Journal of Health Promotion*, 9(3), 121-122.
- Perez-Rios, N., Ramos-Valencia, G., & Ortiz, A. P. (2008). Cesarean delivery as a barrier for breastfeeding initiation: the Puerto Rican experience. [Research Support, N.I.H., Extramural]. *Journal of Human Lactation*, 24(3), 293-302.
- Petrofsky, J. S., Cuneo, M., Dial, R., & Morris, A. (2005). Muscle activity during yoga breathing compared to abdominal crunches. *Journal of Applied Research*, 5(3), 501-507.
- Pizer, A. (2007a, 20th June 2007). Prenatal Yoga: The first Trimester. Retrieved 26th July, 2007, from <http://yoga.about.com/od/prenatalyoga/a/firsttrimester.htm>
- Pizer, A. (2007b, 20th June 2007). Yoga poses to avoid when pregnant. Retrieved 26th July, 2007, from [http://yoga.about.com/od/prenatalyoga/a/firsttrimester\\_2.htm](http://yoga.about.com/od/prenatalyoga/a/firsttrimester_2.htm)

- Porter, C. L., & Hsu, H. C. (2003). First-time mothers' perceptions of efficacy during the transition to motherhood: links to infant temperament. *Journal of Family Psychology, 17*(1), 54-64.
- Pryor, J. E., Thompson, J. M., Robinson, E., Clark, P. M., Becroft, D. M., Pattison, N. S., et al. (2003). Stress and lack of social support as risk factors for small-for-gestational-age birth. *Acta Paediatrica, 92*(1), 62-64.
- Pullon, S., & Bliss, B. (2006). *New Zealand Pregnancy Book*. Wellington, NZ: Briget Williams Books Limited.
- Quick, J., Greenlick, M., & Roghmann, K. (1981). Prenatal care and pregnancy outcome in an HMO and general population: a multivariate cohort analysis. *American Journal of Public Health, 71*, 381-390.
- Quinlivan, J., Petersen, R. W., & Nichols, C. N. (1999). Patient preference the leading indication for elective caesarean section in public patients: Results of a 2-year prospective audit. *Australian and New Zealand Journal of Obstetrics and Gynaecology, 39*, 207-214.
- Radzyminski, S. (2003). The Effect of Ultra Low Dose Epidural Analgesia on Newborn Breastfeeding Behaviors. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 32*(3), 322-331.
- Raghuraj, P., & Telles, S. (1997). Muscle power, dexterity, skill and visual perception in community home girls trained in yoga or sports and in regular school girls. . *Indian Journal of Physiology and Pharmacology, 41*, 409 - 415.
- Ranta, P., Spalding, M., Kangas-Saerela, T., Johela, R., Hollmen, A., & Joupilla, P. (1995). Maternal expectations and experiences of labour pain options of 1091 Finnish parturients. *Acta Obstetrica et Gynecologica Scandinavica, 302*, 60-66.
- Ranzini, A., Allen, A., & Yu-Ling, L. (2001). Use of complementary medicines and therapies among obstetric patients. *Obstetrics and Gynecology, 97*(4), 46S.

