A Mixed-Methods Exploration of the Role of Pregnancy Planning on Maternal Physical Activity Behaviors

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Dedication

This thesis is dedicated to my immediate family: my mother, Sherese Palmer Greene; my stepmother Larysa Lewis Greene; my father, Clarence Greene III; my paternal grandfather, Clarence Greene II; and my brother, Caleb Maurice Greene. Additionally, I dedicate this work in remembrance of my maternal grandfather, Joel Palmer, who passed away while I was progressing in my research. I cannot adequately express my gratitude for the motivation, smiles, and love you have all given me. My aspirations are rooted in making you proud.

This thesis is also dedicated to the memory of Amber Thurman, a young mother who lost her life due to reproductive and health injustices. A significant part of my mission is to produce work that ensures her story is never forgotten.

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Abstract

Background: Pregnancy is a life event that is influenced by social, emotional, and cultural factors. Research has shown that pregnancy planning may be linked to decisions surrounding health behaviors in pregnant individuals. Specifically, there are differences in how categories of pregnancy planning may be associated with an individual's decision to either engage in or avoid risky behaviors such as alcohol consumption, smoking, and delaying prenatal care. Existing research has yielded ambiguous results and neglects to consider physical activity (PA) as a separate health behavior that may be linked to an individual's pregnancy planning status. Therefore, this study aims to explore individuals in varying pregnancy planning stages — planned, unplanned, and ambivalent — and their PA behaviors.

Methods: Thirteen pregnant individuals (ages 18-40 years, ≥16 weeks gestation), located in the southeastern region of the United States, participated in the study. Quantitative data were collected using a survey to provide data on participant demographics, pregnancy planning (London Measure of Unplanned Pregnancy [LMUP]), and maternal PA behaviors (Pregnancy Physical Activity Questionnaire [PPAQ]). Nonparametric tests (Mann-Whitney U and Spearman) were conducted due to the non-normal distribution of data (alpha level 0.05). Qualitative data were collected through semi-structured, one-on-one interviews and recorded via Zoom. Verbatim interview transcripts were analyzed by two investigators. Quantitative and qualitative data were analyzed separately and integrated using a convergent, parallel mixed-methods approach.

Results: The PPAQ estimated MET-hours/week and there were no differences by LMUP category (divided into planned, unplanned, and ambivalent). Six themes emerged from the qualitative participant interviews including: overall pregnancy experience, PA education

received from providers, PA during the current pregnancy, pregnancy-related barriers to PA, advice to other pregnant individuals, and support needs and future directions. Collectively, the results revealed variations in pregnancy planning experiences, but findings did not identify differences in PA (MET-hours/week) by LMUP category.

Conclusion: This study provides additional information for future research into maternal PA behavior and pregnancy planning tools. Although quantitative results were not significant in this small sample, the qualitative and combined findings are valuable as they could inform and improve PA-related recommendations for prenatal health and fitness.

Table of Contents

Chapter 1 Introduction 1

Purpose 2

Main Research Question 3

Sub Questions 3

Chapter 2 Review of Literature 4

Overview of Movement & PA Measurement 4

Definitions 4

Domains of PA 5

Objective PA Measurements 5

Subjective PA Measurements 7

Pregnancy & PA 9

Physiological Changes During Pregnancy 9

PA Behavior in Pregnancy 12

Benefits of PA During Pregnancy 13

PA & the Social Ecological Framework 16

Defining & Incorporating the Social Ecological Framework 16

Barriers to PA in Pregnancy 18

Pregnancy Intention 19

Definition & History 19

Selection of Terminology: Pregnancy Planning 20

Categories of Pregnancy Planning: Planned, Unplanned, & Ambivalent 21

Pregnancy Planning & the Connection to PA Behaviors 23

Pregnancy Planning & Mental Health 25
Summary 27
Chapter 3 Methods 28
Participants 28
Sampling Techniques 29
Mixed Methods: Convergent Parallel Design 29
Quantitative Data Collection: Questionnaires 30
Quantitative Data Analysis 34
Qualitative Data Collection: Interviews 34
Qualitative Data Analysis 35
Ethical Commitments 35
Paradigmatic and Positional Considerations 36
Chapter 4 Results 38
Quantitative Results 38
Qualitative Results 46
Overview 46
Theme 1: Overall Pregnancy Experience 46
Affect 46
Systems of Support 47
Mental Load 48
Physical Symptoms 48
Theme 2: PA Education Received from Providers 49
General/Vague Advice 49

No Advice 50
Theme 3: PA During the Current Pregnancy 51
Necessary Exercise Modifications 51
Connections to Planning 53
Body Preparation 53
Theme 4: Pregnancy-Related Barriers to PA 54
Physical 54
Accessibility 56
Fetal Safety Concerns 57
Competing Interests 58
Theme 5: Advice to Other Pregnant Individuals 58
PA Participation 59
Recognizing Unique Needs 60
Theme 6: Support Needs and Future Directions 61
Individual and Ongoing Exercise Prescription 62
Encouragement and Support 62
Safety Boundaries and Modifications 63
Education on PA Benefits 64
Chapter 5 Discussion 65
Physical Activity Patterns in Pregnancy 65
Domain Specific Activity 66
Inconsistencies in Pregnancy Planning Categorization 67
Leisure Time Activity 70

Barriers and Problems with Access 70
Limitations & Future Directions 73
Conclusion 74
References 75
Appendices 86
APPENDIX A: Press Release 86
APPENDIX B: Recruitment Flyer 87
APPENDIX C: Telephone Screening 88
APPENDIX D: Informed Consent 89
APPENDIX E: Demographic Survey 92
APPENDIX F: LMUP Questionnaire 95
APPENDIX G: PPAQ Questionnaire 98
APPENDIX H: PUQE Questionnaire 105
APPENDIX I: Interview Question Guide 106
APPENDIX J: Script for Recruitment 110
APPENDIX K: Email Script for Approved Compensation Consent 111
APPENDIX L: PPAQ Scoring Guide 112
Vita 113

List of Tables

Table 1. Demographic Characteristics of Participants (N=13) 39

Table 2. Supplementary London Measure of Unplanned Pregnancy (LMUP) Questions..... 42

Table 3. Physical Activity Participation by Pregnancy Planning Category..... 43

Table 4. Mann-Whitney U Results (N=13)..... 43

Table 5. Spearman's Rho Nonparametric Correlations (N=13)..... 44

Table 6. Pregnancy Planning Status by Participant Separated by Quantitative and Qualitative . 69

Chapter 1

Introduction

Current United States (U.S.) physical activity (PA) guidelines for pregnant individuals recommend at least 150 minutes (about 2 1/2 hours) of moderate-intensity aerobic activity per week [1, 2]. Early historical recommendations emphasized that pregnant individuals should approach exercise with extreme caution and avoid overexertion [3-5]. Recommendations for moderate-intensity exercise in pregnant individuals were formulated in the 1970s and 1980s through prenatal exercise programs [6]. They began to advance in light of the health and fitness boom to encourage PA as women became included in more sport-related activities [4, 6]. The American College of Obstetrics and Gynecology (ACOG) created guidelines in the late 1990s and early 2000s to support at least 30 minutes of PA (with suggestions of breaking activity up into 15 minute periods) during most days of the week in those without absolute contraindications [7, 8]. PA recommendations became less rigid for pregnant individuals as time progressed [6]. According to the most recent ACOG committee opinion, PA is encouraged during most pregnancies and can be maintained with minimal risks [2].

Even after the release of updated ACOG statements, some healthcare providers remain hesitant to prescribe exercise and PA to pregnant individuals — often due to lack of prescription knowledge or uncertainty [3, 9]. Contrary to prior belief, data show that PA during pregnancy is widely beneficial and important to prevent complications such as excessive gestational weight gain, gestational diabetes, and preterm delivery [1, 2]. Furthermore, PA promotes the maintenance of overall maternal physical health, mental health, and adjustment to the postpartum period [1].

Despite cited benefits of PA during pregnancy, there are a multitude of barriers that hinder pregnant individuals from committing to a consistent exercise and PA regimen. Research shows that barriers are complex and multifactorial for pregnant individuals which may reduce PA across the pregnancy [10]. Using the social ecological framework, barriers can be categorized as intrapersonal, interpersonal, community, organizational, and relating to public policy matters [11]. Since pregnancy is a significant physiological life event, it is important to minimize barriers that could hinder the adoption of healthy behaviors such as PA. Additionally, focusing on certain decision-making processes that occur during this time may provide insight on potential motivators for initiating, maintaining, or adhering to PA. Further research into pregnancy related decision-making may be effective to target key stages, unique barriers, and experiences to support healthy behavior adoption.

The decision-making process that influences behavior adoption in pregnancy is often referred to as pregnancy intention. Pregnancy intention is a complex set of decisions made before and during a pregnancy influenced by social, emotional, and cultural factors [12]. Pregnancy intention can be measured at several stages during pregnancy and is a helpful public health measure for identifying resources for pregnant individuals [12]. A crucial component of pregnancy intention is an individual's planning status which can be divided into the categories of planned, unplanned, and ambivalent [13, 14]. Understanding how pregnancy intention, specifically defined as pregnancy planning, influences PA behavior can help deliver tailored and relevant education to pregnant individuals.

Purpose

The purpose of this study is to examine PA behaviors across planned, unplanned, and ambivalent pregnancies. This research will explore how components of PA behaviors including

but not limited to barriers, frequency, and modality may be affected as pregnant individuals encounter feelings and decision-making about PA during pregnancy. The study will focus on pregnant individuals in their second and third trimesters.

Main Research Question

How might different categories of pregnancy planning — planned, unplanned, or ambivalent —shape PA behaviors?

Sub Questions

- Are there differences in PA MET-hours/week between individuals with planned, unplanned, or ambivalent pregnancies?
- In what ways does pregnancy planning impact the individual's willingness to participate in or maintain PA?
- What barriers to PA are more commonly reported by individuals with planned, unplanned, and ambivalent pregnancies?
- How can health and exercise professionals best promote PA in pregnant individuals?

Chapter 2

Review of Literature

Overview of Movement & PA Measurement

Definitions

PA is any bodily movement through skeletal muscle that results in energy expenditure [15]. PA is complex and can be separated into categories or subdivisions [15]. PA exists in several dimensions, including type of activity, frequency, duration, and intensity [16]. In addition to these dimensions, there are different domains in which PA can transpire. These domains include occupational, domestic, transportation, and leisure [16]. In summary, the dimension describes the activity taking place and the domain defines the context in which the activity occurs. Throughout this literature review, the term PA will be used to include literature referencing PA of all dimensions and domains. Recognizing the many forms of PA is beneficial as it can help to encourage movement in sedentary or low-activity individuals.

Exercise is a subcategory of PA that is planned, structured, purposeful, and repetitive [15]. The purpose of exercise is to improve one or more components of physical fitness such as muscular fitness, cardiorespiratory fitness, flexibility or body composition [15]. The distinction between exercise and PA is important as PA is inclusive of movement that may be more common in special populations. Recently, societal emphasis on physical fitness has led to increased interest in purposeful exercise during pregnancy. The World Health Organization (WHO) 2020 guidelines issued a strong recommendation for pregnant and postpartum individuals to engage in both regular aerobic PA and strength-based activities [17]. Similarly, the Guidelines for Americans support this recommendation and further advises that PA should be gradually increased throughout the pregnancy [1].

Domains of PA

The WHO has categorized PA into domains to specify the nature in which people are engaging with PA. Dividing PA into domains has impacted the way in which we analyze and define guidelines for PA [18] Continuing to define these domains can assist in the way in which we establish interventions for certain groups. Many studies focus on the leisure-time PA (LTPA) domain [18]. According to the WHO guidelines, this domain is defined as PA not required for daily living performed at the discretion of the individual [17]. Activities in this domain include but are not limited to walking for enjoyment, dancing, and gardening [17]. The occupational/work PA domain is defined as PA during paid or voluntary work [17]. This definition occasionally raises concerns as our societal definitions of work have changed. However, the overarching purpose of this domain is to capture PA that is done as a part of work or work-related activities (e.g., lifting boxes, walking up flights of stairs to the copy room). The transportation related PA domain is defined as PA with the purpose of going to and from specific locations [17]. Transportation modalities could include walking, cycling, or wheeling (the act of moving on wheels especially traveling by wheelchair or skates) [17]. The guidelines do put an emphasis on non-motorized forms of transport [17]. Lastly, the household domain is defined as PA that is a part of domestic work [17]. Activities in this domain may include caring for children, sweeping, and mopping [17]. The purpose of this domain is to identify any PA in which individuals engage while at home or upkeeping the home. As mentioned, these domains are not exhaustive, but they help us better understand the context within which PA occurs.

Objective PA Measurements

The measurement of PA is relevant for the assessment energy expenditure to assist in the study of the effects and benefits of PA [19]. There are multiple methods to measure PA that

typically fall under the dichotomous categories of subjective and objective measurement [16]. Objective measurement involves quantitative and concrete methods that measure energy expenditure, motion, and/or physiological components [16]. One of the earliest forms of objective measurement involved direct observation, which was a favored method in early research because of its ability to obtain contextual information [19]. This method is typically used to assess PA in children but proves to be tedious and inconvenient for larger research studies [19]. The current gold standard for measuring energy expenditure is known as the doubly labeled water method (DLW) [16, 19]. DLW is a method of objective assessment that aims to measure metabolic processes [19]. This method is dependent on the difference between the elimination rates of two stable isotopes (oxygen-18 and deuterium) [19]. Even though this is considered the gold standard, it is an expensive method and requires knowledgeable experts to conduct, making it less accessible [19].

A widely used method for objectively measuring PA involves motion sensors. Motion sensors are wearable devices that help measure energy expenditure and additional variables of PA such as acceleration, heart rate, etc. [16]. Motion sensors relevant to the current review can be broken down into the categories of accelerometers or pedometers. Accelerometers have sensors that register movement/acceleration in different planes [19]. Along with the technological advances that have made room for accelerometers, there are pedometers that track accelerative motion. Pedometers use a spring-based system to measure activity in the vertical plane, typically serving the purpose of counting steps [16, 20]. Specific pedometer models have been validated against objective measures like indirect calorimetry [20]. Despite their common use, pedometers have limitations in accuracy as they lack data storage and have difficulty differentiating activity if they are wrist-mounted [20].

An additional limitation of these devices is that there is no current validated algorithm in pregnant individuals. When evaluating the accuracy of monitors in pregnant individuals, there were variations in accuracy based on the brand, wearable location, and walking speed [21]. Errors were frequently found with measurement at slower walking speeds and when worn at the wrist [21]. There are devices making advances toward accurate measurement, but further research is still necessary to validate measures and accelerometer cutoff points in pregnant individuals [21]. Researchers must select the appropriate instrument that is relevant to their study to draw health-related conclusions from observed PA. Objective measurement is typically the standard approach for PA measurement, but there are other methods to measure and quantify PA.

Subjective PA Measurements

In contrast to objective methods of measurement, subjective PA measurements rely on an individual to report and recall their PA [16]. Subjective measurement tools typically involve a form of questionnaire, diary, or activity log [16]. Questionnaires are common due to their convenience and accessibility. Questionnaires typically include questions or scales asking the individual to assess a specific variable [16]. Additionally, questionnaires can be variable in detail and length and may allow the participant to provide a history of PA in several ways [16]. For example, in the Pregnancy Physical Activity Questionnaire (PPAQ), used in the current research study, assesses PA in pregnant individuals with a selection of 32 activities split into household/caregiving, occupational, sports/exercise, transportation, and inactivity [22]. The PPAQ is a widely used questionnaire that has been translated and validated in 13 languages across 70 countries [23]. The PPAQ is currently used in national research studies and when compared with other methods, including wearable cameras and accelerometers, it has reasonable validity in sedentary activity and PA of various intensities [23]. Additionally, the PPAQ is the

only questionnaire to include pregnancy-specific MET values [23]. Each question in the PPAQ has a variety of possible time durations that can be selected by the individual [22]. The individual is also able to add in any additional activities in an open-ended section of the questionnaire [22]. Questions in the PPAQ are unique as they include questions in the household domain section regarding caregiving in the home (e.g. taking care of a parent, other children in the home). This is important for the current study as household and work responsibilities are evolving. Specifically, women have historically been disproportionately impacted by caregiving responsibilities [24]. Given these shifts, the variability and context that questionnaires provide are essential to understanding the activity that an individual engages in.

Questionnaires can be separated into three different categories including: global, short recall, and quantitative history [16]. Global questionnaires provide a snapshot of a person's PA level [16]. For this reason, global questionnaires are typically short in length and primarily used to identify if a participant meets PA recommendations [16]. An example of a global questionnaire is the Exercise Vital Sign which is used to assess minutes spent in moderate to vigorous PA [16]. Short recall PA questionnaires are a way to report the volume of PA and further classify it by dimension or domain [16]. Short recall questionnaires can be self-reported or interviewer reported, and include a variety of activities [16]. An example of a short recall questionnaire is the Compendium of Physical Activities which is used to provide a detailed list of PA MET values, which are units used to express exercise intensity (1 MET is equal to 3.5 mL $O_2 \bullet kg^{-1} \bullet min^{-1}$) [16]. Lastly, quantitative history PA questionnaires are more detailed surveys that require reporting PA over a specified time period [16]. These questionnaires are longer in nature and require the capability to recall PA at different timepoints in the life span [16]. The purpose of a quantitative history questionnaire is to obtain an estimate of PA across the lifespan

to assess health status [16]. The type of questionnaire used will depend on research outcomes, expected participants, cost, and training level/knowledge of the personnel conducting them [16]. For the purposes of the current research study, there will be an explicit focus on short recall questionnaires to capture PA behavior specific to the current pregnancy. The use of subjective measurement of PA in this study will provide convenience, feasibility, and context.

