Advanced Maternal Age and Risk Perception

by

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Abstract

Advanced maternal age (AMA) is linked to several adverse pregnancy outcomes, hence these pregnancies are considered to be "high risk." Risk perception impacts pregnant women's health care use, health behaviors, and adherence to medical recommendations. Yet, a gap remains in the understanding of perception of pregnancy risk and its contributing factors. This mixed methods research study was developed to address this gap, using a conceptual framework based on a literature review and the Psychometric Model of risk perception. The specific objectives of this study were to compare risk perception in nulliparous women of AMA with younger women, determine the factors influencing perception of pregnancy risk, and gain an understanding of women's perspectives of risks associated with AMA.

Between December 2009 and January 2011, a sample of 159 participants (105 women aged 20-29 years and 54 women aged 35 years or older) was recruited from a variety of settings in Winnipeg, Manitoba. Several questionnaires were completed by participants. Descriptive statistics, chi square, t tests, Pearson's *r* correlations, and stepwise multivariate linear regressions were used to analyze data. Fifteen women of AMA were chosen purposefully to participate in individual and semi-structured interviews. Interviews were audio-taped and transcribed verbatim, and content analysis was used to identify themes.

Results revealed that pregnancy-related anxiety, maternal age, medical risk, perceived control (internal), and gestational age were significant predictors of perception of pregnancy risk accounting for 47-49% of the variance in risk perception. Maternal age

interacted in a synergistic manner with pregnancy-related anxiety to increase perception of pregnancy risk levels. In the qualitative component, four main themes emerged from the data: definition of pregnancy risk, factors influencing risk perception, risk alleviation strategies, and risk communication with health professionals.

Women of AMA perceived higher pregnancy risk for both themselves and their fetuses than younger women. However, they were not a homogenous group in their pregnancy risk appraisal. This study contributed to the field by proposing pregnancy-related anxiety as a pregnancy dread factor in risk perception theories. Risk communication is an important element of developing care plans for women of AMA and should be integrated into prenatal care visits.

Keywords: advanced maternal age, perception of pregnancy risk, mixed methods research, high risk pregnancy, anxiety, risk communication.

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Dedication

To my son, and my parents

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Dissertation Organization

This dissertation is organized following the manuscript format, in which three distinct, but inter-related manuscripts constitute the body of the dissertation. Chapter 1 presents an introduction to the topic. Chapter 2 includes a review of pertinent literature that provides a context to situate the current study. Chapter 3 outlines the conceptual framework underlying this study. Chapter 4 describes the design and methods used to conduct the study. Chapters 5, 6, and 7 are stand-alone manuscripts reporting the results and conclusions of this study. Chapter 5 compares perception of pregnancy risk in the two groups of nulliparous women. Chapter 6 determines factors influencing the perception of pregnancy risk and finally, Chapter 7 reports the findings of the qualitative component of the study. This chapter presents participants' perspectives on pregnancy risk and examines their risk appraisals. A brief section prior to each manuscript is included to outline the logic in linking these chapters and to explain how the results of the previous manuscript have informed the subsequent manuscript. Chapter 8 is a discussion section that explains the process of integration of the findings of the two components and provides a general discussion of the overall findings. This chapter also considers limitations and strengths of the study, and proposes recommendations for future research. Tables and figures are found at the end of each chapter and presented in the order they appeared in the text.

Because each manuscript is constructed as a self-contained and standalone research paper, some redundancy between Chapters 2, 3 and 4 and the introduction and methods

sections of the manuscripts exist, which is the results of including this information in each manuscript.

Chapter One: Introduction

Modern social life has had considerable effects on women's reproductive life in the past three decades. Today, it has become more commonplace for women to delay childbearing into their mid thirties and early forties for educational, social, and economic reasons (Benzies et al., 2006; Tough, Benzies, Fraser-Lee, & Newburn-Cook, 2007). The maternal age of 35 years or older at the time of delivery has been defined as advanced maternal age (AMA). According to the National Vital Statistics Report, the birth rate for women aged 35 to 39 years in the United States increased to 47.5 births per 1,000 women in 2007, the highest rate since 1964, and the birth rate for women 40 to 44 years increased to 9.5 births per 1,000 women in 2007, the highest rate since 1968 (Hamilton, Martin, & Ventura, 2009). In Canada, the live birth rate among women of AMA has increased substantially. Between 1995 and 2004, the live birth rate for women aged 35 to 39 years increased by 32.5% (from 28.0 to 37.1 per 1,000 females). Correspondingly the live birth rate for women aged 40 to 44 years increased by 42.9% (from 4.2 to 6.0 per 1,000 females) and the live birth rate for women aged 45 to 49 years increased by 58.8% (from 0.17 to 0.27 per 1,000 females) (Public Health Agency of Canada, 2008).

AMA is associated with adverse pregnancy outcomes and increasing costs in relation to child birth (Zasloff, Schytt, & Waldenstrom, 2007). Several studies have demonstrated an association between AMA and preterm birth, low birth weight, still birth, chromosomal abnormalities, gestational diabetes, and multiple births (Cleary-Goldman et al., 2005; Huang, Sauve, Birkett, Fergusson, & Walraven, 2008; Jacobsson, Ladfors, & Milsom, 2004; Joseph et al., 2005; Newburn-Cook & Onyskiw, 2005). The

recent report of the Canadian Institute for Health Information (CIHI) on births from 2006–2007 through 2008–2009, demonstrated that the risks of gestational diabetes, cesarean section, placenta previa, labour complications and interventions, preterm birth, small for gestational age, and chromosomal defects were higher among Canadian women of AMA than younger women. Also based on this report, both maternal and neonatal hospital costs were higher for the women of AMA and their infants (Canadian Institute for Health Information, 2011). Due to the increased risk at AMA, pregnancy at age 35 years or older is considered to be a "high risk" pregnancy. Nevertheless, it is not clear how women of AMA perceive and evaluate their pregnancy risk compared to younger women.

Risk perception is about capturing the myriad meanings and weights that an individual assigns to the experience of being at increased risk (Pilarski, 2009) and is something quite different from risk (Sjoberg, 2000). This concept was introduced in 1960 by Bauer as a two dimensional structure, which included uncertainty and adverse consequences. Risk perception has been defined as "one's expectancy about the probability of an event" (Weinstein et al., 2007, p.147) or "beliefs about potential harm" (Brewer et al., 2007, p.136). Risk perception is incorporated as a key concept in constructing several theories of health behavior such as the Health Belief Model (Janz & Becker, 1984), Protection Motivation Theory (Maddux & Rogers, 1983), and Prospect Theory (Kahneman & Tversky, 1979). Most of these theories assume that individual's decisions regarding health-related behaviors are based on rational analyses of risks and benefits.

Pregnancy risk perception is important because it affects pregnant women's health care utilization, motivations to seek prenatal care, decisions about place of birth or choice about intensive medical interventions, adherence to medical procedures and recommendations, and healthy behaviors (Atkinson & Farias, 1995; Carolan & Nelson, 2007; Kolker & Burke, 1993; Kowalewski, Jahn, & Kimatta, 2000; Spielberger & Gorsuch, 1983). Unlike health care providers' understandings of risk that are the result of their knowledge, training, experiences, and values, pregnant women's understandings of risk are more contextual and individualized (Handwerker, 1994), reflecting their values, education, and social class (Searle, 1996; Saxell, 2000). Current knowledge indicates that pregnancy risk perception is highly individualized and that it is not exclusively based on medical diagnoses (Heaman, Gupton, & Gregory, 2004). For instance, results of a study by Gray in 2006 demonstrated an incongruity in risk assessment by pregnant woman and their care providers in which women tended to underestimate their pregnancy risk compared to their providers. Another study demonstrated that several factors other than medical risk may contribute to perception of pregnancy risk in which the majority of these factors are not identified yet (Gupton, Heaman, & Cheung, 2001). Knowledge of women's attitudes toward pregnancy risk may facilitate risk communication between health care providers and pregnant women (Jordan & Murphy, 2009). Current risk communication approaches that are mainly based on epidemiological risk factors, without attention to women's perceptions, might not entirely meet the needs of high risk women (Kowalewski et al., 2000). In spite of the importance of understanding the risk perception concept in providing high quality prenatal care, a gap remains in the understanding of perception of pregnancy risk and its contributing factors.

Purpose of the Study

The purpose of this research was to explore risk perception of nulliparous women of AMA from an in-depth perspective and to compare their risk perception to that of younger women (age 20 to 29 years). To achieve this goal, a mixed methods research study was employed. The main research question for this study was "How do nulliparous women of AMA perceive the risk of their pregnancies?" This mixed methods research study was composed of a quantitative component and a qualitative component. Each component included several specific research objectives, developed based on the literature review presented in Chapter 2. To facilitate reading of the dissertation, these objectives will be introduced in Chapter 3.

Significance of the Study

Pregnancy at age 35 years or older is considered to be a medically high risk situation. However, little is known about women's perception of pregnancy risk at AMA. Current knowledge indicates that pregnancy risk perception is an important factor in pregnant women's health care use and decision making during pregnancy. In spite of the significance of risk perception, current pregnancy risk assessment systems do not include women's beliefs and concerns. This work is an essential precursor in developing an understanding of women's pregnancy risk appraisal. The results will provide concrete, useful knowledge for designing effective approaches to caring for pregnant women, particularly women of advanced maternal age. Understanding how women perceive pregnancy risk can also assist policy makers in developing better policy and more effective programs in areas involving risk management.

Chapter Two: Literature Review

This literature review provides an overview of advanced maternal age (AMA) and perception of pregnancy risk. This review was undertaken to establish a context to examine the perception of pregnancy risk at AMA. The following five themes were addressed in this review: 1. A review of the trend of delayed childbearing and contributing factors; 2. A summary of risks associated with pregnancy at AMA; 3. An overview of the definitions and theoretical underpinnings of risk perception and factors influencing risk perception; 4. A summary of current knowledge in perception of pregnancy risk; and 5. A review of perception of pregnancy risk at AMA.

The Trend of Delayed Childbearing and Contributing Factors

In the past three decades, maternal age has increased worldwide. The fertility rate for women of AMA is growing fast in developed countries. For example, in Australia since 2003, the fertility rate for women aged 35 to 39 years has exceeded that of women aged 20 to 24 years (Australian Bureau of Statistics, 2010). Between 1991 and 2001 in the United States, the number of first births per 1000 women aged 35 to 39 years increased by 36% and the rate for women aged 40 to 44 years increased by 70% (Heffner, 2004). In Canada, between 1995 and 2004, the live birth rate for women aged 35 to 39 years, 40 to 44 years, and 45 to 49 years has increased by 32.5%, 42.9%, and 58.8%, respectively (Public Health Agency of Canada, 2008).

The trend of delayed childbearing has been contemporaneous with recent social changes that provided greater employment opportunities for women, and increased

female labour force participation (Tudiver, 2005). In current Canadian society, more women are in the labour force than ever before. In 2008, women accounted for more than 47% of the labour force in Canada (Statistcs Canada, 2009). Several other factors may also influence decisions about the timing of childbearing, including acceptance of delayed commencing of childbearing, decreasing family size, late marriage, advances in equality in the workplace, and increasing educational opportunities for women (Benzies et al., 2006; Carolan, 2003; Freeman-wang & Beski, 2002; Windridge & Berryman, 1999; Usta & Nassar, 2008). Advances in health care have also provided broader reproductive rights for women and contributed to increasing rates of delayed childbearing. Longer life expectancy, more effective contraceptive techniques, modern infertility treatments, and developments in obstetric care are some examples in this regard (Carolan, 2003; Delpisheh, Brabin, Attia, & Brabin, 2008; Tudiver, 2005; Windridge & Berryman, 1999).

Tough, Benzies, Fraser-Lee, and Newburn-Cook (2007), a group of researchers from Alberta, conducted a study on the timing of childbearing among Canadian men and women. One of the objectives of their study was to determine the factors influencing the timing of childbearing for non-parenting men and women. The survey was completed by 500 men and 1,006 women from two cities in Alberta (Calgary and Edmonton). Researchers reported that there were four factors that respondents consider in timing their childbearing including: financial security, their partner's suitability to parent, their own interest in or desire for having children, and their partner's interest in or desire for having children. They concluded that delayed pregnancy may be a consequence of not finding the right partner, financial instability, and lack of awareness about the risks associated

with AMA. In this regard, Benzies et al. (2006) conducted a qualitative study of 45 Canadian women aged 20 to 48 years to examine the factors that influence Canadian women's decisions about the timing of motherhood. The results of this qualitative study suggested that decisions about the timing of childbearing were complex and influenced by several individual, familial, and societal factors. The investigators reported that older participants were more likely to value independence, having a stable relationship, and readiness to start a family than younger women.

Risks Associated with Pregnancy at AMA

Even though women of AMA are more likely than younger women to be well educated, have more knowledge about pregnancy and its complications, and be engaged in healthy behaviors (Bayrampour & Heaman, 2011), there are increased risks for adverse pregnancy outcomes at AMA. Although some researchers have argued that the absolute rate of adverse outcomes associated with AMA is low and most women of AMA will have the desired pregnancy outcomes (Joseph et al., 2007), literature supports the premise that AMA is an independent risk factor for poor pregnancy outcomes. In the following section, maternal and fetal mortality and morbidity associated with pregnancy at AMA are outlined and reasons for increased adverse pregnancy outcomes at AMA are discussed.

Mortality. There is a dramatic increase in the overall maternal mortality rate with increasing maternal age in developed countries (Hansen, 1986; Temmerman, Verstraelen, Martens, & Bekaert, 2004). Temmerman (2004) reported women aged 35 to 39 years in Belgium had a sevenfold increased risk for pregnancy-related death in comparison to

women giving birth in their 20s (22.1 vs. 2.9 per 100,000 live births). Based on the Confidential Enquiries into Maternal Mortality Report in the United Kingdom, thrombosis and hypertension were the leading causes of maternal death in 1994-1996 among all ages. Death as a result of hypertension was reported to be related to increasing maternal age and was five times more likely in women aged 40 years or older than in women aged ≤25 years (De, 2000). In Canada (excluding Quebec) between 1997-2000, women aged 35 to 39 years had a fivefold increased risk for maternal mortality ratio (MMR) per 100,000 live births, compared to women aged 20 to 24 years (Health Canada, 2004).

It should be noted that despite the increased maternal mortality with advancing maternal age, because maternal mortality occurs rarely in developed countries, the use of maternal mortality as an indicator of maternal health has been challenged, and maternal morbidity has been suggested as an appropriate alternative measure (Carolan, 2003; Temmerman et al., 2004; Waterstone, Bewley, & Wolfe, 2001).

Morbidity. Pregnancy at AMA is associated with pregnancy complications and adverse outcomes such as preterm birth, low birth weight, still birth, chromosomal abnormalities, preeclampsia or eclampsia, and gestational diabetes. (Cleary-Goldman et al., 2005; Huang et al., 2008; Jacobsson et al., 2004; Joseph et al., 2005; Newburn-Cook & Onyskiw, 2005). Moreover, women of advanced maternal age are more likely to experience assisted conception, cesarean section, assisted vaginal delivery, and multiple births. Also, their newborns are more likely to be macrosomic or need intensive care (Delbaere et al., 2007; Delpisheh et al., 2008). Joseph et al. (2005) conducted a

population-based study of all women in Nova Scotia, who delivered a singleton fetus between 1988 and 2002. The purpose of the research was to determine if the rates of pregnancy complications, preterm birth, small for gestational age, perinatal mortality, and serious neonatal morbidity were higher among women of AMA compared to women aged 20 to 24 years. They found that women of AMA were more likely to have hypertension, diabetes mellitus, placental abruption, or placenta previa, preterm birth, and small for gestational age. In another Canadian study, older maternal age was determined as a significant risk factor for hysterectomy due to atonic postpartum haemorrhage (Joseph et al., 2007). The recent analysis of the Canadian Institute for Health Information (CIHI) of births from 2006–2007 through 2008–2009 demonstrated that pregnancies at AMA is associated with several adverse maternal and neonatal outcomes (Canadian Institute for Health Information, 2011). Current knowledge suggests that the effect of increasing maternal age is a continuum rather than a threshold effect (Montan, 2007).

Explanations for the increased adverse pregnancy outcomes at AMA. Although the exact mechanisms underlying this issue are not fully explained yet, the following reasons may be noted: First, an aging reproductive system might contribute to increased adverse pregnancy outcomes (Cleary-Goldman et al., 2005; Jolly, Sebire, Harris, Robinson, & Regan, 2000; O'Leary et al., 2007; Treacy, Robson, & O'Herlihy, 2006; Yuan et al., 2000). An inefficiency of the aging myometrium is associated with myometrium incompetency and decrease in the number of oxytocin receptors resulting in increased risk of dysfunctional labour patterns and induction of labor (Bianco et al., 1996; Bobrowski & Bottoms, 1995; Usta & Nassar, 2008). Decreased pelvic compliance

and reduced maternal voluntary effort during labor are also documented (Bell et al., 2001; Treacy et al., 2006).

Another explanation is increasing prevalence of preexisting disease at AMA. The contribution of aging of other systems and rising incidence of medical conditions and chronic disease such as cardiovascular disease, arthritis, and diabetes might increase the risk of adverse perinatal outcomes (Cleary-Goldman et al., 2005; Cnattingius, Cnattingius, & Notzon, 1998; Delbaere et al., 2007; Usta & Nassar, 2008).

Another possible explanation is that advancing mother's age is associated with declining fecundity. Therefore, older women are more likely to require infertility treatment to become pregnant than younger women. Evidence indicates that pregnancy outcomes are worse among pregnancies with assisted reproductive technology (ART) than non ART pregnancies (Salihu, Wilson, Alio, & Kirby, 2008; Usta & Nassar, 2008). A study by Buckett et al. (2007) demonstrated that ART pregnancies are more likely to be associated with an increased risk of multiple pregnancy, cesarean delivery, and congenital abnormality. Findings of a recent review suggested that spontaneous pregnancies in untreated infertile women may be at higher risk for obstetrical complications and perinatal mortality than spontaneous pregnancies in fertile women (Allen, Wilson, & Cheung, 2006).

Obesity, which has become a common issue in the western world, might be another reason for increased adverse pregnancy outcomes at AMA. In Canada, the proportion of obese pregnant women increased from 3.2% in 1988 to 10.2% in 2002. Maternal obesity has a documented association with adverse maternal and fetal outcomes,

particularly among women of AMA, who are at increased risk for several pregnancy complications (Rowlands, Graves, de, McIntyre, & Callaway, 2010). Even moderately obese women had an increased risk of pregnancy-induced hypertension, antepartum venous thromboembolism, labour induction, caesarean section, and wound infection (Montan, 2007).

Definition and Theoretical Underpinnings of Risk Perception

Risk has been defined as an "uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value" (Aven & Renn, 2009, p. 6). Risk perception can be different from actual risk (Sjoberg, 2000) and includes meanings that each individual assigns to being at increased risk (Pilarski, 2009). In 1960, risk perception was introduced by Bauer as a two dimensional structure including uncertainty and adverse consequences. Risk perception has been defined as "one's expectancy about the probability of an event" (Weinstein et al., 2007, p.147) or "beliefs about potential harm" (Brewer et al., 2007, p.136). Nevertheless, risk perception is a complex concept that is not completely understood in the literature (Pilarski, 2009). Risk perception is integrated as a key concept in constructing several theories of health behavior such as the Health Belief Model (Janz & Becker, 1984), Protection Motivation Theory (Maddux & Rogers, 1983), and Prospect Theory (Kahneman & Tversky, 1979). Most of these theories assume that an individual's decisions about health behaviors are based on the rational analyses of potential risks and possible benefits.

Risk perception theories. There are numerous theories which attempt to explain risk perception. The most well-known theories are the Cultural Theory and the Psychometric Model.

Cultural Theory. This theory was developed by Douglas and Wildavsky (1982) and assumes that risk perception is socially and culturally framed. Based on this theory, people's values, attitudes, and worldviews are characterised within their social structure and context, and these values and worldviews shape the individual's perception and evaluation of risks. Cultural Theory groups people into four categories based on their concerns about different types of risk: some people are more concerned with risks associated with technology and the environment (egalitarian), while others focus on war and other threats to the markets (individualistic), law and order (hierarchic), or none of the above (fatalistic) (Sjoberg, 2000). According to this theory, the most important predictors for selecting what people fear or do not fear are socially shared worldviews. These worldviews are called cultural biases, which determine individuals' perceptions, not their cognitive processes and feelings (as stated in the Psychometric Model) (Dake, 1992; Wildavsky & Dake, 1990).

Psychometric Model. The Psychometric Model focuses mainly on cognitive factors that influence individuals' risk perception. Two key cognitive factors in this model are the dread risk factor and the unknown risk factor (Slovic, Fischoff, & Lichtenstein, 1980; Slovic, 1987). This theory approaches risk as a subjective issue; "risk does not exist 'out there', independent of our minds and cultures, waiting to be measured" (Slovic, 1992, p.119).

The Psychometric Model was introduced in 1978 by Fischhoff et al. They evaluated the importance of people's judgments about risk by studying nine characteristics of risk: voluntariness of risk, newness, immediacy of effect, public knowledge about risk, scientists' knowledge (the extent that risks are known in literature), control over risk, its potential for catastrophic (multiple-fatality) consequences, the severity of consequences, and common dread. They found that these nine characteristics of risk influenced judgments of perceived and acceptable risk and were highly inter-correlated. Therefore, they reduced these characteristics to two dimensions; the degree to which a risk is unknown and the degree to which a risk elicits dread (Fischoff, Slovic, Lichtenstein, Read, & Combs, 1978; Gerend, Aiken, & West, 2004).

Factors influencing risk perception. Based on the literature, risk perception is a multifactorial concept, which is the result of an individual's cognitions and motivations and is influenced by the social, political, and cultural environment (Slovic, 1992). Unlike experts' risk estimation, mostly based on statistical and probabilistic information (Boholm, 1998), people's risk assessments may be influenced by several factors. The following sections introduce some of these factors: social and cultural contexts; familiarity with, availability, and representativeness of risk; perceived control over risk; gender; age; and trust in the source of information.

Social and cultural contexts. Social and cultural contexts are essential to how people understand and perceive risk (Weyman & Kelly, 1999). As stated in Cultural Theory, a social structure forms individuals' values and manners. Therefore, the values

and worldviews of certain social or cultural contexts outline different risk perceptions (Douglas & Wildavsky, 1982).

Familiarity. Familiarity with risk refers to the extent that an individual has knowledge of, or is familiar with, a risk. The degree of familiarity with risk is part of the wider concept of "unknown risk", which is considered one of two important concepts in the Psychometric Model of risk perception (Fischoff et al., 1978; Williamson & Weyman, 2005). Familiarity is related to personal experience of risk, risk knowledge, and the perceived control over risk (Williamson & Weyman, 2005).

Availability. Risk availability influences risk perception. Individual or non individual experience (e.g., through the media or a friend's illness) with a risk may increases its perceived availability, and as a result, its perceived possibility (Gerend, Aiken, West, & Erchull, 2004).

Representativeness. Risk representativeness (similarity) is also considered an important factor in judging the probability of an event. According to Kahneman and Tversky (1973), "people predict the outcome that appears most representative of the essential features of the evidence" (p. 237). In other words, the probability of an event is evaluated by its similarity to events with comparable characteristics (Gerend et al., 2004).

Perceived control. There is growing interest in understanding the role of perceived control in risk perception. Research indicates that people with higher perceived control perceive themselves as less vulnerable to negative health outcomes. Alternatively,

people with lower perceived control over their own health may feel at a higher risk for adverse health outcomes (Gerend et al., 2004).

Gender. Gender may influence perceived risk. In general, men have a tendency to rate the risks associated with hazards lower than do women (Hawkes & Rowe, 2008; Boholm, 1998).

Trust. Because not all people experience an actual risk, their perceptions of risk are mostly through information that is received from different sources. Therefore, the degree of trust that people have in risk information sources is important in risk perception (Williamson & Weyman, 2005).

Age. Age also might play a role in risk perception. Although older age usually is considered as a risk factor for developing several diseases, Gerend et al. (2004) reported that in their study on perceived risk of osteoporosis, breast cancer, and heart disease, older women had a lower perceived risk in comparison to younger women.

Risk Perception during Pregnancy

The concept of pregnancy risk has grown in recent years, partly due to advances in pregnancy risk knowledge and technologies and also increasing community knowledge (Carolan, 2003). A "high risk pregnancy" has been defined as a pregnancy in which there is a probability of adverse outcomes for the mother or baby, which is greater than for the general pregnant population (James & Stirrat, 1988). Similar to risk perception in other fields, pregnancy risk perception is highly individualized and several factors may influence the perception of pregnancy risk (Heaman et al., 2004). The term risk may be

interpreted differently by health care providers and women. While health care providers' understandings of risk are the result of their knowledge, training, experiences, and values, women's understandings of risk are more contextual and individualized (Handwerker, 1994) and reflect their values, education, and social class (Saxell, 2000; Searle, 1996). Johanson, Newburn, and Macfarlane (2002) believe that for developing clinically effective services, women's wishes and fears should be addressed. There is evidence indicating that pregnancy risk perception affects pregnant women's health care use and motivations to seek prenatal care. For instance, Blankson et al. (1994) found that the discrepancy between high risk pregnant women's risk perception and care providers' risk perception may be responsible for missed prenatal appointments. In another study, Atkinson et al. (1995) conducted 51 qualitative interviews to explore the relationship between perceptions of pregnancy risk and pregnant women's motivations for using health services in Brazil. Researchers reported that from the women's perspective, the most important risks related to pregnancy were cesarean section, abortion (induced and spontaneous), high blood pressure, and anaemia. They found that women's risk perception may not be always related to the medical diagnosis, and risk may be explained in different language and concepts than the biomedical model. Atkinson et al. (1995) also reported that there were many factors affecting risk perception such as health services' characteristics and structures and the context within which women live. They suggested that approaches to understanding perceptions of health risks should be comprehensive and broad.

Kolker and Burke (1993) determined a relationship between risk perception and the decision making process about prenatal diagnosis. Suplee et al. (2007) stated that risk

perception may influence women's decisions during pregnancy about place of birth or about their choices in having intensive medical interventions. Kowalewski et al. (2000) conducted a study to identify barriers to use of referral level care by high risk pregnant women. These researchers found that the problem of access to care goes far beyond distance and costs. They concluded that the current risk approach that is mainly based on epidemiological risk factors is not helpful to high risk mothers.

Factors influencing perception of pregnancy risk. According to the literature, there are several factors affecting perception of pregnancy risk. In 2004, a qualitative study by Heaman, Gupton, and Gregory was conducted to identify factors that pregnant women considered in making personal risk assessments. They found that their participants' assessment of risk was a multidimensional process and influenced by several factors such as self image of their own general health, health and family history, the healthcare system, and the odds of the unforeseen and unknown complications. Based on findings of Heaman et al., women who perceived themselves as healthy perceived lower risk for their pregnancy than women who had less positive views of themselves or their pregnancies. They also found that women's health history, current health status, previous reproductive experiences, and family histories played an important role in risk appraisal. Patterson (1993) reported that their pregnant participants defined pregnancy risk based on their experiences of problematic change and on the assessment of their care providers. Atkinson et al. (1995) reported that pregnant women's perceived risks can be influenced by health services' structure and practices and also women's socio-economic status.

From a quantitative perspective, Gupton, Heaman, and Cheung (2001) explored the relationship between biomedical, psychosocial, and demographic risk factors with perception of pregnancy risk. Results of their study revealed that biomedical risk and state anxiety were predictors of perception of pregnancy risk. They also reported that women with complicated pregnancies perceived their risk as significantly higher than those with uncomplicated pregnancies. In another study, the degree of confidence that pregnant women had about the health care they received was found to be related to their perceived risk (Heaman et al., 2004). Feedback from peers may also contribute to perception of pregnancy risk. Patterson (1993) reported that black pregnant women in defining pregnancy risk not only were considering their own experiences and the health care provider's assessment, but also were relying upon the feedback they received from the counsel of other black women.

Risk Perception at AMA

As discussed in an earlier section, pregnancy at AMA is associated with a variety of adverse pregnancy outcomes (Cleary-Goldman et al., 2005; Hung, 2008; Jacobsson et al., 2004; Joseph et al., 2005; Joseph et al., 2007). Carolan and Nelson (2007) suggested that concept of risk at AMA may be composed of two parts: the physiological challenges associated with AMA and medical risks, and the social discourse of risk associated with pregnancy at AMA and timing of childbearing. Recently, a few studies were conducted that have provided some insights into women's knowledge of risks associated with AMA. For example, Tough et al. (2006) conducted a study to determine women's knowledge about maternal age-related reproductive risks, such as pregnancy complications

associated with low birth weight (LBW), preterm delivery, and multiple birth. Computer-assisted telephone interviews were conducted with 1,044 randomly selected women who delivered their first live-born infant in Calgary or Edmonton, Alberta. Their findings demonstrated that although most women were aware of conception difficulties associated with AMA, the majority of them were not informed about adverse pregnancy outcomes related to increased maternal age including multiple birth, caesarean section, preterm delivery, and LBW. The results of another study conducted by these researchers indicated that most non-parenting Canadians were not informed about risks associated with delayed childbearing (Tough et al., 2007).

A few studies have focused on perception of pregnancy risk at AMA as a primary interest. The perception of risk was mainly discussed as a part of pregnancy experiences at AMA. Windridge (1999), in a study on women's experiences of giving birth after age 35 years, reported that women of AMA were more informed about risks associated with pregnancy and were more likely to admit that their baby's life might have been at risk during labor compared to women aged 20-29 years. Therefore, these women may believe that their age makes their infants particularly vulnerable. Another important study on this topic is an Australian work. In 2005, Carolan conducted a qualitative study of 22 primigravid women aged 35 years or older with uncomplicated pregnancies. The initial purpose of this qualitative study was to understand the experiences of first mothering for women over age 35 years. Later, Carolan and Nelson (2007) undertook a secondary analysis of the original data and examined the transcripts to find statements and terms that were related to risk. They reported four themes central to perception of pregnancy risk of these women, including "realizing I was at risk," "hoping for reassurance,"

"dealing with uncertainty," and "getting through it/negotiating risk." They found that the notions of risk had impacted negatively on older mothers in terms of concern and additional surveillance. Their participants had experienced a high level of concern and anxiety in spite of having healthy and full-term pregnancies. The notable limitation of this study is that it is a secondary analysis and no specific questions about perception of risk were asked.

A study by Saxell (2003) had a primary focus on perception of pregnancy risk at AMA. Saxell (2003) designed a qualitative study to explore women's understanding and beliefs about the risks associated with nulliparous pregnancy over age 35 years. This Canadian qualitative study was composed of ten participants, and the results showed that the pregnant women experienced challenges in regards to risk labeling. These women attempted to cope with these concerns by rejecting the label of high risk and creating a safe environment free from stress and conflict. Saxell stated the need for developing a new model of care according to these women’s needs. A significant limitation of this study was that data were collected retrospectively (36 months after delivery). In addition, its unique population (participants who chose midwifery care) should be considered in the interpretation of the results.

The review of the literature on risk perception at AMA highlights that little research has been conducted in this area. The purpose of this study was to gain further understanding and knowledge about risk perception and its contributing factors at AMA. In the next chapter, this review will be incorporated in the conceptual framework of the study.

Chapter Three: Conceptual Framework

In this chapter, the conceptual framework underlying this study will be introduced. Risk perception is an area with many unsolved and poorly understood issues (Hawkes & Rowe, 2008). Experts in the field of risk perception believe that current theories applied in risk perception are not comprehensive and can explain only a small fraction of the whole phenomenon (Slovic, Monahan, & MacGregor, 2000). Although there is no widely accepted model of risk perception that explains what factors and in what ways are related to risk perception (Hawkes & Rowe, 2008), the Psychometric Model is currently considered as the best theory in this area (Slovic et al., 2000). Therefore, for the purpose of this study, the Psychometric Model of risk perception is employed as the core component of the conceptual framework. However, due to the complex and multidimensional nature of risk perception, especially among women of AMA who are faced with the conceptualization of multiple risks, several other concepts were added to the Psychometric Model to achieve a better understanding of risk perception at AMA.

As mentioned earlier, the Psychometric Model consists of two core concepts: the unknown risk and the amount of a dread feeling evoked by risk. In this study, risk knowledge and pregnancy-related anxiety were selected to represent the "unknown" and "dread factor" respectively. In addition to these two concepts, four concepts were identified by the literature review to be important in constructing perception of pregnancy risk: medical risk, health status, cognitive heuristics (availability and similarity), and

perceived control. The following is a description of how these concepts were applied in the current study.