- Raub, J. A. (2002a). Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. *Journal of Alternative and Complementary Medicine*, 8(6), 797-812.
- Raub, J. A. (2002b). Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. [Review]. *Journal of Alternative & Complementary Medicine*. 8(6):797-812, 2002 Dec.
- Reibel, D. K., Greeson, J. M., Brainard, G. C., & Rosenzweig, S. (2001). Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population. *General Hospital Psychiatry*, 23(4), 183-192.
- Reid, A. J., Carroll, J. C., Ruderman, J., & Murray, M. A. (1989). Differences in intrapartum obstetric care provided to women at low risk by family physicians and obstetricians. *Canadian Medical Association Journal*, 140(6), 625-633.
- Riordan, J. (2005). Perinatal and Intrapartum care: Casarean births. In J. Riordan (Ed.), *Breastfeeding and Human Lactation* (3rd ed.). London: Jones and Bartlett Publishers.
- Robinson, J. N., Norwitz, E. R., Cohen, A. P., & Lieberman, E. (2000). Predictors of Episiotomy Use at First Spontaneous Vaginal Delivery. *Obstet Gynecol*, 96(2), 214-218.
- Rode, L., Hegaard, H. K., Kjaergaard, H., Moller, L. F., Tabor, A., & Ottesen, B. (2007). Association Between Maternal Weight Gain and Birth Weight. *Obstet Gynecol*, 109(6), 1309-1315.
- Rooney, B. L., & Schaubert, C. W. (2002). Excess pregnancy weight gain and long term obesity: one decade later. *Obstetrics and Gynecology*, 100(2), 245-252.
- Rowe-Murray, H. J., & Fisher, J. R. W. (2002). Baby friendly hospital practices: cesarean section is a persistent barrier to early initiation of breastfeeding. [Comparative Study Research Support, Non-U.S. Gov't]. *Birth*, 29(2), 124-131.
- Rowe, R. E., & Garcia, J. (2003). Social class, ethnicity and attendance for antenatal care in the United Kingdom: a systematic review. *Journal of Public Health Medicine*, 25(2), 113-119.

- Royal College of Obstetricians and Gynaecologists, R. (2003). *Antenatal care: Routine care for the health pregnant woman*. London: Royal College of Obstetricians and Gynaecologists.
- Royal College of Obstetricians and Gynaecologists, R. (2004). Methods and Materials used in Perineal Repairs. *Guideline No. 23*. Retrieved 14th May, 2007, from [http://www.rcog.org.uk/resources/Public/pdf/perineal\\_repair.pdf](http://www.rcog.org.uk/resources/Public/pdf/perineal_repair.pdf)
- Royal College of Obstetricians and Gynaecologists, R. (2006). *Alcohol consumption and the outcomes of pregnancy: RCOG Statement No. 5*. Internet: Royal College of Obstetricians and Gynaecologists.
- Royal College of Obstetrics and Gynaecology Clinical Effectiveness Support Unit (RCOG). (2001). *The national sentinel caesarean section audit report*. London: RCOG Press.
- Rudnicki, S. R., Graham, J. L., Habboushe, D. F., & Ross, R. D. (2001). Social support and avoidant coping: correlates of depressed mood during pregnancy in minority women. *Women & Health, 34*(3), 19-34.
- Rutledge, T. P., Reis, S. E., Olson, M. M., Owens, J. P., Kelsey, S. F. P., Pepine, C. J., et al. (2004). Social Networks Are Associated With Lower Mortality Rates Among Women With Suspected Coronary Disease: The National Heart, Lung, and Blood Institute-Sponsored Women's Ischemia Syndrome Evaluation Study. *SO - Psychosomatic Medicine November/December 2004;66*(6):882-888.
- Ryan, G., Sweeney, P., & Solala, A. (1980). Prenatal care and pregnancy outcome. *American Journal of Obstetrics & Gynecology, 137*, 876– 881.
- Ryding, E. L. (1993). Investigation of 33 women who demanded a cesarean section for personal reasons. *Acta Obstet Gynecol Scand, 72*, 280–285.
- Ryding, E. L., Wijma, B., Wijma, K., & Rydhstrom, H. (1998). Fear of childbirth during pregnancy may increase the risk of emergency cesarean section. *Acta Obstetrica et Gynecologica Scandinavica, 77*(5), 542-547.