Pregnancy & PA

Physiological Changes During Pregnancy

Pregnancy is a life event that requires many different physiological changes to support the development of a fetus. Expectant individuals often shift to low-intensity activities because of symptoms associated with physiological changes [10]. Along with physical discomforts, individuals report feeling restricted and hindered by their ever-changing pregnant bodies [10]. As pregnancy progresses, further adaptations are made to accommodate the growing fetus. As such, there can be occurrences of low back pain due to changes to the spinal curvature and postural alterations [25, 26]. Changes to the lumbar angle were a big focus in early research because of the associations to low back pain and lordosis [26]. Early evidence from Franklin and Kerr support the symptoms reported above as their results showed an increase in lumbar angle during pregnancy [26]. Bullock et al. also found significant increases in lumbar and thoracic curvatures (kyphosis increasing by 7.2 degrees; lordosis increasing by 6.6 degrees over a 16-week period) [27].

Newer research provides differing conclusions regarding spinal changes occurring in the pregnant body. A study conducted by Biviá-Roig et al. found no changes in lumbar flexion nor rotation of the pelvis when comparing nulliparous, antepartum, and postpartum measures [28]. In other words, they found no changes to the lumbar or pelvic region. Instead, they found average

electromyography (EMG) activation during a standing position increased significantly for pregnant women (erector spinae=4.6 ± 3.1; biceps femoris=3.4 ± 4.1) compared to nulliparous and postpartum measures (erector spinae=2.1 ± 2.0; biceps femoris=1.4 ± 1.9) [28]. The proposed explanation from this study is that the posterior muscles increase in activity to prevent significant disturbance to the spinal curvature [28].

Bivia-Roig et al. further investigated these findings to clarify the impacts pregnancy has on the muscles, ligaments, and surrounding connective tissue [29]. Relaxin is a hormone which exerts its effect on the musculoskeletal system resulting in viscoelastic properties of ligaments [29, 30]. During pregnancy, there is an increase in relaxin resulting in the increased laxity of the ligaments [28]. As a result, relaxin plays a significant role in processes like bone remodeling, alteration of ligament mechanics, and the maintenance of skeletal muscle [30]. The reported EMG activation in Bivia-Roig et al. reflects how the erector spinae may be impacted by relaxin [29]. This is further supported by their findings in which increased erector spinae activation was observed in pregnant women who were bending forward [29]. Due to the influence of relaxin and potential deformation of viscoelastic tissues (from repeated flexion movement), the erector spinae remain active for a longer period for an increased range of flexion [29]. Relaxin also binds to receptors significant to the musculoskeletal system [31]. It regulates inflammation, regeneration, and fibrosis, playing an essential role in musculoskeletal processes like muscle regeneration and bone remodeling. Relaxin promotes increased laxity by altering cartilage/tendon stiffness via the activation of collagenase, impacting the way mechanoreceptors are stimulated [29, 31]. The mechanoreceptors make the lumbar joints less stable and more susceptible to injury [29]. In summary, relaxin during pregnancy alters lumbar motion and stability, resulting in symptoms such as low back pain. The exact degree to which the spinal

curvature is impacted is ambiguous, but exercise programs and PA may be a solution for mediation of the symptoms associated with postural/hormonal changes [29].

The cardiovascular system has a critical role in directing blood flow and delivering essential nutrients to the developing fetus [32]. Regardless of pre-pregnancy training status, there are important changes to the cardiovascular system during pregnancy to accommodate for blood and nutrient demands that must be delivered to the placenta as well as cardiovascular changes that impact the heart and blood flow [33]. Resting heart rates can increase up to 8 beats per minute (bpm) in early pregnancy [34]. The heart rate tends to continue its increasing trend until a plateau occurs in about the third trimester [35]. In contrast to heart rate, evidence suggests that in early pregnancy there is a drop in systolic and diastolic blood pressure (BP) [32, 36]. In the latter half of pregnancy, there is an increase in BP up until delivery [32]. Blood volume increases by about 1500 mL which causes an increased amount of blood to return to the heart (preload) [35, 37]. Stroke volume increases due to the rise in overall blood volume [28]. There is a resultant increase in cardiac output (Q) due to both elevated heart rate and stroke volume [33, 35]. Overall, Q increases by about 40% during pregnancy with maximum Q occurring around 20-28 weeks [38]. In comparison, Q during pregnancy is almost double that of a non-pregnant individual [28]. Furthermore, Q varies outside of singleton pregnancies and can be 15-20% higher when carrying twins [33, 35]. Intrinsic changes are prefaced by the structural change of the heart as it is pushed upwards and rotated forward [35]. Further cardiovascular changes may occur depending on complications during pregnancy [35]. Overall, the heart plays an important role in circulation for fetal growth and development [32].

Pregnancy also impacts the anatomy and functioning of the pulmonary system [35]. The body must undergo certain adaptations as the oxygen demand during pregnancy increases [38]. A

combination of hormonal influence and the expanding uterus create a progressive chest wall adaptation to accommodate the growing fetus [35]. There are a series of anatomical changes including an elevated diaphragm, an increase in chest diameter, and change in the angle of the ribs [35, 38, 39]. These changes alter the lung capacity and volume during pregnancy [39]. Furthermore, increases in progesterone and relaxin act directly on the medulla to result in an increase in the frequency of breathing [39]. Specifically, there are increases in ventilation, tidal volume, oxygen consumption, and a decrease in functional residual capacity [39]. Overall, there is an impairment of the ability to exercise anaerobically and aerobically which impacts the time, type, and intensity of the activity in which pregnant individuals can engage [2].

PA Behavior in Pregnancy

There is increasing evidence that PA participation declines during pregnancy [40, 41]. According to Evenson et al., half of the women (50.6%) in a national sample reported being less active during pregnancy compared to the previous year [40]. Borodulin et al. concluded pregnant individuals self-reported at least some PA in the second and third trimesters [42]. However, the level of PA decreased between the second and third trimesters in fairly light, hard, and very hard categories of PA [42]. Specifically, there were significant decreases in fairly light care-related activity, total care-related activity, fairly-light household related outdoor activity, total care-related care activity, somewhat hard recreational activity, hard recreational activity, and very hard recreational activity [42]. This suggests that the distribution of PA across domains may shift as pregnancy progresses. PA participation declines further in pregnant individuals with twin gestations [43]. Meah et al. analyzed activity patterns of women with multifetal pregnancies and found 27% of subjects completed no PA at all, and 57% engaged in PA but were below recommendations [43]. Expectant individuals often shift to low-intensity activities because of

symptoms associated with physiological changes [10]. Cited physical discomforts associated with more strenuous PA include but are not limited to breast tenderness, sore knees, pressure from the uterus, and breathing difficulties [10]. Further research is needed to determine other factors beyond any physiological aspects (e.g., emotional, psychological, behavioral) that may contribute to high rates of physical inactivity during pregnancy. Being aware of physiological changes in pregnancy is important for understanding the degree to which pregnant individuals choose to engage in PA.

Benefits of PA During Pregnancy

Despite any challenges, research has shown there are several benefits to PA during pregnancy. Stated benefits according to ACOG include an increase in vaginal delivery, as well as decreases in gestational hypertension, excessive gestational weight gain (EGWG), gestational diabetes mellitus (GDM), preterm birth, and cesarean delivery [2]. GDM is one of the most common pregnancy complications and is described as a glucose intolerance that develops during the gestational period [44, 45]. Exercise has been cited to potentially have a protective effect on GDM [46, 47]. Research supports the idea that PA may be an effective strategy for GDM prevention and management [45]. Huifen et al. reported a decrease in blood glucose levels after an intervention involving moderate intensity resistance exercise in pregnant women (control = -5.08 ± 0.17 mg/dL vs. exercise = -4.97 ±.21 mg/dL) [48]. When compared to the control group, the utilization rate and amount of insulin were lower in the exercise group (control=17.4% utilization; 2.05 ± 5.04 u/d vs. exercise=2.3% utilization; 0.33 ± 2.14 u/d [48]. However, it's important to note that the amount of exercise associated with reductions in GDM are often higher than current PA recommendations [49].

In another study, Barakat et al. compared a supervised exercise intervention to a standard care control group in pregnant individuals. The exercise group performed moderate intensity aerobic and resistance exercises for 30-35 minutes [50]. The results showed significant differences between groups in oral glucose tolerance test results (OGTT) (control=121.63 mg/dL vs. exercise=116.56 mg/dL) and overall GDM diagnosis (control=6.8% vs. exercise= 2.6%) [50]. These studies follow a trend in which collective bouts of PA improve blood glucose levels. There is a significant focus on the prevention of GDM as well as pregnancy outcomes in GDM as it is associated with pre-eclampsia, delivering a large for gestational age neonate and associated birth injuries, neonatal hypoglycemia and hyperbilirubinemia, and even stillbirth [45, 48, 51-53].

Regarding GDM, it is important to discuss related conditions. EGWG has been shown to predict GDM [54]. The Institute of Medicine has provided recommendations for gestational weight gain during pregnancy based on pre-pregnancy body mass index categories that include ranges for second and third trimester weekly weight gain and overall weight gain (standardized to 40 weeks gestation) [55, 56]. According to these guidelines, normal weight women should gain about 0.4 kg (0.88 lbs.) every week during the second/third trimesters [55]. Additionally, underweight women should gain about 0.5 kg (1.1 lbs.) every week, while obese women should gain 0.2 kg (0.44 lbs.) every week [55]. Anything above these guidelines is considered EGWG [55, 57]. In the Barakat et al. study, there was a greater number of women in the control group who gained weight excessively compared to the exercise group (30.2% vs 20.5%, respectively; 95% CI= 0.389-0.916; p=0.018) [50]. In a more recent intervention by Acosta-Manzano et al., pregnant women completed a supervised aerobic and resistance training intervention in which they showed decreased weight gain and weight retention [47]. Statistically, exercise did not significantly prevent EGWG but it was found to reduce the maternal-fetal pro-inflammatory

status measured by cytokines (e.g., fractalkine, interleukin 6, interleukin 8, interleukin 10, interleukin 1β, interferon γ, TNF-α) in maternal and cord serum, and in colostrum and mature milk [47]. This means PA, specifically in the form of exercise, plays a role in decreasing inflammatory markers that promote the negative effects of EGWG [47]. Furthermore, although some studies did not reach statistical significance, the majority indicated that insufficient PA or a sedentary lifestyle were linked to an increased risk of EGWG [58]. Using PA to appropriately manage weight during pregnancy is beneficial as EGWG is associated with adverse outcomes, fetal programming, and childhood outcomes [57, 59].

Another significant benefit of PA is its impact on the delivery method [2]. While the choice of delivery method is available for pregnant individuals, there are some long term concerns associated with cesarean delivery like increased risk of blood loss in future pregnancies and infection [60]. Considering these concerns, there is evidence that PA could improve chances of vaginal delivery [2]. A meta-analysis on the effects of exercise on mode of delivery, reviewed 10 randomized controlled trials (RCTs) in which regular bouts of PA increased the frequency of vaginal delivery [61]. Furthermore, exercise in the second and third trimesters reduced the rates of cesarean delivery (RR=1.14; 95% CI=1.01-1.32; p=0.048; RR=0.66; 95% CI= 0.46-0.96; p=0.028, respectively) [61]. It is notable that results were more applicable to women with low to moderate levels of PA compared to women already engaging in moderate to vigorous PA [61]. Barakat et al. compared an exercise group to a control group, in which the exercise group adhered to three sessions of conditioning lasting 40-45 minutes [62]. After the intervention, it was concluded that the percentage of cesarean and instrumental deliveries in the exercise group were significantly lower than in the control group (exercise=15.9%, N=22; 11.6% N=16 vs. control= 23%, N=35; 19.1% N=29, respectively, p=0.03) [62]. A retrospective study examining

the effects of prenatal exercise and yoga on labor, delivery, and pregnancy cited the impacts of PA on the rates of cesarean deliveries [63]. Women were divided into a control group and exercise group in which exercise options included walking, aerobic exercise, pelvic floor exercises, and yoga [63]. The exercise group experienced a significantly lower delivery duration (exercise= 401.50 ± 50.01 minutes; control= 607.00 ± 45.03 minutes) [63]. Rates of cesarean delivery for the exercise group were 37%, but 95% for the control group. These findings are significant as they shed more light on how delivery is impacted by PA.

Overall, these studies demonstrate that PA is beneficial for multiple pregnancy health outcomes including GDM, EGWG, and minimizing delivery intervention techniques. Future studies might focus on exploring how information about PA benefits are perceived and translated into action.

PA & the Social Ecological Framework

Defining & Incorporating the Social Ecological Framework

In addition to physiological barriers to PA there are intrapersonal, interpersonal, organizational, community, and public policy factors that can influence PA engagement. These components are based within ecological models that help us to understand human health behavior [11]. Social ecological models (SEM) provide the perspective that factors at multiple levels can influence health behaviors [11]. There are many ecological models, but the central theme emphasizes people's interactions with their physical and sociocultural surroundings [11]. For the purposes of this literature review and research study, the most relevant SEM will be McElroy's Ecological model of health behavior. This model focuses on individual social environmental factors [64]. It assumes that changes in the social environment help to facilitate change in the individual [64]. Within the model, intrapersonal factors are defined as

characteristics unique to the individual [65]. Important components at the intrapersonal level include but are not limited to attitudes, beliefs, language, and perceptions [65]. Interpersonal factors involve the network or community in which an individual exists [65]. Components of the interpersonal level include but are not limited to health care providers, family, friends, and spouses [65]. One of the most influential factors on the interpersonal level are relationships because they serve as a basis for information, emotional support, and social resources [64].

Organizational factors which are settings in which people engage in formal work [64]. Examples of these settings include but are not limited to universities, schools, offices, professional groups, and facilities [64]. Organizations are considered as a factor of the SEM because it can have a positive or negative effect on the health of its members [64]. Typically, when focusing on organization level interventions, the focus of the intervention is usually the employees [64]. The next level in the model is a factor labeled as community. Community has different definitions rooted in sociology because humans can belong to multiple community groups [64]. Overall, the most important aspect of community is that it has different meanings and applications for health-based interventions [64]. The last level are factors that fall under the realm of public policy. As people who operate in various societal settings, we are influenced by the policies that govern a particular space. Policies influence behaviors based on potential restrictions or potential incentives [64]. In conclusion, there are several factors that determine health behaviors. These factors can become barriers or enablers to PA based on the sociocultural environment that an individual operates in.

The current study will incorporate the SEM by highlighting variables that may influence PA participation in relation to pregnancy planning status. It is important to note that the decision-making process in pregnancy is not an isolated event. The extent to which an individual plans a

pregnancy can be influenced by intrapersonal, interpersonal, organizational, community, or public policy factors. For example, an individual may plan a pregnancy based upon the support and resources provided at both the intrapersonal (e.g., partner, family) and organizational levels (e.g., workplace support, maternity leave, advancement opportunities). By using the SEM as a guiding framework this study aims to provide insight on contextual factors that influence the pregnancy-decision making process. Understanding the intersection of the two may help to navigate and manage pregnancy-related barriers to PA.

Barriers to PA in Pregnancy

Barriers operate within the framework of the SEM. It is important to acknowledge barriers that may be unique in pregnancy to target potential solutions. In a study by Evenson & Moos, pregnant individuals claim that intrapersonal barriers have the biggest impact on their PA levels [66]. Fifty two percent of women in the study stated that intrapersonal health barriers were the main barrier in relation to PA including fatigue, shortness of breath, concern with complications, and musculoskeletal problems [66]. Women within this study were situated into focus groups in which they expanded on the problems they faced when attempting to engage in PA. Many of the responses emphasized being tired, having less energy, and experiencing bouts of breathlessness when engaging in PA [66].

Overall, the literature reflects a combination of barriers impacting PA levels in pregnancy. Analyzing barriers is important as barriers can be different based on the context in which the pregnant individual exists. Furthermore, the conditions in which a pregnant individual exist may influence decisions related to pregnancy planning. The recognition of these barriers is important as they could be similar across pregnancy planning groups.

Pregnancy Intention

Definition & History

The definition of pregnancy intendedness has changed across time. Across history, births that occurred because of marriage were "wanted births" while others were classified as "unwanted" [67]. Large families were considered a societal norm due to high mortality rates for infants [67]. At the beginning of the 20th century, family planning became more common as families focused on attempting to limit the size of their families [67]. As better family planning options became widely available, the National Surveys of Family Growth was designed to ask about family life, marriage, infertility, and contraception use [68]. The National Surveys of Family Growth in 1973 was among the first surveys to assess pregnancy intention by asking women questions like, "Was the reason you stopped using any methods because you, yourself wanted to become pregnant?" and "At the time you became pregnant, did you, yourself, want to have a(nother) baby at some time?" [68]. While these questions are aimed to assess pregnancy intent, this survey never uses the language of intent, instead it frames it under the concept of wantedness [67]. As a result, responses and analyses of this survey sparked questions about the definition of pregnancy intent [67].

Due to its complexity, current literature has divided pregnancy intention into measures including but not limited to wantedness, intendedness, timing, and planning status [67]. Often intendedness, wantedness, and timing are used interchangeably [67]. Therefore, when referring solely to pregnancy intention, the aim is to capture the desire for pregnancy and its timing. However, the terminology fails to capture the complex nuances of pregnancy experiences [69]. Researchers like Sable argue that intendedness may be too complex of a concept to measure considering the emotional, social, and psychological factors that play into it [69]. For example,

when responding to questions of intention, a woman may feel inclined to give a socially desirable response in contrast to her true feelings [70]. This is one of the many examples that prove intention becomes complicated upon closer assessment.

Despite the complexity and debates on intendedness, this concept has still been used as a measure in public health. Close to 40% of births in the U.S. in 2019 were labeled as unintended [71]. Unintended pregnancies are defined as pregnancies that are perceived as unwanted or mistimed [71]. Unintended pregnancy is a significant concept as it contributes to excessive population growth, changes in quality of life, and population health [72]. Risk factors for unintended pregnancy include limited access to family planning services, low socioeconomic status (SES), and a lack of knowledge about or access to contraceptive methods. [72].

As of 2019, There were high rates of unintended pregnancy among low-income Americans, Non-Hispanic Black Americans, and adolescents — due to the defining terms of unintended pregnancy, current social standards perceive teenage pregnancies as early or wrongly timed. These characteristics are important to note, as unintended pregnancies can have harmful outcomes for these groups including but not limited to, psychological distress, unsafe abortions, and an increased risk of suicide [72]. In summary, there is a vast history regarding the terminology associated with pregnancy intention. Evidence suggests the literature needs to explore pregnancy intention with greater detail and possibly from a new perspective.

