LEISURE-TIME PHYSICAL ACTIVITY PERCEPTIONS, INFLUENCES, AND BEHAVIOR DURING PREGNANCY

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ABSTRACT

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Psychosocial factors, which may facilitate or impede pregnancy leisure-time physical activity (LTPA) have been identified by pregnant women. Although the influence of each factor is unclear, some may be vital in enabling pregnant women to participate in sufficient levels of LTPA. The Risk Perception Attitude Framework (RPA) suggests risk perceptions and efficacy beliefs interact to predict self-protective behavior. Therefore, the first purpose of this dissertation was to examine the joint influence of pregnancy risk perceptions and LTPA efficacy beliefs on LTPA behavior among pregnant women. An additional factor which may impact LTPA behavior, but which has not been examined thoroughly, is religion. Thus, the second purpose of this dissertation was to examine the influence of religion (specifically the Latter-day Saint (LDS) faith) on pregnancy LTPA and potential psychosocial factors which influence pregnancy LTPA.

A convenience sample of pregnant women (n=302) was recruited via prenatal clinics and word-of-mouth from mid-Michigan as well as Salt Lake City, Utah. Data were collected from a 15-minute survey (via iPad or paper copy) completed by all study participants. RPA defined attitudinal groups were created via a median split of both pregnancy risk perceptions (high/low) and LTPA efficacy beliefs (high/low) for both moderate and vigorous LTPA. Moderate LTPA was dichotomized as meeting current LTPA guidelines [moderate LTPA \geq 150 min/week] or not, while vigorous LTPA was dichotomized as performing any [vigorous LTPA >0 min/week], or not. Chi-square and logistic regression analyses were utilized to examine group differences for both moderate and vigorous LTPA. Hierarchical logistic regression was utilized to examine further the joint influence of pregnancy risk perceptions and LTPA efficacy beliefs on pregnancy LTPA. Four religious groups were defined as LDS, and non-LDS high, moderate, and low religiosity (as determined via tertiles). Group differences for LTPA as well as pregnancy risk, LTPA efficacy, physical activity social support, and discussions with prenatal healthcare providers were determined via chi-square analyses and logistic regression.

Responsive and proactive pregnant women (those with high efficacy beliefs) were most likely to meet moderate LTPA guidelines and participate in any vigorous LTPA compared to the other attitudinal groups. Hierarchical logistic regression did not reveal an interactive effect of pregnancy risk perceptions and LTPA efficacy beliefs for meeting moderate LTPA guidelines or any vigorous LTPA participation. LDS women were less likely to meet moderate LTPA guidelines, but more likely to participate in vigorous LTPA compared to non-LDS women. LDS women reported higher levels of moderate and vigorous LTPA efficacy.

The results suggest that high LTPA efficacy beliefs are important in facilitating greater levels of pregnancy LTPA. Our findings partially extend the scope of the RPA, specifically to classifying pregnant women with respect to LTPA behavior. Although this investigation did not find a significant interactive effect between pregnancy risk perceptions and LTPA efficacy beliefs, their joint consideration should not be discounted in future investigations. Interventions aiming to increase pregnancy LTPA should focus on methods to heighten pregnant women's LTPA efficacy beliefs such that avoidant pregnant women become responsive and indifferent pregnant women become proactive. Copyright by CHRISTOPHER P. CONNOLLY 2014

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CHAPTER 1

INTRODUCTION

Physical activity during pregnancy provides a host of health benefits to both mother and fetus. For the mother, these include a reduced risk of gestational diabetes,¹⁻³ preeclampsia,^{4,5} unhealthy gestational weight gain,⁶ and prolonged labor.^{7,8} Fetal health benefits include prevention of excessive fetal weight gain,⁹ as well as a reduced risk of adverse birth outcomes, including preterm delivery^{10,11} and operative delivery.¹² Therefore, the importance of physical activity on maternal-fetal health cannot be overstated.

Despite the many beneficial effects of physical activity during pregnancy, volume and intensity typically decrease as gestation progresses.¹³⁻¹⁵ Moreover, it is evident that many pregnant women do not participate in sufficient amounts of leisure-time physical activity (LTPA) throughout pregnancy, with only 14-29% meeting the minimum recommendation of at least 150 minutes of moderate-intensity activity per week.^{16,17} Furthermore, population-based investigations have indicated that as many as 35-44% of pregnant women have not participated in any moderate LTPA within the previous month.^{17,18}

Various barriers to LTPA during a healthy pregnancy have been identified, including lack of time,¹⁹⁻²³ fatigue,^{19-21,23,24} physical discomfort,^{19-23,25} and childcare responsibilities.^{19,22,26} Additionally, pregnant women have reported a number of psychosocial factors limit LTPA. These include unfavorable perceptions towards physical activity,²⁵⁻²⁸ lack of adequate healthcare provider (HCP) advice,^{23,27} and insufficient levels of social support.²⁷ Although preliminary research suggests each of these psychosocial factors influences LTPA among pregnant women,

more thorough analyses of each variable, including the extent to which they affect various subgroups of pregnant women, are needed.

This dissertation focused on psychosocial factors that may influence pregnancy LTPA, including pregnancy risk perceptions, physical activity beliefs, physical activity discussions with prenatal HCPs, and physical activity social support (Figure 1.1). The joint influence of pregnancy risk perceptions and LTPA efficacy beliefs on pregnancy LTPA were explored. The influence of physical activity social support and physical activity discussions with prenatal HCPs on pregnancy LTPA were not directly investigated. However, a previously unconsidered potential influence to pregnancy LTPA (religion) will be a central focus of this dissertation. More specifically, differences among various religious groups with respect to LTPA and each of these potential psychosocial influences will be examined.



Figure 1.1. Psychosocial factors that potentially influence LTPA during pregnancy.

POTENTIAL PSYCHOSOCIAL INFLUENCES ON PREGNANCY LTPA

Pregnancy Risk Perceptions and LTPA Efficacy Beliefs

A part of this dissertation will utilize the Risk Perception Attitude Framework (RPA), which originates from the Extended Parallel Process Model (EPPM), and stipulates that perceptions for a specific risk and efficacy beliefs for a health behavior to protect against that risk, jointly determine the participation in that behavior.²⁹ While the EPPM focuses on how individuals process a given message about a threat, the RPA pertains to how individuals' risk perceptions lead to action. Within the RPA, four attitudinal groups are formed (responsive, proactive, avoidant, indifferent), based on risk perceptions (high/low) and efficacy beliefs (high/low). Theoretically, individuals with higher perceptions of the risk and higher efficacy beliefs for the behavior (responsive group) will be most likely to engage in that behavior.²⁹ Although this framework has not yet been applied within a physical activity context, it is an ideal tool to use when studying pregnant women, given the protective feelings that an expectant mother may feel for her unborn child. Utilizing the RPA may reveal the combinations of pregnancy risk perceptions and physical activity efficacy beliefs that drive pregnancy LTPA.

Results from qualitative investigations indicate it is common for women to have some level of concern or worry about the health and safety of their babies during pregnancy.^{25,30} Women with "high-risk" pregnancies or previous complications may perceive either their personal health or that of their babies' to be more at risk^{31,32} and expect more medical interventions³³ than do women with uncomplicated pregnancies. Among nulliparous women, pregnancy risk perceptions may be higher among those with higher pregnancy-related anxiety as well as those at lower gestational ages.³⁴ Such feelings of risk can theoretically comprise

perceptions of how likely an adverse outcome is (perceived susceptibility) and how severe it would be (perceived severity) if it occurred. The perception that LTPA is protective against adverse prenatal health outcomes (response efficacy) may be a powerful motivator for pregnant women to be physically active, particularly if women believe the risk of such outcomes to be great. However, only a few investigations have attempted to assess these perceptions, and have indicated that the majority of pregnant women believe moderate LTPA to be somewhat safe^{16,20} and beneficial.³⁵ In contrast, fewer pregnant women believe in the safety^{16,20} and health benefit³⁵ of vigorous LTPA despite evidence that it is not detrimental and may be protective to mother and baby. Assessing the extent to which pregnant women perceive physical activity to be beneficial and or safe is complex, as are the mechanisms by which these perceptions develop. There is a need to more precisely examine risk perceptions during pregnancy and also response efficacy of LTPA behavior in order to better understand their impact on LTPA among pregnant women. The relationship between LTPA self-efficacy and LTPA behavior during pregnancy has been studied more thoroughly, particularly over the past decade. Results suggest that LTPA selfefficacy may predict women's LTPA during pregnancy as they transition from prepregnancy into the first trimester.^{25,36} Moreover, researchers have shown that LTPA self-efficacy predicts LTPA during the second trimester, while the self-efficacy to overcome physical activity barriers predicts LTPA in the third trimester.²¹

Optimal combinations of pregnancy risk perceptions and LTPA efficacy beliefs in influencing pregnancy LTPA are not well-studied. However, Gaston and Prapavessis³⁷ recently examined the influence of these individual perceptions on exercise behavior among 105 second and third-trimester pregnant women. Results showed that perceived susceptibility, response efficacy, and self-efficacy all are indirectly related to exercise behavior, with these relationships

mediated by goal intention and implementation intention. However, within this investigation, the perception that physical activity is protective was considered *generally* for pregnancy health, rather than the specific health and safety of the baby. Additionally, combinations of physical activity efficacy beliefs and pregnancy risk perceptions were not assessed. Determining the joint influence of LTPA efficacy beliefs (response efficacy and self-efficacy) and risk perceptions specific to the safety of the baby (perceived severity and susceptibility) on LTPA behavior may provide meaningful insight into how sufficient levels of physical activity can be achieved during pregnancy.

Social Support and Discussions with Prenatal Healthcare Providers

Pregnancy has been described as a self-identifying experience, which introduces many women to challenges and fears not previously experienced.³⁸⁻⁴⁰ The role of a pregnant woman's social network may be critical during such a time. Specifically in regards to LTPA, qualitative research has shown that social support enables pregnant women to overcome barriers and be more physically active.^{19,24} Melender⁴¹ indicated that talking about physical activity concerns with trusted support sources is influential in minimizing perceptions of fear during pregnancy. Although physical activity advice that pregnant women receive from family members may outweigh that of other individuals,¹⁹ it is possible that various sources have influence on pregnant women's perceptions towards physical activity through either the encouragement or discouragement of being physically active.^{42,43} Thus, there is a need to assess total physical activity social support as well as social support from specific sources.

The prenatal healthcare provider (HCP) may also have tremendous impact on a pregnant woman's physical activity perception and behavior, given his/her regular personal interactions

with the woman as well as his/her expertise in maternal-fetal health. Of specific interest are the discussions that prenatal HCPs may have with their patients, an avenue through which accurate physical activity information, including the current LTPA recommendations, may be presented. However, it appears prenatal HCPs do not discuss physical activity with pregnant women on a regular basis.^{27,44,45} Additionally, unclear or out-of-date physical activity information may be given during the discussions that do take place.^{44,46,47} Not surprisingly, some pregnant women have reported uncertainty regarding LTPA participation due to a lack of guidance from their prenatal HCP.^{23,27} Yet prenatal HCP discussions and social support are possible means by which physical activity perceptions and behavior among pregnant women may be improved. How these differ between subgroups of pregnant women has not yet been specifically investigated.

Religion

Given that individuals often identify and draw strength from spiritual beliefs when faced with health challenges or significant life events,⁴⁸ the influence of spirituality on perceptions and behaviors may be unique during pregnancy. This may be especially pertinent for Latter-day Saint (LDS) pregnant women (otherwise known as Mormons), who have had consistently higher rates of childbearing compared to other religious denominations^{49,50} and report pregnancy and childbirth to both be deeply personal and spiritual.⁵¹ The role of the family is deeply integrated within LDS theology and many LDS women view having and raising children to be a sacred responsibility and divine experience.⁵² Additionally, LDS members live by a strict health code, which consists of abstaining from addictive substances and living a healthy lifestyle. Given these unique doctrines, it is possible that LDS pregnant women. Likewise, these hypothetical differences may be reflected in the physical activity social support received and prenatal HCP physical

activity discussions. It does not appear that previous investigations have explored the impact of spirituality or religiosity during pregnancy on physical activity behavior, nor on psychosocial influences of physical activity. However, investigating these differences may offer a unique and important perspective with respect to the role of spirituality/religion in a healthy pregnancy.

Psychosocial factors that appear to influence physical activity behavior among pregnant women are complex and difficult to assess. The overall purpose of this dissertation is to gain a better understanding of the psychosocial factors that may influence LTPA during pregnancy. This study will be a unique examination of pregnant women's pregnancy risk perceptions, LTPA efficacy beliefs, LTPA behavior, and the how these and social influences of physical activity (social support and discussions with prenatal HCP) differ between LDS and non-LDS pregnant women of different religiosity levels. Findings may encourage practitioners and researchers working with pregnant women to more fully integrate psychosocial and religious factors into interventions aiming to improve LTPA participation during pregnancy.

RESEARCH AIMS

Specific Aim 1: To develop a survey instrument to measure pregnant women's pregnancy risk perceptions, LTPA efficacy beliefs, and LTPA in order to utilize the Risk Perception Attitude Framework (RPA).

Aim 1 is not hypothesis driven.

Specific Aim 2: To determine the pregnancy risk perceptions and LTPA efficacy beliefs in a convenience sample of 300-400 pregnant women from mid-Michigan and Salt Lake City, Utah regions.

Aim 2 is not hypothesis driven.

Specific Aim 3: To determine if differences exist in meeting the moderate LTPA guidelines among pregnancy risk perception/moderate LTPA efficacy attitudinal groups as defined by the RPA.

Hypothesis 3: Pregnant women with high pregnancy risk perceptions and high LTPA efficacy beliefs (responsive group) as well as those low pregnancy risk perceptions and high LTPA efficacy beliefs (proactive group) will be more likely to meet the moderate LTPA guidelines than will women with high pregnancy risk perceptions and low LTPA efficacy beliefs (avoidant group) as well as those with low pregnancy risk perceptions and low LTPA efficacy beliefs (indifferent group).

Specific Aim 4: To determine if differences exist in vigorous LTPA participation among pregnancy risk perception/vigorous LTPA efficacy attitudinal groups as defined by the RPA.

Hypothesis 4: Pregnant women with high pregnancy risk perceptions and high LTPA efficacy beliefs (responsive group) will be more likely to participate in any vigorous LTPA compared to a) women with low pregnancy risk perceptions and high LTPA efficacy beliefs (proactive group), b) women with high pregnancy risk perceptions and low LTPA efficacy beliefs (avoidant group), and c) women with low pregnancy risk perceptions and low LTPA efficacy beliefs (indifferent group).

Specific Aim 5: To determine if the interaction of pregnancy risk perceptions and moderate LTPA efficacy is associated with meeting moderate LTPA guidelines among pregnant women.

Hypothesis 5: The interaction of pregnancy risk perceptions and moderate LTPA efficacy beliefs will be associated with meeting the moderate LTPA guidelines.

Specific Aim 6: To determine if the interaction of pregnancy risk perceptions and vigorous LTPA efficacy is associated with participating in any vigorous LTPA among pregnant women.

Hypothesis 6: The interaction of pregnancy risk perceptions and vigorous LTPA efficacy beliefs will be associated with participating in vigorous LTPA.

Specific Aim 7: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with LTPA, pregnancy risk perceptions, and LTPA efficacy beliefs among pregnant women.

Hypothesis 7.1: LDS pregnant women will be more likely to meet the moderate LTPA guidelines and participate in any vigorous LTPA compared to non-LDS pregnant women of high, moderate, and low religiosity.

Hypothesis 7.2: LDS pregnant women will not differ in pregnancy risk perceptions compared to non-LDS pregnant women of high, moderate, and low religiosity.

Hypothesis 7.3: LDS pregnant women will have higher efficacy beliefs toward moderate and vigorous LTPA compared to non-LDS pregnant women of high, moderate, and low religiosity.

Specific Aim 8: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with prenatal HCP discussions, perceived satisfaction with these discussions, and perceived physical activity social support among pregnant women.

Hypothesis 8.1: LDS pregnant women will be more likely to report discussing physical activity with their prenatal HCPs compared to non-LDS pregnant women of high, moderate, and low religiosity.

Hypothesis 8.2: LDS pregnant women who have physical activity discussions with their prenatal HCPs will feel more satisfied with these discussions compared to non-LDS pregnant women (of high, moderate, and low religiosity) who have physical activity discussions with their prenatal HCPs.

Hypothesis 8.3: LDS pregnant women will perceive higher levels of total physical activity social support compared to non-LDS pregnant women of high, moderate, and low religiosity.

Hypothesis 8.4: LDS pregnant women will perceive higher levels of physical activity social support from family compared to non-LDS pregnant women of high, moderate, and low religiosity.

Hypothesis 8.5: LDS pregnant women will perceive higher levels of physical activity social support from significant others compared to non-LDS pregnant women of high, moderate, and low religiosity.

OVERVIEW OF DISSERTATION

This dissertation is presented in five chapters. Chapter one consists of the introduction, aims, and hypotheses. Chapter two is a detailed review of the literature pertaining to each of the research aims. Chapter three contains a comprehensive description of study procedures, including survey instrument development, participant recruitment, variables of interest, and statistical analyses. Chapter four details the results of this dissertation, specifically addressing each research aim. The fifth and final chapter of this dissertation summarizes the overall dissertation findings and includes recommendations for future research pertaining to the relationships between LTPA perception and behavior among pregnant women, as well as the influence of religiosity on LTPA-related variables during pregnancy.

REFERENCES

REFERENCES

- 1. Dempsey JC, Sorensen TK, Williams MA, et al. Prospective study of gestational diabetes mellitus risk in relation to maternal recreational physical activity before and during pregnancy. *Am J Epidemiol.* Apr 1 2004;159(7):663-670.
- 2. Dempsey JC, Butler CL, Sorensen TK, et al. A case-control study of maternal recreational physical activity and risk of gestational diabetes mellitus. *Diabetes Res Clin Pract*. Nov 2004;66(2):203-215.
- **3.** Oken E, Ning Y, Rifas-Shiman SL, Radesky JS, Rich-Edwards JW, Gillman MW. Associations of physical activity and inactivity before and during pregnancy with glucose tolerance. *Obstet Gynecol.* Nov 2006;108(5):1200-1207.
- **4.** Rudra CB, Sorensen TK, Luthy DA, Williams MA. A prospective analysis of recreational physical activity and preeclampsia risk. *Med Sci Sports Exerc*. Sep 2008;40(9):1581-1588.
- 5. Sorensen TK, Williams MA, Lee IM, Dashow EE, Thompson ML, Luthy DA. Recreational physical activity during pregnancy and risk of preeclampsia. *Hypertension*. Jun 2003;41(6):1273-1280.
- 6. Stuebe AM, Oken E, Gillman MW. Associations of diet and physical activity during pregnancy with risk for excessive gestational weight gain. *Am J Obstet Gynecol*. Jul 2009;201(1):58 e51-58.
- 7. Clapp JF, 3rd. The course of labor after endurance exercise during pregnancy. *Am J Obstet Gynecol.* Dec 1990;163(6 Pt 1):1799-1805.
- **8.** Melzer K, Schutz Y, Soehnchen N, et al. Effects of recommended levels of physical activity on pregnancy outcomes. *American journal of obstetrics and gynecology*. Mar 2010;202(3):266 e261-266.
- **9.** Pivarnik JM. Potential effects of maternal physical activity on birth weight: brief review. *Med Sci Sports Exerc.* Mar 1998;30(3):400-406.
- **10.** Hegaard HK, Hedegaard M, Damm P, Ottesen B, Petersson K, Henriksen TB. Leisure time physical activity is associated with a reduced risk of preterm delivery. *Am J Obstet Gynecol.* Feb 2008;198(2):180 e181-185.
- **11.** Juhl M, Andersen PK, Olsen J, et al. Physical exercise during pregnancy and the risk of preterm birth: a study within the Danish National Birth Cohort. *Am J Epidemiol*. Apr 1 2008;167(7):859-866.

- 12. Voldner N, Froslie KF, Haakstad LA, Bo K, Henriksen T. Birth complications, overweight, and physical inactivity. *Acta Obstet Gynecol Scand*. 2009;88(5):550-555.
- **13.** Fell DB, Joseph KS, Armson BA, Dodds L. The impact of pregnancy on physical activity level. *Matern Child Health J.* Sep 2009;13(5):597-603.
- **14.** Mottola MF, Campbell MK. Activity patterns during pregnancy. *Can J Appl Physiol.* Aug 2003;28(4):642-653.
- **15.** DiNallo JM, Le Masurier GC, Williams NI, Downs DS. Walking for health in pregnancy: assessment by indirect calorimetry and accelerometry. *Res Q Exerc Sport*. Mar 2008;79(1):28-35.
- **16.** Mudd LM, Nechuta S, Pivarnik JM, Paneth N. Factors associated with women's perceptions of physical activity safety during pregnancy. *Prev Med.* Aug-Sep 2009;49(2-3):194-199.
- **17.** Evenson KR, Wen F. National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. *Prev Med.* Mar 2010;50(3):123-128.
- **18.** Evenson KR, Savitz DA, Huston SL. Leisure-time physical activity among pregnant women in the US. *Paediatr Perinat Epidemiol*. Nov 2004;18(6):400-407.
- **19.** Evenson KR, Moos MK, Carrier K, Siega-Riz AM. Perceived barriers to physical activity among pregnant women. *Matern Child Health J.* May 2009;13(3):364-375.
- **20.** Duncombe D, Wertheim EH, Skouteris H, Paxton SJ, Kelly L. Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery*. Aug 2009;25(4):430-438.
- **21.** Cramp AG, Bray SR. A prospective examination of exercise and barrier self-efficacy to engage in leisure-time physical activity during pregnancy. *Annals of behavioral medicine: a publication of the Society of Behavioral Medicine.* Jun 2009;37(3):325-334.
- **22.** Cioffi J, Schmied V, Dahlen H, et al. Physical activity in pregnancy: women's perceptions, practices, and influencing factors. *Journal of midwifery & women's health*. Sep-Oct 2010;55(5):455-461.
- **23.** Krans EE, Chang JC. A will without a way: barriers and facilitators to exercise during pregnancy of low-income, African American women. *Women & health.* Nov 30 2011;51(8):777-794.
- **24.** Da Costa D, Ireland K. Perceived benefits and barriers to leisure-time physical activity during pregnancy in previously inactive and active women. *Women & health*. 2013;53(2):185-202.

- **25.** Hegaard HK, Kjaergaard H, Damm PP, Petersson K, Dykes AK. Experiences of physical activity during pregnancy in Danish nulliparous women with a physically active life before pregnancy. A qualitative study. *BMC Pregnancy Childbirth*. 2010;10:33.
- **26.** Marshall ES, Bland H, Melton B. Perceived barriers to physical activity among pregnant women living in a rural community. *Public health nursing*. Jul 2013;30(4):361-369.
- 27. Clarke PE, Gross H. Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery*. Jun 2004;20(2):133-141.
- **28.** Weir Z, Bush J, Robson SC, McParlin C, Rankin J, Bell R. Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. *BMC Pregnancy Childbirth.* 2010;10:18.
- **29.** Rimal RN, Real K. Perceived risk and efficacy beliefs as motivators of change: Use of the risk perception attitude (RPA) framework to understand health behaviors. *Hum Commun Res.* Jul 1 2003;29(3):370-399.
- **30.** Gibbins J, Thomson AM. Women's expectations and experiences of childbirth. *Midwifery*. Dec 2001;17(4):302-313.
- **31.** Gupton A, Heaman M, Cheung LW. Complicated and uncomplicated pregnancies: women's perception of risk. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG.* Mar-Apr 2001;30(2):192-201.
- **32.** Lee S, Ayers S, Holden D. Risk perception of women during high risk pregnancy: A systematic review. *Health Risk Soc.* 2012;14(6):511-531.
- **33.** Heaman M, Beaton J, Gupton A, Sloan J. A comparison of childbirth expectations in high-risk and low-risk pregnant women. *Clinical nursing research*. Aug 1992;1(3):252-265.
- **34.** Bayrampour H, Heaman M, Duncan KA, Tough S. Predictors of Perception of Pregnancy Risk among Nulliparous Women. *Jognn-J Obst Gyn Neo*. Jul 2013;42(4):416-427.
- **35.** Evenson KR, Bradley CB. Beliefs about exercise and physical activity among pregnant women. *Patient Educ Couns.* Apr 2010;79(1):124-129.
- **36.** Hinton PS, Olson CM. Predictors of pregnancy-associated change in physical activity in a rural white population. *Matern Child Health J.* Mar 2001;5(1):7-14.
- **37.** Gaston A, Prapavessis H. Maternal-fetal disease information as a source of exercise motivation during pregnancy. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association.* Nov 2009;28(6):726-733.

- **38.** Lundgren I, Dahlberg K. Women's experience of pain during childbirth. *Midwifery*. Jun 1998;14(2):105-110.
- **39.** Parratt J. The impact of childbirth experiences on women's sense of self: a review of the literature. *Aust J Midwifery*. 2002;15(4):10-16.
- **40.** Melender HL, Lauri S. Fears associated with pregnancy and childbirth--experiences of women who have recently given birth. *Midwifery*. Sep 1999;15(3):177-182.
- **41.** Melender HL. Fears and coping strategies associated with pregnancy and childbirth in Finland. *Journal of midwifery & women's health*. Jul-Aug 2002;47(4):256-263.
- **42.** Bradley DE. Religious Involvement and Social Resources Evidence from the Data Set Americans Changing Lives. *J Sci Stud Relig.* Jun 1995;34(2):259-267.
- **43.** Ellison CG, George LK. Religious Involvement, Social Ties, and Social Support in a Southeastern Community + a Study of a Theoretical-Model Linking Institutional Church Participation and Social Network Relationships. *J Sci Stud Relig.* Mar 1994;33(1):46-61.
- **44.** Ferrari RM, Siega-Riz AM, Evenson KR, Moos MK, Carrier KS. A qualitative study of women's perceptions of provider advice about diet and physical activity during pregnancy. *Patient Educ Couns*. Feb 8 2013.
- **45.** Evenson KR, Pompeii LA. Obstetrician practice patterns and recommendations for physical activity during pregnancy. *J Womens Health (Larchmt)*. Sep 2010;19(9):1733-1740.
- **46.** Bauer PW, Broman CL, Pivarnik JM. Exercise and pregnancy knowledge among healthcare providers. *J Womens Health (Larchmt)*. Feb 2010;19(2):335-341.
- **47.** Entin PL, Munhall KM. Recommendations regarding exercise during pregnancy made by private/small group practice obstetricians in the USA. *J Sport Sci Med.* Sep 2006;5(3):449-458.
- **48.** Sulmasy DP. A biopsychosocial-spiritual model for the care of patients at the end of life. *The Gerontologist.* Oct 2002;42 Spec No 3:24-33.
- **49.** Heaton TB. How Does Religion Influence Fertility, the Case of Mormons. *J Sci Stud Relig.* Jun 1986;25(2):248-258.
- **50.** Thornton A. Religion and Fertility Case of Mormonism. *J Marriage Fam.* 1979;41(1):131-142.
- **51.** Callister LC, Semenic S, Foster JC. Cultural and spiritual meanings of childbirth. Orthodox Jewish and Mormon women. *J Holist Nurs*. Sep 1999;17(3):280-295.

52. Asplund-Campbell. *With child: Mormon women on mothering.* Salt Lake City, UT: Signature Books; 1998.

CHAPTER 2

REVIEW OF LITERATURE

INTRODUCTION

The health benefits of physical activity during pregnancy for both mother and child are many and highlight the need for pregnant women to be physically active. However, recent research suggests that few pregnant women are meeting the most current physical activity recommendations.¹ Pregnant women have reported a number of barriers which prevent them from being physically active during this unique time, some of which concern how physical activity is perceived.²⁻⁵ The extent to which, and underlying reasons why, psychosocial factors influence gestational leisure-time physical activity (LTPA) is unclear, with the possibility of notable variability between subgroups of pregnant women depending on cultural norms, support systems, or past experiences.

Some potential psychosocial influences to pregnant women participating in LTPA include the perceived risk of pregnancy, the perceived efficacy beliefs of LTPA, the physical activity discussions with a prenatal healthcare provider (HCP), and the social support received with respect to physical activity (Figure 2.1). It is important to more precisely assess these factors in order to gain a comprehensive understanding of how they may influence pregnancy LTPA. One method by which some of these psychosocial factors may be examined is the Risk Perception Attitude Framework (RPA),⁶ which fundamentally involves a perceived risk (such as harm to the baby during pregnancy) and perceived efficacy beliefs for a health behavior (such as LTPA during pregnancy). This framework may provide a novel insight into the combined

influence of pregnancy risk perceptions and LTPA efficacy beliefs on LTPA among pregnant women.

Religiosity may affect a pregnant woman's LTPA perception and behavior, given the reported spiritual nature of pregnancy and childbirth. This may be especially true for pregnant women who are members of the Church of Jesus Christ of Latter-day Saints (LDS), otherwise known as the "Mormon" church. The role of the family is deeply essential in LDS theology, and therefore many LDS members view having and raising children to be a sacred responsibility and experience. Additionally, LDS members live by a health code, which doctrinally requires members to abstain from addictive substances and to engage in healthy behaviors. However, little is known about the influence of religious beliefs (including Mormonism), on physical activity perception, psychosocial influences of physical activity, and LTPA during pregnancy.

Figure 2.1. Variables of interest in examining potential psychosocial influences on LTPA during pregnancy.



PHYSICAL ACTIVITY DURING PREGNANCY

History of Recommendations

Exercise during pregnancy has not been encouraged for most of the 20^{th} century. The most notable initial physical activity recommendations for pregnant women were issued by the American College of Obstetricians and Gynecologists (ACOG) in 1985.⁷ Although these recommendations endorsed low-impact moderate intensity physical activity, multiple restrictions were proposed including a maternal heart rate of no greater than 140 beats/min and strenuous exercise not lasting more than 15 minutes. Since this time, an array of research investigations have been conducted to evaluate the impact of gestational physical activity on maternal-fetal health, many providing strong evidence in favor of pregnant women being physically active. The result has been a 30-year evolution in physical activity recommendations for pregnant women.⁸ The most recent ACOG recommendations are substantially less conservative and suggest at least 30 minutes of moderate-intensity exercise on most days of the week for healthy pregnant women.⁹ However, women are still cautioned about strenuous exercise, particularly with respect to activities that may be associated with an increased risk of falling, physical contact, or abdominal trauma. In 2008, the U.S. Department for Health and Human Services released the first federal recommendations for physical activity during pregnancy.¹⁰ These largely agree with the 2002 ACOG guidelines, and suggest pregnant women should participate in at least 150 minutes of moderate-intensity aerobic activity per week, regardless of prepregnancy activity level. Additionally, the 2008 guidelines¹⁰ suggest that pregnant women who have participated consistently in vigorous-intensity physical activity may continue to be active at this intensity throughout gestation, provided their activity program is developed with the knowledge of the prenatal healthcare provider (HCP).