- Saisto, T. (2001). *Obstetric, psychosocial, and pain-related background, and treatment of fear of childbirth*. Helsinki: University of Helsinki.
- Saisto, T., & Halmesmaki, E. (2003). Fear of childbirth: a neglected dilemma. *Acta Obstetricia et Gynecologica Scandinavica*, 82(3), 201-208.
- Saisto, T., Kaaja, R., Ylikorkala, O., & Halmesmaki, E. (1999). Reduced pain tolerance during and after pregnancy in women suffering from fear of labour. *Pain*, 93, 123-127.
- Saisto, T., Salmela-Aro, K., Nurmi, J. E., & Halmesmaki, E. (2001). Psychosocial predictors of disappointment with delivery and puerperal depression. A longitudinal study. *Acta Obstetricia et Gynecologica Scandinavica*, 80(1), 39-45.
- Sandman, C. A., Barron, J. L., Demet, E. M., Chicx-Demet, A., Rothenberg, S. J., & Zea, F. J. (1990). Opioid Peptides and Perinatal Development: Is Beta-Endorphin a Natural Teratogen?. Clinical Implications. *Annals of the New York Academy of Sciences*, 579(1), 91-108.
- Saper, R. B., Eisenberg, D. M., Davis, R. B., Culpepper, L., & Phillips, R. S. (2004). Prevalence and patterns of adult yoga use in the United States: results of a national survey. *Alternative Therapies in Health and Medicine*, 10(2), 44-49.
- Schell, F. J., Allolio, B., & Schonecke, O. W. (1994). Physiological and psychological effects of Hatha-Yoga exercise in healthy women. *International Journal of Psychosomatics*, 41(1-4), 46-52.
- Scholl, T. O. (2005). Iron status during pregnancy: setting the stage for mother and infant. *American Journal of Clinical Nutrition*, 81(5), 1218S-1222S.
- Scholl, T. O., Hediger, M. L., Bendich, A., Schall, J. I., Smith, W. K., & Kruegar, P. M. (1997). Use of multivitamin/mineral prenatal supplements: influence on the outcome of pregnancy. *American Journal of Epidemiology*, 146(2), 134-141.
- Sehdev, H. M. (2005). Cesarean delivery. *Journal*. Retrieved from <http://www.emedicine.com/med/topic3283.htm>

- Selvamurthy, W., Sridharan, K., Ray, U. S., Tiwary, R. S., Hegde, K. S., Radhakrishnan, U., et al. (1998). A new physiological approach to control essential hypertension. *Indian Journal of Physiology and Pharmacology*, 42, 205-213.
- Sewell, J. E. (1993). Cesarean section - A brief history, A Brochure to Accompany an Exhibition on the History of Cesarean Section at the National Library of Medicine April 30 - August 31, 1993 Available from [http://www.nlm.nih.gov/exhibition/cesarean/cesarean\\_1.html](http://www.nlm.nih.gov/exhibition/cesarean/cesarean_1.html)
- Shaffer, H. (1997). Comparing hatha yoga with dynamic group psychotherapy for enhancing methadone maintenance treatment. *Alternative Therapies*, 3(4), 57-67.
- Shannahoff-Khalsa, D. S. (2004). An introduction to Kundalini yoga meditation techniques that are specific for the treatment of psychiatric disorders. [Review] [38 refs]. *Journal of Alternative & Complementary Medicine*. 10(1):91-101, 2004 Feb.
- Sharma, M. (2007). *Lessons from evaluating a yoga-based behavioral intervention for smoking cessation*. Paper presented at the American Public Health Association [APHA] 13th Annual Meeting and Expo.
- Shetty, A., Burt, R., Rice, P., & Templeton, A. (2005). Women's perceptions, expectations and satisfaction with induced labour--a questionnaire-based study. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, 123(1), 56-61.
- Siege-Riz, A. M., Adair, L. S., & Hobel, C. J. (1994). Institute of Medicine maternal weight gain recommendations and pregnancy outcome in a predominantly Hispanic population. *Obstet Gynecol*, 84(4), 565-573.
- Simkin, P. (1989). Childbearing in Social-Context. *Women & Health*, 15(3), 5-21.
- Simkin, P., Whalley, J., & Keppler, A. (2001). Labor and Birth. In *Pregnancy, childbirth and the newborn: The complete guide* (pp. 209 - 256). Deephaven, MN Meadowbrook.
- Singh, V., Wisniewski, A., Britton, J., & Tattersfield, A. (1990). Clinical practice: Effect of yoga breathing exercises (pranayama) on airway reactivity in subjects with asthma. *Lancet*, 335, 1381-1383.