Selection of Terminology: Pregnancy Planning

The debate on terminology may seem trivial, but in terms of pregnancy intention, wording matters. Historically, research grouped all decision-making variables related to pregnancy under the broad umbrella of “pregnancy intention.” The current author acknowledges pregnancy intention as the overarching term within the literature but wishes to present a case for

the adoption and use of the term “pregnancy planning” within the current study. Intendedness is rooted in wantedness and desire which involves contributing factors like a person’s community, partner, and values [70]. On the contrary, planning has to do with concepts like life goals, preparation, and sociocultural status [70]. Although intendedness and planning are closely related, their relationship does not imply synonymity [73]. The distinction is specifically important for research regarding pregnancy-associated behavior, as pregnancy planning is tied to behavior [73]. Directly seeking or avoiding pregnancy relates to conscious control and behavioral choices [73]. Therefore, when linking the pregnancy experience to changes in behavior, it is important to attempt to define and isolate the explicit concept of pregnancy planning. Throughout this literature review, different terms may be used to discuss the evidence associated with the connection to health behaviors as previous studies have adopted various approaches to terminology.

Categories of Pregnancy Planning: Planned, Unplanned, & Ambivalent

Current literature coins the terms “planned” and “unplanned” as important descriptors for pregnancy planning categories [13]. Planned pregnancies are described as pregnancies that happened at the right time [13]. A qualitative study by Barrett et al. exploring pregnancy planning terminology found respondents defining planned pregnancy under concepts including but not limited to things like partner agreement, conscious decisions/“trying for a baby,” and stopping contraception [13]. On the other hand, unplanned pregnancies are described as pregnancies that occurred earlier than desired [13]. Barrett et al. reported respondents equating unplanned with concepts like not thinking about pregnancy beforehand, poor timing, or viewing it as accidental [13].

In a study by Arteaga et al., pregnancy plans were tied to emotions, as planned pregnancies were described using positive emotions and unplanned pregnancies were described using negative emotions [74]. In addition to emotions being relevant, social dynamics were important to the development of pregnancy plans as participants placed an importance on partner agreeance to define planned pregnancies [74]. In other words, participants considered a pregnancy planned when there was communication and shared desires between partners to become pregnant [74]. On the other hand, the distinguishing characteristics of unplanned pregnancies for participants were failure of contraception methods and the element of surprise, in which the pregnancy "just happened" [74].

Terminology involving pregnancy planning has historically been dichotomous in nature but there is also the need to acknowledge an experience in pregnancy known as "ambivalence." The concept of ambivalence in relation to pregnancy planning is a state of feeling when the pregnant individual is unsure or has conflicting feelings [14]. Ambivalence is important to distinguish as a separate category as it does not confine a pregnant individual to a single experience of pregnancy. Arteaga et al. held interviews with younger individuals (18-24) in which the concept of ambivalence was described as not exactly not trying — participants weren't actively planning for a pregnancy but they were not preventing one either [74]. Other descriptions of ambivalence included the description of not planning to become pregnant but they would still be okay if pregnancy occurred [74]. Over 70% of the sample agreed that the perspective of ambivalence existed and were able to provide distinct definitions for it [74]. Factors such as being a person of color, being older than 30, and using less effective contraception are often associated with ambivalence [14]. Additionally, factors like access to quality family planning resources, SES, healthcare availability, and social influences may impact

an individual's perception of ambivalence. Ambivalence being a newer category, particularly with younger adults, may suggest exploration of PA patterns within this group. Recognizing pregnancy planning status when engaging with pregnant individuals can help us gain additional information on the term of ambivalence and reveal characteristics that may be tied to specific pregnancy planning groups such as SES, marital status, or age.

Pregnancy Planning & the Connection to PA Behaviors

Given that PA is a recommended healthy behavior during pregnancy, researchers have assessed PA in relation to pregnancy planning. A key study in this research was conducted by Nascimento et al. in a large group of pregnant individuals in Brazil [75]. The purpose of this cross-sectional study was to assess exercise and PA via self-report questionnaires to examine characteristics of daily activities in pregnancy [75]. Pregnancy planning was not the main outcome, but it was assessed alongside other measures. Pregnancy planning status was assessed via "yes" or "no" responses. In other words, those who replied "yes" to this question were planning pregnancy while those who replied "no" were not. Within this study, there was a higher rate of PA in planned pregnancies compared to unplanned pregnancies. (56% vs. 43.8%, respectively) [75]. Furthermore, individuals with unplanned pregnancies were more likely to be sedentary compared to those with planned pregnancies (51.6% vs. 48.4%, respectively) [75]. While no statistical analyses were performed on the differences in planning, the authors concluded that individuals should be encouraged to adopt PA, specifically using prenatal visits to encourage healthy habit adoption in individuals who identify as ambivalent or planned [75]. Furthermore, addressing and encouraging PA regimens in prenatal care and planning can potentially prevent the low prioritization of PA [75]. Limitations of this study include the

challenges in generalizing results to a U.S. population and the absence of conclusions drawn from the pregnancy planning portion of the data.

Another approach that has been taken in relation to pregnancy planning is through the lens of preconception. A longitudinal study conducted by Chuang et al. in the U.S. assessed associations between preconception health behaviors and future pregnancy intent [76]. In other words, these individuals were not pregnant but had reproductive capacity [76]. Results were collected at baseline and at a 2-year follow up [76]. Within this study, 9% of women were considering pregnancy in the next year, 37% were considering pregnancy in the distant future, and 53% were not considering pregnancy at all [76]. Findings from this study conclude that negative longitudinal behavior was seen in PA [76]. Forty nine percent of individuals displayed negative longitudinal behavior in relation to PA and were categorized as "remaining unhealthy, without improvement" [76]. In other words, pregnancy plans did not impact PA engagement, low PA rates were observed in both those intending to be pregnant and those not intending to be pregnant.

Like Chuang et al, Ayoola and colleagues looked at preconception health behaviors and attitudes [77]. This study focused on the health behaviors of low-income women like drinking, smoking, PA, and consumption of multivitamins [77]. Like the previous study, PA was not explored in isolation and women were of reproductive age but not actively pregnant. Within the sample, 35% of the women were planning to get pregnant within the next six months, while 29% were unsure of their pregnancy planning status [77]. In contrast to Chuang et al., this study showed 73% of individuals not planning a pregnancy were physically active, compared to 82% of those planning a pregnancy [77]. Additionally, 73% of ambivalent individuals were also

physically active [77]. It should be noted this study included a high proportion of individuals who were already engaging in PA, as 75% of the total sample reported being active [77].

Considering these studies, the current study seeks to explore more clear connections to PA. We hypothesize that individuals not planning pregnancies will need guidance toward starting PA. Additionally we hypothesize, that individuals planning pregnancy may have been active prior to pregnancy but may need assistance maintaining and progressing PA throughout their pregnancy. Lastly, we hypothesize that ambivalent individuals may have been active prior to pregnancy but may need assistance to not stop PA upon discovery of pregnancy. These hypotheses and potential findings will be valuable in providing important insight for clinicians and exercise professionals when developing tailored PA interventions.

Pregnancy Planning & Mental Health

In addition to associations between pregnancy intention and physical health, it is important to also take into consideration the relationship between pregnancy planning and mental health. There is a growing concern about mental health in the U.S. According to the National Institute of Health (NIH), in 2022 the number of adults categorized as having any mental illness was about 59 million people [78]. Within these rates, females in the U.S. have a higher prevalence of mental illness compared to males [78] . A contributing factor to mental illness rates in females is the decline in mental health specific to the perinatal and postpartum periods. We specifically see increases in mental illness within this population because of increased stress response, lack of support, and reduced resilience [79]. Perinatal mental illness is a term that refers to psychiatric disorders that occur during pregnancy and up to one year after delivery [80]. These disorders can include but are not limited to postpartum anxiety disorders (PPAD), perinatal/postpartum depression (PPD), postpartum psychosis, and postpartum blues [80]. Mental

health during and following pregnancy is of importance as this is a unique and critical life event in which the development of a mental illness can negatively impact maternal and fetal outcomes [80].

A study by Mercier et al. showed pregnancy intention has been specifically linked to PPD [81]. In the study, participants were asked about pregnancy plans during their second trimester [81]. Following their pregnancy, they were evaluated using the Edinburgh Postpartum Depression Scale for PPD between 3 and 12 months postpartum [81]. Upon analysis, depression was more common for individuals with unintended pregnancies [81]. These results were more profound at the 12-month mark when comparing unplanned pregnancies to planned pregnancies [81].

Further evidence of pregnancy planning being associated with mental health was provided via secondary analysis of a prospective cohort of pregnant individuals [82]. Pregnancy planning and timing were evaluated in relation to psychiatric diagnoses and measures of psychological distress [82]. Participants were only included if they chose to continue their pregnancy to full term [82]. According to this analysis, pregnancies that were not planned and poorly timed were significantly linked to major depressive episodes [82]. Pregnant individuals who considered their pregnancies poorly timed showed associations with all major psychological measures including major depressive episodes, general anxiety, and perceived stress [82]. Findings of this analysis suggest that pregnancy planning and timing may have a larger impact on the mental wellbeing of the pregnant individual. Further research is needed to explore the potential bidirectional association between pregnancy planning and mental health. Analyzing this relationship is important as conditions like PPD and PPAD have been associated with adverse birth outcomes. While the current study does not explore mental health outcomes, it does

recognize that pregnancy planning status may be connected to the mental health of pregnant individuals.

Summary

There are several physiological adaptations in pregnancy that make it a unique period for individuals. PA recommendations are more valuable to pregnant individuals when they can account for changes, barriers, and preferences in pregnancy. Research on PA in pregnancy is growing to encourage PA and work toward more specific recommendations. The literature provides evidence for benefits of PA in pregnancy and a describes it as one of the methods for mitigating both physical and mental challenges in pregnancy. The current study seeks to explore pregnancy planning status in pregnant individuals and its potential impacts on PA behavior in pregnancy. We hypothesize that planning status may be associated with differences in PA behavior like engagement, frequency, duration, maintenance, preferences, and intensity. Exploring behavioral differences can provide insights for health and exercise professionals regarding PA recommendations and safety, potentially supporting more informed decision-making across pregnancy planning stages.

Chapter 3

Methods

Participants

Pregnant individuals ages 18-40 years, at least 16 weeks gestation on the projected date of their interview were recruited for this research study. Participant characteristics included individuals who were primarily English-speaking, accessible via internet (to have access to the teleconference), and willing to discuss their experiences with pregnancy and family planning. Exclusion criteria included conception methods using assisted reproductive technology, PA contraindications/limitations, and individuals advised not to exercise during their pregnancy. Participants were recruited via contacts within relevant community groups and posting flyers **[APPENDIX B]** in local locations serving the demographic such as obstetric/women's health clinics, coffee shops, and prenatal exercise groups. The participants went through an initial telephone screening process **[APPENDIX C]**, where they were asked preliminary questions to ensure they fit the inclusion criteria of the study. On the call with a study staff member, the purpose and overview of the study procedures were explained. Questions about the study were answered during the screening call. If participants met the criteria and were interested in moving forward with study participation, they were sent a personal Qualtrics link that included the informed consent **[APPENDIX D]** approved by the UTK Institutional Review Board and supplemental questionnaires (described below). Participants were asked to answer the questionnaires as honestly and accurately as possible. Once a study staff member confirmed the completion of all forms, the participant's interview was scheduled via Zoom. All participants who completed the interview were given a $50 gift card from a national retailer for their time.

Sampling Techniques

A combination of purposive and convenience sampling was used to select participants for the study. Within most studies, a single sampling technique is used to select eligible participants for a study. Combining sample techniques was both necessary and advantageous for the current study, given the chosen population was vulnerable and the circumstance (i.e., pregnancy) was time-sensitive. Purposeful sampling helped to achieve the goal of providing rich data and selecting individuals who were experienced with our phenomenon [83]. Specifically, it was important to select individuals who were representative of varying PA levels and pregnancy planning stages. Convenience sampling was used to reach pregnant individuals who were in the southeastern region of the U.S. We continued recruitment until we achieved data saturation – the point at which gathering data reveals no new concepts [84]. Research shows that data saturation is typically reached in the qualitative realm approximately within 9 and 17 interviews with around 12 being the average [85]. The number of interviews conducted in the current study was 13, questionnaires were collected on all 13 participants. While qualitative data reached saturation, the small sample size limited the statistical power of the quantitative data. As a result, the quantitative results in the current study are limited in their ability to detect clinically meaningful differences.

Mixed Methods: Convergent Parallel Design

The research design for collecting and analyzing data in this study followed a mixed method design known as the convergent parallel design. The purpose of using this design is to analyze the quantitative and qualitative results separately [86]. After analyzing these results separately, the data were merged to compare the results to one another [86]. Upon the production of results, a conclusion was interpreted from the convergence of the data [86]. This design was

beneficial for this research as pregnancy planning is a complex concept. Analyzing and interpreting the data from two different approaches provided a deeper understanding of pregnancy planning, from both a quantitative and qualitative standpoint. Relying solely on questionnaires to analyze pregnancy planning and PA does not provide sufficient context to capture potential variations in PA engagement. Similarly, basing the analysis only on qualitative interview data fails to offer insights into the frequency or statistical relationships between pregnancy planning and PA. Furthermore, this mixed method design was helpful as the strengths of each data approach were used to complement one another — even when their respective findings did not align [86]. The design was carried out as shown in **Figure 1.**

Quantitative Data Collection: Questionnaires

The London Measure of Unplanned Pregnancy (LMUP) **[APPENDIX F],** a validated questionnaire, measures the degree of planning of a current pregnancy [87]. This questionnaire was developed by Geraldine Barrett and colleagues in the United Kingdom around 2004 with the purpose of developing a measure of pregnancy intention based on public perspectives [87]. Despite its origins in the United Kingdom, the LMUP has been validated in the U.S. [87]. The benefits of this questionnaire include brevity, convenience, and flexible questioning approach (e.g., options to select all that apply, inclusion of partner discussion, approachable verbiage). Scores on the LMUP range from 0 to 12, with higher numbers aligning with increasing degrees of pregnancy planning [87]. Scores can be divided into 3 groups: 0-3 (unplanned), 4-9 (ambivalent), and 10-12 (planned) [87].

For this study, the LMUP was adapted to be more specific to PA behavior. The original LMUP contains questions regarding lifestyle behaviors adopted before pregnancy. The supplementary questions used for this study broadened the scope to include behavior specific to

PA before and after pregnancy recognition, including factors such as frequency and intensity. It is important to note that the supplementary questions were not validated in prior research, they were developed in this study for exploratory purposes. Despite the addition of questions,

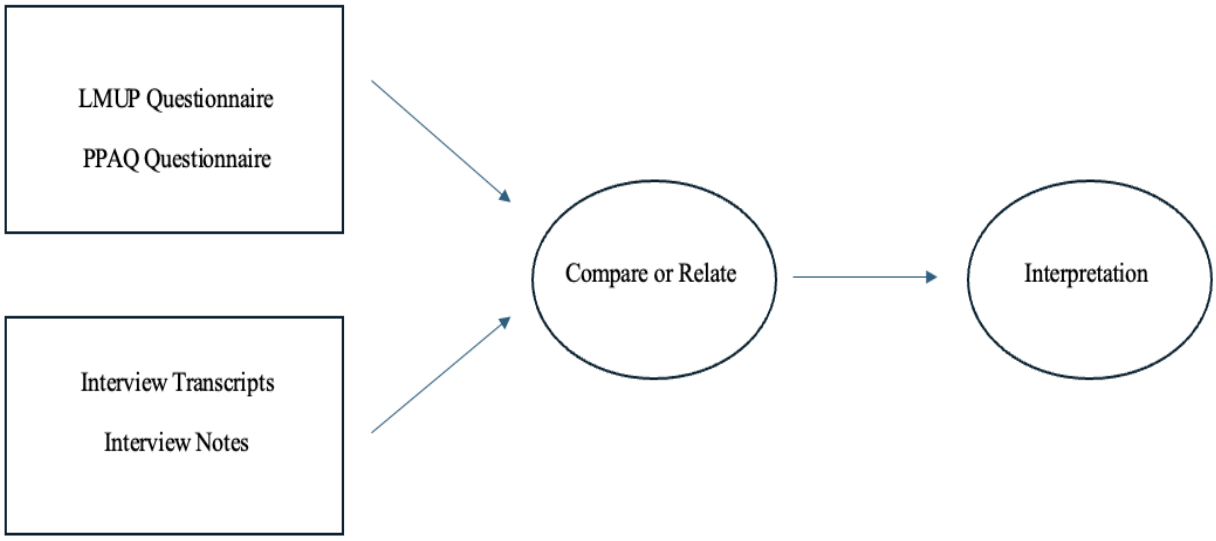

Figure 1. Convergent Parallel Mixed Method Design

participants received pregnancy planning classifications only based on the original validated LMUP questions (questions 1-6).

The Pregnancy Physical Activity Questionnaire (PPAQ) **[APPENDIX G]** is a self-report questionnaire that aims to analyze an individual's PA in their current trimester of pregnancy. The PPAQ was created by Chasan-Taber and colleagues to address the frequency, type, and duration of activity [22]. The questionnaire provides multiple choices for the participant to select from to best categorize time spent in a series of activities. Options for answer selection range from none (indicating no time in that activity) to more than a few hours [22]. Questions range to identify PA in different domains (occupational, household, transport, leisure) [22]. The purpose of the PPAQ in this study was for preliminary quantification of PA. Quantification of PA can help identify PA behavior, analyze potential PA patterns within groups, and establish context to ask questions about prior PA.

The Motherisk-Pregnancy-Unique Quantification of Emesis and Nausea (PUQE) **[APPENDIX H]** is a self-report questionnaire used by clinicians to evaluate the severity of nausea and vomiting [88]. The questionnaire is a method used to quantify the episodes of vomiting during pregnancy [88]. The questionnaire is typically three items and asks respondents to identify the volume of nausea bouts in a day ranging from none to more than 7 times [89]. The original PUQE focused on symptoms over a 12-hour period; however, it has recently been modified to a 24-hour period to account for the sleep cycle [89]. Scoring of the PUQE is numerically based ranging from no symptoms (0-3), mild symptoms (4-6), moderate symptoms (7-12), to severe symptoms (13-15) [88]. The purpose of this questionnaire within this study was to collect data related to nausea and vomiting because it can be physically debilitating for

pregnant individuals depending on the severity and frequency of episodes. Being aware of these episodes can help to determine if PA was influenced by severe nausea.