Health Benefits

An ample body of evidence suggests that physical activity during pregnancy provides numerous health benefits to the maternal-fetal unit. For example, researchers have shown that physical activity is associated with decreased risk of gestational diabetes and preeclampsia.¹¹⁻¹⁶ Additionally, regular physical activity during pregnancy has also been shown to assist in healthy levels of gestational weight gain,¹⁷⁻¹⁹ an extremely important protection considering the numerous associations that gestational obesity has with adverse outcomes to the maternal-fetal unit.²⁰ There is also evidence of possible psychological benefit, including of lower levels of anxiety 21,22 and depressive symptoms, 21,23 as well as higher levels of self-esteem 24,25 and overall psychological well-being.²¹ Moreover, regular physical activity may be an effective adjunctive treatment for psychological disturbances and clinical depression during pregnancy, reducing feelings of anxiety and depression, and also improving mood.²⁶ Gestational physical activity also yields notable health benefits for the child in-utero and upon delivery. Although there are mixed results regarding the impact of physical activity during pregnancy on optimal fetal birth weight,²⁷ the general consensus is that maternal activity results in healthy decreases in birth weight within the optimal, recommended range.^{28,29} Additionally, there is evidence that maternal physical activity is inversely associated with a number of adverse birth outcomes including labor duration^{30,31} as well as risk of preterm delivery^{32,33} and operative delivery.^{31,34} However, not all studies investigating these birth outcomes have found significant relationships with maternal physical activity during pregnancy.³⁵⁻³⁷

LTPA Trends among Pregnant Women

Leisure-time physical activity (LTPA) refers to activities that individuals participate in that do not include occupational, transportation, or household responsibilities. Historically, most research on pregnancy and exercise has focused on LTPA, the belief being that a) it is easier to measure than occupational activity and b) most women studied do not participate in jobs requiring large amounts of physical activity. Ning et al.³⁸ reported that approximately 61% of pregnant women participate in some form of LTPA, somewhat greater than the 48% reported by Zhang and Savitz.³⁹ However, Zhao et al.⁴⁰ examined data from the Behavioral Risk Factor Surveillance System (BRFSS) and found that participation in pregnancy LTPA increased from 67% in 2001 to 73% in 2009. Regardless of the true prevalence, the majority of this LTPA likely involves walking, which is by far the most common choice of activity among pregnant women.^{1,41,42}

It is clear from nationally-representative studies that LTPA participation during pregnancy appears to be largely insufficient, with only a fraction of pregnant women meeting the most current physical activity recommendations. Evenson et al.⁴² examined BRFSS data from the year 2000 with the intent to determine LTPA trends among a nationally-representative sample of pregnant women. The investigators found that 15.8% met the then recommended LTPA levels. Furthermore, Evenson and Wen¹ analyzed self-reported data from the 1999-2006 National Health and Nutrition Examination Survey (NHANES) and found that only 14% of pregnant women met the moderate-intensity LTPA recommendations (\geq 150 minutes/week). However, when vigorous-intensity LTPA was included, approximately 23% met current recommendations.

Studies examining pregnancy LTPA using self-reported instruments indicate a decrease in participation as pregnancy progresses.⁴³⁻⁴⁵ Rousham et al.⁴⁶ found via self-report and also objective monitoring that physical activity among a small sample of pregnant women (n=57)significantly decreased from the second to third trimester, suggesting that LTPA reduction may be most prominent in the final stages of pregnancy. Further investigations have indicated that both volume and intensity of LTPA (including walking) decrease during the second half of pregnancy.^{47,48} Evenson and Wen⁴⁹ expanded this research by examining nationallyrepresentative, free-living accelerometer data from 359 pregnant women. The investigators found that moderate to vigorous intensity physical activity was significantly lower for the third trimester (7.6 min/day) compared to the previous two trimesters, but that gestational activity was actually higher in the second trimester (14.3 min/day) than the first trimester (11.5 min/day). These trimester-specific physical activity trends may be partially a result of the dynamic physiological changes and discomforts common throughout gestation, which possibly include pregnancy-induced nausea in the first trimester and general physical discomfort and increased weight in the third trimester.

OVERVIEW OF BARRIERS TO LTPA DURING PREGNANCY

Over the past decade, various investigations have attempted to identify and gain a more comprehensive understanding of barriers to LTPA during pregnancy. Evenson et al.⁵ examined perceived LTPA barriers quantitatively among 1,535 pregnant women using a socioecologic framework. Nearly 85% of these women reported an intrapersonal barrier (an influence or characteristic experienced specifically within oneself) to be the primary reason for their lack of physical activity. These results (as well as those from other quantitative investigations) provide evidence to suggest that a lack of time, lack of energy, and physical discomfort to be the three
most common reasons why pregnant women are not physically active.^{3,5,50} Although quantitative investigations which have examined LTPA barriers during pregnancy (Table 2.1) generally indicate both physical and environment/lifestyle barriers limit LTPA during pregnancy, they provide little evidence of psychosocial influences. However, these investigations are limited by their homogeneous samples (mostly white, affluent) and their study purposes, which primarily involve only the identification of barriers, and only those that are considered to be most prominent.

A number of qualitative investigations (Table 2.2) have also been performed to examine barriers to LTPA. In contrast to the quantitative investigations, these studies have focused number on specific subgroups of pregnant women including low income-African American women,⁵¹ women living in a rural community,⁵² and women previously physically active prior to pregnancy.⁴ The qualitative methodology has allowed for a deeper examination of barriers, including how prominent each is among various populations. Findings from these qualitative investigations confirm a number of physical and environment/lifestyle barriers which keep pregnant women from being physically active. However, they also illuminate a myriad of psychosocial influences not evident from the quantitative investigations. The literature pertaining to each category of pregnancy LTPA barriers is described in tabular form below (Table 2.1, Table 2.2). Given the focus of this dissertation, the psychosocial factors are reviewed in upcoming sections of this chapter in slightly greater detail compared to the physical and environment/lifestyle factors.

STUDY	SAMPLE	BARRIERS		
		<u>Physical</u>	<u>Environment/</u> <u>Lifestyle</u>	<u>Psychosocial</u>
Duncombe et al. (2009)	n=158 2 nd /3 rd trimester Affluent	FatigueFeel "unwell"	• Lack time	
Evenson et al. (2009)	n=1,535 2 nd /3 rd trimester Affluent, mostly white	FatiguePhysical discomfort	Lack time	• Concern for baby
Cramp & Bray (2009)	n=160 2 nd /3 rd trimester Affluent, white	FatiguePhysical limitations	 Lack time Work Weather	Lack motivation
DaCosta & Ireland (2013)	n=84 1 st /2 nd trimester Affluent, white	• Fatigue	 Lack time Facility access	

Table 2.1. Percei	ived barriers to L'	TPA during pregna	ncv (quantitative	investigations).

STUDY	SAMPLE	BARRIERS		
		<u>Physical</u>	<u>Environment/</u> <u>Lifestyle</u>	<u>Psychosocial</u>
Symons Downs & Hausenblas (2004)	n=74 Affluent, mostly white	FatiguePhysical limitationsBody size	 Lack time Childcare Weather	Concern for babyLack motivation
Evenson et al. (2009)	n=58 2 nd /3 rd trimester Multi-racial	FatiguePhysical discomforts	ChildcareWeather	Concern for babyLack motivationConflicting adviceLack support
Cioffi et al. (2010)	n=19 All trimesters Affluent	 Physical discomforts Body size	 Lack time Childcare Work	 Concern for baby Lack motivation Uncertainty about physical activity
Weir et al. (2010)	n=14 3 rd trimester Overweight, Obese	FatiguePhysical discomfortsBody size	WorkFacility Access	Concern for babyLack motivationLack supportLack confidence
Hegaard et al. (2010)	n=19 3 rd trimester Nulliparous, Active prepregnancy	FatiguePhysical discomfortsBody size		 Concern for baby Lack motivation
Krans & Chang (2011)	n=34 All trimesters, Low SES, African American	FatiguePhysical discomfortsBody size	Lack timeChildcareFacility accessFinancial reasons	 Lack support Lack HCP guidance
Marshall et al. (2012)	n=88 All trimesters Rural community	FatiguePhysical discomforts	 Lack time Childcare Work	Concern for babyLack motivationConcern for self

 Table 2.2. Perceived barriers to LTPA during pregnancy (qualitative investigations).

PHYSICAL, ENVIRONMENTAL, AND LIFESTYLE INFLUENCES ON LTPA DURING PREGNANCY

Fatigue and Lack of Energy

The most common physical barrier to pregnant women being physically active relates to fatigue and lack of energy.⁵ This barrier is moderately high in more than 70% of pregnant women.⁵³ Various qualitative investigations examining barriers to pregnancy LTPA report that women are overwhelmed by how fatigued they are and that it decreases their motivation to be physically active.^{4,51,52} Additionally, the percentage of women who indicate pregnancy-related fatigue as a barrier to physical activity remains fairly consistent throughout gestation, with perhaps slightly elevated values during the first and third trimesters.^{3,50} During the first trimester, fatigue and lack of energy may partially be a result of the hormonal changes or increased metabolic demand common towards the beginning of pregnancy.^{54,55} However, during the third trimester, it has been suggested that fatigue is most likely the result of general physical discomforts which may disrupt sleeping periods.^{54,55}

Anthropometric Change and Musculoskeletal Discomforts

Pregnancy is characterized by women as being physically demanding and includes dynamic anthropometric changes that can make it difficult for pregnant women to manage even everyday tasks.⁵⁶ In addition to the notable cardiovascular and thermoregulatory adaptations to pregnancy, women typically experience an increase in body weight and abdominal mass as pregnancy progresses, as well as possible increases with joint laxity and lumbar lordosis.^{29,57} Often, these anatomical changes yield musculoskeletal discomforts such as back pain, leg pain, or hip pain,^{57,58} particularly toward the end of pregnancy. This has been confirmed by Duncombe et al.,³ who found that the percentage of women (n=158) experiencing physical

discomforts increases from the beginning of the second semester until well into the third trimester. The prevalence of these discomforts was assessed at 16-23 weeks, 24-31 weeks, and 32-38 weeks gestation, and included body soreness (40%, 66%, 73%), leg cramps (25%, 57%, 63%), groin pain (14%, 31%, 42%) and shortness of breath (52%, 68%, 80%). Such discomforts have been identified by pregnant women as a prominent barrier to being physically active and may be a primary reason for significant LTPA decreases during the third trimester.^{48,59} Among a sample of 1,535 pregnant women (27-30 weeks gestational age) from the central North Carolina area, 17% reported physical discomfort or pain as their primary barrier to physical activity.⁵ Moreover, the percentage of both nulliparous and multiparous pregnant women who cite musculoskeletal discomfort as a barrier to physical activity increases as gestation progresses.⁵⁰ Women who regularly experience such discomforts may be concerned that being physically active may be increase the risk of harm to her baby.⁶⁰ Although the sample is small and homogenous, a recent case study of five Danish pregnant women reported that the experience of these physical discomforts resulted in feelings of fear for the health of the baby.⁶¹

Pregnancy-Induced Nausea

Pregnancy-induced nausea or vomiting are experienced by 75-80% of pregnant women^{62,63} and may contribute to the discontinuance of certain modalities or intensities of LTPA from a woman's lifestyle.⁴ Researchers suggest this specific physical discomfort results from both biological and psychosocial factors.⁶⁴ Indeed, nausea and vomiting during pregnancy has been shown to be related to depressive symptoms and inversely related to social support.⁶⁵ Qualitative investigations seeking a deeper understanding of the barriers to pregnancy LTPA have reported nausea and vomiting play a role in preventing pregnant women being physically active.⁶⁶⁻⁶⁸ This may be particularly prominent during the first trimester.³ In contrast to other

investigations examining nausea and physical activity during pregnancy, Owe et al⁶⁹ conducted a large (n=34,908), population-based investigation which found that second-trimester pregnant women who experience any level of nausea were 22% less likely to participate in regular physical activity. However, physical activity levels did not differ between women who did and did not experience nausea in the third trimester.

Work/Childcare

Results from a recent quantitative investigation (n=1,535), showed that 24.6% of pregnant women believe a "lack of time" to be the primary reason for their lack of LTPA, more than any other barrier.⁵ In the case of this investigation (and others), "lack of time" encompasses work and or household responsibilities, given the time commitment both require. Pereira et al.⁴⁴ examined individual lifestyle factors that influence change in levels of physical activity among 1,442 pregnant women in the Boston, Massachusetts area and found that 60% regularly worked at a full-time occupation (\geq 35 hours/week). Although employment level during pregnancy did not significantly predict the likelihood of achieving sufficient levels of pregnancy physical activity, it did predict whether or not pregnant women became insufficiently active at 6 months postpartum. Work-related responsibilities have been reported in qualitative investigations as a prominent barrier to pregnancy LTPA;^{52,70,71} however, the frequency at which this is reported appears to decrease towards the end of pregnancy (24 weeks, 13.3%; 30 weeks, 7.7%; 36 weeks, 4.2%).⁵⁰ Like work-related barriers to pregnancy LTPA, childcare has often been reported by pregnant women to limit their LTPA.^{5,51,52,68,70} Pereira et al.⁴⁴ also examined the influence of childcare and found that women with at least one child at home were 58% more likely to engage in insufficient levels of physical activity (≥ 150 minutes/week) compared to women with no

children yet in their care. However, this relationship has not found elsewhere in the literature, including a population-based investigation using BRFSS data.⁴²

Facility Access

Access to exercise gyms and public recreational facilities are listed in quantitative investigations by a small percentage of women as a main barrier to pregnancy LTPA. However, as previously mentioned, these investigations are limited by their homogenous samples, namely affluent, high SES, mostly white populations. Recently, Krans and Chang⁵¹ used a qualitative design to assess barriers to 34 low SES, African American pregnant women from an urban community. Their findings highlight the prominence of environmental barriers in this population, with pregnant women reporting minimal public resources for physical activity, limited space for recreation, and outdated facilities. Furthermore, many study participants discussed how financial constraints preclude them from purchasing memberships to local gyms or private wellness facilities.

PSYCHOSOCIAL INFLUENCES ON LTPA DURING PREGNANCY

The extent to which various psychosocial factors influence pregnant women's LTPA behavior is unclear and necessitates further investigation. Generally, how pregnant women perceive the pregnancy experience and physical activity participation may dictate their behavior. Likewise, prenatal social support and discussions with prenatal HCPs (which may act as a form of informative support) may be effective mechanisms by which perceptions are formed or reinforced, and pregnancy LTPA is influenced. By and large, prior investigations attempting to investigate these influences among pregnant women are few and are limited by small, homogeneous samples and imprecise means of assessment. Risk perceptions comprise both perceived severity and perceived susceptibility. Perceived severity is how severe an individual believes a specific risk to be, while perceived susceptibility is how susceptible the individual believes they are to that specific risk.⁷² For the purposes of this dissertation, the specific risk was defined as harm to the baby during pregnancy. Efficacy beliefs comprise both response efficacy and self-efficacy. Response efficacy is how strongly the individual believes that engaging in a specific behavior can protect against that specific aforementioned risk, and self-efficacy is how confident the individual is that he/she can successfully engage in that specific behavior.⁷² This dissertation defined the specific behavior as LTPA during pregnancy, and in accordance with current recommendations for both moderate and vigorous-intensity physical activity.¹⁰ In contrast to pregnant women who have high efficacy beliefs regarding LTPA during pregnancy and also those who are undecided on their beliefs for the health benefits of LTPA, some women may believe LTPA during pregnancy to be dangerous for their baby. For this purpose, risk perceptions of physical activity were also assessed.

Pregnancy Risk Perceptions

In addition to anatomical and physiological discomforts experienced throughout gestation, there is evidence that the experience of pregnancy is also psychologically challenging for many women. However, this small body of evidence consists primarily of investigations attempting to assess the complex emotions and feelings that expectant mothers have towards childbirth, immediate postnatal recovery, and postpartum life-alteration among small, homogeneous samples. While pregnancy and childbirth can be an empowering and self-identifying experience,^{73,74} some pregnant women have reported high levels of anxiety, depression, and stressful life events.⁷⁵ However, results of qualitative investigations designed to specifically examine barriers to pregnancy LTPA show it is not uncommon for pregnant women

to have feelings of uncertainty.^{2,51} Such feelings appear to be particularly common among firsttime mothers, who have no previous experience with pregnancy and childbirth.⁷⁶

Risk perceptions with respect to pregnancy appear to be complex and multi-faceted. Melender⁷⁶ investigated feelings and experiences of fear during pregnancy via questionnaire among 329 pregnant women (16-40 weeks gestational age) from Finland and showed that fears regarding childbirth, cesarean section, postpartum family life as well as regarding health of mother and baby were more common among nulliparous than multiparous women. For some pregnant women, the fear they have during pregnancy is focused specifically on possible harm to their babies.⁷⁶ Not surprisingly, adverse outcomes that women have personally experienced or vicariously experienced (most likely via a family member or close friend) from previous pregnancies may exacerbate these fears.⁷⁶

Eide et al.⁷⁷ examined the relationship between mothers' fear for babies' health and their experience of a specific traumatic experiences prior to and during pregnancy among a large cohort of pregnant women (n=58,139) from Norway. Investigators found that the odds of having strong worries about the babies health were significantly and substantially greater among pregnant women who reported a negative experience for a previous pregnancy (OR=2.16, CI=1.79-2.63) as compared to pregnant women who had only positive experiences previously. However, "negative experience" was not defined by the study investigators. Additionally, the odds of strong worries were significantly greater for pregnant women who felt distrust for antenatal care (OR=1.75, CI=1.55-1.99), reported pelvic pain (OR=1.14, CI=1.04-1.25), and experienced childhood physical abuse (OR=1.62, CI=1.26-2.08), sexual abuse (OR=1.30, CI=1.03-1.64), and both (OR=2.10, CI=1.68-2.62), compared to those women who had not. A possible limitation to these findings, however, is that "worry for the baby's health" was assessed

via a single question asking the frequency that the mother worries. This result was then dichotomized into "strong" and "less than strong" for the purposes of this investigation. While few investigations assess risk perceptions specific to the baby's health, perceived severity appears to only have been examined generally. It appears that the susceptibility that a pregnant woman feels that her baby could experience harm has not been assessed.

LTPA Response Efficacy

Pregnant women's perceptions of whether LTPA specifically reduces the risk of harm to the baby have not yet been investigated. Evenson and Bradley⁷⁸ conducted a study assessing the physical activity beliefs of 1,306 mostly white and well-educated pregnant women (27-30 weeks gestational age). Approximately 73% of pregnant women believed moderate intensity physical activity provided some benefit, but only 13% believed in the benefit of vigorous intensity physical activity. However, this investigation did not specify what "benefit" referred to or ask follow-up questions pertaining to whether physical activity is protective against specific health risks.

Various qualitative investigations have evaluated how beneficial pregnant women believe regular LTPA to be. One such investigation, which involved a small sample (n=19) of pregnant women queried during all three trimesters, found that pregnant women believe LTPA provides both physical and mental health benefits.⁷⁰ Specifically, these women reported stress reduction, increased energy, maintenance of fitness levels, and preparation for the difficulty of labor as benefits. In another investigation, pregnant women who were active prepregnancy (n=19), reported that physical activity during pregnancy increased energy levels, feelings of happiness and relaxation, decreased gestational weight gain, and improved back pain and blood

circulation.⁴ Weir et al.⁷¹ examined LTPA beliefs of overweight and obese pregnant women (n=14). Participants most frequently reported regaining prepregnancy body weight as a benefit of physical activity; however, a generally easier pregnancy/labor and improved mood were also cited as benefits. However, when discussing the health benefits of physical activity, pregnant women in each of these investigations referred only to their own personal health (rather than the health of the baby). Although pregnant women have reported the risks of pregnancy physical activity as a part of various qualitative studies, it appears only one investigation exists in which pregnant women (n=34, low-income, African American) openly discuss their beliefs that physical activity is healthy for their baby.⁵¹ In many of these qualitative investigations, women were encouraged to openly discuss or describe their beliefs, yet few voiced a belief in physical activity health benefits for the baby. Thus, it is possible that pregnant women are more convinced of the health benefits that LTPA provides to them personally compared to health benefits provided to their babies.

Perceived health benefits of LTPA during pregnancy have also been assessed via survey designs. Symons Downs and Hausenblaus⁷⁹ utilized an Exercise Beliefs Questionnaire that asked 89 pregnant women (mostly-white, highly-educated) to list the health benefits that they believe physical activity provides. Approximately 34% of pregnant women listed an improvement in mood as a benefit to LTPA, compared to nearly 30% who believed in an increase in energy, and 21% who believed in the maintenance of fitness. Approximately 15% listed an improvement in labor and delivery as a health benefit of LTPA. Duncombe et al.³ longitudinally assessed reasons second and third trimester pregnant women (n=158, high SES) participated in LTPA. For three different gestational age ranges (16-23 weeks, 24-31 weeks, 32-38 weeks) the percentage of women who exercised for various reasons decreased. These included: to maintain

fitness (74.2%, 64.7%, 52.8%), lose weight (6.3%, 3.3%, 2.1%), relive stress (34.6%, 30.7%, 28.2%), and experience enjoyment (53.5%, 52.3%, 38.7%).

LTPA Self-Efficacy

Researchers have shown that physical activity self-efficacy plays a critical role in determining pregnancy LTPA. Hinton and Olsen⁸⁰ a prospective investigation among 622 pregnant women from upstate New York (mostly-white) and found that exercise self-efficacy significantly predicted increased self-reported pregnancy LTPA compared to prepregnancy levels (β =0.09). Hausenblas and Symons Downs⁸¹ used the theory of planned behavior to investigate exercise behavior among first trimester pregnant women (n=104, mostly-white, high-SES) and found that perceived behavioral control (which conceptually is similar to self-efficacy) predicted exercise behavior. Symons Downs and Hausenblas⁷⁹ used the same construct to investigate exercise behavior among second trimester pregnant women (n=89, mostly-white, high-SES). However, the investigators found the results somewhat contradicted the findings among first trimester women, in that intention, rather than perceived behavioral control (β =0.17, p=NS), predicted exercise behavior. Moreover, their investigation revealed that the strongest predictor of exercise intention was not perceived behavioral control, but rather attitude. The difference between the results of these two investigations possibly infers that first trimester women have higher physical activity self-efficacy then do second trimester women. This is plausible given that the second trimester is characterized by substantial fetal growth compared to the first trimester. Physical changes and discomforts become more apparent, and the mother can begin to feel the baby kick. It is possible that this could result in women feeling like they should be more cautious with, or are unable to participate in LTPA, thereby decreasing LTPA efficacy

beliefs. If this is the case, it would be despite the improvement in fatigue and nausea levels commonly experienced as women progress from the first to the second trimester.

Cramp et al.⁵⁰ examined exercise self-efficacy and barrier self-efficacy (belief to be able to overcome barriers to physical activity) via questionnaire among 160 pregnant women (18-30 weeks gestational age, mostly-white, high-SES, highly-educated) with the intent to determine whether either predicts LTPA. Findings from this investigation showed that exercise self-efficacy predicted current LTPA from gestational weeks 18-24 (β =0.32, R^2 =0.26) and 30-36 (β =0.41, R^2 =0.37) and barrier self-efficacy from weeks 24-30 (β =0.40, R^2 =0.32). This relationship is confirmed qualitatively by Hegaard et al.,⁴ who retrospectively (at 37 weeks GA) assessed physical activity barriers and experiences throughout pregnancy of 20 pregnant women, who were physically active prepregnancy. Findings revealed that all participants continued to be active throughout pregnancy, the majority maintaining their LTPA levels by altering physical activity modality and intensity as pregnancy progressed to lessen their concerns of possible harm to the baby. The investigators suggest that study participants were able to accomplish this because they had high levels of self-efficacy to overcome physical activity barriers by adopting a slightly different exercise plan.

Da Costa and Ireland⁸² examined pregnancy LTPA influences among 84 first trimester previously active and inactive women (mostly-white, high-SES). Questionnaires were provided to participants, with the purpose of specifically assessing exercise social support, depressive symptoms, physical activity beliefs and barriers, fatigue, and physical activity self-efficacy. Investigators found overall that physical activity self-efficacy was associated with stronger beliefs of LTPA benefits among both previously active (β =0.49, R^2 =0.24) and inactive women (β =0.61, R^2 =0.36). Additionally, low physical activity-self efficacy was related to perceived

greater impact of LTPA barriers among both the previously active (β = -0.48, R^2 =0.64) and inactive groups (β = -0.33, R^2 =0.35).

It appears only one investigation has examined specifically how pregnancy risk perceptions (perceived vulnerability and severity) and LTPA efficacy beliefs (response and selfefficacy) predict LTPA behavior.⁸³ The investigators utilized Protection Motivation Theory (PMT)⁸⁴ in assessing 208 pregnant women in their second or third trimester for each of these variables, as well as goal intention, implementation intention, and physical activity. PMT posits that in the face of a threat, an individual protects themselves based on the perceived severity and vulnerability of the threat, as well as the response and self-efficacy they have towards a protective behavior.⁸⁵ The risk/efficacy variables are virtually the same for this theory and the RPA; however, PMT focuses more on fear appraisal (risk and coping) in messaging and claims that goal intention and implementation intention mediate the relationship between the four risk/efficacy variables and the behavior. Furthermore, the RPA (an extremely young framework) jointly considers the risk variables (perceived severity and susceptibility) as well as the efficacy variables (response and self-efficacy), and contextualizes them as attributes of an individual rather than the appraisal of a message. In this investigation (which utilized PMT), ⁸³ a subgroup of pregnant women (n=105) received an informational brochure regarding vulnerability and severity of adverse pregnancy conditions as well as the response efficacy of physical activity in reducing that risk and suggestions about how to increase exercise self-efficacy. The investigators found that perceived susceptibility (r=0.26), response efficacy (r=0.66), and selfefficacy (r=0.55) were significantly related to goal intention, but that when examined via multiple regression, only response efficacy and self-efficacy were significant predictors (β =0.48, β =0.34, R^2 =0.51). Goal intention in turn predicted implementation intention, which then

predicted LTPA behavior. However, it should be mentioned that this investigation did not specifically characterize the risk as harm to the baby, but rather as "developing health problems during pregnancy."

LTPA Risk Perceptions

Risk perceptions that pregnant women have towards LTPA has received attention recently in the scientific literature. In a cross-sectional investigation conducted by Mudd et al.,⁸⁶ safety perceptions of gestational physical activity were assessed in an ethnically diverse sample of 296 pregnant women (12-36 weeks GA) from nine prenatal care practices in western Michigan. Although perceived safety of physical activity was assessed via five-point Likert scale, the data were dichotomized for analytic purposes into "safe" (safe and somewhat safe) and "unsafe/unsure" (unsure, somewhat unsafe, very unsafe). Approximately 89% of the sample believed that it was safe to perform moderate physical activity and 80% indicated their intent to be active during pregnancy. In contrast, only 36% believed participating in vigorous physical activity to be safe. Specifically, pregnant women with lower socioeconomic status (SES), less than high school education, or who identified themselves as a race/ethnicity other than non-Hispanic white, associated feelings of moderate-intensity activity with being unsafe. Similarly, pregnant women who indicated less than high school education, nulliparity, or Hispanic race/ethnicity had higher odds of unsafe perceptions about vigorous-intensity physical activity.

Duncombe et al.³ examined perceptions towards LTPA during pregnancy among 158 pregnant women and found somewhat different results. Specifically, 77% of women believed participating in moderate activity three to five times a week to be somewhat or very safe, whereas 11% believed it unsafe. For moderate activity participation greater than five days per

week, 53% believed moderate activity greater than five times per week to be somewhat or very safe, whereas 27% believed it to be somewhat unsafe. For vigorous physical activity, 6% or the sample believed three to five times per week was somewhat or very safe, whereas 82% believed it to be unsafe. Pregnant women also believed greater than five days per week of vigorous intensity activity to be extremely unsafe (2.5% somewhat safe, 85% unsafe. These findings indicate that pregnant women perceive physical activity to be substantially less safe than what Mudd et al.⁸⁶ reported. This difference may be due to the assessment physical activity perceptions. Specifically, Duncombe et al.³ framed questions regarding the safety of a physical activity intensity with the frequency of such activity per week (i.e. number of days), whereas Mudd et al.⁸⁶ did not specify the frequency, but rather asked about participation at that intensity in general. It is important to note that neither investigation assessed risk/safety perceptions of physical activity specifically with respect to mother or the baby, but rather asked about perceptions in general.

The perception of LTPA risk has been qualitatively assessed among pregnant women who were physically active prepregnancy. Hegaard et a.1⁴ found that every pregnant women assessed in their investigation (n=19) expressed at least some worry regarding the effects of being physically active during pregnancy, regardless of their moderately high prepregnancy LTPA. Rather than discontinuing physical activity participation, most participants in this investigation, despite their feelings of concern, chose to continue to be physically active (rather than discontinue) by modifying LTPA. More specifically, these women chose to switch activity modalities. Most replaced those of vigorous intensity (such as jogging and strength training) with those of moderate-intensity (such as swimming). Additionally, participants from this investigation who had experienced fertility treatment, previous miscarriage, or who knew

someone who had experienced miscarriage expressed particular concern about harming their baby. Likewise, Evenson et al.⁵ found that potential past pregnancy complications, such as fertility issues, are prevalent among women (n=58) who cite fear of harming their unborn baby as their primary barrier to LTPA.

Fear of harming the unborn child may be the most notable reason why pregnant women are particularly avoidant of vigorous-intensity physical activity.⁴ Overall, it appears that pregnant women do not perceive moderate physical activity to be risky as it pertains to them, but may not be convinced regarding the health of their baby. It appears that vigorous physical activity is not trusted by the majority of pregnant women who have been studied. Risk perceptions and fears appear to stem, at least in part, from feelings of uncertainty regarding the health effects of LTPA participation.⁷⁰

Physical Activity Discussions with Prenatal Healthcare Providers

The extent to which LTPA behavior changes throughout pregnancy may be partially a product of the physical activity information received from various sources.^{2,5,8} If true, the providers of such information perhaps play a critical role in determining the LTPA among pregnant women, given the possible influence that information has on beliefs and perceptions. Prenatal HCPs are in the unique and influential position to advocate for recommended levels of gestational physical activity and construct personalized activity plans for pregnant women. However, for this potential influence to take effect, prenatal HCPs must be convinced of the beneficial effects of gestational physical activity and also be committed to helping pregnant women reach at least minimal levels of activity.

Preliminary findings indicate that physical activity discussions between prenatal HCP and pregnant women do not occur frequently enough, and consist of outdated or inaccurate information. Clarke and Gross² found that approximately one in five pregnant women report receiving confusing and or contradictory advice regarding physical activity at some point during pregnancy. Moreover, Ferrari et al.⁸⁷ found that pregnant women rarely received gestational physical activity advice and recommendations from prenatal HCPs, confirming the findings of Clarke and Gross² as well as Evenson and Pompeii⁸⁸ who found that only 18% and 23.5% of pregnant women received such instruction. Slightly better results were reported by Krans et al.,⁸⁹ who found that 31% of pregnant women engaged in a physician-initiated physical activity discussion at some point during gestation. However when assessed from the viewpoint of obstetricians, 52% report discussing exercise with their patients.⁹⁰ Moreover, Bauer et al.⁹¹ found that 66% of prenatal physician offices gave exercise advice to their patients, although such information is less likely to occur among younger physicians. The possibility that HCPs who typically prescribe pregnancy LTPA are more likely to participate in these investigations may account for the patient-provider discrepancy in the reported nature of these discussions.

Ferrari et al⁸⁷ qualitatively assessed pregnant women's (n=58, multi-race) perceptions of HCP physical activity via 13 race-stratified focus groups. Participants felt they were rarely given physical activity advice from their prenatal HCP, and that when such discussions occurred, they were dissatisfied with the advice given. More specifically, the findings indicated that pregnant women often perceive physical activity advice from HCPs to be vague and somewhat unclear. In certain cases among pregnant women, the physician or practitioner may be extremely conservative with activity recommendations.⁹² It is also possible that the HCP does not have a sufficient knowledge of the current physical activity research or familiarity with the most recent

physical activity recommendations. For example, the findings of Entin et al.⁹⁰ show that 62% of obstetricians still specify a maximum heart rate during prenatal exercise and more than 50% suggest reduced activity during the third trimester for healthy pregnancies, neither of which is part of the most recent guidelines. Likewise, Bauer et al.⁹¹ found that 64% of prenatal health care providers caution pregnant women that heart rate during activity should not exceed 140 beats per minute, a recommendation that was removed from all guidelines after 1985. Thus, prenatal HCPs' expertise with respect to pregnancy LTPA is questionable.

It appears that obstetric healthcare professionals may not receive the training necessary to advocate for gestational physical activity. Leiferman et al.⁹³ recently administered a closed-item survey to prenatal health care providers, including obstetricians, midwives, and family medicine physicians providing obstetric care. The investigators found that 17% of these providers had never received any professional training regarding gestational physical activity, and of the providers that did, 69% believed the instruction to be "fair" or "poor". Additionally, the investigators found that only 43% of providers believed their patients followed the gestational physical activity advice they provided.⁹³ Therefore, provider-led physical activity discussions with pregnant women may be insufficient or vague if the providers perceive their patients are not accepting or implementing the recommendations given.