Risk knowledge. The degree of familiarity with risk or risk knowledge is part of the wider concept of "unknown risk", which is the first concept in the Psychometric Model of risk perception (Boholm, 1998; Fischoff et al., 1978; Williamson & Weyman, 2005).

Dread factor. In applying the second concept, it was assumed that a greater feeling of dread might be observed in women who have more anxious feelings about having a healthy pregnancy with desirable outcomes. This placement is supported by the findings of a previous study, which illustrated that state anxiety predicted perception of pregnancy risk (Gupton et al., 2001).

Medical risk. Previous research supports the role of objective medical risk in constructing perception of pregnancy risk. For example, Atkinson et al. (1995) reported that although their participants' risk perception was sometimes different than modern medical perspectives, there was not always conflict between women's lay perceptions and medical explanations. Findings of two other studies also supported the inclusion of medical history and personal and family health history as important in the determination of perception of pregnancy risk (Gerend et al., 2004; Heaman et al., 2004).

Health status. A woman's current health status might be important in her interpretation of the amount of dread. The findings of Heaman et al. (2004) suggested that women considered their own general health in their pregnancy risk appraisal.

Cognitive heuristics. Cognitive heuristics, mental guidelines that are used to process whether risk knowledge is available or represented (Boholm, 1998), is another significant concept arising from the literature review. The availability heuristic refers to "a cognitive shortcut used for judging the probability of an event by the ease with which examples of the event come to mind" (Gerend et al., 2004, p.248). In other words, the availability heuristic is a cognitive plan for processing and understanding information and it refers to what people remember, not to what actually has happened (Boholm, 1998). The similarity or representativeness heuristic reflects "a cognitive shortcut used for judging the probability of an event by its similarity to events with comparable features" (Gerend et al., 2004, p.248).

Perceived control. There is growing evidence regarding the significance of a person's self-image (Heaman et al., 2004) and perceived control (Kolker et al., 1993) in risk perception. If people have some measure of control over a potential risk, they may consider that as less risky. In fact, from this perspective, a controllable risk that poses a high degree of risk is perceived safer than others which are less risky but uncontrollable (Nordgren, Van Der Pligt, & Van Harreveld, 2007). Results of a study by Kolker and Burke in 1993 that was conducted to describe the relationship between risk perception and decision making about prenatal diagnosis, demonstrated that perceived control, the severity or impact of the outcome (dread factor), and the psychological availability of the risk can influence risk perception (Kolker & Burke, 1993).

Because the main interest of this study was to understand the perception of pregnancy risk at AMA, maternal age was also included in the conceptual framework. In

the review of the literature, perception of pregnancy risk appears to be influenced by perceived control, cognitive heuristics (availability and similarity), health status, and medical risk. Because the Psychometric Model does not include some of these concepts, a new conceptual framework to study perception of pregnancy risk was developed based on the literature review and guided by the Psychometric Model of risk perception. Figure 1 illustrates the conceptual framework of the study. In addition to anxiety and risk knowledge, five new factors identified through the literature review were also included in the framework. Later, through in-depth interviews of women for the qualitative component of this mixed methods study, gestational age was identified as another important factor in perception of pregnancy risk and was included in the framework as the eighth variable.

Figure 1. Conceptual framework of the study

Research Questions

As noted in Chapter One, the purpose of this research was to advance an understanding of perception of pregnancy risk at AMA. A mixed methods research study with both qualitative and quantitative components was employed to address this question. In each component of the mixed methods research different aspects of the phenomenon were studied.

Research questions for the quantitative component. The objectives of the quantitative component were to compare perception of pregnancy risk in women of AMA (age 35 years or older) to younger women (age 20 to 29 years) and to determine the association of pregnancy-related anxiety, risk knowledge, perceived control, health status, medical risk, gestational age, cognitive heuristics, and maternal age with perception of pregnancy risk. The following were the research questions for this component:

1. Is perception of pregnancy risk in nulliparous women of AMA different from nulliparous women aged 20 to 29 years?
2. What are the associations of pregnancy-related anxiety, risk knowledge, perceived control, health status, medical risk, gestational age, cognitive heuristics, and maternal age with perception of pregnancy risk among nulliparous women?
3. How does maternal age interact with pregnancy-related anxiety, risk knowledge, perceived control, health status, medical risk, gestational age, and cognitive heuristics in relation to perception of pregnancy risk in nulliparous women?

Research questions for the qualitative component. The objectives of the qualitative component of the study were to explore how nulliparous women of AMA evaluate and define pregnancy risk and to arrive at a detailed understanding of their risk perception. The following were the research questions for the qualitative component:

1. How do nulliparous women of AMA define pregnancy risk?
2. What factors, including risk perception, affect decision making about timing of childbearing in women of AMA?
3. Why do women of AMA feel that their pregnancy is/is not at risk? Which factors influence perception of pregnancy risk for women of AMA?
4. What were the experiences of women of AMA with risk communication from health care providers during this pregnancy? How do women feel their perceptions of risk differed from that of their health care providers, if at all?
5. What impact, if any, does being labeled high risk have on the women's life and health behaviors?

Chapter Four: Design and Methods

In this chapter the overall plan for addressing the research questions will be described. This study employed mixed methods research with both qualitative and quantitative components. In the beginning of the chapter, the mixed methods approach is explained, followed by a detailed description of the research design, setting, sampling methods, data collection procedures, selection of measurement methods (instruments), and methods of data analysis for both quantitative and qualitative components. Finally, the ethical considerations are outlined.

Mixed Methods Research

Traditionally, research has been conducted from either a quantitative or a qualitative paradigm. In 2004, Johnson and Onwuegbuzie proposed mixed methods research as the third major research paradigm, along with qualitative research and quantitative research, to recognize that both quantitative and qualitative research are important and to encourage the advocators of the two former paradigms to move beyond their classic arguments (Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007). Mixed methods research has been defined as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative methods in a single study or a program of inquiry" (Tashakkori & Creswell, 2007, p.4). According to Creswell (2008), mixed methods research helps answer questions to which qualitative or quantitative approaches alone would not provide a satisfactory answer. Mixed methods research is unique because it gives the researcher an ability to apply all possible methods and use both numbers and

words and combine inductive and deductive thinking to address the research problem (Creswell & Plano Clark, 2007). Mixed methods research employs more than one research method; for example, a mixed methods research study may include two quantitative methods or two qualitative methods or one qualitative and one quantitative method (Peter & Gallivan, 2004). The current mixed methods study included both qualitative and quantitative components and each component will address different aspects of risk perception at AMA.

Paradigm (world view). Paradigms have been defined as "worldviews or all-encompassing ways of experiencing and thinking about the world, including beliefs about morals, values, and aesthetics" (Morgan, 2007, p. 50). While data collection and analysis techniques are not linked to paradigms, the researchers' attitudes toward and treatment of data is completely influenced by the researcher's world view. Hence, the resulting mix and how the researcher will treat the results analytically are determined by the researcher's paradigm (Sandelowski, 2000a). This mixed methods study is based on the pragmatism paradigm. Pragmatism has been defined as "a deconstructive paradigm that debunks concepts such as 'truth' and 'reality' and focuses instead on 'what works' as the truth regarding the research questions under investigation" (Teddlie & Tashakkori, 2003, p.713). It has been argued that this paradigm is the overarching paradigm for mixed methods research because it supports the position that qualitative and quantitative research methods can be used in a single study; the research question is of primary importance rather the method or the philosophical worldviews; and finally, it provides a practical and applied research philosophy to direct methodological choices rather than a

forced dichotomous choice between postpositivism and constructivism (Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003).

Study Design

Based on the timing of the quantitative and qualitative methods, a mixed methods research design can be classified as either sequential or concurrent (Giddings & Grant, 2006). In the sequential design, one component is completed first. Then, based on the results, the second or third components are designed. In the concurrent design, both methods are employed at the same time and data are collected concurrently. Typically, the main intention of concurrent design is to verify, cross-validate, explain or confirm findings from one method with those from another (Creswell & Plano Clark, 2007; Giddings & Grant, 2006). In both designs, either method could have equal significance to answering the research question or one set of findings can be used as a secondary method to complement the other (Giddings & Grant, 2006; Wilkins & Woodgate, 2008). In the current study, both qualitative and quantitative methods were employed concurrently, and an equal weight was assigned to each component; therefore, a concurrent design was employed to address the research questions.

Sampling

In mixed methods research, a combination of quantitative and qualitative sampling techniques may be used. According to Teddlie and Yu (2007), there are four sampling techniques for mixed methods research: basic mixed methods sampling,

sequential mixed methods sampling, concurrent mixed methods sampling, multilevel mixed methods sampling, and a combination of mixed methods sampling strategies.

Sampling for the purpose of the present study was based on a concurrent mixed methods sampling. There are two concurrent mixed methods sampling techniques: In the first method, sampling procedures for each component take place independently. In other words, quantitative sampling techniques are used to collect data for the quantitative component and purposive sampling techniques are used to generate data for the qualitative component. In the second method, both quantitative and qualitative sampling techniques are utilized to create a single sample (Teddlie & Yu, 2007). Sampling for the current study included a combination of both convenience sampling (quantitative) and purposive sampling (qualitative).

In a concurrent study, it is recommended that researchers use the same individuals for both quantitative and qualitative data collections, because selecting different individuals, who have different demographic characteristics, may influence comparability of the results (Creswell & Plano Clark, 2007; Creswell & Tashakkori, 2007). In this study, a sub-set of women participating in the quantitative component was invited to participate in the qualitative interviews.

Quantitative Component

Design. The objectives of this component were to compare risk perception in women of AMA with younger women and to determine the role of pregnancy-related anxiety, risk knowledge, medical risk, health status, cognitive heuristics, perceived

control, maternal age, and gestational age in constructing risk perception during pregnancy. To achieve these goals, a comparative descriptive design, with a correlational component to examine factors associated with perception of pregnancy risk, was employed. Because this design is used to examine and describe differences in the variables of the two groups that occur naturally in a setting, it can appropriately address the objectives of this study (Burns & Grove, 2005).

There were one dependent and eight independent variables in the current study. Perception of pregnancy risk was the dependent variable and the independent variables included pregnancy-related anxiety, risk knowledge, medical risk, health status, cognitive heuristics, perceived control, maternal age, and gestational age. In addition, several interaction terms were later defined between maternal age and those independent variables that had a significant bivariate relationship with perception of pregnancy risk.

Study setting. Participants were recruited from selected physician's offices and prenatal classes, and from the outpatient departments and antepartum units of two tertiary hospitals, St. Boniface General Hospital and the Health Sciences Centre in Winnipeg, Manitoba.

Population and sample. Data were collected between December 2009 and January 2011. All nulliparous women (defined as a woman who has never completed a pregnancy beyond 20 gestational weeks) attending selected physician's offices, prenatal classes, and the outpatient departments and antepartum units of St. Boniface General Hospital and the Health Sciences Centre comprised the population of the study. The sample was confined to nulliparous women to minimize the effect of previous pregnancy

experiences on risk perception. The sample consisted of two groups of women. Group one included nulliparous women aged 35 years or older and group two included nulliparous women between the ages of 20 to 29 years. The maternal age of 20 to 29 years has been used as a comparison group in several previous studies (Bayrampour & Heaman, 2011; Jacobsson et al., 2004; Windridge & Berryman, 1999; Ziadeh & Yahaya, 2001). All nulliparous women attending the study settings were considered as potential participants and were evaluated based on eligibility criteria. Therefore, a convenience sampling method was employed to recruit participants in this study.

Inclusion criteria. The following criteria were used in recruiting participants:

1. Nulliparous women,
2. Age between 20 to 29 years for younger women and age 35 years or older for women of AMA,
3. Singleton pregnancy,
4. Ability to speak, read, and write in English, and
5. Gestational age of 28 weeks or more (because women in the third trimester of their pregnancy might be more adapted to their pregnancy situation and be more informed).

Exclusion criteria. Any known and severe psychological disorder was considered as an exclusion criterion.

Instruments. All participants completed the Perception of Pregnancy Risk Questionnaire (PPRQ), the Pregnancy-related Anxiety scale, the Knowledge of Maternal Age-related Risks of Childbearing Questionnaire, the SF-12v2 Health Status Survey, the

Multidimensional Health Locus of Control (MHLC) Questionnaire, the Prenatal Scoring Form, and a demographic and childbirth data collection form. To measure the cognitive heuristics of availability and similarity, two questions were adapted from questions used by Gerend et al. (2004). To examine the availability heuristic, women were asked to report the number of female friends they knew with a complicated pregnancy. To examine the representativeness (similarity) heuristic, women were asked to rate their perceived similarity to the typical pregnant woman of the same age who developed pregnancy complications. The questionnaire is available in Appendix A. The Prenatal Scoring Form can be found in Appendix B.

The PPRQ consists of a nine-item scale including a five-item "Risk for Baby" subscale and a four-item "Risk for Self" subscale. This questionnaire uses a series of nine visual analog scales (VAS) to measure the perception of pregnancy risk. Respondents are asked to place a vertical mark through the line to indicate their assessment of risk for each item, yielding a score ranging from 0 to 100. Scores for the nine items are added together and then divided by nine to yield an overall risk perception score out of 100. Higher scores indicate higher levels of perceived risk. This scale has good internal consistency reliability, with a Cronbach’s coefficient alpha of 0.87 for the total scale, an alpha of 0.84 for the "Risk for Baby" subscale, and an alpha of 0.81 for the "Risk for Self" subscale (Heaman & Gupton, 2009). Validity of the scale was assessed using a sample of 199 women in the third trimester of pregnancy. The concurrent validity of the scale was confirmed by its correlation with the Spielberger State Anxiety Inventory (Spielberger & Gorsuch, 1983) (r=.46, p<.001). In addition, construct validity was

demonstrated using the known-groups technique and through convergent validity (Heaman & Gupton, 2009).

The Pregnancy-related Anxiety scale was used to assess a woman's fears and worries about her baby's health, her own health, and labor and delivery (Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999). The scale consists of ten items rated on a 4-point Likert scale ranging from one (1 = *never or not at all*) to four (4 = *a lot of the time or very much*). The internal consistency reliability of the scale is acceptable (alpha = 0.78). An exploratory factor analysis by Rini et al. (1999) revealed that the items were best represented by a single score. The total score is computed by reversing scores where applicable and calculating the mean of responses to all items, yielding a score ranging from one to four. Higher scores indicate higher levels of pregnancy-related anxiety (Rini et al., 1999; Wadhwa, Sandman, Porto, Dunkel-Schetter, & Garite, 1993).

The Knowledge of Maternal Age-related Risks of Childbearing scale developed by Tough et al. (2006) was utilized to measure risk knowledge. This scale consists of ten questions about various risks associated with advancing maternal age, answered as true, false, or don't know. Nine of these questions were used in this study. The number of correct responses was tabulated, yielding a score from zero to nine. According to Tough et al. (2006), the face and content validity of the scale was ensured through focus group testing, pilot interviews, and consultation with medical experts.

The SF-12v2 Health Status Survey is a shorter version of the SF-36v2® Health Survey (Ware, Jr., Kosinski, & Keller, 1996). The SF-12v2 measures functional health and well-being from the patient's point of view. The SF-12v2 is useful in measuring two

components including physical health (PCS) and mental health (MCS) functioning and covers the same eight health domains as the SF-36v2 with one or two questions per domain. These domains include: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. The reliability and validity tests of the SF-12v2 have been proven to be satisfactory. Its Cronbach's coefficient alpha is 0.88 for the physical component summary (PCS) and 0.82 for the mental component summary (MCS) (Cheak-Zamora, Wyrwich, & McBride, 2009).

The MHLC was used to measure women's perceived control (Wallston, Wallston, & DeVellis, 1978). The MHLC has been applied successfully as a measure of perceived control in a wide variety of populations, including pregnant women (Baldwin, 2006). This instrument is composed of 18 items about perceived control over health outcomes measured on a six-point Likert scale ranging from one (1 = *strongly disagree*) to six (6 = *strongly agree)*. The instrument includes three subscales that measure health-specific perceived control in the following areas: internal, chance, and powerful others. Based on Wallston et al. (1978), there is no such thing as a "total" MHLC score. Higher scores in each subscale indicate greater belief in that subscale domain of control over health. According to Wallston et al. (1978), correlations in the predicted direction of the MHLC scales with health status confirmed some evidence of predictive validity of the scale. Cronbach's coefficient alpha for the MHLC subscales (six-item forms) ranges from 0.67 to 0.77.

The Prenatal Scoring Form developed by the College of Physicians and Surgeons of Manitoba was used to collect data related to medical risk (Coopland et al., 1977). This instrument consists of 26 possible factors related to the woman's reproductive history, her present medical condition, and complications of the present pregnancy. Each factor is scored with a numerical value ranging from zero to three according to its presence or absence. The total score is calculated by adding each factor's score and may range from zero to 49. Women with risk scores of 0-2 are considered at low risk, those with scores of 3-6 at high risk, and those with scores of 7 or more at extreme risk. In this scale, two points are assigned for maternal age $\geq$ 35 years. In the current study, to avoid a linear effect of maternal age distribution on this score, the two points assigned for maternal age $\geq$ 35 years were deleted.

The MHLC and the Prenatal Scoring Form are in the public domain. Permissions were obtained from the respective authors to administer the PPRQ (Appendix C), the Pregnancy-related Anxiety scale (Appendix D), and the Knowledge of Maternal Age-related Risks of Childbearing (Appendix E) scale in this study. A license was purchased to administer the SF-12v2 Health Status Survey. A demographic and childbirth data collection form was developed to collect descriptive information on the sample. These variables included maternal age, marital status, family income, education, race/ethnicity, childbirth education, and information about the pregnancy not captured with the other instruments.

Data collection procedures. In the quantitative component, two approaches were used for participant recruitment. In the first approach, the student met with nursing

personnel of the hospital settings and private physician's offices to explain the study and answer questions. The charge nurse or her/his designate identified potential participants and obtained permission for the student to speak to these participants. A script was developed for the charge nurse or his/her designate to use when approaching potential participants to determine their willingness to receive an explanation of the study (Appendix F). If potential participants agreed to speak with the student, the student approached them and introduced herself and invited them to participate (see script in Appendix G for this in-person contact with potential participants). The student explained the study verbally and in written form and all potential participants had the opportunity to ask questions about their participation. All participants in this approach signed a consent form (Appendix H). A mutually convenient time and place was arranged to complete the survey. After consent had been obtained, the woman completed the questionnaires and then was interviewed by the student to complete the Prenatal Scoring Form. Questionnaires were offered to women in a specified order. The PPRQ was offered first, followed by the cognitive heuristics questions, the Multidimensional Health Locus of Control (MHLC) scale, the SF-12v2 Health Survey, the Pregnancy-related Anxiety scale, the Knowledge of Maternal Age-Related Risks of Childbearing scale, and the demographic childbirth data collection form, respectively. Finally, the student interviewed women to complete the Prenatal Scoring Form.

In the second approach, the staff members in various settings were asked to screen for women who met the inclusion criteria, and to determine their willingness to consider participating in this study. If potential participants agreed to learn more about the study, a package of questionnaires with a cover letter (Appendix I) was handed to them to be

completed and returned in the stamped addressed envelope to the researcher. The completion and return of the questionnaire signified implied consent.

Sample size. Although there is no clear agreement on the optimum sample size for regression analysis, an absolute minimum of 10 participants per predictor variable has been recommended for regression equations when using six or more predictors (Harris, 2001). In the current study, variables that were correlated with the dependent variable were entered in the first step of the analysis (11 variables); therefore, a minimum sample of 110 participants was required.

It was originally planned to recruit 200 participants, 100 per group. After starting data collection, it was realized that the participant recruitment process was not proceeding as quickly as was expected, specifically for the AMA group. Although the number of women who delay their first pregnancy until AMA is increasing, the proportion of pregnant women in this cohort is still relatively small, therefore resulting in fewer eligible women for the AMA group. For example, results of a recent national survey that used a large, randomly selected sample of Canadian women having a singleton birth illustrated that the number of respondents who were both nulliparous (prior to the birth of their baby) and AMA was quite small (4.7% of the whole sample) (Bayrampour & Heaman, 2011). After recruiting participants for 14 months, the final sample consisted of 105 women aged 20-29 years and 54 women aged 35 years or older.

Data analysis. Descriptive statistics were used to summarize the demographic data from the participants and to compare the two groups of women by each variable. Independent t-tests were performed to examine the differences between mean levels of

perception of pregnancy risk, pregnancy-related anxiety, medical risk, health status, and perceived control in younger and older women. Chi-square analyses were conducted to examine the differences in proportions between categorical variables in the two groups. Where the chi-square test could not be performed (i.e., the frequency of one or more categories in studied variables was less than five), the Fisher's exact test was reported. All descriptive and inferential statistics were conducted using PASW (Predictive Analytics Software) Statistics for Windows version 18.0.2. An alpha level of 0.05 was used for all statistical tests.

For the total sample and each group, separate Pearson's r correlation matrices were constructed to explore linear associations between the medical risk score, pregnancy-related anxiety score, the subscales of the perceived control score (i.e., internal, chance, and powerful others), subscales of health status (i.e., PCS, MCS, physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health), and selected demographic and childbirth variables (i.e., maternal age, gestational age, and education) with the perception of pregnancy risk score.

Both backward and forward stepwise multivariate linear regression analyses were conducted to investigate relationships between risk perception and various predictors, and to determine the strength of significant predictors in the sample. The perception of pregnancy risk score was the dependent variable in the regression models. Only those factors that had a significant bivariate relationship with the criterion were entered in the equations (Abu-Bader, 2006). In the stepwise regression model, variables were

sequentially removed from or included in the model. The deletion or addition was based on the variable's association with the outcome after adjusting for any other variables in the model (Katz, 2006). In the first model, perceived control (internal), pregnancy-related anxiety, cognitive heuristics (availability), five subscales of the health status variable (i.e., physical functioning, role limitations due to physical health problems, general health perceptions, vitality, and mental health), medical risk, gestational age, and maternal age (as a continuous variable) were entered. Prior to developing the second model, several interaction terms were defined between maternal age and the independent variables entered in the first model. The second model was tested to determine whether the effects of these factors on perception of pregnancy risk score were modified by maternal age. In addition, a multiple-line plot was created to investigate the interaction pattern between maternal age and anxiety score with the perception of risk score. A multiple-line plot is a scatter plot with lines and colors that are used "to present and compare data between measurements by overlaying them in a single graph" (Lolov & Edrev, 2007, p.127).

Maternal age was entered in the regression models as a continuous variable. However it was entered as a dichotomous variable in the plot to demonstrate the interaction effects across younger and older groups.

Qualitative Component

Design. A qualitative descriptive study was undertaken to obtain a rich and detailed source of explanatory data regarding risk perception from women of AMA. As described by Sandelowski (2000b), a qualitative descriptive study provides "a comprehensive summary of an event in the everyday terms of those events" (p.336). The

qualitative descriptive method is a distinctive and valuable technique that offers a direct description of phenomena which is still interpretive (Sandelowski, 2010). In other words, as Sandelowski (2000b) stated, this kind of research can address both descriptive and interpretive validity to account for participants' observations and their understandings of these events.

Sample. Potential participants for this component were chosen purposefully from among the quantitative participants. In purposeful sampling, the sample is intentionally selected according to the needs of the study (Coyne, 1997). In qualitative inquiry, sample size relies on the concept of "saturation," which is the point at which no new information or themes are observed in the data. In qualitative research, there is always the potential for new data to emerge, therefore saturation is determined when new data are contributing very little to the themes or categories (Guest, Bunce, & Johnson, 2006). In this study, saturation was reached after interviewing 15 participants. Participants were selected to ensure diversity in characteristics, most notably gestational age, and pregnancy complications. In addition, participants were recruited to reflect a range of scores using the Perception of Pregnancy Risk Questionnaire (Heaman & Gupton, 2009) used in the quantitative component, to ensure including participants with different levels of perceived risk.

Data collection procedures. The student asked selected women who had participated in the quantitative component of the study if they were willing to participate in the qualitative component. A mutually convenient time and place were arranged to conduct the interview. Potential participants were provided with a written and verbal

explanation of the qualitative component of the study. Each participant signed a consent form (Appendix J). In-depth, semi-structured, face to face interviews, using an interview guide (Appendix K), were conducted by the researcher. All interviews were audio-recorded and transcribed verbatim. To provide a description of the context of the interview, the student also completed a contact summary sheet that summarized the field experience (Appendix L). As Miles and Huberman (1994) stated, these summaries can be used to suggest new themes, and capture thoughtful impressions and reflections.

Data analysis. Data analysis was carried out concurrently with data collection. Descriptive statistics were used to summarize the demographic data from the participants and transcripts were analyzed using a content analysis technique. Content analysis is defined as any technique for making inferences by objectively and systematically identifying specified characteristics of messages (Holsti, 1969). In other words, content analysis is a systematic and replicable method used for condensing many words of text into fewer content categories based on explicit rules of coding (Stemler, 2001). In this technique, first the transcripts were read in full. Then, analysis continued using standard qualitative analysis techniques of open coding by inputting and sorting codes, using NVivo version 9. Next, the definition of each code was created and codes were clustered into categories. Finally the categories were grouped to create themes.

Rigor. According to Davies and Dodd (2002), rigor refers to the reliability and validity of qualitative research; however, it does not necessitate the sense of replicability of the research in different situations, which is common in quantitative research. In fact, visibility of research practices and accountability of the data analysis are the essence of

rigor in qualitative inquiry. In the current study, a validation process for the qualitative component was performed during and after conducting the research using two strategies. In the first method, member checking was used in which the results were verified with participants by asking them to confirm the researcher's interpretations during interviews and after obtaining interpretations. Second, the results were confirmed with peer review and debriefing through regular meeting with the dissertation advisor to achieve a jointly developed interpretation of the data. Dependability was obtained through use of an audit trail. In this strategy, contextual information, and participant's reflections were documented. The ways to address confirmability in this study were using direct quotes and confirming the findings with participants during interviews.

Ethical Considerations

The research ethics board approval and agency access approvals were obtained prior to commencing data collection. This project was reviewed and approved by the University of Manitoba Education/Nursing Research Ethics Board (Appendix M & N), Health Sciences Centre Research Impact Committee (Appendix O), St. Boniface Hospital Research Review Committee (Appendix P), and Winnipeg Regional Health Authority Research Review Committee (Appendix Q).

Potential participants were provided with a written and verbal explanation about the study, and participants signed a consent form, where applicable. The following considerations were addressed: participation was voluntary; refusal to participate did not affect services received; study participants were fully informed of the nature of the study as well as of their rights and obligations as research participants, including the right to

withdraw at any time without negative consequences. To ensure confidentiality, participants were informed that their inputs were kept strictly confidential and the interviews contained no names. Instead, participants were assigned a research code number. In addition, participants were not identifiable from any quotes or descriptive data used in conjunction with quotations. A list linking the participant study number and name was kept in a secure place separate from the participant file containing the questionnaire forms. All information was stored in a locked filing cabinet in a locked research office in the Faculty of Nursing at the University of Manitoba with access denied to anyone except the student and her advisor. All data including completed questionnaires, transcripts, compact discs, and electronic storage devices have been stored in a locked cabinet and will be destroyed seven years after the completion of study.

There were no ethical dilemmas during this project. There were no immediate or direct benefits associated with this research to the participants. There were no potential risks associated with this type of research. However, there was a possibility that discussing the topic of pregnancy risk, particularly with those women of AMA, might trigger some anxiety or concern. Therefore during interviews, the student did not directly state that pregnancies at AMA are high risk and instead focused on obtaining the woman's perception of her risk status. It was also planned that if a participant became anxious or upset by the presented information or questions, the student would offer to make a referral to a social worker. There was no need to make any referral during the course of the study.

Chapter Five: Manuscript One

Introduction to Findings

The results of this study are presented as a series of three papers, found in Chapters 5 to 7. Each chapter is composed of an introductory section which provides background information to each specific research objective, and a results section in which research findings are presented in the form of a publishable manuscript.

In the quantitative component of this study, nulliparous women aged 35 years or older were compared to nulliparous women aged 20 to 29 years. Although the maternal age of 20 to 29 years has been used as a comparison group in several previous studies (Bayrampour & Heaman, 2011; Jacobsson et al., 2004; Windridge & Berryman, 1999; Ziadeh & Yahaya, 2001), to ensure that the maternal age of 20 to 29 years was an appropriate age range to address the objectives of this study, the younger group was divided into two sub-categories: nulliparous women aged 20 to 24 and nulliparous women aged 25 to 29 years. It was noted that even though there were significant differences between the two groups in demographic characteristics (i.e., education, income level, ethnicity, and marital status), there were no significant differences between the two groups in major study variables including perception of pregnancy risk, pregnancy-related anxiety, perceived control subscales, health status subscales, medical risk, and risk knowledge (data not shown). Therefore, nulliparous women aged 20 to 29 years were retained as a comparison group in data analyses.

One of the objectives of this mixed methods research study was to determine whether perception of pregnancy risk of women of AMA is different from that of women

aged 20-29. The first manuscript, *Comparison of Perception of Pregnancy Risk of Nulliparous Women of Advanced Maternal Age and Younger Age*, addresses the first research question of the quantitative component of this study. Also, in this manuscript, risk knowledge, pregnancy-related anxiety, perceived control, prenatal risk score, and health status were compared between the two groups and the relationships between these variables and the perception of pregnancy risk were examined in each group.

The article has been submitted to the *Journal of Midwifery & Women's Health* for consideration for publication. The journal is a peer-reviewed journal and mainly publishes manuscripts that address midwifery, women's health, education, evidence-based practice, public health, and policy. The student wrote this article, while the student's advisor and her committee members provided constructive suggestions on the manuscript.

Manuscript 1: Comparison of Perception of Pregnancy Risk of Nulliparous Women of Advanced Maternal Age and Younger Age

Abstract

Objectives: Over the last three decades, the proportion of women who have delayed childbearing into their mid thirties and early forties has been increasing. Because advanced maternal age (AMA) is associated with several adverse maternal, fetal, and neonatal outcomes, these pregnancies are considered to be "high risk". Research indicates that pregnancy risk perception is an important factor in pregnant women's health care utilization and decision making during pregnancy. The objectives of this study were to compare risk perception in pregnant women of AMA (aged 35 years or older) with younger women (aged 20-29 years) and to explore the relationship between perception of pregnancy risk and selected variables.

Methods: A sample of 159 nulliparous pregnant women (105 in the younger group and 54 in the older group) were recruited from a variety of settings in Winnipeg, Manitoba, Canada. Women were asked to complete questionnaires to assess perception of pregnancy risk, risk knowledge, pregnancy-related anxiety, perceived control, health status, and medical risk.

Results: Women of AMA had higher education levels, were more likely to work during pregnancy, and had higher medical risk scores than younger women**.** Women of AMA perceived higher pregnancy risk for both themselves and their fetuses than younger women. They rated their risks of cesarean section, dying during pregnancy, preterm birth, having a baby with a birth defect or one needing admission to NICU higher than those of

younger women. There were no significant differences between the groups on pregnancy-related anxiety, knowledge of risk, perceived control, and health status.

Conclusions: Women of AMA have a higher perception of pregnancy risk than younger women. Current evidence suggests that incorporating discussions of pregnancy risk into prenatal care visits may assist pregnant women of AMA to make more informed choices and avoid unnecessary interventions.

Keywords: advanced maternal age, perception of pregnancy risk, anxiety, high risk pregnancy.

Introduction

Advanced maternal age (AMA) has been defined as a maternal age of 35 years or older at the time of delivery. Over the last three decades, the proportion of women who have delayed childbearing into their mid thirties and early forties has increased. In the United States, the birth rate for women aged 35–39 years increased to 47.5 births per 1,000 women in 2007, the highest rate since 1964, and the birth rate for women 40–44 years increased to 9.5 births per 1,000 women in 2007, the highest rate since 1968 (Hamilton, Martin, & Ventura, 2009). In Canada, the proportion of live births to women aged 35-39 and 40-49 years as a proportion of all births increased from 9.8% and 1.4% respectively, in 1995, to 12.9% and 2.6% in 2004 (Public Health Agency of Canada, 2008).