Quantitative Data Analysis

Quantitative data were analyzed after the LMUP and PPAQ were scored. The purpose of quantitative analysis was to explore whether pregnancy planning status had an impact on PA. The data were analyzed to calculate the mean MET-hours per week, both overall as well as by domain. The data were not normal, as confirmed by the Shapiro-Wilk test, likely due to the small sample size. Therefore, a nonparametric Mann-Whitney U test and Spearman's Rho were conducted using the SPSS analytical software (IBM SPSS, Armonk, NY). For the Mann-Whitney U test, the null hypothesis was the median MET-hours per week are the same for both LMUP groups (planned and ambivalent), while the alternative was the distribution of median MET-hours per week were different. Testing was conducted at an alpha-level of 0.05. Findings were compared with the qualitative data to fill gaps and statistically support or challenge findings.

Qualitative Data Collection: Interviews

One-on-one interviews were conducted with all participants via teleconference. Interviews were scheduled based on participant availability. All interviews used the same script **[APPENDIX I]** and semi-structured format. Participants were reminded that the interview was voluntary, and the extent of sharing was at their discretion. Probes and follow-up inquiries for clarification were used to support standardized questioning and participant understanding. Interview durations ranged from 14 to 47 minutes, with 22 minutes being the average. Given the sensitive and private nature of the topic, participants were also given a list of community

resources related to maternal physical and mental well-being at the conclusion of the study **[APPENDIX I]**.

Qualitative Data Analysis

Interview transcripts were imported from Zoom cloud recording. Following download, transcripts were manually reviewed and cleaned for accuracy. Data from the interviews were analyzed by at least two investigators via open coding and axial coding techniques using ATLAS.ti (ATLAS.ti, Berlin, Germany). During the open coding portion of data analysis, inductive coding techniques were used to assign codes based on the data. Once concepts become repetitive in nature, the investigator switched to axial coding techniques to make connections between the developed concepts. In the axial coding process, these codes were grouped into categories and subcategories to help point to larger themes. The purpose of creating themes through axial coding was to highlight ideas and metaphors that were associated with pregnancy planning. Following the review and defining themes, a report was written to summarize the results of themes identified in each interview. These findings were compared with data found in quantitative measurement to fill gaps and provide context.

Ethical Commitments

While conducting this research, the investigators worked hard to ensure ethicality at every stage. The study placed the highest importance on ethical considerations, ensuring all participants were treated with care, respect, and sensitivity. Extensive discussions amongst the research team were held regarding the utilization of verbiage during interviews, resources for individuals, and researchers' positionality. In addition to the perspectives provided by study staff and co-authors, participants were allowed to review statements to ensure participant's voice was not lost or distorted.

Paradigmatic and Positional Considerations

I am an African American female from the inner cities of Georgia. I grew up in a middle-class, non-denominational Christian, community-oriented, split-parent environment. As a daughter of a single mother post-divorce, I developed an interest in the complexities of motherhood specifically in support systems, mental health and decision-making, and family planning. As is common in many African American families, I have much respect for my family's matriarchs. Therefore, I was inspired to do work that serves as a resource to women and mothers. Since I am not a mother myself, I consider myself an outsider to the population of the current study. From this outsider perspective, I find value in cultivating shared knowledge for women to use. Considering both the advantages and disadvantages of my outsider perspective, I believe that this perspective did impact data collection. As an outsider, I was able to sympathize with the stories of participants, but I was unable to empathize. This may have led to misunderstandings or missed opportunities for additional probes in interview data collection.

Identifying paradigms are essential as they offer insight into a researcher's perspectives, methodology, ontology, axiology, and epistemology [90]. Paradigmatically, I identify as a pragmatist. Rooted in the philosophy of John Dewey, pragmatism acknowledges truth in objective reality but recognizes truth as flexible and ever-changing [90]. It emphasizes that problems can be addressed through multiple lines of action and that solutions are not one-size-fits-all [90]. Pragmatism in research values the utility of an answer over its absolute accuracy, recognizing answers are connected to the vast nature of human experience [90]. This paradigm strongly aligns with the aims of the present study — to explore the varied experiences tied to pregnancy planning and PA behavior. Pragmatism supports the use of mixed methods, enabling a more comprehensive response to research questions [90]. Through this lens, I aim to develop a

deeper understanding of the pregnancy experience that can inform and inspire meaningful action amongst health and exercise professionals.

Chapter 4

Results

Quantitative Results

The total number of participants screened for the study was 17 pregnant individuals. Participants moved past screening if they met inclusion criteria and agreed to participate in the study. Two participants were lost as they delivered before their scheduled interview, one participant did not meet inclusion criteria, and one participant was not responsive to multiple contact attempts. Although no participants were excluded for PA contraindications/limitations, the investigators note that one participant was diagnosed with gestational hypertension, and one had a past back surgery. After further discussion with both participants to clarify their respective health histories, investigators used professional judgement in the decision to include these participants in the current study. Investigators felt warranted in this decision as both participants' providers cleared them for PA with no significant restrictions that interfered with their typical/desired PA modalities.

Table 1 shows the demographic characteristics of the sample. On average, participants were in their early thirties (30.2 ± 3.4 years), predominantly White, employed, first-time mothers with planned pregnancies. **Table 1** also presents results of the standard LMUP questionnaire. Scores categorized 8 participants as planned and 5 participants as ambivalent. No participants' scores categorized their pregnancy as unplanned. Raw scores ranged from 5-12 (on an overall scale of 0-15), with a mean ± standard deviation of 9.69 ± 2.78. **Table 1** additionally presents overall outcomes of the PUQE questionnaire as the number of participants that scored in each category related to severity of emesis and nausea. Raw PUQE scores ranged from 3-7 (on an overall scale of 0-15), with a mean ± standard deviation of 4.62 ± 1.76.

Table 1. Demographic Characteristics of Participants (N=13)

	N (%)
Age	
20-25	2 (15.4)
26-30	4 (30.8)
31-35	7 (53.8)
Race	
Black	3 (23.1)
White	9 (69.2)
Mixed Race	1 (7.7)
Ethnicity	
Hispanic	2 (15.4)
Non-Hispanic	10 (76.9)
Prefer not to report	1 (7.7)
Education	
Trade School/Certification	1 (7.7)
Some College	1 (7.7)
Associate's Degree	1 (7.7)
Bachelor's Degree	2 (15.4)
Master's Degree	4 (30.7)
Professional Degree or higher (MD, PhD, JD, etc.)	4 (30.7)
Marital Status	
Single, never married	1 (7.7)
Single, and cohabitating with a significant other	2 (15.4)
Married	10 (76.9)
Other Children	
None	6 (46.2)
1	4 (30.7)
2	1 (7.7)
3	2 (15.4)

Table 1. Continued

Employment Status	
Employed for wages, part-time	1 (7.7)
Employed for wages, full-time	10 (76.9)
Not employed outside the home, looking for work	1 (7.7)
Employed for wages, full-time and student	1 (7.7)
London Measure of Unplanned Pregnancy (LMUP) Score Distribution	
Planned	8 (61.5)
Ambivalent	5 (38.5)
Pregnancy Unique Quantification of Emesis (PUQE) Score Distribution	
No symptoms	5 (38.5)
Mild	5 (38.5)
Moderate	3 (23.1)
Severe	0

Table 2 shows the questions and number of participants corresponding to each supplementary LMUP question (survey question numbers 7 through 12) that ask about PA related variables before pregnancy recognition and after pregnancy recognition. The purpose of these supplementary questions was to explore behavior specific to PA before and after pregnancy recognition.

Table 3 summarizes the PPAQ questionnaire results in average MET-hours per week by PA domain and quantitative pregnancy planning category. Two non-parametric tests were conducted due to the non-normal distribution of data. Both the Mann-Whitney U and Spearman's rho nonparametric correlations were conducted to determine if any domain was associated with LMUP (pregnancy planning) categories. The Mann-Whitney U test used a categorical classification for pregnancy planning category while Spearman's rho correlation treated LMUP scores (i.e., quantitative pregnancy planning scores) as a continuous variable (0-12). Both categorical and continuous analyses were run to account for potential limitations in statistical power due to the small sample size.

Figure 2 is a visual representation of the breakdown of PA MET-hours/week by domain for both pregnancy planning groups (planned and ambivalent). There were no unplanned pregnancies quantitatively identified in this study. The figure shows that total activity in MET-hours/week is similar for both pregnancy planning groups. The figure also depicts that activity varied in each domain with household and occupational domains having more MET-hours/week. While transport and leisure domain had lower values for MET-hours/week.

Table 2. Supplementary London Measure of Unplanned Pregnancy (LMUP) Questions

Question/Statement	**Response Options**	**N (%)**
Before you became pregnant, did you do anything to improve your physical activity in preparation for pregnancy? (Please select all that apply)	Sought exercise advice from a professional (doctor, personal trainer, exercise physiologist)	1 (7.7)
	Joined a gym/recreation center	3 (23.1)
	Sought exercise advice from family or friend members	0
	Attended an exercise class/group in some capacity	1 (7.7)
	Engaged in physical activity for leisure purposes	5 (38.5)
	Sought medical/health advice	0
	Took some other action	2 (15.4)
	I did not do any of the above before my pregnancy	6 (46.2)
After you recognized you were pregnant, did you do anything to improve your physical activity during pregnancy (Please select all that apply)	Sought exercise advice from a professional (doctor, personal trainer, exercise physiologist)	4 (30.7)
	Joined a gym/recreation center	1 (7.7)
	Sought exercise advice from family or friend members	2 (15.4)
	Attended an exercise class/group in some capacity	0
	Engaged in physical activity for leisure purposes	9 (69.2)
	Sought medical/health advice	6 (46.2)
	Took some other action	1 (7.7)
	I did not do any of the above before my pregnancy	0
Before I became pregnant...	I engaged in about 150 minutes of physical activity in a week	6 (46.2)
	I engaged in about 90 minutes of physical activity in a week	3 (23.1)
	I engaged in about 60 minutes of physical activity in a week	2 (15.4)
	I engaged in about 30 minutes of physical activity in a week	2 (15.4)
	I engaged in about 10 minutes of physical activity in a week	0
	I engaged in about 0 minutes of physical activity in a week	0
After I recognized I was pregnant...	I engaged in about 150 minutes of physical activity in a week	6 (46.2)
	I engaged in about 90 minutes of physical activity in a week	2 (15.4)
	I engaged in about 60 minutes of physical activity in a week.	0
	I engaged in about 30 minutes of physical activity in a week	2 (15.4)
	I engaged in about 10 minutes of physical activity in a week.	2 (15.4)
	I engaged in about 0 minutes of physical activity in a week	1 (7.7)
After you recognized you were pregnant, how would you describe the intensity of your physical activity sessions?	Light	6 (46.2)
	Moderate	7 (53.8)
	Vigorous	0

Table 3. Physical Activity Participation by Pregnancy Planning Category

PA Domain	Overall (N=13)	Planned (N=8)	Ambivalent (N=5)
Total Activity	259.5 ± 185.8	254.7 ± 203.4	267. 3 ± 176.11
Household	108.4 ± 79.2	94.6 ± 62.26	130.5 ± 105.2
Transportation	30.1 ± 43.4	43.07 ± 51.9	9.4 ± 8.7
Leisure	24.5 ± 18.1	27.9 ± 20.5	19.2 ± 13.8
Occupational	96.5 ± 97.5	89.2 ± 97.4	90.2 ± 107.8

Note: Values are mean MET-hours per week ± standard deviation. PA=physical activity.

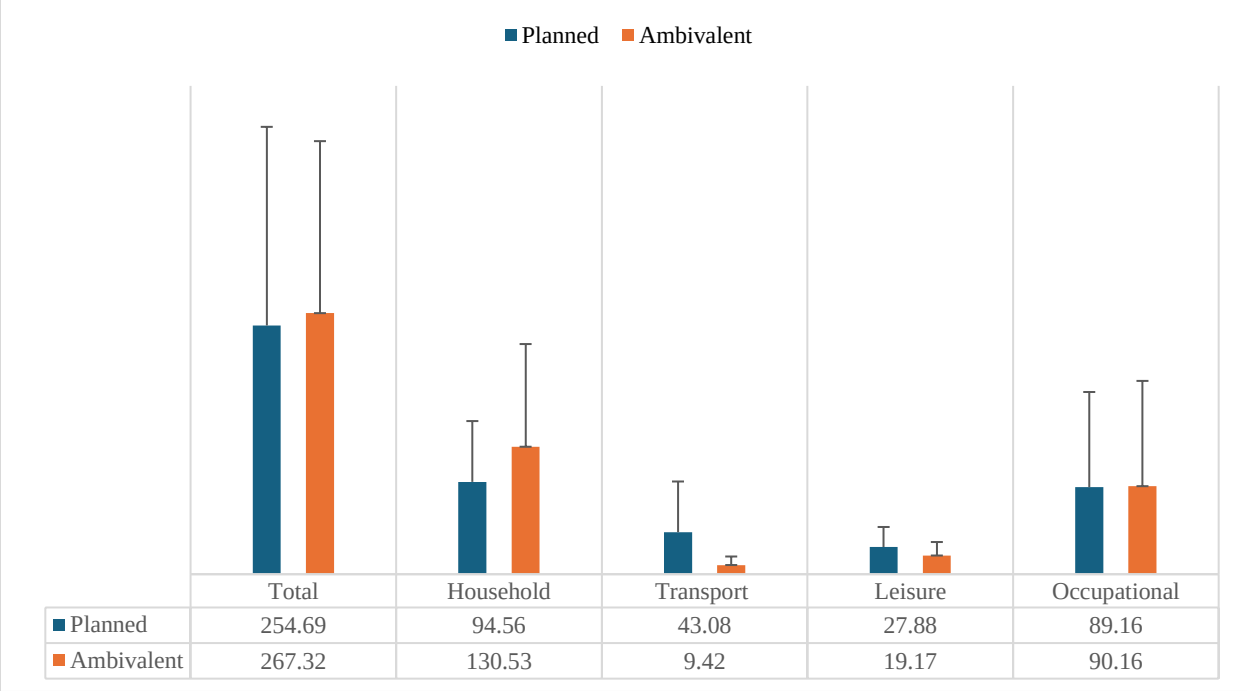

Figure 2. MET-hours/week by domain for planned vs. ambivalent pregnancies (N=13)

Table 4 presents the Mann-Whitney U results which showed MET-hours were not statistically different between the planned and ambivalent pregnancy groups across any activity domain. There were no statistically significant differences across ranked distributions between the groups, according to the Mann-Whitney U (total activity median=200.80 MET-hours/week, IQR=157.37.10, p=0.622; household activity median=89.67 MET-hours/week, IQR=130.37, p=0.724; transportation activity median=10.50 MET-hours/week, IQR=29.51, p=0.222; leisure activity median=14.98 MET-hours/week, IQR=22.25, p=0.354; occupational activity median=57.79 MET-hours/week, IQR=104.54, p=0.833). For overall activity, the U-value is 16.00 which indicates a moderate amount of overlap in ranked scores for the sample size, but the p-value suggests non-significance. For the household domain, the U-value is 17.00 suggesting moderate overlap in ranked scores, but the p-value does not attain significance. For the transportation domain, there is less overlap in ranked scores with a U-value of 11.00, but the p-value does not attain significance. For the leisure domain, the U-value is 13.50 indicating a smaller overlap in ranked scores as well, but the p-value does not attain significance. Lastly, the occupational domain has the highest U-value of 18.00 indicating more overlap in ranked scores, the p-value supports this and does not attain statistical significance. Cliff's delta (δ) were provided to estimate the effect size between the two pregnancy planning groups for each domain (total δ=0.20, household δ=0.15, transportation δ=0.45, leisure δ=0.38, occupational δ=0.10).

Table 5 shows Spearman's Rho correlation results indicating no statistically significant correlations between continuous LMUP scores (with higher numbers aligning with increasing degrees of pregnancy intention) and PA domain. Total activity (ρ=-0.151, p=.623), household activity (ρ=-0.117, p=.704), leisure activity (ρ=0.138, p=.652), and occupational activity

Table 4. Mann-Whitney U Results (N=13)

PA Domain	Mann-Whitney U	Cliff's Delta	Median	Interquartile Range	Significance (p-value)
Total	16.00	0.20	200.80	157.37	0.622
Household	17.00	0.15	89.67	130.37	0.724
Transportation	11.00	0.45	10.50	29.51	0.222
Leisure	13.50	0.38	14.98	22.25	0.354
Occupational	18.00	0.10	57.79	104.54	0.833

Note: U-value close to 0 means ranked values stronger in one group, suggesting less overlap and a greater difference in rank distributions suggesting significance, U ranges from 0-40 (n^1*n^2).
Cliff's delta (δ) calculated using (2*(U/(n1*n2)))-1[91].
PA=physical activity.
No group difference attained statistical significance (p <.05).

Table 5. Spearman's Rho Nonparametric Correlations (N=13)

PA Domain	Correlation Coefficient	Interpretation	Significance (p-value)
Total	-0.151	Weak	.623
Household	-0.117	Weak	.704
Transportation	0.415	Moderate	.159
Leisure	0.138	Weak	.652
Occupational	0.009	Very weak	.978

Correlation coefficient values (relationship between continuous LMUP [pregnancy planning] score and PA domain) range from -1 to +1. PA=physical activity.
There was no statistical significance (p <.05) for any value.

(ρ=0.009, *p*=.978) all had weak, non-significant correlations. Transport activity (ρ=0.415, *p*=.159) had a moderate, correlation estimate that did not attain statistical significance.

Qualitative Results

Overview

All 13 participants completed a semi-structured interview. Six main themes emerged from the interviews: (a) overall pregnancy experience: affect, systems of support, mental load, physical symptoms; (b) PA education received from providers: general/vague advice, no advice; (c) PA during the current pregnancy: necessary exercise modifications, connection to planning, body preparation; (d) pregnancy-related barriers to PA: physical, accessibility, fetal safety concerns, competing interests; (e) advice to other pregnant individuals: PA participation, recognizing unique needs; and (f) support needs and future directions: individual and ongoing exercise prescriptions, encouragement and support, safety boundaries and modifications, education on PA benefits.