- Sjogren, B. (1997). Reasons for anxiety about childbirth in 100 pregnant women. *Journal of Psychosomatic Obstetrics & Gynecology*, 18(4), 266-272.
- Sjogren, B., & Thomassen, P. (1997). Obstetric outcome in 100 women with severe anxiety over childbirth. *Acta Obstetrica et Gynecologica Scandinavica*, 76(10), 948-952.
- Smith, C. A., Collins, C. T., Cyna, A. M., & Crowther, C. A. (2006). Complementary and alternative therapies for pain management in labour. [Review]. *The Cochrane Database of Systematic Reviews*, 1.
- Smith, G. C. S., Pell, J. P., & Bobbie, R. (2003). Caesarean section and risk of unexplained stillbirth in subsequent pregnancy. *The Lancet*, 362(9398), 1779-1784.
- Smith, J. F., Hernandez, C., & Wax, J. R. (1997). Fetal Laceration Injury at Cesarean Delivery. *Obstetrics & Gynecology*, 90(3), 344-346.
- Society of Obstetricians and Gynaecologists of Canada, S. (2005). Guidelines for operative vaginal birth. Number 148, May 2004. *International Journal of Gynaecology & Obstetrics*. 88(2):229-36, 2005 Feb.
- Soderquist, J., Wijma, K., & Wijma, B. (2001). Traumatic stress late in pregnancy. *Journal of Anxiety Disorders*, 18, 127-142.
- Solomon, C. G., Willett, W. C., Carey, V. J., Rich-Edwards, J., Hunter, D. J., Colditz, G. A., et al. (1997). A prospective study of pregravid determinants of gestational diabetes mellitus. *Journal of the American Medical Association*, 278(13), 1078-1083.
- Sorensen, T. K., Williams, M. A., Lee, I. M., Dashow, E. E., Thompson, M. L., & Luthy, D. A. (2003). Recreational Physical Activity During Pregnancy and Risk of Preeclampsia. *Hypertension*, 41(6), 1273-1280.
- Sparrowe, L. (2003). The history of yoga. Excerpted from Yoga, A Yoga Journal Book.  
Retrieved 19/04/04, 2004
- Sparrowe, L., & Walden, P. (2002). *The woman's book of yoga and health*. Boston: Shambhala Publications, Inc.

- Sport and Recreation New Zealand (2006). Pregnancy and physical activity. *Journal*. Retrieved from [www.sparc.org.nz](http://www.sparc.org.nz)
- Statistics New Zealand. (2006). *Births and Deaths March 2006 quarter*. Statistics New Zealand.
- Sternfeld, B. (1997). Physical activity and pregnancy outcome. Review and recommendations. *Sports Medicine*, 23(1).
- Stockman, A. F., & Altmaier, E. M. (2001). Relation of Self-Efficacy to Reported Pain and Pain Medication Usage During Labor *Journal of Clinical Psychology in Medical Settings*, 8(3), 161-166.
- Stowell, J. R., McGuire, L., Robles, T., Glaser, R., & Kiecolt-Glaser, J. K. (2003). Psychoneuroimmunology. In A. M. Nezu, C. M. Nezu, P. A. Geller & I. B. Weiner (Eds.), *Handbook of Psychology. Volume 9, Health Psychology* (pp. 75-95). New York: Wiley & Sons, Inc. (US).
- Strauss, S. (2005). *Positioning yoga: Balancing acts across cultures*. Oxford: Berg.
- Streeter, C. C., Jensen, E., Perlmutter, R., Cabral, H. J., Tian, H., Terhune, D. B., et al. (2007). Yoga asana sessions increase brain GABA levels: A pilot study. *Journal of Alternative & Complementary Medicine*, 13(4), 419-426.
- Streissguth, A. P., Barr, H. M., & Sampson, P. D. (1990). Moderate Prenatal Alcohol Exposure: Effects on Child IQ and Learning Problems at Age 7 1/2 Years. *Alcoholism: Clinical and Experimental Research*, 14(5), 662-669.
- Sultan, A. H., Kamm, M. A., Hudson, C. N., Thomas, J. M., & Bartram, C. I. (1993). Anal-sphincter disruption during vaginal delivery. *The New England Journal of Medicine*, 329(26), 1905-1911.
- Szeverenyi, P., Poka, R., Hetey, M., & Torok, Z. (1998). Contents of childbirth-related fear among couples wishing the partner's presence at delivery. *Journal of Psychosomatic Obstetrics & Gynecology*, 19, 38-43.

- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Boston, MA: Allyn and Bacon.
- Taylor, M. J. (2003). Yoga therapeutics: An ancient, dynamic systems theory. *Techniques in Orthopaedics*, 18(1), 115-125.
- Teasdill, W. (1999). *Yoga for Pregnancy*. London: Gaia Books Ltd.
- Telles, S., & Naveen, K. V. (1997). Yoga for rehabilitation: an overview. *Indian Journal of Medical Sciences*, 51(4), 123-127.
- Tenore, J. L. (2003). Methods for cervical ripening and induction of labor.[see comment]. *American Family Physician*, 67(10), 2123-2128.
- Teti, & Gelfand. (1991). Maternal self efficacy scale. In B. K. Redman (Ed.), *Measurement tools in patient education*. (pp. 206-209). New York: Springer Pub. Co.
- Teti, D. M., & Gelfand. (1991). Maternal self efficacy scale. In B. K. Redman (Ed.), *Measurement tools in patient education*. (pp. 206-209). New York: Springer Pub. Co.
- Teti, D. M., & Gelfand, D. M. (1991). Behavioral competence among mothers of infants in the first year: The mediational role of maternal self-efficacy. *Child development*, 62, 918-929.
- Teti, D. M., Hess, C. R., & O'Connell, M. (2005). Parental perceptions of infant vulnerability in a preterm sample: prediction from maternal adaptation to parenthood during the neonatal period. 26(4), 283(210).
- Teti, D. M., O'Connell, M. A., & Reiner, C. D. (1996). Parenting sensitivity, parental depression and child health: The mediational role of parental self-efficacy. *Early Development and Parenting*, 5, 237-250.
- The Information Centre, C. H. S. (2006). NHS Maternity Statistics, England: 2004-05. Bulletin: 2006/08/HSCIC. Retrieved 9th April, 2007, from [http://www.ic.nhs.uk/webfiles/publications/maternityeng2005/NHSMaternityStatistics260506\\_PDF.pdf](http://www.ic.nhs.uk/webfiles/publications/maternityeng2005/NHSMaternityStatistics260506_PDF.pdf)

- The Perinatal and Maternal Mortality Review Committee (PMMRC). (2009). *Perinatal and maternal mortality in New Zealand 2006: Second report to the minister of health: July 2008 to June 2009*. Wellington: Ministry of Health.
- Thompson, J. F., Roberts, C. L., Currie, M., & Ellwood, D. A. (2002). Prevalence and persistence of health problems after childbirth: associations with parity and method of birth. *Birth*, 29(2), 83-94.
- Thorngren-Jerneck, K., & Herbst, A. (2001). Low 5-Minute Apgar Score: A Population-Based Register Study of 1 Million Term Births. *Obstet Gynecol*, 98(1), 65-70.
- Thorsdottir, I., & Birgisdottir, B. E. (1998). Different weight gain in women of normal weight before pregnancy: postpartum weight and birth weight. *Obstet Gynecol*, 92(3), 377-383.
- Tiran, D. (2005). NICE guideline on antenatal care: routine care for the healthy pregnant woman - recommendations on the use of complementary therapies do not promote clinical excellence. *Complementary Therapies in Clinical Practice*, 11(2), 127-129.
- Tiran, D., & Chummun, H. (2004). Complementary therapies to reduce physiological stress in pregnancy. *Complementary Therapies in Nursing and Midwifery*, 10(3), 162-167.
- Tiran, D., & Mack, S. (2000). *Complementary therapies for pregnancy and childbirth* (2nd ed.). London, UK: Bailliere Tindall.
- Tournaire, M., & Theau-Yonneau, A. (2007). Complementary and Alternative Approaches to Pain Relief During Labor. *eCAM*, nem012.
- Tucker, J., & McGuire, W. (2004). Epidemiology of preterm birth. *BMJ*, 329(7467), 675-678.
- Turner, M. J., Rasmussen, M. J., Turner, J. E., Boylan, P. C., MacDonald, D., & Stronge, J. M. (1990). The Influence of Birth Weight on Labor in Nulliparas. *Obstet Gynecol*, 76(2), 159-163.
- Uchino, B. N., Cacioppo, J. T., & Kiecolt-Glaser, J. K. (1996). The Relationship Between Social Support and Physiological Processes: A Review With Emphasis on Underlying Mechanisms and Implications for Health. *Psychological Bulletin*, 119(3), 488-531.