Pregnancy at AMA may be the result of infertility, planned postponement of motherhood, or previous fetal losses (Delpisheh, Brabin, Attia, & Brabin, 2008). Delayed

pregnancy may also be a consequence of not finding the right partner, financial instability, and lack of awareness about the risk associated with AMA (Tough, Benzies, Fraser-Lee, & Newburn-Cook, 2007). Several factors contribute to increasing rates of delayed childbearing such as longer life expectancy, more effective contraceptive techniques, modern infertility treatments, and developments in obstetric care (Carolan, 2003; Delpisheh et al., 2008; Tudiver, 2005; Windridge & Berryman, 1999). In addition, changes in societal values may influence the decision about the timing of childbearing including acceptance of delayed commencing of childbearing, decreasing family size, late marriage, advances in equality in the workplace, and increasing labour force participation and educational and employment opportunities for women (Benzies et al., 2006; Carolan, 2003; Freeman-wang & Beski, 2002; Usta & Nassar, 2008; Windridge & Berryman, 1999).

Generally, nulliparous women are more likely to be employed and to have higher socioeconomic status than multiparous women. These women may be more likely to consider postponing their first pregnancy to accommodate their career and social lifestyle demands (Delpisheh et al., 2008). Women of AMA typically have a higher socioeconomic status than their younger counterparts and differ from them in several demographic and obstetric characteristics, health behaviors and knowledge (Bayrampour & Heaman, 2011; Delbaere et al., 2007; Delpisheh et al., 2008; Hammarberg & Clarke, 2005; Joseph et al., 2009; Windridge & Berryman, 1999). However, a link between AMA and several adverse pregnancy outcomes has been documented in previous research including preterm birth, low birth weight, still birth, chromosomal abnormalities, and multiple births (Cleary-Goldman et al., 2005; Huang, Sauve, Birkett, Fergusson, &

Walraven, 2008; Jacobsson, Ladfors, & Milsom, 2004; Joseph et al., 2005). Increased perinatal risks associated with AMA have resulted in categorizing these pregnancies as "high risk". Nevertheless, it is not clear how these women perceive and evaluate their pregnancy risks compared to younger women.

Risk perception is something different from risk, and reflects "one's expectancy about the probability of an event" (Weinstein et al., 2007, p.147). Previously, a few qualitative studies have been conducted to explore risk perception among women of AMA. Their results suggest that most women in this group were concerned about risks associated with their pregnancies (Carolan & Nelson, 2007; Saxell, 2003). One limitation of these studies is that risk perception was not clearly defined and was often used interchangeably with the concept of "worry". Pregnancy risk perception is important, because it affects pregnant women's health care utilization, motivations to seek prenatal care, decisions about place of birth, choices about intensive medical interventions, adherence to medical procedures and recommendations, and health behaviours (Atkinson & Farias, 1995; Kowalewski, Jahn, & Kimatta, 2000; Suplee, Dawley, & Bloch, 2007). Therefore, a careful examination of perception of pregnancy risk is warranted.

A review of the empirical literature revealed no quantitative studies on this topic to determine whether risk perception among women of AMA is different than that of younger pregnant women. The objective of this study was to compare perception of pregnancy risk in nulliparous women of AMA with nulliparous women aged 20-29 years. In addition, risk knowledge, pregnancy-related anxiety, perceived control, prenatal risk

score, and health status were compared between the two groups. Finally, the relationships between these variables and perception of pregnancy risk were explored in each group.

Methods

A comparative descriptive design was employed to examine and describe differences in the variables of the two groups, which occur naturally in a setting (Burns & Grove, 2005). A convenience sample of pregnant women in their third trimester ($\geq$ 28 weeks) with singleton pregnancy who could speak, read, and write in English were recruited. Data were collected between December 2009 and January 2011 from selected physician's offices, prenatal classes, and outpatient departments and antepartum units of two tertiary hospitals in Winnipeg, Manitoba. The sample consisted of two groups of women: nulliparous women aged 20-29 years and nulliparous women aged 35 years or older. The maternal age of 20-29 has been used as a comparison group in previous studies (Bayrampour & Heaman, 2011; Jacobsson et al., 2004; Windridge & Berryman, 1999; Ziadeh & Yahaya, 2001).

Two approaches were used for participant recruitment. In the first approach, the researcher provided written and verbal explanations about the study to potential participants in the hospital settings and private physician's offices, and those who were willing to participate signed a consent form and completed the questionnaires. In the second approach, the staff members in other settings were asked to screen for women who met the inclusion criteria and to determine their willingness to consider participating in this study. If potential participants agreed to learn more about the study, a package of questionnaires with a cover letter was handed to them to be completed and returned in the

stamped addressed envelope to the researcher. The completion and return of the questionnaire signified implied consent. This project was approved by the University of Manitoba Education/Nursing Research Ethics Board, Health Sciences Centre Research Impact Committee, St. Boniface Hospital Research Review Committee, and Winnipeg Regional Health Authority Research Review Committee.

Instruments. All participants completed the Perception of Pregnancy Risk Questionnaire (PPRQ), the Pregnancy-related Anxiety scale, Knowledge of Maternal Age-related Risks of Childbearing Questionnaire, the SF-12v2 Health Status Survey, the Multidimensional Health Locus of Control (MHLC) Questionnaire, the Prenatal Scoring Form, and a demographic and childbirth data collection form.

The PPRQ consists of a nine-item scale including a five-item "Risk for Baby" subscale and a four-item "Risk for Self" subscale. This questionnaire uses a series of nine visual analog scales (VAS) to measure the perception of pregnancy risk. Respondents are asked to place a vertical mark through the line to indicate their assessment of risk for each item, yielding a score ranging from zero to 100. Scores for the nine items are added together and then divided by nine to yield an overall risk perception score out of 100. Higher scores indicate higher levels of perceived risk. This scale has good internal consistency reliability, with a Cronbach’s alpha of 0.87 for the total scale, 0.84 for the "Risk for Baby" subscale, and 0.81 for the "Risk for Self" subscale (Heaman & Gupton, 2009). Validity of the scale was assessed using a sample of 199 women in the third trimester of pregnancy. The concurrent validity of the scale was confirmed by its

correlation with state anxiety. In addition, construct validity was demonstrated using the known-groups technique and through convergent validity (Heaman & Gupton, 2009).

The Pregnancy-related Anxiety scale was used to assess a woman's fears and worries about her baby's health, her own health, and labor and delivery (Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999). The scale consists of 10 items rated on a scale from one (1 = *never or not at all*) to four (4 = *a lot of the time or very much*). Higher scores indicate higher levels of pregnancy-related anxiety. The internal consistency reliability of the scale is acceptable (alpha = 0.78) (Rini et al., 1999; Wadhwa, Sandman, Porto, Dunkel-Schetter, & Garite, 1993).

The Knowledge of Maternal Age-related Risks of Childbearing scale developed by Tough et al. (2006) was utilized to measure risk knowledge. This scale consists of 10 questions about various risks associated with advancing maternal age, answered as true, false, or don't know. Nine of these questions were used in this study. The number of correct responses was tabulated, yielding a score from zero to nine. The face and content validity of the scale was ensured through focus group testing, pilot interviews, and consultation with medical experts.

The SF-12v2 Health Status Survey is a shorter version of the SF-36v2® (Ware, Jr., Kosinski, & Keller, 1996) and measures functional health and well-being from the patient's perspective. The SF-12v2 is useful in measuring two components including physical health (PCS) and mental health (MCS) functioning and covers the same eight health domains as the SF-36v2. The reliability and validity tests of the SF-12v2 have been proven to be satisfactory. Its Cronbach's coefficient alpha is 0.88 for the physical

component summary (PCS) and 0.82 for the mental component summary (MCS) (Cheak-Zamora, Wyrwich, & McBride, 2009).

The MHLC was used to measure women's perceived control (Wallston, Wallston, & DeVellis, 1978). The MHLC has been applied successfully as a measure of perceived control in a wide variety of populations, including pregnant women (Baldwin, 2006). This instrument is composed of 18 items and includes three subscales that measure health-specific perceived control in the following areas: internal, chance, and powerful others. Cronbach's coefficient alpha for the MHLC subscales (six-item forms) ranges from 0.67 to 0.77 (Wallston et al., 1978).

The Prenatal Scoring Form developed by the College of Physicians and Surgeons of Manitoba was used to collect data related to medical risk (Coopland et al., 1977). This instrument consists of 26 possible factors related to the woman's reproductive history, her present medical condition, and complications of the present pregnancy. Women with risk scores of 0 to 2 are considered at low risk, those with scores of 3 to 6 at high risk, and those with scores of 7 or more at extreme risk. In this scale, two points are assigned for maternal age $\geq$ 35 years. In the current study, to avoid a linear effect of maternal age distribution on this score, the two points assigned for maternal age $\geq$ 35 years were deleted.

Data analysis. Descriptive statistics were calculated to compare the two groups of women by each variable. Independent t-tests were performed to examine the differences between means of level of perception of pregnancy risk, pregnancy-related anxiety, medical risk, health status, and perceived control in younger and older women. Chi-

square analyses or the Fisher's exact test were conducted to examine the differences in proportions between categorical variables in the two groups. All descriptive and inferential statistics were conducted using PASW (Predictive Analytics Software) Statistics for Windows version 18.0.2. An alpha level of .05 was used for all statistical tests.

For each group, separate Pearson's *r* correlation matrices were constructed to explore linear associations between the medical risk score, pregnancy-related anxiety score, the subscales of the perceived control, subscales of health status, and selected demographic and childbirth variables with the perception of pregnancy risk score.

Results

The sample consisted of 159 nulliparous women: 105 women (66%) aged 20-29 years and 54 women (34%) aged 35 years or older. The majority of women were recruited from outpatient clinics or prenatal classes (n=135). Twenty four participants were recruited from antepartum inpatient units or antepartum home care program (12 participants in each group). The mean age for the younger group of women at the time of participation was 25.67 years (*SD*=3.10) and for older group was 37.39 years (*SD*=2.00). The mean gestational age for the younger group was 34.95 weeks (*SD* = 3.63) and for the older group was 33.01 weeks (*SD* = 3.94). Sample characteristics are summarized in Table 1 and Table 2.

Pregnancy characteristics. There was a significant difference between the two groups in timing of the current pregnancy. A higher percentage of women of AMA

reported wanting to become pregnant sooner than those in the younger group (64.8% vs. 25.7%), and younger women were more likely to report wanting to become pregnant later (34.3% vs. 3.7%) (p <.001). There was no significant difference between the two groups in the proportion attending prenatal classes.

A slightly higher proportion of women of AMA reported having pregnancy complications than younger women, (41.5% vs. 37.1%) however the difference was not statistically significant. Anemia was the most common problem among both groups: 21.9% of younger women and 18.5% of older women reported having low blood iron. While 17.0% of women of AMA reported use of fertility medications to become pregnant, only 2.9% of younger women did, and this difference was significant (p =.003). In addition, 9.4% of women of AMA and 1.0% of younger women reported use of fertility procedures (i.e., IVF, ICSI, or IUI) to become pregnant (p =.017).

Perception of pregnancy risk. The independent t-test was used to test for differences in perception of pregnancy risk between the younger and older age groups. Women aged 35 years or older had significantly higher mean perception of pregnancy risk scores than younger women. Similarly, women of AMA reported significantly higher levels of perception of "risk for self" and "risk for baby" than women aged 20-29 years (Table 3). We also examined the differences in each item comprising the PPRQ. As shown in Table 4, pregnant women of AMA reported significantly higher levels of perception of risk of having cesarean section, dying during pregnancy, having a baby being born prematurely, having a baby with a birth defect or one admitted to the neonatal intensive care unit (NICU) than women aged 20-29 years. There were no significant

differences between the two groups regarding perception of risk of hemorrhaging, risk for self during pregnancy, and risk of baby dying. There was a negative correlation between gestational age in weeks and risk perception in the older group of women (r = -0.30, *p* =.031), but not in the younger group.

Pregnancy-related anxiety. There were no significant differences between the two groups in pregnancy-related anxiety (Table 3). However, there were strong positive correlations between pregnancy-related anxiety and perception of pregnancy risk in both groups ($p < .001$) (Table 5).

Risk knowledge. There were no significant differences between the two groups in total score for knowledge of maternal age-related risks of childbearing (Table 3). The majority of women in both groups (91.4% of younger group and 83.3% of older group) were aware that women aged 35 years or older experience more fertility problems than younger women. An interesting finding was that fewer women of AMA than younger women were aware that pregnancy at AMA is more likely to be associated with higher rates of medical problems (63.0% vs. 80.8%), cesarean birth (25.9% vs. 41.0%), preterm birth (22.2% vs. 30.5%), and low birth weight (13.0% vs. 19.0%). Women of AMA had better knowledge about AMA related pregnancy risks including a higher risk of having a multiple birth (50.0% vs. 21.0%), being eligible for amniocentesis (77.8% vs. 51.4%), and having a baby with Down Syndrome (88.9% vs. 78.1%) or a congenital anomaly (58.8% vs. 46.7%). A positive correlation between risk knowledge and perception of pregnancy risk was found only in the older group ($r = 0.30$, $p = .028$) (Table 5).

Health status. There were no significant differences between the groups in physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, mental health, PCS, and MCS (Table 3). As shown in Table 5, different patterns of correlations with perception of pregnancy risk were found. In the older group, vitality and physical functioning had significant negative correlations with perception of pregnancy risk. In the younger group, role limitations due to physical health problems were significantly correlated with perception of risk. Mental health had a significant negative correlation with perception of pregnancy risk in both groups, although this correlation was stronger in the AMA group than the younger group (r = -0.50 vs. r = -0.21). The mental component summary score was significantly correlated with the perception of pregnancy risk in women of AMA (r = -0.38).

Perceived control. Health-specific perceived control was compared using the following three subscales: internal, chance, and powerful others. The differences between the two groups were not significant (Table 3). A significant negative correlation was found between internal perceived control and perception of pregnancy risk in the younger group (r = -0.32, p =.001) but not in the older group (Table 5).

Medical risk. Women of AMA had significantly higher medical risk scores than younger women even after removing the age factor points (p =.009) (Table 3). Interestingly, there was no significant correlation between medical risk score and perception of pregnancy risk in older group. A moderately strong positive correlation was

found between these variables in the younger group of women ($r = 0.41$, $p < .001$) (Table 5).

Discussion

This study compared two groups of nulliparous women to determine differences in perception of pregnancy risk, selected psychological measures, health status and medical risk. Consistent with current literature, women of AMA had a higher socioeconomic status than younger women (Delbaere et al., 2007; Delpisheh et al., 2008; Hammarberg & Clarke, 2005; Joseph et al., 2009). Our findings revealed that women of AMA had a higher perception of pregnancy risk than younger women, which is consistent with the increased risk of medical complications in this age group. These results suggest that a medically known risk factor, such as age, may influence perception of pregnancy risk. To our knowledge, there is no previous quantitative research attempting to measure and compare perception of pregnancy risk between younger and older pregnant women. However, findings of a qualitative study by Carolan and Nelson (2007) stated that most women of AMA learned that they were regarded as being "at risk" because of their age through interaction with the health system. Similarly, a study in the United Kingdom in 1999, which explored women's experiences of giving birth after age 35, reported that these women were more informed about risks associated with pregnancy and were more likely to acknowledge that their baby's life might have been at risk during labor (Windridge & Berryman, 1999).

The results of a U.S. study in 2008 illustrated that women of AMA perceived their risk of having a baby with Down syndrome to be higher than did younger women

(Caughey, Washington, & Kuppermann, 2008). In the current study, differences between the two groups in perception of pregnancy risk subscales were more evident in the perceived risks for the fetus (i.e., prematurity, birth defect, NICU admission) than for the mother. As Windridge et al. (1999) stated, women of AMA may believe that their age makes their infants particularly vulnerable. There is evidence suggesting that pregnant women's intention to prevent harm to the fetus might drive most of their pregnancy and labor decisions (Romero, Coulson, & Galvin, 2011).

Our findings demonstrate that women of AMA perceived their risk of having a cesarean section to be significantly higher than did younger women. Consideration of the fact that women of AMA have higher rates of cesarean section than younger women (Bayrampour & Heaman, 2010) may raise the question of whether perceived risk of cesarean section influences the mode of delivery, particularly resulting from maternal request for a cesarean delivery (Bayrampour & Heaman, 2011). Although contributing factors to higher cesarean rates, such as infertility and poor reproductive history, are more common among women of AMA (Dulitzki et al., 1998; Horey, Weaver, & Russell, 2004; O'Leary et al., 2007; Treacy, Robson, & O'Herlihy, 2006), research suggests that along with medical indications, psychological factors may contribute to higher rates of cesarean section. Wagner (2000) declares that fear and lack of confidence are the main reasons that women choose cesarean birth. Findings of a recent study demonstrated that being somewhat to very worried about the delivery and its safety for the fetus correlated with preference for mode of delivery, and that a woman’s desire for choosing cesarean section increases substantially as worries increase (Romero et al., 2011). A previous Canadian study illustrated that in comparison to younger women, women of AMA were more likely

to request a cesarean birth from their health care providers at any point during their pregnancy, or to have a cesarean birth recommended by their health care provider before labor (Bayrampour & Heaman, 2011).

Pregnancy-related anxiety was strongly correlated with perception of pregnancy risk in both groups. However, there was not a significant difference between the two groups in levels of pregnancy-related anxiety. Compared to a U.S. study that examined pregnancy-related anxiety among White and Hispanic women with various parities (Rini et al., 1999), our participants in both groups had a relatively higher mean level of anxiety. One possible explanation is that nulliparous women might have a higher anxiety level than multiparous women. There are some statements in the literature claiming that AMA might be associated with higher anxiety due to awareness of several risks associated with older age such as fertility issues, coexisting obstetric complications, and also competing social roles and responsibilities (Neumann & Graf, 2003; Suplee et al., 2007). The results of our study do not support these statements. In the current study, although women of AMA reported a higher prevalence of infertility problems, their mean anxiety level was not different than younger women. This could be a sign of coping effectively with being a potentially high risk pregnancy. Similar levels of anxiety for both groups also suggest that there are factors other than risk perception that may influence maternal anxiety.

The scores on the perceived control subscales in our study were similar to those of nulliparous women in a U.S. study (Lowe, 2000). Although we expected women of AMA to have higher levels of perceived control, because of having higher education and socioeconomic status, there was no significant difference between the two groups in

mean level of perceived control subscales. This lack of significance might be explained by the fact that the MHLC scale measures a person's perceived control over his/her health, which might be different than a person's perceived control over his/her life.

There were no significant differences in the health status subscales between the two groups, suggesting that pregnant women of AMA perceived their bodies to be as healthy as younger women. In both groups, mean scores on almost all the SF12 health survey subscales were higher than those for non-pregnant women at the same ages (Ware, Kosinski, Turner-Bowker, & Gandek, 2009). An interesting finding was that in the younger group, role limitations due to physical health problems was correlated with perception of pregnancy risk, while in women of AMA, vitality and physical functioning showed a correlation with perception of risk. These results suggest that pregnant women at various ages consider different aspects of health to assess risk. While health problems, and the limitations imposed by them, are more significant from the younger women's perspective, women of AMA may focus on body performance and energy level in their appraisal of risk.

Although it was expected that women of AMA would be more informed about risks associated with delayed childbearing (Wagner, 2000), we found no significant difference in mean scores of knowledge of maternal age-related risks of childbearing between the younger group (M=4.59) and the older group (M=4.81). Similarly, Tough et al. (2006) reported that many women in various age groups were unaware of the potential consequences of delayed childbearing. As they suggested, these results indicate that the

majority of women, including women of AMA, are making family-planning decisions without having sufficient information.

Limitations of the study that need consideration when interpreting the results include the use of convenience sampling for collecting data. Due to a non-random method of sample selection, those who volunteered to participate might have been different than those who did not, resulting in selection bias. We encountered difficulties in recruiting nulliparous women of AMA, hence the two groups were not equal in size. The smaller sample size for the older group should be considered in the interpretation of the results. Although confining the sample to nulliparous women helped minimize the effect of previous pregnancy experiences on risk perception, this limits generalization of the results to multiparous women.

Future research is warranted to explore the role of risk perception on maternal request for cesarean section. Furthermore, research is encouraged to identify predictors of pregnancy-related anxiety and to determine the roles of maternal age and risk perception in maternal anxiety.

Conclusion

According to our results, women of AMA perceive a higher risk for their pregnancies than do younger women. Although this perception is consistent with the increased risk of adverse maternal, fetal, and neonatal outcomes associated with AMA (Cleary-Goldman et al., 2005; Huang et al., 2008; Jacobsson et al., 2004; Joseph et al., 2005), more research is warranted to situate medical risk in relation to perception of

pregnancy risk. It is important that in prenatal care visits, health care providers consider a woman's risk perception and assist her in understanding her individual risk based on personal health factors. For instance, women of AMA in this study perceived a higher risk of cesarean section. Current knowledge indicates that even at AMA, cesarean section is often not a necessary intervention (Treacy et al., 2006). Discussing these issues with pregnant women and clarifying any misconceptions will help them to acquire a better understanding of their risk. On the other hand, providing appropriate risk communication and offering pregnancy and childbirth education along with acknowledging women's personal experiences may empower women to include their own understanding in pregnancy risk appraisal (Jordan & Murphy, 2009). These approaches might be beneficial in making more informed choices and avoiding unnecessary interventions.

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Table 1. Comparison of Characteristics of Younger (Aged 20-29 years) and Older (Age ≥35 years) Nulliparous Women Using Independent t-test

Variable	Maternal Age		*t*	*p*
	Age 20-29 (n=105)	Age ≥ 35 (n=54)		
	M (*SD*)	M (*SD*)		
Gestational age	34.95 (3.63)	33.01 (3.94)	3.09	.002
Education (years of formal)	15.00 (3.02)	17.33 (4.19)	-3.96	< .001
Work hours before pregnancy	38.00 (10.21)	41.15 (12.35)	-1.67	.100
Work hours during pregnancy	35.98 (9.18)	40.03 (11.92)	-2.25	.020

Table 2. Comparison of Characteristics of Younger (Aged 20-29 years) and Older (Age ≥35 years) Nulliparous Women Using Fisher's Exact Test (Two-sided)

Characteristics	Maternal Age		*p*
	Age 20-29 (n=105) n (%)	Age ≥ 35 (n=54) n (%)	
Marital status			
Married or Living common-law	94 (89.5)	52 (96.3)	
Single (widowed, separated, divorced, or single)	11 (10.5)	2 (3.7)	.22
Race/ethnicity			
White	76 (72.4)	40 (74.1)	
Aboriginal (Métis or First Nations)	12 (11.1)	2 (3.7)	
Other	17 (16.8)	12 (22.2)	.53
Education			
Incomplete high school	7 (6.7)	1 (1.9)	
Complete high school or less than four years university degree	60 (57.1)	21 (38.9)	
Four years university degree or higher	38 (36.2)	32 (59.3)	.016
Family income			
$0-$39,999	25 (25.0)	3 (5.8)	
$40,000-$99,999	60 (60.0)	20 (38.4)	
$100,000 and above	15 (15.0)	29 (55.8)	< .001

Working at a paid job before pregnancy	100 (95.2)	53 (98.1)	
Yes	5 (4.8)	1 (1.9)	.67
No			
Working at a paid job during pregnancy	87 (82.9)	52 (96.3)	
Yes	18 (17.1)	2 (3.7)	.02
No			

Table 3. Comparison of Scores on Study Variables of Younger (Aged 20-29 years) and Older (Age >35 years) Nulliparous Women Using Independent t-test

Variable	Maternal Age		*t*	*p*
	Age 20-29 (n=105) M (*SD*)	Age ≥ 35 (n=54) M (*SD*)		
PPRQ total score	20.71 (15.40)	29.67 (16.55)	-3.37	.001
PPRQ subscale - Risk for Self	21.40 (16.29)	30.97 (15.86)	-3.29	.001
PPRQ subscale - Risk for Baby	20.15 (16.94)	28.50 (18.89)	-2.83	.005
Pregnancy-related Anxiety	1.91 (0.43)	1.87 (0.39)	0.54	.593
Knowledge of Maternal Age-related Risks of Childbearing	4.59 (1.93)	4.81 (2.30)	-0.65	.517
SF-12v2 Physical Component Summary	43.77 (8.52)	42.83 (10.03)	0.62	.84
SF-12v2 Mental Component Summary	50.51 (8.17)	50.24 (7.47)	0.21	.54
SF-12v2 Physical Functioning	59.52 (31.08)	59.26 (36.44)	0.05	.960
SF-12v2 Role Physical	60.19 (22.53)	53.00 (26.26)	1.79	.075

SF-12v2 Bodily Pain	77.14 (18.38)	75.46 (23.54)	0.50	.621
SF-12v2 General Health	77.88 (17.32)	79.70 (15.73)	-0.63	.533
SF-12v2 Vitality	49.76 (19.14)	44.44 (20.98)	1.61	.111
SF-12v2 Social Functioning	75.71 (23.12)	74.06 (25.46)	0.41	.681
SF-12v2 Role Emotional	81.67 (20.66)	79.17 (21.58)	0.71	.478
SF-12v2 Mental Health	70.19 (15.61)	71.93 (16.61)	-0.65	.519
Perceived Control (Internal)	25.53 (4.03)	26.49 (4.05)	-1.40	.163
Perceived Control (Chance)	16.03 (4.17)	15.15 (4.58)	1.18	.239
Perceived Control (Powerful Others)	18.32 (5.01)	17.69 (5.66)	0.71	.481
Medical Risk [a]	2.52 (1.75)	3.35 (1.97)	-2.64	.009

[a] After deletion of the two points assigned for maternal age $\geq$ 35 years

Table 4. Comparison of Scores on Each Item in the Perception of Pregnancy Risk Questionnaire of Younger (Aged 20-29 years) and Older (Age ≥35 years) Nulliparous Women Using Independent t-test

Variable	Maternal Age		*t*	*p*
	Age 20-29 (n=105) M (*SD*)	Age ≥ 35 (n=54) M (*SD*)		
Risk for myself during pregnancy	24.88 (21.27)	29.42 (18.85)	-1.37	.191
Risk for my unborn baby	26.09 (21.12)	33.85 (20.63)	-2.21	.028
Risk of hemorrhaging	20.86 (20.34)	26.20 (19.05)	-1.64	.111
Risk of cesarean section	30.69 (24.42)	52.07 (28.00)	-4.97	< .001
Risk of dying	9.18 (14.22)	13.85 (12.37)	-2.25	.026
Risk of baby being born prematurely	23.23 (27.69)	32.46 (27.99)	-1.98	.049
Risk of baby having a birth defect	17.29 (19.59)	28.39 (22.38)	-3.22	.002
Risk of baby needing to go to the NICU	20.36 (20.85)	30.22 (23.95)	-2.68	.008
Risk of baby dying	13.81 (17.26)	17.57 (16.18)	-1.33	.185

Table 5. Pearson Correlation Coefficients between Perception of Pregnancy Risk Score and Major Study Variables

	Maternal Age	
Variable	Age 20-29 (n=105)	Age ≥ 35 (n=54)
Gestational Age	-.08	-.30*
Education	.03	.04
Pregnancy-related Anxiety	.59***	.60***
Knowledge of Maternal Age-related Risks of Childbearing	-.11	.30*
SF-12v2 Physical Component Summary	-.16	-.17
SF-12v2 Mental Component Summary	-.10	-.38**
SF-12v2 Physical Functioning	-.13	-.35*
SF-12v2 Role Physical	-.24*	-.16
SF-12v2 Bodily Pain	.04	-.04
SF-12v2 General Health	-.14	-.15
SF-12v2 Vitality	-.18	-.32*

SF-12v2 Social Functioning	-.004	-.9
SF-12v2 Role Emotional	-.04	-.26
SF-12v2 Mental Health	-.21*	-.50***
Perceived Control (Internal)	-.32**	-.14
Perceived Control (Chance)	.09	.16
Perceived Control (Powerful Others)	.06	.004
Medical Risk Score	.41**	.18

*$p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Chapter Six: Manuscript Two

Introduction to Chapter Six

In the previous chapter, it was found that differences between nulliparous women of AMA and younger age go beyond their demographic characteristics and include a higher perception of pregnancy risk for women of AMA and their fetuses.

The manuscript presented in this chapter, *"Predictors of Perception of Pregnancy Risk among Nulliparous Women,"* presents the central findings of this dissertation. The first several paragraphs of this manuscript present a review of the literature on factors contributing to perception of pregnancy risk, followed by introducing the conceptual framework underlying this research. Subsequent to this, there is an explanation of data analysis and reporting the results. The findings of this manuscript address the second and the third questions of the quantitative component. The discussion section of this report discusses the arrangement of conceptual framework factors and relates them to the current literature.

The student wrote this article, while the student's advisor and her committee members provided constructive suggestions on the manuscript. The potential journal for this manuscript will be determined later.

Manuscript 2: Predictors of Perception of Pregnancy Risk among Nulliparous Women

Abstract

Objectives: The literature suggests that perception of pregnancy risk impacts pregnant women's health care use, health behaviors, and adherence to medical procedures and recommendations. Yet, a gap remains in the understanding of perception of pregnancy risk and its contributing factors. The objectives of this study were to determine factors associated with perception of pregnancy risk and to examine the role of maternal age in pregnancy risk assessment, using a new conceptual framework based on a review of relevant literature and the Psychometric Model of risk perception.

Methods: Between December 2009 and January 2011, a convenience sample of nulliparous pregnant women in their third trimester with a singleton pregnancy was recruited from variety of settings in Winnipeg, Manitoba. Stepwise multivariate linear regression analyses were conducted to achieve the research objectives.

Results: Of the eight proposed factors in the conceptual framework, five factors were significant predictors of perception of pregnancy risk, including pregnancy-related anxiety, maternal age, medical risk, perceived control (internal), and gestational age. An interaction between the pregnancy-related anxiety score and maternal age was determined.

Conclusion: There are several factors contributing to perception of pregnancy risk, of which at least half are not yet identified. Future studies are warranted to explore these

factors. This knowledge may have implications for developing more effective risk communication models.

Introduction

Risk is defined as "uncertainty about and severity of the consequences or outcomes of an activity with respect to something that humans value" (Aven & Renn, 2009, p.2). Although risk is a common concept, there are considerable variations in its definition, perception, and evaluation (Hampel, 2006). Risk perception is about capturing the myriad meanings and weights that an individual assigns to the experience of being at increased risk (Pilarski, 2009) and is something quite different from risk (Sjoberg, 2000). Originally, risk perception was introduced by Bauer in1960 as a two dimensional structure that included uncertainty and adverse consequences. Currently, risk perception is defined as "one's expectancy about the probability of an event" (Weinstein et al., 2007, p.147) or "beliefs about potential harm" (Brewer et al., 2007, p.136).

The concept of risk during pregnancy has grown in recent years, which is partly due to advances in pregnancy risk knowledge and technologies within antenatal care and also to increasing community knowledge (Carolan & Nelson, 2007). A high risk pregnancy has been defined as a pregnancy in which there is a likelihood of an adverse outcome for the mother or baby that is greater than for the general pregnant population (James & Stirrat, 1988). Advanced maternal age (AMA), defined as pregnancy at age 35 years or older, is a known risk factor for adverse pregnancy outcomes (Cleary-Goldman et al., 2005; Huang, Sauve, Birkett, Fergusson, & Walraven, 2008; Jacobsson, Ladfors, & Milsom, 2004; Joseph et al., 2005). Research suggests that pregnancy risk perception is

significant, because it can affect pregnant women's health care use, motivations to seek prenatal care, decisions about place of birth or choice about intensive medical interventions, adherence to medical procedures and recommendations, and health behaviors (Atkinson & Farias, 1995; Kowalewski, Jahn, & Kimatta, 2000; Suplee, Dawley, & Bloch, 2007). The importance of risk perception has been also emphasized by its central placement as a concept in several theories of health behavior such as the Health Belief Model (Janz & Becker, 1984), Protection Motivation Theory (Maddux & Rogers, 1983), and Prospect Theory (Kahneman & Tversky, 1979).

Although current knowledge indicates that pregnancy risk perception is highly individualized and that it is not exclusively based on medical diagnoses (Heaman, Gupton, & Gregory, 2004), a gap remains in the understanding of perception of pregnancy risk and its contributing factors. While health care providers' understandings of risk are the result of their knowledge, training, experiences, and values, pregnant women's understandings of risk are more contextual and individualized (Handwerker, 1994), reflecting their values, education, and social class (Saxell, 2000; Searle, 1996). A study by Gray in 2006 demonstrated an incongruity in risk appraisal by pregnant woman and their primary nurses in which pregnant women tended to underestimate their pregnancy risk compared to their nurses. These variations imply that the current risk communication approach, which is mainly based on epidemiological risk factors without attention to women's perceptions, might not entirely meet the needs of high risk women (Kowalewski et al., 2000).