Theme 1: Overall Pregnancy Experience

Participants in this study shared their general experience during pregnancy which provided insight into the characteristics that were at the forefront of their pregnancy. Four categories emerged including affect, systems of support, mental load, and physical symptoms. Participants described their general mood states, various networks of support, mental states during the current pregnancy, and physical challenges with the current pregnancy.

Affect

This category focuses on affect within the pregnancy experience encompassing participants' emotional states, thoughts, and attitudes toward pregnancy. Most participants reported having a positive experience expressing affect such as happiness and excitement. The

participants had only minor complaints related to the pregnancy and often expressed that they felt their pregnancy was normal. While acknowledging a largely positive experience, participants expressed mixed emotional responses as well. This included feelings of shock, surprise, and uncertainty. Mixed reactions were attached to having to process pregnancy recognition and changing emotions. Naturally, there were a few participants that reported more negative experiences than positive.

> *P109: I feel pretty content being pregnant like, I don't feel miserable like, get this baby out right now, you know. But just kind of enjoying it, probably like the fact that it took us a while to get pregnant, I think, also helps like my perspective of like putting even like the uncomfortable things into perspective of like this isn't bad, you know. It's like all for a great purpose. So, I think, overall, I've had a pretty good experience.*

> *P112: It's been wonderful. Yeah, I feel great. I started off strong. I didn't have morning sickness. Who knows why?*

> *P106: It's hard to be pregnant, it's not. It's not a magical...it can be magical... like it's everything at once, and it also sucks a lot. So, it's really hard to be pregnant.*

> *P103: It was kind of like it took a minute for me to process what was actually going on. And then um, probably yeah, about like 3 or 4 days later, I was like oh, okay, I'm actually starting to get excited about this.*

Systems of Support

This category includes the systems of support surrounding the participants. This includes familial, partner, community, financial, and workplace support. Most participants expressed that they felt well supported and had multiple levels of support. The most common type of support expressed was familial and partner support. Workplace support was also mentioned and manifested as work flexibility or coworker support.

> *P105: Yeah, I guess you know, I've always had people in my life who are very supportive, and you know my family was able to be very active.*

> *P107: I have a good community of friends and family and a partner who are here to help me definitely. So, we have a village.*

P106: At work, I knew I was gonna be able to have the accommodations that I needed.

P116: So, I see the nurse in our office, so she usually chats with me about what I do. I walk a lot so she just kind of keeps up with like, "are you still walking?"

Mental Load

General psychological stressors of pregnancy were described in interviews. Within this category, participants focused on the mental strain associated with pregnancy that can bring uncertainty and additional stressors. Participants expressed concerns about mental health and described experiencing a heavy emotional toll. Participants also discussed mental load outweighing their desire for PA.

P103: I mean, it is true what they say that like your mind kinda shifts. I don't even know how to explain it really. It went into like a panic mode of I have to definitely plan kind of thing.

P107: It's probably like a mental battle too because you feel like you have to get so much in order all at once, but then you're also tired. So, then you just want to do better, but then you just don't.

P101: I feel like throughout it too, like it's been more...about just as much about like my mental clarity as it has been um like physical, because it is like, can be overwhelming.

P109: The prep [pregnancy preparation] was not related a lot to physical preparation and more for me, like mental and emotional prep.

Physical Symptoms

Physical pregnancy symptoms contributed to participants' day-to-day moods and were described as an inconvenience for most participants. Symptoms mentioned by the current participants were typical of those often cited during pregnancy including nausea, pelvic and low back pain, and general sickness.

P111: I just felt really like down, like as everyone does, you know, kind of felt like nauseous in the background of life.

P113: I was really sick for a lot longer than my first pregnancy, and it seemed like it was a lot worse too. So, I think the first time I was pregnant, I felt better by like 9 weeks or something, so it was pretty quick. This time it was like 18 weeks; I was still getting sick like daily.

P102: It's really my mainly the physical symptoms. It's just like UGH! Now I'm in the pelvic pain where the baby is kind of...dropping.

Theme 2: PA Education Received from Providers

Participants shared how their healthcare provider discussed PA with them since healthcare professionals are often regarded as the primary source of guidance during pregnancy. As such, it was important for the study team to explore the nature of advice that is currently being communicated by providers. Two categories emerged from the data shared including general/vague advice and no advice.

General/Vague Advice

Most participants (N=7) mentioned their healthcare provider gave general or vague advice toward PA. Specifically, providers emphasized maintaining activity they were engaging in prior to pregnancy. Within these recommendations, participants mentioned they were told to avoid heavy lifting or newer activity. Some participants mentioned they were simply given handouts, while others engaged in a verbal discussion with a provider. Even providers that acknowledged the benefits of PA, did not go into specific details. As a result, participants were confused about what was safe for themselves and the fetus, and desirous of more complete information.

P101: They discussed kind of keep doing the same thing you've been doing before. They gave me some like handouts on different things, but in general they encouraged to continue to stay active if I felt well, um, and not trying anything new.

P113: Yeah, I think they just kind of did a general spiel about most people are comfortable continuing the level of exercise that they're already kind of used to once they get pregnant. So, they basically said, don't suddenly try kickboxing or crazy things.

P109: I feel like my-the direction that I received was like um, a little confusing just with like if I wasn't exercising, but yet you want me to exercise, but yet I'm not supposed to start a new routine? What do I do?

P112: It was your basic, no more than 40 pounds.

P113: I guess maybe somewhere it probably said no like heavy lifting and stuff, but I don't even really remember if they put like an exact number on that, or if it was just kind of in general.

No Advice

Some participants (N=5) reported receiving no guidance related to PA from their healthcare providers. Lack of discussion led participants to do research on their own, rely on support networks, or use prior knowledge from previous pregnancies. This lack of provider guidance also led to two participants placing blame on themselves for a lack of knowledge, specifically feeling they failed to ask the correct questions regarding PA.

P102: So, they haven't really talked to me about it. If I'm being honest, cause I guess you know like they ain't see nothing that was questionable, if that makes sense?

P106: I think in the beginning they just asked like, "Do you exercise like?" and then you say "no" and then they're like "Well you should", the end!

P114: When I first started having kids, you'd see people in the gym bench pressing pregnant. Okay, dancing doing all these things and you don't know that unless you-you're on social media. I've never been told that by no doctor.

P117: This pregnancy, I don't think that's been a topic that's come up, which is maybe because I haven't asked as many questions as maybe with the first pregnancy.

Theme 3: PA During the Current Pregnancy

Participants provided details about the PA that they were engaging in during pregnancy. They provided their accounts of PA intensity, duration, and frequency. Responses provided clarity and context to the PA experience in their pregnancy. As a result, 3 categories were created: necessary exercise modifications, connections to planning, and body preparation. The category necessary exercise modifications contain 3 subcategories: reduced volume or intensity, no change in PA, and modality change.

Necessary Exercise Modifications

Some participants (N=8) expressed the need to adjust their PA in some way to maintain their desired activity level. Modification was often achieved by reducing the activity volume or intensity (N=6), changing the modality of PA altogether (N=4), or a combination of these methods. Those who did not make such adjustments reported a decline in their PA. On the other hand, some participants (N=5) described no change in PA at all.

Reduced Volume or Intensity

In this study, the subcategory of reduced volume or intensity was defined as a decrease in the effort toward the activity —such as switching from a perceived high intensity to a lower intensity, reducing weight in resistance activities, performing less activities in a time bout. This was noteworthy as participants did not report stopping activity altogether but instead, they adjusted the workload to remain active in some capacity. These modifications were often made to accommodate the physical changes and pregnancy symptoms experienced.

> *P113: I still ride my horse probably once a week, but it's for a shorter time and just less intensity.*

> *P111: The weightlift I'm doing is probably between 10 and 20 pounds pretty much exclusively. It was closer to like the 40 to 50 pounds of the same exercises before pregnancy.*

P112: I'm in a good place but there are certain movements that I might not do back-to-back, so I might not do deadlifts right after I squat. Or I might not do deadlifts back-to-back days.

P112: I'm at like 80% of what I was doing in terms of the weight I am lifting. I'm definitely not jogging as fast.

Modality Change

This subcategory encompasses participants' descriptions related to changing PA mode so that they could engage in PA with comfort. The reasons cited for modality changes were most often pain or physical discomfort.

P101: I started getting some really bad pain. I guess like, pelvic floor area? I'm not exactly sure, honestly, but just like some growing pain I felt like. And so... I was doing super low impact during that timeframe and walking a lot and doing yoga a lot.

P109: I think like the twisting motion of like the way like where I was swimming was just not working out. So, I stopped doing that, and I think that definitely like my exercise dipped obviously because...I was really trying to rest and...I continued to do like a lot of things on like a birth ball.

No Change in PA

This subcategory acknowledges participants who described their activity level as unchanged during pregnancy. Although less common, there were a few participants who described being able to maintain their usual level and modality of activity. It should be noted that one participant indicated they were inactive prior to pregnancy and during pregnancy.

P105: But yeah, we pretty much maintained physical activity level. Even after I found out I was pregnant.

P112: On average, I'm still at the gym 3 days a week, and in terms in session length, I would say it's probably just about 45 minutes and things have pretty much stayed the same.

P106: Yeah, I would say, stay the same. I just got my pregnancy ball a lot earlier.

Connections to Planning

This category emerged as the participants began to make connections between their pregnancy planning and PA behaviors. Participants who qualitatively identified themselves as having unplanned pregnancies began to conceptualize PA in a future planned pregnancy. One individual who identified themselves as having a planned pregnancy began to make more specific PA goals for their next pregnancy. This highlights that individuals may need guidance or prompts to initiate PA behavior.

> *P107: Definitely. If I had planned this, then I probably would have been looking up like um, pregnant yoga or something like that, because I know they have those classes out there and it's a good way to like get out and find other pregnant mothers and socialize and stuff. So, I definitely probably would have planned a bit better.*

> *P109: I think my second pregnancy, if that happens, I'll think about it differently of like okay, first trimester, like I should be doing so, you know and like or even starting postpartum, like getting my body in shape more regularly.*

Body Preparation

Lastly, engaging in activity during pregnancy seemed to be connected to a desire to prepare the body for late stages of pregnancy, labor, and even postpartum periods. Several participants reported being proactive with stretching, physical therapy (PT), and labor-based movement to promote smoother transitions into labor. Many participants discussed using PA for the sole purpose of preparing themselves for labor. Participants acknowledged that labor requires endurance and felt that their bodies must be prepared in some way to approach it. There also seemed to be extra motivation to pursue PA for the benefits of an unmedicated or smoother labor process.

> *P102: I would say I approached it a little bit more, you know like I said, finding Youtube videos to get me prepared for labor because, you know I'm trying to just get her up out of here, and you know trying to have this baby really soon.*

P105: I know in pregnancy, its definitely not about losing weight, but I want to maintain muscle and stamina to be able to try to have an unmedicated labor. But also I know that this is going to help me if I do need to have a C-section or induction anything like any intervention.

P109: I really want to have an unmedicated birth, and to do everything as naturally as possible. So, part of like a huge thing with that is like baby positioning and making sure that like he's in optimal position, so that then I can have a vaginal birth, and things can progress naturally without drugs. But I think all the exercising hat I'm doing is all focused on getting him ready and getting my body ready for labor.

P111: I'm trying to do more and more, because I'm trying to ramp up to do that, some of that prep for the birth now.

P112: But being physically active only, I can only hope it will help me in labor with endurance and strength and all that.

Theme 4: Pregnancy-Related Barriers to PA

Within the discussion related to PA during pregnancy, participants discussed some of the things that prevented or stopped them from engaging in PA (i.e., barriers). These barriers were separated into the 4 categories: physical, accessibility, fetal-safety concerns, and competing interests. The physical category included two subcategories defined as: health concerns and pregnancy symptoms. All barriers were discussed with participants to give context to PA participation.

Physical

Physical barriers were the most heavily discussed barrier within the interviews. Having to make accommodations because of pain was described as a key influence on PA engagement. Most of the participants discussed the challenges of having to adjust to their growing abdomen. One participant explicitly stated, "*There's such an emotional social part of like pregnancy, where your body is changing a lot and you have to embrace it.*" Additionally, health concerns

and pregnancy symptoms emerged as subcategories of physical barriers as these were two distinct topics for participants.

Health Concerns

Participants experienced health challenges during pregnancy that impacted their relationship with PA. Although all received approval from their providers to remain active, they noted that certain health challenges made PA more difficult. These health concerns were associated with some level of pain/discomfort, which at times led to negative reactions to movement.

> *P106: It is frustrating, knowing, like feeling like you're not having a healthy pregnancy like you're not being healthy, and you're not treating your body as you should be, because I'm not moving when moving is literally causing debilitating pain.*

> *P109: I was telling them like I'm a little nervous about like with the weight gain, and with like the extra strain on my pelvis, like what is that going to do to the places that were affected from my back surgery?*

> *P114: I was also diagnosed with low iron, and I've never had that and which I've got my third- I got my third iron infusion on the (DATE), and I feel good like that was the last one, but that was sucking the life out of me.*

> *P116: I must have strained my back when I was like 28 weeks, and that was like really hurting.*

Pregnancy Symptoms

Physical pregnancy symptoms are common as most pregnant individuals encounter them to some extent. The participants identified these symptoms as a barrier to PA. Commonly reported symptoms included nausea, back or pelvic pain, and fatigue. Participants expressed that the presence of multiple symptoms or more intense symptoms made it increasingly difficult to feel motivated to engage in PA.

> *P101: Sixteen weeks is when I started um, like getting some pain like pelvic floor. Or I think, even like sciatica area. So yeah, if I like, was working out or walking too much, I would like have to be down and out the rest of the day.*

P111: What my midwives have told me is round ligament pain has been a lot more severe this time than with my last pregnancy. It started like at 16 weeks, or something which is really early. Usually, it's like 30. So, and it's worse now than when I was full term with my son.

P105: My energy level definitely went down during that time, and I was pretty nauseous. Had pretty bad morning sickness, but throughout the day and I kind of was on this bell curve, where I was low energy.

P105: I was able to maintain physical activity up until you know 9 or 10 weeks, and then I was just so nauseous, and your energy level goes down so it was very hard to feel motivated to workout.

P107: I think the biggest one is actually being physically tired. It's kind of something you just can't help being pregnant. I've heard it from every pregnant woman is just tired. They want to sleep, they want to rest.

P114: I'll still do my little housework, but I have no energy.

Accessibility

Concerns with access emerged when participants described not being able to engage with PA because of financial concerns and unsuitable PA conditions. Weather was a cited barrier, suggesting that there was a preference for outdoor activity, but such options are not always feasible. Some participants (N=2) expressed that the cost of fitness classes and physical therapy were too expensive. These findings emphasize the critical role access plays in PA; if PA isn't affordable or difficult to engage in, pregnant individuals may be discouraged from engaging. Additionally, if the perceived cost —whether financial, physical, or emotional—outweighs the benefits, participants were likely to opt out of PA altogether.

P113: I would love to do things like pelvic floor PT [physical therapy] and stuff like that, but financially it wasn't very accessible to me. It was going to be out of a price point that I felt comfortable paying for something like that.

P113: So, I mean, I've had to make adjustments because it needs to fit within my lifestyle and be reasonable. So, I think that if we had access to stuff like that wasn't so expensive, it would be helpful to be able to exercise more normally during pregnancy.

P111: It's gonna get very hot... it's probably gonna be past like 97 degrees. Now, it used to be like a 102, I could run to like 110, but I'm too old for that now but it's going to be probably 100 every single day from June something to August something.

P106: I don't live in the neighborhood, and I don't have access to walkways, so I can't if I leave out, it's literally like the highway... That's something that I really wish I would have in terms of like walks with the stroller and like in a safe way.

P106: A 30-minute class that I'm gonna have to spend like 200 dollars, that I'm not necessarily gonna love it.

Fetal Safety Concerns

Most participants (N=7) described being cautious while engaging in PA as they were concerned about the safety of the fetus. They discussed feelings of fear/nervousness approaching activity as they were uncertain of the limitations of PA while pregnant. Participants wanted to be active, but they did not want to engage in any type of PA that could potentially hurt the fetus. There also seemed to be challenges with navigating safe PA alone. Additionally, individuals with a history of reproductive issues seemed to be more cautious about activity.

P103: I don't want to overwork myself to where you know, they tell you that you go into a premature birth um, you know it lowers the oxygen levels.

P105: I quit doing any crazy amounts of running because I had that history of an ectopic. I was like, I don't want to mess up my tube or anything like that, you know. I don't know which is probably nonsensical because by the time you find out you're pregnant it's implanted already, you know, like but still, I was just kind of like, all right, let's avoid that.

P109: I think I was like scared to work out in the first trimester like I said not knowing if my body was going to be able to like carry this baby and feeling like if it's like I knew that exercise was safe and technically like good for me, but for some reason, I'm like I

can't move. I can't-I can't mess this up like what if I do something to you know that's too strenuous or like my heart rate gets too high.

P112: There's definitely not enough research that goes into what is safe. Um, am I going to kill my baby because I lifted 50 pounds off the floor, like, there's just a lot of fear with that.

Competing Interests

This category summarizes the barriers that participants faced when balancing PA with other responsibilities. Participants discussed choosing to spend time with other children, partners, and work over PA. There was acknowledgement that PA was important, but participants had other obligations that took precedence.

P106: I'm not gonna spend my Saturday morning away from my family. That's the time to be with my son. So it does feel like I have to choose between investing time in me and like putting in this like, I'm already taking PT, but I do that because I have the flexibility of doing that during work hours, but if it's something like I have to choose, I don't feel comfortable choosing that time over being with my son.

P106: Like having another thing on my schedule, because my calendar is like full all the time. It's like with work; I'm like I have a lot of stuff. So, it's also nice to not have something, and with all the medical appointments and doing physical therapy! I was like, I don't need another thing in my calendar.