- United Kingdom Department of Health. (1995). *Sensible Drinking: The Report of an Inter-Departmental Working Group*. London: UK Department of Health.
- United Nations. (2006). *Millennium Indicators Database*. New York: Department of Economic and Social Affairs, Statistics Division.
- United Nations Population Fund. (2004). *State of the world population 2004: The Cairo Consensus at Ten: Population, Reproductive Health and The Global Effort to End Poverty*. New York: United Nations Population Fund.
- Vause, T., Martz, P., Richard, F., & Gramlich, L. (2006). Nutrition for healthy pregnancy outcomes. *Applied Physiology, Nutrition, & Metabolism = Physiologie Appliquee, Nutrition et Metabolisme*, 31(1), 12-20.
- Verma, A., Weir, A., Drummond, J., & Mitchell, B. F. (2005). Performance profile of an outcome measure: morbidity assessment index for newborns. *J Epidemiol Community Health*, 59(5), 420-426.
- Vickers, A., & Zollman, C. (1999). ABC of complementary medicine: Hypnosis and relaxation therapies. *British Medical Journal (International edition)*, 319(7221), 1346-1350.
- Villar, J., Ba'aqeel, H., Piaggio, G., Lumbiganon, P., Belizan, J. M., Farnot, U., et al. (2001). WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care. *Lancet*, 357(9268), 1551.
- Vincent, R. D., & Chestnut, D. H. (1998). Epidural analgesia during labour. *American Family Physician*, 58(8), 1785.
- Visco, A. G., Viswanathan, M., Lohr, K. N., Wechter, M. E., Gartlehner, G., Wu, J. M., et al. (2006). Cesarean Delivery on Maternal Request: Maternal and Neonatal Outcomes. *Obstet Gynecol*, 108(6), 1517-1529.
- Viteri, F. E., & Berger, J. (2005). Importance of pre-pregnancy and pregnancy iron status: can long-term weekly preventive iron and folic acid supplementation achieve desirable and safe status? *Nutrition Reviews*, 63(12 Pt 2), S65-76.

- Wadhwa, P. D., Culhane, J. F., Rauh, V., & Barve, S. S. (2001). Stress and Preterm Birth: Neuroendocrine, Immune/Inflammatory, and Vascular Mechanisms. *Maternal and Child Health Journal*, 5(2), 119-125.
- Wadhwa, P. D., Sandman, C. A., Porto, M., Dunkel-Schetter, C., & Garite, T. J. (1993). The association between prenatal stress and infant birth weight and gestational age at birth: a prospective investigation. *American Journal of Obstetrics & Gynecology*, 169(4), 858-865.
- Wagner, M. (2000). Choosing caesarean section. *The Lancet*, 356(9242), 1677-1680.
- Waldenstrom, U., Borg, I. M., Olsson, B., Skold, M., & Wall, S. (1996). The childbirth experience: a study of 295 new mothers. *Birth*, 23(3), 144-153.
- Waldenstrom, U., & Irestedt, L. (2006). Obstetric pain relief and its association with remembrance of labor pain at two months and one year after birth. *Journal of Psychosomatic Obstetrics & Gynecology*, 27(3), 147-156.
- Walker, B., & Erdman, A. (1984). Childbirth Education Programs: The Relationship Between Confidence and Knowledge. *Birth*, 11(2), 103-108.
- Wang, C., Collet, J. P., & Lau, J. (2004). The effect of Tai Chi on health outcomes in patients with chronic conditions. *Archives of Internal Medicine*, 164(5), 493-501.
- Wang, M. L., Dorer, D. J., Fleming, M. P., & Catlin, E. A. (2004). Clinical Outcomes of Near-Term Infants. *Pediatrics*, 114(2), 372-376.
- Wang, S. (2003). Backaches related to pregnancy: the risk factors, etiologies, treatments and controversial issues. *Current Opinion in Anaesthesiology*, 16, 269-273.
- Webster, J., Linnane, J. W., Dibley, L. M., Hinson, J. K., Starrenburg, S. E., & Roberts, J. A. (2000). Measuring social support in pregnancy: can it be simple and meaningful? *Birth*, 27(2), 97-101.