Understanding how women perceive pregnancy risk can assist health care providers and policy makers in providing high quality prenatal care and developing better guidelines and more effective programs in areas involving communication of risk and risk management. The objectives of this study were to determine factors associated with the perception of pregnancy risk and to explore the impact of maternal age on risk perception.

Conceptual Framework

Risk perception is an area with many unsolved and poorly understood issues. There is no widely accepted model of risk perception that identifies which factors are related to risk perception and in what manner (Hawkes & Rowe, 2008). Experts in the field of risk perception believe that current theories applied in risk perception are not comprehensive and can only explain a small part of this concept (Sjoberg, 1996). The Psychometric Model of risk perception is one of the well known and practical theories in this area (Slovic, Monahan, & MacGregor, 2000) that has been previously employed in studying risk perception of pregnancy (Chuang et al., 2008). The current study is based on this theory; however, additional concepts identified in the literature review were also added to the model to strengthen the conceptual framework.

Psychometric Model of risk perception. The Psychometric Model focuses mainly on cognitive factors that influence an individual's risk perception. In the psychometric approach, risk is considered as a subjective issue, which "does not exist 'out there', independent of our minds and cultures, waiting to be measured"(Slovic, 1992, p.119). The Psychometric Model was introduced in 1978 by Fischhoff and colleagues

who conducted a study in which there was an emphasis on the importance of people's judgment about risk. In their study, two dimensions were identified: one dimension was typified by new, involuntary, poorly known activities, often with delayed consequences (the degree to which a risk is unknown) and the second dimension mostly revealed the certainty of death given that adversity occurs (the degree to which a risk induces dread) (Fischoff, Slovic, Lichtenstein, Read, & Combs, 1978; Gerend, Aiken, & West, 2004). Today, the dread factor and the unknown factor are considered as two main cognitive aspects of this paradigm dictating individuals' perception of risk (Slovic, Fischoff, & Lichtenstein, 1980; Slovic, 1987). In this study, risk knowledge and pregnancy-related anxiety represented the "unknown" and "dread factor" respectively. The degree of familiarity with risk or risk knowledge is considered as part of the wider construct of "unknown risk" in the Psychometric Model (Boholm, 1998; Fischoff et al., 1978; Williamson & Weyman, 2005). Anxiety represents the dread factor in our conceptual framework, because a greater feeling of dread may be observed in women who have more anxious feelings about having a healthy pregnancy with desirable outcomes. This placement is supported by the findings of a previous study that demonstrated state anxiety predicted perception of pregnancy risk (Gupton, Heaman, & Cheung, 2001).

Summary of the literature review. Numerous factors have been identified in previous research that can influence an individual's risk perception including the social and cultural contexts (Douglas & Wildavsky, 1982; Weyman & Kelly, 1999), familiarity with (Fischoff et al., 1978; Williamson & Weyman, 2005), and availability of the risk (Gerend, Aiken, West, & Erchull, 2004), risk representativeness (Kahneman & Tversky,

1973), perceived control (Gerend et al., 2004), gender (Boholm, 1998; Hawkes & Rowe, 2008), age (Gerend et al., 2004), and trust in the source of risk information (Williamson & Weyman, 2005).

There is growing evidence regarding the significance of a person's self-image (Heaman et al., 2004) and perceived control (Kolker et al., 1993) in risk perception. People tend to see a potential hazard as less risky if they have some measure of control over the risk. In other words, people believe that controllable risks that may pose a high degree of risk are safer than others which are less risky but uncontrollable (Nordgren, Van Der Pligt, & Van Harreveld, 2007). A study by Kolker and Burke in 1993 was conducted to describe the relationship between risk perception and decision making about prenatal diagnosis. They found that perceived control, the severity or impact of the outcome (dread factor), and the psychological availability of the risk (through individual or indirect experiences) can influence risk perception.

Cognitive heuristics, mental guidelines that are used to process whether risk knowledge is available or represented (Boholm, 1998), is another significant concept arising from the literature review. Availability and representativeness heuristics are found to be relevant to risk perception. The availability heuristic refers to "a cognitive shortcut used for judging the probability of an event by the ease with which examples of the event come to mind" (Gerend et al., 2004, p.248). In other words, the availability heuristic is a cognitive scheme for processing information. In fact, it relates to what people remember, not to what actually has happened (Boholm, 1998). The similarity or representativeness

heuristic reflects "a cognitive shortcut used for judging the probability of an event by its similarity to events with comparable features" (Gerend et al., 2004, p.248).

A few studies have been conducted to identify factors influencing perception of pregnancy risk. Heaman, Gupton, and Gregory (2004) reported that their participants considered four areas in assessment of their pregnancy risk including: self image of their own general health, health and family history, the healthcare system, and the odds of the unforeseen and unknown complications. Patterson in 1993 found that black pregnant women determined their pregnancy risk based on their own experiences of the risk (pregnancy complication), the assessment of the health care provider, and the counsel of other black women (Patterson, 1993). From a quantitative perspective, Gupton, Heaman, and Cheung (2001) explored the relationship between biomedical, psychosocial, and demographic risk factors with perception of pregnancy risk. Results of their study revealed that biomedical risk and state anxiety were predictors of perception of pregnancy risk. In their study, women with complicated pregnancies perceived their risk as significantly higher than those with uncomplicated pregnancies. Current knowledge suggests that biomedical risk might be important in the determination of perception of pregnancy risk (Gerend et al., 2004; Gupton et al., 2001; Heaman et al., 2004) and that a woman's health status may influence her assessment of the risk (Gupton et al., 2001).

In the review of the literature, perception of pregnancy risk appears to be influenced by perceived control, cognitive heuristics (availability and similarity), health status, and medical risk. Because the Psychometric Model does not include some of these concepts, a new conceptual framework to study perception of pregnancy risk was

developed based on the literature review and guided by the Psychometric Model of risk perception. Figure 1 illustrates the conceptual framework of the study. In addition to anxiety and risk knowledge, five new factors were included in the framework based on the literature review. Later, through in-depth interviews of women in the qualitative component of this mixed methods study, gestational age was identified as another important factor in perception of pregnancy risk and was included in the analysis as the eighth variable. We believe that due to the complex and multidimensional nature of risk perception, adding these concepts to the main theory may be beneficial in achieving a better understanding of risk perception. As such, this study sought to answer the following questions: 1. What is the relationship of maternal age, risk knowledge, pregnancy-related anxiety, cognitive heuristics, perceived control, medical risk, health status and gestational age with perception of pregnancy risk among nulliparous women? 2. What are the most significant predictors of perception of pregnancy risk? 3. How does maternal age interact with risk knowledge, pregnancy-related anxiety, cognitive heuristics, perceived control, medical history, and health status in relationship to perception of pregnancy risk?

Methods

This study was part of a larger mixed methods research study. The quantitative component of the research was designed to compare risk perception of women of AMA and younger age; hence two groups of women were recruited, aged 20-29 years and aged 35 years or older. The results of the comparative analyses were reported elsewhere

(Bayrampour, Heaman, Tough, & Duncan, 2011), while the focus of this report is to describe the factors associated with perception of pregnancy risk.

We employed a descriptive correlational design to address the research questions. A convenience sample of nulliparous pregnant women in their third trimester (≥ 28 weeks) with a singleton pregnancy who could speak, read, and write in English was recruited. Data were collected between December 2009 and January 2011, from selected physician's offices, prenatal classes, and outpatient departments and antepartum units of two tertiary hospitals in Winnipeg, Manitoba. Two approaches were used for participant recruitment. In the first approach, the researcher provided written and verbal explanations about the study to potential participants in the hospital settings and private physician's offices, and those who were willing to participate signed a consent form and completed the questionnaires. In the second approach, the staff members in other settings were asked to screen for women who met the inclusion criteria, and to determine their willingness to consider participating in this study. If potential participants agreed to learn more about the study, a package of questionnaires with a cover letter was handed to them to be completed and returned to the researcher in a stamped addressed envelope. The completion and return of the questionnaire signified implied consent. This project was approved by the University of Manitoba Education/Nursing Research Ethics Board, Health Sciences Centre Research Impact Committee, St. Boniface Hospital Research Review Committee, and Winnipeg Regional Health Authority Research Review Committee.

Instruments. All participants completed the Perception of Pregnancy Risk Questionnaire (PPRQ), Knowledge of Maternal Age-related Risks of Childbearing Questionnaire, the Pregnancy-related Anxiety scale, the Multidimensional Health Locus of Control (MHLC) Questionnaire, the SF-12v2 Health Status Survey, the Prenatal Scoring Form, and a demographic and childbirth data collection form. To measure the cognitive heuristics of availability and representativeness (similarity), two questions were developed by the authors, adapted from questions used by Gerend et al. (2004). To examine the availability heuristic, we asked women to report the number of female friends they knew with a complicated pregnancy. To examine the representativeness heuristic, we asked women to rate their perceived similarity to a typical pregnant woman of the same age who developed pregnancy complications.

The PPRQ consists of a nine-item scale including a five-item "Risk for Baby" subscale and a four-item "Risk for Self" subscale. This questionnaire uses a series of nine visual analog scales (VAS) to measure the perception of pregnancy risk. Respondents are asked to place a vertical mark through the line to indicate their assessment of risk for each item, yielding a score ranging from 0 to 100. Scores for the nine items are added together and then divided by nine to yield an overall risk perception score out of 100. Higher scores indicate higher levels of perceived risk. This scale has good internal consistency reliability, with a Cronbach’s coefficient alpha of 0.87 for the total scale, an alpha of 0.84 for the "Risk for Baby" subscale, and an alpha of 0.81 for the "Risk for Self" subscale (Heaman & Gupton, 2009). Validity of the scale was assessed using a sample of 199 women in the third trimester of pregnancy. The concurrent validity of the

scale was confirmed by its correlation with the Spielberger State Anxiety Inventory (Spielberger & Gorsuch, 1983) (r=.46, p<.001). In addition, construct validity was demonstrated using the known-groups technique and through convergent validity (Heaman & Gupton, 2009).

The Pregnancy-related Anxiety scale was used to assess a woman's fears and worries about her baby's health, her own health, and labor and delivery (Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999). The scale consists of ten items rated on a 4-point Likert scale ranging from one (1 = *never or not at all*) to four (4 = *a lot of the time or very much*). The internal consistency reliability of the scale is acceptable (alpha = 0.78). An exploratory factor analysis by Rini et al. (1999) revealed that the items were best represented by a single score. The total score is computed by reversing scores where applicable and calculating the mean of responses to all items, yielding a score ranging from one to four. Higher scores indicate higher levels of pregnancy-related anxiety (Rini et al., 1999; Wadhwa, Sandman, Porto, Dunkel-Schetter, & Garite, 1993).

The Knowledge of Maternal Age-related Risks of Childbearing scale developed by Tough et al. (2006) was utilized to measure risk knowledge. This scale consists of ten questions about various risks associated with advancing maternal age, answered as true, false, or don't know. Nine of these questions were used in this study. The number of correct responses was tabulated, yielding a score from zero to nine. According to Tough et al. (2006), the face and content validity of the scale was ensured through focus group testing, pilot interviews, and consultation with medical experts.

The SF-12v2 Health Status Survey is a shorter version of the SF-36v2® Health Survey (Ware, Jr., Kosinski, & Keller, 1996). The SF-12v2 measures functional health and well-being from the patient's point of view. The SF-12v2 is useful in measuring two components including physical health (PCS) and mental health (MCS) functioning and covers the same eight health domains as the SF-36v2 with one or two questions per domain. These domains include: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. The reliability and validity tests of the SF-12v2 have been proven to be satisfactory. Its Cronbach's coefficient alpha is 0.88 for the physical component summary (PCS) and 0.82 for the mental component summary (MCS) (Cheak-Zamora, Wyrwich, & McBride, 2009).

The MHLC was used to measure women's perceived control (Wallston, Wallston, & DeVellis, 1978). The MHLC has been applied successfully as a measure of perceived control in a wide variety of populations, including pregnant women (Baldwin, 2006). This instrument is composed of 18 items about perceived control over health outcomes measured on a six-point Likert scale ranging from one (1 = *strongly disagree*) to six (6 = *strongly agree)*. The instrument includes three subscales that measure health-specific perceived control in the following areas: internal, chance, and powerful others. Based on Wallston et al. (1978), there is no such thing as a "total" MHLC score. Higher scores in each subscale indicate greater belief in that subscale domain of control over health. According to Wallston et al. (1978), correlations in the predicted direction of the MHLC scales with health status confirmed some evidence of predictive validity of the scale.

Cronbach's coefficient alpha for the MHLC subscales (six-item forms) ranges from 0.67 to 0.77.

The Prenatal Scoring Form developed by the College of Physicians and Surgeons of Manitoba was used to collect data related to medical risk (Coopland et al., 1977). This instrument consists of 26 possible factors related to the woman's reproductive history, her present medical condition, and complications of the present pregnancy. Each factor is scored with a numerical value ranging from zero to three according to its presence or absence. The total score is calculated by adding each factor's score and may range from zero to 49. Women with risk scores of 0-2 are considered at low risk, those with scores of 3-6 at high risk, and those with scores of 7 or more at extreme risk. In this scale, two points are assigned for maternal age $\geq$ 35 years. In the current study, to avoid a linear effect of maternal age distribution on this score, the two points assigned for maternal age $\geq$ 35 years were deleted.

A demographic and childbirth data collection form was used to collect information related to the sample and potentially confounding variables that may affect risk perception. These variables include marital status, family income, education, race/ethnicity, childbirth education, and information about the pregnancy.

Data analysis. An alpha level of 0.05 was used for all statistical tests. All descriptive and inferential statistics were conducted using PASW (Predictive Analytics Software) Statistics for Windows version 18.0.2. Descriptive statistics were conducted to describe the sample and scores on the measures. The proportion of participants with

missing values was low, with the exception of the income variable (4.4%). Missing data were excluded from the analyses.

Pearson's *r* correlation matrices were constructed to explore linear associations among the perception of pregnancy risk score, the medical risk score, pregnancy-related anxiety score, the subscales of the perceived control score (i.e., internal, chance, and powerful others), subscales of health status (i.e., physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health), cognitive heuristics subscales (i.e., familiarity and similarity), and selected demographic and childbirth variables (i.e., maternal age and gestational age). Next, partial correlations controlling for age were conducted to assess linear associations of the perception of pregnancy risk score with other independent variables and to determine the strength and direction of significance.

Both backward and forward stepwise multivariate linear regression analyses were conducted to investigate relationships between risk perception and various predictors, and to determine the strength of significant predictors in the sample. The perception of pregnancy risk score was the dependent variable in regression models. Only those factors that had a significant bivariate relationship with the criterion were entered in the equations (Abu-Bader, 2006). In the stepwise regression model, variables were sequentially removed from or included in the model. The deletion or addition was based on the variable's association with the outcome after adjusting for any other variables in the model (Katz, 2006). In the first model, perceived control (internal), pregnancy-related

anxiety, cognitive heuristics (availability), five subscales of health status variable (i.e., physical functioning, role limitations due to physical health problems, general health perceptions, vitality, and mental health), medical risk, gestational age, and maternal age (as a continuous variable) were entered. Prior to developing the second model, several interaction terms were defined between maternal age and the independent variables entered in the first model. The second model was conducted to determine whether the effects of these factors on perception of pregnancy risk score were modified by maternal age. In addition, a multiple line plot was created to investigate the interaction pattern between maternal age and anxiety score with the perception of risk score. Maternal age was entered in regression models as a continuous variable. However it was entered as a dichotomous variable in the plot to demonstrate the interaction effects across younger and older groups.

Although there is no clear agreement on the optimum sample size for regression analysis, an absolute minimum of 10 participants per predictor variable has been recommended for regression equations when using six or more predictors (Harris, 2001). In the current study, variables that were correlated with the dependent variable were entered in the first step of the analysis (11 variables including subscales), therefore, a minimum sample of 110 participants was required.

Results

The final sample consisted of 159 participants: 105 nulliparous women aged 20-29 years and 54 nulliparous women aged 35 years or older. Participants ranged in age from 20 to 44 years. The majority of participants (91.8%) were married or living

common-law and the rest (8.2%) were single. Seventy two percent of participants reported an annual family income of $40,000 or higher. The mean number of years of formal education was 15.77 (*SD*=3.61). Almost 72% of participants were White and the majority of women reported working before and during pregnancy. The mean gestational age at the time of participation was 34.29 weeks (*SD* = 3.84) and ranged from 28 to 41 weeks.

The PPRQ score for the total sample ranged from 0 to 75.89 (M= 23.64, *SD*=16.20) and "risk for self" ranged from 0 to 90.75 (M=24.45, *SD*=16.49) and "risk for baby" varied from 0 to 89.40 (M=22.99, *SD*=18.01). Table 1 illustrates descriptive statistics, including means and standard deviations, for the other variables measured in the study.

Significant positive correlations were found between the perception of pregnancy risk score and the medical risk score, pregnancy-related anxiety score, and maternal age. There were significant negative correlations between the perception of pregnancy risk score and physical functioning, role physical, vitality, mental health, and perceived control (Table 2). However, after controlling for maternal age in partial correlations, there were no significant correlations between physical functioning, role limitations due to physical health problems, or vitality and the perception of risk score. On the other hand, by controlling for maternal age, the cognitive heuristic (availability) and general health variables became significantly correlated with the perception of risk score (Table 2). The sociodemographic characteristics of income and education were not correlated with risk perception.

In order to answer research questions two and three, two stepwise multivariate linear regression analyses were conducted to estimate a model that best predicts perception of pregnancy risk among pregnant women.

Model 1: The results of this model revealed that four factors were significant predictors of perception of risk, F (5, 145) = 26.35, p <0.001. With a standardized beta of 0.45 (p <0.001), pregnancy-related anxiety emerged as the strongest predictor of perception of pregnancy risk, accounting for 30% of the variance in the perception of risk. The second strongest factor was medical risk (β=.25; p <0.001). The third and the fourth strongest variables were maternal age (β=.22; p <0.01) and gestational age (β=.16; p <0.05), respectively. The results indicated that a higher perception of pregnancy risk was a function of higher levels of pregnancy-related anxiety, higher medical risk, older maternal age, and lower gestational age (Table 3). Overall, the model explained almost 47% of the variance in perception of pregnancy risk ($R^2_{adjusted}$ =0.45). The resulting regression equation was as follows: Perception of pregnancy risk= 0.98 + (17.08 x anxiety) + (2.16 x medical risk) + (0.57x age) + (- 0.64 x gestational age in weeks).

Model 2: In this model, the effect of maternal age on other predictors was examined using interaction terms. The resulting regression analysis demonstrated that medical risk, gestational age, and perceived control (internal) significantly predicted the perception of pregnancy risk score. In addition, results demonstrated an interaction between pregnancy-related anxiety score and maternal age (Table 4), indicating that the relationship between each of the interacting variables (maternal age and anxiety) and perception of pregnancy risk may depend on the value of the other interacting variable. In

the other words, the variances in the risk perception score due to anxiety level depend on maternal age. A comparison of model 1 and model 2 illustrates that the simultaneous influence of these variables on the risk perception score is greater than their additive values. In fact, maternal age works in a synergistic fashion with anxiety score to increase the perceived risk score. Figure 2 illustrates the estimated marginal means of perception of pregnancy risk score by anxiety levels for the younger (20-29 years) and older ($\geq$ 35 years) group of women. At the same level of anxiety, women aged 35 years or older had higher perception of risk scores than younger women.

In the second model, medical risk, gestational age, and perceived control (internal), and the interaction of maternal age and anxiety, which works in a multiplicative way (age x anxiety), were predictors of the perception of pregnancy risk. This model accounted for 49% ($R^2_{adjusted}$ =0.47) of the variance in risk perception score and indicated that the perception of pregnancy risk score increased when medical risk increased and gestational age and perceived control decreased.

Discussion

This study was conducted to identify factors contributing to perception of pregnancy risk among nulliparous women using a conceptual framework developed based on a literature review and the Psychometric Model of risk perception. Of the eight proposed factors in the conceptual framework, four factors were significant predictors of perception of pregnancy risk in the first model, including pregnancy-related anxiety, medical risk, maternal age, and gestational age. In the model incorporating interactions with maternal age, perceived control (internal) also approached significance (p=.054).

Thus, overall, five of the factors in the conceptual framework were supported. These models accounted for 47-49% of the variance in risk perception. This finding is noteworthy, because current theories of risk perception only account for five to 20 percent of variations in risk perception (Sjoberg, 1996). Results of research by Gupton et al. (2001), who examined the role of anxiety, medical risk, stress, self-esteem, and social support in predicting perception of pregnancy risk, revealed that the predictive power of their models varied from 19-31%. In their study, state anxiety and medical risk predicted perception of pregnancy risk. This suggests that the addition of perceived control, maternal age and gestational age into our conceptual framework has significantly improved the predictive power of the model.

Current research suggests that emotions are important factors in risk perception and stronger emotions may led to a higher level of perceived risk (Xie, Wang, Zhang, Li, & Yu, 2011). Our findings determined pregnancy-related anxiety as the strongest predictor of perception of pregnancy risk, supporting its role as a dread factor in the conceptual framework. Chuang et al. (2008), who also employed the Psychometric Model to study risk perception, examined the feeling of dread using psychosocial stress or lower health status variables. They did not find a significant association between risk perception and these defined dread factors. Furthermore, in another study of perception of pregnancy risk, stress was not a predictor for risk perception among women with complicated pregnancies, while state anxiety was a significant predictor (Gupton et al., 2001). These results imply that pregnancy-related anxiety might be an appropriate measure of the dread factor and may be a more reliable factor than stress to predict perception of pregnancy

risk. However, careful consideration needs to be given to selecting a measurement of anxiety and also to differentiate the contribution of trait, state, and pregnancy-related anxiety (Spielberger, Rickman, & Sartorius, 1990). In the current study, pregnancy-related anxiety had a stronger association with perception of pregnancy risk than state anxiety measured as a general concept by Gupton et al. (2001) (r =0.56 vs. r =0.36), suggesting that these concepts measure different aspects of anxiety.

In our study, maternal age was determined to be a predictor of perception of pregnancy risk. Although women of AMA had higher medical risk scores than younger women, even after controlling for medical risk, maternal age remained as a significant predictor of perception of pregnancy risk suggesting that this association was independent from the effect of medical risk. In addition, a significant interaction effect was revealed between maternal age and pregnancy-related anxiety in relation to perception of risk. In other words, while anxiety may contribute to a higher perceived risk in pregnant women, its effect will be more prominent in women of AMA than younger women. Some researchers believe that AMA might be associated with higher anxiety due to awareness of several risks associated with older age such as fertility issues, coexisting obstetric complications, and also competing social roles and responsibilities (Neumann & Graf, 2003; Suplee et al., 2007). Although our findings suggest that an anxious woman at AMA may have higher perception of risk than her younger counterpart, as Xie et al. (2011) stated, it is not evident whether emotions such as anxiety lead to higher risk perception or vice versa. Because the causal relationship between anxiety and risk perception is not clear, a precise conclusion requires further research.

As expected, objective medical risk was a significant predictor of risk perception. This result is consistent with the results of another Canadian study of pregnant women who had various parities (Gupton et al., 2001) and also with the results of a U.S. study that used the PPRQ to assess risk perception in a group of pregnant women. The latter study reported that higher PPRQ scores were associated with patients' enrolment in a high risk clinic (Headley & Harrigan, 2009).

In the current study, health status was not a significant predictor of perception of pregnancy risk. This result is consistent with findings of Chuang et al. in 2008 who reported that general health measured by the SF-12v2 Health Survey was not a significant predictor of increased risk perception of adverse pregnancy outcomes.

According to our findings, perception of pregnancy risk altered over the course of the pregnancy, with women having higher perceptions of risk at earlier gestational ages. This pattern could be due to women becoming more optimistic about the outcome of their pregnancy as it advances and women pass gestational ages where miscarriage and very early preterm birth are likely. Although there is no previous study to examine changes in risk perception over the duration of pregnancy, Buist, Gotman, and Yonkers (2011), who explored the changing nature of generalized anxiety disorder in relation to the course of pregnancy, found that anxiety symptoms were highest in the first trimester and decreased across pregnancy. Similarly, Ohman, Grunewald, and Waldenstrom (2009) reported that worry about the baby's health subsided continuously from early pregnancy to the postpartum period.

Previous research suggested that perceived control plays an important role in risk appraisal. Results of our study determined a border line position as predictor for one of the perceived control subscales (internal). In a study by Audrain et al. (1997), low levels of perceived control over cancer were related to high levels of perceived risk. The authors stated that women with high levels of perceived risk and low levels of perceived control may be most vulnerable to distress. However, Gerend et al. (2004) reported that they did not find a relationship between perceived risk and the controllability and preventability of the risk. This might be explained by the fact that their study focused on characteristics of the risk rather than the degree of the individual's perceived control.

Interestingly, in our study, knowledge of age-related risks of childbearing was not a significant predictor of perceived risk, even after testing for its interaction with maternal age. This finding is consistent with a previous study that examined women's risk perception for developing chronic disease. Their results indicated that perceived risk does not completely reflect women's knowledge of objective risk of disease (Gerend et al., 2004). Similarly, Kim et al. (2007), who examined risk perception for diabetes among women with a history of gestational diabetes mellitus (GDM), found that knowledge of GDM as a risk factor for diabetes is not necessarily sufficient to increase risk perception. In their study, although the majority of women were aware that gestational diabetes was a risk factor for future diabetes, only 16% had high perception of risk for developing the disease. Similarly, Dearborn, Lewis, and Mino (2010) conducted a study to assess pregnant women's knowledge about HIV, their perception of personal risk, and willingness to be tested. They reported no relationship between HIV knowledge and risk

perception or test acceptance. In contrast, Chuang et al. (2008) reported that increased familiarity with preterm or low-birthweight birth through experience with the outcome (personal or family history) or known predictors (smoking, being underweight) correlated with greater perceived risk. They concluded that predictors that did not contribute to risk perception in their analysis were not well known to be associated with preterm/low-birthweight birth by women. This discrepancy draws attention to one aspect of risk assessment that can be especially challenging and that is to distinguish risk knowledge from risk experience. The latter has been also identified as "risk representativeness" by Kahneman & Tversky (1973), stating that often the most representative outcomes will be predicted by people. Findings from the qualitative component of this study also supported this perspective by suggesting that risk knowledge had a limited impact on risk perception, while risk experience might dramatically contribute to the perception of pregnancy risk.

Although some research suggests that the cognitive heuristics of availability and similarity of the risk might contribute to perceived risk, we did not observe similar relationships. This result might be due to using a single item measure (developed by the authors for this study) that has not been previously psychometrically evaluated and may not have accurately measured the concept. Also, availability and similarity may be attributable to other experiences that we did not measure in this study. Because these variables have emerged in previous research on risk perception, the role of cognitive heuristics in risk perception will need further study. Also developing a valid and reliable scale to measure this concept in relation to pregnancy risk is encouraged.

This study has both strengths and limitations. One of its strengths is that we recruited only nulliparous women to minimize the effect of previous pregnancy experiences on risk perception. Furthermore, our conceptual framework was based on the literature on perception of pregnancy risk. The comprehensiveness of our conceptual framework can be supported by its high predictive power in the regression models. Also, the majority of variables were measured using valid and reliable instruments. Limitations of the study that require consideration when interpreting the results include the use of convenience sampling for collecting data. Due to a non-random method of sample selection, those who volunteered to participate might have been different than those who did not, resulting in selection bias. Because our sample included two distinct age groups of women, some variables might be affected by the larger proportion of the sample between the ages of 20-29 years. In addition, because the sample was recruited from a nulliparous population of women, the results might not be generalizable to multiparous women.

Implications for Practice

Results of this study have implications for efforts to improve prenatal care and risk communication and also provide the impetus for future research. Our findings supported that women's risk assessments are not only based on information and cognitive processes, but are also affected by psychological factors and social values (Fischhoff, Bostrom, & Quadrel, 1993; Tversky & Kahneman, 1974). A woman's perception of pregnancy risk is not identical with her medical risk condition. There are several other factors contributing to her risk perception, of which at least half are not identified yet.

Future studies should be conducted to discover these factors. Our findings also suggest that merely offering information about risk might not contribute to alterations in risk perception to any great extent. An effective risk communication might benefit from strategies other than providing factual information about risk. Although providing information is fundamental and is often considered the first step in changing behaviour or intervening, information should be offered in a way that can be related to a woman's life experiences. As Carolan (2009) stated, some women might benefit from translating epidemiological risk into real life instances in order to help them to process the risk.

Health care providers should be aware that a woman’s perception of pregnancy risk is highly individualized and could be different from medical risk assessment; therefore, a discussion about the woman's risk perception should be integrated into the prenatal care visit. This communication will enhance the quality of care by incorporating the women's perspective in planning their own care and also providing an opportunity to identify women with higher anxiety levels. Women with high levels of perceived risk and of AMA may be more vulnerable for higher anxiety and should be targeted for interventions to foster accurate risk perceptions and decrease anxiety levels. Detection of anxious pregnant women may provide an opportunity to refer them to mental health services to engage them in appropriate interventions prenatally and postnatally. Anxiety during pregnancy has been associated with several adverse outcomes. In general, women with high levels of anxiety are at higher risk of spontaneous early labour, preterm delivery, lower birth weight, fetal distress, and operative or instrumental deliveries. In addition their newborns are more likely to have a poor neonatal adaptation, admission to

neonatal ICU, and excessive crying, irritability, hostility, and erratic sleep (Consonni et al., 2010; Fishell, 2010). Hosseini et al. (2009) reported that trait anxiety during pregnancy predicted shortened gestational age and lower birthweight. In another study, pregnancy-related anxiety was associated with decreased gestational age (Wadhwa et al., 1993). Taking into consideration the association between anxiety and adverse perinatal outcomes and also its central situation in perception of pregnancy risk, understanding of the nature of the relationship between risk perception and anxiety requires further research.

Conclusion

This study confirmed that previously known factors in risk perception (e.g., perceived control and medical risk) may be applicable in the state of pregnancy. Although earlier qualitative research suggested that AMA might contribute to a higher risk perception, our study provided a quantitative verification for these statements by identifying maternal age as a significant predictor for perception of pregnancy risk. Our study contributed to the perception of pregnancy risk literature by identifying a new predictor (i.e., gestational age) and also proposing pregnancy-related anxiety as a pregnancy dread factor in risk perception theories. Furthermore, our findings draw attention to the interactive effects of maternal age and pregnancy-related anxiety in increasing perception of pregnancy risk. This result emphasizes that health care professionals need to take extra caution in risk communication with women of AMA. Future research should be conducted to situate anxiety and perception of pregnancy risk

more accurately in relation to each other. This knowledge may have implications in developing more effective risk communication models.