P113: You know home workout programs and stuff like that a couple of times a week, but it's felt impossible to do with her, and I guess I'm just not really willing to give up the couple hours at the end of the day that I have with her to work out.

P116: I'll sometimes miss days or cut days short, or whatever, because I have kids now or like they'll want to go with me if I go out on a walk, and they're slow and which is fine, but you know, it's not the same amount of exercise.

Theme 5: Advice to Other Pregnant Individuals

Participants gave advice to other pregnant individuals related to PA. These responses generated 2 main categories: PA participation and recognizing unique needs. PA participation

was further divided into subcategories based on advice related to activity: before pregnancy and for mental coping. Across responses, participants encouraged others to listen to their bodies, to engage in realistic movement, and to honor the uniqueness of their pregnancy journey. Most participants seemed enthusiastic to provide advice and used the opportunity to reflect on their own experiences with PA.

PA Participation

Participants advised that other pregnant individuals engage in some type of PA including recommendations such as performing "*basic movements*" and stretching. PA advice given by participants may help highlight where they themselves felt they were lacking. This could provide insight and guidance for future research studies in this population.

Participation Before Pregnancy

Participants widely acknowledged the benefits of PA and mentioned that adopting healthy PA behaviors before pregnancy is a key component of PA maintenance. Their responses highlighted the value of taking a proactive approach to PA.

> *P112: Yeah, I mean, if people are not working out, I would say start! Strength is wonderful... I would encourage women to start because it can't hurt your pregnancy at all. So, I think it's helpful to start prior to.*

> *P116: I think that there's probably some degree of like people get nervous to start physical activity during a pregnancy when they haven't been active before, and so just to like combat that, I think it's beneficial. Obviously, it's beneficial to be active throughout your life, but it's beneficial to kind of have something in place before you're pregnant just to maybe not be so nervous about that.*

> *P117: I guess maybe advice would be um, starting habits now that you'd want to continue, because sometimes during pregnancy it's a little harder to start something new because you have a lot on your plate and so, if you already have some habits going of course you can always start something new, but the pregnancy can add you know it takes energy, and so if you can start something ahead of time that can be helpful.*

Mental Coping

After recognizing the increased mental load during pregnancy, participants advised other pregnant individuals to use PA as a coping mechanism. Participants acknowledged the emotional benefits of PA in which they created a connection between movement and positive feelings. They placed an importance on movement for the maintenance of a healthy mental state describing PA as a coping strategy for anxiety, overwhelming feelings, and restlessness.

> *P101: Like it just helped me to have mental clarity. I feel like throughout it too, it's been more... about just as like my mental clarity as it has been like physical, because it like can be overwhelming. So it's helped me just feel like I'm staying consistent and still feeling like myself throughout it.*
>
> *P103: My therapist eventually was like "Hey you need to go to the gym; you need to get some energy out. You need to feel better through that" So, I kind of worked with her.*
>
> *P103: But I will say someone that has struggled with anxiety before sitting in the house it causes a lot of just like built up tension just not doing anything. It made me a little like anxious, and it wasn't even normally like anxiety. You would think of something that is going on in your life, something that your mind is racing towards. But I realized that with being pregnant, your body's just changing, and there's a lot of things going on that I would just get kind of my body would feel anxious for absolutely no reason. And then I remember my cousin was like "Just go take a walk, just go lap around. Don't be anywhere that you're in. Just go walk." And then from there I started kind of like walking around just around the neighborhood.*
>
> *P109: I'm kind of a little restless these days, and I feel like doing those kinds of exercises, and like bouncing on a birth ball and like those kinds of things are good for me mentally to give me something to do while I'm just waiting around.*
>
> *P114: Try to keep yourself busy, because sitting around makes it worse.*

Recognizing Unique Needs

Many participants (N=10) spoke on the recognition of unique needs during pregnancy as they discussed advice about approaching PA in a way that is relevant. A common phrase amongst participants was that pregnant individuals should "*listen to their body"* and adjust PA based on their needs. The tone of this advice was encouraging and seemed to promote self-

reflection. Participants highlighted engaging in realistic movement and ignoring external influences that could be potentially discouraging based upon viewing overwhelming amounts of information or setting unrealistic body goals (e.g., fitness influencers, Google searches, video clips). This advice to other individuals suggests a focus on self-compassion and autonomy when navigating PA during pregnancy.

> *P109: Your experience is unique and like to not compare it and like to pay attention to what your body needs, because everybody's body is different.*
>
> *P105: Yeah, I mean, I would definitely encourage women to stay active during their pregnancy as much as they can definitely learn about how their bodies move, what feels good, and then try to just use that throughout the pregnancy as much as they can.*
>
> *P106: So, let's find ways in which you're doing it in a way that feels good and feels healing. It feels comfortable to you, if that means running a 5k because that is who you are, amazing! If that means, you know, rolling on your ball because you haven't moved in a long time, awesome!*
>
> *P113: So, I think social media makes us think that you're supposed to be this like tiny little super mom that's in the gym for the whole 9 months, and for me that was never gonna happen. I don't know why, I even had the thought, cause that's not who I am normally, anyway before pregnancy. So, I think that trying to keep up with your goals for what you're doing currently is reasonable for a lot of people. But I don't think we necessarily set ourselves up for success as far as what we expect out of our bodies and stuff. And I think that we need to be realistic and say, I'm growing a whole person like I'm gonna do what I can with exercise but not kill myself over it.*

Theme 6: Support Needs and Future Directions

Participants shared how healthcare providers and exercise professionals could better support their PA journeys while pregnant. Participants expressed their perspectives on what PA-related guidance should entail and what types of support would help them improve their relationship with PA. These discussions generated four key categories including: individual and ongoing exercise prescriptions, encouragement and support, safety boundaries and modifications, and education on PA benefits. While these responses were based on their experience with providers, they help to highlight potential gaps in provider-patient communication. Many

participants expressed the desire to engage in PA but from their perspective felt there was a lack of relevant and tailored PA information.

Individual and Ongoing Exercise Prescription

Most participants (N=7) expressed a strong desire for an individualized exercise prescription with follow up from healthcare providers. From their perspective, the minimal PA knowledge that they were given was vague and confusing. Participants requested assistance with navigating recommendations and resources that are specific to their pregnancy. Participants also expressed beliefs that recommendations should start early in pregnancy and continue throughout. Some even emphasized the need for prescriptions tailored to each trimester —as the body is going through different changes at each stage.

> *P103: So, I guess just having those open kind of conversations, and just kind of basing what the pregnant mom is kind of going through, whether it's kind of not being active at all, and just like kind of a couch hippo, or kind of being way too active and kind of putting something in jeopardy. So, I think it's just kind of balancing out and finding out a game plan.*

> *P109: I think I would have liked to have resources that were like catered towards like not just prenatal, but like trimesters, or like different season, like type, you know? Like a different timeline of pregnancy.*

> *P112: I have a coworker who is pregnant at the same time as me, she got the same recommendation and has a very different lifestyle outside of what I do... Maybe more history of the patient prior to that conversation or more resources available, I just don't think that exists really.*

> *P116: In terms of like actually recommending things like again, there's a lot of documented benefits to exercise that, I think can be more explicitly recommended to people.*

Encouragement and Support

Alongside discussing more explicit guidance, a small number of participants (N=3) expressed the need for verbal encouragement and affirmation. They expressed a need for

validation from a trusted external source such as a healthcare provider. Participants expressed that encouragement is a key support in navigating the difficulties of pregnancy alongside PA.

> *P101: So just encouraging movement, no matter what it looks like, and that it doesn't have to look a certain way.*
>
> *P106: So, it's really hard to be pregnant. So just validating people on that journey.*
>
> *P117: But it's been helpful to receive encouragement that you can kind of continue as long as you're not really pushing yourself.*

Safety Boundaries and Modifications

With fetal safety being a top priority, participants expressed a desire to understand limitations and boundaries of PA. A few participants (N=4) reported feelings of fear when considering the adoption of PA and emphasized the need for clear information to make it more approachable. In addition to safety, participants expressed a need for guidance on appropriate modifications so that they can continue to engage in some form of the PA that they enjoy safely and with confidence. Participants also brought up the notion of trust—they want information that is credible and trustworthy as we are in an era with a vast quantity of poor and conflicting sources.

> *P109: There's just so much information out there. I think as a pregnant person like sifting through it all to figure out like what's legitimate and what is like maybe someone else's preference. Or you know where's the wiggle room? Where's the gray area? What are some things that are absolute no's. I think that can be helpful. But like I don't know, Who do you-Who can you trust?*
>
> *P114: I think they should let people know what they should and can't be able to do, because you could tell someone to you know, stay active, and stay busy, but what are our limits? You know, if you guys don't tell us the exact things, like what are the facts.*
>
> *P117: I think it's been helpful when, what do you call it? when there's a workout, but there's alternate, or I forget the word. But there's modifications, I suppose, modifications so that you can still participate, even if you know I can't lie belly on the floor, or whatever pregnancy kind of prevents you from doing, but having workouts with modifications is helpful.*

Education on PA Benefits

Finally, participants expressed that being educated on PA and its benefits would be useful. Participants found value in feeling informed which might reinforce their ability to maintain movement with confidence and disregard negative feedback. Highlighting the benefits of PA could provide additional motivation for PA and help to justify staying active, especially when they encounter external messages that discourage PA during pregnancy.

> *P108: If they could relay the benefits of those exercises and routines like if they could find stretches or routines, exercise or whatever that specifically would help reduce like I don't know, nausea or back aches or groin pain, headaches, stuff like that then I think people would be more- pregnant women would be more inclined to do them.*

> *P111: Something that can give them more information on how important it is to protect your abs how important it is to both strengthen your pelvic floor and have control over relaxing your pelvic floor.*

> *P116: It would be nice to have some kind of better way to like succinctly summarize like, here is the benefits that you can you know, give to yourself into your pregnancy.*

Chapter 5

Discussion

This mixed methods study aimed to investigate the influence of pregnancy planning on PA behaviors. To our knowledge, it is the first to use a convergent parallel design to explore pregnancy planning categories in connection to PA behavior. Previous studies have attempted to focus on the connection between health behavior and pregnancy planning (11, 63, 64, 80). However, there are methodological, terminology, and contextual gaps in previous research that fail to generate detailed conclusions on PA. The current study utilized different approaches to methodology and terminology choice to provide a more comprehensive understanding of the topic. PA was considered from an overall standpoint, by domain, by PA variables (e.g., intensity and modality), and qualitatively by participant description. Overall, this study produced unique findings resulting from the similarities and dissimilarities of the various methods.

Physical Activity Patterns in Pregnancy

Existing literature shows that PA participation decreases as pregnancy progresses [42, 75]. Findings in the current study supported existing literature showing similar results. Quantitative results in this study used the PPAQ for activity measurement which revealed no significant differences in the rank sums of MET-hours per week between planned and ambivalent groups. This supports findings from Nascimento et al. that revealed no significant difference in PA when separated by planning category [75]. Although there was no statistically significant difference between the groups in the current study, modest decreases in PA across the pregnancy were reported in the adapted LMUP questions. Twenty three percent of participants reported engaging in 90 minutes per week of PA before pregnancy, but after pregnancy recognition only 15% of participants reported 90 minutes of PA per week. Additionally, 15% of

participants reported engaging in PA 60 minutes per week before pregnancy, which decreased to 0% of participants reporting engagement after pregnancy recognition. Nascimento et al. reported similar findings in which participants reported lower activity levels during pregnancy compared to before pregnancy [75]. Their study found that most pregnant individuals (55.2% of their sample) stopped exercising due to pregnancy. Given the similar findings in the current study, this may suggest that a decrease in PA upon pregnancy recognition is a key element of the pregnancy experience.

The current study differs in that participants were either meeting PA recommendations (N=6) — pursuing 150 minutes per week before and after pregnancy recognition — or they engaged in shorter time bouts of activity after pregnancy recognition (10 to 30-minute sessions). Similar to Nascimento et al., there were decreases in PA in several participants, but 46% of the sample was still meeting the recommended amount of time for PA in the week. As a result, the findings in the current study build on the Nascimento et al. study by suggesting PA patterns in pregnancy may show a decline for the majority of women but ultimately are individualized with some individuals being able to maintain PA. Additionally, it may suggest that although some individuals experience a decline in PA, there is an increased effort to stay active when the right conditions and supports are in place.

Domain Specific Activity

Previous literature describes higher reports of activities in household and leisure domains throughout pregnancy compared to other PA domains [40, 42, 75]. For the current study, domains in which PA engagement occurred the most differ from previous literature. When observing MET-hours per week, the highest values occurred in the household and occupational domains. The leisure and transportation domains had lower MET-hours per week values. This

may suggest that other variables are at play when pregnant individuals are choosing how to engage with PA. The underlying reasons for more frequent engagement with household and occupational domains may reflect broader differences in lifestyle, motivation, or societal norms. Additionally, it may support claims that women are engaging in work inside and outside of the home. This finding builds on domain-specific literature by discussing variability in PA engagement across pregnant individuals. Findings may help tailor and inform interventions to encourage pregnant individuals to meet PA recommendations.

Inconsistencies in Pregnancy Planning Categorization

The LMUP used in the current study was developed in 2004 originating in the U.K. with publications starting back in 2002 [13, 87]. The U.S. validation of the LMUP was conducted by Morof et al. in 2012, which included 346 women aged 15-45 [92]. Since its evaluation, only a couple of studies in the U.S. have called the questionnaire into further review [93, 94]. The utility, validity, and reliability of the LMUP are important as it is a widely used tool that is currently being used for intervention work [95]. In the U.K. the LMUP was used to implement antenatal care, and it was described as beneficial for establishing rapport, personalization of care, and providing a preface for valuable discussion [95]. While these benefits were identified in pregnant individuals in the U.K., the current findings suggest additional research should be done to explore their relevance and effectiveness in pregnant individuals in the U.S.

When comparing quantitative and qualitative data in the current study, participants had inconsistent results for their pregnancy planning categorizations (see **Table 6**). According to the LMUP, participants in the current study only scored as planned (N=8) or ambivalent (N=5). Contrary to this, participants described in the interviews that their pregnancy was either planned (N=8), ambivalent (N=3), or unplanned (N=2). This demonstrates a discrepancy in participant

self-expression and categorization via objective scoring. This could suggest that participants were hesitant to reveal pregnancy plans, participants misinterpreted questioning, there is a gap in knowledge surrounding terminology in pregnancy planning, or the LMUP tool needs further examination. **Table 6** summarizes the planning category comparison between the two methods. Six participants had inconsistent categorizations, with LMUP scores indicating one category but describing their experience/category differently in their interview. These findings suggest there may be a benefit to refining pregnancy planning assessment tools.

The original evaluation of the LMUP does acknowledge that childbearing plans do change and intentions can vary from actions [92]. In the current study, it is important to note that about 46% of the sample changed their pregnancy planning status from the questionnaire to the interviews. While the quantitative results offer numerical values and qualitative interviews are based on narrative descriptions, variations in pregnancy planning status within the same individual raise important questions about how language, interpretation, and question style function within the LMUP. The current findings suggest the need for additional assessment of terminology and tools for pregnancy planning as it is a complex measurement impacting reproductive health. In the current sample, the inconsistencies in pregnancy planning status between data collection methods suggest the literature may benefit from the reevaluation of the LMUP, particularly by refining the tool for pregnant individuals in the U.S.

Table 6. Comparison of Quantitative and Qualitative Pregnancy Planning Status

Participant	**Quantitative (via LMUP Survey Scores)**	**Qualitative (via Interview)**
101	Planned	Planned
102	Ambivalent	Planned
103	Ambivalent	Ambivalent
105	Planned	Ambivalent
106	Planned	Planned
107	Ambivalent	Unplanned
109	Planned	Planned
111	Ambivalent	Planned
112	Planned	Planned
113	Planned	Planned
114	Ambivalent	Unplanned
116	Planned	Planned
117	Planned	Ambivalent

LMUP=London Measure of Unplanned Pregnancy

Leisure Time Activity

When exploring results within the PPAQ leisure section, every participant reported walking for fun or exercise. This aligns with existing literature that has revealed walking as the most preferred type of activity during pregnancy [96]. Participants frequently contributed both their physical and mental well-being to walking. Several participants mentioned walking as relief for anxiety or overwhelming feelings during their pregnancy. These findings add to literature surrounding the discussion on walking to maintain a healthy pregnancy — mentally and physically. For example, a randomized controlled trial by Taniguchi & Sato revealed that walking improved depression, mood, and confusion in sedentary pregnant individuals [97]. While the current study did not include formal mental health assessments, it does provide qualitative insight on how particular activities such as walking play a meaningful role in supporting mental health. These findings build on the qualitative work of Lovett et al. in which participants — primarily in the postpartum period — also described walks as a method to cope with anxiety and adjusting to motherhood [98]. Despite the difference in timing between these studies, there are alignments in the preference for walking. In summary, there appears to be value in the promotion of walking as an effective and feasible PA modality in pregnancy through interventions and public health messaging.

Barriers and Problems with Access

The current participants reported being generally well-supported in a variety of contexts. Most were educated, married or partnered, and employed. Despite having participants that characterize themselves as well-supported individuals, they not-surprisingly still discussed relevant barriers to PA. It is important to understand barriers operate on a complex and multi-layered system. Barriers are the product of multiple interwoven factors that can be

conceptualized in the SEM. Findings in the current study suggest significant barriers within intrapersonal, interpersonal, and organizational components of the SEM framework.

One of the barriers to PA discussed by participants was cost. Three participants were unable to access prenatal PT, prenatal fitness classes, and external referrals due to it being unaffordable. Although socioeconomic data were not collected in our sample, the demographic data that were collected (i.e., employment status, education) suggest that most of the current participants might be perceived as individuals who were likely to find supplemental prenatal care affordable. This finding raises more alarming concerns regarding potential gaps in access for pregnant individuals who are underemployed, of lower SES backgrounds, have lower education levels, are from diverse racial/ethnic groups, and/or are battling with the emotional burden of ambivalent or unplanned pregnancies. There is evidence that individuals of lower SES are more likely to have unplanned pregnancies [77]. A study by Ayoola et al. done in the preconception period show that low income individuals who were not planning or unsure about pregnancy were less likely to engage in healthy behaviors such as multivitamin use, not smoking, and not consuming alcohol [77]. While this study showed no negative relationship between PA behavior and pregnancy planning status, individuals who were not planning or unsure about pregnancy had higher rates of fair/poor health [77]. The study by Ayoola et al. called for education and PA participation for low-income individuals to prevent high body mass index values prior to pregnancy to prevent EGWG, GDM, and other adverse conditions in pregnancy.