The impact of prenatal HCPs on physical activity behavior among pregnant women is not well understood. However, the preliminary evidence reviewed above suggests the frequency and quality of physical activity discussions between HCPs and pregnant women are less than optimal. Despite this, prenatal care appointments remain a promising avenue for supportive messages to be communicated by HCPs, possibly with the intent of increasing pregnant women's response and or self-efficacy of LTPA. In general, understanding how individuals respond or

will respond to supportive messages is extremely complex. Burleson⁹⁴ suggests four critical factors in determining the outcome of such communication: the actual message, the source of the message, the interactional context, and the recipient of the message. Prenatal HCPs have at least partial control over the first three factors if they choose to deliver supportive physical activity messages to patients.

The actual HCP message should naturally be consistent with the most current physical activity guidelines, but also may be most effective at improving pregnancy LTPA if highly person-centered,⁹⁵ meaning the message directly recognizes the feelings and challenges of the pregnant woman. In other words, these discussions may be most effective if both provider and patient participate, including the pregnant woman's expression of concerns and difficulties towards LTPA and the provider's acknowledgement and understanding of these as well as the provision of advice and personalized recommendations. HCPs are optimal suppliers of supportive messages given their occupational position and the opportunity they often have to communicate one-on-one with patients. MacGeorge et al.⁹⁶ suggest that a messenger's credibility and expressed confidence in the message increase the recipient's perception of the message and also the possibility of adhering to the message content. Regarding the context in which the supportive message is given, discussions between prenatal HCPs and pregnant women will most often occur in a professional setting, where privacy and personal communication can be ensured. Additionally, a pregnant woman may consider such discussions to be highly relevant and more important than in non-pregnant situations, given the concern she may feel for the health of her baby. In any event, a great deal is still unknown regarding the current quality of these discussions as well as pregnant women's perceptions of prenatal HCPs' advice. These discussions must be assessed more precisely to understand their true impact on pregnancy LTPA.

Furthermore, it is necessary to establish whether certain subgroups of pregnant women are more likely to engage in physical activity discussions with prenatal HCPs and perceive those discussions to be meaningful.

Physical Activity Social Support

The concept of social support is generally considered to be an act by one individual that aides another in carrying out a certain task or goal successfully.⁹⁷ Historically difficult to assess given its complexity, social support is currently considered a multidimensional construct when examining how it relates to certain health behaviors.^{98,99} Four broad categories are commonly utilized in the assessment of social support: emotional social support, informational social support, belonging social support, and tangible social support (Figure 2.2).¹⁰⁰ However, it is difficult to capture social support from each of these dimensions to determine how they collectively influence the behavior. Regardless of social support's operational breakdown, a sizeable array of evidence has been provided that it is potentially a crucial element with respect to to LTPA during pregnancy. More specifically, social support, as complex as it is to assess, may act as the mechanism by which common barriers to gestational physical activity are overcome.

Emotional	Informational	Belonging	Tangible
• Providing concern, trust, attachment, encouragement, or affection	•Providing adive, direction, or information	• Providing companionship or affiliation with others	• Providing direct aid, services, or assistance

Figure 2.2. Desciption of commonly-used categories for social support.

In general, social support significantly predicts quality of life among pregnant women.¹⁰¹ Prominent influences of social support also pertain to labor and delivery, including labor difficulty, birth outcomes, and fetal development both prenatally and postnatally.¹⁰²⁻¹⁰⁶ From a psychological perspective, social support during pregnancy has been shown to be closely related to psychological well-being, including low levels of anxiety, stress, and depressive symptoms prenatally and postnatally.¹⁰⁷⁻¹⁰⁹

Among 84 first-trimester pregnant women (mostly-white, high-SES), Da Costa and Ireland⁸² found social support to be inversely related to reported barriers to gestational physical activity among women who were the least active prepregnancy (β = -0.40, R^2 =0.35). However, the authors suggest that low levels of social support may not significantly decrease LTPA participation among women who were physically active prior to pregnancy. Furthermore, qualitative investigations have reported that pregnant women believe social support from family or friends to be critical in enabling them to overcome barriers to LTPA.^{5,70} Among pregnant women who have childcare responsibilities, tangible social support from family or friends in the form of babysitting is crucial. For low-income pregnant women who may struggle with environmental barriers to physical activity , social support provided via group exercise may be particularly crucial to achieving sufficient physical activity levels. These women report that not only does social support provide a safer environment in which women can be active, but also it assists women in overcoming feelings of self-conciousness while increasing motivation to participate in physical activity.⁵¹

Informational social support from family or friends may have a critical impact on minimizing perceptions of fear of harming the fetus as a result of gestational physical activity. Clarke and Gross² conducted prospective investigation among 57 pregnant women and found

that nearly all received some physical activity advice at one point during their pregnancy, with approximately half of the women reporting on more than three occasions. However, often this advice is contradictory to what pregnant women may have heard from other sources, which could increase uncertainty towards the health benefit of physical activity. Although there is evidence that pregnant women seek out physical activity information in books and magazines early in pregnancy,⁶⁰ family and friends are clearly the more preferred and constant source of physical activity advice throughout pregnancy.⁶⁰ Pregnant women also have reported that talking about and gaining more knowledge about pregnancy-related concerns with their families can help alleviate potential fears during pregnancy.⁷⁶ In fact, pregnant women have suggested that physical activity advice and information they receive from family outweighs the advice received from prenatal HCPs.⁵ However, it must also be considered that the strong influence of familial informational support towards pregnant women may be negative, if unconditional avoidance of physical activity is suggested. For example, Clarke and Gross² found that family discouragement of LTPA at 25 weeks gestational age occurs among 59% of pregnant women. At 34 weeks gestational age, such discouragement occurs with 85% of pregnant women. Such discouragement of gestational physical activity from family members may be even more prominent among less healthy subgroups of pregnant women, such as those who are overweight or obese.⁷¹

Although more research is required to understand the nature of physical activity social support during pregnancy, the preliminary consensus highlights the important role it plays in allowing pregnant women to be active. The importance of physical activity social support may be best understood when assessed in relation to specific exercise barriers; however, it is clear that all dimensions of social support play a role in overcoming their collective disabling influence.

Therefore researchers should attempt to assess social support from an emotional, informational, tangeble, and esteem standpoint. Additionally, support that pregnant women receive from their social network, including family, friends, and significant others, should be assessed individually as well as collectively, in order to understand the most influential sources of physial activity social support. This will allow for the examination social support differences between subgroups of pregnant women, for each of these individual sources.

UTILIZING THE RISK PERCEPTION ATTITUDE FRAMEWORK

Various theoretical approaches have been utilized to evaluate to understanding risk and efficacy as they pertain to preventative behavior, including Rosenstock's Health Belief Model (HBM),¹¹⁰ Roger's Protection Motivation Theory (PMT),⁸⁴ and Witte's Extended Parallel Process Model (EPPM).⁷² The HBM or the PMT individually consider the variables which make up risk (perceived severity and susceptibility) and efficacy (response and self-efficacy) in the EPPM and RPA. Further differences from the RPA include the HBM's integration of external influences (e.g. cues to action, barriers) and the PMT's posit that intention mediates perceptions/beliefs and behavior. The RPA⁶ is in actuality a derivation from the EPPM, which focuses heavily on how a *threat* inherent in a message is processed by the individual and which results in either danger-control or fear-control action.¹¹¹ In contrast, the RPA centers on perceived *risk*, an attribute of the individual (rather than a message). Efficacy is the other essential component of the RPA in that it has also been shown to moderate the relationship between risk perception and the preventative health behavior.

The RPA posits that an individual's personal perception of a risk and efficacy beliefs for a behavior jointly govern the intent to engage in a specific health behavior. Utilizing the RPA

allows for participants to be categorized into one of four distinct attitudinal groups, which are created via combinations of risk perceptions (high/low) and efficacy beliefs (high/low). Theoretically, the RPA should allow health interventions to target the needs of attitudinally similar individuals.⁶ The EPPM posits that 1) those with high risk perceptions and high efficacy beliefs will be more likely to engage in the behavior compared to those with high risk perceptions and low efficacy beliefs and also that 2) for those with low risk perceptions, efficacy beliefs will have minimal effect on the behavior.^{72,111} Likewise, the RPA adopts these hypotheses, given the four attitudinal groups (responsive, proactive, avoidance, indifference) are made up of high/low combinations of risk perceptions and efficacy beliefs (Figure 2.3) (these will be further described in Chapter 3 of this dissertation). Thus, both the RPA and EPPM suggest that the high risk/high efficacy group (responsive) should be more motivated and likely to participate in the protective behavior than the other attitudinal groups. While the EPPM theorizes the remaining three groups should not significantly differ, the RPA additionally suggests the indifferent (low risk/low efficacy) group will be less motivated to participate in the protective behavior compared to the proactive (low risk/high efficacy) and avoidant (high risk/low efficacy) groups.



Figure 2.3. Risk percpetion and efficacy belief attitudinal groups created within the RPA.

Compared to the comprehensive and well-researched EPPM literature base, RPA research is in its infancy and has yet to provide a consistent trend regarding attitudinal group differences across investigations. However, notable RPA investigations have been conducted over the past decade, some with the intent to manipulate risk perceptions, and others not. Given that this dissertation does not seek to alter perceptions through a prepared message, RPA investigations that abstain from risk or efficacy manipulation are most relevant to be reviewed. Rimal and Real⁶ conducted a telephone survey among 319 adults in the College Station, Texas area with the purpose of determining whether the RPA was a useful tool with respect to skin cancer (risk) and skin cancer-related protective behaviors. Investigators found that the responsive group was significantly more likely to seek information on skin cancer preventative

behaviors and regularly use sunscreen than the avoidance group. Additionally, the proactive group was significantly more likely to seek information, use sunscreen, and engage in skin-cancer self-inspections than the indifferent group.

Real¹¹² investigated perceptions of workplace safety and information seeking among a random sample of production workers (n=645) at a manufacturing facility utilizing the RPA. Hierarchical regression analyses revealed the interaction between perceived risk and safety beliefs, after controlling for prior worksite injury, were related to intention for and engaging in safety behavior. The investigator also reported that the safety behavior (such as wearing protective equipment), intention to engage in safety behavior, and intention to seek information were greater for the responsive group compared to the avoidant group, and also the proactive group as compared to the indifferent group.

Rimal et al.¹¹³ used the RPA to explore the joint influence of risk perception of HIV/AIDS and the efficacy beliefs of preventative behaviors on the actual participating in those behaviors among 890 Malawi residents. Findings from hierarchical regression revealed that the interaction of HIV/AIDS risk and preventative behavior efficacy predicted the intention to practice monogamy. Moreover, the responsive group had higher intentions to be monogamous compared to all other attitudinal groups. Rimal and Juon¹¹⁴ sought to utilize the RPA to examine breast cancer preventative behavior among 413 immigrant Indian women. Similar to previous investigations, breast cancer risk perceptions and preventative behavior efficacy beliefs significantly predicted the preventative behaviors of information seeking, breast selfexaminations, and clinical breast screenings. Information seeking was significantly greater and self-examinations were significantly more frequent among responsive and proactive groups as compared to avoidant and indifferent groups.

The RPA appears to be an optimal instrument for use within this dissertation given the concern a pregnant woman may feel for the health of her unborn baby. This framework can reveal the joint influence of pregnancy risk perceptions and physical activity efficacy beliefs on LTPA among pregnant women and also provide useful information for future interventions regarding prenatal attitudinal groups.

THE POTENTIAL INFLUENCE OF RELIGION ON LTPA DURING PREGNANCY

Another psychosocial factor which potentially influences LTPA behavior during pregnancy is religion, or rather religious beliefs. Some women have reported pregnancy, labor, and childbirth to be self-affirming events that may result in feelings of personal empowerment and strength.^{73,115} For this reason, pregnancy has also been described as a time of spiritual connectedness, some women specifically reporting that spirituality positively affects their pregnancy via comfort, guidance, support, and increased confidence.¹¹⁶ Quantitative and qualitative investigations with small samples have reported that women with high-risk pregnancies seem to demonstrate a particularly great reliance on religious beliefs and practices,^{117,118} given the uncertainty and worry they feel.

It appears that religious beliefs during pregnancy may have some impact on maternalfetal health. More specifically, spirituality and religiosity have been shown to be inversely related to adverse health behaviors, such as smoking, drinking, and marijuana use among pregnant women.^{119,120} Kim and Sobal¹²¹ found a significant relationship between religious commitment and physical activity among non-pregnant women after controlling for demographics including, age, race, marital status, employment, and education. However, in this investigation, findings were only significant when religious commitment was conceptualized as

monetary donations, a variable which may be influenced by various other factors beyond spirituality. The relationship between religiosity and physical activity during pregnancy has not been evaluated specifically. However, some pregnant women report effects from physical activity to be similar to those from spiritual experiences, including feelings of peace and enlightenment.⁷⁰ The influence of spirituality and religion on pregnancy health behaviors should be assessed further, particularly as it pertains to dietary habits and LTPA.

The Case of Mormonism

Given that some religious denominations advocate for health behaviors and also a traditional religious emphasis on having children, the question arises as to whether physical activity participation and also psychosocial influences of physical activity are different between religious subgroups of pregnant women. The Church of Jesus Christ of Latter-day Saints, otherwise known as Mormons, is of particular interest. The Latter-day Saints (LDS) church is currently the fourth largest religious denomination in United States with over 6 million members, who comprise some 14 million members worldwide.¹²²

For LDS members, the family unit is considered to be of divine origin. LDS leadership has repeatedly reiterated that the supposed ancient commandment given to "multiply and replenish the Earth" remains in effect today.¹²³ Moreover, many within the LDS church believe that within the family unit, the greatest satisfaction and feelings of happiness can be found. Additionally, LDS doctrine teaches that family relationships, those between husbands, wives, and children, endure in some existence after death. Because of this teaching that the family is "eternal" and the source of ultimate happiness, LDS members view marriage, familial relationships, and raising children as deeply sacred.¹²⁴

Decisions pertaining to when LDS parents should begin a family or attempt to have a child is considered extremely personal and something to be prayerfully considered between husband and wife. Many LDS members believe they can receive revelation from God pertaining to when to begin or extend their family. Because of the divine direction that many feel they receive in this regard, motherhood is typically viewed by LDS women as one of the most important roles they can have.¹²⁵ Thus, the experience of pregnancy and childbirth is considered an extremely spiritual and inherently sacred (although not an easy) experience by many LDS women.¹²⁶ Not surprisingly, LDS women have indicated the intention to have significantly more children and consistently had higher rates of childbearing compared to other Judeo-Christian faiths common in North America.¹²⁷ It has also been shown that mean parity is higher for religiously-active LDS women.¹²⁸

LDS members also fundamentally believe and live by a strict health code, known as the "Word of Wisdom" which includes the abstinence to alcohol, tobacco, coffee, black tea, illegal drugs, and other addictive substances. As a part of this health code, LDS members are expected to make healthy dietary choices and be physically active. While adherence to this health code has not be specifically examined, a recent investigation examining cancer risk factors and religious practices among more than 800 Utah residents found that only 0.4% of religiously active LDS members currently consume alcohol and 0% engage in smoking behavior.¹²⁹ Consequently, LDS men and women have been found to have lower rates of cardiovascular events and cancer, as well as an increased longevity compared to non-LDS members.¹³⁰⁻¹³² While many non-LDS individuals certainly live by a similar health code, the LDS faith considers the "Word of Wisdom" to be doctrine, acting literally as if a commandment from God. Thus,

given LDS members' views on having children and on living a healthy lifestyle, it is plausible that differences exist regarding LTPA, perceptions towards LTPA, and other potential influences of LTPA between LDS pregnant women and non-LDS pregnant women.

SUMMARY

The health benefits of regular physical activity to women are many, and suggest a protective effect during pregnancy. Despite this, many pregnant women do not engage in sufficient levels of LTPA. In addition to the commonly reported reasons which keep nonpregnant women from being physically active, pregnancy overlays a number of additional barriers, which include discomforts, fears, and lack of support. The influence of both pregnant women's pregnancy risk perceptions and physical activity efficacy beliefs on LTPA has received some attention in the scientific literature over the past decade. However, more research, utilizing more precise assessments of these beliefs, is clearly needed. Additionally, the combined influence of pregnancy risk perceptions and physical activity efficacy beliefs has not yet been explored. The impact of social support and prenatal HCPs has been considered as a part of research investigations only recently. Before effective physical activity interventions can be designed around these psychosocial factors of pregnancy LTPA, the influence of each should be more thoroughly understood. Few investigations have attempted to do this systematically. Religiosity is also a potential factor to be considered, given its potential psychosocial elements. Although the relationship between religion and physical activity has not been explored among pregnant women, specific religious beliefs (such as those found in the LDS church) may dictate this health behavior as uniquely important. Differences in pregnancy LTPA and potential psychosocial factors of pregnancy LTPA between various levels of religiosity may initiate an understanding of its potential influence during the complex and sometimes spiritual experience

of pregnancy. Thus, two primary questions drive this dissertation: 1) whether pregnancy LTPA is jointly influenced by pregnant women's pregnancy risk perceptions and physical activity efficacy beliefs, and also 2) whether religiosity (particularly LDS) affects LTPA participation as well as the psychosocial influences on LTPA (such as pregnancy risk perceptions, LTPA beliefs, physical activity discussions with prenatal HCP, and physical activity social support) during pregnancy.

REFERENCES

REFERENCES

- 1. Evenson KR, Wen F. National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. *Prev Med.* Mar 2010;50(3):123-128.
- 2. Clarke PE, Gross H. Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery*. Jun 2004;20(2):133-141.
- **3.** Duncombe D, Wertheim EH, Skouteris H, Paxton SJ, Kelly L. Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery*. Aug 2009;25(4):430-438.
- 4. Hegaard HK, Kjaergaard H, Damm PP, Petersson K, Dykes AK. Experiences of physical activity during pregnancy in Danish nulliparous women with a physically active life before pregnancy. A qualitative study. *BMC Pregnancy Childbirth*. 2010;10:33.
- 5. Evenson KR, Moos MK, Carrier K, Siega-Riz AM. Perceived barriers to physical activity among pregnant women. *Matern Child Health J.* May 2009;13(3):364-375.
- 6. Rimal RN, Real K. Perceived risk and efficacy beliefs as motivators of change: Use of the risk perception attitude (RPA) framework to understand health behaviors. *Hum Commun Res.* Jul 1 2003;29(3):370-399.
- 7. ACOG. Exercise during pregnancy and the prenatal period. Washington, D.C.1985.
- 8. Downs DS, Chasan-Taber L, Evenson KR, Leiferman J, Yeo S. Physical activity and pregnancy: past and present evidence and future recommendations. *Res Q Exerc Sport*. Dec 2012;83(4):485-502.
- **9.** ACOG committee opinion. Exercise during pregnancy and the postpartum period. Number 267, January 2002. American College of Obstetricians and Gynecologists. *Int J Gynaecol Obstet*. Apr 2002;77(1):79-81.
- **10.** United States. Dept. of Health and Human Services. 2008 physical activity guidelines for *Americans : be active, healthy, and happy!* Washington, DC: U.S. Dept. of Health and Human Services; 2008.
- **11.** Zhang C, Solomon CG, Manson JE, Hu FB. A prospective study of pregravid physical activity and sedentary behaviors in relation to the risk for gestational diabetes mellitus. *Arch Intern Med.* Mar 13 2006;166(5):543-548.

- **12.** Rudra CB, Sorensen TK, Luthy DA, Williams MA. A prospective analysis of recreational physical activity and preeclampsia risk. *Med Sci Sports Exerc*. Sep 2008;40(9):1581-1588.
- **13.** Saftlas AF, Logsden-Sackett N, Wang W, Woolson R, Bracken MB. Work, leisure-time physical activity, and risk of preeclampsia and gestational hypertension. *Am J Epidemiol*. Oct 15 2004;160(8):758-765.
- Sorensen TK, Williams MA, Lee IM, Dashow EE, Thompson ML, Luthy DA. Recreational physical activity during pregnancy and risk of preeclampsia. *Hypertension*. Jun 2003;41(6):1273-1280.
- **15.** Oken E, Ning Y, Rifas-Shiman SL, Radesky JS, Rich-Edwards JW, Gillman MW. Associations of physical activity and inactivity before and during pregnancy with glucose tolerance. *Obstet Gynecol.* Nov 2006;108(5):1200-1207.
- **16.** Dempsey JC, Butler CL, Williams MA. No need for a pregnant pause: physical activity may reduce the occurrence of gestational diabetes mellitus and preeclampsia. *Exerc Sport Sci Rev.* Jul 2005;33(3):141-149.
- **17.** Stuebe AM, Oken E, Gillman MW. Associations of diet and physical activity during pregnancy with risk for excessive gestational weight gain. *Am J Obstet Gynecol*. Jul 2009;201(1):58 e51-58.
- **18.** Giroux I, Inglis SD, Lander S, Gerrie S, Mottola MF. Dietary intake, weight gain, and birth outcomes of physically active pregnant women: a pilot study. *Appl Physiol Nutr Metab.* Oct 2006;31(5):483-489.
- **19.** Haakstad LA, Voldner N, Henriksen T, Bo K. Physical activity level and weight gain in a cohort of pregnant Norwegian women. *Acta Obstet Gynecol Scand.* 2007;86(5):559-564.
- **20.** Leddy MA, Power ML, Schulkin J. The impact of maternal obesity on maternal and fetal health. *Reviews in obstetrics and gynecology*. Fall 2008;1(4):170-178.
- **21.** Da Costa D, Rippen N, Dritsa M, Ring A. Self-reported leisure-time physical activity during pregnancy and relationship to psychological well-being. *J Psychosom Obstet Gynaecol.* Jun 2003;24(2):111-119.
- **22.** Goodwin A, Astbury J, McMeeken J. Body image and psychological well-being in pregnancy. A comparison of exercisers and non-exercisers. *Aust N Z J Obstet Gynaecol*. Nov 2000;40(4):442-447.
- **23.** Downs DS, DiNallo JM, Kirner TL. Determinants of pregnancy and postpartum depression: prospective influences of depressive symptoms, body image satisfaction, and exercise behavior. *Ann Behav Med.* Aug 2008;36(1):54-63.

- **24.** Wallace AM, Boyer DB, Dan A, Holm K. Aerobic exercise, maternal self-esteem, and physical discomforts during pregnancy. *J Nurse Midwifery*. Nov-Dec 1986;31(6):255-262.
- **25.** Koniak-Griffin D. Aerobic exercise, psychological well-being, and physical discomforts during adolescent pregnancy. *Res Nurs Health*. Aug 1994;17(4):253-263.
- 26. Davis K, Dimidjian S. The Relationship Between Physical Activity and Mood Across the Perinatal Period: A Review of Naturalistic and Clinical Research to Guide Future Investigation of Physical Activity-Based Interventions for Perinatal Depression. *Clin Psychol-Sci Pr.* Mar 2012;19(1):27-48.
- 27. Pivarnik JM. Potential effects of maternal physical activity on birth weight: brief review. *Med Sci Sports Exerc.* Mar 1998;30(3):400-406.
- **28.** Pivarnik JM, Mudd L. Physical activity during pregnancy and postpartum: what have we learned? *Physical Activity and Fitness Research Digest*. 2009.
- **29.** Pivarnik J, Chambliss HO, Clapp JF, et al. Impact of physical activity during pregnancy and postpartum on chronic disease risk. *Medicine and Science in Sports and Exercise*. May 2006;38(5):989-1006.
- **30.** Clapp JF. The course of labor after endurance exercise during pregnancy. *Am J Obstet Gynecol*. Dec 1990;163(6 Pt 1):1799-1805.
- **31.** Melzer K, Schutz Y, Soehnchen N, et al. Effects of recommended levels of physical activity on pregnancy outcomes. *American journal of obstetrics and gynecology*. Mar 2010;202(3):266 e261-266.
- **32.** Hegaard HK, Hedegaard M, Damm P, Ottesen B, Petersson K, Henriksen TB. Leisure time physical activity is associated with a reduced risk of preterm delivery. *Am J Obstet Gynecol.* Feb 2008;198(2):180 e181-185.
- **33.** Juhl M, Andersen PK, Olsen J, et al. Physical exercise during pregnancy and the risk of preterm birth: a study within the Danish National Birth Cohort. *Am J Epidemiol*. Apr 1 2008;167(7):859-866.
- **34.** Voldner N, Froslie KF, Haakstad LA, Bo K, Henriksen T. Birth complications, overweight, and physical inactivity. *Acta Obstet Gyn Scan.* 2009;88(5):550-555.
- **35.** Leiferman JA, Evenson KR. The effect of regular leisure physical activity on birth outcomes. *Matern Child Health J.* Mar 2003;7(1):59-64.
- **36.** Collings CA, Curet LB, Mullin JP. Maternal and fetal responses to a maternal aerobic exercise program. *Am J Obstet Gynecol*. Mar 15 1983;145(6):702-707.
- **37.** Klebanoff MA, Shiono PH, Carey JC. The effect of physical activity during pregnancy on preterm delivery and birth weight. *Am J Obstet Gynecol*. Nov 1990;163(5 Pt 1):1450-1456.
- **38.** Ning Y, Williams MA, Dempsey JC, Sorensen TK, Frederick IO, Luthy DA. Correlates of recreational physical activity in early pregnancy. *J Matern Fetal Neonatal Med.* Jun 2003;13(6):385-393.
- **39.** Zhang J, Savitz DA. Exercise during pregnancy among US women. *Ann Epidemiol.* Jan 1996;6(1):53-59.
- **40.** Zhao GX, Ford ES, Tsai J, et al. Trends in Health-Related Behavioral Risk Factors Among Pregnant Women in the United States: 2001-2009. *J Womens Health*. Mar 2012;21(3):255-263.
- **41.** Petersen AM, Leet TL, Brownson RC. Correlates of physical activity among pregnant women in the United States. *Med Sci Sports Exerc*. Oct 2005;37(10):1748-1753.
- **42.** Evenson KR, Savitz DA, Huston SL. Leisure-time physical activity among pregnant women in the US. *Paediatr Perinat Epidemiol.* Nov 2004;18(6):400-407.
- **43.** Fell DB, Joseph KS, Armson BA, Dodds L. The impact of pregnancy on physical activity level. *Matern Child Health J.* Sep 2009;13(5):597-603.
- **44.** Pereira MA, Rifas-Shiman SL, Kleinman KP, Rich-Edwards JW, Peterson KE, Gillman MW. Predictors of change in physical activity during and after pregnancy: Project Viva. *Am J Prev Med.* Apr 2007;32(4):312-319.
- **45.** Schmidt MD, Pekow P, Freedson PS, Markenson G, Chasan-Taber L. Physical activity patterns during pregnancy in a diverse population of women. *Journal of women's health*. Oct 2006;15(8):909-918.
- **46.** Rousham EK, Clarke PE, Gross H. Significant changes in physical activity among pregnant women in the UK as assessed by accelerometry and self-reported activity. *Eur J Clin Nutr*. Mar 2006;60(3):393-400.
- **47.** Downs DS, LeMasurier GC, DiNallo JM. Baby steps: pedometer-determined and self-reported leisure-time exercise behaviors of pregnant women. *J Phys Act Health*. Jan 2009;6(1):63-72.
- **48.** DiNallo JM, Le Masurier GC, Williams NI, Downs DS. Walking for health in pregnancy: assessment by indirect calorimetry and accelerometry. *Res Q Exerc Sport*. Mar 2008;79(1):28-35.
- **49.** Evenson KR, Wen F. Prevalence and correlates of objectively measured physical activity and sedentary behavior among US pregnant women. *Prev Med.* Jul-Aug 2011;53(1-2):39-43.

- **50.** Cramp AG, Bray SR. A prospective examination of exercise and barrier self-efficacy to engage in leisure-time physical activity during pregnancy. *Ann Behav Med.* Jun 2009;37(3):325-334.
- **51.** Krans EE, Chang JC. A will without a way: barriers and facilitators to exercise during pregnancy of low-income, African American women. *Women & health*. Nov 30 2011;51(8):777-794.
- **52.** Marshall ES, Bland H, Melton B. Perceived barriers to physical activity among pregnant women living in a rural community. *Public health nursing*. Jul 2013;30(4):361-369.
- **53.** Lee KA, Dejoseph JF. Sleep Disturbances, Vitality, and Fatigue among a Select Group of Employed Childbearing Women. *Birth-Iss Perinat C*. Dec 1992;19(4):208-213.
- **54.** Chang JJ, Pien GW, Duntley SP, Macones GA. Sleep deprivation during pregnancy and maternal and fetal outcomes: is there a relationship? *Sleep Med Rev.* Apr 2010;14(2):107-114.
- **55.** Lee KA, Zaffke ME, McEnany G. Parity and sleep patterns during and after pregnancy. *Obstetrics and Gynecology.* Jan 2000;95(1):14-18.
- **56.** Nicholls JA, Grieve DW. Performance of Physical Tasks in Pregnancy. *Ergonomics*. Mar 1992;35(3):301-311.
- **57.** Hartmann S, Bung P. Physical exercise during pregnancy--physiological considerations and recommendations. *J Perinat Med.* 1999;27(3):204-215.
- **58.** Nicholls JA, Grieve DW. Posture, Performance and Discomfort in Pregnancy. *Appl Ergon.* Apr 1992;23(2):128-132.
- **59.** Evenson KR. Towards an Understanding of Change in Physical Activity from Pregnancy Through Postpartum. *Psychol Sport Exerc.* Jan 2011;12(1):36-45.
- **60.** Gross H, Bee PE. Perceptions of effective advice in pregnancy The case of activity. *Clinical Effectiveness in Nursing.* 2004;8:161-169.
- **61.** Hanghoj S. When it hurts I think: Now the baby dies. Risk perceptions of physical activity during pregnancy. *Women Birth.* Sep 2013;26(3):190-194.
- **62.** Gadsby R, Barnie-Adshead AM, Jagger C. A prospective study of nausea and vomiting during pregnancy. *Br J Gen Pract.* Jun 1993;43(371):245-248.
- **63.** Lacroix R, Eason E, Melzack R. Nausea and vomiting during pregnancy: A prospective study of its frequency, intensity, and patterns of change. *American journal of obstetrics and gynecology*. Apr 2000;182(4):931-937.

- **64.** Buckwalter JG, Simpson SW. Psychological factors in the etiology and treatment of severe nausea and vomiting in pregnancy. *American journal of obstetrics and gynecology*. May 2002;186(5 Suppl Understanding):S210-214.
- **65.** Chou FH, Lin LL, Cooney AT, Walker LO, Riggs MW. Psychosocial factors related to nausea, vomiting, and fatigue in early pregnancy. *J Nurs Scholarsh*. 2003;35(2):119-125.
- 66. Beilock SL, Feltz DL, Pivarnik JM. Training patterns of athletes during pregnancy and postpartum. *Res Q Exerc Sport*. Mar 2001;72(1):39-46.
- **67.** Marshall NE, Spong CY. Obesity, pregnancy complications, and birth outcomes. *Seminars in reproductive medicine*. Dec 2012;30(6):465-471.
- **68.** Downs DS, Hausenblas HA. Women's exercise beliefs and behaviors during their pregnancy and postpartum. *J Midwifery Wom Heal*. Mar-Apr 2004;49(2):138-144.
- **69.** Owe KM, Nystad W, Bo K. Correlates of regular exercise during pregnancy: the Norwegian Mother and Child Cohort Study. *Scandinavian journal of medicine & science in sports*. Oct 2009;19(5):637-645.
- **70.** Cioffi J, Schmied V, Dahlen H, et al. Physical activity in pregnancy: women's perceptions, practices, and influencing factors. *J Midwifery Womens Health*. Sep-Oct 2010;55(5):455-461.
- 71. Weir Z, Bush J, Robson SC, McParlin C, Rankin J, Bell R. Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. *BMC Pregnancy Childbirth*. 2010;10:18.
- 72. Witte K. Putting the Fear Back into Fear Appeals the Extended Parallel Process Model. *Commun Monogr.* Dec 1992;59(4):329-349.
- **73.** Parratt J. The impact of childbirth experiences on women's sense of self: a review of the literature. *Aust J Midwifery*. 2002;15(4):10-16.
- 74. Larkin P, Begley CM, Devane D. Women's experiences of labour and birth: an evolutionary concept analysis. *Midwifery*. Apr 2009;25(2):E49-E59.
- **75.** Whitehead NS, Brogan DJ, Blackmore-Prince C, Hill HA. Correlates of experiencing life events just before or during pregnancy. *J Psychosom Obstet Gynaecol*. Jun 2003;24(2):77-86.
- **76.** Melender HL. Fears and coping strategies associated with pregnancy and childbirth in Finland. *J Midwifery Womens Health.* Jul-Aug 2002;47(4):256-263.
- 77. Eide J, Hovengen R, Nordhagen R. Childhood abuse and later worries about the baby's health in pregnancy. *Acta Obstet Gyn Scan.* Dec 2010;89(12):1523-1531.