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Table 6. Descriptive Statistics for Major Study Variables

Variable	N	Range	(Min-Max)	M (*SD*)
PPRQ score	158	75.8	(0-75.8)	23.64 (16.20)
Risk for Self	158	90.7	(0-90.7)	24.45(16.49)
Risk for Baby	159	89.4	(0-89.4)	22.99 (18.01)
Perceived Control (Internal)	156	27.0	(9.0-36.0)	25.86 (4.05)
Perceived Control (Chance)	150	21.0	(6.0-27.0)	15.73 (4.32)
Perceived Control (Powerful Others)	154	28.0	(6.0-34.0)	18.11 (5.23)
Pregnancy-related Anxiety	157	2.1	(1.1-3.2)	1.90 (.42)
Risk Knowledge	159	9.0	(0-9.0)	4.67 (2.06)
SF-12 (Physical Functioning)	159	100.0	(0-100.0)	59.43 (32.88)
SF-12 (Role Physical)	157	100.0	(0-100.0)	57.72 (24.04)
SF-12 (Bodily Pain)	159	100.0	(0-100.0)	76.57 (20.22)
SF-12 (General Health)	149	75.0	(25.0-100.0)	78.49 (16.77)
SF-12 (Vitality)	159	75.0	(0-75.0)	47.96 (19.88)
SF-12 (Social Functioning)	158	100.0	(0-100.0)	75.16 (23.86)
SF-12 (Role Emotional)	159	87.5	(12.5-100.0)	80.82 (20.94)
SF-12 (Mental Health)	157	75.0	(25.0-100.0)	70.78 (15.92)
Medical Risk	157	8.0	(1.0-9.0)	2.86 (1.85)

Table 7. Pearson Correlation Coefficients between Perception of Risk Score and Major Study Variables and Partial Correlation Coefficients (Controlling for Maternal Age)

Variable	Not Adjusted	Controlling for Age
Maternal Age	.29***	-
Cognitive Heuristics (availability)	.11	.20*
Cognitive Heuristics (similarity)	.10	.13
Gestational Age	- .21**	-.17*
Perceived Control (Internal)	- .21**	-.20*
Pregnancy-related Anxiety	.56***	.47*
Risk Knowledge	.06	.11
SF-12 (Physical Functioning)	- .21*	-.16
SF-12 (Role Physical)	- .24**	-.12
SF-12 (General Health)	-.12	-.22*
SF-12 (Vitality)	- .25**	-.21
SF-12 (Mental Health)	- .29***	-.26**
Medical Risk Score	.36***	.25**

* $p<0.05$

** $p<0.01$

*** $p<0.001$

Table 8. Multiple Regression Analysis (without Interactions) - Perception of Pregnancy Risk as the Dependent Variable

Predictor	Unstandardized Coefficients		β	*t*	*p*
	B	SE B			
Pregnancy-related Anxiety	17.08	2.36	.45	7.23	<.001
Medical Risk	2.16	.54	.25	4.00	<.001
Maternal Age	.57	.16	.22	3.52	.001
Gestational Age	-.64	.26	.25	-2.49	.014
Perceived Control (Internal)	-.42	.24	-.11	-1.74	.084

Note. N=159. R^2=.47, Adjusted R^2 = .45, F = 26.00, p <.001. Variables entered into model included: perceived control (internal), pregnancy-related anxiety, cognitive heuristics (availability), five subscales of health status variable (i.e., physical functioning, role limitations due to physical health problems, general health perceptions, vitality, and mental health), medical risk, gestational age, and maternal age (as a continuous variable).

Table 9. Multiple Regression Analysis (With Interactions) - Perception of Pregnancy Risk as the Dependent Variable

Predictor	Unstandardized Coefficients		β	*t*	*p*
	B	SE B			
Pregnancy-related Anxiety	-9.66	11.76	-.26	-.82	.41
Medical Risk	2.22	.53	.26	4.17	<.001
Maternal Age	-1.08	.73	-.43	-1.48	.14
Gestational Age	-.59	.26	-.14	-2.31	.02
Perceived Control (Internal)	-.47	.24	-.12	-1.96	.05
Maternal Age x Pregnancy-related Anxiety	.90	.39	.99	2.32	.02

Note. N=159. R^2*=.49, Adjusted* R^2 *= .47, F = 33.27, p <.001. Variables entered into the model included: maternal age, perceived control (internal), pregnancy-related anxiety, medical risk, gestational age, and their interactions with maternal age.*

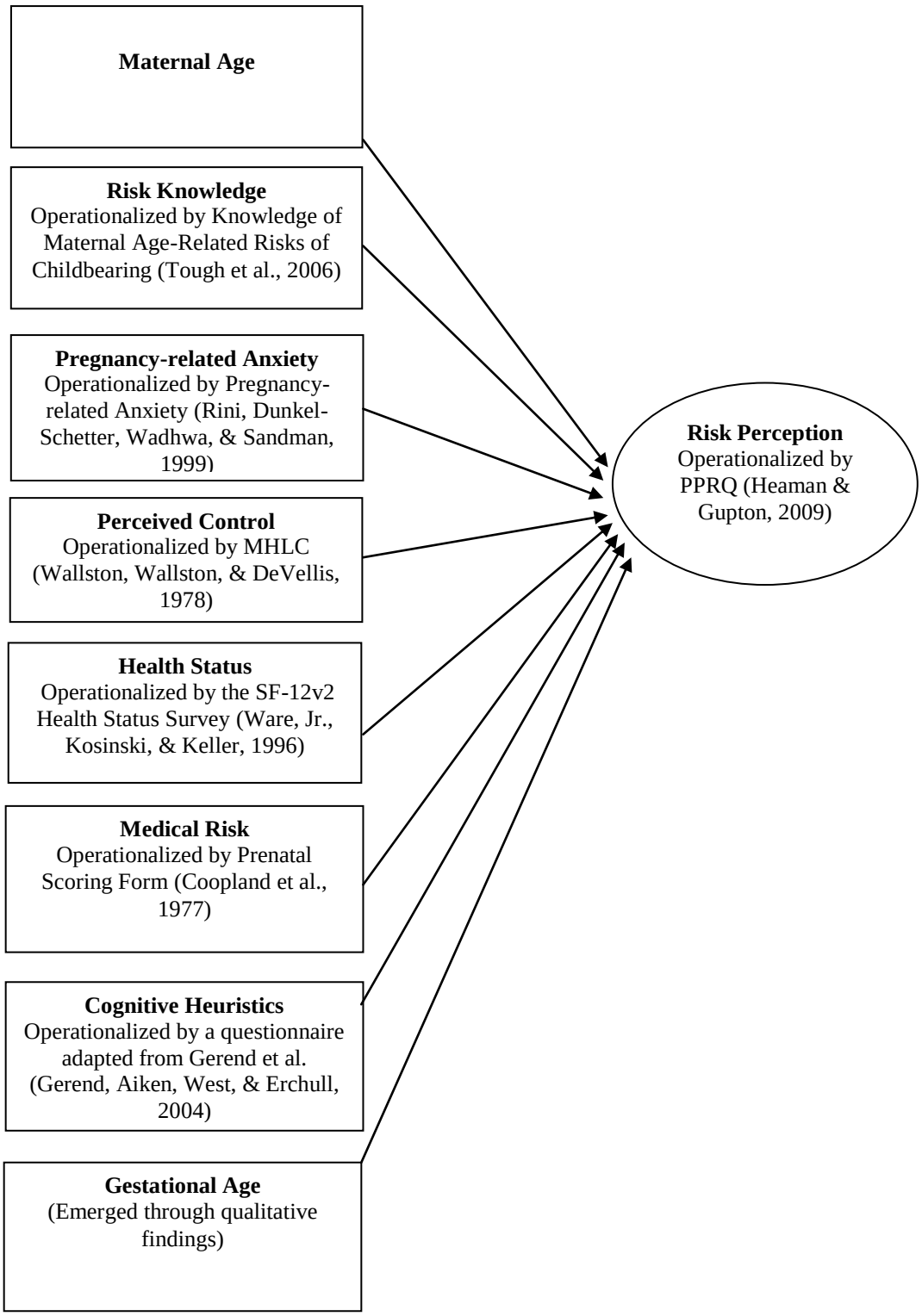

Figure 1. Conceptual framework of the study

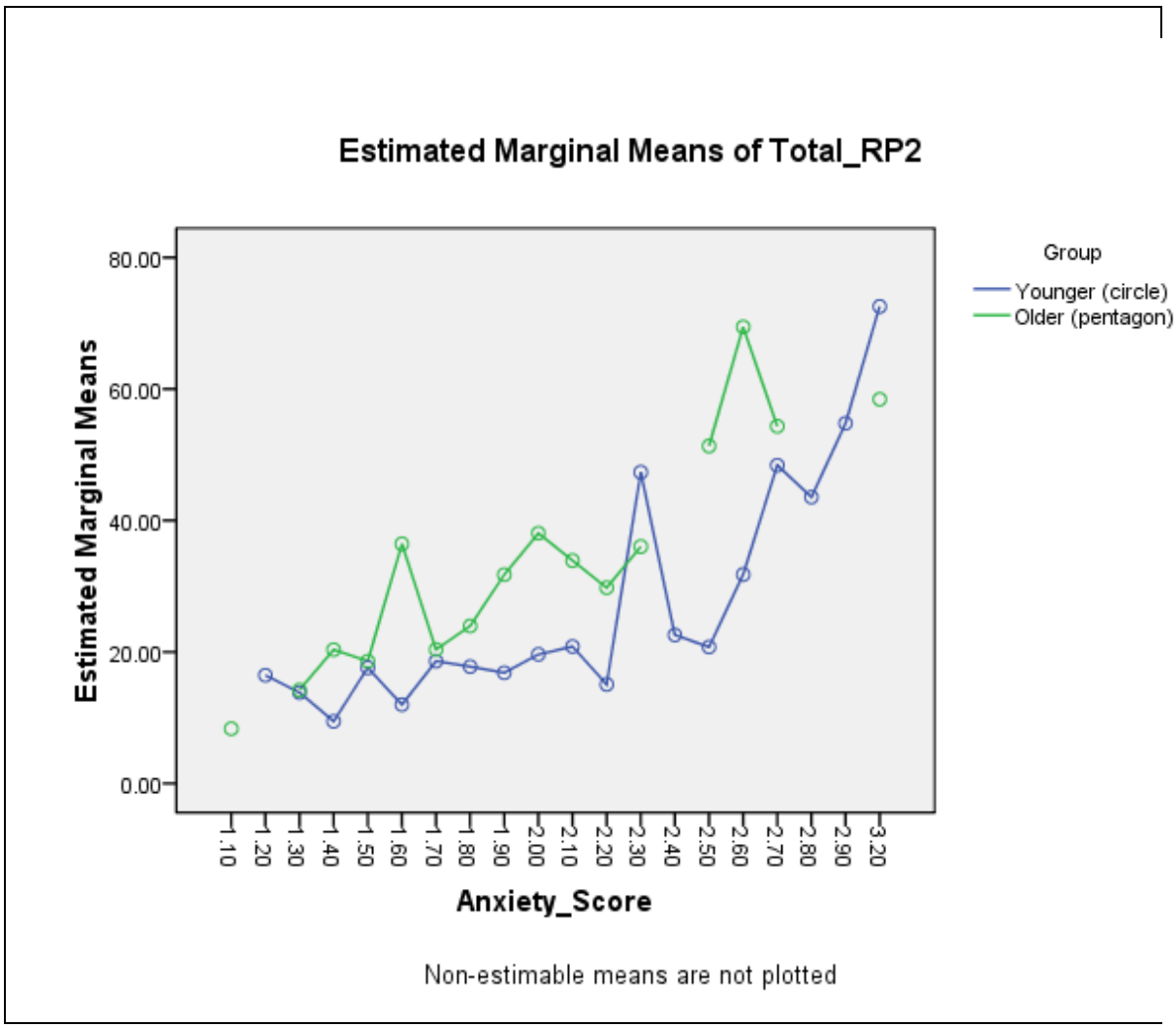

Figure 2. The effect of maternal age on the perception of pregnancy risk-anxiety scores

Graph of estimated marginal means of perception of pregnancy risk score by anxiety levels for the younger (20-29) and older (35≥) maternal age (age as a dichotomous variable).

Chapter Seven: Manuscript Three

Introduction to Chapter Seven

The preceding two chapters presented the results of the quantitative component of the study. The following chapter reports the findings of the qualitative component. Similar to the two previous chapters, it has been formatted into a publishable manuscript entitled "*Advanced Maternal Age and Risk Perception: A Qualitative Study*". The manuscript begins with an introduction and explanation of the methods, followed by presenting results and discussing their implications.

Although this manuscript mainly focused on the qualitative component, its results have been combined with some data in the first paper to enrich interpretation of data. Selected quantitative measures including the Perception of Pregnancy Risk Questionnaire (PPRQ), perceived control, and pregnancy-related anxiety measures have been incorporated with the qualitative data to enrich background information about participants. The content of this paper along with the findings of the second manuscript (Chapters Six and Seven) formed the foundation for the development of the final conceptual framework of the study that will be presented in Chapter 8.

The student wrote this article, while the student’s advisor and her committee members provided constructive suggestions on the manuscript. The potential journal for this manuscript will be determined later.

Manuscript 3: Advanced Maternal Age and Risk Perception: A Qualitative Study

Abstract

Objectives: Advanced maternal age (AMA) is associated with several adverse pregnancy outcomes, hence these pregnancies are considered to be "high risk." A review of the empirical literature suggests that it is not clear how women of AMA evaluate their pregnancy risk. This study aimed to address this gap by exploring the risk perception of pregnant women of AMA.

Methods: A qualitative descriptive study was undertaken to obtain a rich and detailed source of explanatory data regarding perceived risk from 15 women of AMA. The sample was recruited from a variety of settings in Winnipeg, Canada. In-depth interviews were conducted with nulliparous women $\geq$ 35 years, in the third trimester, and with singleton pregnancies. Interviews were recorded and transcribed verbatim, and content analysis was used to identify themes arising from the data.

Results: Four main themes emerged: definition of pregnancy risk, factors influencing risk perception, risk alleviation strategies, and risk communication with health professionals.

Conclusion: Several factors may influence the perception of pregnancy risk including physiological aspects, gestational age, psychological elements, cognitive heuristics, predictability of risk, and health care provider's opinion. Consideration of these influential factors may help individuals who care for pregnant women of AMA to gain insight into how these women perceive their pregnancy risk.

Introduction

In the past three decades, a growing number of women have delayed their childbearing for educational, social, and economic reasons (Benzies et al., 2006; Tough, Benzies, Fraser-Lee, & Newburn-Cook, 2007). Pregnancy at advanced maternal age (AMA) is associated with several adverse pregnancy outcomes (Cleary-Goldman et al., 2005; Hung, 2008; Jacobsson, Ladfors, & Milsom, 2004; Joseph et al., 2005; Joseph et al., 2007); therefore, it is considered a "high risk" pregnancy. The concept of risk at AMA may be composed of two components: the physiological challenges because of an aging reproductive system, and the social discourse of risk and timing of childbearing (Carolan & Nelson, 2007).

Pregnancy risk perception may affect pregnant women's health care use, motivations to seek care, pregnancy and labour decisions, adherence to medical recommendations, and health behavior (Atkinson & Farias, 1995; Kowalewski, Jahn, & Kimatta, 2000; Suplee, Dawley, & Bloch, 2007). Risk perception is incorporated as a key concept in constructing several theories of health behavior such as the Health Belief Model (Janz & Becker, 1984), Protection Motivation Theory (Maddux & Rogers, 1983), and Prospect Theory (Kahneman & Tversky, 1979).

Although pregnancy at age 35 years or older is considered a medically high risk situation, little is known about perception of pregnancy risk of women of AMA. Most previous work on risk perception at AMA has focused on increased risk of genetic abnormalities, while the general concept of pregnancy risk perception has received less consideration. Current knowledge of risk perception at AMA is based on a few studies,

most of them primarily focused on pregnancy experiences and in which risk perception was discussed as part of the pregnancy experiences. In a qualitative study, Saxell (2003) explored the understandings and beliefs of ten women of AMA about the risks associated with their pregnancies. The author reported that these women found being labeled high risk very challenging; hence, several participants rejected this labeling as part of their coping mechanism. Probably, Saxell's study is the only research that primarily focused on understanding the risk perception of women of AMA; however, the limitations of this study, such as retrospective data collection (36 months after delivery) and its unique population (participants who chose midwifery care), should be considered in the interpretation of the results. Windridge and Berryman's (1999) study of 107 British women's experiences of giving birth at AMA demonstrated that women of AMA may perceive a higher risk for their babies during labor because of their older age.

Another notable study in this field is an Australian qualitative study of 22 primigravid women of AMA. This study was initially conducted to understand the experiences of women of AMA (Carolan, 2005). Later, in 2007, Carolan and Nelson published a secondary analysis based on that research. They identified four themes central to perception of pregnancy risk including "realizing I was at risk," "hoping for reassurance," "dealing with uncertainty," and "getting through it/negotiating risk" (p.540). The authors observed high levels of concern and anxiety among participants, in spite of these women having healthy pregnancies, and suggested that the notion of risk may have negative impacts on these women.

Considering the lack of literature in this area and limitations associated with the previous studies, we conducted a mixed methods research study to further the existing knowledge about risk perception and its contributing factors at AMA. The study reported here is the qualitative component of the mixed methods study. The goals of this qualitative study were to explore how nulliparous women of AMA evaluate and define their pregnancy risk and to arrive at a detailed understanding of their risk perception. To achieve these objectives, the following questions were explored: 1. How do nulliparous women of AMA define pregnancy risk? 2. Why do women of AMA feel that their pregnancy is, or is not, at risk? Which factors influence perception of pregnancy risk of women of AMA? 3. What are the experiences of women of AMA with risk communication from health care providers during pregnancy? How do women feel their perceptions of risk differ from those of their health care providers, if at all? 4. What impact, if any, did being labeled high risk have on these women's lives and behaviors?

Methods

A qualitative descriptive study was undertaken to obtain a rich and detailed source of explanatory data regarding risk perception from women of AMA. As described by Sandelowski (2000), a qualitative descriptive study provides "a comprehensive summary of an event in the everyday terms of those events." (p.336). Qualitative descriptive method is a distinctive and valuable technique that offers a direct description of phenomena, which is still interpretive (Sandelowski, 2010). In other words, as Sandelowski (2000) stated, this kind of research can address both descriptive and

interpretive validity to account for participants' observations and their understandings of these events.

The sample consisted of 15 nulliparous women aged 35 years or older. Participants were chosen purposefully from among the participants in the quantitative component of the mixed methods research study. In purposeful sampling, participants are intentionally selected according to the needs of the study (Coyne, 1997). Other criteria for participation in the larger mixed methods study were singleton pregnancy, ability to speak, read, and write in English, and gestational age of 28 weeks or greater. Any known severe psychological disorder was an exclusion criterion. Data were collected over 14 months (December 2009 to January 2011) from selected physician's offices and outpatient prenatal care clinics at two tertiary hospitals in Winnipeg, Manitoba. Participants were selected to ensure diversity in demographic and obstetric characteristics, most notably gestational age, and pregnancy complications. In addition, participants were recruited to reflect a range of scores using the Perception of Pregnancy Risk Questionnaire (Heaman & Gupton, 2009) used in the quantitative component, to ensure including participants with different levels of perception of pregnancy risk. In qualitative inquiry, sample size relies on the concept of "saturation" which is the point at which no new information or themes are observed in the data (Guest, Bunce, & Johnson, 2006). Saturation was reached after interviewing 15 participants.

This project was reviewed and approved by four committees prior to commencing data collection: the University of Manitoba Education/Nursing Research Ethics Board, Health Sciences Centre Research Impact Committee, St. Boniface Hospital Research

Review Committee, and Winnipeg Regional Health Authority Research Review Committee. The researcher asked selected women who had participated in the quantitative component of the study if they were willing to participate in the qualitative component. Potential participants were provided with a written and verbal explanation of the qualitative component of the study. Each participant signed a consent form. A mutually convenient time and place were arranged to conduct the interviews. In-depth, semi-structured, face to face interviews, using an interview guide, were conducted by the researcher. All interviews were audio-recorded and transcribed verbatim.

Data analysis was carried out concurrently with data collection. Transcripts were analyzed using a content analysis technique. Content analysis is defined as any technique for making inferences by objectively and systematically identifying specified characteristics of messages (Holsti, 1969). In other words, content analysis is a systematic and replicable method used for condensing many words of text into fewer content categories based on explicit rules of coding (Stemler, 2001). In this method, first the transcripts were read in full; then, analysis proceeded using the standard qualitative analysis techniques of open coding by inputting and sorting codes using NVivo version 9. Next, the definition of each code was created and identified codes were clustered into categories, and finally the categories were grouped into themes. Descriptive statistics were used to summarize the demographic data from the participants. As mentioned earlier, this study was part of a mixed methods research study in which several instruments were administered. In this report, selected quantitative measures including the Perception of Pregnancy Risk Questionnaire (PPRQ) (Heaman & Gupton, 2009),

perceived control (internal) (Wallston, Wallston, & DeVellis, 1978), and pregnancy-related anxiety (Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999) scores have been reported to enrich background information about participants and enhance the interpretations of findings. The scores on these scales, taken from the respondents age 35 or older in the larger mixed methods study (n=54), were divided into tertiles representing low, middle, and high scores (Table 1). Table 2 illustrates the number of participants in each tertile. Diversity in the sample allowed for the documentation of variations in risk appraisal and also the identification of important issues that were common across participants.

According to Davies and Dodd (2002), rigor refers to the reliability and validity of qualitative research; however it does not necessitate the sense of replicability of the research in different situations that is common in quantitative research. In fact, visibility of research practices and accountability of the data analysis are the essence of rigor in qualitative research. In the current study, a validation process for the qualitative component was performed during and after conducting the research using two strategies. In the first method, member checking was used in which the results were verified with participants by asking them to confirm the researcher's interpretations during interviews and after obtaining interpretations. Second, the results were confirmed with peer review and debriefing through regular meeting with the dissertation advisor to achieve a jointly developed interpretation of the data. Dependability was obtained through use of an audit trail. In this strategy, contextual information and participant’s reflections were

documented. The ways to address confirmability in this study were using direct quotes and confirming the findings with participants during interviews.

Results

The sample for this study consisted of 15 participants. The age range of participants was 35 to 44 years (M_{age}= 37.6 years). The majority of women were highly educated with a mean educational level of 18.7 years. All participants were married or living common-law. All except one had been working during pregnancy. Over half (53.3%) of the women reported an annual family income of $100,000 or over. All participants were in the last trimester of their pregnancies, with a mean gestational age of 35.6 weeks (ranging from 32 to 40 weeks). All participants except one considered their pregnancy to be planned. Table 3 and Table 4 illustrate selected demographics and obstetrics characteristics of the sample.

Participants delayed their childbearing for a variety of reasons. The primary reason for some women was lifestyle choices (n=6). This group of women described being focused on their career, education, travel, or that they did not feel that they were ready to have children until they reached an older age. Delayed marriage was the primary reason for six other participants. Finally, three women identified infertility issues as their primary reason for postponed childbearing. It should be noted that infertility was also reported among participants in the delayed marriage and lifestyle choices groups, however it was not their prime reason for delayed childbearing.

The findings of this study were categorized into the following themes: definition of pregnancy risk, factors influencing risk perception, risk alleviation strategies, and risk communication with health professionals.

Definition of pregnancy risk. This theme describes participants' understandings of pregnancy risk and explains how they defined risk. Most women acknowledged that there are some increased risks at AMA; however, a number of them felt that the risk has been overestimated. For example, one of the participants stated that "those numbers don't matter," and another mentioned that "it's an overreaction, frankly." Women's understandings of risks associated with AMA were reflected most often in comments about their awareness of infertility issues and genetic abnormalities. A big concern for most women was infertility problems associated with delayed childbearing rather than pregnancy-related issues. Most of the women who delayed marriage reported that they decided to become pregnant soon after getting married to minimize the effect of age factor on their fecundity. Almost all participants in our study were aware of increased risk of genetic abnormalities, particularly Down syndrome, with AMA.

It was noted that participants' understanding of risk tended to be extensive and comprehensive; they considered their pregnancy as more of a societal issue in which personal, interpersonal, and societal elements were significant, rather than merely a biomedical matter. For our participants, the meaning of risk was broader than medical issues and included the extent of their support network, their ability to control situations, and whether they had a secure relationship, a planned pregnancy, a flexible job or healthy lifestyle and behavior. It is noteworthy that some of these elements were also identified

by participants as factors influencing their timing of pregnancy. The following quote is an example of the comprehensiveness of risk definition by one of participants with an uncomplicated pregnancy:

> "A high risk pregnancy to me would have been if I had no control over my work environment . . . So even just the ability to be able to work from home . . . if I was working in more a violent situation, if I was in a bad relationship I think that would make me more of a high risk pregnancy, than my personal age or my personal health . . . I think it's more my surroundings than, than me . . . cause I can control what I do right? I control what I eat, I can control when I go to bed, I can control the people around me, like I can control those things, but if I can't control those things then potentially my environment would be more my risk factor." Participant 13

Factors influencing risk perception. The magnitude of the perception of pregnancy risk differed among our participants. In data analysis, nine factors were identified that determined perception of pregnancy risk including: cognitive heuristics (availability and similarity of the risk), predictability of the risk, health status, pregnancy complications, gestational age, perceived control, poor fertility history, anxiety, and health care provider's opinion.

Cognitive heuristics. The concept of "availability of risk" is a cognitive heuristic and refers to "a cognitive shortcut used for judging the probability of an event by the ease with which examples of the event come to mind" (Gerend, Aiken, West, & Erchull, 2004, p.248). Based on participants' explanations, this concept appeared to be very fundamental in risk appraisal. One participant with high perception of pregnancy risk score explained: "if it [risk] happens to other people, then it could happen to me." Accordingly, women's understandings of risk were mostly based on their experiences of real cases in life, and they mainly relied on these data in pregnancy risk assessment:

> "From my experience in Europe, where most women are having their children in their thirties and not their twenties and, to be honest, I didn't, and I lived there for a long time, I didn't see the amount of Down's Syndrome or other physical abnormalities that you see here." Participant 11

Most participants had an example of pregnancy at AMA among one of their family members, friends or colleagues. An interesting point was that most participants were not concerned about the parity of these women in order to compare their pregnancy with them. Availability of a positive example in mind or a favorable family history of fertility at AMA was often reported as a reassuring factor that increased women's perceived ability to conceive at AMA and to have a successful pregnancy.

> "I know a lot of women that are having their first child in their forties . . . and everything has worked out fantastic, so I always looked at them as sort of my mentors or role models." Participant 5

These participants often perceived their pregnancy as being low risk. Another participant with both low perception of pregnancy risk score and anxiety score and an uncomplicated pregnancy commented:

> "Both like my mother had me when she was thirty-six, I think, and my partner's mother had her last one when she was forty-one, so it's, it doesn't seem that abnormal in my . . . and actually my grandma had my mother at forty-four so. And I think maybe that, that as well, like, made me feel less risky as well cause I had, you know, generations before me that had late babies and with no complications." Participant 8

On the other hand, participants who were familiar with the risks associated with AMA, through personal or vicarious experiences, expressed more concerns and had an increased perceived risk. One of the participants with a fairly healthy pregnancy and high perception of pregnancy risk score and high anxiety score mentioned:

> "A friend of mine got pregnant; I think she was 36, and she did have a baby who had so many problems that they were surprised the baby's heart was even still beating in her womb, so she ended up terminating that pregnancy, and she's still broken up about . . . so I was debating this . . . So yeah I did have that one friend, and of course, the woman who told me about her near death experience in labour." Participant 4

The "similarity" is another component of cognitive heuristics and reflects "a cognitive shortcut used for judging the probability of an event by its similarity to events with comparable features" (Gerend et al., 2004, p.248). Although the concept of similarity was frequently used by participants to evaluate the likelihood of the risk, they also assessed their pregnancy risk by comparing their critical characteristics with those who developed a pregnancy complication. The following comment is an example of using the similarity heuristic in risk appraisal by a 37 year-old participant:

> "I had that friend who was thirty-six and had a baby who had Trisomy 18, and she felt that it was because of her age, I won't say advanced age, but she is not as healthy as I am. She actually may have an alcohol problem, and she's taken a lot of medications in her life for depression and all kinds of things, and she doesn't really work out very much, and she just wasn't as healthy [as I am]."Participant 4

Predictability of the risk. Based on our participants' explanations, predictability of the risk was an important element in pregnancy risk appraisal; a predicted pregnancy complication was perceived as a low risk situation by women than a non-predicted and unexpected problem. One participant with a low perceived risk score, who had severe morning sickness in early pregnancy, described it as a "typical pregnancy symptom" that could happen in "every pregnancy." On the other hand, another participant with high perception of risk and low perceived control scores, who had to stop working for an unexpected, threatened premature labour stated:

> It's been challenging, so it's not what I expected . . . the (risk) perception was higher because I did not expect to feel an almost arthritic pain the last two months, I didn't expect that morning sickness would be 24 hours a day for five months instead of three, neither of us were expecting this . . . I was expecting to work until my due date and come to the hospital and you know I was ready to be like every other mom, well most other moms where you work till the end and sometimes you just go from work straight to the hospital in labour." Participant 6

A 37 year-old participant with a high perception of risk score who was diagnosed with gestational diabetes explained that:

> "Both of my parents have adult onset diabetes, and my mother had gestational diabetes with my brother when she was roughly the same age as me, and so I, I pretty much expected to have gestational diabetes, so I was careful right from the beginning, making sure that I was exercising and trying to eat healthfully and so on . . . so I was cautious about that . . . [however] I was surprised to find that I had needed the insulin for it as opposed [to] control by diet; that was a bit of a shock. It was a shock to discover that it was that severe to begin with and that I would need the insulin." Participant 9

Health status. Good health was frequently identified as a factor that decreased risk when participants assessed their pregnancy risk in relation to age. Most women in our study considered themselves healthy and felt that they had control over their physical health. They often emphasized their good health as a balancing capacity in pregnancy risk assessment. A 35 year-old participant at 30 weeks of gestation with a low perception of risk score commented:

> "Because I was, I'm always, I've always been a quite a healthy person, it, it never really concerned me that much that I was older and having a baby." Participant 8

Pregnancy complications. Among our participants, three women had gestational diabetes, one had vaginal bleeding before 20 weeks, and one had both vaginal bleeding

before 20 weeks and threatened preterm labor. Based on participants' comments, pregnancy complications had some influence on the perception of pregnancy risk; depending on the type of complication, its impact on the woman's life, and the degree to which the woman felt that complication had been controlled. For instance, the woman with threatened preterm labor who had to quit work expressed a high risk perception. On the other hand, the other three women, who described their gestational diabetes as a well-controlled situation, had low to moderate perception of risk scores. The following statement was made by one of participants who had a moderate perceived risk score:

> "I've developed gestational diabetes in the end but that's probably due to the fact that I already had polycystic ovary syndrome, so there was already insulin resistance . . . there was nauseous initially but no vomiting, um a lot of weight gain, but again that's the insulin resistance, so it's been an easy pregnancy, I suppose." Participant 11

Women with pregnancy complications often had higher pregnancy-related anxiety scores. One of the participants with gestational diabetes expressed concerns regarding having a larger baby than average and also long-term consequences of diabetes:

> "The first week [after diagnosis] I was very very sad, I was very sad because I, I was concerned, you know, having a big baby and, and he has any complication [in] the pregnancy, um I was very sad for him that I may be passing this gene." Participant 12

Gestational age. Most participants pointed out that they felt more relaxed about risk and related problems as their pregnancy progressed. The participants described pregnancy as having several milestones, and passing each phase seemed to increase their confidence to have a healthy pregnancy:

> "As time went on, it got a little bit easier to feel like I wasn't at as much risk in terms of the pregnancy." Participant 7
>
> "As I get closer [to delivery] and I haven't had any problems I'm getting more and more confident and I feel a little bit better." Participant 1

Most women's explanations reflected that their perception of risk was consistent with the actual probability of risk according to gestational age. They expressed concerns in every phase of pregnancy starting with miscarriage and genetic risk and leading to third trimester risks such as preeclampsia. Toward the end of pregnancy, the meaning of an older age as a risk factor for women with uncomplicated pregnancies remained simply a number. Some women used phrases such as "it was just that number and that's it!"