Affordability is an organizational level barrier that demonstrates the need for broader system level initiatives to improve accessibility. If individuals who are in seemingly privileged positions report difficulties accessing PA, it is highly likely that those from more disadvantaged groups encounter even greater barriers. Health care providers might improve PA adherence by

offering low- or no-cost options for PA, providing trial care plans, or partnering with local governances to organize free community based prenatal PA initiatives.

Another barrier expressed by participants was accessibility in terms of competing interests. These barriers fall into intrapersonal and interpersonal categories as participants described fatigue, caring for other children, and time with family as common barriers to PA. Low energy levels are an intrapersonal barrier that directly impact the individual's PA engagement. Existing literature cites fatigue as one of the most reported barriers to leisure-time PA in pregnant individuals and one that is a barrier regardless of the methodology used [99]. This finding is supported by participant descriptions in the current study of tiredness, fatigue, and sleepiness. The interpersonal barriers such as family time and caretaking of other children were prevalent in the current study as participants frequently mentioned not wanting to sacrifice time with partners or children to engage in PA. Additionally, having other children in the home provides an extra challenge as time and attention may be limited. Previous literature in pregnant individuals cites these as common barriers with solutions potentially centered in time-management interventions and education [66].

The findings in the current study add to the literature to provide contextualized insights into how these barriers manifest in pregnancy. This study further emphasizes the importance of acknowledging barriers when addressing pregnant populations. Additionally, these results suggest a need for the design of interventions that are sensitive to the values and time commitments of expectant mothers. Overall, this study supports and builds on existing literature by providing insight on pregnancy-related barriers through the SEM. While the barriers cited were not linked to pregnancy planning status, it is valuable for future literature to continue to assess barriers that are unique to pregnancy.

Limitations & Future Directions

A limitation in the study is that the interviewing process itself is inherently subject to bias as the interviewer has the choice of their interviewing style, variations in questioning, and probes. Even subtle differences in word choice or question interpretation may influenced participant response. In contrast, these factors can enhance participant engagement and prompt authentic responses. One of the main strengths of a semi-structured interview format is its ability to produce more participant-led interviewing. Interviewers are encouraged to adapt questioning, probes, and body language to participant response. As a result, while the chosen method of conducting individual interviews lends itself to variability, it also supports the collection of diverse perspectives, which is valuable when discussing complex topics such as pregnancy planning and PA. That said, supplementing the qualitative method in the future (e.g., using focus groups) could provide enhanced insight and more detailed participant responses.

Another limitation of this study includes the sample; the sample size was 13 pregnant individuals living in the southeastern region of the U.S. The distribution of PA was not normally distributed leading to the use of non-parametric statistical testing. The current sample was somewhat homogeneous in that most participants had similar demographic characteristics in terms of education, marital status, and race/ethnicity, which limits the generalizability of the findings. Pregnancy planning experiences can vary by geographical location, cultural practices, the presence (or absence) of social support, and societal beliefs. As such, conducting similar research in different locations, in those lacking active partner support, and/or from underrepresented race/ethnic groups could lead to variation in pregnancy planning groups and a different perspective to this line of research. In further recognition of the need for diverse perspectives, the current study also lacked insight from healthcare providers or exercise

professionals, relying solely on the perspective of pregnant individuals to provide information about their experience with receiving PA recommendations. This could have led to a misrepresentation of the information that is distributed to participants by providers. Although findings lack generalizability, they may still be beneficial in providing accumulating evidence that PA in pregnancy is influenced by multiple factors.

Conclusion

In conclusion, this study adds meaningful information to the limited body of literature exploring the connection between pregnancy planning and PA. While previous studies have explored other health behaviors, few studies have specifically focused on PA in the context of pregnancy and include specific pregnancy planning terminology — assessed both quantitatively and qualitatively. To our knowledge, this is the first study to provide a mixed methods analysis exploring pregnancy planning and PA behavior. The data do not show differences in PA by pregnancy planning group for this sample. However, these data do show the connection between PA and pregnancy planning is not consistent depending on how it is asked. Interpreted findings of the qualitative and quantitative data suggests a need for the refinement of pregnancy planning assessment tools. Additionally, the current findings highlight relevant topics of interest to pregnant individuals of which healthcare providers should be aware. Interview data in this study offers insight to researchers conducting pregnancy PA interventions and programs in terms of preferences, barriers, the desire for more education, and personal exercise prescription.

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Appendices

APPENDIX A: Press Release

Are you currently expecting and willing to share your thoughts and experiences related to physical activity during your pregnancy?

Pregnant individuals, ages 18-40 years, are needed to participate in a one-time interview with other pregnant individuals. This exciting research study at the University of Tennessee, Knoxville aims to understand if pregnancy planning affects physical activity participation. Qualified participants must have internet access and be at least 16 weeks pregnant. The study requires up to 20 minutes for telephone screening, 30 minutes for online questionnaires, and up to 90 minutes for the one-time one-on-one interview. Participants will be compensated in the form of a $50 Target gift card upon completion of the study.

If interested or for more information please contact Mikayla Greene or Dr. Lyndsey Hornbuckle in the Department of Kinesiology, Recreation, and Sports Studies at 865-974-1288 or utkexercise@gmail.com.

APPENDIX B: Recruitment Flyer

THE UNIVERSITY OF TENNESSEE KNOXVILLE

Are you currently expecting and willing to share your thoughts and experiences related to physical activity during your pregnancy?

Pregnant individuals, ages 18-40 years, are needed to participate in interviews. This exciting research study aims to understand if pregnancy planning affects physical activity participation.

Qualified participants must have internet access and be at least 16 weeks pregnant. The study requires up to 20 minutes for telephone screening, 30 minutes for online questionnaires, and up to 90 minutes for a one-on-one interview. Participants will be compensated in the form of a $50 Target gift card upon completion of the study.

If interested, please contact Mikayla Greene or Dr. Lyndsey Hornbuckle at **865-974-1288** or **utkexercise@gmail.com**



APPENDIX C: Telephone Screening

Initial Telephone Screening

INTRODUCTION – In order to determine if you qualify for this research study, I am going to ask you some questions about your health and present condition. You may stop answering the questions at any time and you do not have to answer any questions that make you feel uncomfortable.

1. May I please have your current age? _____
2. May I please have your expected due date? _____
3. Is English the primary language in your home? YES or NO

- If NO: Do you feel proficient enough in your English speaking and understanding to participate in an interview? YES or NO

4. Do you have reliable access to the internet? YES or NO
5. Have you been advised by a primary care physician to not engage in physical activity? YES or NO

- If YES, please explain briefly: _____

6. Do you have any disabilities or conditions that limit your physical activity? YES or NO

- If YES, please explain briefly: _____

7. Did you use assisted reproductive technology for conception purposes? (*Examples include in vitro fertilization, previously frozen embryos, fertility treatments*)? YES or NO
8. Are you willing to discuss your pregnancy experience in an interview? YES or NO

CONCLUSION – Based on the information that you have provided, it appears that you do/do not qualify for this research study. Do we have your permission to retain the information collected from this screening survey until the completion of this study? YES or NO

(If "no," we will destroy this information immediately.)

APPENDIX D: Informed Consent

CONSENT FOR RESEARCH PARTICIPATION

RESEARCH STUDY TITLE
A Mixed-Method Exploration on the Role of Pregnancy Planning on Physical Activity Behaviors

CO-INVESTIGATOR
Mikayla Greene, BS, CPT - Department of Kinesiology, Recreation, & Sport Studies
University of Tennessee, Knoxville
PRINCIPAL INVESTIGATOR
Lyndsey Hornbuckle, PhD, RD - Department of Kinesiology, Recreation, & Sport Studies
University of Tennessee, Knoxville

INTRODUCTION
You are invited to participate in research conducted at the University of Tennessee, Knoxville. Being in this research study is voluntary, and you should only agree if you completely understand how we intend to use your feedback and want to volunteer to allow the information that you contribute to be used for research and future exercise program development. This brief text contains information that will help you decide whether you want to be part of this research. Please take the time to read it carefully and contact the study team if anything is unclear.

PURPOSE
The purpose of this study is to examine physical activity (PA) behaviors in relation to pregnancy planning. This research will explore whether factors related to PA (examples: barriers, frequency, and type) may be affected as pregnant individuals encounter feelings and decision-making about PA during pregnancy. This study seeks to recruit pregnant individuals in their second or third trimesters. Participants must have access to internet and be open to engaging in dialogue with a moderator about their experiences with PA as it relates to their pregnancy planning. The information collected will be used to inform future PA recommendations for pregnant individuals. Our main goal is to understand PA behaviors based on varying plans for pregnancy.

PARTICIPATION
If you choose to participate in this study, you can expect the following:

- You will be asked to complete a telephone screening to ensure eligibility for the study (*Up to 20 minutes*)
- You will be asked to fill out electronic questionnaires as truthfully as possible. *(Up to 30 minutes)*
- You will be asked to participate in one-time designated one-on-one interview via Zoom. The discussion will be facilitated by a trained moderator. *(Up to 90 minutes)*
- We will video record your responses via Zoom teleconference software so that we can better remember and analyze the feedback shared. After the interview, the research staff will transcribe (type out what was said) and remove any names or identifying information. Video recordings will be deleted after transcription.

VOLUNTARY PARTICIPATION

It is completely up to you to whether you want to participate in this study. If you agree to participate in the interview, you are not required to answer all questions asked by the researchers. Even if you decide to be part of the study now, you may change your mind and stop at any time by informing the investigators and/or study staff in-person, via e-mail, or via telephone. If you choose not to participate at all, or if you change your mind about participating, your decision will not affect your relationship with the researchers or the University of Tennessee conducting this research. Further, you will not lose any services, benefits, or rights you would normally have.

RISKS

This research is considered no more than minimal risk. This means there is no more expected risk to you than what you might experience in a typical day. Online activities always carry a risk of data breach, but we use University approved systems that minimize breach opportunities. This survey data will be securely stored in a restricted access folder.

We recognize that the topics discussed in this interview may invoke emotional responses. Specifically, individuals may become emotional talking about their pregnancy and the feelings associated with pregnancy. To acknowledge this risk, the lead investigator and supporting faculty on this study have been trained to work with pregnant individuals and respect the complexity tied to pregnancy experiences and emotions. Furthermore, following the conclusion of the interview discussion, a list of community resources can be provided for additional support if needed.

BENEFIT

Your participation will help us learn more about whether individual pregnancy experiences affect PA behaviors. This will help inform future research studies and could benefit health professionals (exercise professionals, obstetrician-gynecologists, nurse practitioners, public health researchers, etc.), which may ultimately assist in improving health of other pregnant individuals.

CONFIDENTIALITY

Your feedback collected during the interview will be used for research purposes only. We will assign you a subject identification code and a pseudonym of choice to use during the interview instead of your name. All information and data collected will only be identified by your subject identification code or pseudonym when analyzing individual data. All information will be stored electronically on a secure Microsoft Teams server that encrypts data, requires multi-factor authentication, and provides custom security settings. Paper note taking during the interview will be stored in a secure file cabinet in the research team laboratory space. No information which could identify you (name, individual descriptions, etc.) will be shared in any professional publications or presentations related to our analysis of the data, or databases where your information and study results may be stored. Information will solely be shared amongst the research team and approved study staff. Demographic information requested by the study staff will only be reviewed by study staff and will NOT be shared in any way during the interview.

FUTURE RESEARCH

We will keep your information and feedback for future research and may also share this information with other researchers in future studies without obtaining additional informed consent. Your name and other information that could identify you will be removed before any such use.

COMPENSATION
Participants will be compensated in the form of a single $50 Target gift card upon completion of the study. Completion of the study requires qualification via telephone screening, filling out questionnaires, and attending/providing information within the one-on-one interview.

COSTS
It will not cost you anything to be in this study. All study costs and procedures related directly to the study will be paid for by the study.

CONTACT INFORMATION
If you have any questions about this research, please contact Mikayla Greene at mgree117@vols.utk.edu or (678) 650-1544, or Dr. Lyndsey Hornbuckle at lhornbuc@utk.edu or (865) 974-1288. If you have any questions about your rights as a research participant, please contact the Institutional Review Board (IRB) of the University of Tennessee, Knoxville, at utkirb@utk.edu or (865) 974-7697. You may also contact the IRB with any problems, complaints, or concerns you have about the research study.

CONSENT QUESTION
Please view the next screen to provide your consent to participate in this study. By providing consent, I agree that I have read this form, and the research study has been explained to me. I have been given the chance to ask questions, and my questions have been answered. If I have more questions, I have been told who to contact.

If you would like to participate in the study, please select the option that says “Yes, I agree to participate in this study.” If you do not want to participate in this study, please select the option that says, “No, I do NOT agree to participate in this study.”

APPENDIX E: Demographic Survey

Subject ID: _____ Group:_____ Date: _____

Demographic Survey

Please complete the following demographic survey as honestly and accurately as possible. While completing this section, please note that in research, we often present demographic information in categories. We understand labels are limiting. Please make the selections that you feel describe you best. You have the option to NOT report for any question.

1. **Please identify your race:**

☐ American Indian/Alaskan Native
☐ Asian
☐ Native Hawaiian or Other Pacific Islander
☐ Black
☐ White
☐ Mixed Race (please include): _____
☐ Other: _____
☐ Prefer not to report

2. **Please identify your ethnicity:**

☐ Hispanic
☐ Non-Hispanic
☐ Prefer not to report

3. **Please identify your gender:**

☐ Man
☐ Woman
☐ Transgender Man
☐ Transgender Woman
☐ Nonbinary
☐ Gender questioning
☐ Other: _____
☐ Prefer not to report

4. **Please identify the sex you were assigned at birth:**

☐ Female
☐ Male
☐ Intersex
☐ Prefer not to report

5. **Please identify the highest level of education you have received:**

☐ Less than a High School Diploma/Some High School
☐ High School Diploma
☐ Trade School/Certification
☐ Some College
☐ Associate's degree
☐ Bachelor's degree
☐ Master's Degree
☐ Professional degree or higher (MD, PhD, JD, etc.)
☐ Prefer not to report

6. **Please identify your current marital status:**

☐ Married
☐ Widowed
☐ Divorced
☐ Separated
☐ Single, and cohabitating with a significant other
☐ Single, Never Married
☐ Prefer not to report

7. **Please identify the option that best describes you:**

☐ Not with living dependents
☐ Living with dependents
☐ If yes, how many? _____
☐ Prefer not to report

8. **Please identify your current employment status:**

☐ Employed for wages, full-time (at least 35 hours per week)
☐ Employed for wages, part-time (less than 35 hours per week)
☐ Employed for wages, but on family/medical leave
☐ Not employed outside the home, not looking for work
☐ Not employed outside the home, looking for work
☐ Part-Time Student
☐ Full-Time Student
☐ Other: _____
☐ Prefer not to report

9. **Please identify your total number of pregnancies:**

☐ 1
☐ 2
☐ 3

☐ 4
☐ 5
☐ 6
☐ 7 or greater
☐ Prefer not to report

10. Please identify your number of live births:

☐ 0
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7 or greater
☐ Prefer not to report

APPENDIX F: LMUP Questionnaire

Subject ID: _____ Group:_____ Date: _____

CIRCUMSTANCES OF PREGNANCY

Below are some questions that ask about your circumstances and feelings around the time you became pregnant. Please think of your **current pregnancy** when answering the questions below.

1) In the month that I became pregnant.....
(Please select the statement which most applies to you):
□ I/we were not using contraception
□ I/we were using contraception, but not on every occasion
□ I/we always used contraception, but knew that the method had failed (i.e. broke, moved, came off, came out, not worked etc) at least once
□ I/we always used contraception

2) In terms of becoming a mother *(first time or again)*, I feel that my pregnancy happened at the.....
(Please select the statement which most applies to you):
□ right time
□ ok, but not quite right time
□ wrong time

3) Just before I became pregnant.....
(Please select the statement which most applies to you):
□ I intended to get pregnant
□ my intentions kept changing
□ I did not intend to get pregnant

4) Just before I became pregnant....
(Please select the statement which most applies to you)
□ I wanted to have a baby
□ I had mixed feelings about having a baby
□ I did not want to have a baby

In the next question, we ask about your partner - this might be (or have been) your husband, a partner you live with, a boyfriend, or someone you've had sex with once or twice.

5) Before I became pregnant....
(Please select the statement which most applies to you)
□ My partner and I had agreed that we would like me to be pregnant
□ My partner and I had discussed having children together, but hadn't agreed for me to get pregnant
□ We never discussed having children together

6) Before you became pregnant, did you do anything to improve your health in preparation for pregnancy?
(Please select all that apply)
□ took folic acid
□ stopped or cut down smoking
□ stopped or cut down drinking alcohol
□ ate more healthily
□ sought medical/health advice
□ took some other action, please describe _____
or
□ I did not do any of the above before my pregnancy

7) Before you became pregnant, did you do anything to improve your physical activity in preparation for pregnancy?
(Please select all that apply)
□ sought exercise advice from a professional (doctor, personal trainer, exercise physiologist)
□ joined a gym/recreation center
□ sought exercise advice from family or friend members
□ attended an exercise class/group in some capacity
□ engaged in physical activity for leisure purposes
□ sought medical/health advice
□ took some other action, please describe _____
or
□ I did not do any of the above before my pregnancy

8) After you recognized you were pregnant, did you do anything to improve your physical activity during pregnancy?
(Please select all that apply)
□ sought exercise advice from a professional (doctor, personal trainer, exercise physiologist)
□ joined a gym/recreation center
□ sought exercise advice from family or friend members
□ attended an exercise class/group in some capacity
□ engaged in physical activity for leisure purposes
□ sought medical/health advice
□ took some other action, please describe _____
or
□ I did not do any of the above after I recognized my pregnancy

9) In the month that I became pregnant…
(Please select the statement which most applies to you)
□ I increased my physical activity routine by a significant amount.
□ I slightly increased my physical activity routine.
□ I did not change my physical activity routine.
□ I decreased my physical activity routine.