- **78.** Evenson KR, Bradley CB. Beliefs about exercise and physical activity among pregnant women. *Patient Educ Couns*. Apr 2010;79(1):124-129.
- **79.** Downs DS, Hausenblas HA. Exercising for two: examining pregnant women's second trimester exercise intention and behavior using the framework of the theory of planned behavior. *Women's health issues : official publication of the Jacobs Institute of Women's Health.* Nov-Dec 2003;13(6):222-228.
- **80.** Hinton PS, Olson CM. Predictors of pregnancy-associated change in physical activity in a rural white population. *Matern Child Health J.* Mar 2001;5(1):7-14.
- **81.** Hausenblas HA, Downs DS. Prospective examination of the Theory of Planned Behavior applied to exercise behavior during women's first trimester of pregnancy. *J Reprod Infant Psyc.* Aug 2004;22(3):199-210.
- **82.** Da Costa D, Ireland K. Perceived benefits and barriers to leisure-time physical activity during pregnancy in previously inactive and active women. *Women & health*. 2013;53(2):185-202.
- **83.** Gaston A, Prapavessis H. Maternal-fetal disease information as a source of exercise motivation during pregnancy. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association.* Nov 2009;28(6):726-733.
- **84.** Rogers RW. A protection motivation theor of fear appeals and attitude change. *The Journal of Psychology*. 1975;91:93-114.
- **85.** Rogers RW. Protection Motivation Theory of Fear Appeals and Attitude-Change. *J Psychol.* 1975;91(1):93-114.
- **86.** Mudd LM, Nechuta S, Pivarnik JM, Paneth N. Factors associated with women's perceptions of physical activity safety during pregnancy. *Prev Med.* Aug-Sep 2009;49(2-3):194-199.
- **87.** Ferrari RM, Siega-Riz AM, Evenson KR, Moos MK, Carrier KS. A qualitative study of women's perceptions of provider advice about diet and physical activity during pregnancy. *Patient Educ Couns.* Feb 8 2013.
- **88.** Evenson KR, Pompeii LA. Obstetrician practice patterns and recommendations for physical activity during pregnancy. *Journal of women's health*. Sep 2010;19(9):1733-1740.
- **89.** Krans EE, Gearhart JG, Dubbert PM, Klar PM, Miller AL, Replogle WH. Pregnant women's beliefs and influences regarding exercise during pregnancy. *J Miss State Med Assoc*. Mar 2005;46(3):67-73.

- **90.** Entin PL, Munhall KM. Recommendations regarding exercise during pregnancy made by private/small group practice obstetricians in the USA. *J Sport Sci Med.* Sep 2006;5(3):449-458.
- **91.** Bauer PW, Broman CL, Pivarnik JM. Exercise and pregnancy knowledge among healthcare providers. *Journal of women's health*. Feb 2010;19(2):335-341.
- **92.** Doran F, Davis K. Factors that influence physical activity for pregnant and postpartum women and implications for primary care. *Aust J Prim Health.* 2011;17(1):79-85.
- **93.** Leiferman J, Gutilla MJ, Paulson J, Pivarnik J. Antenatal physical activity counseling among healthcare providers. *Open Journal of Obstetrics and Gynecology*. 2012;2:346-355.
- **94.** Burleson BR. Understanding the outcomes of supportive communication: A dual-process approach. *J Soc Pers Relat*. Feb 2009;26(1):21-38.
- **95.** Burleson BR. Emotional support skills. In: Greene JO, Burleson BR, eds. *Handbook of communication and social interaction skills*. Mahwah, NJ: Erlbaum; 2003:551-594.
- **96.** MacGeorge EL, Feng B, Thompson ER. "Good" and "bad" advice: How to advise more effectively. In: Motley MT, ed. *Studies in applied interpersonal communication*. Thousand Oaks, CA: Sage; 2008:145-164.
- 97. Cohen S, Syme SL. Social support and health. Orlando, Fla.: Academic Press; 1985.
- **98.** Rees T, Hardy L, Evans L. Construct validity of the social support survey in sport. *Psychol Sport Exerc.* May 2007;8(3):355-368.
- **99.** Richman JM, Rosenfeld LB, Hardy CJ. The Social Support Survey a Validation-Study of a Clinical Measure of the Social Support Process. *Res Social Work Prac.* Jul 1993;3(3):288-311.
- **100.** Rees T, Hardy L, Ingledew DK, Evans L. Examination of the validity of the Social Support Survey using confirmatory factor analysis. *Res Q Exerc Sport*. Dec 2000;71(4):322-330.
- **101.** Emmanuel E, St John W, Sun J. Relationship between social support and quality of life in childbearing women during the perinatal period. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG.* Nov-Dec 2012;41(6):E62-70.
- **102.** Collins NL, Dunkel-Schetter C, Lobel M, Scrimshaw SC. Social support in pregnancy: psychosocial correlates of birth outcomes and postpartum depression. *J Pers Soc Psychol*. Dec 1993;65(6):1243-1258.

- **103.** Feldman PJ, Dunkel-Schetter C, Sandman CA, Wadhwa PD. Maternal social support predicts birth weight and fetal growth in human pregnancy. *Psychosom Med.* Sep-Oct 2000;62(5):715-725.
- **104.** Kennell J, Klaus M, McGrath S, Robertson S, Hinkley C. Continuous emotional support during labor in a US hospital. A randomized controlled trial. *Jama*. May 1 1991;265(17):2197-2201.
- **105.** Norbeck JS, Tilden VP. Life stress, social support, and emotional disequilibrium in complications of pregnancy: a prospective, multivariate study. *J Health Soc Behav*. Mar 1983;24(1):30-46.
- **106.** Orr ST. Social support and pregnancy outcome: a review of the literature. *Clin Obstet Gynecol.* Dec 2004;47(4):842-855; discussion 881-842.
- **107.** Albrecht SA, Rankin M. Anxiety levels, health behaviors, and support systems of pregnant women. *Matern Child Nurs J.* Spring 1989;18(1):49-60.
- **108.** Glazier RH, Elgar FJ, Goel V, Holzapfel S. Stress, social support, and emotional distress in a community sample of pregnant women. *Journal of psychosomatic obstetrics and gynaecology*. Sep-Dec 2004;25(3-4):247-255.
- **109.** Lancaster CA, Gold KJ, Flynn HA, Yoo H, Marcus SM, Davis MM. Risk factors for depressive symptoms during pregnancy: a systematic review. *American journal of obstetrics and gynecology*. Jan 2010;202(1):5-14.
- **110.** Rosensto.Im. Historical Origins of Health Belief Model. *Health Educ Quart*. 1974;2(4):328-335.
- **111.** Witte K, Allen M. A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Educ Behav.* Oct 2000;27(5):591-615.
- **112.** Real K. Information seeking and workplace safety: A field application of the risk perception attitude framework. *J Appl Commun Res.* 2008;36(3):339-359.
- **113.** Rimal RN, Bose K, Brown J, Mkandawire G, Folda L. Extending the Purview of the Risk Perception Attitude Framework: Findings from HIV/AIDS Prevention Research in Malawi. *Health Commun.* 2009;24(3):210-218.
- **114.** Rimal RN, Juon HS. Use of the Risk Perception Attitude Framework for Promoting Breast Cancer Prevention. *J Appl Soc Psychol*. Feb 2010;40(2):287-310.
- **115.** Lundgren I, Dahlberg K. Women's experience of pain during childbirth. *Midwifery*. Jun 1998;14(2):105-110.

- **116.** Jesse DE, Schoneboom C, Blanchard A. The effect of faith or spirituality in pregnancy: a content analysis. *Journal of holistic nursing : official journal of the American Holistic Nurses' Association.* Sep 2007;25(3):151-158; discussion 159.
- **117.** Price S, Lake M, Breen G, Carson G, Quinn C, O'Connor T. The spiritual experience of high-risk pregnancy. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG.* Jan-Feb 2007;36(1):63-70.
- **118.** Lobel M, Yali AM, Zhu W, DeVincent CJ, Meyer BA. Beneficial associations between optimistic disposition and emotional distress in high-risk pregnancy. *Psychol Health*. Feb 2002;17(1):77-95.
- **119.** Page RL, Ellison CG, Lee J. Does religiosity affect health risk behaviors in pregnant and postpartum women? *Matern Child Health J.* Sep 2009;13(5):621-632.
- **120.** Jesse DE, Reed PG. Effects of spirituality and psychosocial well-being on health risk behaviors in Appalachian pregnant women. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG.* Nov-Dec 2004;33(6):739-747.
- **121.** Kim KH, Sobal J. Religion, social support, fat intake and physical activity. *Public Health Nutr.* Sep 2004;7(6):773-781.
- **122.** *Yearbook of American & Canadian Churches.* United States of America: The National Council of the Churches of Christ in the United States of America; 2012.
- **123.** *The Family: A Proclamation to the World*: The Church of Jesus Christ of Latter-day Saints; 1995.
- **124.** Heaton TB, Goodman KL. Religion and Family Formation. *Rev Relig Res.* 1985;26(4):343-359.
- **125.** Asplund-Campbell. *With child: Mormon women on mothering.* Salt Lake City, UT: Signature Books; 1998.
- **126.** Callister LC, Semenic S, Foster JC. Cultural and spiritual meanings of childbirth. Orthodox Jewish and Mormon women. *Journal of holistic nursing : official journal of the American Holistic Nurses' Association.* Sep 1999;17(3):280-295.
- **127.** Thornton A. Religion and Fertility Case of Mormonism. *J Marriage Fam.* 1979;41(1):131-142.
- **128.** Merrill RM, Lyon JL, Jensen WJ. Lack of a secularizing influence of education on religious activity and parity among Mormons. *J Sci Stud Relig.* Mar 2003;42(1):113-124.

- **129.** Daniels M, Merrill RM, Lyon JL, Stanford JB, White GL. Associations between breast cancer risk factors and religious practices in Utah. *Preventive Medicine*. Jan 2004;38(1):28-38.
- **130.** Lyon JL, Gardner JW, West DW. Cancer incidence in Mormons and non-Mormons in Utah during 1967--75. *J Natl Cancer Inst.* Nov 1980;65(5):1055-1061.
- **131.** Lyon JL, Gardner K, Gress RE. Cancer incidence among Mormons and non-Mormons in Utah (United States) 1971-85. *Cancer Causes Control.* Mar 1994;5(2):149-156.
- **132.** Lyon JL, Wetzler HP, Gardner JW, Klauber MR, Williams RR. Cardiovascular mortality in Mormons and non-Mormons in Utah, 1969--1971. *American journal of epidemiology*. Nov 1978;108(5):357-366.

CHAPTER 3

METHODS

STUDY DESIGN

This dissertation utilizes a survey-based methodology, with the purpose of assessing pregnant women's leisure-time physical activity (LTPA), pregnancy risk perceptions, and LTPA efficacy beliefs. It was also the intent of this investigation to collect data on potentially influential sources of physical activity information and support, including pregnant women's social support network and prenatal healthcare provider (HCP). Additionally, religiosity data was collected for the purpose of determining if pregnant women of a particular religious subgroup (Latter-day Saints (LDS)) differ in terms of LTPA behavior, perceptions, and potential social influences, from three groups of non-LDS pregnant women, those of high, moderate, and low religiosity. Prenatal clinics within the state of Michigan, as well as clinics within Salt Lake City, UT were identified as the primary means of participant recruitment for this investigation. Data collection for this dissertation occurred over a three month period (February-April 2014). The procedures for this investigation were approved by Institutional Review Boards at Michigan State University (IRB# x14-050e, January 2014, Appendix A) and the University of Utah (IRB# 00070835, February 2014, Appendix B) and given exempt status. Therefore, participants did not sign a consent form.

PARTICIPANT RECRUITMENT

Those eligible for participation in this investigation included pregnant women of any ethnic or educational background, socioeconomic status, or religious identification who were 18-45 years of age. Pregnant women were excluded if carrying more than one baby, having received prescribed bed rest from a prenatal HCP during the current pregnancy, or unable to communicate fluently in either English or Spanish. Therefore, few physical criteria pertaining to their pregnancies disqualified women from participating in this investigation. However, multiple physical characteristics pertaining to past and current pregnancy were assessed to ensure sufficient statistical control, if necessary.

Data collection for this investigation took place at multiple locations throughout the states of Michigan and Utah. Specifically, pregnant women were recruited from clinics in the greater Lansing community including, MSU Women's Healthcare Clinic (Lansing, MI) and Sparrow/MSU OBGYN Residency Clinic (Lansing, MI). In order to satisfy Specific Aims 7 and 8 of this study, it was necessary to obtain data from pregnant women of the LDS faith. Thus, data collection also occurred at multiple clinics within the University of Utah's Health Science Center (Salt Lake City, UT), a general geographical location in the United States where LDS population is high. At all prenatal clinics involved with this study (including those from mid-Michigan and Salt Lake Cit), convenience sampling was utilized to recruit pregnant women either before a regularly scheduled appointment with their prenatal healthcare provider or immediately following this appointment. Women were invited by a member of the prenatal nursing staff to complete either a 15-minute electronic survey via iPad computer tablet (Lansing clinics) or a paper copy survey (Salt Lake City clinics). Finally, pregnant women were recruited via word-of-mouth in multiple locations, including the greater Lansing area (Michigan), Saginaw County (Michigan), and the Lafayette/West Lafayette community (Indiana). At every data collection site, potential participants were informed as to the study procedures, the content of the survey, and the compensation they would receive as thanks for their participation.

DATA COLLECTION

Data collection at this study's mid-Michigan site was conducted by a research team consisting of the study coordinator (CPC) and 16 undergraduate research assistants, two of whom served as supervisors of this research team. All participated in data collection and/or data entry, and thus were considered "study investigators". To ensure consistency in data collection procedures among undergraduate research assistants, the study coordinator provided a detailed set of written instructions and met regularly with the research team members both collectively and individually. After each data collection session, the responsible undergraduate assistant reported back to both the study coordinator (CPC) and undergraduate supervisors on the effectiveness of the session and on whether data collection procedures were followed. Data collection at the Salt Lake City clinics was conducted by research staff at the University of Utah's Health Science Center. The study coordinator (CPC) trained the research staff remotely on all study protocols and communicated with the Salt Lake City site supervisor on a bi or triweekly basis to ensure consistency in data collection procedures.

For each study participant, a study investigator first explained the basic format and components of the survey and reminded participants of their option to discontinue participation at any point if desired. After agreeing to take the survey, participants were provided with an iPad computer tablet (or paper survey) by the study investigator and asked to read through the informed consent page. If they wished to continue, participants were asked to click "agree" (iPad) or check "agree" (paper) at the bottom of the consent page (Appendix C/Appendix D). The investigator informed the participant that they would be present to answer any questions the participant may have regarding survey items or directions. Participants then completed the survey (Appendix E) via iPad or paper copy at their self-selected pace. Following completion of

the survey, participants were thanked and given a \$10 gift card to Target (no expiration date) for assisting in the proposed investigation. In the rare instance when a participant was called in for her appointment before survey completion, the study investigator collected the computer tablet and informed the participant and prenatal nurse of the opportunity to finish their survey immediately following the prenatal care appointment.

DATA MANAGEMENT

The electronic version of this survey was powered by the Qualtrics survey platform. Specifically, the Qualtrics Offline App was utilized, which allowed the survey to be administered without the need of a wireless internet connection. At the end of each data collection session, a study investigator connected the iPad device to a wireless connection, tested the connection for stability, and uploaded all completed electronic surveys to the password-protected online database (through Qualtrics). The study investigator then informed the study coordinator (CPC) of the number of surveys collected and uploaded during that session. Data from paper surveys were entered into the Qualtrics Offline App by study investigators. For each data entry session, the study coordinator observed the data entry for every tenth survey to ensure accuracy. Furthermore at each session, after five surveys had been entered into the Qualtrics Offline App, the iPad device was connected to a secure wireless internet signal, and data were uploaded to the online database. Following each data collection or data entry session, the study coordinator downloaded all data from the online database into a password-protected excel file to ensure security of all information collected. Data from incomplete surveys were not included for analysis in this investigation.

THEORETICAL FRAMEWORK

In order to more precisely understand how pregnant women perceive physical activity and also how those perceptions predict physical activity behavior, the Risk Perception Attitude Framework (RPA) was utilized.¹ Utilizing the RPA as a theoretical framework in this investigation is unprecedented for a variety of possible reasons. First, the risk being assessed does not pertain to the woman herself, but rather her unborn baby. Second, the risk perceptions and efficacy beliefs in this population may be recently-formed at the time of assessment given that participants recently discovered they are pregnant. Furthermore, these perceptions may rapidly evolve as pregnancy progresses and women experience its transient physical and psychological challenges. Lastly, the RPA has not yet been used to assess perceived efficacy of physical activity behavior in protecting against a health risk.

Risk perceptions comprise both perceived severity (how severe one believes the risk is) and perceived susceptibility (how susceptible one believes they are to the risk) (Figure 3.1).² Efficacy beliefs comprise both response efficacy (how strongly one believes the health behavior can protect against the risk) and self-efficacy (how confident one is that s/he is able participate in the health behavior) (Figure 3.1).^{2,3} Accordingly, four attitudinal groups can be created within this framework, typically via a median split of both risk perceptions and efficacy beliefs (Figure 3.2). The *responsive* group comprises individuals with high levels of risk perception and efficacy beliefs; this group is both highly motivated and able to participate in a given behavior. Individuals in the *proactive* group are able to participate in the specific behavior but lack the motivation, as their efficacy beliefs are high but their risk perceptions (thus, their incentives to act) are low. The *avoidance* group includes individuals who have high levels of risk perception

behavior. Lastly, the *indifferent* group has the least motivation to participate in a specific behavior, in that individuals in this group do not perceive great risk and have little efficacy towards that behavior. A prominent advantage of this categorization schema is that interventions can be designed with the purpose of targeting individuals placed within one of these four specific groups, each having a distinct combination of risk perceptions and efficacy beliefs.

Figure 3.1. Risk perception and efficacy belief components as defined by the RPA.





Figure 3.2. Risk percpetion and efficac belief attitudinal groups created within the RPA.

The RPA has been used in previous investigations to assess risk perceptions and efficacy beliefs in regards to skin cancer and information-seeking behavior,¹ workplace accidents and workplace safety behavior,⁴ cancer and dietary habits,⁵ HIV contraction and condom use,⁶ as well as breast cancer and self-examination behavior.⁷ A purpose of this investigation is to understand pregnant women's perceptions of harmful risk to the unborn child and their efficacy beliefs with respect to pregnancy LTPA as a protective mechanism against those harmful risks.

SURVEY DEVELOPMENT

The survey for this investigation (Appendix E) was developed by researchers at Michigan State University with the intent of gaining a more precise understanding of the perceptions and beliefs that pregnant women have with respect to LTPA, as well as the potential influences of social support and the prenatal HCP. To ensure that our survey was ready for use as a part of this investigation, a series of nine cognitive interviews were conducted among pregnant women (two LDS, seven non-LDS) matching the inclusion criteria for this investigation. The cognitive interviews consisted of a face-to-face, informal discussion through which all sections of the survey were reviewed. Feedback was provided to investigators regarding the clarity of individual survey items for each section. Additionally, investigators inquired as to whether any survey item was perceived as too personal or invasive and also whether additional questions should be added. Information obtained from these cognitive interview sessions allowed for final revisions of the survey instrument to be made. No names, addresses, or other identifiable information were collected, ensuring participant anonymity. Thus, exempt approval for this investigation was sought and granted.

SURVEY OVERVIEW

The survey used for this investigation consisted of 77 survey items, categorized within seven primary sections. Specific content of each section is detailed in Table 3.1, and reflects the question and section order throughout the survey. This survey was designed with the intent for participation to last no longer than 15 minutes. It was believed that a moderate length survey would enable study participants to complete study procedures before being called into their scheduled appointment with their prenatal HCP. In order to prevent fatigue effects among study participants, survey questions considered to be most direct to comprehend and easiest for the respondent to recall information were ordered towards the end of the survey (social support, demographics, religious beliefs).

SECTION	CONTENT
(1) LTPA Behavior	 Moderate LTPA (current) Vigorous LTPA (current) Moderate LTPA (prepregnancy) Vigorous LTPA (pregpregnancy)
(2) Pregnancy Risk/LTPA Beliefs	 Pregnancy Risk Perceptions LTPA Efficacy Beliefs (moderate PA) LTPA Risk Perceptions (moderate PA) LTPA Efficacy Beliefs (vigorous PA) LTPA Risk Perceptions (vigorous PA)
(3) Pregnancy History	 "High Risk" status Parity Miscarriage Pre-term Birth Operative Delivery Fertility Treatment Adverse Conditions (current) Adverse Conditions (previous pregnancy) Bedrest Prescription (previous pregnancy)
(4) Prenatal HCP/Patient Interaction	 Physical Activity Discussion (current) Physical Activity Discussion (previous pregnancy) Physical Activity Recommendations Perceived Satisfaction with Discussion Perceived Expertise Informational Sources Prenatal HCP Encouragement of PA
(5) Physical Activity Social Support	 Support from Significant Other Support from Family Support from Friends Encouragement of physical activity
(6) Demographics	 Age Race Gestational Age Education Household Income Childcare Responsibilities Significant Other
(7) Religious Beliefs	Belief in GodReligious AffiliationReligiosity

Table 3.1. Content overview for the study instrument (Appendix E).

VARIABLES OF INTEREST

Leisure-Time Physical Activity

Participants were asked to report LTPA prior to and during pregnancy (Appendix E; Items 1-4, 5-8). Specifically, these survey items asked pregnant women to consider activities, sports, or recreational activities that they participate in in their "leisure time," rather than as a part of their job or occupational or household responsibilities. Participants were asked how many days per week and for approximately how many minutes per day they typically participated in both moderate and vigorous-intensity LTPA. Moderate physical activity was described as activities that cause small increases in breathing or heart rate. Vigorous physical activity was described as activities that cause large increases in breathing or heart rate. Examples of both moderate and vigorous physical activities were provided in the survey directions to assist pregnant women in categorizing their LTPA participation. For both moderate and vigorous LTPA, typical days per week and minutes per day of reported activity were multiplied, providing total minutes per week at each intensity. These physical activity questions were slightly adapted from items within the Global Physical Activity Questionnaire (GPAQ) and from the 2013-2014 National Health and Nutrition Examination Survey (NHANES). Among non-pregnant individuals, these questions have demonstrated excellent test-retest reliability (ICC=0.90 (moderate); ICC=0.96(vigorous)) and acceptable criterion validity (r=0.36 (moderate); r=0.48(vigorous)) with respect to objective monitoring (Actigraph GTM1 accelerometer).⁸ However, the reliability and validity of these have not yet been assessed among pregnant women.

Pregnancy Risk Perceptions

Pregnancy risk severity and susceptibility items were adapted from the Risk Behavior Diagnosis Scale,⁹ with harm to a pregnant woman's baby considered as the perceived risk (Appendix E; Items 9-10). For each risk perception item, study participants reported how strongly they agree or disagree with the given statement using a 7-point Likert-type scale (1=Strongly Disagree; 7=Strongly Agree). For risk susceptibility, each participant indicated how strongly she agrees or disagrees that her baby could experience a harmful effect during pregnancy. For risk severity, each participant indicated how strongly she agrees or disagrees that a harmful effect that her baby would experience is severe. For the purposes of this dissertation, perceived pregnancy severity and susceptibility were averaged into a single risk perceptions score.

LTPA Efficacy Beliefs

LTPA response and self-efficacy items were likewise adapted from the Risk Behavior Diagnosis Scale,⁹ with LTPA participation as the recommended response (Appendix E; 11-12, 15-16). For each efficacy belief item, pregnant women reported how strongly they agree or disagree with the given statement using a 7-point Likert-type scale (1=Strongly Disagree; 7=Strongly Agree). Response and self-efficacy for LTPA were assessed for both moderate and vigorous intensity. In accordance with the most current recommendations of 150 of moderateintensity activity per week,¹⁰ each participant indicated for response efficacy how strongly she agrees or disagrees that participating in 30 minutes of moderate physical activity, five times per week will help protect her baby from harm. Likewise for self-efficacy, each participant indicated how strongly she agrees or disagrees that she can participate in 30 minutes of moderate physical activity, five times per week. The current vigorous physical activity guidelines stipulate that pregnant women may exercise at high intensities if they have regularly done so previously throughout their pregnancy.¹⁰ Given this guideline is only for pregnant women who are consistently active at this intensity, the response efficacy item for vigorous physical activity has been hypothetically framed. Therefore, each participant indicated how strongly she agreed or disagreed with the belief that if a pregnant woman has been vigorously active prepregnancy, and continues to be vigorously active during pregnancy, this activity will help protect her baby from harm. For self-efficacy of vigorous LTPA, each participant indicated how strongly she agrees or disagrees that she can participate in some vigorous physical activity during pregnancy. For the purposes of this dissertation, response efficacy and self-efficacy were averaged into a single efficacy beliefs score for both moderate and vigorous LTPA.

LTPA Risk Perceptions

Two survey items assessed risk perceptions that pregnant women have for LTPA (Appendix E; Items 13, 17). Participants reported how strongly they agree or disagree with the given statement using a 7-point Likert-point scale (1=Strongly Disagree; 7=Strongly Agree). For moderate LTPA, each participant indicated how strongly she agrees or disagrees that participating in 30 minutes of activity, five times per week is harmful to her baby. For vigorous LTPA, each participant indicated how strongly she agrees or disagrees that if a woman was vigorously active before and so far during pregnancy, that participating in vigorous LTPA could harm her baby.

Discussion and Satisfaction of Discussion with Prenatal HCP

Pregnant women were queried whether or not they have discussed physical activity with a prenatal health care provider (OBGYN, midwife, or prenatal nurse) (Appendix E; Item 30). In order to gain an understanding of the quality and effectiveness of these discussions, participants also indicated how satisfied or unsatisfied they feel with that discussion using a 7-point Likerttype scale (1=Very Unsatisfied; 7=Very Satisfied) (Appendix E; Item 32). These survey items were not drawn from previous literature, but rather were developed by the researcher directing this study.

Physical Activity Social Support

Survey items assessing physical activity social support are taken from the Multidimensional Scale of Perceived Social Support (MSPSS) and framed within a physical activity context (Appendix E; Items 40-54).¹¹ The MSPSS allows for social support to be rated via twelve items on a 7-point Likert-type scale (1=Strongly Disagree; 7=Strongly Agree). Advantages of the MSPSS include the shortness of the scale, the consideration of multiple dimensions of social support, and the assessment of social support from three different sources via subscales (family, friends, and significant other). The total scale is internally reliable with a Cronbach's alpha of 0.88 and a test-retest reliability of 0.85.¹¹ Confirmatory factor analysis has shown that scale questions had high loading on the subscales for which they were intended (family, friends, significant others) with minimal cross-loading, confirming these as functional subscales. Zimet et al.¹¹ additionally assessed internal reliability for the family (0.87), friends (0.85), and significant other (0.91) subscales. Additionally, test-retest reliability was found to be high for family (0.85), friends (0.75), and significant other (0.72) subscales.¹¹ Moreover, the MSPSS has been investigated among pregnant women,¹² showing excellent reliability for the total scale (0.92) and also the subscales for family (0.90), friends (0.94), and significant other (0.90). Answers (7-point Likert-type scale) for the four items pertaining each to family, friends, and significant other were averaged, providing a measure of physical activity social support provided by each of the three social support sources. Answers from all twelve items were averaged to generate the total physical activity social support score for each participant.

Religion and Religiosity

Participants were asked to what religious affiliation they belong to or most identify with (Appendix E; Item 66). Given dissertation Aims 7 and 8, this allowed for the participants to indicate whether they were a member of the LDS faith. In order to assess religiosity of all study participants, a series of ten questions (Appendix E; Item 68-77) from the Santa Clara Strength of Religious Faith Questionnaire (SCSORF) were utilized.¹³ These questions allow for religiosity to be rated via a 4-point Likert-type scale (1=Strongly Disagree; 4=Strongly Agree). High internal reliability has been found for the SCSORF among general university (Chronbach alpha=0.94) and highly-religious university students (0.95),^{13,14} high school students (0.96),¹⁵ and medical/cancer patients (0.87-0.94).^{16,17} The SCSORF has also demonstrated exceptional convergent validity with respect to other measures of religious faith.^{13,18,19} Furthermore, factor analysis has revealed the SCSORF is comprised of a single factor.^{14,20} Answers from all ten items (4-point Likert-type scale) were summed to generate the total religiosity score for each participant (range 10-40). It was assumed that LDS pregnant women would report very high religiosity scores, yet are culturally different from non-LDS pregnant women of higher religiosities. As such, LDS pregnant women were grouped separate from non-LDS participants. Religiosity score tertiles were calculated to categorize all non-LDS participants as high

religiosity (36-40 score), moderate religiosity (20-35 score), and low religiosity (10-19 score). Thus, all study participants could be allocated into one of four religiosity groups: LDS, non-LDS high religiosity, non-LDS moderate religiosity, or non-LDS low religiosity.

STATISTICAL ANALYSES

All statistical analyses were performed using IBM SPSS 22.0. An alpha level of p <0.05 was used to determine statistical significant for each analysis.

Specific Aim 1: To develop a survey instrument to measure pregnant women's pregnancy risk perceptions, LTPA efficacy beliefs, and LTPA in order to utilize the Risk Perception Attitude Framework (RPA).

In order to determine internal consistency for pregnancy risk perceptions and LTPA efficacy beliefs (for both moderate and vigorous intensity), Cronbach's alpha coefficients were calculated.

Specific Aim 2: To determine the pregnancy risk perceptions and LTPA efficacy beliefs in a convenience sample of 300-400 pregnant women from mid-Michigan and Salt Lake City, Utah regions.

The distribution for each variable was examined by calculating skewness and kurtosis. Kolmogorov-Smirnov (K-S) tests were additionally performed to observe whether the distribution for each variable significantly differed from a normal distribution. Nonnormal distributions were evident for pregnancy risk perceptions (skewness=1.12; kurtosis=0.45; K-S test p<0.001) as well as LTPA efficacy beliefs for both moderate (skewness=-0.70; kurtosis=0; K-S test p<0.001) and vigorous intensity (skewness=-0.20; kurtosis=-0.63; K-S test p=0.002). Therefore, pregnancy risk perception and LTPA efficacy belief scores were categorized as such: strong agreement (\geq 6.5), some agreement (4.5-6.0), unsure or some disagreement (2.0-4.0), and strong disagreement (\leq 1.5). Frequency and percentages were calculated for each, and histograms were also constructed. The medians and ranges for these variables were also calculated.

Specific Aim 3: To determine if differences exist in meeting the moderate LTPA guidelines among pregnancy risk perception/moderate LTPA efficacy attitudinal groups as defined by the RPA.