Perceived control. Participants' comments reflected that most of them had a good sense of internal control, both over their life situations and their health. Considering the pregnancy-related anxiety and risk perception scores of participants and their explanations, it is apparent that high perceived control may be related to a lower perceived risk. The following quote was expressed by a 39 year-old participant who had high perceived control and low perception of risk scores:

> "I just [know] the way my body responds to things . . . I understand my body, I'm very in tune with how my body works and I can always tell when something's not right." Participant 1

Conversely, low perceived control was often observed with high perceived risk, although sometimes religious beliefs changed the equation. The following statement was made by a 44 year-old participant who had both low perceived control and low perceived risk scores:

> "Both of us felt strongly that um you know we believe strongly in God and that he was in control." Participant 7

Poor fertility history. A number of participants mentioned that they lost a sense of control over their bodies and health to a great extent after enduring infertility experiences. Based on our participants' explanations, it was noted that a history of infertility or miscarriage contributed to loss of perceived control and resulted in increased risk perception in pregnancy. The impact of previous fertility issues on the current pregnancy was expressed by words such as worry, stress, and fear. A 37 year-old woman with a high risk perception score and a history of infertility commented:

> "I planned to get pregnant . . . and I wasn't able to, like the first thing that came to my mind, I'm not a life giver, it's not because you wanted to get pregnant at this month you'll get pregnant, I am not in control. If I'm not given that then I can't do, it's beyond my powers." Participant 15

The following quote was expressed by a 37 year-old woman with a previous miscarriage who had a high perception of risk:

> "I wasn't at [risk] first, but then after I lost the first baby, I thought well maybe this is because I'm old . . . I was stressed, I didn't really deal with it." Participant 4

A 44 year-old participant believed that infertility treatments had a negative impact on her physical health. This belief was also tracked in other participants' explanations who had also dealt with infertility experiences:

> "I think what plays into how I perceive my pregnancy is, is not just my age, it's the journey I took to get here, it was because it took four years to get here . . . and it was a hard four years. My body wasn't [at risk], I wasn't, when we first started trying I was extremely healthy and in shape and, and felt ready, and then as I went

> through all the fertility procedures my health, it affected my health . . . and I didn't feel myself, I didn't feel as strong as I was, so coming into a pregnancy now where I was coming off of all that fertility stuff, it made me feel like I might be at a higher risk." Participant 7

Anxiety. Although most participants in this study expressed some degree of concern for the health and well-being of their babies, only a few women were actually very anxious about this matter. Nevertheless, we found that these women often did not use "anxiety" as a term to describe their anxious feelings. For instance, the following quote comes from a 39 year-old participant who had a high anxiety score:

> "There still is a little bit in the back of my mind, once the baby is born . . . is the baby going to, is everything going to be okay with the baby and through delivery and through labour? So there is a little bit, not anxiety, I wouldn't say anxiety, but a little bit of concern." Participant 5

"Being emotional" was another term that a 35 year-old participant with high anxiety and moderate perception of risk scores used to express her feelings:

> "I'm a little bit emotional, I think that's my biggest, been my biggest struggle throughout the entire pregnancy is my emotional state. First with being so worried and then hormones, I wasn't, I was depressed, and now I'm having trouble sleeping, which is causing a lot of frustration, and I'm really uncomfortable." Participant 2

According to participants' explanations, waiting for screening results, bed rest and limiting physical activities due to pregnancy complications (e.g., morning sickness) contributed to their risk perception. One participant with high perceived risk and high anxiety scores who experienced morning sickness in early pregnancy explained:

> "I didn't feel very good for many months, so I couldn't eat, I was barfing a lot, so that probably added to my stress being home all day cause I couldn't work and

> not being able to eat, so that always, you know, increases your stress, and it lowers your resistance too." Participant 4

Feeling that this pregnancy might be their last chance to have a biological child might increase anxiety for these women and add to the dilemma. A 40 year-old participant with complicated pregnancy who had high perception of risk and low perceived control scores explained:

> "High risk mostly is, or my perception of high risk is if something happened to myself or my child, this may be my only chance to be pregnant and deliver a child." Participant 6

Health care providers' opinion. Health care providers' perspectives about risk and their reaction to, and interpretation of, risk had a considerable influence on the women's understandings and assessments of their own risk. Participants' explanations revealed that health care providers' opinions, as experts in risk assessment, were very valuable and relied upon by women. Although care providers do not usually disclose their personal opinion, women may grasp this by observing care providers reactions and body language. Women may include this information in determination of their risk levels, especially if there is an uncertainty associated with the level of vulnerability. Taking into consideration that several participants in this study did not have major discussions with their health care providers about risks associated with AMA, it might give these women a degree of confidence that there are no serious concerns. A 37 year-old participant with low perception of risk and low anxiety scores stated:

> "My family doctor called me to tell me that the baby has to have an ultrasound after a month, but the doctor here doesn't seem, doesn't seem bothered by it, so I don't think it's got anything to do with the baby having, like, mental or physical

> disability of any sorts; I think it's just more, just something for them to look at." P 13

Risk alleviation strategies. Several strategies were reported by the participants to alleviate and/or cope with their pregnancy risk. This process, for our participants, involved educating themselves and engaging in a healthy lifestyle, reassuring surveillance tests, overlooking the risk, religious beliefs, and balancing their risk by emphasis on positive social aspects of AMA.

Educating themselves and engaging in a healthy lifestyle. Some participants spoke of gathering information to know "what actual risks are and to be prepared." Participants with low perceived risk scores and high or moderate perceived control scores often reported that they had prepared themselves for pregnancy complications to "not be surprised by risk." A 39 year-old participant with low perception of risk and high perceived control scores stated:

> "I'm healthy, I'm fine and I've prepared myself, I've educated myself . . . Yeah I think it would be less stressful [if I were younger] because I wouldn't have to educate myself so much. I would have educated myself but I feel like I had to do that extra little bit of research because I was in that high risk group, I was in that you know 'more chance of something going wrong group.' So I educated myself a little bit more." Participant 1

The participants were also focused on improving their lifestyle and engaging in healthy behaviors. Healthy behavior and lifestyle were perceived as protective factors against pregnancy risk.

Reassuring surveillance tests. Because most women were aware of the association between genetic problems with AMA, receiving reassuring screening tests

results were reported as a relieving factor. A desire to seek actual and tangible signs of baby's health to confirm that "it's a normal baby" was evident in the interviews:

> "When I had one [ultrasound], and I saw that everything was okay, he was developing okay, then I had the tests done, the blood test, I said okay, he's a normal baby, so I stopped worrying." Participant 12

Some participants chose to take screening tests as part of their preparation to deal with anticipatory issues and to decrease concerns related to fetal health. Undertaking screening tests was a result of women's tendency to plan and be prepared and was reported by several participants:

> "We just wanted to do it for our own sake of mind, just for our own peace of mind. I like planning my life, I like preparing for things, I like being educated and ready for whatever, I wanted to know, if I'm going to have a baby with Down's syndrome. I want to know so that I'm prepared, so that I can educate myself as to what this baby's needs are going to be. At least if you've prepared a little bit, you might be able to handle it differently." Participant 1

Overlooking (ignoring) the risk. Some participants reported an inclination to disregard the risk to avoid excessive stress and anxiety. In fact, overlooking the risk was a very common approach among our participants, even among those who educated themselves and were engaged in a healthy lifestyle:

> "I've been trying not to let research or other reports or what I read influence my way of thinking . . . I know they exist, I'm not saying that ignorance is bliss, but I just don't focus on it." Participant 1

The following quote describes this approach by a 44 year-old participant who had low perceived risk and low perceived control scores. She and her partner decided not to undergo genetic screening tests.

> "I did a fair bit of reading but then at the same time I also got to a point where when I was pregnant I put the reading aside because. . . I just found it was starting to increase a lot of anxiety about all the things that could go wrong or be wrong. . . considering my age and considering the risks . . . I started having too much fear about everything that could go wrong, and I didn't want to go into the constant anxiety about it . . . we didn't want to be ignorant about it, like we, we did all our research and awareness, uh like I said, we made sure we were eating healthy, but I mean other than that ,there's [not much] else you can do, you can't, it's out of our control . . . once we talked through some of those anxieties, we took all the necessary precautions to make sure that it was a healthy pregnancy and other than that, the rest is out of our hands." Participant 7

Religious beliefs and hope. Religious beliefs and hope were other alleviating factors described by some participants. They reported that these beliefs helped them to stay calm and feel that they were not alone. A woman with a high perceived risk score commented that:

> "I think my, my faith in, in God somehow kind of like helps me go to sleep at night, you know like I mean I pray..." Participant 15

Another participant with high perceived risk and low perceived control scores expressed that her religious beliefs were important in how she dealt with the risk. This participant also decided not to undergo genetic screening tests.

> "I think that's a matter of our faith and our belief, um that you know, I mean, if God created this child, if God chooses to take this child, then that's his decision to make and not ours, so we're not playing God by taking that child's life." Participant 9

Emphasis on positive social aspects of AMA. A trend to emphasize positive aspects of pregnancy at AMA was tracked in the interviews. From some of our participants' perspectives, an older age improved their readiness to be a parent by having an established relationship and career, being mature both emotionally and personally, and

developing problem solving skills through having various life experiences. Our participants weighed these advantages against biomedical risk in their risk assessment. The following quotes are from participants who had moderate perceived risk scores:

> "There's a risk, and it's high risk. But if, if you ask me if I would prefer being pregnant [at this age] or at twenty-four, I would say right now. I was not emotionally prepared at that time to have a baby, I don't think . . . I was not strong, a strong woman that I'm right now, I have much more to offer my son [now] than if I was young." Participant 12

> "I do think that I would probably have more energy ten years ago, but at the same time, emotionally, I wasn't ready. I was immature and irresponsible still ten years ago. Now I'm more mature and more emotionally ready for it." Participant 2

Communication with health professionals. Communication about risk from health professionals mostly focused on recommending screening tests. Participants' explanations reflected that, in the majority of cases, there was not a discussion about other age-related risks. On the other hand, most women preferred not to initiate risk communication. They reported receiving extra information about risk associated with AMA as pointless and most likely stressful, because they believed they would not be able to change their risk factor, age:

> "There was no real discussion or anything like that, that came into play. It was just more focused on your health and taking care of yourself and eating well and exercising." Participant 3

> "I was aware, and I knew, and he was extremely open to questions; he's very approachable, so I knew that if I had concerns, or if I had questions about it, I could talk to him, but I didn't feel the need." Participant 7

Some participants found risk discussions with their health care provider stressful. In reviewing participants' statements and their anxiety scores, it was apparent that

anxiety may influence the way a pregnant woman interprets risk information and the contents of risk communication. The following quote was offered by a 37 year-old participant who had both high anxiety and high perceived risk scores:

> "I was scared after talking to the genetic counsellor for sure. The nurse with my GP always mentioned it, every visit, she would say, 'well you do have high risks because of your age.' Every week. I know my age; you don't have to keep driving the point home . . . Cause I had a lot of fear actually, when I was meeting with the genetic counsellor and with the nurse at my family doctor's office. I was strongly encouraged to go for genetic counselling because of my advanced age. The terminology that the doctors and nurses and everybody [used], advanced age, advanced age, I'm not eighty, but okay, I suppose I'm over 35 . . . And they would show me charts, like, oh this is how your risk increases once you've reached 35, and you kind of feel a fear that you know something's going to go wrong cause you're over 35. And the genetic counsellor drew all these charts and showed me my risk. But after the genetic counselling and the results came back from all the tests, it turns out I have an extremely low risk, so I'm not sure why they try to scare you like that." Participant 4

Discussion

Women of AMA delayed their childbearing for a variety of reasons. The most common factors for late childbearing among our participants were lifestyle choices and late marriage, followed by fertility issues. Although only a few participants identified fertility problems as their primary reason for delayed pregnancy, several women who delayed their childbearing intentionally also had fertility issues prior to becoming pregnant. Some of these findings are consistent with those of previous Canadian studies (Tough et al., 2007; Benzies et al., 2006). Tough et al. found that timing of childbearing among Canadian men and women was influenced by not finding the right partner, not having financial stability, and lack of awareness about the risks associated with AMA (Tough et al., 2007).

One of the objectives of this study was to determine the definition of pregnancy risk from perspectives of women of AMA. Based on the findings, the definition of risk for women of AMA, similar to that of pregnant women of other ages (Heaman, Gupton, & Gregory, 2004), had a broader scope than medical risks or physical challenges and encompassed various social and personal characteristics. As such, the definition of pregnancy risk for our participants also included consideration of the extent of their support networks, ability to control situations, and whether they had an established relationship, a planned pregnancy, a flexible job or healthy lifestyle and behavior. These findings support the position that approaches to understanding perception of health risks should be comprehensive and broad (Atkinson & Farias, 1995) and suggest that an inclusive risk communication might benefit from including women's criteria of risk definition.

The findings revealed that nulliparous women of AMA were not a homogenous group in their pregnancy risk assessment. Indeed, the perception of pregnancy risk varied considerably among these women. Several issues were identified in the interviews that influenced the perception of pregnancy risk including cognitive heuristics (risk availability and similarity), predictability of risk, physiological aspects (health status, pregnancy complications, gestational age, and personal reproductive history), psychological elements (perceived control and anxiety), and health care provider's opinion.

In the current study, as is the case in previous research (Carolan, 2004), pregnancy at AMA was frequently acknowledged to be high risk due to an increased risk

of genetic abnormalities. However, other medical risks associated with AMA received less consideration. Carolan & Nelson (2007) reported that their Australian participants realized they were at higher risk only after becoming pregnant and through communication with their health care providers. However, our participants described risks associated with AMA as "common knowledge in society," which is consistent with another Canadian study (Saxell, 2003). Although our participants were mostly aware of risks associated with AMA, the majority of them did not consider themselves to be high risk. This apparent disconnect can be explained by the fact that general risk and personal risk differ, and people typically tend to rate their personal risk lower in comparison to general risk (Sjoberg, 2000). For instance, the results of a study on perceived risk of osteoporosis illustrated that two thirds of women aged 40 to 86 years perceived their risk of developing this condition as lower than other women at their ages (Gerend, Erchull, Aiken, & Maner, 2006). The underestimation of personal risk is referred as an "unrealistic optimism" (Weinstein, 1980), and might be related to one's perceived control (Sjoberg, 2000).

The majority of women in our study were well-educated and perceived themselves to be prepared to accept child raising responsibilities. They frequently spoke of having a good sense of control over their bodies and life circumstances. A link has been identified between perceived control and risk perception in previous research (Audrain et al., 1997). In our study, those participants who believed they had good control over their physical health also perceived a lower risk for their pregnancy. We also noticed that a woman's perceived control over health may be important in engaging in

various actions to maintain the balance between risk and health. In this regard, a relationship between perceived control and health service utilization has been documented in previous research (Chipperfield & Greenslade, 1999).

Women reported that having a poor reproductive history contributed to increased risk perception. Failure to become pregnant in initial attempts or previous loss of pregnancy may have threatened these women's beliefs in their abilities to manage their own health. This statement is supported by Campbell, Dunkel-Schetter, and Peplau (1991) who reported that infertility may be perceived as a threat to an infertile person's life's goals, contributing to a low perception of control. These findings imply that poor reproductive history may be a significant factor in increasing perception of pregnancy risk. Further research is needed to substantiate this result. In addition, results of a recent U.S. study demonstrated that previous prenatal loss was a predictor of depression and anxiety in a subsequent pregnancy, independent of other psychosocial and obstetric factors (Blackmore et al., 2011). This highlights a need to address the concerns of women who have had a poor pregnancy outcome in the past to minimize their stress and anxiety in following pregnancies.

Based on our results, pregnancy complications may alter risk perception. This effect might vary depending on the type of complication, its manageability, and its consequences for a woman's daily life. Alternatively, good physical health and healthy behaviours and lifestyles were reported as risk alleviating factors. This finding echoes that of Gerend et al. (2004) who reported that personal health actions from the women's perspectives can reduce their risk. Carolan (2004) reported that their participants were

very keen to know "what they were facing" by seeking more information; our participants rather were focused on risk reducing behaviour and, in fact, their information seeking patterns were mostly based on improving health rather than merely investigating potential risks. In our study, the "information quests"(Carolan, 2004), in which women sought out a wide range of information, were commonly reported in the preconception period. After becoming pregnant, however, women mostly limited seeking information to avoid increased anxiety.

Women experienced a decrease in their perceived risk with advancing gestational weeks. This could be due to women becoming adapted to the state of being pregnant or becoming more positive about the outcome of their pregnancy as it advanced. An uncomplicated pregnancy and favourable screening results may contribute to decreased perception of risk over the course of pregnancy as well. A decline in worry about the baby's health from early pregnancy to the postpartum period has been reported in previous research (Ohman, Grunewald, & Waldenstrom, 2009).

Similar to other studies (Carolan, 2004; Carolan, 2005; Saxell, 2003; Yuan et al., 2000) , our participants reported concerns about fetal health and well-being, particularly genetic abnormalities. While some participants decided not to undergo genetic screening tests, most women in our study chose to know if their fetus had any health problem by doing ultrasound scans and genetic screening tests. Most participants found the screening tests reassuring about their baby's health. This tendency has been described as "hoping for reassurance" in previous research (Carolan & Nelson, 2007). Although receiving comforting screening results was recognized as a relief factor by most women, as Baillie,

Smith, Hewison, and Mason (2000) have noted, for a number of women, feelings of anxiety remained throughout the pregnancy.

There were notable variations among participants in expressing and wording their feelings of anxiety. Anxiety was described vaguely by our participants; in fact, it was sometimes hard for women to identify and name these feelings. This suggests that some women with high levels of anxiety might use different terms to communicate their feelings. This attitude makes the identification of anxiety in these women a challenge. There is evidence that antenatal anxiety is very prevalent and can increase the odds of postnatal depression (Heron, O'Connor, Evans, Golding, & Glover, 2004). Therefore, identification of women with anxiety is crucial so that effective interventions can be targeted appropriately. Although creating a relaxed environment and establishing a non judgmental communication pattern in prenatal care visits may be beneficial for anxious women in disclosing their actual feelings about potential risks, there is growing evidence suggesting that prenatal screening should include both depression and anxiety (Furber, Garrod, Maloney, Lovell, & McGowan, 2009; Matthey, 2004; Swalm, Brooks, Doherty, Nathan, & Jacques, 2010). We support this perspective and believe that using a reliable screening tool to assess anxiety in pregnant woman may be useful to identify women who would benefit from strategies to reduce anxiety. A recent study in Australia demonstrated that the anxiety subscale of the Edinburgh Postnatal Depression Scale might be a reliable measure to screen antenatal anxiety (Swalm et al., 2010).

Women described being hopeful despite having higher perceived risk and anxiety levels. It appeared that the struggle between hoping for a desirable pregnancy outcome

and anxiety about potential risks can lead to a state of uncertainty. Sun, Hsia, and Sheu (2008), in a qualitative study of women of AMA, reported similar ambivalent and conflicted feelings, characterized by apparent pleasure and hidden fear. This attitude has been called a "jubilant apprehension" by Yuan et al. (2000), which describes feelings of great joy and satisfaction, but also worry about childbirth outcomes.

Consistent with research in other fields, our results demonstrated that pregnant women's personal or vicarious experience with a risk may increase the psychological availability of the risk and consequently, its perceived probability (Gerend et al., 2004; Weinstein, 1987). In fact, being familiar with risk, through researching information or indirect experiences, may contribute to women's risk perception. We also noticed that predicting risk and expecting it influenced participants' risk perception. A risk that is expected might be perceived as less risky than an unexpected risk. In the literature, the perceived characteristics of the risk such as prevalence, controllability, preventability, and seriousness along with the availability and representativeness heuristics are important elements in constructing risk perception (Weinstein, 1980; Weinstein, 1982). A qualitative study by Patterson (1993) demonstrated that an unexpected shift in health situation or pregnancy outcomes was identified as a high risk condition by pregnant women, while the expected changes were considered as no risk. One explanation is that anticipating the risk and being prepared to deal with it may increase a woman's perceived control and, consequently, decrease her risk perception.

Comparison was a common risk appraisal strategy among our participants. However, their evaluations were distinct from those of health professionals in that

women often compared their risk to a known population such as their family members, friends, or stories from real people, which is completely different from risks determined by epidemiological studies at a population level. This discrepancy can be explained by the fact that pregnant women's understanding of risk is mostly based on their personal data from real cases of their life experiences (Tversky & Kahneman, 1974; Heaman et al., 2004).

While discrepancies between pregnant women's and health care providers' appraisals of risk were documented in previous research (Corbin, 1987; Gray, 2006; Heaman, Beaton, Gupton, & Sloan, 1992), what appears to be less emphasized is the influence of health care providers' attitudes towards the risk on pregnant women's risk perception. Several women in this study reported no risk communication with their health care providers that focused on age as a risk factor. This has been interpreted by most participants as there not being any serious concern and may imply that pregnant women trust their health care provider's opinion. In this regard, Heaman et al. (2004) reported that women with or without pregnancy complications rely on their health care providers in assessing risk status. A few participants reported negative risk communication with their health care providers. These participants also reported higher anxiety and concern about the well-being of their fetus and pregnancy outcomes. Whether risk communication patterns can affect the anxiety or whether anxiety itself will alter women's interpretation of risk communication is not clear and needs further research.

Implications

In the experience of our participants, any emphasis on mother's good health by their care providers was described as reassuring. Conversely, negative messages about age by purely emphasizing pregnancy risks were described as very destructive and challenging, particularly for women with high levels of anxiety. Although offering risk information is part of risk communication process, the woman's mental health should be considered to avoid unnecessary stress.

Our results suggest that real stories can alter risk perception. This finding has important implications for practice and public health education. Risk must be tangible for women in order to be recognized and potentially addressed. Interventions to decrease unhealthy behaviours should target this concept to alter risk perception. As Williamson & Weyman (2005) suggested when individuals have less experience or knowledge of risks, the media (e.g., documentary movies) can play an important role in increasing their understanding of those risks.

The following advantages informed our interpretations of the results. First, the data were analyzed based on the literature and previously known factors in risk perception. Furthermore, the addition of quantitative measures (i.e., perception of pregnancy risk, anxiety, and perceived control) enabled us to achieve a better understanding of the qualitative data. Another major strength was the contemporaneous exploration of risk perception during the pregnancy.

It is important to consider the following limitations when interpreting and applying the results. First, our sample was representative of a middle class and married population; these characteristics may limit the generalization of the results. This is a small study based on 15 interviews in one geographical area in Canada; therefore, the results may not be generalizable to other populations. Finally, we recognize that selection bias may have been introduced as those who volunteered to participate might have been different than those who did not.

Conclusion

Pregnancy at AMA within a healthy context and in the absence of other risk factors was perceived as a low risk pregnancy by our participants. Their understanding of the age factor in these healthy pregnancies remained only as a "number" or "common knowledge in society." However, in the presence of risk factors such as pregnancy complications, limited physical activity, unfavourable screening tests results, previous poor reproductive history, and anxiety, the risk associated with age was highlighted, and women were inclined to recognize their age as a risk factor for their pregnancy. The findings of our study verified results of previous research (Atkinson & Farias, 1995; Heaman et al., 2004) in that pregnant women's definition of risk goes beyond biomedical considerations.

This study contributes to the AMA literature by identifying several factors that influence the perception of pregnancy risk including cognitive heuristics (risk availability and similarity), predictability of risk, physiological aspects (health status, pregnancy complications, gestational age, and personal reproductive history), psychological

elements (perceived control and anxiety), and health care provider's opinion. These influential factors may help individuals who care for pregnant women of AMA to gain insight into their perception of pregnancy risk and improve the quality and efficiency of prenatal care.

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Table 10. Classifications of the PPRQ, Pregnancy-related Anxiety, and Perceived Control (internal) Scores in Tertiles Using Data for Women of AMA from the Advanced Maternal Age and Risk Perception Study (n=54)

Instrument	Range of Scores	Low Tertile	Middle Tertile	High Tertile
Perception of Pregnancy Risk Questionnaire	3.56-69.44	<18.68	18.68-35.33	>35.33
Pregnancy-related Anxiety	1.10-3.20	<1.71	1.71-2.00	>2.00
Perceived Control (internal)	16.00-36.00	<24.01	24.01-28.00	>28.00

Table 11. Frequency of Participants in each Tertile (N=15)

Instrument	Low	Moderate	High
Perception of Pregnancy Risk Questionnaire	6	5	4
Pregnancy-related Anxiety	5	6	4
Perceived Control (internal)	4	8	3

Table 12. Demographic Characteristics of Participants (N=15)

Characteristic	N
Marital Status	
Married	14
Living common-law	1
Race/ethnicity	
White	11
Other (non-White or Aboriginal)	4
Education	
Incomplete high school	0
Complete high school or less than four years university degree	2
Four years university degree or higher	13
Family Income	
$0-$39,999	0
$40,000-$99,999	6
$100,000 and above	8
Working at a Paid Job before Pregnancy	
Yes	15
No	0
Working at a Paid Job during Pregnancy	
Yes	14
No	1

Table 13. Obstetrics Characteristics of Participants (N=15)

Characteristic	N
Wanted to Become Pregnant	
Sooner	6
Now	8
Not at all	1
Number of Previous Miscarriages	
None	10
One	2
Two	1
Three or more	2
Use of Fertility Medications to Become Pregnant	
Yes	3
No	12

Chapter Eight: Discussion

The rate of pregnancy at age 35 years or older has increased in recent decades. Yet, a gap remains in the understanding of perception of pregnancy risk of women of AMA. This mixed methods study was designed to address this gap by testing a new conceptual framework guided by the Psychometric Model of risk perception and a review of the literature. This chapter first describes how the two components of the study were integrated, followed by a general discussion to link the manuscripts and outline the contributions of this study to the field as a whole. Next, the strengths and limitations of the study are addressed. Finally, recommendations for future research and implications for practice are discussed.

Integration of Findings

As Bryman (2007) stated, the end product of a mixed methods project should be "more than the sum of the individual quantitative and qualitative parts" (p.8). In fact, the two components of this type of research must be integrated, linked, and connected to each other (Bryman, 2007). The integration, as Creswell and Tashakkori (2007) declared, may be in the form of "comparing, contrasting, building on, or embedding one type of conclusion with the other" (p.108).

This concurrent mixed methods study integrated analysis of quantitative data collected by using several instruments with qualitative data from semi-structured interviews. Using a mixed methods approach, the student compared or integrated the factors contributing to perception of pregnancy risk (obtained from descriptive data and

multiple regression analyses) with the women's perspectives (obtained from 15 qualitative interviews). In the current study, the integration of the two components mainly occurred at the interpretation level. However, in data analysis, the two components also influenced each other by incorporating a few elements of the other component.

Integrations of findings at the data analysis level. As Sandelowski (2000a) stated, in combining of data, either qualitative and quantitative data sets can be linked together while each data set remains analytically separate from the other (linking), or these data can be taken together to create a single data set (transforming). In the current study, quantitative and qualitative data sets were linked together. The following section explains how the two components influenced each other at this level.

How did qualitative data influence quantitative analysis? The original conceptual framework of the study, which was based on the Psychometric Model of risk perception and findings from the literature review, consisted of seven concepts. Later, through in-depth interviews of women in the qualitative component, gestational age was identified as an important factor in perception of pregnancy risk. Therefore, this variable was incorporated into the conceptual framework as the eighth variable and was included in the quantitative analyses.

How did quantitative data influence qualitative analysis? Selective data measured in the quantitative component were linked to qualitative data to enrich background information about participants. These measures included perception of pregnancy risk (Heaman & Gupton, 2009), perceived control (internal) (Wallston et al., 1978), and pregnancy-related anxiety (Rini et al., 1999) scores. Through this step,

quantitative data were linked with the qualitative data set to assist in analysis of the interviews. This approach enhanced the understanding of qualitative data and consequently improved the quality of the interpretation of the findings. For example, none of the qualitative participants communicated directly about their anxious feelings associated with increased pregnancy risk. However, quantitative scores identified three participants with high anxiety levels. These women used words other than anxiety to describe their feelings, such as "being emotional" or "having a little bit of concern". With combination of these two data sets, it was revealed that some women of AMA may not communicate their anxious feelings directly, and health care providers should be aware of the use of these alternate wordings by pregnant women. Another example is that the student grouped qualitative participants based on their perception of pregnancy risk scores into three groups: participants with low, moderate, or high perception of pregnancy risk. Being aware of participants' perception of pregnancy risk scores impacted the entire process of qualitative data analysis and enhanced the explication of data; in fact, tracking patterns of participants' understandings of risk was made possible by this approach. It was also helpful to recognize and situate factors influencing pregnant women's risk perception more accurately. Due to the complex nature of risk perception, it is apparent that embedding quantitative information into the qualitative data set advanced the study of this phenomenon.

Integrations of findings at data interpretation level. The results of the two components were integrated at the discussion level. The following section illustrates how the findings of the two studies were put together to create a more comprehensive

conclusion than relying solely on those of the separate components. Mainly, the findings of the two components were combined to modify the conceptual framework. In addition, an inclusive understanding of perception of pregnancy risk at AMA was developed by merging the findings of the two components.

Conceptual Framework

Quantitative results. Based on findings of the quantitative component of the study, of the eight proposed factors in the conceptual framework, four factors were significant predictors of perception of pregnancy risk in the first regression model, including pregnancy-related anxiety, maternal age, medical risk, and gestational age. In the interaction model, perceived control (internal) also approached significance (p=.054). Therefore, five of the factors in the conceptual framework were supported in this component.

In addition, results demonstrated an interaction between pregnancy-related anxiety score and maternal age. It was found that the simultaneous influence of these variables on the risk perception score was greater than their additive values. This implied that the variances in the risk perception score due to anxiety level depend on maternal age and that maternal age works in a synergistic manner with anxiety score to increase the perceived risk score.

Qualitative results. In the qualitative component, ten factors were discussed by women as influencing their perception of pregnancy risk, including: poor fertility history, health status, pregnancy complications, gestational age, maternal age, anxiety, cognitive

heuristics (availability and similarity of the risk), predictability of the risk, perceived control, and health care provider's opinion. Of these factors, five factors represented the significant factors of the quantitative component (i.e., anxiety, medical risk, maternal age, perceived control, and gestational age).

Discrepancies between the two components. Qualitative findings supported two factors in the conceptual framework that were not supported by quantitative findings including cognitive heuristics (availability and similarity) and health status. There is inconsistency in the literature regarding the role of health status in risk perception. For instance, Chuang et al. in 2008 reported that in their study, general health measured by the SF-12v2 Health Survey was not a significant predictor of increased risk perception of adverse pregnancy outcomes. Alternatively, the findings of a qualitative study by Heaman et al. (2004) demonstrated that women considered their own general health in their pregnancy risk appraisal.

Qualitative results demonstrated that being aware of risk, through researching information or individual and non individual experiences (e.g., through a friend's illness or the media), may contribute to pregnant women's risk perception. These findings are consistent with literature on risk perception in that personal or vicarious experience with a risk may increase the psychological availability of the risk and, consequently, its perceived probability (Gerend et al., 2004; Weinstein, 1987). Nevertheless, none of the cognitive heuristic variables were supported in the quantitative component.

New factors emerging from qualitative data. Three new factors were identified in the qualitative data. Predictability of risk was one of these new factors addressing a

risk attribute. Two other factors were more specific to the health context and included poor fertility history and health care providers' opinion.

Product of Compared or Integrated Findings

Based on compared or integrated findings, a new conceptual framework for perception of pregnancy risk was proposed (Figure 2). As illustrated in Figure 2, there are ten factors that contribute to perception of pregnancy risk at AMA including cognitive heuristics (availability and similarity of the risk), predictability of the risk, health status, medical risk, gestational age, maternal age, perceived control, poor fertility history, anxiety, and health care provider's opinion. Based on findings of this mixed methods research, five factors of this conceptual framework, including pregnancy-related anxiety, medical risk, perceived control, maternal age, and gestational age, explain 47-49% of the variance in perception of pregnancy risk. Future research is warranted to examine the contribution of the remaining five factors, identified through qualitative analysis, to perception of pregnancy risk. The following section expands discussion of common findings of the two components.