10) Before I became pregnant…
(Please select the statement which most applies to you)
□ I engaged in about 150 minutes of physical activity in a week.
□ I engaged in about 90 minutes of physical activity in a week.
□ I engaged in about 60 minutes of physical activity in a week.
□ I engaged in about 30 minutes of physical activity in a week.
□ I engaged in about 10 minutes of physical activity in a week.
□ I engaged in about 0 minutes of physical activity in a week.

11) After I recognized I was pregnant…
(Please select the statement which most applies to you)
□ I engaged in about 150 minutes of physical activity in a week.
□ I engaged in about 90 minutes of physical activity in a week.
□ I engaged in about 60 minutes of physical activity in a week.
□ I engaged in about 30 minutes of physical activity in a week.
□ I engaged in about 10 minutes of physical activity in a week.
□ I engaged in about 0 minutes of physical activity in a week.

12) After you recognized you were pregnant, how would you describe your intensity of your physical activity sessions?
(Please select the statement which most applies to you)
□ light
□ moderate
□ vigorous

APPENDIX G: PPAQ Questionnaire

Subject ID: _____ Group:_____ Date:

Pregnancy Physical Activity Questionnaire

Please check the answer(s) that coordinate with your response. If you have additional comments, please include them at the end of the questionnaire. **It is very important you tell us about yourself honestly.** There are no right or wrong answers. We just want to know about the things you did **during the last 3 months**.

Today's Date: _____

When is your baby due (month/day/year)? _____

During this trimester, when you are NOT at work, how much time do you usually spend:

1. **Preparing meals (cook, set table, wash dishes)**
- ☐ None
- ☐ Less than ½ hour per day
- ☐ ½ to almost 1 hour per day
- ☐ 1 to almost 2 hours per day
- ☐ 2 to almost 3 hours per day
- ☐ 3 or more hours per day

2. **Carrying children**
- ☐ None
- ☐ Less than ½ hour per day
- ☐ ½ to almost 1 hour per day
- ☐ 1 to almost 2 hours per day
- ☐ 2 to almost 3 hours per day
- ☐ 3 or more hours per day

3. **Dressing, bathing, feeding children while you are sitting**
- ☐ None
- ☐ Less than ½ hour per day
- ☐ ½ to almost 1 hour per day
- ☐ 1 to almost 2 hours per day
- ☐ 2 to almost 3 hours per day
- ☐ 3 or more hours per day

4. **Taking care of an older adult**
- ☐ None
- ☐ Less than ½ hour per day
- ☐ ½ to almost 1 hour per day
- ☐ 1 to almost 2 hours per day
- ☐ 2 to almost 3 hours per day

 3 or more hours per day

5. Dressing, bathing, feeding children while you are standing

 None
 Less than ½ hour per day
 ½ to almost 1 hour per day
 1 to almost 2 hours per day
 2 to almost 3 hours per day
 3 or more hours per day

6. Sitting using a computer or writing while you are not at work

 None
 Less than ½ hour per day
 ½ to almost 1 hour per day
 1 to almost 2 hours per day
 2 to almost 3 hours per day
 3 or more hours per day

7. Playing with children while you are sitting or standing

 None
 Less than ½ hour per day
 ½ to almost 1 hour per day
 1 to almost 2 hours per day
 2 to almost 3 hours per day
 3 or more hours per day

8. Watching TV or a video

 None
 Less than ½ hour per day
 ½ to almost 2 hours per day
 2 to almost 4 hours per day
 4 to almost 6 hours per day
 6 or more hours per day

9. Playing with children while you are walking or running

 None
 Less than ½ hour per day
 ½ to almost 1 hour per day
 1 to almost 2 hours per day
 2 to almost 3 hours per day
 3 or more hours per day

10. Sitting and reading, talking, or on the phone, while not at work

 None
 Less than ½ hour per day
 ½ to almost 2 hours per day
 2 to almost 4 hours per day
 4 to almost 6 hours per day
 6 or more hours per day

11. Playing with pets

 None
 Less than ½ hour per day

- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

12. Heavier cleaning (vacuum, mop, sweep, wash windows)

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

13. Light cleaning (make beds, laundry, iron, put things away)

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

14. Mowing lawn while riding on a lawn mower

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

15. Shopping (for food, clothes, or other things)

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

16. Mowing lawn using a walking mower, raking, gardening

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

Going Places…

During this trimester, how much time do you usually spend:

17. Walking slowly to go to places (such as to the bus, work, visiting) Not for fun or exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

18. Driving or riding in a car or on public transportation

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

19. Walking quickly to go to places (such as to the bus, work, or school) Not for fun or exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

For Fun or Exercise

During this trimester, how much time did you usually spend:

20. Walking slowly for fun or exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

21. Swimming, water walking, or water exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

22. Walking more quickly for fun or exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

23. Dancing

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

24. Walking quickly up hills for fun or exercise

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

25. Yoga, Pilates, stretching, core strengthening exercises, or yoga/Pilates/stretching exercise videos or computer games

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

26. Jogging

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

27. Cardiovascular exercise machines (treadmill, stationary bike, elliptical, stair climber, rowing machine)

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

28. Prenatal exercise class

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

29. Aerobic exercise classes, aerobic exercise videos or computer games

- None

- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

30. Weightlifting, resistance exercises

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

31. Team sports (volleyball, basketball, softball, etc.)

- None
- Less than ½ hour per day
- ½ to almost 1 hour per day
- 1 to almost 2 hours per day
- 2 to almost 3 hours per day
- 3 or more hours per day

32. Are you doing something else for fun or exercise? Please tell us what it is below.

Please fill out this next section if you work for wages, work as a volunteer, or if you are a student. If you are a homemaker, out of work, or unable to work, please SKIP these questions.

At Work..
During this trimester, how much time do you usually spend:

33. Sitting or working in class

- None
- Less than ½ hour per day
- ½ to almost 2 hours per day
- 2 to almost 4 hours per day
- 4 to almost 6 hours per day
- 6 or more hours per day

34. Standing or slowly walking at work while carrying things (heavier than a 1-gallon milk jug)

- None
- Less than ½ hour per day
- ½ to almost 2 hours per day
- 2 to almost 4 hours per day
- 4 to almost 6 hours per day
- 6 or more hours per day

35. Standing or slowly walking at work not carrying anything

- None

- Less than ½ hour per day
- ½ to almost 2 hours per day
- 2 to almost 4 hours per day
- 4 to almost 6 hours per day
- 6 or more hours per day

36. Walking quickly at work while carrying things (heavier than a 1-gallon milk jug)

- None
- Less than ½ hour per day
- ½ to almost 2 hours per day
- 2 to almost 4 hours per day
- 4 to almost 6 hours per day
- 6 or more hours per day

37. Walking quickly at work not carrying anything

- None
- Less than ½ hour per day
- ½ to almost 2 hours per day
- 2 to almost 4 hours per day
- 4 to almost 6 hours per day
- 6 or more hours per day

Comments:

APPENDIX H: PUQE Questionnaire

Subject ID: _____ Group:_____ Date: _____

Pregnancy- Unique Quantification of Emesis and Nausea

Please select the answer that suits your situation the best.

On average in a day, for how long do you feel nauseated or sick to your stomach?

a. Not at all
b. <1 hour
c. 2-3 hours
d. 4-6 hours
e. >6 hours

On average in a day, how many times do you vomit or throw up?

a. Not at all
b. 1-2 times
c. 3-4 times
d. 5-6 times
e. >7 times

On average in a day, how many times have you had retching or dry heaves without bringing anything up (in other words, without vomiting)?

a. Not at all
b. 1-2 times
c. 3-4 times
d. 5-6 times
e. >7 times

APPENDIX I: Interview Question Guide

Question Guide

Welcome and thank you for participating. Today, we are going to discuss your experiences with pregnancy planning and whether it relates to your physical activity during pregnancy. There are no right or wrong answers, and everything you share is valuable to us. Please be reminded that everything shared will be kept confidential within the research team.

We will now begin the discussion portion of the interview which will be driven by the prompts and questions that I provide. A large part of the interview will include a discussion about physical activity. For the purposes of this discussion, we will define physical activity per the American College of Sports Medicine as any bodily movement produced by the contraction of skeletal muscles resulting in an increase in energy use over what is used during rest. This may include a wide variety of activities including but not limited to walking for any purpose, carrying children, household chores, and purposeful exercise.

BEGIN QUESTIONS

Rapport Building:

1. Tell me about your overall experience during your current pregnancy.

<u>Probes</u>*: This may include initial feelings, reactions of family/friend members/partners, current employment and/or changes in employment, or any thoughts/attitudes that you would like to share related to becoming pregnant.*

2. Tell me about your experience planning your current pregnancy.

<u>Probes</u>*: This may include circumstances related to your pregnancy planning, your readiness for a pregnancy, or your plans/expectations during your pregnancy.*

3. Tell me about how your healthcare provider discussed physical activity during this pregnancy with you?

<u>Probes</u>*: Was physical activity encouraged? Discouraged? Were any limitations suggested?*

Primary Questions:

4. Tell me about your typical physical activity participation before this pregnancy.

<u>Probes</u>*: Type of activity, typical duration, typical frequency (for example, number of days per week), location of physical activity, preferred intensity*

5. Tell me about your physical activity participation after you discovered that you were pregnant.

<u>Probes</u>*: Type of activity, typical duration, typical frequency (for example, number of days per week), location of physical activity, preferred intensity*

6. Tell me about any barriers that you have encountered that have impacted your ability to stay physically active during this pregnancy.

7. If you are currently participating in physical activity, what are your preferred types of physical activities now that you are pregnant?

<u>Probes</u>*: This may include broad types (for example, cardiovascular, resistance/strength, or flexibility training) or specific types (for example, walking or prenatal yoga).*

8. **Question dependent on LMUP classification (participants will be classified based on LMUP scores)**
    a. In what ways has feeling ready for your pregnancy impacted the way you approach physical activity?
    Probes: This may include factors like whether you prioritized physical activity, physical activity frequency, physical activity type, managing barriers, etc.

    OR

    b. In what ways has not feeling ready for your pregnancy impacted the way you approach physical activity?

    Probes: This may include factors like whether you prioritized physical activity, physical activity frequency, physical activity type, managing barriers, etc.

    OR

c. In what ways has feeling unsure about your pregnancy impacted the way you approach physical activity?

    Probes: This may include factors like whether you prioritized physical activity, physical activity frequency, physical activity type, managing barriers, etc.

9. In what ways do you think health and exercise professionals can support the promotion of physical activity during pregnancy that are ready for?
10. Is there any advice you would give to other women related to physical activity during pregnancy (particularly as it relates to pregnancy planning)?

Summary/Wrap Up:
11. That covers everything we would like to ask you today. Is there anything else you feel that we didn't ask that you would like me to know about the impact of your pregnancy planning on your physical activity behaviors?

Thank you so much for participating in this study! We very much appreciate your honesty and trust in us. Once we have finalized data collection and analysis, we will reach out via email to confirm that what we have written about your experiences accurately reflects what you have shared today. This process will likely occur in mid-to-late May.

If you feel you need additional support based on the topics covered today, we are happy to provide you with a list of community resources to assist in that process.

National Resources

National Maternal Mental Health Hotline - 1-833-943-5746
A free, confidential helpline for anyone experiencing maternal mental health challenges, including depression and anxiety.

WIC (Women, Infants, and Children) Program - www.fns.usda.gov/wic
Provides nutrition support for low-income pregnant women, new mothers, and young children.

OptionLine - www.optionline.org
Provides free, confidential counseling and resources for women facing an unplanned pregnancy, including adoption options, parenting, and support for decision-making.

Adoption Network Law Center - www.adoptionnetwork.com
Offers guidance on adoption, helping women who may be considering adoption as an option for their pregnancy.

National Domestic Violence Hotline - 1-800-799-7233
Offers free legal advice and representation for women, particularly in cases of custody, housing, and pregnancy discrimination related to domestic issues.

Planned Parenthood - www.plannedparenthood.org
Offers reproductive health services, including birth control, pregnancy testing, and counseling.

Postpartum Support International - 1-800-944-4773
Offers mental health support for new moms, including help for postpartum depression and anxiety.

Knoxville Area Resources

Planned Parenthood of Tennessee and Northern Mississippi - plannedparenthood.org
Offers reproductive health services, including prenatal care, family planning, and health education.

The Nest Knoxville - (865) 247-5296
Offers physical therapy, mental health services, and lactation consultation for Knoxville residents. It is considered a safe, educational, and supportive space for birthing individuals residing in the Greater Knoxville area.

Perinatal Mental Health Local Providers - https://psidirectory.com/w:tennessee
A directory of local providers in Tennessee that specialize in perinatal and postpartum mental health services.

Helping Mamas Knoxville - https://tennessee.helpingmamas.org/
A non-profit organization serving the Knoxville area filling the gap between direct services and essentials. Responsible for distributing diapers, period products and care items within Knoxville.

The Lotus Program – thelotusprogramexperience.org
Holistic chef & womb practitioner who focuses on fertility menstruation, pregnancy, birth and postpartum.

APPENDIX J: Script for Recruitment

Script for Recruitment
A. Hello, I wanted to talk to you about an opportunity to participate in a research study. Are you interested?
(Wait for participant response. If YES, proceed to section C. If NO, proceed to section B.)
B. Thank you for your time today. If you ever change your mind, you can reach out to our study staff using the contact information on our flyer. *(Issue flyer and reference contact information.)*
C. Thank you for your interest in the study! If you have a few minutes, I'd like to tell you a little more about it. Do you have time to talk?
(Wait for participant response. If YES, proceed to section E. If NO, proceed to section D.)
D. Is there an email or phone number where I can reach you to send more information or follow up later? *(Record contact information and reach out later.)*
E. The research study I'm referencing is focused on examining physical activity behaviors in relation to pregnancy planning. This is a research study affiliated with the University of Tennessee of Knoxville. We're looking for pregnant individuals in their second or third trimester who have internet access and are willing to share their experiences with physical activity as it relates to pregnancy planning. Those who participate in the study will be asked to complete about 20 minutes of a telephone screening, 30 minutes' worth of online surveys and then participate in a 90-minute one time interview via Zoom. Participation is completely voluntary, and the research involves no more than minimal risk. You will receive a $50 Target gift card at the completion of the interview for your time. This research may help inform future research studies to improve health in pregnant individuals.
If you're still interested, the next step would be to briefly collect your contact information and schedule a pre-screening phone call to see if you qualify for the study. Are you interested in participating?
(Wait for participant response. If YES, proceed to section F. If NO, proceed to section B.)
F. Thank you for your interest! May I please have your name, phone number, email, and a preferred contact time? (*Record participant's name, phone number, email, and preferred contact time/day.)* A study staff member will be in contact with you as soon as possible to begin the screening process. If you change your mind or have any questions before the screening call, please feel free to reach out to co-investigator Mikayla Greene or principal investigator Lyndsey Hornbuckle at 865-974-1288. The contact information can also be found on the flyer *(Issue flyer and reference contact information).*
Have a great day!

APPENDIX K: Email Script for Approved Compensation Consent

Hello,
You are being contacted because you are currently enrolled in a study at the University of Tennessee, Knoxville, in the Department of Kinesiology, Recreation, & Sports Studies. The study, titled "A Mixed-Method Exploration on the Role of Pregnancy Planning on Physical Activity Behaviors," is led by Principal Investigator Lyndsey Hornbuckle and Co-Investigator Mikayla Greene.
The study is making a change to its compensation. When you initially enrolled, you consented to participate with no compensation or direct benefit. There have been changes in which we can provide a single 50$ Target gift card for completion of the study. You will receive compensation following the completion of your one-on-one interview.
Please find the link for re-consent through Qualtrics attached to this email. If you decide not to provide re-consent, your participation in the study will proceed under the terms of the original agreement. You also have the right to decline re-consent and withdraw from the study entirely. Please reach out to the study staff with questions or concerns at 865-974-1288 or utkexercise@gmail.com. If you have any questions about your rights as a research participant, please contact the Institutional Review Board (IRB) of the University of Tennessee, Knoxville, at utkirb@utk.edu or (865) 974-7697. You may also contact the IRB with any problems, complaints, or concerns you have about the research study.

Survey Link:

APPENDIX L: PPAQ Scoring Guide

Calculations

To calculate an estimate of weekly energy expenditure for each activity, multiply the duration (hours/week) by the intensity

Duration

The lowest bound of each response is used to estimate hours/week, due to the tendency for over-reporting of physical activity. Using the table below, find the hours/week score assigned to the response for each question.

Question Number	Duration Category	Hours/Week
1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32	None	0
	Less than ½ hour per day	0.84
	½ to almost 1 hour per day	3.5
	1 to almost 2 hours per day	7
	2 to almost 3 hours per day	14
	3 or more hours per day	21
8, 10, 33, 34, 35, 36, 37	None	0
	Less than ½ hour per day	0.84
	½ to almost 2 hour per day	3.5
	2 to almost 4 hours per day	14
	4 to almost 6 hours per day	28
	6 or more hours per day	42

Example Calculation, if participant answered ½ to almost 1 hour per day for question 4 (e.g. taking care of an older adult) the hours/week estimate is:

3.5. hours/week

If participant answered 2 to almost 4 hours per day for question 8 (e.g. Watching TV or Video) the hours/week estimate is:

14 hours/week

Vita

Mikayla Greene was born December 28, 2001, in Riverdale, GA. She was raised in GA by her mother (Sherese Greene) and father (Clarence Greene III) with her brother (Caleb Greene). Mikayla attended Douglas County High School and The University of Georgia. She completed her Bachelor of Science in Exercise Science with a minor in Human and Family Development in December 2022. In the Fall of 2023, she began attending the University of Tennessee Knoxville, where she acquired her Master of Science in Kinesiology with a concentration in Exercise Physiology. Following the completion of her degree she plans to attend Emory University for a second master's in nursing to become a labor & delivery nurse and eventually pursue a nurse practitioner terminal degree. Mikayla plans to pursue research from a clinical and academic standpoint focused on maternal health and maternal mental health.