A median split of both pregnancy risk perceptions (high/low) and moderate LTPA efficacy beliefs (high/low) allowed for the creation of four attitudinal groups (combinations of high/low risk and efficacy). Moderate LTPA, as defined by minutes per week, was determined to be non-normally distributed (skewness=2.35, kurtosis=7.78, K-S test p<0.001). Thus, moderate LTPA was dichotomized as "meeting moderate LTPA" guidelines" (≥150 minutes/week) and "not meeting moderate LTPA guidelines." To assess categorical participant characteristics, chi-square analyses were performed to determine if relative frequency differed among attitudinal groups. Pairwise comparisons with Bonferonni adjustments were examined specifically for meeting the moderate LTPA guidelines. Kruskal-Wallis tests were performed to determine differences in continuous participant characteristics among attitudinal groups. Logistic regression analysis was utilized to examine the odds of meeting the moderate LTPA guidelines for each attitudinal group. Therefore, odds ratios and 95% confidence intervals were calculated for the responsive, proactive, and avoidant groups, with the avoidant group serving as the referent category. Due to the lack of literature examining the relationship between

physical activity perceptions and LTPA behavior during pregnancy, no definitive variable could be identified as a potentially important covariate to adjust for in this analysis. However, results of the previously described chi-square and Kruskal-Wallis analyses showed a number of variables to be significantly related (p<0.05) to our attitudinal groupings. These variables were examined systematically via a forward stepwise method (by examining Wald statistics) to determine whether they significantly entered (p<0.05) the regression model. Those that did enter, were kept in the regression model for analysis, while those that did not enter, were excluded.

Specific Aim 4: To determine if differences exist in vigorous LTPA participation among pregnancy risk perception/vigorous LTPA efficacy attitudinal groups as defined by the RPA.

A median split of both pregnancy risk perceptions (high/low) and vigorous LTPA efficacy beliefs (high/low) allowed for the creation of four attitudinal groups (combinations of high/low risk and efficacy). Vigorous LTPA, as defined by minutes per week, was determined to be non-normally distributed (skewness=2.86, kurtosis=10.5, K-S test p<0.001). Thus, vigorous LTPA was dichotomized as "participating in any vigorous LTPA" and "not participating in vigorous LTPA." To assess categorical participant characteristics, chi-square analyses were performed to determine if relative frequency differed among attitudinal groups. Pairwise comparisons with Bonferonni adjustments were examined specifically for participating in any vigorous LTPA. Kruskal-Wallis tests were performed to determine differences in continuous participant characteristics among attitudinal groups. Logistic regression analysis was utilized to examine the odds of participating in vigorous-intensity LTPA for each attitudinal group. Therefore, odds ratios and 95% confidence intervals were calculated for the responsive,

proactive, and avoidant groups, with the indifferent group serving as the referent category. Due to the lack of literature examining the relationship between physical activity perceptions and LTPA behavior during pregnancy, no definitive variable could be identified as a potentially important covariate to adjust for in this analysis. However, results of the previously described chi-square and Kruskal-Wallis analyses showed a number of variables to be significantly related (p<0.05) to our attitudinal groupings. These variables were examined systematically via a forward stepwise method (by examining Wald statistics) to determine whether they significantly entered (p<0.05) the regression model. Those that did enter, were kept in the regression model for analysis, while those that did not enter, were excluded.

Specific Aim 5: To determine if the interaction of pregnancy risk perceptions and moderate LTPA efficacy is associated with meeting moderate LTPA guidelines among pregnant women.

An interaction term for pregnancy risk perceptions and moderate LTPA efficacy beliefs (pregnancy risk x LTPA efficacy) was first created. In order to reduce multicollinearity, variables used to create this interaction term were mean centered and then standardized prior to the formation of the interaction term, as recommended by Aiken and West.²¹ Pearson and Spearman correlation coefficients were calculated to determine the relationships for potentially important covariates with the independent variables (pregnancy risk perceptions, moderate LTPA efficacy beliefs, pregnancy risk x LTPA efficacy interaction) as well as dependent variable (meeting moderate LTPA guidelines). Hierarchical logistic regression was utilized to examine both the main and interaction effects on meeting the moderate LTPA guidelines. First added to the model were the demographic control variables (step 1) and psychosocial control variables (step 2). Next,

main effects were explored with the addition of pregnancy risk perceptions and moderate LTPA efficacy beliefs (step 3). Finally, the pregnancy risk x LTPA efficacy interaction term was added to the model (step 4). The statistical significance of change in variance (ΔR^2) was explored for each step. Participant characteristics that were identified as control variables through the statistical analyses for Aim 3 were controlled for as a part of this analysis. Moderate LTPA risk perception (psychosocial control variable) was also controlled for due to its theoretical rationale as a potential confounding factor and also its significant bivariate correlation with pregnancy risk perceptions, moderate LTPA efficacy beliefs, and meeting moderate LTPA guidelines during pregnancy (see Table 4.4, Chapter 4).

Specific Aim 6: To determine if the interaction of pregnancy risk perceptions and vigorous LTPA efficacy is associated with participating in any vigorous LTPA among pregnant women.

An interaction term for pregnancy risk perceptions and vigorous LTPA efficacy beliefs (pregnancy risk x LTPA efficacy) was first created. In order to reduce multicollinearity, variables used to create this interaction term were mean centered and then standardized prior to the formation of the interaction term, as recommended by Aiken and West.²¹ Pearson and Spearman correlation coefficients were calculated to determine the relationships for potentially important covariates with the independent variables (pregnancy risk perceptions, vigorous LTPA efficacy beliefs, pregnancy risk x LTPA efficacy interaction) as well as dependent variable (meeting moderate LTPA guidelines). Hierarchical logistic regression was utilized to examine both the main and interaction effects on meeting the moderate LTPA guidelines. First added to the model were the demographic control variables (step 1) and psychosocial control variables (step 2). Next,

the main effects were explored with the addition of pregnancy risk perceptions and vigorous LTPA efficacy beliefs (step 3). Finally, the pregnancy risk x LTPA efficacy interaction term was added to the model. The statistical significance of change in variance (ΔR^2) was explored for each step. Participant characteristics that were identified as control variables through the statistical analyses for Aim 4 were controlled for as a part of this analysis. Vigorous LTPA risk perception (psychosocial control variable) was also controlled for due to its theoretical rationale as a potential confounding factor and also its significant bivariate correlation with pregnancy risk perceptions, vigorous LTPA efficacy beliefs, and participating in vigorous LTPA during pregnancy (see Table 4.6, Chapter 4).

Specific Aim 7: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with LTPA, pregnancy risk perceptions, and LTPA efficacy beliefs among pregnant women.

Religious groups were formed as previously described in this chapter. Non-normal distributions were found for the dependent variables: moderate LTPA (skewness=2.35, kurtosis=7.78, K-S test p<0.001), vigorous LTPA (skewness=2.86, kurtosis=10.5, K-S test p<0.001), pregnancy risk perceptions (skewness=1.08, kurtosis=0.28, K-S test p<0.001), moderate LTPA efficacy beliefs (skewness=-0.70, kurtosis=0.13, K-S test p<0.001), and vigorous LTPA efficacy beliefs (skewness=-0.70, kurtosis=0.62, K-S test p=0.002). Moderate LTPA efficacy beliefs (skewness=-0.11, kurtosis=-0.62, K-S test p=0.002). Moderate LTPA was dichotomized as "meeting moderate LTPA guidelines" (\geq 150 minutes/week) and "not meeting moderate LTPA guidelines." Vigorous LTPA was dichotomized as "participating in any vigorous LTPA" and "not participating in vigorous LTPA." Pregnancy risk perception score was dichotomized as "strong disagreement" (\leq 1.5 for score) and "all else." Moderate LTPA efficacy was

dichotomized as "strong agreement" (≥6.5 for score) and "all else." Vigorous LTPA efficacy was dichotomized as "some agreement" (≥4.5 for score) and "unsure or some disagreement." To assess categorical participant characteristics, chi-square analyses were performed to determine if relative frequency differed among religious groups. Kruskal-Wallis tests were performed to determine differences in continuous participant characteristics among religious groups. Pairwise comparisons with Bonferonni adjustments were examined for all dependent variables. Logistic regression analysis was utilized to calculate odds ratios and 95% confidence intervals for the non-LDS religious groups (high, moderate, and low). The LDS religious group served as the referent category given the general interest of this Aim was to determine how LDS pregnant women differ from each of the non-LDS groups. The relationship between religion and LTPA behavior during pregnancy has rarely been investigated, and therefore no definitive variable could be identified as a potentially important covariate to adjust for in this analysis. However, the previously described chi-square and Kruskal-Wallis analyses showed a number of variables to be related to the religious groups (p<0.05). These variables were examined systematically via a forward stepwise method (by examining Wald statistics) to determine whether they significantly entered (p<0.05) the regression model. Variables that did significantly enter were kept in the adjusted model.

Specific Aim 8: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with prenatal HCP discussions, satisfaction with these discussions, and physical activity social support among pregnant women.

Religious groups were formed as previously described in this chapter. Non-normal distributions were found for the dependent variables: satisfaction of physical activity discussion with prenatal HCP (skewness=-1.07, kurtosis=0.94, K-S test p<0.001), total social support (skewness=-1.27, kurtosis=2.02, K-S test p<0.001), and social support from family (skewness=-1.09, kurtosis=0.91, K-S test p<0.001), friends (skewness=-1.09, kurtosis=0.83, K-S test p<0.001), and significant other (skewness=-1.90, kurtosis=3.18, K-S test p < 0.001). Median splits were utilized in order to dichotomize each variable as "high" and "low." Whether discussion of physical activity with prenatal HCP occurred (a further dependent variable), was already dichotomized as "yes" or "no." To assess categorical participant characteristics, chi-square analyses were performed to determine if relative frequency differed among religious groups. Kruskal-Wallis tests were additionally performed to determine differences in continuous demographic characteristics among religious groups. Pairwise comparisons with Bonferonni adjustments were examined for all dependent variables. Logistic regression analysis was utilized to calculate odds ratios and 95% confidence intervals for the non-LDS religious groups (high, moderate, and low), with the LDS religious group serving as the referent category. The relationship between religion and LTPA behavior during pregnancy has not yet been investigated, and therefore no definitive variable could be identified from previous literature as a potentially important covariate to adjust for in these analyses.

However, the previously described chi-square and Kruskal-Wallis analyses showed a number of variables to be related to the religious groups (p<0.05). These variables were examined systematically via a forward stepwise method (by examining Wald statistics) to determine whether they significantly entered (p<0.05) the regression model. Variables that did significantly enter were kept in the adjusted model.

APPENDICES

Appendix A: IRB Approval – Michigan State University

Figure 3.3. Study IRB approval by Michigan State University. **MICHIGAN STATE** Initial IRB UNIVERSITY Application Determination January 28, 2014 *Exempt* To: James Pivarnik 27 I.M. Sports Circle IRB#x14-050e Category: Exempt 2 Re[.] Approval Date: January 16, 2014 Title: Leisure-time physical activity perceptions, influences, and behavior during pregnancy The Institutional Review Board has completed their review of your project. I am pleased to advise you that your project has been deemed as exempt in accordance with federal regulations. This approval letter is being re-issued at the PI's request to revise the title from "Leisure-time physical activity perceptions, influences, and behavior during pregnancy: Utilizing the Risk Perception Attitude Framework and assessing the effect of Mormonism" to: "Leisure-time physical activity perceptions, influences, and behavior during pregnancy." The IRB has found that your research project meets the criteria for exempt status and the criteria for the protection of human subjects in exempt research. Under our exempt policy the Principal Investigator assumes the responsibilities for the protection of human subjects in this project as outlined in the assurance letter and exempt educational material. The IRB office has received your signed assurance for exempt research. A copy of this signed agreement is appended for your information and records. Renewals: Exempt protocols do not need to be renewed. If the project is completed, please submit an Application for Permanent Closure. Revisions: Exempt protocols do not require revisions. However, if changes are made to a protocol that may no longer meet the exempt criteria, a new initial application will be required. Problems: If issues should arise during the conduct of the research, such as unanticipated problems, adverse events, or any problem that may increase the risk to the human subjects and change the category of review, notify the IRB office promptly. Any complaints from participants regarding the risk and benefits of the project must be reported to the IRB. Follow-up: If your exempt project is not completed and closed after three years, the IRB office will Office of Regulatory Affairs contact you regarding the status of the project and to verify that no changes have occurred that may Human Research affect exempt status **Protection Programs** Please use the IRB number listed above on any forms submitted which relate to this project, or on any **Biomedical & Health** correspondence with the IRB office. Institutional Review Board (BIRB) Good luck in your research. If we can be of further assistance, please contact us at 517-355-2180 or Community Research Institutional Review Board via email at IRB@msu.edu. Thank you for your cooperation. (CRIRB) Social Science Behavioral/Education Institutional Review Board (SIRB) Sincerely, A. Miller Olds Hall 408 West Circle Drive, #207 East Lansing, MI 48824 (517) 355-2180 Fax: (517) 432-4503 Harry McGee, MPH Vice Chair, Biomedical and Health Institution Review Board (BIRB) Human Research Protection Program Email: irb@msu.edu /ww.humanresearch.msu.edu c: Christopher Connolly, Maria Lapinski, Lanay Kazmirzack, Deborah L. Feltz, Rebecca Schlaff

Appendix B: IRB Approval – University of Utah

Figure 3.4. Study IRB approval by University of Utah.



Appendix C: Informed Consent (Electronic)

LEISURE-TIME PHYSICAL ACTIVITY PERCEPTIONS, INFLUENCES, AND BEHAVIOR DURING PREGNANCY

Participant Informed Consent Form (ELECTRONIC)

You are being asked to participate in a research study about how pregnant women feel about physical activity during pregnancy.

Subjects must be women who are currently pregnant, can speak fluent English and/or Spanish, not be on bed rest as prescribed by your OBGYN for your pregnancy status, and be 18 – 45 years of age.

This research project's main objective is to determine how pregnant women feel about physical activity during pregnancy and to see if their feelings lead to participation in physical activity.

Your participation will consist of taking a 15-minute online survey using a computer device while you wait for your doctor appointment. The survey will ask you questions about your physical activity beliefs, current exercise habits, pregnancy history, any support you receive to be physically active, and your religious beliefs. Your participation in this survey will assist us in better understanding what pregnant women believe about physical activity and how it relates the baby's health.

Your participation in the research study is completely voluntary. You may choose not to participate and/or you may withdraw at any point during the study if you change your mind. There will be no penalty for choosing not to participate. All responses will be confidential. Also, no identifying information, such as name, email address, or residential address will be collected. Additionally, we will not use your personal medical records to collect any information.

As a thank you for participation, you will receive a \$10 gift card to Target after completing the survey. If you are not finished with the survey before getting called into your appointment with your doctor, you will be able to complete it afterwards.

The researchers for this project are: Christopher Connolly, Dr. James Pivarnik, Dr. Lanay Mudd, Dr. Maria Lapinski, and Dr. Deborah Feltz at Michigan State University, Dr. Rebecca Schlaff at Saginaw Valley State University, and Dr. Robert Silver at the University of Utah. If you have any questions about the research study, please contact Christopher Connolly at 765-418-1713, <u>connol57@msu.edu</u>.

If you have questions about your rights as a research participant, would like to obtain information or off input, or would like to register a complaint about this study, you may contact the Michigan State University's Human Research Protection Program, 408 W. Circle Dr., Room 207 Olds Hall, Est Lansing, MI., 48823, (517-355-2180 or irb@msu.edu).

By clicking on the button below, you indicate your voluntary agreement to participate in this online survey.

_____ Agree (Agree will lead them to the survey)

Appendix D: Informed Consent (Paper Copy)

LEISURE-TIME PHYSICAL ACTIVITY PERCEPTIONS, INFLUENCES, AND BEHAVIOR DURING PREGNANCY

Participant Informed Consent Form (PAPER COPY)

You are being asked to participate in a research study about how pregnant women feel about physical activity during pregnancy.

Subjects must be women who are currently pregnant, can speak fluent English and/or Spanish, not be on bed rest as prescribed by your OBGYN for your pregnancy status, and be 18 – 45 years of age.

This research project's main objective is to determine how pregnant women feel about physical activity during pregnancy and to see if their feelings lead to participation in physical activity.

Your participation will consist of taking a 15-minute survey while you wait for your doctor appointment. The survey will ask you questions about your physical activity beliefs, current exercise habits, pregnancy history, any support you receive to be physically active, and your religious beliefs. Your participation in this survey will assist us in better understanding what pregnant women believe about physical activity and how it relates the baby's health.

Your participation in the research study is completely voluntary. You may choose not to participate and/or you may withdraw at any point during the study if you change your mind. There will be no penalty for choosing not to participate. All responses will be confidential. Also, no identifying information, such as name, email address, or residential address will be collected. Additionally, we will not use your personal medical records to collect any information.

As a thank you for participation, you will receive a \$10 gift card to Target after completing the survey. If you are not finished with the survey before getting called into your appointment with your doctor, you will be able to complete it afterwards.

The researchers for this project are: Christopher Connolly, Dr. James Pivarnik, Dr. Lanay Mudd, Dr. Maria Lapinski, and Dr. Deborah Feltz at Michigan State University, Dr. Rebecca Schlaff at Saginaw Valley State University, and Dr. Robert Silver at the University of Utah. If you have any questions about the research study, please contact Christopher Connolly at 765-418-1713, <u>connol57@msu.edu</u>.

If you have questions about your rights as a research participant, would like to obtain information or off input, or would like to register a complaint about this study, you may contact the Michigan State University's Human Research Protection Program, 408 W. Circle Dr., Room 207 Olds Hall, Est Lansing, MI., 48823, (517-355-2180 or irb@msu.edu).

By checking the space below, you indicate your voluntary agreement to participate in this survey.

_____ Agree
Appendix E: Survey Instrument

PART 1 - PHYSICAL ACTIVITY DURING PREGNANCY

We would like to ask you about moderate and vigorous-intensity physical activities that you perform in your leisure-time. Activities during "leisure-time" refer to exercise, sports, or recreational activities that are not a part of your job or household responsibilities. "Moderate physical activity" includes activities that cause small increases in breathing or heart rate such as brisk walking, light swimming, or bicycling. "Vigorous physical activity" includes activities that cause large increases in breathing or heart rate such as running, aerobic dance, or intense swimming or bicycling. Please provide the response that most closely represents your leisure-time physical activity that you participate in.

For the next four questions, we will ask you about your moderate and vigorous leisure-time physical activity <u>prior to this pregnancy</u>.

1) Prior to this pregnancy, how many days per week did you typically participate in <u>moderate</u> physical activity?

0 1 2 3 4 5 6 7

- 2) Prior to this pregnancy, how many minutes per day did you typically spend participating in <u>moderate</u> physical activity (If you answered "0" for question 1, please skip this question)?
- 3) Prior to this pregnancy, how many days per week did you typically participate in <u>vigorous</u> physical activity?

0 1 2 3 4 5 6 7

4) Prior to this pregnancy, how many minutes per day did you typically spend participating in <u>vigorous</u> physical activity (If you answered "0" for question 3, please skip this question)?

For the next four questions, we will ask you about your moderate and vigorous leisure-time physical activity <u>during this pregnancy</u>.

5) During this pregnancy, how many days per week do you typically participate in <u>moderate</u> physical activity?

0 1 2 3 4 5 6 7

6) During this pregnancy, how many minutes per day do you typically spend participating in <u>moderate</u> physical activity (if you answered "0" for question 5, please skip this question)?

7) During this pregnancy, how many days per week do you typically participate in <u>vigorous</u> physical activity?

0 1 2 3 4 5 6 7

8) During this pregnancy, how many minutes per day do you typically spend participating in <u>vigorous</u> physical activity (if you answered "0" for question 7, please skip this question)?

PART 2 - BELIEFS ABOUT PREGNANCY

We would like to first ask how at risk you feel your baby is during this pregnancy. For each question, please mark the number on the scale that most accurately represents your feelings.

Marking "1" means you most strongly disagree with the statement. Marking "7" means you most strongly agree with the statement.

9) It is possible that my baby will experience a harmful effect during pregnancy.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	igree					Agree

10) A harmful effect that my baby would experience during pregnancy is severe.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

For the next four questions, we will ask you about your beliefs that you have towards <u>moderate physical activity during this pregnancy</u>.

Marking "1" means you most strongly disagree with the statement. Marking "7" means you most strongly agree with the statement.

11) Participating in 30 minutes of moderate physical activity per day, five times per week helps protect my baby from harm.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	igree					Agree

12) I can participate in 30 minutes of moderate physical activity per day, five times per week while pregnant.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

13) Participating in 30 minutes of moderate physical activity per day, five times per week is harmful to my baby.

1	2	3	4	5	6	7
Stroi	ngly					Strongly
Disa	gree					Agree

14) Women who participated in moderate activities before pregnancy should participate in moderate physical activity during pregnancy.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

For the next questions, we would like to ask you about your beliefs that you have towards <u>vigorous</u> physical activity during pregnancy.

15) If a pregnant woman was vigorously active before and so far during pregnancy (including you), participation in vigorous physical activity during pregnancy would help protect her baby from harm.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

16) I can participate in some vigorous physical activity while pregnant.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	igree					Agree

17) If a pregnant woman was vigorously active before pregnancy (including you), participation in vigorous physical activity during pregnancy could harm her baby.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

18) Women who participated in vigorous activities before pregnancy should participate in vigorous physical activity during pregnancy.

			-		-	
1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	gree					Agree

PART 3 - PREGNANCY HISTORY

For these next questions, we would like to ask you about your personal pregnancy and delivery history. Please mark the response that most closely represents your experiences. Some questions will relate to your current pregnancy, and some will relate to a previous pregnancy (if you have had one).

- 19) During this pregnancy, has your prenatal physician informed you that you are "high-risk"? Yes
 - No
 - No

20) How many children have you given birth to?

None One Two Three More than three

21) Have you had a miscarriage?

Yes

No

- 22) If you answered "yes" for question 21, how many miscarriages have you had (if you answered "No" for question 21, please skip this question)?
 - One Two Three More than three

23) For a previous pregnancy, did you deliver your child pre-term?

Yes No Not applicable 24) For a previous pregnancy, did you deliver your child via C-section?

Yes No

Not applicable

25) Have you ever sought help from a healthcare provider to get pregnant?

Yes

No

26) Select any of the conditions listed below that you have been diagnosed with during your <u>current</u> pregnancy (select all that apply).

Gestational Diabetes (diabetes first diagnosed during pregnancy) Pregnancy-Induced Hypertension (high blood pressure) Major Depressive Disorder (clinical depression) Hyperemesis Gravidarum (severe nausea) None of the above

27) Select any of the conditions listed below that you were diagnosed with during a <u>previous</u> pregnancy (select all that apply).

Gestational Diabetes (diabetes first diagnosed during pregnancy) Pregnancy-Induced Hypertension (high blood pressure) Major Depressive Disorder (clinical depression) Hyperemesis Gravidarum (severe nausea) None of the above

28) During a previous pregnancy, have you ever been prescribed bedrest?

Yes No Not applicable

PART 4 - PRENATAL HEALTH CARE PROVIDER

For these next questions, we would like to ask you about whether you have discussed physical activity during pregnancy with your doctor or midwife and the nature of those discussions. Please mark the response that most accurately represents your feelings.

29) During a previous pregnancy, did you and an OBGYN, midwife, or prenatal nurse discuss physical activity during pregnancy?

Yes No Unsure Not applicable 30) During this pregnancy, have you and an OBGYN, midwife, or prenatal nurse discussed physical activity during pregnancy?

Yes No

31) If you answered "Yes" for question 30, did you initiate this discussion of being physically active during pregnancy or did an OBGYN, midwife, or prenatal nurse initiate the discussion (if you answered "No" for question 30, please skip this question)?

You

Your OBGYN/midwife/prenatal nurse

32) If you answered "Yes" for question 30, please indicate on the scale below how satisfied you feel regarding this physical activity discussion with an OBGYN, midwife, or prenatal nurse (if you answered "No" for question 30, please skip this question)?

1	2	3	4	5	6	7
Very						Very
Unsat	tisfied					Satisfied

33) If you answered "Yes" for question 30, please indicate on the scale below what you believe his/her expertise is regarding physical activity during pregnancy and the effects it has on you and your baby (if you answered "No" for question 30, please skip this question).

1	2	3	4	5	6	7
Low						High
Experti	ise					Expertise

- 34) If you answered "No" for question 30, would you have the desire to discuss physical activity during pregnancy with an OBGYN, midwife, or prenatal nurse (if you answered "Yes" for question 30, please skip this question)?
 - Yes No
- 35) During this pregnancy, has an OBGYN, midwife, or prenatal nurse discussed the current physical activity recommendations for pregnant women with you (At least 150 minutes of moderate physical activity per week)?

Yes

No

Marking "1" means you most strongly disagree with the statement. Marking "7" means you most strongly agree with the statement.

36) During this pregnancy, an OBGYN, midwife, or prenatal nurse encourages me to be physically active.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	igree					Agree

37) I feel adequately informed regarding the benefits and risks of physical activity during pregnancy.

1	2	3	4	5	6	7
Stro	ngly					Strongly
Disa	igree					Agree

- 38) Have you ever sought out information about physical activity during pregnancy from another source besides from an OBGYN, midwife, or prenatal nurse?
 - Yes No
- 39) Please select the means by which you would <u>most prefer</u> to receive accurate information on physical activity during pregnancy (circle only one answer).

Discussion with your OBGYN or midwife Pamphlet or Booklet Video Online Document Informative Magazines Family or Friends

PART 5 - SOCIAL SUPPORT

For these next questions, we would like to ask you about the support you currently receive for you participating in physical activity. We will ask about the physical activity-support you receive from family, friends, and your significant other during this pregnancy. For each question, please circle the number on the scale that most accurately represents your feelings. For the questions which pertain to a "significant other", if you do not feel like you have such a person in your life right now, please mark "Not applicable".

Marking "1" means you most strongly disagree with the statement. Marking "7" means you most strongly agree with the statement.

40) Regarding	physica	al activi	ty, my s	ignifica	nt other	· is ava	ailable when I ar	n in need.
	1	2	3	4	5	6	7	Not applicable
	Strong	ıly					Strongly	
	Disagr	ee					Agree	
41) I can share	e my su	ccesses	and cha	allenges	about	physic	al activity with i	my significant other.
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagr	ee					Agree	
42) My family	really t	ries to ł	nelp me	be phy	sically a	ctive.		
	1	2	3	4	5	6	7	Not applicable
	Strong	ily					Strongly	
	Disagr	ее					Agree	
43) I get the e active.	motion	al help a	and sup	port I n	eed fro	m my	family so that I	can be physically
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagr	ree					Agree	
44) My signific physical a	cant oth ctivity.	ner is a i	real sou	rce of c	omfort	to me	when I am cond	cerned or unsure about
	1	2	3	4	5	6	7	Not applicable
	Strong	ıly					Strongly	
	Disagr	ee					Agree	
45) My friend	s really	try to h	elp me	so that	I can be	physi	cally active.	
	1	2	3	4	5	6	7	Not applicable
	Strong	ıly					Strongly	
	Disagr	ee					Agree	

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46) Regarding	physica	l activit	ty, I can	count o	on my fi	riends	when things are	e not going well.
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagre	ee					Agree	
								с ч
47) I can talk a	bout th	e conce	erns I ha	ave tow	ards ph	ysical a	activity with my	family.
	1	2	3	4	5	6	/	Νοτ αρριιζαδιε
	Strong	iy aa					Strongly	
	Disugre	20					Agree	
48) I have frier	nds with	n whom	n I can s	hare my	/ succes	ses an	d challenges ab	out physical activity.
-	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagre	ee					Agree	
40) My cignific	ant oth	or caro	c about	my foo	lings to	warde	nhucical activity	
49) IVIY SIGIIIIIC	.ant 0th 1	2	3 about	Λ IIIy lee	5	6	7	Not annlicable
	± Strong	2 Iv	5	7	5	0	, Stronaly	Not applicable
	Disaar	'Y 00					Δaree	
	Disugit						Agree	
50) My family	is willin	g to he	lp me n	nake de	cisions a	about p	physical activity	
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagre	ee					Agree	
51) I can talk a	bout th	e conce	erns I ha	ave tow	ards nh	vsical a	activity with my	friends
	1	2	3	4	5	6	7	Not applicable
	- Strona	_ lv	0	•	0	0	, Stronalv	
	Disaare	., Р					Aaree	
							g	
52) My family	encoura	ages me	e to be	physical	lly activ	e durir	ng pregnancy.	
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagre	ee					Agree	
53) My friends	encour	raσo ma	a to he	nhysical	ly activ	o durin	g pregnancy	
SS/ Wry menus	1	2	3	4	5	6	7	Not annlicable
	- Strona	L Iv	5	•	5	U	, Stronalv	
	Disagre	е 20					Agree	
	5						5	
54) My signific	ant oth	er enco	ourages	me to k	pe physi	cally a	ctive.	
	1	2	3	4	5	6	7	Not applicable
	Strong	ly					Strongly	
	Disagre	ee					Agree	

PART 6 - DEMOGRAPHICS

For these next questions we would like to ask about some of your basic demographic information. Please provide the response that most closely represents you.

55) What is your age? _____

56) What is your race?		

57) How many weeks pregnant are you (If you do not know, please write unsure)? _____

58) Are you currently carrying more than one baby (i.e. twins, triplets, etc.)?

Yes No Unsure

59) What is the highest level of education you have completed?

Less than High School High School/GED Associate Degree (2 year) Bachelor Degree (4 year) Graduate Degree Other

60) What is your estimated annual household income? Less than \$10,000 \$10,000-\$30,000 \$30,001-\$50,000 \$50,001-\$70,000 Greater than \$70,000

61) In what U.S. state do you currently reside? Utah Michigan Other_____

62) How many children do you currently care for in your household?

63) Do you currently have a "significant other"?

Yes No

PART 7 - RELIGIOUS BELIEFS

For the next four questions we would like to ask about some of your basic religious beliefs. Please provide the response that most closely represents you.

64) Do you believe in a God or some sort of higher power?

Yes No

- 65) Do you regularly practice a religion?
 - Yes
 - No

66) To what religious affiliation do you belong or do you most identify with?

67) Do you feel that your faith actively promotes a healthy lifestyle?

Yes

No

For these last ten questions, please mark the number on the scale that most accurately represents your feelings

Marking "1" means you strongly disagree with the statement. Marking "4" means you strongly agree with the statement.

68) My religious faith is extremely important to me.

1	2	3	4
Stron	gly	Strongly	
Disag	iree		Agree

69) I pray daily.

1	2	3	4
Strong	ly	Strongly	
Disagre	ее		Agree

70) I look to my faith as a source of inspiration.

1	2	3	4
Strongly	Strongly		
Disagre	е		Agree

71) I look to my faith as providing meaning and purpose in my life.

1	2	3	4
Stron	gly	Strongly	
Disag	iree		Agree

72) I consider myself active in my faith, church, or place of worship.

1	2	3	4
Strong	gly	Strongly	
Disagi	ree		Agree

73) My faith is an important part of who I am as a person.

1	2	3	4
Strong	ly	Strongly	
Disagre	ee		Agree

74) My relationship with God is extremely important to me.

1	2	3	4
Strong	ly	Strongly	
Disagr	ee		Agree

75) I enjoy being around others who share my faith.

1	2	3	4
Strongly	/		Strongly
Disagre	е		Agree

76) I look to my faith as a source of comfort.

1	2	3	4
Strong	gly		Strongly
Disagi	ree		Agree

77) My faith impacts many of my decisions.