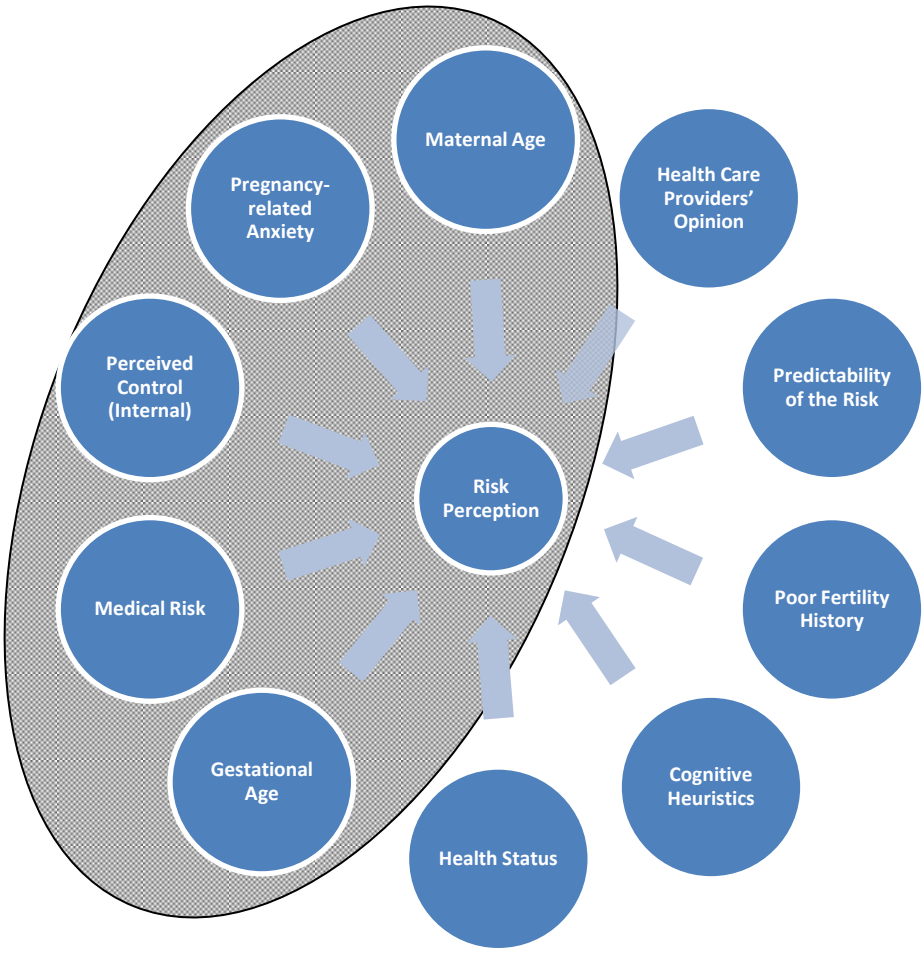

Figure 2. Modified conceptual framework

All variables presented in this framework were supported by the qualitative findings; however, only variables in the shaded area were supported by the quantitative findings (in the model with interactions between maternal age and pregnancy-related anxiety)

Current knowledge suggests that emotions are important factors in risk perception and stronger emotions may lead to a higher level of perceived risk (Xie, Wang, Zhang, Li, & Yu, 2011). Quantitative findings determined pregnancy-related anxiety as the strongest predictor of perception of pregnancy risk, supporting its role as the dread factor in the conceptual framework. Similarly, the majority of participants in the qualitative component who were concerned or anxious about their pregnancy also perceived higher risk for their pregnancy and fetuses.

In both components, objective medical risk was a significant predictor of risk perception, which is consistent with previous research (Gupton et al., 2001; Headley & Harrigan, 2009). Although women of AMA had higher medical risk scores than younger women, maternal age remained as a significant predictor of perception of pregnancy risk even after controlling for medical risk. This finding suggests that the association of perception of risk and maternal age is independent of the effect of medical risk, and older maternal age contributes to increased perception of pregnancy risk. However, results of the qualitative component revealed that the perception of pregnancy risk varied considerably among participants, indicating that nulliparous women of AMA are not homogeneous in their assessment of pregnancy risk.

Findings of both components supported the idea that perception of pregnancy risk altered over the course of the pregnancy, with women having higher perceptions of risk at earlier gestational ages. This could be due to women becoming adapted to the state of being pregnant or becoming more positive about the outcome of their pregnancy as it advanced. Although there is no previous study to examine changes in risk perception over

the course of pregnancy, results of a study by Buist, Gotman, and Yonkers (2011) demonstrated that in pregnancy, anxiety symptoms were highest in the first trimester and decreased over pregnancy. Likewise, another study showed that concern about the baby's health abated continuously from the beginning of pregnancy to the postpartum period (Ohman, Grunewald, & Waldenstrom, 2009).

In the literature, low levels of perceived control over risk were reported to be related to high levels of perceived risk (Audrain et al., 1997). In the quantitative component, one of the perceived control subscales (internal) remained in the final model and approached statistical significance (p=.054); with a larger sample size, it may have been significant. Similarly, those participants in the qualitative component who believed they had good control over their physical health also perceived a lower risk for their pregnancy.

Contribution to the Field

The findings of this study extended our understandings about pregnancy at AMA, and its results may serve as the foundation to enhance the quality of care for this growing cohort. Although this research enhanced the current knowledge about perception of pregnancy risk at age 35 years or older, its most significant contribution was to develop a conceptual framework to study risk perception in pregnancy. The findings from the two components were utilized to modify and redesign the initial conceptual framework in order to construct a new model (Figure 2). The regression models of the quantitative component accounted for about half of the variance in risk perception. This level is high, considering that the predictive power of models in an earlier study varied from 19% to

31% (Gupton et al, 2001). In that study, state anxiety and medical risk were significant predictors of perception of pregnancy risk (Gupton et al., 2001). This suggests that including perceived control, maternal age and gestational age significantly improved the predictive power of models in the current study. Taking into consideration that theories of risk perception only account for a small proportion of variations in risk perception (Sjoberg, 1996), these findings are noteworthy.

The current study also verified that previously known factors in the risk perception field, such as perceived control and medical risk, may be applicable in the state of pregnancy. This study added to the literature on perception of pregnancy risk by identifying a new predictor (i.e., gestational age) and also highlighting the interactive effects of maternal age and pregnancy-related anxiety in increasing the perception of pregnancy risk.

Furthermore, the study contributed to the literature on perception of pregnancy risk by proposing pregnancy-related anxiety as a pregnancy dread factor in risk perception theories. In 2008, Chuang et al. examined the feeling of dread in pregnancy using psychosocial stress or lower health status variables and did not find any significant association between risk perception and these defined dread factors. Another study of perception of pregnancy risk showed that stress was not a predictor for risk perception among women with complicated pregnancies, while state anxiety was a significant predictor (Gupton et al., 2001). In the current study, pregnancy-related anxiety was determined as the strongest predictor of perception of pregnancy risk. These findings

suggest that pregnancy-related anxiety is a more reliable factor than stress to predict perception of pregnancy risk.

Future Research

Although the results of the current study extended knowledge about perception of pregnancy risk, it also raised many more questions and indicated new directions for future research:

1. While this study contributed to the initial development of a conceptual framework for perception of pregnancy risk, the model requires further refinement and testing. Research is encouraged to test the relationships proposed in this model. Specifically, there were three new factors that emerged from the qualitative data, including predictability of risk, poor fertility history, and health care providers' opinion. Future studies are needed to quantify these factors and determine their contribution to perception of pregnancy risk.

2. Neither of the cognitive heuristic variables was supported in quantitative study, while they were identified in qualitative findings. This discrepancy may be attributable to using a single item measure (developed by the student for this study), which has not been previously psychometrically evaluated and may not have accurately measured the concept. Also, availability and similarity may be caused by other experiences that were not measured in this study. Because these variables emerged from the qualitative data and the literature on risk perception also supports their contribution, future research should

focus on developing a valid and reliable scale to measure cognitive heuristics in relation to pregnancy risk to determine their role in perception of pregnancy risk.

3. Findings of the current study demonstrated that women of AMA perceived their risk of having a cesarean section to be significantly higher than did younger women. Research indicates that women of AMA have higher rates of cesarean section than younger women (Bayrampour & Heaman, 2010). There is growing evidence signifying that along with medical indications, psychological factors may also contribute to higher rates of cesarean section (Wagner, 2000). Findings of a recent study demonstrated that a woman's desire for choosing cesarean section increases considerably as worries about the delivery and its safety for the fetus increase (Romero, Coulson, & Galvin, 2011). Because women of AMA are more likely to request a cesarean birth from their health care providers at any point during their pregnancy, or to have a cesarean birth recommended by their health care provider before labor (Bayrampour & Heaman, 2011), it is advisable to investigate whether risk perception influences maternal request for cesarean section.

4. In the current study, pregnancy-related anxiety was the strongest predictor of risk perception. However, as Xie et al. (2011) stated, it is not apparent whether emotions such as anxiety cause higher risk perception levels or vice versa. The causal relationship between anxiety and risk perception may not be fully realized until further research is conducted.

5. In this study, risk knowledge was not a significant predictor of risk perception in the quantitative component. However, familiarity with risk appeared as an important factor in the qualitative analysis. In the literature, familiarity with risk is a broad concept

that includes both risk knowledge and personal experiences of risk (Williamson & Weyman, 2005). These results suggest that integrating the measures of familiarity with risk into the measure of risk knowledge may better address the "unknown factor" in the Psychometric Model. In other words, the combination of both familiarity with risk (through individual and non individual experiences) and risk knowledge may appropriately represent this concept. Future research is warranted to explore this proposition.

Strengths and Limitations of the Study

This study had a number of positive features that allowed for a contribution to the research literature. For instance, the study contained high quality measures, and the majority of variables were measured using valid and reliable instruments. Another strength of the study was the exclusive recruitment of nulliparous women to minimize the effect of previous pregnancy experiences on risk perception. Furthermore, the study was built upon a conceptual framework based on the literature review and a well-known risk perception theory. The comprehensiveness of this conceptual framework was supported by its moderate to high predictive power in the regression models. Employing mixed methods research was another major strength of the study. The embedding of quantitative measures into qualitative data was useful in achieving a better understanding of data. Moreover, because previous research on perception of pregnancy risk was mainly retrospective, the contemporaneous exploration of risk perception during the pregnancy was another strength for this study.

Despite these strengths, the study also contained a number of limitations that require consideration when interpreting the results. A convenience sampling method was employed for collecting data. Due to a non-random method of sample selection, those who volunteered to participate might have been different than those who did not, resulting in selection bias. However, the characteristics of the two groups in this study were comparable to the characteristics of participants in a recent secondary analysis of a national survey of maternity experiences (Bayrampour & Heaman, 2011). Due to challenges in recruiting nulliparous women of AMA, the two groups were not equal in size and some variables might be affected by the larger proportion of the sample between the ages of 20-29 years. Therefore the smaller sample size for the older group should be considered in the interpretation of the results. Use of instrument without established reliability and validity (i.e., Knowledge of Maternal Age-related Risks of Childbearing Questionnaire and cognitive heuristics questions) was another limitation of this study. In the current study, the knowledge scale had a Cronbach's coefficient alpha of .60. Finally, confining the sample to nulliparous women may limit generalization of the results to multiparous women.

Implications for Practice

It is hoped that the results will increase the understanding of the perception of pregnancy risk and improve the quality of care for pregnant women, particularly women of AMA. The current research represents a step forward towards this goal, as the results have several implications for efforts to improve prenatal care and risk communication.

Findings supported that women's risk evaluations are not only based on information, but also affected by psychological factors and social values (Fischhoff, Bostrom, & Quadrel, 1993; Tversky & Kahneman, 1974). A woman's perception of pregnancy risk may be different than her actual medical risk or the care provider's risk assessment. There are several factors, other than medical risk, that contribute to perception of pregnancy risk. Health care providers should be aware that a woman's perception of pregnancy risk is highly individualized and could be different from medical risk assessment; therefore, a discussion about the woman's risk perception should be integrated into the prenatal care visits. This communication will improve the quality of care by integrating the woman's perspective in planning her own care.

Proper risk communication is an important element of developing care plans for women of AMA. It is important that in prenatal visits, health care providers help the pregnant woman to understand her individual risk based on personal health factors. For instance, women of AMA in this study perceived a higher risk of cesarean section. Current knowledge indicates that even at AMA, cesarean section is often not a necessary intervention (Treacy et al., 2006). Discussing these issues with pregnant women and explaining any misconceptions will help them to attain a better understanding of their risk. On the other hand, efforts should be concentrated on offering pregnancy and childbirth education, along with acknowledging women's personal experiences, to empower women to incorporate their own understandings in pregnancy risk appraisal (Jordan & Murphy, 2009). These strategies will be valuable in assisting women in making more informed decisions.

Although providing information in risk communication is essential and is often considered as the first step in changing behavior or intervening, findings suggest that simply offering risk information might not alter risk perception to any great extent. An effective risk communication will benefit from strategies other than providing factual information by instead offering information in a way that can be related to a woman's life experiences. As Carolan (2009) stated, translating epidemiological risk into real life examples can help pregnant women to understand and process the risk. A risk message must be tangible for women in order to be recognized and potentially addressed. Results of this study suggested that real stories can influence risk perception. Targeting this concept in clinical practice and public health education programs may contribute to a decrease in unhealthy behaviours through risk perception alteration. Although media are in a position to play an important role in this regard, most of their messages about pregnancy at AMA have been favorable and encouraging (Heffner, 2004). Developing documentaries that highlight several risks associated with AMA, through presenting real stories of women, may increase public awareness and understanding of the risk.

In the experience of the participants, any emphasis on mother’s good health by their care providers was described as reassuring, while negative messages about age were reported as being disturbing, particularly for women with high anxiety levels. Women with high levels of perceived risk and of AMA may be at a higher risk for excessive anxiety. Anxiety during pregnancy has been associated with several adverse outcomes (Consonni et al., 2010; Fishell, 2010). Detection of anxious pregnant women may provide an opportunity to refer them to mental health services to engage them in appropriate

interventions prenatally and postnatally. It is recommended that in risk communication sessions, a woman's mental health be considered to avoid unnecessary stress and worry.

Conclusion

Findings revealed that women of AMA had a higher perception of pregnancy risk than younger women. This study provided a quantitative verification for previous qualitative studies by identifying maternal age as a significant predictor for perception of pregnancy risk. However, results of the qualitative component clarified that nulliparous women of AMA were not a homogenous group in their pregnancy risk assessment and the perception of pregnancy risk varied considerably among these women. An uncomplicated pregnancy at AMA in the absence of factors such as pregnancy complications, limited physical activity, unfavourable screening tests results, previous poor reproductive history, and anxiety was perceived as a low risk pregnancy by the participants. However, in the presence of medical or social risk factors, the risk associated with age was highlighted, and women then tended to identify their age as a risk factor for their pregnancy.

A woman's perception of pregnancy risk is not identical with her medical risk condition. There are several other factors contributing to her risk perception, of which at least half are not identified yet. Future studies should be conducted to discover these factors.

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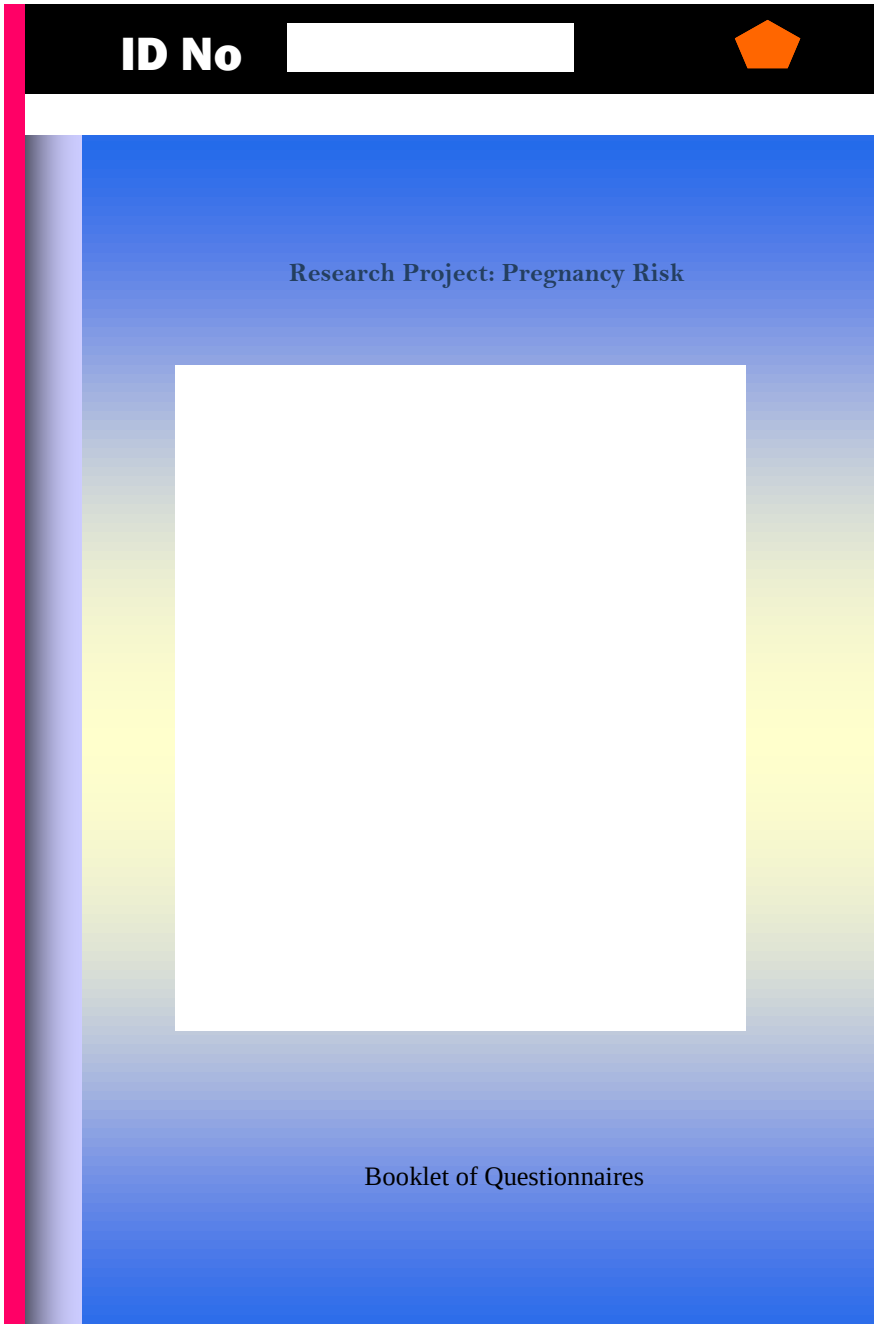
Appendix A: Questionnaire



PERCEPTION OF PREGNANCY RISK QUESTIONNAIRE

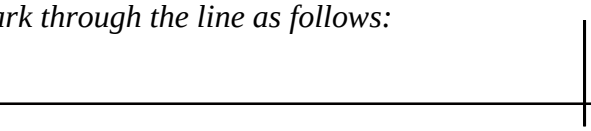
The following questions ask you to rate your perception of personal risk during this pregnancy, and your perception of risk for your unborn child. There are no right or wrong answers. We are only seeking your opinion. Make your "best guess" of your risk and your unborn child's risk for a poor health outcome. Do not put your name on the form. On each of the following rating scales, please put a vertical mark through the line to indicate your assessment of risk for each item (see example).

EXAMPLE:

My chances of winning the lottery are:

No Chance At All _____ *Extremely High Chance*

If you thought your chances of winning the lottery were very high, you might place your vertical mark through the line as follows:



No Chance At All _____ *Extremely High Chance*

1. The risk for myself during this pregnancy is:

No Risk At All _____ Extremely High Risk

2. The risk for my unborn baby during this pregnancy is:

No Risk At All _____ Extremely High Risk

3. My risk of hemorrhaging (losing too much blood) during this pregnancy is:

No Risk At All _____ Extremely High Risk

4. My risk of having a caesarean section is:

No Risk At All _____ Extremely High Risk

5. My risk of dying during this pregnancy is:

No Risk At All _____ Extremely High Risk

6. My baby's risk of being born prematurely is:

No Risk At All _____ Extremely High Risk

7. My baby's risk of having a birth defect is:

No Risk At All _____ Extremely High Risk

8. My baby's risk of needing to go to the Neonatal Intensive Care Unit is:

No Risk At All _____ Extremely High Risk

9. My baby's risk of dying during this pregnancy is:

No Risk At All _____ Extremely High Risk

COGNITIVE HEURISTICS

- **The following questions are about sources which can be important in risk perception. On each of the following questions, please circle the option that best describes your situation for each item.**

1. During the last three months, how many media communications (for example information from the TV, radio, newspaper, or a magazine) do you recall hearing or seeing on the topic of pregnancy complications in relation to mother's age?
   (1) None
   (2) One or two
   (3) Three or four
   (4) Five or six
   (5) Seven or more

2. Did you receive any information on pregnancy complications in relation to mother's age from your doctor or another health care professional in the last twelve months?
   (1) No
   (2) Yes

3. How many of your female relatives or friends have had pregnancy complications in the past 2 years?
   (1) None
   (2) One
   (3) Two
   (4) Three
   (5) Four or more

4. How similar do you believe you are to the typical woman who gets pregnancy complications at your age?
   (1) Not at all similar
   (2) A little similar
   (3) Somewhat similar
   (4) Similar
   (5) Very similar

5. To what extent do you agree with the following statement? <u>“Pregnant women at your age, who haven’t had any pregnancy complications, are not likely to get them.”</u>

(1) Strongly disagree
(2) Disagree
(3) Neutral
(4) Agree
(5) Strongly agree

MULTIDIMENSIONAL HEALTH LOCUS OF CONTROL

- **The following questions ask you to rate your sense of control. For each of the following statements, please circle the number which indicates the extent to which you agree or disagree with the statement.**

1=STRONGLY DISAGREE **(SD)** **2**=MODERATELY DISAGREE **(MD)** **3**=SLIGHTLY DISAGREE **(D)**	**4**=SLIGHTLY AGREE **(A)** **5**=MODERATELY AGREE **(MA)** **6**=STRONGLY AGREE **(SA)**

		SD	MD	D	A	MA	SA
1	If I get sick, it is my own behavior which determines how soon I get well again.	1	2	3	4	5	6
2	No matter what I do, if I am going to get sick, I will get sick.	1	2	3	4	5	6
3	Having regular contact with my physician is the best way for me to avoid illness.	1	2	3	4	5	6
4	Most things that affect my health happen to me by accident.	1	2	3	4	5	6
5	Whenever I don't feel well, I should consult a medically trained professional.	1	2	3	4	5	6
6	I am in control of my health.	1	2	3	4	5	6
7	My family has a lot to do with my becoming sick or staying healthy.	1	2	3	4	5	6
8	When I get sick, I am to blame.	1	2	3	4	5	6
9	Luck plays a big part in determining how soon I will recover from an illness.	1	2	3	4	5	6
10	Health professionals control my health.	1	2	3	4	5	6

11	My good health is largely a matter of good fortune.	1	2	3	4	5	6
12	The main thing which affects my health is what I myself do.	1	2	3	4	5	6
13	If I take care of myself, I can avoid illness.	1	2	3	4	5	6
14	Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.	1	2	3	4	5	6
15	No matter what I do, I 'm likely to get sick.	1	2	3	4	5	6
16	If it's meant to be, I will stay healthy.	1	2	3	4	5	6
17	If I take the right actions, I can stay healthy.	1	2	3	4	5	6
18	Regarding my health, I can only do what my doctor tells me to do.	1	2	3	4	5	6

The SF-12v2 Health Status Survey has been removed due to copyright restrictions; see: http://www.qualitymetric.com

PREGNANCY-RELATED ANXIETY SCALE

- **The next set of questions is about your feelings and expectations about the birth and your baby. Please indicate your own feelings about each statement below by choosing one of the options. Circle your response.**

1. I am confident of having a normal childbirth. Would you say…

   (1) NOT AT ALL

   (2) SOMEWHAT

   (3) MODERATELY

   (4) VERY MUCH

2. I think my labor and delivery will go normally.

   (1) NOT AT ALL

   (2) SOMEWHAT

   (3) MODERATELY

   (4) VERY MUCH

3. I have a lot of fear regarding the health of my baby.

   (1) NOT AT ALL

   (2) SOMEWHAT

   (3) MODERATELY

   (4) VERY MUCH

4. I am worried that the baby could be abnormal.

   (1) NOT AT ALL

   (2) SOMEWHAT

   (3) MODERATELY

   (4) VERY MUCH

5. I am afraid that I will be harmed during delivery.

(1) NOT AT ALL

(2) SOMEWHAT

(3) MODERATELY

(4) VERY MUCH

- **The following statements are about things about pregnancy and new babies that might concern you. Please indicate whether these things never concern you, concern you some of the time, most of the time, or a lot of the time. Circle your response.**

6. I am concerned (worried) about how the baby is growing and developing inside me. Would you say…

(1) NEVER

(2) SOMETIMES

(3) MOST OF THE TIME

(4) ALMOST ALL OF THE TIME

7. I am concerned (worried) about losing the baby.

(1) NEVER

(2) SOMETIMES

(3) MOST OF THE TIME

(4) ALMOST ALL OF THE TIME

8. I am concerned (worried) about having a hard/difficult labor and delivery.

(1) NEVER

(2) SOMETIMES

(3) MOST OF THE TIME

(4) ALMOST ALL OF THE TIME

9. I am concerned (worried) about taking care of a new baby.

(1) NEVER

(2) SOMETIMES

(3) MOST OF THE TIME

(4) ALMOST ALL OF THE TIME

10. I am concerned (worried) about developing medical problems during the pregnancy.

(1) NEVER

(2) SOMETIMES

(3) MOST OF THE TIME

(4) ALMOST ALL OF THE TIME

KNOWLEDGE OF MATERNAL AGE-RELATED RISKS OF CHILDBEARING

- **The following questions ask you to rate your knowledge about medical risks associated with pregnancy. Please check off whether you think the statement is true or false.**

Question	True	False	Don't Know
1. Women 35 years and older experience more problems getting pregnant than younger women.			
2. Women 35 years and older are more likely to have a baby with Down Syndrome compared to younger women.			
3. Women 35 years and older are more likely to have a baby with a congenital anomaly than younger women.			
4. Women 35 years and older are more likely to develop medical problems during pregnancy than younger women.			
5. Women 35 years and older are more likely to have a multiple birth than younger women (even if not using fertility treatment).			
6. Women 35 years and older are eligible for amniocentesis during pregnancy.			
7. Women 35 years and older are more likely to have a cesarean section than younger women.			
8. Women 35 years and older are more likely to have a preterm baby than younger women.			
9. Women 35 years and older are more likely to have a low birth weight baby than younger women.			
10. Women 20 years and younger are at higher risk of having a low birthweight baby than women 20-29 years.			

DEMOGRAPHIC AND CHILDBIRTH DATA COLLECTION

- **The following questions ask you about your current pregnancy and your demographic characteristics.**

1. What is your age? _____years

2. How many weeks pregnant are you? _____ weeks

3. Thinking back to just before you became pregnant, would you say that you wanted to be pregnant...?
   (1) Sooner
   (2) Later
   (3) Then
   (4) Not at all

4. Did you use any fertility medications (for example Clomid) to help you get pregnant?
   (1) Yes
   (2) No

5. Did you use any fertility medical procedures (for example IVF, ICSI, or IUI) to help you get pregnant?
   (1) Yes
   (2) No

6. Including your current pregnancy, how many times have you been pregnant? This includes pregnancies ending in a miscarriage, abortion, or a tubal pregnancy. ____

7. How many pregnancies ended in a miscarriage?_____

8. How many pregnancies ended in a tubal or ectopic pregnancy? _____

9. How many pregnancies ended in a therapeutic or induced abortion? _____

10. How old were you when you became pregnant for the first time? ____

11. Have you attended any prenatal classes with this pregnancy?
    (1) Yes

(2) No

If yes, how many classes have you attended? _____

12. Did you have any problems or complications during this pregnancy?

(1) Yes
(2) No

If yes, please specify _____

13. What is your current marital status?
    (1) Married and living with spouse
    (2) Common-law relationship or live-in partner
    (3) Single - never married
    (4) Divorced
    (5) Separated
    (6) Widowed

14. If you are living with a partner or husband, how long have you been living together with your current husband or partner?
    _____ years

15. What is your highest level of education? This includes complete and incomplete (Please circle highest level).
    1. No schooling
    2. Incomplete Elementary school
    3. Complete Elementary school
    4. Incomplete Junior High School
    5. Complete Junior High School
    6. Incomplete High School
    7. Complete High School
    8. Incomplete Non-University (Vocational/technical)
    9. Complete Non-University (Vocational/technical)
    10. Incomplete University
    11. Diploma/Certificate (e.g. hygienists)
    12. Bachelor's Degree
    13. Professional Degree (Vet, Dr., Lawyer)
    14. Master's Degree
    15. Doctorate

16. How many years of formal education have you completed starting with grade one and not counting repeated years at the same level? _____ Years

17. Did you work at a paid job of any kind before your current pregnancy?
    (1) Yes
    (2) No

    a. If yes, on average, how many hours did you work for pay each week before your pregnancy? (This total includes all of your jobs: full-time and part-time) _____ hours

18. Have you worked at a paid job of any kind during your current pregnancy?
    (1) Yes
    (2) No

    a. If yes, on average, how many hours did you work for pay each week during your pregnancy? (This total includes all of your jobs: full-time and part-time)_____ hours

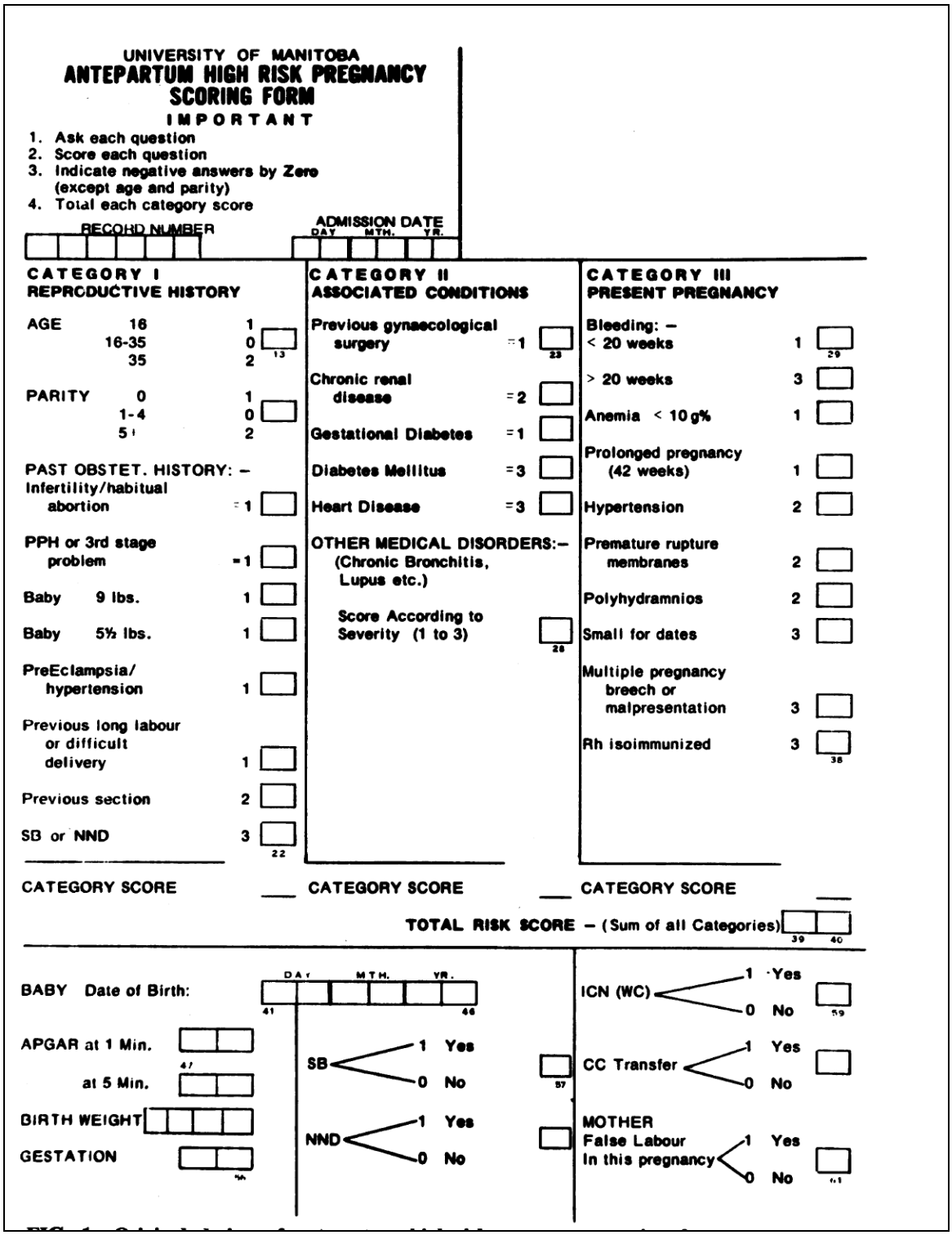
19. We would like to know the total income of all the members of your household for this past year before tax and deductions. Please remember that your response will be kept confidential.
    1. No income
    2. Under $10,000
    3. $10,000-19,999
    4. $20,000-29,999
    5. $30,000-39,999
    6. $40,000-49,999
    7. $50,000-59,999
    8. $60,000-69,999
    9. $70,000-79,999
    10. $80,000-89,999
    11. $90,000-99,999
    12. $100,000 or over

20. Which of the following best describes your racial/ethnic background? Would you say...

    1. Aboriginal - Inuit
    2. Aboriginal - Metis
    3. Aboriginal - First Nations
    4. Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan)
    5. Black (e.g., African, Haitian, Jamaican, Somali)
    6. Chinese

7. Filipino
8. Japanese
9. Korean
10. Latin American
11. South Asian (e.g., East Indian, Pakistani, Punjabi, Sri Lankan)
12. South East Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)
13. White (Caucasian)
14. Other (please specify _____)

Appendix B: Prenatal Scoring Form



UNIVERSITY OF MANITOBA

ANTEPARTUM HIGH RISK PREGNANCY SCORING FORM

IMPORTANT

1. Ask each question
2. Score each question
3. Indicate negative answers by Zero (except age and parity)
4. Total each category score

RECORD NUMBER

ADMISSION DATE DAY MTH. YR.