- Wegner, E. K., & Bernstein, I. M. (2007, 4th January 2007). Operative vaginal delivery. *UpToDate, Patient Information* 15.1. Retrieved 2nd May, 2007, from <http://patients.uptodate.com/topic.asp?file=labordel/7855&title=Operative+Vaginal+delivery>
- Weinstock, M. (2001). Alterations induced by gestational stress in brain morphology and behaviour of the offspring. *Progress in Neurobiology*, 65(5), 427-451.
- Weiss, J. L., Malone, F. D., Emig, D., Ball, R. H., Nyberg, D. A., Comstock, C. H., et al. (2004). Obesity, obstetric complications and cesarean delivery rate-a population-based screening study. *American Journal of Obstetrics and Gynecology*, 190(4), 1091-1097.
- Weller, I. M., & Corey, P. N. (1998). A study of the reliability of the Canada Fitness Survey questionnaire. *Medicine & Science in Sports & Exercise*, 30(10), 1530-1536.
- Wen, S. W., Liu, S., Kramer, M. S., Marcoux, S., Ohlsson, A., Sauve, R., et al. (2001). Comparison of Maternal and Infant Outcomes between Vacuum Extraction and Forceps Deliveries 10.1093/aje/153.2.103. *Am. J. Epidemiol.*, 153(2), 103-107.
- Wikipedia. (2007, 7 July 2007). Hatha Yoga. Retrieved 12th July, 2007, from [http://en.wikipedia.org/wiki/Hatha\\_yoga](http://en.wikipedia.org/wiki/Hatha_yoga)
- Wilkinson, C., McIlwaine, G., Boulton-Jones, C., & Cole, S. (1998). Is the caesarean section rate inevitable? *British Journal of Obstetrics and Gynaecology*, 105, 45-52.
- Williams, C. S., Davenport, E. S., Sterne, J. A., Sivapathasundaram, V., Fearne, J. M., & Curtis, M. A. (2000). Mechanisms of risk in preterm low-birthweight infants. *Periodontology* 2000, 23(1), 142-150.
- Williams, K. A., Petronis, J., Smith, D., Goodrich, D., Wu, J., Ravi, N., et al. (2005). Effect of Iyengar yoga therapy for chronic low back pain. *Pain*, 115(1-2), 107-117.
- Williams, R. (1999). Healthy pregnancy, healthy baby. Exercise, good food, and prenatal care are the keys. *FDA Consumer*, 33(2), 18-22.