1	2	3	4
Stron	gly		Strongly
Disag	gree		Agree

Appendix F: Recruitment Flyer



Study Title: Leisure-Time Physical Activity Perceptions, Influences, and Behavior during Pregnancy

Appendix G: Dissertation Funding Sources

Dissertation Funding Sources

(Participant compensation, iPad devices, travel, and supplies)

- **1. Research Practicum and Dissertation Fellowship** College of Education, Michigan State University Funded - \$3,355
- 2. Research and Professional Development Fellowship Department of Kinesiology, Michigan State University Funded - \$700
- **3. Research Enhancement Award** The Graduate School, Michigan State University Funded - \$950

(Study investigator support – University of Utah)

4. The Center for Physical Activity and Health Department of Kinesiology, Michigan State University Funded - \$6,000

(Study coordinator assistantship support)

- 5. College of Education Seed Grant College of Education, Michigan State University Funded - \$4,089
- 6. Dissertation Completion Fellowship College of Education/The Graduate School, Michigan State University Funded - \$6,000

Not Funded

- 1. Henry David Research Grant American Psychological Foundation Not Funded - \$1,500
- 2. Dissertation Research Support Fellowship College of Education, Michigan State University Not Funded - \$4,000

REFERENCES

REFERENCES

- 1. Rimal RN, Real K. Perceived risk and efficacy beliefs as motivators of change: Use of the risk perception attitude (RPA) framework to understand health behaviors. *Hum Commun Res.* Jul 1 2003;29(3):370-399.
- 2. Witte K. Putting the Fear Back into Fear Appeals the Extended Parallel Process Model. *Commun Monogr.* Dec 1992;59(4):329-349.
- **3.** Rimal RN. Perceived risk and self-efficacy as motivators: Understanding individuals' long-term use of health information. *J Commun.* Dec 2001;51(4):633-654.
- **4.** Real K. Information seeking and workplace safety: A field application of the risk perception attitude framework. *J Appl Commun Res.* 2008;36(3):339-359.
- **5.** Sullivan HW, Burke Beckjord E, Finney Rutten LJ, Hesse BW. Nutrition-related cancer prevention cognitions and behavioral intentions: testing the risk perception attitude framework. *Health Educ Behav*. Dec 2008;35(6):866-879.
- 6. Rimal RN, Bose K, Brown J, Mkandawire G, Folda L. Extending the Purview of the Risk Perception Attitude Framework: Findings from HIV/AIDS Prevention Research in Malawi. *Health Commun.* 2009;24(3):210-218.
- 7. Rimal RN, Juon HS. Use of the Risk Perception Attitude Framework for Promoting Breast Cancer Prevention. *J Appl Soc Psychol*. Feb 2010;40(2):287-310.
- **8.** Herrmann SD, Heumann KJ, Der Ananian CA, Ainsworth BE. Validity and reliability of the Global Physical Activity Questionnaire (GPAQ). *Measurement in Physical Education and Exercise Science*. 2013;17(3):221-235.
- **9.** Witte K, Cameron KA, McKeon JK, Berkowitz JM. Predicting risk behaviors: development and validation of a diagnostic scale. *Journal of health communication*. Oct-Dec 1996;1(4):317-341.
- **10.** United States. Dept. of Health and Human Services. 2008 physical activity guidelines for *Americans : be active, healthy, and happy!* Washington, DC: U.S. Dept. of Health and Human Services; 2008.
- **11.** Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. *J Pers Assess*. Spr 1988;52(1):30-41.
- **12.** Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric Characteristics of the Multidimensional Scale of Perceived Social Support. *J Pers Assess*. Win 1990;55(3-4):610-617.

- **13.** Plante TG, Boccaccini M. The Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology.* 1997;45:375-387.
- **14.** Freiheit SR, Sonstegard K, Schmitt A, Vye C. A psychometric evaluation of the Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology*. 2006;55:27-33.
- **15.** Plante TG, Boccaccini M. Reliability and validity of the Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology*. 1997;45:429-437.
- **16.** Sherman AC, Plante TG, Simonton S, Adams DC, Burris K, Harbison C. Assessing religious faith in medical patients: Cross-validation of the Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology*. 1999;48:129-142.
- **17.** Sherman AC, Plante TG, Simonton S, Adams DC, Harbison C, Burris SK. A multidimensional measure of religious involvement for cancer patients: the Duke Religious Index. *Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer*. Mar 2000;8(2):102-109.
- **18.** Plante TG, Yancey S, Sherman AC, Guertin M, Pardini D. Further validation for the Santa Clara Strength of Religious Faith Questionnaire. *Pastoral Psychology*. 1999;48:11-21.
- **19.** Plante TG. The Santa Clara Strength of Religious Faith Questionnaire: Assessing Faith Engagement in a Brief and Nondenominational Manner. *Religions*. Dec 2010;1(1):3-8.
- **20.** Sherman AC, Simonton S, Adams DC, et al. Measuring religious faith in cancer patients: Reliability and construct validity of the Santa Clara Strength of Religious Faith Questionnaire. *Psycho-Oncol.* Sep-Oct 2001;10(5):436-443.
- **21.** Aiken LS, West SG, Reno RR. *Multiple regression : testing and interpreting interactions*. Newbury Park, Calif.: Sage Publications; 1991.

CHAPTER 4

RESULTS

We planned to recruit at least 300 pregnant women who met the participant inclusion criteria (18-45 years of age, fluent English or Spanish speaker, not on prescribed bedrest). Although 360 pregnant women participated in this investigation, 18 women were excluded from final analyses as a result of incomplete LTPA data, 20 as a result of incomplete psychosocial or religious data, and 10 as a result of carrying more than one fetus. Furthermore, 10 women were excluded as a result of self-reported LTPA \geq 3 standard deviations above the mean. The final analytic sample for this investigation was 302 participants, as shown in Figure 4.1. Data from 141 participants were provided by investigators from the University of Utah's Health Science Center in Salt Lake City, Utah. Data from the remaining 161 participants were provided by study investigators located in the mid-Michigan area at Michigan State University.

Participant characteristics for the total analytic sample are displayed in Table 4.1. In total, 27.2% (n=82) of the sample reported meeting the current moderate LTPA guidelines (\geq 150 minutes per week)¹ as compared to 41.1% (n=124) of participants who achieved these guidelines prior to pregnancy. Likewise, 30.1% (n=91) reported participating in any vigorous LTPA as compared to 62.9% (n=190) who participated in any vigorous LTPA prior to pregnancy. The total analytic sample for this investigation had a median age of 28 (range 18-45) and a median gestational age of 27 weeks (range 5-40). Participants were primarily Caucasian (72.8%, n=220) and multiparous (63.9%, n=193), with the majority having at least some college education (59.3%, n=179). Nearly two-thirds of participants (n=199) reported having discussed LTPA with their prenatal HCP sometime during the current pregnancy.



Figure 4.1. Participant flowchart for the total analytic sample.

	(n=302)
<u>median (range)</u>	
Age (years)	28 (15, 45)
Gestational Age (weeks)	27 (5, 40)
<u>frequency (percentage)</u>	
Parity	
Nulliparous	109 (36.1)
Multiparous	193 (63.9)
Race	
Caucasian	220 (72.8)
Non-Caucasian	82 (27.2)
Education	
High School or less	123 (40.7)
Some College	179 (59.3)
Income	
≤\$30,000	136 (45.5)
>\$30,000	163 (54.5)
Miscarriage	91 (30.1)
Preterm Birth	40 (13.2)
C-section	54 (17.9)
Previous Conditions [†]	36 (11.9)
Current Conditions [†]	38 (12.6)
Moderate LTPA Efficacy	
Strong agreement	71 (23.5)
Vigorous LTPA Efficacy	
Strong agreement	25 (8.2)
Pregnancy Risk	
Strong disagreement	148 (49.0)
Moderate LTPA Risk	
Strong disagreement	205 (67.9)
Vigorous LTPA Risk	
Strong disagreement	68 (22.5)
Discussed LTPA w/ HCP	199 (65.9)
Pre Met LTPA Guidelines	124 (41.1)
Meet LTPA Guidelines	82 (27.2)
Pre Any Vigorous LTPA	190 (62.9)
Any Vigorous LTPA	90 (30.1)

 Table 4.1. Participant characteristics for total sample.

†Gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, or major depressive disorder.

Specific Aim 1: To develop a survey instrument to measure pregnant women's pregnancy risk perceptions, LTPA efficacy beliefs, and LTPA in order to utilize the Risk Perception Attitude Framework (RPA).

General development procedures and content overview of the survey instrument utilized for this dissertation are described in Chapter 3. Pregnancy risk perception (harm to the baby during pregnancy) questions assessing perceived severity and perceived susceptibility demonstrated acceptable internal consistency (Cronbach's alpha (α) = 0.78). LTPA efficacy beliefs questions assessed response and self-efficacy for both moderate and vigorous LTPA and demonstrated acceptable internal consistency ($\alpha = 0.69$, $\alpha = 0.67$).

Specific Aim 2: To determine the pregnancy risk perceptions and LTPA efficacy beliefs in a convenience sample of 300-400 pregnant women from mid-Michigan and Salt Lake City, Utah regions.

Figure 4.2 demonstrates the non-normal distributions for pregnancy risk perceptions (skewness=1.08, kurtosis=0.28, K-S test p<0.001) and moderate LTPA efficacy beliefs (skewness=-0.70, kurtosis=0.13, K-S test p<0.001). Although less skew was evident for vigorous LTPA efficacy beliefs, the distribution was still found to be non-normal (skewness=-0.11, kurtosis=-0.62, K-S test p=0.002) (Figure 4.2). Approximately half of the sample (49.0%, n=148) reported strong disagreement with the susceptibility/severity of a harmful effect their babies could experience during pregnancy, and a further 40.7% (n=123) indicated some disagreement. Just over 50% (n=152) of participants reported some agreement with response/self-efficacy of moderate LTPA, and a further 23.5% (n=71) indicated strong

agreement. With respect to the vigorous LTPA efficacy, strong agreement was reported by only 8.2% (n=25); however, 41.1% (n=124) reported some agreement. As a point of interest, 68% (n=205) of participants indicated strong disagreement that moderate LTPA participation has a harmful effect on the baby as compared to approximately 23% (n=68) for vigorous LTPA. Table 4.2 provides the median and range for each of these variables (and also moderate and vigorous LTPA in min/week) given the non-normal distribution of data.

Figure 4.2. Histograms depicting the frequencies of (*A*) pregnancy risk perceptions, (*B*) moderate LTPA efficacy beliefs, and (*C*) vigorous LTPA efficacy beliefs (7=strongly agree, 1= strongly disagree).



	(n=302)
<u>median (range)</u>	
Moderate LTPA (min/week)	90 (0, 1080)
Vigorous LTPA (min/week)	0 (0, 360)
Prepregnancy Moderate LTPA (min/week)	120 (0, 1080)
Prepregnancy Vigorous LTPA (min/week)	37.5 (0, 450)
Pregnancy Risk [†]	2.0 (1.0, 7.0)
Moderate LTPA Efficacy†	5.5 (1.0, 7.0)
Vigorous LTPA Efficacy†	4.0 (1.0, 7.0)
	1 1 1

Table 4.2. LTPA descriptive statistics for total sample.

†For all risk and efficacy variables; 7=strongly agree, 1=strongly disagree

Specific Aim 3: To determine if differences exist in meeting the moderate LTPA guidelines

among pregnancy risk perception/moderate LTPA efficacy attitudinal groups as defined by the

RPA.

Descriptive statistics for demographic characteristics of each attitudinal group are displayed in Table 4.3. Chi-square analyses indicated differences among attitudinal groups for race, education, income, preterm birth, adverse maternal conditions for a prior pregnancy, moderate LTPA risk perception, total physical activity social support, as well as physical activity social support from family and friends (p<0.05).

	Responsive	Proactive	Avoidant	Indifferent	-
	(n=87)	(n=72)	(n=67)	(n=76)	p-value
<u>median (range)</u>	. , ,	· · ·	. ,	· · · ·	•
Age (years)	28 (19, 39)	28.5 (19, 40)	28 (19, 40)	26 (15, 45)	0.191
Gestational Age (weeks)	24 (8, 40)	28 (5, 40)	24.5 (8, 40)	29.5 (6, 40)	0.062
<u>frequency (percentage)</u>					
Parity					0.356
Nulliparous	33 (37.9)	21 (29.2)	29 (43.3)	26 (34.2)	
Multiparous	54 (62.1)	51 (70.8)	38 (56.7)	50 (65.8)	
Race					< 0.001*
Caucasian	78 (89.7)	51 (70.8)	48 (71.6)	43 (56.6)	
Non-Caucasian	9 (10.3)	21 (29.2)	19 (28.4)	33 (43.4)	
Education					< 0.001*
High School or less	21 (24.1)	28 (38.9)	26 (38.8)	48 (63.2)	
Some College	66 (75.9)	44 (61.1)	41 (61.2)	28 (36.8)	
Income					0.003*
≤\$30,000	31 (35.6)	31 (43.1)	27 (40.9)	47 (63.5)	
>\$30,000	56 (64.4)	41 (56.9)	39 (59.1)	27 (36.5)	
Miscarriage	23 (26.4)	23 (31.9)	22 (32.8)	23 (30.3)	0.823
Preterm Birth	13 (14.9)	5 (6.9)	13 (19.4)	9 (11.8)	0.037*
C-section	13 (14.9)	14 (19.4)	11 (16.4)	16 (21.1)	0.841
Previous Conditions [†]	5 (5.7)	6 (8.3)	12 (17.9)	13 (17.1)	0.016*
Current Conditions [†]	10 (11.5)	6 (8.3)	13 (19.4)	9 (11.8)	0.246
LTPA Risk					< 0.001*
Strong disagreement	68 (78.2)	65 (90.3)	24 (35.8)	48 (63.2)	
All else	19 (21.8)	7 (9.7)	43 (64.2)	28 (36.8)	
Total Social Support					0.037*
High	46 (52.9)	45 (62.5)	28 (41.8)	32 (42.1)	
Low	41 (47.1)	27 (37.5)	39 (58.2)	44 (57.9)	
Family Social Support					0.011*
High	51 (58.6)	44 (61.1)	25 (37.3)	34 (44.7)	
Low	36 (41.4)	28 (38.9)	42 (62.7)	42 (55.3)	
Friend Social Support					0.015*
High	49 (56.3)	46 (63.9)	29 (43.3)	31 (40.8)	
Low	38 (43.7)	26 (36.1)	38 (56.7)	45 (59.2)	
Sig Other Social Support					0.349
High	49 (56.3)	45 (62.5)	32 (47.8)	40 (52.6)	
Low	38 (43.7)	27 (37.5)	35 (52.2)	36 (47.4)	
Discussed LTPA w/ HCP	58 (66.7)	46 (63.9)	47 (70.1)	48 (63.2)	0.815
Pre Met LTPA Guidelines	43 (49.4)	34 (47.2)	20 (29.9)	27 (35.5)	0.044*
Meet LTPA Guidelines	33 (37.9)	24 (33.3)	13 (19.4)	12 (15.8)	0.004*

Table 4.3. Participant characteristics of attitudinal groups (moderate LTPA).

*Significant differences comparing RPA groups (p <0.05). †Gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, or major depressive disorder.

The frequency of participants meeting moderate LTPA guidelines during pregnancy significantly differed among groups, $\chi^2(3)=13.50$, p=0.004. Pairwise comparisons with Bonferonni adjustments were performed and revealed that the frequency of meeting moderate LTPA guidelines was significantly greater for the responsive group compared to the indifferent group (Figure 4.3). No other significant differences in meeting the moderate LTPA guidelines were found.



Figure 4.3. Relative frequency of meeting moderate LTPA guidelines by attitudinal groups.

Logistic regression was performed to determine the odds of meeting moderate LTPA guidelines during pregnancy for each attitudinal group. The overall unadjusted model was statistically significant ($\chi^2(3)=13.83$, p=0.003), but explained only 6.5% of the variance in meeting the guidelines. Table 4.4 shows the responsive group had 3.26 times the odds (CI=1.53-6.92) of achieving the moderate LTPA guidelines as compared to the indifferent group, whereas the proactive group had 2.67 times the odds (CI=1.21-5.86). The avoidant group did not have significantly greater odds than did the indifferent group of achieving these guidelines.

Of the demographic characteristics that differed significantly among attitudinal groups (Table 4.3), only income level, moderate LTPA risk perception, and meeting LTPA guidelines prior to pregnancy significantly entered the logistic regression model. The adjusted model was also statistically significant ($\chi^2(6)$ =70.84, p<0.001) and explained 30.5% of the variance in meeting moderate LTPA guidelines. Further results of the adjusted model are displayed in Table 4.4 and show the responsive group had 3.23 times the odds (CI=1.35-7.74) of meeting the guidelines as compared to the indifferent group. After controlling for potential confounding variables, the difference between the proactive and indifferent groups bordered on statistical significance. As with the unadjusted analyses, odds ratio differences were not apparent between the avoidant group and indifferent group in the adjusted model.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
Indifferent				
Avoidant	1.28 [0.54-3.05]	0.571	1.94 [0.72-5.21]	0.188
Proactive	2.67 [1.21-5.86]	0.015*	2.44 [0.99-6.01]	0.052
Responsive	3.26 [1.53-6.92]	0.002*	3.23 [1.35-7.74]	0.008*

Table 4.4. Odds of meeting moderate LTPA guidelines by attitudinal groups.

*Significantly different compared to indifferent group (p<0.05).

†Adjusted for income, moderate LTPA risk perception, and meeting moderate LTPA guidelines prior to pregnancy.

Specific Aim 4: To determine if differences exist in vigorous LTPA participation among pregnancy risk perception/vigorous LTPA efficacy attitudinal groups as defined by the RPA.

Descriptive statistics for demographic characteristics of each attitudinal group are displayed in Table 4.5. Kruskal-Wallis analyses suggested that age and gestational age differ among attitudinal groups. Chi-square analyses indicated differences among attitudinal groups for race, education, income, miscarriage, preterm birth, and vigorous LTPA risk perception

(p<0.05).

	Responsive	Proactive	Avoidant	Indifferent	-
	(n=81)	(n=68)	(n=73)	(n=80)	p-value
median (range)					
Age (years)	27 (19, 39)	29 (17, 40)	29 (19, 40)	25 (15, 45)	0.006*
Gestational Age (weeks)	23 (8, 40)	32 (5, 40)	26 (8, 40)	27.5 (6, 40)	0.020*
<u>frequency (percentage)</u>					
Parity					0.161
Nulliparous	31 (38.3)	17 (25.0)	31 (42.5)	30 (37.5)	
Multiparous	50 (61.7)	51 (75.0)	42 (57.5)	50 (62.5)	
Race					< 0.001*
Caucasian	69 (85.2)	51 (75.0)	57 (78.1)	43 (53.8)	
Non-Caucasian	12 (14.8)	17 (25.0)	16 (21.9)	37 (46.3)	
Education					
High School or less	26 (32.1)	25 (36.8)	21 (28.8)	51 (63.7)	< 0.001*
Some college	55 (67.9)	43 (63.2)	52 (71.2)	29 (36.3)	
Income					0.003*
≤\$30,000	32 (40.0)	28 (41.8)	26 (35.6)	50 (63.3)	
>\$30,000	48 (60.0)	39 (58.2)	47 (64.4)	29 (36.7)	
Miscarriage	15 (18.5)	25 (36.8)	30 (41.1)	21 (26.3)	0.010*
Preterm Birth	10 (12.3)	5 (7.4)	16 (21.9)	9 (11.3)	0.009*
C-section	13 (16.0)	14 (20.6)	11 (15.1)	16 (20.0)	0.903
Previous Conditions [†]	9 (11.1)	8 (11.8)	8 (11.0)	11 (13.8)	0.872
Current Conditions [†]	8 (9.9)	7 (10.3)	15 (20.5)	8 (10.0)	0.135
LTPA Risk					<0.001*
Strong disagreement	16 (19.8)	31 (45.6)	3 (4.1)	18 (22.5)	
All else	65 (80.2)	37 (54.4)	70 (95.9)	62 (77.5)	
Total Social Support					0.398
High	43 (53.1)	38 (55.9)	31 (42.5)	39 (48.8)	
Low	38 (46.9)	30 (44.1)	42 (57.5)	41 (51.2)	
Family Social Support					0.157
High	46 (56.8)	39 (57.4)	30 (41.1)	39 (48.6)	
Low	35 (43.2)	29 (42.6)	43 (58.9)	41 (51.2)	
Friend Social Support					0.404
High	46 (56.8)	37 (54.4)	32 (43.8)	40 (50.0)	
Low	35 (43.2)	31 (45.6)	41 (56.2)	40 (50.0)	
Sig Other Social Support					0.504
High	46 (56.8)	41 (60.3)	35 (47.9)	44 (55.0)	
Low	35 (43.2)	27 (39.7)	38 (52.1)	36 (45.0)	0.00
Discussed LTPA w/ HCP	54 (66.6)	41 (60.3)	51 (69.9)	53 (66.3)	0.685
Pre Any Vigorous LTPA	62 (76.5)	45 (66.2)	37 (50.7)	46 (57.5)	<0.006*
Any Vigorous LTPA	41 (50.6)	26 (38.2)	4 (5.5)	20 (25.0)	<0.001*

Table 4.5. Participant characteristics of attitudinal groups (vigorous LTPA).

*Significant differences comparing RPA groups (p <0.05).

†Gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, or major depressive disorder

The frequency of participating in any vigorous LTPA during pregnancy significantly differed among groups ($\chi^2(3)$ =40.34, p<0.001). Pairwise comparisons with Bonferonni corrections were performed and revealed that the frequency of participating in vigorous LTPA was significantly greater for the responsive group compared to the avoidant and indifferent groups (Figure 4.4). Additionally, both proactive and indifferent groups had a higher frequency of participating in vigorous LTPA than did the avoidant group (Figure 4.4).

Figure 4.4. Relative frequency of participating in any vigorous LTPA by attitudinal groups.



Logistic regression was performed to determine the odds of participating in any vigorous LTPA during pregnancy for each attitudinal group. The overall unadjusted model was statistically significant ($\chi^2(3)$ =45.91, p<0.001) and explained only 20.0% of the variance in meeting the guidelines. Table 4.6 shows the responsive group had 3.08 times the odds (CI=1.58-5.99) of participating in vigorous LTPA as compared to the indifferent group. However, the

avoidant group had significantly lower odds (OR=0.17, CI=0.06-0.54) compared to the indifferent group. The proactive group approached significantly greater odds of achieving the guidelines compared to the indifferent group.

Of the demographic characteristics that significantly differed among attitudinal groups (Table 4.5), only education level, vigorous LTPA risk perception, and participating in vigorous LTPA prior to pregnancy significantly entered the logistic regression model. The adjusted model was also statistically significant ($\chi^2(6)=116.86$, p<0.001) and explained 45.5% of the variance in vigorous LTPA participation. Further results of the adjusted model are displayed in Table 4.6 and show the responsive group had 3.65 times the odds (CI=1.60-8.36) of participating in vigorous LTPA as compared to the indifferent group, with the avoidant group having had significantly lower odds (aOR=0.25, CI=0.07-0.86). Like the unadjusted model, adjusted results revealed the odds of participating in vigorous LTPA to be near statistically greater for the proactive group than the indifferent group.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
Indifferent				
Avoidant	0.17 [0.06-0.54]	0.001*	0.25 [0.07-0.86]	0.028*
Proactive	1.86 [0.92-3.75]	0.080	2.24 [0.95-5.27]	0.064
Responsive	3.08 [1.58-5.99]	0.002*	3.65 [1.60-8.36]	0.002*

Table 4.6. Odds of participating in and vigorous LTPA by attitudinal groups.

*Significantly different compared to indifferent group (p<0.05).

†Adjusted for education, vigorous LTPA risk perception, and participating in vigorous LTPA prior to pregnancy.

Specific Aim 5: To determine if the interaction of pregnancy risk perceptions and moderate LTPA efficacy is associated with meeting moderate LTPA guidelines among pregnant women.

Correlations between demographic characteristics and the independent variables and dependent variable are displayed in Table 4.7. Moderate LTPA risk perception and multiparity were weakly inversely associated with the likelihood of meeting the moderate LTPA guidelines (r=-0.12 and r=-0.13, p<0.05). Meeting moderate LTPA guidelines prior to pregnancy was moderately associated with meeting moderate LTPA guidelines during the current pregnancy (r=0.43, p<0.05).

Table 4.8 shows the results from the hierarchical logistic regression analyses. For step 1, demographic control variables (income level, meeting moderate LTPA guidelines prior to pregnancy) were entered into the model and explained 25.9% of the variance in meeting moderate LTPA guidelines during pregnancy. Specifically, those who met these guidelines prior to pregnancy were 8.20 times more likely (p<0.001) to meet them during pregnancy compared to those who did not. For step 2, the single psychosocial control variable (moderate LTPA risk perception) was entered into the model and explained an additional 1.6% of the variance. The main effects of pregnancy risk perceptions and moderate LTPA efficacy beliefs were tested in step 3. Results from this step explained an additional 6.4% of the variance in meeting moderate LTPA guidelines. Those with higher pregnancy risk perceptions (per 0.5 increase on 1-7 agreement scale) had significantly greater odds (OR=1.37, p<0.05) of meeting the moderate LTPA guidelines compared to those with lower risk perceptions. Likewise, those with higher efficacy beliefs for moderate LTPA (per 0.5 increase on 1-7 agreement scale) had significantly greater odds (OR=1.82, p<0.01). In the final step, the interaction term for pregnancy risk and

moderate LTPA efficacy was entered into the model but was not significant. In total, the model explained 34% of the variance in meeting moderate LTPA guidelines during pregnancy.

Variable	Pregnancy Risk Perceptions	Mod LTPA Efficacy Beliefs	Pregnancy Risk x LTPA Efficacy	Met LTPA Guidelines
Age	.100	.070	044	046
Gestational Age	156**	117*	.013	015
Total Social Support	.049	.201**	.047	.003
Mod LTPA Risk Perception	.216**	364**	149**	125*
Parity (multiparous)	117*	022	012	115*
Race (Caucasian)	.196**	.227**	010	.071
Education (>High School)	.219**	.269**	108	009
Income (>\$30,000)	.168**	.156**	091	071
Past Miscarriage	001	051	108	.021
Past Preterm Birth	.148*	111	024	.081
Past C-Section	053	114	.012	.011
Previous Conditions [†]	.019	247**	.003	074
Current Conditions†	.081	126*	055	.038
Discussed LTPA w/ HCP	.085	.016	034	.015
Pre Met LTPA Guidelines	.019	.211**	.052	.429**

Table 4.7. Bivariate correlations among demographic and moderate LTPA variables.

*Significant correlation (p<0.05).

**Significant correlation (p<0.01).

[†]Gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, or major depressive disorder.

Exp(β)	95% C.I.	ΔR^2
		.259***
0.69	[0.39-1.21]	
8.20***	[4.56-14.88]	
		.016*
0.74	[0.54-1.01]	
		.064***
1.37*	[1.02-1.84]	
1.82**	[1.24-2.68]	
		NS
0.94	[0.66-1.36]	
		.340***
	Exp(β) 0.69 8.20*** 0.74 1.37* 1.82** 0.94	Exp(β)95% C.I.0.69[0.39-1.21]8.20***[4.56-14.88]0.74[0.54-1.01]1.37*[1.02-1.84]1.82**[1.24-2.68]0.94[0.66-1.36]

Table 4.8. Predictors of meeting moderate LTPA guidelines.

*Significant correlation (p<0.05).

**Significant correlation (p<0.01).

***Significant correlation (P<0.001).

[†]Variables centered and standardized according to Aiken & West.²

Specific Aim 6: To determine if the interaction of pregnancy risk perceptions and vigorous LTPA efficacy is associated with participating in any vigorous LTPA among pregnant women.

Correlations among demographic characteristics and the independent variables and dependent variable are displayed in Table 4.9. Vigorous LTPA risk perception and having experienced preterm birth for a previous pregnancy were weakly inversely associated with participating in vigorous LTPA (r= -0.16 and r= -0.14, p<0.05). Participating in vigorous LTPA prior to pregnancy was moderately associated with vigorous LTPA participation during the current pregnancy (r=0.44, p<0.05).

Table 4.10 shows the results from the hierarchical logistic regression analyses. For step 1, demographic control variables (education, participating in any vigorous LTPA prior to pregnancy) were entered into the model and explained 32.8% of the variance in vigorous LTPA participation during pregnancy. Specifically, those who participated in vigorous LTPA prior to pregnancy had significantly greater odds (OR=25.29, p<0.001) to do so during pregnancy compared to those who did not. However, pregnant women with some level of college education had significantly lower odds (OR=0.48, p<0.05) of participating in vigorous LTPA compared to those with lower education levels. For step 2, the single psychosocial control variable (vigorous LTPA risk perception) was entered into the model and explained a further 2.1% of the variance. The main effects of pregnancy risk perceptions and vigorous LTPA efficacy beliefs were tested in step 3. Results from this step explain an additional 16.6% of the variance in vigorous LTPA participation during pregnancy. The pregnancy risk perceptions score was not significantly related to vigorous LTPA participation during pregnancy. However, those with higher vigorous LTPA efficacy beliefs (per 0.5 increase on 1-7 agreement scale) had 4.09 times greater odds (p<0.01) compared to those with lower vigorous LTPA efficacy. In the final step, the interaction term for pregnancy risk and vigorous LTPA efficacy was entered into the model, but was not significant. In total, the model explained 51.5% of the variance in vigorous LTPA participation.

Variable	Pregnancy Risk Perceptions	Vig LTPA Efficacy Beliefs	Pregnancy Risk x LTPA Efficacy	Any Vigorous LTPA
Age	.100	.089	106	097
Gestational Age	156**	.043	008	.015
Total Social Support	.049	.165**	.087	.087
Vig LTPA Risk Perception	.202**	383**	093	156**
Parity (parous)	117*	.070	041	077
Race (Caucasian)	.196**	.222**	102	005
Education (>High School)	.219**	.126*	139*	102
Income (>\$30,000)	.168**	.104	098	089
Past Miscarriage	001	102	108	070
Past Preterm Birth	.148*	140	.016	143*
Past C-Section	053	028	.030	099
Previous Conditions ⁺	.019	031	.040	001
Current Conditions†	.081	068	071	.012
Discussed LTPA w/ HCP	.085	022	010	.122*
Pre Any Vigorous LTPA	.044	.187**	.009	.444**

Table 4.9. Bivariate correlations among demographic and vigorous LTPA variables.

*Significant correlation (p<0.05).

**Significant correlation (p<0.01).

[†]Gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, or major depressive disorder.

	Εχρ(β)	95% C.I.	ΔR^2
Step 1: Demographic Controls			.328***
Education	0.48*	[0.27-0.85]	
Pre Any Vigorous LTPA	25.29***	[8.86-72.19]	
Step 2: Psychosocial Controls			.021*
LTPA Risk Perception	0.79*	[0.65-0.96]	
Step 3: Risk and Efficacy Effects			.166***
Pregnancy Risk Perceptions ⁺	1.04	[0.75-1.46]	
LTPA Efficacy Beliefs†	4.09***	[2.57-6.49]	
Step 4: Interaction			NS
Pregnancy Risk x LTPA Efficacy ⁺	1.41	[0.86-2.29]	
Total R ²			.515***
*Significant correlation (p<0.05).			

Table 4.10. Predictors of participating in vigorous LTPA.

***Significant correlation (p<0.001).

[†]Variables centered and standardized according to Aiken & West.²

Specific Aim 7: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with LTPA, pregnancy risk perceptions, and LTPA efficacy beliefs among pregnant women.

Demographic characteristics of each religious group are displayed in Table 4.11. Education and income level significantly differed among religious groups ($\chi^2(3)=15.71$, p=0.001; $\chi^2(3)=38.14$, p<0.001) with LDS pregnant women more likely to have completed at least some college education and have a higher income level compared to non-LDS high, moderate, and low religiosity pregnant women. LDS pregnant women were also more likely to be Caucasian than non-LDS pregnant women of low and moderate religiosity, who in turn were more likely to be Caucasian than non-LDS high religiosity pregnant women ($\gamma^2(3)=42.25$, p<0.001). Differences were not seen among religious groups for the likelihood of experiencing miscarriage, preterm birth, C-section, adverse maternal conditions during this pregnancy, and adverse maternal conditions during a previous pregnancy. LDS pregnant women were more likely to be multiparous than non-LDS pregnant women of moderate and low religiosity ($\chi^2(3)=19.92$, p<0.001), but not more so than non-LDS high religiosity pregnant women. Furthermore, LDS pregnant women were more likely to seek the help of a healthcare professional for the purpose of becoming pregnant compared to non-LDS pregnant women of high, moderate, or low religiosity $(\chi^2(3)=10.80, p<0.013)$. LTPA behavior and perception variables for each religious group are displayed in Table 4.12.