CATEGORY I
REPRODUCTIVE HISTORY

AGE	16	1
	16-35	0
	35	2
PARITY	0	1
	1-4	0
	5+	2
PAST OBSTET. HISTORY: – Infertility/habitual abortion		=1
PPH or 3rd stage problem		=1
Baby 9 lbs.		1
Baby 5½ lbs.		1
PreEclampsia/ hypertension		1
Previous long labour or difficult delivery		1
Previous section		2
SB or NND		3

CATEGORY SCORE ___

CATEGORY II
ASSOCIATED CONDITIONS

Previous gynaecological surgery	=1
Chronic renal disease	=2
Gestational Diabetes	=1
Diabetes Mellitus	=3
Heart Disease	=3
OTHER MEDICAL DISORDERS:– (Chronic Bronchitis, Lupus etc.) Score According to Severity (1 to 3)	

CATEGORY SCORE ___

CATEGORY III
PRESENT PREGNANCY

Bleeding: – < 20 weeks	1
> 20 weeks	3
Anemia < 10 g%	1
Prolonged pregnancy (42 weeks)	1
Hypertension	2
Premature rupture membranes	2
Polyhydramnios	2
Small for dates	3
Multiple pregnancy breech or malpresentation	3
Rh isoimmunized	3

CATEGORY SCORE ___

TOTAL RISK SCORE – (Sum of all Categories)

BABY Date of Birth: DAY MTH. YR.

APGAR at 1 Min.

at 5 Min.

BIRTH WEIGHT

GESTATION

SB 1 Yes 0 No

NND 1 Yes 0 No

ICN (WC) 1 Yes 0 No

CC Transfer 1 Yes 0 No

MOTHER False Labour In this pregnancy 1 Yes 0 No

Appendix C: Permission to use the Perception of Pregnancy Risk Questionnaire

Ms. Hamideh Bayrampour
Doctoral Student, PhD in Applied Health Sciences Program
University of Manitoba

Dear Hamideh:

I am pleased to grant you permission to use the Perception of Pregnancy Risk Questionnaire (PPRQ) as an instrument for your dissertation research project entitled, "Advanced Maternal Age and Risk Perception." Permission for use of the revised 9-item PPRQ is given with the understanding that the instrument will be administered in its complete form with all scales intact, and that the source of the questionnaire will be appropriately referenced in all documents and publications pertaining to the study:

> Heaman, M., & Gupton, A. (In press). Psychometric testing of the Perception of Pregnancy Risk Questionnaire. *Research in Nursing and Health*.

Other references related to the PPRQ are as follows:

> Heaman, M., Gupton, A., & Gregory, D. (2004). Factors influencing pregnant women's perception of risk. *MCN The American Journal of Maternal Child Nursing*, *29*(2), 111-116.
>
> Gupton, A., Heaman, M., & Cheung, L. (2001). Complicated and uncomplicated pregnancies: Women's perception of risk. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 30*(2), 192-201. (Note that this study used the former 11-item version of the PPRQ)

Please feel free to contact me if you have any questions. Good luck with your project.

Sincerely,

Maureen Heaman, RN, PhD
Professor and CIHR Chair in Gender and Health

Appendix D: Permission to use the Pregnancy-related Anxiety Scale

At Thu, 20 Aug 2009 13:06:20 -0400, Rini, Christine wrote:

Dear Hamideh,

I'm attaching a handout with the scale. The items that need to be reverse coded are numbers 1 and 2. Please let me know if you need any more information. Good luck with your project!

Best regards,
Christine

Christine Rini, Ph.D.
Assistant Professor
Department of Oncological Sciences
Program for Cancer Prevention and Control
Mount Sinai School of Medicine
One Gustave L. Levy Place, Box 1130
New York, NY 10029

Phone: 212-659-5555

Appendix E: Permission to use the Knowledge of Maternal Age-related Risks of Childbearing Questionnaire

Inbox: RE: Knowledge of Maternal Age-Related Risks of Childbearing Questionnaire (1 of 854)

Mark as: Move | Copy This message to Back to Inbox

Delete | Reply | Forward | Redirect | View Thread | Message Source | Save as | Print

Date: Tue, 11 Aug 2009 10:17:28 -0600 [11:17:28 CDT]
From: Suzanne Tough <Suzanne.Tough@albertahealthservices.ca>
To: Hamideh Bayrampour <umbayrah@cc.umanitoba.ca>
Subject: RE: Knowledge of Maternal Age-Related Risks of Childbearing Questionnaire
Headers: Show All Headers

Hi Hamideh,
Please accept this as permission to use the Knowledge of Maternal Age Related Risks of Childbearing Questionnaire.
The questions were scored as correct or incorrect based on the following:

Women 35 or older experience more porblemns getting pregnant than women in their 20's = true
Women 35 or older are more likely to have a baby with Down's syndrome than women in their 20's = true
Women 35 or older are more likely to have a baby with a congenital anomaly than women in their 20's = true
Women 35 or older are more likely to develop medical problems during pregnancy than women in their 20's = true
Women 35 or older are more likely to have twins or triplets than women in their 20's, even if not using fertility treatment = true
Women 35 or older are eligible for amniocentesis or other genetic screening during their pregnancy= true
Women 35 or older are more likely than women under 35 to need a caesarian section when they give birth = true
Women 35 or older are more likely to have a premature baby than women under 35 = true
Women 35 or older are more likely to have a low birth weight baby than women under 35 = true
Women who are 20 or younger are at higher risk of having a low birth weight baby than women aged 20 to 29 = true
The chance of having a low birth weight baby depends on the fathers age= false

Cheers,
Suzanne

Suzanne Tough, PhD
Professor, Departments of Paediatrics and Community Health Sciences, Faculty of Medicine, University of Calgary
Health Scholar, Alberta Heritage Foundation for Medical Research
Scientific Director, Alberta Centre for Child, Family and Community Research
T. 403.955.2272 F. 403.955.5979 suzanne.tough@albertahealthservices.ca

Appendix F: Script for Approaching Potential Participants

The charge nurse or his/her designate were asked to approach potential participants to obtain their permission to explain the study:

"A researcher, a doctoral student from the University of Manitoba, is conducting a study about perceived risk during pregnancy. Women who are currently pregnant, at age 20-29 years or at age 35 years and older, and are in the third trimester of pregnancy are being approached to participate in the study. Would you be agreeable to have the Researcher tell you more about the study? You don't have to decide whether to participate until you have received an explanation about the study and have had the opportunity to ask questions."

Appendix G: In-Person Contact with Potential Participants

"Hello, my name is Hamideh Bayrampour. I am a doctoral student from the University of Manitoba conducting a study to understand women's perceived pregnancy risk. Would you be willing to read this written explanation about the study? You do not have to decide whether to participate until after you read the explanation." (If the potential participant agreed, she was provided with a copy of the *"Research Information and Consent Form"* and given time to read it.)

"Do you have any questions? Would you like to participate in the study?" (If the answer was no, the woman was thanked and contact ended. If the answer was yes, informed consent was obtained.)

Appendix H : Research Subject Information and Consent Form (For Quantitative Component)

UNIVERSITY OF MANITOBA | Faculty of Nursing

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax (204) 474-7682

RESEARCH SUBJECT INFORMATION AND CONSENT FORM
(Participants in Quantitative Component)

Research Project Title: Advanced Maternal Age and Risk Perception

Principal Investigator: Hamideh Bayrampour, PhD student, Department of Applied Health Sciences, University of Manitoba

Thesis Advisor: Dr. Maureen Heaman, Professor, Faculty of Nursing, Room 268 Helen Glass Centre for Nursing, University of Manitoba, Winnipeg, MB R3T 2N2. Phone 204-474-6222.

Sponsor (Funding Agency): This research was supported by a grant from the Manitoba Institute of Child Health.

You are being asked to take part in a research study. This information form should give you a basic idea of what the research is about and what you are being asked to do. You will be given a copy of this form to keep. If you have any questions about the study, feel free to ask the researcher. Please take the time to read this carefully.

Purpose of the Study:
The purpose of this study is to compare perception of pregnancy risk in pregnant women at aged 35 years and older to pregnant women at aged 20 to 29 year and to identify factors that affect these women's pregnancy risk perception. This study is being conducted for the researcher's thesis research project.

Women Who May Participate in the Study:
Women are being asked to take part in this study if they are currently pregnant (no previous pregnancies greater than 20 weeks gestation), age 20-29 or 35 and older, in the third trimester of pregnancy, and receiving prenatal care from one of prenatal care clinics at Health Sciences Center, St. Boniface General Hospital, or selected private physicians' offices in the city of Winnipeg.

Procedures:
If you agree to take part in this study, the researcher will ask you to complete a series of questionnaires. You will be asked a number of questions about your pregnancy, your

perception of risk about this pregnancy, and your current health status. You will also be asked about things that might contribute in forming your perceived risk of this pregnancy, and basic demographic questions about yourself. Also, the researcher will interview you about your medical history and pregnancy complications and write down your answers on a questionnaire form. This will take about 30 minutes of your time. Some of those women at aged 35 and older who agree to participate may also be asked to participate in a second phase of the study consisting of an interview with open ended questions related to the decisions and pregnancy risks.

Confidentiality:
All information gathered for this study will be kept strictly confidential, except if you reveal a situation of child abuse, in which case the law says we must report the abuse. Medical records that contain your identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. Your questionnaire forms will be identified with a unique code number that has been assigned only to you. Your name will not appear anywhere on the questionnaire forms. The researcher will keep a list of participant names that match these code numbers. This list will be destroyed as soon as the study is completed. This list and the questionnaire forms will be stored separately in a locked filing cabinet at the University of Manitoba. Your completed questionnaire forms will stay in a locked cabinet and then be destroyed 7 years after the study ends. Only the researcher; Hamideh Bayrampour, her thesis advisor; Dr. Maureen Heaman, and a data entry clerk will have access to the answers on your questionnaires. Your individual identity will not be revealed in reports or articles that describe the results of this study.

Representatives of the sponsor (funding agency), the Education/Nursing Research Ethics Board at the University of Manitoba, and St. Boniface General Hospital or Health Sciences Center (if you are a patient of these institutions) may review your research-related records to make sure this study meets quality guidelines.

Risks:
There are no known risks to participating in this study.

Benefits:
There are no direct benefits involved in participating in this study. However, your answers may help to improve prenatal care for other women at your age.

Voluntary Participation and Withdrawal:
Your participation in this study is completely voluntary. You can withdraw from this study without consequences and your decision about whether or not to take part will not affect the care you receive in any way. You have the right to not answer any of the questions you are asked. You also have the right to stop taking part in the study at any time, without prejudice or consequence.

Feedback to Participants:

We will mail you a summary of the results of the study if you would like one. Please complete the attached page with your name and address if you would like to receive a summary of the results.

Statement of Consent
Your signature on this form means that you have had the study explained to you in a language that you understand, all questions have been answered to your satisfaction, and that you agree to take part as a subject. In no way does this waive your legal rights, nor does it release the researchers, funding agency, or involved institutions from their legal and professional responsibilities. You can stop taking part in the study at any time, and /or refuse to answer any questions you are not comfortable with. You should feel free to ask questions at any time during or after the study from either Hamideh Bayrampour, doctoral student, (Ph. 204-272-1604) or her thesis supervisor, Dr. Maureen Heaman (Ph. 204-474-6222).

This research has been approved by the Education/Nursing Research Ethics Board of the University of Manitoba. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Secretariat at 204-474-7122, or e-mail margaret_bowman@umanitoba.ca. A copy of this consent form has been given to you to keep for your records.

_____ _____
Participant's Signature Date

Printed name of above:_____

_____ _____
Researcher and/or Delegate's Signature Date

Printed name of above:_____

ALL SUBJECTS MUST SIGN AND DATE THEIR OWN SIGNATURE.

Are you willing to be approached at a later date to determine your interest in participating in an open-ended interview for the qualitative part of this study?

Yes _____ No_____

If yes, please complete the following contact information:

Name:_____

Address:_____

Phone number:_____

Email Address:_____

Research Project:

Advanced Maternal Age and Risk Perception

If you would like to receive a summary of the results of this study, please fill out your name and address and give this page to the Researcher.

Name:_____

Address:_____

Postal code:_____

Appendix I : Invitation Letter

UNIVERSITY OF MANITOBA | Faculty of Nursing

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax. (204) 474-7682

Invitation to Participation in the Study

Dear Pregnant Mother,

Thank you for accepting to learn more about this study. You are invited and encouraged to participate in a research study entitled "Advanced Maternal Age and Risk Perception" that is being conducted by Ms. Hamideh Bayrampour, PhD student, and Dr. Maureen Heaman from the Faculty of Nursing at the University of Manitoba. This research has been approved by the Education/Nursing Research Ethics Board of the University of Manitoba.

The purpose of this study is to compare perception of pregnancy risk in pregnant women at aged 35 years and older to pregnant women at aged 20 to 29 years and to identify factors that affect these women's pregnancy risk perception. Women are being asked to take part in this study if they are currently pregnant (no previous pregnancies greater than 20 weeks gestation), age 20-29 or 35 and older, in the third trimester of pregnancy (28 weeks and greater) with singleton pregnancies (expecting one baby), and receiving prenatal care from a variety settings in Winnipeg.

Participation in the study is entirely voluntary. Participating in the study will mean that you will have an opportunity to contribute to the understanding of how a pregnant woman assesses her and her unborn baby's risk during pregnancy. Your participation would consist of completing the enclosed package of questionnaires. You will be asked a number of questions about your pregnancy, your perception of risk about this pregnancy, your current health status, and basic demographic questions about yourself. This will take about 30 minutes of your time. You could complete this package of questionnaires either at clinic, before or after your visit, or at your home. You may refuse to answer any questions on the questionnaire and you may withdraw from the study at any time. After completing the package of questionnaires, please return them to me in the stamped addressed envelope. Please refer to the attached "Study Information" for more information about the study.

On behalf of myself and my advisor, Dr. Heaman, I would like to take this opportunity to thank you for considering this request. You should feel free to ask questions at any time during or after

the study from either Hamideh Bayrampour, PhD student, (Ph. 204-272-1604) or her thesis supervisor, Dr. Maureen Heaman (Ph. 204-474-6222).

Yours truly,

Hamideh Bayrampour
Ph.D. Student
Department of Applied Health Sciences
Faculty of Nursing
89 Curry Place, University of Manitoba
Winnipeg, MB
R3T 2N2 Canada
Phone:(204)272-1604
Fax:(204)474-6013
Email: umbayrah@cc.umanitoba.ca

Study Information

Research Project Title: Advanced Maternal Age and Risk Perception

Researcher: Hamideh Bayrampour, PhD Student, Department of Applied Health Sciences, University of Manitoba

Thesis Advisor: Dr. Maureen Heaman, Professor, Faculty of Nursing, Room 268 Helen Glass Centre for Nursing, University of Manitoba, Winnipeg, MB R3T 2N2. Phone 204-474-6222.

Purpose of the Study:

The purpose of this study is to compare perception of pregnancy risk in pregnant women at aged 35 years and older to pregnant women at aged 20 to 29 year and to identify factors that affect these women's pregnancy risk perception. This study is being conducted for the researcher's thesis research project.

Women Who May Participate in the Study:

Women are being asked to take part in this study if they are currently pregnant (no previous pregnancies greater than 20 weeks gestation), age 20-29 or 35 and older, in the third trimester of pregnancy with a singleton pregnancy, and receiving prenatal care from variety of settings within Winnipeg.

Procedures:

There are a series of questionnaires in this package. These questions are about your pregnancy, your perception of risk about this pregnancy, and your current health status. You will also be asked about things that might contribute in forming your perceived risk of this pregnancy, and basic demographic questions about yourself. This will take about 30 minutes of your time. If you agree to take part in this study, please answer these questions either at the clinic or your home and return it in the stamped addressed envelope to the researcher.

Confidentiality:

All information gathered for this study will be kept strictly confidential. No names are requested on the questionnaire and therefore all responses will be anonymous and confidential. You will not be identified in any reports or presentations about the study. Your questionnaire forms will be identified with a unique code number that has been assigned only to you. The questionnaire forms will be stored in a locked filing cabinet at the University of Manitoba. Your completed questionnaire forms will stay in a locked cabinet and then be destroyed 7 years after the study ends. Only the researcher, Hamideh Bayrampour, her thesis advisor, Dr. Maureen Heaman, and a data entry clerk will have access to the answers on your questionnaires.

Representatives of the sponsor (funding agency), the Education/Nursing Research Ethics Board at the University of Manitoba, and Research Review Committee of Winnipeg Regional Health Authority (WRHA), St. Boniface General Hospital or Health Sciences Center (if you are a patient of these institutions) may review your research-related records to make sure this study meets quality guidelines.

Your completion and return of the attached questionnaire indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities.

Risks:

There are no known risks to participating in this study.

Benefits:

There are no direct benefits involved in participating in this study. However, your answers may help to improve prenatal care for other women at your age.

Voluntary Participation and Withdrawal:

Your participation in this study is completely voluntary. Your decision about whether or not to take part will not affect the care and service you receive in any way. You have the right to not answer any of the questions you are asked. You should feel free to ask questions at any time during or after the study from either Hamideh Bayrampour, doctoral student, (Ph. 204-272-1604) or her thesis supervisor, Dr. Maureen Heaman (Ph. 204-474-6222).

Qualitative Phase:

If you are at age 35 years and older, you are also eligible to take part in a second phase of this research study that involves participating in an in-depth interview with the researcher, which will take about 60 minutes of your time and would be conducted at a time and place convenient to you. If you are willing to be approached at a later date to learn more about this phase and to determine your interest in participating in this interview, please call the researcher at 272-1604 or e-mail umbayrah@cc.umanitoba.ca.

Feedback to Participants:

We will send you a summary of the results of the study, if you would like one. Please call researcher at 272-1604, or e-mail umbayrah@cc.umanitoba.ca, if you would like to receive a summary of the results.

This research has been approved by the Education/Nursing Research Ethics Board of the University of Manitoba. If you have any concerns or complaints about this project you

may contact any of the above-named persons or the Human Ethics Secretariat at 204-474-7122, or e-mail margaret_bowman@umanitoba.ca. Please keep this information sheet for your records.

Appendix J: Research Subject Information and Consent Form (For Qualitative Component)

UNIVERSITY OF MANITOBA | Faculty of Nursing

Helen Glass Centre for Nursing
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-7452
Fax (204) 474-7682

RESEARCH SUBJECT INFORMATION AND CONSENT FORM
(Participants in Qualitative Component)

Research Project Title: Advanced Maternal Age and Risk Perception

Principal Investigator: Hamideh Bayrampour, PhD student, Department of Applied Health Sciences, University of Manitoba

Thesis Advisor: Dr. Maureen Heaman, Professor, Faculty of Nursing, Room 268 Helen Glass Centre for Nursing, University of Manitoba, Winnipeg, MB R3T 2N2. Phone 204-474-6222.

Sponsor (Funding Agency): This research was supported by a grant from the Manitoba Institute of Child Health.

You are being asked to take part in a research study. This information form should give you a basic idea of what the research is about and what you are being asked to do. You will be given a copy of this form to keep. If you have any questions about the study, feel free to ask the researcher. Please take the time to read this carefully.

Purpose of the Study:
The purpose of this study is to explore how pregnant women at age 35 and older perceive their pregnancy risk, and what factors influence their risk perception and decision making about timing of childbearing. This study is being conducted for the researcher's thesis research project.

Women Who May Participate in the Study:
Women are being asked to take part in this study if they are currently pregnant (no previous pregnancies greater than 20 weeks gestation), age 35 and older, in the third trimester of pregnancy, and receiving prenatal care from one of prenatal care clinics at Health Sciences Center, St. Boniface General Hospital, or selected private physicians' offices in the city of Winnipeg.

Procedures:
If you agree to take part in this study, the researcher will interview you about your perceived risk of this pregnancy. You will be asked a number of questions about your pregnancy, your perception of risk about this pregnancy, and your decision to be pregnant. You will also be

asked about things that might contribute in forming your perceived risk of this pregnancy, questions about your feelings and experiences about this pregnancy. The interview will take approximately one hour, and will take place at a time and location that is convenient for you. The interview will be recorded and later transcribed (typed out). You will also be asked some background questions by the researcher about your age, marital status, income and ethnic background in order to complete a brief demographic form. She also might write down some notes during interview. Once the data obtained during the study has been analyzed, the researcher may contact you to discuss the results of the study in order to verify the findings of the study.

Confidentiality:
All information gathered for this study will be kept strictly confidential, except if you reveal a situation of child abuse, in which case the law says we must report the abuse. Medical records that contain your identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. Your interview records including audio recordings, notes, and transcripts will be identified with a unique code number that has been assigned only to you. Your name will not appear anywhere on these documents. The researcher will keep a list of participant names that match these code numbers. This list will be destroyed as soon as the study is completed. This list and the audio recordings, notes, and transcripts will be stored separately in a locked filing cabinet at the University of Manitoba. The audio recording of your interview and its transcript will stay in a locked cabinet and then be destroyed 7 years after the study ends. Only the researcher; Hamideh Bayrampour, her thesis advisor; Dr. Maureen Heaman, and a transcriptionist; who will be typing out the recorded interviews will have access to the audio recordings, notes, and transcripts. The transcriptionist will sign a pledge of confidentiality to maintain the confidentiality. Your individual identity will not be revealed in reports or articles that describe the results of this study.

Representatives of the sponsor (funding agency), the Education/Nursing Research Ethics Board at the University of Manitoba, and St. Boniface General Hospital or Health Sciences Center (if you are a patient of these institutions) may review your research-related records to make sure this study meets quality guidelines.

Risks:
There are no known risks to participating in this study.

Benefits:
There are no direct benefits involved in participating in this study. However, your answers may help to improve prenatal care for other women at your age.

Voluntary Participation and Withdrawal:
Your participation in this study is completely voluntary. You can withdraw from this study without consequences and your decision about whether or not to take part will not affect the care you receive in any way. You have the right to not answer any of the questions you are asked. You also have the right to stop taking part in the study at any time, without prejudice or consequence.

Feedback to Participants:
We will mail you a summary of the results of the study if you would like one. Please complete the attached page with your name and address if you would like to receive a summary of the results.

Statement of Consent
Your signature on this form means that you have had the study explained to you in a language that you understand, all questions have been answered to your satisfaction, and that you agree to take part as a subject. In no way does this waive your legal rights, nor does it release the researchers, funding agency, or involved institutions from their legal and professional responsibilities. You can stop taking part in the study at any time, and /or refuse to answer any questions you are not comfortable with. You should feel free to ask questions at any time during or after the study from either Hamideh Bayrampour, doctoral student, (Ph. 204-272-1604), or her thesis supervisor, Dr. Maureen Heaman (Ph. 204-474-6222).

This research has been approved by the Education/Nursing Research Ethics Board of the University of Manitoba. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Secretariat at 204-474-7122, or e-mail margaret_bowman@umanitoba.ca. A copy of this consent form has been given to you to keep for your records.

_____ _____
Participant's Signature Date

Printed name of above:_____

_____ _____
Researcher and/or Delegate's Signature Date

Printed name of above:_____

ALL SUBJECTS MUST SIGN AND DATE THEIR OWN SIGNATURE.

After all of the interviews for the study have been reviewed and analyzed by the researcher, the researcher may contact you again to discuss the findings of the study. The purpose of this is to ensure that the results of the study are accurate and true to the views of the participants. This is an important step in the research project.

Please fill in the following contact information:

I agree to be contacted to review the findings of the study_____Yes_____No

Name: _____

Address: _____

Phone Number: _____

Research Project:
Advanced Maternal Age and Risk Perception

If you would like to receive a summary of the results of this study, please fill out your name and address and give this page to the Researcher.

Name:_____

Address:_____

Postal code:_____

Appendix K: Interview Guide

1. Please tell me a little bit about yourself?
   a) When did you become pregnant?

2. Please tell me about your decision to get pregnant?
   a) When did you decide to start your family?
   b) Why did you decide to get pregnant?
   c) If you have a partner, how did your partner influence this decision?
   d) Why didn't you want to get pregnant sooner?
   e) What is the primary reason you decided to delay pregnancy?
   f) What/who influenced your decision to being pregnant?
   g) What is the primary reason you decided to get pregnant now?

3. Please describe for me your understanding about your pregnancy after age 35?
   a) If you had gotten pregnant before age 35, do you think your pregnancy would be different from this pregnancy? Why or why not?
   b) Please describe for me your opinion about the risks associated with your pregnancy (try to find thoughts and worries).

4. Some studies show that pregnancy at age 35 and above is more complicated than pregnancy at younger ages. Do you think that you are at a higher risk for pregnancy complications compared to a younger woman? Why or why not?
   a) In decision making about pregnancy, was this issue important for you? Were there other factors that you considered in advance?

5. Could you please describe to me your experiences with how your health care providers informed you about the risks associated with your pregnancy?
   a) Do you consider your pregnancy to be at high risk? If so, when did you first realize that your pregnancy is a high risk pregnancy?
   b) Does your partner consider your pregnancy to be at high risk? Why or why not?
   c) Who indicated that your pregnancy is a high risk pregnancy?
   d) What was your reaction to that? Please describe what your feelings were after that?
   e) What does it mean for you to be at higher risk?
   f) Did you feel you needed more description about your situation? Which questions came to mind? Did you ask these questions? Were you satisfied with the answers?
   g) What were your wishes about this communication?

h) Had this communication any impact on your beliefs about your pregnancy?

Appendix L: Contact Summary Sheet for Interviews

Contact date:_____ Participant Number: _____

1. Brief description of interviewee and anyone else present during interview:

2. Place of interview:

3. Context of interview (anything noteworthy that might influence responses):

4. What were the main themes or issues in this contact?

5. What new themes, speculations or hunches were suggested by the contact?

6. Where should energy be placed during the next contact, and what kinds of information should be sought?

Appendix M: Education/Nursing Research Ethics Board Approval Certificate

UNIVERSITY OF MANITOBA | OFFICE OF RESEARCH SERVICES
Office of the Vice-President (Research)

CTC Building
208 - 194 Dafoe Road
Winnipeg, MB R3T 2N2
Fax (204) 269-7173
www.umanitoba.ca/research

APPROVAL CERTIFICATE

August 26, 2009

TO:

Hamideh Bayrampour (Advisor – M. Heaman)
Principal Investigator

FROM: **Lorna Guse, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2009:095**
"Advanced Maternal Age and Risk Perception"

Please be advised that your above-referenced protocol has received human ethics approval by the **Education/Nursing Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- **if you have funds pending human ethics approval, the auditor requires that you submit a copy of this Approval Certificate to Eveline Saurette in the Office of Research Services, (e-mail eveline_saurette@umanitoba.ca, or fax 261-0325), including the Sponsor name, before your account can be opened.**

- **if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.**

The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/ors/ethics/ors_ethics_human_REB_forms_guidelines.html) **in order to be in compliance with Tri-Council Guidelines.**

Appendix N: Education/Nursing Research Ethics Board Renewal Approval Certificate

UNIVERSITY OF MANITOBA | Ethics
Office of the Vice-President (Research)

CTC Building
208 - 194 Dafoe Road
Winnipeg, MB R3T 2N2
Fax (204) 269-7173
www.umanitoba.ca/research

RENEWAL APPROVAL

August 14, 2010

TO: **Hamideh Bayrampour**
Principal Investigator

FROM: **Stan Straw, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2009:095**
"Advanced Maternal Age and Risk Perception"

Please be advised that your above-referenced protocol has received approval for renewal by the **Education/Nursing Research Ethics Board**. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Bringing Research to Life

Appendix O: Health Sciences Center Research Access Approval Certificate

Health Sciences Centre
Winnipeg

Office of the Director of Research

Dial Direct 204-787-2404
Fax 204-787-4547

October 19, 2009

Hamideh Bayrampour
Principal Investigator
272 Lake Village Rd., Wpg MB R3T 4M8

Dear Hamideh Bayrampour

RE: ADVANCED MATERNAL AGE AND RISK PERCEPTION.

ETHICS #: E2009:095 RIC #: RI09:151

The above-named protocol, **has been evaluated and approved** by the HSC Research Impact Committee.

The Department of Research wishes you much success with your study.

Sincerely

Karen Shaw-Allan
Research Protocol Officer
Health Sciences Centre

cc: Director of Research
Ancillary Services, Finance Division

Appendix P: St. Boniface Hospital Research Access Approval Certificate

Hôpital général St-Boniface General Hospital
Research Review Committee
Approval Form

Principal Investigator: **Ms. H. Bayrampour**

RRC Reference Number: **RRC/2009/1022**

Date: **December 18, 2009**

Protocol Title: **Advanced Maternal Age and Risk Perception**

The following is/are approved for use:

- **Protocol, reviewed at the October 7, 2009 Research Review Committee Meeting**
- **Research Participant Information and Consent Form, Quantitative Component, version 3 dated November 18, 2009**
- **Research Participant Information and Consent Form, Qualitative Component, version 3 dated November 18, 2009**

The above was approved by Dr. B. Light, Chairperson, Research Review Committee, St. Boniface General Hospital, on behalf of the Committee. As the recommendations by the Research Review Committee have been met, final approval is now granted.

Any significant changes to the study Protocol and Informed Consent Form must be reported to the Research Review Committee along with any other documents required as per Standard Operating Procedures for Clinical Investigators.

Sincerely yours,

Dr. B. Light
Chairperson, Research Review Committee
St. Boniface General Hospital

Please quote the above reference number on all correspondence.
Inquiries should be directed to the RRC Secretary
Telephone: (204) 235-3623 **Fax**: (204) 237-9860
N1004 – 409 Taché, Winnipeg, MB, Canada R2H 2A6

Appendix Q: Winnipeg Regional Health Authority Research Access Approval Certificate

Winnipeg Regional Health Authority / Office régional de la santé de Winnipeg
Caring for Health / *À l'écoute de notre santé*

200 – 1155 Concordia Avenue
Winnipeg, Manitoba
R2K 2M9 CANADA

April 23, 2010

Ms. Hamideh Bayrampour
Department of Applied Health Sciences
University of Manitoba
Winnipeg, MB R3T 2N2

Dear Ms. Bayrampour:

Re: "Advanced Maternal Age and Risk Perception Study" –
WRHA Reference No: 2010-008

We are pleased to inform you that your research access request for the above-named study has been approved by the Winnipeg Regional Health Authority (WRHA) Research Review Committee pending confirmation that the following conditions are met or agreed to:

- You, your co-investigators, and your research assistants comply with the relevant privacy legislation as indicated below.

  [X] *The Personal Health Information Act*

  [ ] *The Freedom of Information and Protection of Privacy Act*

  [ ] *The Personal Health Information Act* and *The Freedom of Information and Protection of Privacy Act*

- You complete and return the attached Confidentiality Agreement(s) to Judy Li, Concordia Hip & Knee Institute, WRHA, 200 – 1155 Concordia Avenue, Winnipeg, MB R2K 2M9;
- You submit to our attention any significant changes in your proposal prior to implementation or any significant changes during the course of the study;
- You submit a summary of the final results of the study to the WRHA and provide us with a copy of any publications arising from the study;
- It is an expected courtesy that WRHA will be given a minimum of five working days advance notice of publication or presentation of results with policy implications, in order to be prepared for public response;
- You agree to be accountable for appropriate storage and elimination of material.

Thank you for selecting the Winnipeg Regional Health Authority as the site to conduct your research. Please let us know should you encounter any site-related difficulties during the course of your study.

We extend best wishes for successful completion of your study.

Yours Sincerely,

Dr. Michael Moffatt, M.D., MSc., FRCPC
Executive Director, Division of Research and Applied Learning
Chair, Research Review Committee
Winnipeg Regional Health Authority

cc. Ms. Arlene Wilgosh, WRHA
Dr. John Arnett, Chair, HREB

Encl: ***PHIA Agreement***