- Wong, C. A., Scavone, B. M., Peaceman, A. M., McCarthy, R. J., Sullivan, J. T., Diaz, N. T., et al. (2005). The risk of cesarean delivery with neuraxial analgesia given early versus late in labor. *The New England Journal of Medicine*, 352(7), 655-665.
- Woolery, A., Myers, H., Sternlieb, B., & Zeltzer, L. (2004). A yoga intervention for young adults with elevated symptoms of depression. *Alternative Therapies in Health and Medicine*, 10(2), 60-63.
- World Bank. (2006). Maternal Mortality: at a glance (Publication. Retrieved 17th May 2007, from World Bank,;  
<http://siteresources.worldbank.org/INTPHAAG/Resources/AAGMatMort06.pdf>
- World Health Organisation. (1985). Appropriate technology for birth. *Lancet*, 8452(2), 436-437.
- World Health Organisation. (1997). *Care in normal birth: A practical guide. Report of a technical working group* Geneva: Division of reproductive health, World Health Organisation.
- World Health Organisation. (1998). *Promoting active living in and through schools. Policy statement and guidelines for action. Report of a WHO meeting, Esbjerg, Denmark, 25-27 May 1998*. Denmark: World Health Organisation.
- World Health Organisation. (2000). *Managing Complications in Pregnancy and Childbirth: Section 3 - Procedures* Retrieved 14th May, 2007, from  
[http://www.who.int/reproductive-health/impac/Procedures/Episiotomy\\_P71\\_P75.html](http://www.who.int/reproductive-health/impac/Procedures/Episiotomy_P71_P75.html)
- World Health Organisation. (2001). Research on antenatal care and maternal mortality and morbidity. *Progress in Reproductive Health Research*, 56, 8.
- World Health Organisation. (2003). Physical Activity Facts: World Health Organization Global Strategy on Diet, Physical Activity and Health. Retrieved 4th Jul7, 2007, from  
<http://www.who.int/dietphysicalactivity/publications/facts/pa/en/>
- World Health Organisation. (2004). *Maternal mortality in 2000: estimates developed by WHO, UNICEF and UNFPA*. Geneva: World Health Organisation.

- World Health Organisation. (2005a). *Low birthweight: Country, regional and global estimates*. Geneva: World Health Organisation.
- World Health Organisation. (2005b). *The World health report: 2005: make every mother and child count*. Geneva: World Health Organisation.
- World Health Organisation. (2006a). *Definitions and metadata*. Geneva: World Health Organisation.
- World Health Organisation. (2006b). *Neonatal and Perinatal Mortality: Country, regional and global estimates* Geneva: World Health Organisation.
- World Health Organisation (2007). Antenatal care coverage. *Journal*, 2. Retrieved from <http://www.who.int/whosis/indicators/2007ANC/en/print.html>
- World Health Organisation (Ed.). (2002). *International Statistical Classification of Diseases and Related Health Problems* (10th Revision. ed.). Geneva: World Health Organisation.
- World Health Organisation, UNFPA, UNICEF, & World Bank. (1999). *Reduction of maternal mortality. A joint WHO/UNFPA/UNICEF/World Bank statement*. Geneva.
- World Health Organization, & UNICEF. (2004). Far more pregnant women getting antenatal care. Geneva, New York: World Health Organisation, UNICEF.
- Yadin, E., & Thomas, E. (1998). Limbic mechanisms of anxiety and stress. In A. Levy, E. Grauer, D. Ben-Nathan & E. R. de Kloet (Eds.), *New frontiers in stress research: Modulation of brain function*. Amsterdam: Harwood academic publishers.
- Yildirim, G., & Sahin, N. H. (2004). The effect of breathing and skin stimulation techniques on labour pain perception of Turkish women.[see comment]. [Clinical Trial Controlled Clinical Trial]. *Pain Research & Management*, 9(4), 183-187.
- Yoga Journal. (2008, February 26, 2008). Yoga Journal Releases 2008 "Yoga in America" Market Study. Retrieved 14th November, 2008, from [http://www.yogajournal.com/advertise/press\\_releases/10](http://www.yogajournal.com/advertise/press_releases/10)

Young, C., Kuehl, T. J., Sulak, P. J., & Allen, S. R. (2000). Gestational diabetes screening in subsequent pregnancies of previously healthy patients. *American Journal of Obstetrics and Gynaecology*, 182(5).

Zhang, J., Yancey, M. K., Klebanoff, M. A., Schwarz, J., & Schweitzer, D. (2001). Does epidural analgesia prolong labor and increase risk of cesarean delivery? A natural experiment. *American Journal of Obstetrics & Gynecology*, 185(1), 128-134.