	LDS	Non-LDS	Non-LDS	Non-LDS	<u>.</u>
	(n=94)	(Hign Rel.) $(\mathbf{n}=75)$	(Mod Rel.) $(n=68)$	(Low Rel.) $(n=65)$	p-value
median (range)	(1 > 1)		(12 00)	(11 00)	
Age (years)	29 (20, 45)	27 (17, 36)	26.5 (18, 40)	28 (15, 38)	0.064
Gestational Age (weeks)	27.5 (6, 40)	26 (10, 40)	27 (5, 40)	28 (20, 35)	0.894
Religiosity Score	40 (11, 40)	39 (36, 40)	28 (20, 35)	12 (10, 19)	< 0.001*
frequency (percentage)					
Parity					< 0.001*
Nulliparous	19 (20.2)	27 (36.0)	28 (41.2)	35 (53.8)	
Multiparous	75 (79.8)	48 (64.0)	40 (58.8)	30 (46.2)	
Race					< 0.001*
Caucasian	87 (92.5)	36 (48.0)	48 (70.6)	49 (75.4)	
Non-Caucasian	7 (7.4)	39 (52.0)	20 (29.4)	16 (24.6)	
Education					0.001*
High School or less	24 (25.5)	41 (54.7)	31 (45.6)	27 (41.5)	
Some College	70 (74.5)	34 (45.3)	37 (54.4)	38 (58.5)	
Income					< 0.001*
≤\$30,000	19 (20.2)	44 (60.3)	42 (61.8)	31 (48.4)	
>\$30,000	75 (79.8)	29 (39.7)	26 (38.2)	33 (51.6)	
Miscarriage	29 (30.9)	20 (26.7)	24 (35.3)	18 (27.7)	0.683
Preterm Birth	18 (19.1)	5 (6.7)	8 (11.8)	9 (13.8)	0.159
C-section	19 (20.2)	10 (13.3)	13 (19.1)	12 (18.5)	0.258
Previous Conditions†	11 (11.7)	11 (14.7)	10 (14.7)	4 (6.2)	0.420
Current Conditions [†]	9 (9.6)	11 (14.7)	9 (13.2)	9 (13.8)	0.755
Fertility Treatment	19 (20.2)	5 (6.7)	4 (5.9)	7 (10.8)	0.013*

Table 4.11. Demographic characteristics for religious groups.

*Significant differences comparing religious groups (p<0.05). †Religiosity scores range from 10-40 (per the Santa Clara Strength of Religious Faith Questionnaire)

	LDS	Non-LDS (High Rel.)	Non-LDS (Mod Bel)	Non-LDS	n voluo
	(n=94)	(n=75)	(n=68)	(n=65)	p-value
<u>frequency (percentage)</u>					
Pre Met LTPA Guidelines	33 (35.1)	30 (40.0)	31 (45.6)	30 (46.2)	0.443
Met LTPA Guidelines	18 (19.1)	19 (25.3)	16 (23.5)	29 (44.6)	0.003*
Pre Any Vigorous LTPA	64 (68.1)	43 (57.3)	44 (64.7)	39 (60.0)	0.492
Any Vigorous LTPA	31 (33.0)	31 (41.3)	15 (22.1)	14 (21.5)	0.027*
Pregnancy Risk					0.011*
Strong disagreement	37 (39.4)	44 (58.7)	28 (41.2)	39 (60.0)	
All else	57 (60.6)	31 (41.3)	40 (58.8)	26 (40.0)	
Moderate LTPA Efficacy		. ,	. ,		0.247
Strong agreement	25 (26.6)	22 (29.3)	12 (17.6)	12 (18.5)	
All else	69 (73.4)	53 (70.7)	56 (82.4)	53 (81.5)	
Vigorous LTPA Efficacy		. ,	. ,		0.005*
Agreement	56 (59.6)	42 (56.0)	29 (42.6)	22 (33.8)	
Unsure or disagreement	38 (40.4)	33 (44.0)	39 (57.4)	43 (66.2)	
Moderate LTPA Risk					0.142
Strong disagreement	70 (74.5)	54 (72.0)	41 (60.3)	40 (61.5)	
All else	24 (25.5)	21 (28.0)	27 (39.7)	25 (38.5)	
Vigorous LTPA Risk		. ,	. ,	. ,	0.943
Strong disagreement	23 (24.5)	17 (22.7)	14 (20.6)	14 (21.5)	
All else	71 (75.5)	58 (77.3)	54 (79.4)	51 (78.5)	

Table 4.12. LTPA behavior and perceptions of religious groups.

*Significant differences comparing religious groups (p<0.05).

The relative frequency of participants in each group meeting moderate LTPA guidelines during pregnancy was examined via chi-square analysis with Bonferroni adjustments. Results showed differences among religious groups ($\chi^2(3)=13.64$, p=0.003), with LDS pregnant women being less likely to meet moderate LTPA guidelines compared to non-LDS low religiosity pregnant women (Figure 4.5), but not the other religiosity groups. Logistic regression analyses were performed, with the unadjusted model ($\chi^2(3)=12.94$ p=0.005) indicating that non-LDS low religiosity pregnant women had higher odds (OR=3.43, CI=1.67-6.91) of meeting the moderate LTPA guidelines compared to LDS pregnant women (Table 4.13). However, this explained only 6.1% percent of the variance. After controlling for potential confounding variables (pregnancy risk perceptions and participating in any vigorous LTPA), the first adjusted model[†] remained
statistically significant ($\chi^2(5)=25.28$, p<0.001) and explained 11.6% percent of the variance. As displayed in Table 4.13, adjusted findings[†] also show that non-LDS low religiosity pregnant women had higher odds (aOR=4.17, CI=1.99-8.75) of meeting moderate LTPA guidelines compared to LDS pregnant women. In a final adjusted analysis, moderate LTPA efficacy beliefs and meeting moderate LTPA guidelines prior to pregnancy were additionally controlled for, resulting in a significant model ($\chi^2(7)=91.38$, p<0.001) that explained 37.9% of the variance. Adjusted findings indicated the same significant differences in odds of meeting the moderate LTPA recommendations as the previous models, with non-LDS low religiosity pregnant women having greater odds (aOR=5.43, CI=2.28-12.9) compared to LDS pregnant women (Table 4.13). Non-LDS high and moderate religiosity pregnant women did not significantly differ from LDS pregnant women for these analyses.

Chi-square analysis indicated the relative frequency of pregnant women who participated in any vigorous LTPA during pregnancy significantly differed among religious groups $(\chi^2(3)=3.22, p=0.027)$. However, when Bonferroni adjustments were applied to the p value, group differences were not observed. The unadjusted logistic regression model was statistically significant $(\chi^2(3)=9.24, p=0.026)$ but did not indicate that non-LDS pregnant women of any religiosity level differed from LDS pregnant women with respect to the odds of vigorous LTPA participation (Table 4.14). The first adjusted model[†] controlled for vigorous LTPA efficacy beliefs and meeting moderate LTPA guidelines. This model significantly explained $(\chi^2(5)=65.22, p<0.001)$ 27.5% of the variance but again showed no differences in the odds of vigorous LTPA participation between non-LDS pregnant women and LDS pregnant women. A final adjusted model additionally controlled for education level and vigorous LTPA participation prior to pregnancy and explained 53.7% of the variance ($\chi^2(7)=143.89$, p<0.001). Once again, no significant differences in the odds of participating in vigorous LTPA were observed.





 Table 4.13. Odds of meeting moderate LTPA guidelines during pregnancy by religious groups.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.43 [0.69-3.00]	0.335	1.42 [0.67-3.02]	0.357
Non-LDS Mod Religiosity	1.30 [0.61-2.80]	0.500	1.44 [0.66-3.15]	0.356
Non-LDS Low Religiosity	3.40 [1.67-6.91]	0.001*	4.17 [1.99-8.75]	0.001*

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for pregnancy risk perceptions and participating in any vigorous LTPA.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.43 [0.76-2.69]	0.264	1.79 [0.88-3.63]	0.110
Non-LDS Mod Religiosity	0.58 [0.28-1.18]	0.130	0.73 [0.33-1.60]	0.431
Non-LDS Low Religiosity	0.56 [0.27-1.16]	0.118	0.72 [0.31-1.67]	0.447

Table 4.14. Odds of participating in any vigorous LTPA during pregnancy by religious groups.

* Significantly different compared to LDS religiosity group (p<0.05).

†Adjusted for vigorous LTPA efficacy beliefs and meeting moderate LTPA recommendations.

Chi-square analyses indicated religious groups differed in having strong disagreement with pregnancy risk ($\chi^2(3)=11.11$, p=0.011). However, when Bonferroni adjustments were applied, these differences were no longer apparent. The unadjusted logistic regression model was statistically significant ($\chi^2(3)=11.18$, p=0.011) and indicated that non-LDS high and low religiosity pregnant women were more likely (OR=2.19, CI=1.18-4.06; OR=2.31, CI=1.21-4.41) to have strong disagreement compared to LDS pregnant women (Table 4.15). The adjusted model[†] was significant ($\chi^2(6)=22.57$, p<0.001) and controlled for race, education, and preterm birth from a previous pregnancy. Although adjusted analyses[†] explained 14.7% of the variance in the odds of having strong disagreement with pregnancy risk, differences between LDS and non-LDS pregnant women of any religiosity were not observed (Table 4.15).

Table 4.15. Odds of strong disagreement with pregnancy risk by religious groups.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	2.19 [1.18-4.06]	0.013*	1.18 [0.51-2.75]	0.698
Non-LDS Mod Religiosity	1.08 [0.57-2.04]	0.816	0.98 [0.43-2.24]	0.965
Non-LDS Low Religiosity	2.31 [1.21-4.41]	0.011*	2.06 [0.82-5.18]	0.125

* Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for race, education, and preterm birth from a previous pregnancy.

The relative frequency of participants indicating strong agreement with response/selfefficacy of moderate LTPA during pregnancy did not significantly differ among religious groups $(\chi^2(3)=4.13, p=0.247)$ according to chi-square analysis with Bonferroni adjustments. The unadjusted logistic regression model was additionally not significant $(\chi^2(3)=4.19, p=0.242)$; however, an adjusted model[†] (in which education, vigorous LTPA efficacy, and meeting moderate LTPA guidelines were controlled for) was statistically significant $(\chi^2(6)=60.58, p<0.001)$. For both the unadjusted and adjusted models, the odds of pregnant women reporting strong agreement with moderate LTPA efficacy did not differ between LDS pregnant women and non-LDS pregnant women of any religiosity (Table 4.16).

Chi-square analysis with Bonferroni adjustments indicated the relative frequency of participants reporting at least some agreement with the response/self-efficacy of vigorous LTPA during pregnancy differed among religious groups ($\chi^2(3)=12.73$, p=0.005). Specifically, LDS pregnant women were more likely to have some agreement with vigorous LTPA efficacy compared non-LDS low religiosity pregnant women (Figure 4.6). Unadjusted results from logistic regression analysis ($\chi^2(3)=12.88$, p=0.005) explained only 5.6% of the variance, but also indicated that non-LDS moderate and low religiosity pregnant women had significantly lower odds (OR=0.51, CI=0.27-0.95; OR=0.35, CI=0.18-0.67) of agreeing with vigorous LTPA efficacy compared to LDS pregnant women (Table 4.17). After controlling for potential confounding variables (race, education, and participating in any vigorous LTPA during pregnancy), the adjusted model[†] remained significant ($\chi^2(6)=54.88$, p<0.001), but explained 22.2% of the variance. As shown in table 4.17, adjusted results[†] indicated only non-LDS low religiosity pregnant women in having some agreement with vigorous LTPA efficacy.





Table 4.16. Odds of strong agreement with moderate LTPA efficacy during pregnancyby religious groups.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.15 [0.58-2.25]	0.693	1.64 [0.75-3.59]	0.215
Non-LDS Mod Religiosity	0.59 [0.27-1.28]	0.183	0.83 [0.35-1.96]	0.674
Non-LDS Low Religiosity	0.63 [0.29-1.36]	0.625	0.77 [0.32-1.89]	0.571

* Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for education, vigorous LTPA efficacy beliefs, and meeting moderate LTPA guidelines.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	0.86 [0.47-1.60]	0.640	1.24 [0.60-2.55]	0.568
Non-LDS Mod Religiosity	0.51 [0.27-0.95]	0.034*	0.72 [0.36-1.43]	0.345
Non-LDS Low Religiosity	0.35 [0.18-0.67]	0.002*	0.44 [0.22-0.90]	0.025*

Table 4.17. Odds of some agreement with vigorous LTPA efficacy during pregnancy by religious groups.

* Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for race, education, and participating in vigorous LTPA.

Specific Aim 8: To determine the relationship of religion (Latter-day Saints [LDS] vs. non-LDS (high religiosity) vs. non-LDS (moderate religiosity) vs. non-LDS (low religiosity)) with prenatal HCP discussions, satisfaction with these discussions, and physical activity social support among pregnant women.

LTPA social characteristics for each religious group are displayed in Table 4.18. Differences were not found among religious groups in discussing LTPA with a prenatal HCP during pregnancy ($\chi^2(3)=1.17$, p=0.760). This was confirmed via results from logistic regression analyses (Table 4.19). The unadjusted model was not significant ($\chi^2(3)=1.16$, p=0.762). Although the second model[†] (adjusted for parity, total social support, and participation in vigorous LTPA) was significant ($\chi^2(6)=16.78$, p=0.010) and explained 7.5% of the variance, it did not show that the odds of discussing LTPA with a prenatal HCP differed between LDS and non-LDS pregnant women of any religiosity (Table 4.19).

	LDS	Non-LDS	Non-LDS	Non-LDS	_
		(High Rel.)	(Mod Rel.)	(Low Rel.)	p-value
	(n=94)	(n=75)	(n=68)	(n=65)	
<u>frequency (percentage)</u>					
Discussed LTPA w/ HCP	58 (61.7)	50 (66.7)	46 (67.6)	45 (69.2)	0.760
Satisfaction w/ Discussion					0.669
High	23 (24.5)	24 (32.0)	17 (25.0)	17 (26.2)	
Low	35 (37.2)	26 (34.7)	29 (42.6)	28 (43.1)	
Total Social Support					0.235
High	52 (55.3)	30 (40.0)	35 (51.5)	34 (52.3)	
Low	42 (44.7)	45 (60.0)	33 (48.5)	31 (47.7)	
Family Social Support					0.320
High	51 (54.3)	43 (57.3)	30 (44.1)	30 (46.2)	
Low	43 (45.7)	32 (42.7)	38 (55.9)	35 (53.8)	
Friends Social Support					0.853
High	49 (52.1)	37 (49.3)	33 (48.5)	36 (55.4)	
Low	45 (47.9)	38 (50.7)	35 (51.5)	29 (44.6)	
Sig Other Social Support					0.321
High	57 (60.6)	35 (46.7)	39 (57.4)	35 (53.8)	
Low	37 (39.4)	40 (53.3)	29 (42.6)	30 (46.2)	

Table 4.18. LTPA social characteristics of religious groups.

*Significant differences comparing religious groups (p<0.05).

Chi-square analysis with Bonferroni adjustments likewise did not indicate that religious groups significantly differed in their satisfaction level with prenatal HCP discussions regarding LTPA during pregnancy ($\chi^2(3)=1.56$, p=0.669). When examined via logistic regression, the unadjusted model ($\chi^2(3)=1.54$, p=0.672) was not significant (Table 4.20). An adjusted model[†] which controlled for meeting moderate LTPA guidelines was also not statistically significant ($\chi^2(4)=6.95$ p=0.139). As shown in Table 4.20, differences were not observed among religious groups for the odds of having high satisfaction with HCP physical activity discussion.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.24 [0.66-2.34]	0.505	1.24 [0.63-2.43]	0.533
Non-LDS Mod Religiosity	1.30 [0.67-2.50]	0.436	1.36 [0.68-2.74]	0.385
Non-LDS Low Religiosity	1.40 [0.71-2.73]	0.329	1.32 [0.64-2.71]	0.453

Table 4.19. Odds of discussing physical activity with HCP during pregnancy by religious groups.

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for parity, total social support, and participating in vigorous LTPA.

Table 4.20. Odds of high satisfaction with HCP physical activity discussions during pregnancy by religious groups.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.41 [0.65-3.02]	0.384	1.38 [0.64-3.00]	0.412
Non-LDS Mod Religiosity	0.89 [0.40-1.98]	0.779	0.84 [0.37-1.89]	0.671
Non-LDS Low Religiosity	0.92 [0.41-2.06]	0.846	0.74 [0.32-1.70]	0.475

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for total social support and meeting moderate-LTPA guidelines.

Religious groups did not significantly differ in the relative frequency of pregnant women reporting high physical activity social support received in total ($\chi^2(3)=4.26$, p=0.235), nor in physical activity social support specifically from family ($\chi^2(3)=3.50$, p=0.320) and significant others ($\chi^2(3)=3.50$, p=0.321). Logistic regression results for total social support produced in unadjusted model that was not significant ($\chi^2(3)=4.28$, p=0.232), but indicated the odds of perceiving higher total support were less (OR=0.53, CI=0.29-0.99) for non-LDS high religiosity pregnant women compared to LDS pregnant women (Table 4.21). An adjusted model[†] (which included race and participating in any vigorous LTPA) was significant ($\chi^2(5)=16.97$, p=0.005) and explained 7.3% of the variance, but did not show odds ratio differences among religious groups.

Logistic regression results for the odds of perceiving high levels of physical activity social support from family and significant others are described in Tables 4.22 and 4.23. Unadjusted models for each construct were not significant and did not reveal differences among religious groups. Adjusted models revealed no significant differences among religious groups, with the exception of physical activity social support from significant other. After adjusting for the other social support sources (physical activity social support from family and friends), the model ($\chi^2(5)=86.94$, p<0.001)[†] explained 33.5% of the variance. Adjusted results[†] shown in Table 4.21 indicate that non-LDS high religiosity pregnant women had a significantly lower odds (aOR=0.44, CI=0.21-0.92) than do LDS pregnant women in perceiving a high level of physical activity social support from a significant other.

Table 4.21. Odds of perceiving higher levels of physical activity social support (total)during pregnancy by religious groups.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	0.53 [0.29-0.99]	0.049*	0.72 [0.37-1.41]	0.338
Non-LDS Mod Religiosity	0.86 [0.46-1.60]	0.628	1.08 [0.56-2.08]	0.809
Non-LDS Low Religiosity	0.89 [0.46-1.67]	0.708	1.08 [0.56-2.09]	0.814

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for race and participating in any vigorous LTPA.

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	1.13 [0.62-2.09]	0.689	1.76 [0.81-3.82]	0.154
Non-LDS Mod Religiosity	0.67 [0.36-1.25]	0.204	0.63 [0.29-1.36]	0.236
Non-LDS Low Religiosity	0.72 [0.38-1.36]	0.316	0.64 [0.29-1.41]	0.272

Table 4.22. Odds of perceiving high levels of physical activity social support (family) during pregnancy by religious groups.

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for social support from friends and significant other.

Table 4.23. Odds of perceiving higher levels of physical activity social supp	ort
(significant other) during pregnancy by religious groups.	

	OR (95% C.I.)	p-value	aOR† (95% C.I.)	p-value
LDS				
Non-LDS High Religiosity	0.57 [0.31-1.05]	0.071	0.44 [0.21-0.92]	0.029*
Non-LDS Mod Religiosity	0.87 [0.46-1.65]	0.675	1.06 [0.50-2.22]	0.889
Non-LDS Low Religiosity	0.76 [0.40-1.44]	0.394	0.76 [0.36-1.62]	0.482

*Significantly different compared to LDS religiosity group (p<0.05).

[†]Adjusted for having a significant other and social support from family and friends.

REFERENCES

REFERENCES

- 1. United States. Department of Health and Human Services. 2008 physical activity guidelines for Americans : be active, healthy, and happy! Washington, DC: U.S. Dept. of Health and Human Services; 2008.
- 2. Aiken LS, West SG, Reno RR. *Multiple regression : testing and interpreting interactions*. Newbury Park, Calif.: Sage Publications; 1991.

CHAPTER 5

DISCUSSION

The central purpose of this dissertation was to gain a more comprehensive understanding of the psychosocial factors that may influence LTPA during pregnancy. Specifically, this study examined the joint influence of pregnancy risk perceptions and LTPA efficacy beliefs on pregnancy LTPA behavior at both moderate and vigorous intensities. This was accomplished by utilizing the Risk Perception Attitude Framework (RPA). In addition, this study examined the influence of religious beliefs on pregnancy LTPA and potential psychosocial factors that influence pregnancy LTPA, including pregnancy risk perceptions, LTPA efficacy beliefs, physical activity social support, and discussions pregnant women have with prenatal HCPs.

Just over 27% (n=82) of pregnant women who participated in this investigation reported meeting the current moderate LTPA guidelines of at least 150 minutes of moderate physical activity per week.¹ Population-based investigations have shown noticeably lower prevalences. Evenson et al.² assessed data collected from the Behavioral Risk Factor Surveillance System (BRFSS) in 2000 and found that 15.8% of pregnant women (n=1,979) met the moderate LTPA guidelines most associated with pregnancy at that time, of five bouts per week of at least 30 minutes in duration. Evenson and Wen³ examined data from a different population-based source, the 1999-2006 National Health and Nutrition Examination Surveys (NHANES). The investigators found that the prevalence of meeting the most current moderate LTPA guidelines throughout this time period to be 13.8% (n=1,280). The fact that these are population-based and consist of substantially larger sample sizes may provide partial explanation why the prevalence found in the current study (n=302) is higher. More specifically, the convenience sample in the

current investigation had higher gestational ages, was slightly more educated, and less ethnically diverse. Evenson and Wen⁴ recently examined objective, population-based data (n=396, NHANES) and found that Caucasian pregnant women were more physically active than pregnant women of several other races and ethnicities. Thus, the vastly higher prevalence of Caucasian participants in the current study (compared to those of population-based samples) may account for the higher rate of meeting the moderate LTPA guidelines. Findings from the current study appear to be more in line with other non-population-based investigations, such as that by Mudd et al.,⁵ who utilized adapted BRFSS questions and found that 29% of pregnant women (n=296, ethnically diverse) recruited from western-Michigan prenatal healthcare clinics were meeting current guidelines. Similarities between the current study and Mudd et al.'s study include sample size and recruitment from Michigan-based prenatal healthcare clinics. However Mudd et al. defined meeting LTPA guidelines as performing at least 150 minutes per week of moderate or vigorous activity, whereas the current study considered only moderate activity. This more liberal definition utilized by these investigators might partially explain the slightly higher prevalence found in their study.

Although many investigators have reported data from women who participated in "any" LTPA, few have reported specifically on the frequency of pregnant women who participate in any *vigorous* LTPA. Evenson et al.⁶ sought to understand the effect of vigorous LTPA on birth outcomes and reported that 14% of pregnant women (n=1,699) participated in any vigorous LTPA in the first trimester, compared to 8% in the second trimester. Our findings do not agree with those of Evenson et al., in that 30.1% of our analytic sample typically participated in vigorous LTPA. A possible reason for the discrepancy between these findings involves a difference in the question format. While our participants were asked to self-report number of

days and minutes/per day that they typically participate in vigorous LTPA (as defined as LTPA causing large increases in breathing and heart rate), Evenson et al. asked participants whether they participated in such activities at least twice a week, sometime in the past three months. It is possible that the higher prevalence of any vigorous LTPA participation found in the present investigation is partially a result of not defining "any" as multiple bouts of activity per week. However, it is also possible that vigorous LTPA participation has increased over the years among pregnant women, given that the aforementioned investigation examined 1995-1998 data. While these possibilities may contribute in some part, the higher prevalence for participating in vigorous LTPA found in this study reflects a group that is simply more physically active than pregnant women in general, which may be due in part to the high prevalence of Caucasian participants.

PREGNANCY RISK PERCEPTIONS AND LTPA EFFICACY BELIEFS

Descriptive Results

For this dissertation, pregnancy risk perceptions were determined via a perceived severity question and a perceived susceptibility question, which were averaged into a single pregnancy risk perception score. Most participants indicated disagreement that pregnancy was risky, as defined as a potential harmful pregnancy effect on the unborn baby. More specifically, nearly 90% of the analytic sample was categorized as perceiving "strong disagreement (1.0-1.5 risk score)" or "unsure or some disagreement (2.0-4.0 risk score)" with the susceptibility and severity of this specific risk. Only 1.3% of participants were categorized as perceiving "strong agreement (6.5-7.0 risk score)" with the aforementioned pregnancy risk. Given the weak positive relationship found in this study between pregnancy risk perceptions and education (r=0.22), such

low perceptions of risk may be partially due to a decent portion of study participants having achieved some high school education as their highest level (40.7%). Eide et al.⁷ conducted a large, population-based investigation utilizing the Mother and Child Cohort (Norway) and found that only 3.9% of pregnant women (n=58,139) reported strong agreement regarding the possibility of something adverse occurring to their baby. However, Eide et al. assessed pregnancy risk with only a single question, which asked specifically about the frequency that pregnant women felt worried about their babies being "healthy or normal." Thus, the specific magnitude of the perceived risk was not assessed. This dissertation examined both severity and susceptibility of the pregnancy risk, and found that risk perceptions (as it pertains to the health of the unborn baby) were generally low.

Similar to pregnancy risk perceptions, moderate and vigorous LTPA efficacy were each determined via two questions, one pertaining to response efficacy and one to self-efficacy, which were averaged into a single LTPA efficacy belief score for each activity intensity. For moderate LTPA efficacy, just over half of pregnant women were categorized as having some agreement, with an additional quarter being categorized as having strong agreement. For vigorous LTPA efficacy, nearly half of this study's sample had some agreement, with only a small fraction having had strong agreement. It appears no investigation has jointly considered response and self-efficacy in assessing efficacy beliefs during pregnancy. Additionally, no investigation has specifically examined LTPA efficacy as it pertains to protecting the unborn baby from an adverse health effect. However, general response efficacy beliefs have been examined recently for both moderate and vigorous LTPA during pregnancy. Most notably, Evenson and Bradley⁸ found that 73% of pregnant women agreed with the benefits of moderate LTPA, whereas 13% agreed with the benefits of vigorous LTPA.

At first glance, it appears study participants had slightly higher levels of moderate LTPA efficacy and substantially higher levels of vigorous LTPA efficacy compared to women studied by Evenson and Bradley. However, comparisons must be interpreted with caution given that these previous investigators considered only response efficacy for LTPA (rather than response AND self-efficacy). Additionally, the perceived risk was not specific to the health of either the mother or the baby, but rather in general. Given that this investigation may be the first to assess both perceived susceptibility and severity for pregnancy risk perceptions as well as both response and self-efficacy for LTPA efficacy beliefs, these descriptive results are unique, so direct comparisons to pregnancy risk and LTPA efficacy findings of previous investigations are not possible. Within this context, the results of the current study indicate high LTPA efficacy beliefs for moderate LTPA and somewhat moderate LTPA efficacy beliefs for vigorous LTPA among pregnant women.

Influence on LTPA Behavior during Pregnancy

Utilizing the RP A is advantageous in that it enables a clear classification of the population being studied, specifically by categorizing individuals into attitudinal groups as described below.

- **Responsive --** *High risk perceptions, High efficacy beliefs*
- **Proactive --** Low risk perceptions, High efficacy beliefs
- Avoidant -- High risk perceptions, Low efficacy beliefs
- Indifferent -- Low risk perceptions, Low efficacy beliefs

Given the non-normal distribution of LTPA data, moderate LTPA (min/week) was dichotomized into meeting moderate LTPA guidelines and not meeting these guidelines for analytic purposes.

This study examined group differences for the relative frequency of meeting these guidelines during pregnancy. It was hypothesized that the responsive and proactive groups would be most likely to participate in moderate LTPA, given that both are defined by having high efficacy beliefs, which has been shown to strongly predict moderate LTPA behavior in previous investigations. Findings clearly indicated the responsive and proactive groups to be more likely to meet the moderate LTPA guidelines compared to the avoidant and indifferent groups, but a statistically significant difference was apparent only between the responsive (highest likelihood) and indifferent (lowest likelihood) groups.

These findings are partially consistent with RPA theory in that responsive pregnant women appear more likely than pregnant women of other attitudinal groups to achieve moderate LTPA guidelines. However, given statistical significance was not observed between the responsive group and the proactive or avoidant groups, these results may somewhat vary from theorized attitudinal group differences. Meta-analytic findings from Witte and Allen⁹ revealed that the high threat-high efficacy group (analogous to responsive) was more likely to participate in the recommended response (protective behavior) than high threat-low efficacy (analogous to avoidant) and low threat-high efficacy (analogous to proactive). The investigators also found that the low threat-low efficacy (analogous to indifferent) group was less likely to participate in the recommended response compared to all other attitudinal groups. Although the current study's findings suggest the avoidant group was more likely to meet the moderate LTPA guidelines compared to the indifferent group, this difference was not statistically significant. The lack of difference between these two attitudinal groups may be a result of the low efficacy beliefs consistent in both groups. Given the numerous barriers to regular LTPA during pregnancy (discussed in Chapter 2), expectant mothers, particularly those with little exercise

history, may have little motivation to perform moderate physical activity if they do not perceive a protective benefit for their babies. More specifically, avoidant pregnant women may not participate in sufficient moderate LTPA if they do not believe in its positive impact, and if they must simultaneously cope with other pregnancy-related difficulties (e.g., fatigue, discomfort, lack of time).

This study additionally aimed to investigate attitudinal group differences for vigorous LTPA. As with the moderate LTPA data, vigorous LTPA (min/week) was non-normally distributed, so this variable was dichotomized into participating in any vigorous LTPA and not participating in vigorous LTPA. It was hypothesized that the responsive group would be more likely to participate in any vigorous LTPA compared to the other attitudinal groups, as suggested by the RPA and EPPM. Indeed, findings suggest that responsive pregnant women were most likely to participate in any vigorous LTPA, followed by proactive pregnant women. However, it was also found that the avoidant group was less likely than all other groups to be vigorously physically active, which was unexpected. This specific finding is not in agreement with results from previous investigations, which have revealed the indifferent group to be the least likely to act.^{9,10} With respect to vigorous LTPA, it seems plausible that high pregnancy risk perceptions in the presence of low efficacy beliefs (found in the avoidant group) are associated with extreme fear control responses, possibly including defensive avoidance or denial. Thus, the results of this study indicate that pregnant women who worry about the health of their unborn babies and who do not believe in the health benefit of vigorous LTPA likely avoid vigorous LTPA participation. Moreover, high levels of anxiety found among avoidant individuals¹¹ may prompt those who are pregnant to seek out information regarding their concern for the health and safety of their baby. This anxiety could possibly solidify their conviction to avoid vigorous LTPA. Interestingly, the

same high risk perceptions coupled with high efficacy beliefs appear to trigger high motivations to participate in vigorous LTPA as a protective mechanism, as theorized by Rimal and Real.¹⁰ The impact of LTPA efficacy beliefs on pregnancy LTPA behavior (meeting the moderate LPTA guidelines and participating in vigorous LTPA) appears to be considerable when examined via attitudinal groups, particularly relative to the impact of pregnancy risk perceptions.

In addition to examining risk/efficacy via attitudinal groups, hierarchical regression was also utilized to explore main and interactive effects. Main effects were shown for both pregnancy risk and moderate LTPA efficacy on meeting the moderate LTPA guidelines. Also, a main effect was shown for vigorous LTPA efficacy on participating in vigorous LTPA (although not for pregnancy risk). After controlling for potential confounding variables, including prepregnancy LTPA behavior, pregnancy risk and moderate LTPA efficacy explained a relatively minor percent of the variance (6.4%) in meeting moderate LTPA guidelines during pregnancy. Thus, the main effects with respect to moderate LTPA should be interpreted with caution. Efficacy beliefs explained a more sizable amount (16.6%) of the variance for participating in vigorous LTPA, which again suggests efficacy may play a somewhat larger role than for vigorous LTPA participation than for moderate LTPA behavior. A notable strength to this investigation pertains to the specific assessment of LTPA efficacy beliefs, namely regarding the protective health effect for the unborn baby (rather than the general health effect considered in other investigations). While this offers specificity in the interpretation of this study's findings, it may also be one reason why these results show LTPA efficacy does not explain a higher percent of the variance for moderate and vigorous LTPA behavior. As discussed in Chapter 2 of this dissertation, findings from qualitative investigations and a few non-population-based quantitative investigations may indicate that pregnant women are more convinced of the health

benefits of LTPA for themselves then they are for their babies. If true, then an assessment of LTPA efficacy specified towards the health of the mother may result in LTPA efficacy being a stronger predictor of LTPA behavior.

An interesting finding within this study's main effect results is that vigorous LTPA efficacy has a greater effect on participating in vigorous LTPA than moderate LTPA efficacy on meeting the moderate LTPA guidelines during pregnancy. This is plausible, given that pregnant women may be more likely to regularly engage in moderate LTPA for reasons other than the health of their babies compared to vigorous LTPA. Reasons may include social interaction with other mothers, alleviation of minor physical discomforts, or improving psychological mood. Whereas, vigorous LTPA, presumably perceived to be more difficult, may be performed if expectant mothers are more firmly convinced that it offers a protective health benefit to their babies. Thus, vigorous LTPA response efficacy would theoretically be a stronger predictor of vigorous LTPA behavior compared to moderate LTPA response efficacy predicting moderate LTPA behavior. In seeking to investigate this presumption, post-hoc logistic regression analyses were performed examining the dimensions of risk (severity and susceptibility) and efficacy (response and self) as individual predictors of LTPA. These analyses indicate self-efficacy (OR=1.51, CI=1.17-1.96) to be the only significant predictor of meeting moderate LTPA guidelines, but not response efficacy. In contrast, both self (OR=1.65, CI=1.31-2.09) and response efficacy (OR=1.47, CI=1.16-1.88) have influence on participating in vigorous LTPA, supporting this hypothesis.

Previous RPA investigations have shown risk/efficacy interactions for HIV and remaining monogamous,¹² workplace accidents and wearing protective equipment,¹³ and breast cancer and self-examinations.¹⁴ Although these interactions accounted for a relatively minor

percentage of the overall variance explained, they were statistically significant. Thus, based on these previous results, the current study hypothesized that interactive effects would be observed. As discussed previously, LTPA differences among attitudinal groups (combinations of high/low risk and efficacy) were apparent. This further suggested the possibility of an interaction between pregnancy risk and LTPA efficacy for moderate and vigorous LTPA behavior. However, this study's hierarchical logistic regression results showed no interactive effect for pregnancy risk/moderate LTPA efficacy on meeting moderate LTPA guidelines after controlling for potential confounding variables. Similarly, an interactive effect was not found between pregnancy risk perceptions and vigorous LTPA efficacy beliefs on participating in any vigorous LTPA. Lack of interaction may be related to extremely low pregnancy risk perceptions overall within the sample. Had there been more variability in perceived pregnancy risk (i.e., higher risk perceptions), it is possible that an interaction would have been found. In summary, these crosssectional results indicate that pregnancy risk perceptions and LTPA efficacy beliefs have little interdependence on one another in affecting LTPA behavior during pregnancy. These findings are somewhat parallel to those of Witte and Allen⁹ who conducted a meta-analysis of 23 EPPM investigations and did not find significant interaction between the perceived threat of the message and the perceived efficacy of the recommended response. Similar to the current study's results, however, Witte and Allen's meta-analysis found main effects for perceived threat and efficacy, or rather that the higher level of each led to higher levels of the recommended response. The current study's cross sectional findings distinctly suggest that efficacy beliefs have stronger influence on LTPA behavior than do pregnancy risk perceptions, but especially with respect to vigorous LTPA.

In examining main and interactive effects of pregnancy risk and LTPA efficacy on moderate and vigorous LTPA, several possible confounding variables were controlled for. Having met moderate LTPA guidelines prior to pregnancy explained a large amount of the variance in meeting moderate LTPA guidelines during pregnancy. Similarly, vigorous LTPA performed prior to pregnancy was related to LTPA performed during pregnancy. Most investigations which have examined both prepregnancy LTPA and pregnancy LTPA, have found that women who are active prior to pregnancy are more likely to remain active throughout pregnancy.¹⁵ Owe et al.¹⁶ recently conducted a population-based investigation among more than 34,000 Norwegian pregnancy during the second (OR=18.4, CI=17.2-19.7) and third (OR=4.3, CI=4.08-4.61) trimesters. These strong associations align with the current study's findings. It should be noted that Owe et al. evaluated exercise behavior via frequency (bouts/week) and did not differentiate between moderate and vigorous exercise as in the current investigation.

Findings regarding prepregnancy LTPA appear congruent with Bandura's Social Cognitive Theory,¹⁷ specifically that past experience is a strong predictor of efficacy beliefs, and in turn, behavior. Therefore, the influence of prepregnancy LTPA on a pregnant woman's LTPA efficacy beliefs (and therefore behavior) may depend on how similar she feels pregnancy LTPA (from a difficulty standpoint) is to prepregnancy LTPA. Bandura has also suggested that the influence of past experience depends on the perceived task difficulty.¹⁷ Given the many barriers to LTPA that pregnant women experience, it is likely that some women perceive LTPA to be more difficult to perform during pregnancy compared to prior to pregnancy. Theoretically, pregnant women who successfully engaged in prepregnancy LTPA despite a number of barriers (i.e., lack of time, work, childcare) will have greater efficacy beliefs to engage in LTPA during

pregnancy (with its many barriers), as compared to women who did not experience LTPA barriers prior to pregnancy. Unfortunately, barriers to LTPA were not assessed, so their effect on this study's participants is speculative.

Practical Significance of Findings

This dissertation partially extends the scope of the RPA to LTPA during pregnancy and suggests its potential utility in aiding those attempting to enhance physical activity behavior of expectant mothers. The most commonly utilized physical activity intervention technique among pregnant women has involved providing physical activity information, some investigations resulting in effective behavior change and others not.¹⁸ In general, interventions aiming to improve pregnancy LTPA may be most effective by targeting women who are attitudinally similar.

To generate positive health behavior change, the RPA posits that researchers focus on moving individuals from the indifferent, avoidant, and proactive groups to the responsive group.¹¹ The caveat in this theory is that messages should be designed with specific consideration of which attitudinal group the study participants are moving from, given the previously described group differences. This study's cross sectional findings suggest that efficacy beliefs play a major role in determining moderate and vigorous LTPA behavior, but that pregnancy risk perceptions are of less importance. A possible reason for this is the overall low risk pregnancy risk perceptions reported by this study's participants. These findings suggest the RPA attitudinal groupings to not be completely effective in predicting pregnancy LTPA. However, it is clear that pregnancy LTPA interventions should aim to increase efficacy beliefs, or within the RPA context, move pregnant women from the avoidant to the responsive group or

the indifferent to proactive group. The avoidant group, which has high-risk perceptions and low efficacy beliefs, is perhaps most challenging. Individuals in this group are most likely to engage in "fear control processes", or behaviors that will control their fears (i.e., defensive avoidance, denial, issue derogation) as opposed to behavior which will control the perceived risk (i.e., LTPA).¹⁹ For such individuals, messages designed to increase efficacy beliefs (without increasing perceived risk) are essential.

Messages designed to increase efficacy beliefs may be most effective when incorporating elements suggested within Social Cognitive Theory: performance accomplishments (past experience), vicarious reinforcement (learning through observation/visualization), verbal persuasion (attempting to convince by others), and affective arousal (receiving confidence from feeling good). According to Bandura,¹⁶ performance accomplishments most strongly predict efficacy beliefs, followed by vicarious reinforcement. Thus, given the findings with respect to the influence of prepregnancy LTPA, researchers may consider designing interventions that target less active, non-pregnant women of childbearing age with the purpose of establishing a prepregnancy LTPA routine. Similarly, it may be advantageous to target first-time mothers as they are more likely to become pregnant again as compared to women who have not been pregnant. Another method by which pregnancy LTPA efficacy beliefs could be improved would involve enlisting the assistance of postpartum women who regularly participated in pregnancy LTPA to convey the message. This intervention would utilize vicarious reinforcement and verbal persuasion in order to increase LTPA efficacy beliefs among less active pregnant women. Real¹² suggests keeping an efficacy message simple is essential for it to be effective, particularly for individuals in the avoidant and indifferent groups. Given their low efficacy beliefs regarding the protective behavior, an excessive amount of detail and advanced information may illicit a

"boomerang effect" by impeding efficacy improvement. Such messages may be most effective if coupled with personalized goal setting and multiple assessments of performance, particularly with the various additional barriers that may impede sufficient LTPA participation.

RELIGION AND PREGNANCY LTPA

A final general objective of this dissertation was to examine the influence of religion on pregnancy LTPA behavior and potential psychosocial influences of pregnancy LTPA. These influences include pregnancy risk perceptions, LTPA efficacy beliefs, physical activity social support, and discussions that pregnant women have with prenatal healthcare providers (HCP). Of particular interest to this project is the Latter-day Saint (LDS) or "Mormon" religion, which teaches the importance of living by a strict health code. Additionally, LDS theology focuses heavily on the family unit, including the importance of having and raising children. Given the emphasis within the LDS church on healthy behaviors, this study investigated whether effects of these religious beliefs are evident in LTPA behavior and psychosocial influences during pregnancy.

It was hypothesized that LDS pregnant women would participate in more moderate and vigorous LTPA compared to non-LDS pregnant women. As described previously, both moderate and vigorous LTPA were dichotomized as a result of non-normal distributions. This study's findings show that LDS pregnant women were significantly less likely to meet the moderate LTPA guidelines of at least 150 minutes of activity per week compared to non-LDS low religiosity pregnant women, a result which did not support the proposed hypothesis. Furthermore, relative frequencies and odds ratio calculations indicate that non-LDS high and moderate religiosity pregnant women were also less likely to meet these guidelines compared to

non-LDS low religiosity participants, although these trends were not statistically significant. In contrast, LDS pregnant women and non-LDS high religiosity pregnant women were more likely to participate in vigorous LTPA compared to non-LDS low religiosity pregnant women. It should be noted that logistic regression results showed that religious grouping explained only a small portion of the variance in the prediction of meeting moderate LTPA guidelines and participating in any vigorous LTPA.

In attempting to understand the relationships between religion and LTPA behavior among pregnant women, it is necessary to review the findings with respect to the psychosocial influences to LTPA and how each differs by this investigation's religious grouping. LDS pregnant women were less likely to have strong disagreement with pregnancy risk (indicating higher risk perceptions) compared to non-LDS high and low religiosity pregnant women. However, it appears these differences were somewhat related to previous preterm birth experiences, given that after adjusting for this variable, significant differences between groups were no longer evident. LTPA efficacy differences were also examined among religious groups. LDS pregnant women were more likely to have strong agreement with moderate LTPA efficacy and more likely to have some agreement with vigorous LTPA efficacy compared to non-LDS moderate and low religiosity pregnant women (however, only significant for vigorous LTPA efficacy). Increased levels of vigorous LTPA efficacy among LDS pregnant women may very well be a result of the LDS health code, the "Word of Wisdom." This is considered doctrine to those in the LDS faith and strongly emphasizes the importance of regularly engaging in healthy behaviors, promising physical and spiritual blessings to those who do.²⁰

With seemingly higher risk perceptions and higher LTPA efficacy beliefs compared to lower religiosity groups (although these were not significant except for vigorous LTPA efficacy),

it is plausible that LDS pregnant women would be more likely to meet the moderate LTPA guidelines and participate in any vigorous LTPA. However, this is clearly not the case for meeting the moderate LTPA guidelines given the LDS participants had the lowest rates of all religious groups. In contrast, vigorous LTPA efficacy likely accounts in part for why LDS women were more likely to participate in vigorous LTPA.

It can be speculated that meeting the moderate LTPA guidelines is impeded among LDS pregnant women (and possibly non-LDS women of higher religiosity levels) by factors other than the perceptions and social influences directly examined in this investigation. It has been shown that LDS women have the highest parity rates compared to women of other major Judeo-Christian religious denominations.^{21,22} Additionally, there is a clear relationship between religiosity (in general) and parity.²³ Given the inverse relationship between parity and levels of pregnancy LTPA,²⁴ it is plausible that this might account for lower levels of LTPA. However, LTPA differences did not change among religious groups when parity was controlled for in logistic regression analyses. As discussed in Chapter 2 of this dissertation, one of the more prominent barriers to pregnancy LTPA is a lack of time. A possible explanation to this study's LTPA findings among religious groups could be that pregnant women of higher religiosities (including LDS pregnant women) perceive themselves to be busier throughout the day than are pregnant women of lower religiosity, but this is speculative. Additionally, higher religiosity women may have more family obligations compared to lower religiosity women, possibly resulting in more commitments, errands, and extracurricular activities. Specific to the LDS faith, weekly religious commitments and "family time" are often integrated into the routine of life. Commitments include Sunday services, daily scripture study, weekly church service opportunities, and weekly family home evening (one night/week). Thus the time that LDS

pregnant women have to participate in LTPA may be more limited than non-LDS pregnant women of lower religiosities, and they must choose whether to engage in moderate LTPA or vigorous LTPA with the leisure-time they have.

This study additionally examined religious group differences with respect to physical activity discussion with prenatal HCPs and physical activity social support. Prior to this investigation, impact of religious beliefs on the perceived frequency or quality of HCP-patient interactions has not been thoroughly explored. Thus, it was hypothesized that LDS pregnant women would be more likely to discuss LTPA with their prenatal HCP and would feel more satisfied with these discussions, are somewhat speculative. Contrary to this study's hypotheses, no religious group differences were seen when evaluating whether or not pregnant women discussed LTPA with a prenatal HCP or in the satisfaction level with those discussions. This finding suggests that LDS pregnant women are no more cognizant of pregnancy LTPA compared to non-LDS pregnant women, and therefore do not initiate these discussions with pregnancy HCPs any more so than do non-LDS pregnant women.

In contrast, the relationship between religiosity and social support has been previously investigated, with findings showing a positive association.^{25,26} Accordingly, it was assumed and found in the current study that LDS pregnant women would have a higher religiosity score compared to non-LDS pregnant women, and therefore hypothesized that LDS pregnant women would have higher levels of total social support. The finding that LDS participants were more likely to perceive high levels of total social support compared to non-LDS high religiosity aligns with the proposed hypothesis. However, after race was controlled for, this difference was no longer apparent. In general, perceptions of social support during pregnancy may be greater among Caucasian women compared to non-Caucasian women (particularly Latinas).²⁷ With

respect to this study, greater levels of perceived physical activity social support among LDS pregnant women appears to have been a result of a higher percentage of Caucasian participants among the LDS group (92.5%) as compared to the non-LDS high religiosity group (48.0%).

Given the LDS religion's strong emphasis on the family relationships, we additionally hypothesized that LDS pregnant women would perceive higher levels of support specifically from family and significant others, compared to non-LDS pregnant women of any religiosity level. However, these findings revealed that LDS pregnant women did not differ in perceived family social support from non-LDS pregnant women of any religiosity level. Physical activity social support from family members can be minimal, particularly from past generations (i.e., mother/father, aunts/uncles, grandparents).²⁸ Having lived during times when no guidelines for pregnancy physical activity existed, these individuals may still believe the previous notion that LTPA is dangerous for mother and baby. Despite over three decades of research revealing the health benefits of physical activity during pregnancy as well as more liberal guidelines, recent investigations have shown that immediate family members still try to convince pregnant women of its adverse health effects.²⁸⁻³⁰ Thus all pregnant women, regardless of religious beliefs, may be receiving similar amounts of "negative" physical activity social support from family members.

The gender roles which exist in LDS families are generally considered to be more conservative than those of non-LDS families. Heaton et al.³¹ found that LDS men and women are significantly more likely to believe in the traditional roles (men should make the living, women manage the home) compared to non-LDS mem and women. Despite LDS women believing in their more traditional family role, Heaton et al. also found that LDS women were particularly likely to feel overwhelmed, lonely, and unsuccessful with respect to their roles.

Thus, the current study examined differences among religious groups in perceived social support from significant others. After controlling for having a significant other as well as social support from the family and friends subscales, LDS pregnant women were more likely to perceive higher levels of significant other social support compared to non-LDS high religiosity pregnant women (but not non-LDS moderate and low religiosity groups). The non-LDS high religiosity group was substantially less educated and had lower income levels; therefore, it is possible that these pregnant women are more likely to feel low levels of satisfaction with their significant other, as found in non-pregnant populations.^{32,33} Such dissatisfaction could easily carry over to pregnant women's perceptions of significant other supportive behavior.

Practical Significance of Findings

This dissertation represents one of the first investigations to examine the relationship between religion and LTPA during pregnancy. Study findings show an influence of religiosity, although it accounted for very little of the variance in predicting LTPA behavior. Further study is required to determine if pregnant women of higher religiosities are participating in less *total* LTPA compared to lower religiosity levels. Assessing the amount of occupational physical activity (for many as a homemaker) that pregnant women participate in may be essential to understand LTPA behavior. Pregnant women with children in their care likely participate in high amounts of moderate-intensity activity as a part of their daily routines as being mothers. For such women, when the opportunity for LTPA presents itself, they may desire something different than their occupational activity, and therefore be less inclined to participate in moderate LTPA and more so in vigorous LTPA. Given the higher parity rates for LDS pregnant women compared non-LDS women, this seems a possible explanation for this study's findings regarding LDS women meeting the moderate LTPA guidelines and participating in vigorous LTPA. LDS pregnant women additionally have a unique combination of doctrinal beliefs, which pertain to having children and general health behavior. Given these beliefs, interventions to reduce the influence of physical and lifestyle related LTPA barriers may be needed among LDS pregnant women. Researchers should additionally consider qualitative designs to better ascertain the impact of spirituality/religiosity on LTPA and other health behaviors among specific religious groups during pregnancy.

STUDY LIMITATIONS

Although this dissertation provides novel information with respect to the psychosocial influences to LTPA during pregnancy, our findings are subject to a number of limitations. First, a cross-sectional design was utilized, and collected data when the majority of pregnant women were in the second or third trimesters. A longitudinal design following pregnant women from their first trimester through delivery would have added strength to our findings. Our cross-sectional design allowed for the collecting of significant amount of data on over 300 pregnant women over a period of just three months. This sample size, while adequate, did not provide the precision available to investigators who utilized significantly larger samples.

Another limitation to this investigation involves the assessment of moderate and vigorous LTPA behavior via self-report. Survey questions assessing LTPA were adapted from items within the Global Physical Activity Questionnaire (GPAQ). These questions have demonstrated acceptable criterion validity and excellent test-retest reliability,³⁴ and therefore have been integrated into the National Health and Nutrition Examination Survey (NHANES), a highly cited population-based initiative used to track LTPA and other health behaviors in the United States.

Despite this, self-reporting physical activity via questionnaire has its limitations,³⁵ and has been repeatedly shown to be less valid than objective methods of physical activity assessment.^{36,37}

Our findings may be additionally limited by the specific timeframe in which LTPA data were collected. Our survey instrument contained questions about participants' current LTPA behavior. Given data collection for this investigation occurred from the months of February to April, it is possible that LTPA levels are different than those that would have been evaluated during the summer months. This may be relevant, as over half our analytic sample were recruited from mid-Michigan during one of the coldest winters and springs in recent years in this geographical region.

It should also be acknowledged that this study's findings with respect to perceived risk and LTPA efficacy are limited by single-item assessments. Although these questions were adapted from the often-cited Risk Behavior Diagnostic Scale, Witte et al. ¹⁹ recommends three items for each of the risk (severity, susceptibility) and efficacy (response and self) dimensions. This study aimed to create a survey instrument that could be completed within 15 minutes. Given this and the variety of additional factors that were deemed important to assess, the survey instrument for this investigation could not realistically include more than one item per risk/efficacy dimension.

Finally, this study is limited by the generalizability of our study findings. Our analytic sample was predominantly Caucasian and fairly well educated. It is not known if the findings would be similar in ethnically diverse and low SES populations. Additionally, study investigators neglected to ask pregnant women about perceived risks and LTPA efficacy as it pertains to their own personal health. Given a pregnant woman may feel risk and or benefit for

both her personally and also her baby, such questions would have provided a more complete understanding of how maternal perceptions facilitate LTPA behavior during pregnancy.

STUDY STRENGTHS

There were various strengths to this dissertation. First, this was a multi-site effort, which involved data collection at multiple locations in the mid-Michigan area and Salt Lake City, Utah. Our primary means of recruiting participants involved working directly with various prenatal care clinics and many prenatal HCPs.

Another strength to this investigation is that this study utilized the RPA, a well-respected theoretical framework in the health communication literature. Although relatively new and therefore having a small literature base, the RPA originates from and is theoretically similar to the EPPM, one of the leading fear appeal theories to date. A testament to its parsimony and robust nature, the EPPM has remained unchanged over the years.³⁸ Thus, the RPA is grounded in exceptional health communication theory. To our knowledge this is the first investigation to utilize the RPA within a physical activity or prenatal health context.

Finally, the pregnancy risk in this investigation was defined in a specific manner, namely as a harmful pregnancy effect on the baby. Previous investigations examining pregnant women's perceptions of risk and benefits of physical activity have done so generally, and have not specified whether the "risk" and "benefits" pertain to the mother or the baby.^{4,7,39} Thus, an important and previously unaddressed issue, namely that of concern that a mother feels for her baby, has been specifically applied to the methodological examination of LTPA behavior.

FUTURE RESEARCH DIRECTIONS

Findings from this dissertation introduce a number of future research directions with respect to psychosocial influences of pregnancy LTPA. Now that this study has identified the impact of pregnancy risk perceptions and LTPA efficacy with respect to pregnancy LTPA, interventions should be designed to specifically increase efficacy beliefs among pregnant women. Given its prominence in the message design literature and its many similarities with the RPA, the EPPM should be utilized to create and present persuasive messages to pregnant women regarding LTPA. Various techniques are available for use within such interventions. However, the effectiveness of pregnancy risk and LTPA messages may be increased if prenatal HCPs are integrated in the communication of these messages. Regardless, the overall goal of an intervention should clearly be to help avoidant pregnant women to a more responsive attitude and indifferent pregnant women to a more proactive attitude.

In order to design effective LTPA efficacy messages, a deeper understanding of how such perceptions/beliefs are formed may be valuable. The influence of previous adverse birth outcomes, including preterm birth, operative delivery, and prolonged maternal labor on pregnancy risk perceptions is not well understood. Also unclear is the influence of potentially traumatic pregnancy-related experiences, such as previous miscarriage or infertility. In attempting to understand how these impact levels of perceived risk, researchers should consider vicarious experiences (possibly through an immediate family member or close friend), and not just those that are experienced personally.

Another important research step involves the simultaneous examination of pregnancy risk/LTPA efficacy as it pertains to both the health of the baby AND also the health of the

mother. An advantage of this investigation is that the pregnancy risk was specified as a harmful pregnancy effect on the *baby*. Therefore, LTPA efficacy (specifically response efficacy) was assessed specifically for reducing that risk to the baby. To our knowledge, this dissertation represents the first pregnancy LTPA investigation to have done this. However, a more complete understanding of how pregnancy risk and LTPA efficacy affects pregnant women's LTPA behavior would be possible if risk and efficacy were assessed for both the mother and the baby, separately. This is of particular importance given the pregnant women's pregnancy risk perceptions and LTPA efficacy beliefs may be very different with respect to the health of the mother as compared to the baby.

A number of descriptive investigations would also provide meaningful insight. In order to understand how perceptions change over the course of gestation, pregnant women should be assessed longitudinally, with initial recruitment beginning as early as possible within the first trimester. However, such an investigation would require lengthy time commitments given the natural course of a health pregnancy. Additionally, pregnant women's perceptions towards specific modalities of moderate and vigorous LTPA should be explored, including brisk walking, jogging, swimming, prenatal yoga, and resistance training. Investigations attempting to replicate our findings should consider more diverse samples, particularly multiethnic and of low SES/education, in order to determine whether our findings generalize beyond the specific demographic of this study's participants. According to the defined exclusion criteria of this investigation, pregnant women carrying more than one baby and also high-risk pregnancies were excluded from analysis. These populations need to be assessed in the future to see what differences exist with respect to our sample.
CONCLUSION

This dissertation provides evidence that pregnancy risk perceptions and LTPA efficacy beliefs are related to LTPA behavior during pregnancy. Results suggest that pregnancy LTPA can be increased by altering how pregnant women perceive pregnancy and LTPA so they are proactive or responsive (those with high LTPA efficacy beliefs). Given the substantial maternalfetal health benefits of regular LTPA during pregnancy, this is of utmost importance. This investigation partially designates the RPA as an effective tool for characterizing LTPA behavior among pregnant women. Furthermore, it suggests the EPPM as an optimal tool for pregnancy LTPA interventions given its theoretical similarities with the RPA. The influence of religion on pregnancy LTPA is less well understood. However, this study's results suggest that higher religiosity pregnancy women (including LDS pregnant women), despite higher levels of efficacy beliefs, are less likely to meet the moderate LTPA guidelines during pregnancy, but are more likely to participate in vigorous LTPA. REFERENCES

REFERENCES

- 1. United States. Department of Health and Human Services. 2008 physical activity guidelines for Americans : be active, healthy, and happy! Washington, DC: U.S. Dept. of Health and Human Services; 2008.
- 2. Evenson KR, Savitz DA, Huston SL. Leisure-time physical activity among pregnant women in the US. *Paediatric and perinatal epidemiology*. Nov 2004;18(6):400-407.
- **3.** Evenson KR, Wen F. National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999-2006. *Preventive medicine*. Mar 2010;50(3):123-128.
- **4.** Evenson KR, Wen F. Prevalence and correlates of objectively measured physical activity and sedentary behavior among US pregnant women. *Preventive medicine*. 2011;53:39-43.
- **5.** Mudd LM, Nechuta S, Pivarnik JM, Paneth N. Factors associated with women's perceptions of physical activity safety during pregnancy. *Preventive medicine*. Aug-Sep 2009;49(2-3):194-199.
- **6.** Evenson KR, Siega-Riz AM, Savitz DA, Leiferman JA, Thorp JM, Jr. Vigorous leisure activity and pregnancy outcome. *Epidemiology*. Nov 2002;13(6):653-659.
- 7. Eide J, Hovengen R, Nordhagen R. Childhood abuse and later worries about the baby's health in pregnancy. *Acta obstetricia et gynecologica Scandinavica*. Dec 2010;89(12):1523-1531.
- **8.** Evenson KR, Bradley CB. Beliefs about exercise and physical activity among pregnant women. *Patient education and counseling*. Apr 2010;79(1):124-129.
- **9.** Witte K, Allen M. A meta-analysis of fear appeals: implications for effective public health campaigns. *Health education & behavior : the official publication of the Society for Public Health Education.* Oct 2000;27(5):591-615.
- **10.** Rimal RN, Real K. Perceived risk and efficacy beliefs as motivators of change: Use of the risk perception attitude (RPA) framework to understand health behaviors. *Hum Commun Res.* Jul 1 2003;29(3):370-399.
- **11.** Turner MM, Rimal RN, Morrison D, Kim H. The role of anxiety in seeking and retaining risk information: Testing the risk perception attitude framework in two studies. *Hum Commun Res.* Apr 2006;32(2):130-156.

- **12.** Rimal RN, Bose K, Brown J, Mkandawire G, Folda L. Extending the Purview of the Risk Perception Attitude Framework: Findings from HIV/AIDS Prevention Research in Malawi. *Health Commun.* 2009;24(3):210-218.
- **13.** Real K. Information seeking and workplace safety: A field application of the risk perception attitude framework. *J Appl Commun Res.* 2008;36(3):339-359.
- 14. Rimal RN, Juon HS. Use of the Risk Perception Attitude Framework for Promoting Breast Cancer Prevention. *J Appl Soc Psychol*. Feb 2010;40(2):287-310.
- **15.** Gaston A, Cramp A. Exercise during pregnancy: a review of patterns and determinants. *Journal of science and medicine in sport / Sports Medicine Australia.* Jul 2011;14(4):299-305.
- **16.** Owe KM, Nystad W, Bo K. Correlates of regular exercise during pregnancy: the Norwegian Mother and Child Cohort Study. *Scandinavian journal of medicine & science in sports*. Oct 2009;19(5):637-645.
- **17.** Bandura A. *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall; 1986.
- **18.** Pearce EE, Evenson KR, Downs DS, Steckler A. Strategies to Promote Physical Activity During Pregnancy: A Systematic Review of Intervention Evidence. *American journal of lifestyle medicine*. Jan 1 2013;7(1).
- **19.** Witte K, Cameron KA, McKeon JK, Berkowitz JM. Predicting risk behaviors: development and validation of a diagnostic scale. *Journal of health communication*. Oct-Dec 1996;1(4):317-341.
- **20.** Ford C. The origin of the Word of Wisdom. *Journal of Mormon Histor*. 1998;24(2):129-154.
- **21.** Mosher WD, Williams LB, Johnson DP. Religion and fertility in the United States: new patterns. *Demography*. May 1992;29(2):199-214.
- **22.** Thornton A. Religion and Fertility Case of Mormonism. *J Marriage Fam.* 1979;41(1):131-142.
- **23.** Hayford SR, Morgan SP. Religiosity and Fertility in the United States: The Role of Fertility Intentions. *Social forces; a scientific medium of social study and interpretation*. 2008;86(3):1163-1188.
- 24. Pereira MA, Rifas-Shiman SL, Kleinman KP, Rich-Edwards JW, Peterson KE, Gillman MW. Predictors of change in physical activity during and after pregnancy: Project Viva. *American journal of preventive medicine*. Apr 2007;32(4):312-319.

- **25.** Bradley DE. Religious Involvement and Social Resources Evidence from the Data Set Americans Changing Lives. *J Sci Stud Relig.* Jun 1995;34(2):259-267.
- **26.** Ellison CG, George LK. Religious Involvement, Social Ties, and Social Support in a Southeastern Community + a Study of a Theoretical-Model Linking Institutional Church Participation and Social Network Relationships. *J Sci Stud Relig.* Mar 1994;33(1):46-61.
- 27. Dunkel-Schetter C, Sagrestano LM, Feldman P, Killingsworth C. Social support and pregnancy: A comprehensive review focusing on ethnicity and sulture. In: Pierce GR, Sarason BR, Sarason IG, eds. *Handbook of social support and the family*. New York:Plenum Press; 1994:375-412.
- **28.** Clarke PE, Gross H. Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery*. Jun 2004;20(2):133-141.
- **29.** Evenson KR, Moos MK, Carrier K, Siega-Riz AM. Perceived barriers to physical activity among pregnant women. *Maternal and child health journal*. May 2009;13(3):364-375.
- **30.** Thornton PL, Kieffer EC, Salabarria-Pena Y, et al. Weight, diet, and physical activityrelated beliefs and practices among pregnant and postpartum Latino women: the role of social support. *Maternal and child health journal*. Jan 2006;10(1):95-104.
- **31.** Heaton TB, Goodman KL, Holman TB. In search of a pecular people: Are Mormon familis really different. In:Cornwall M, Heaton TB, Young LA, eds. *Contemporary Mormonism: Social Science Perspectives*. 1994;87-117.
- **32.** Conger RD, Conger KJ, Martin MJ. Socioeconomic Status, Family Processes, and Individual Development. *Journal of Marriage and Family*. Jun 2010;72(3):685-704.
- **33.** Dakin J, Wampler R. Money doesn't buy happiness, but it helps: Marital satisfaction, psychological distress, and demographic differences between low- and middle-income clinic couples. *Am J Fam Ther.* 2008;36(4):300-311.
- **34.** Herrmann SD, Heumann K, J., Der Ananian CA, Ainsworth BE. Validity and reliability of the Global Physical Activity Questionnaire (GPAQ). *Measurement in Physical Education and Exercise Science*. 2013;17(3):221-235.
- **35.** Shephard RJ. Limits to the measurement of habitual physical activity by questionnaires. *British journal of sports medicine*. Jun 2003;37(3):197-206; discussion 206.
- **36.** Westerterp KR. Assessment of physical activity: a critical appraisal. *European journal of applied physiology*. Apr 2009;105(6):823-828.
- **37.** Schutz Y, Weinsier RL, Hunter GR. Assessment of free-living physical activity in humans: an overview of currently available and proposed new measures. *Obesity research.* Jun 2001;9(6):368-379.

- **38.** Maloney EK, Lapinski MK, Witte K. Fear appeals and persuasion: A review and update of the Extended Parallel Process Model. *Social and Personality Psychology Compass.* 2011;5(4):207-219.
- **39.** Gaston A, Prapavessis H. Maternal-fetal disease information as a source of exercise motivation during pregnancy. *Health psychology : official journal of the Division of Health Psychology, American Psychological Association.* Nov 2009;28(6):726-733.