Spring 5-4-2022

Optimizing Intrapartum Outcomes for Midwifery Patients with Obesity

Anna Shields
University of New Mexico, anshields@unm.edu

Optimizing Intrapartum Outcomes for Midwifery Patients with Obesity

Anna Shields, CNM, FNP

A Scholarly Project Submitted to the College of Nursing in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Nursing Practice

University of New Mexico
College of Nursing
Albuquerque, NM

Capstone Chair: Dr. Felina Ortiz, DNP, CNM

Capstone Committee Member: Dr. Noelle Borders, DNP, CNM

Date of Submission: May 2022

Dedication and Acknowledgements

This work is dedicated to the patients and families who were included in this study, in the hopes that the findings of this work will impact care for future patients like themselves.

This work would not have been possible without the support and guidance from the following individuals who supported various steps of the process.

Dr. Felina Ortiz

Dr. Noelle Borders

Dr. Melissa Cole

Blake Boursaw

Beth Brown

Abstract

Existing literature has established that laboring people with obesity have poorer intrapartum outcomes compared to their lower weight counterparts, including elevated c-section rates which increase with increasing BMI. People with obesity are at increased risk for complications related to surgical birth so optimizing chances for vaginal delivery is of utmost importance yet professional guidelines about labor management are lacking. Research has established that people with obesity have longer times in labor especially early labor, need more labor stimulating medications and have physiologic changes that alter the labor process compared to lower weight people. Literature on the impact of midwifery care on this population is lacking. This study compared intrapartum outcomes for primiparous patients with obesity among three provider groups: Nurse Midwives (CNM), OB/GYNs (OB) and Family Practice physicians (FP) practicing at one medium-volume hospital in the American southwest. Induction rates, cesarean outcomes and time in stages of labor were examined. There were no significant differences in cesarean rates although midwives had a lower cesarean rate (20%) compared to OBs (30%) and induced fewer patients (52% vs 75%). In OB patients, there was a significant ($p=0.003$) association between induction of labor and cesarean delivery while outcomes were equivalent for CNM patients. Labor times were not significantly different. In CNM patients, the mean rate of physiologic interventions was the same (2.5 interventions) between those experiencing vaginal and cesarean delivery. This study highlights the importance of reducing non-medically indicated induction of labor in people with obesity, demonstrates potential contributions of the midwifery model of care in this population, while highlighting the need to increase support of physiologic labor across all provider groups.

Table of Contents

Optimizing Intrapartum Outcomes for Midwifery Patients with Obesity

Chapter 1: Introduction

In 2018, 30.5% of American women of childbearing age were affected by obesity, defined as a BMI over 30 kg/m^2. (CDC, 2018) Obesity during pregnancy is associated with increased intrapartum risks in addition to well described differences in labor progression. The current literature has established that people with obesity have longer labors, need higher doses of labor stimulating medications, and are at significantly higher risk of unplanned cesarean delivery. The risk of cesarean delivery increases as BMI increases and has been found to be as high as 69% for those in the highest BMI category. (Teefey et al., 2018) These cesarean rates are profoundly elevated compared to the World Health Organization (WHO) recommended safe cesarean rate of 10-15%, placing laboring people with obesity and their babies at increased risk of complicated deliveries.

Moreover, when a person with obesity undergoes a cesarean delivery, they are at higher risk for severe complications including postpartum hemorrhage, infection, wound dehiscence, and neonatal morbidity. (Stamilio & Scifres, 2014; Wispelwey & Sheiner, 2012) One author found the rate of adverse maternal outcomes, called maternal morbidity, was as high as 51% in patients with obesity who underwent cesarean delivery, as compared to a 5% for those who had a vaginal delivery. (Teefey et al., 2018) Therefore, minimizing the risk of cesarean delivery by tailoring labor management to the unique needs of the obese population is of key importance in promoting the healthiest intrapartum outcomes.

Unfortunately, there is a lack of evidence regarding how intrapartum management decisions can optimize outcomes for this population. Labor progress guidelines established by the American College of Obstetricians and Gynecologists (ACOG) fail to account for differences

in labor patterns across BMI groups and obstetric providers in the United States currently practice without evidence-based guidelines tailored to the obese population. As pregnant people with obesity comprise an increasingly large portion of the obstetric population, there is an urgent need to understand their intrapartum needs and how our current labor management practices affect the risk of outcomes which can have deleterious health sequelae, especially cesarean delivery.

While all obstetric providers have an interest in improving outcomes for this population, most of the literature on this topic has examined physician- managed obstetric care. Certified nurse midwives (CNMs) are perinatal providers who commonly care for low to moderate risk laboring people in hospital environments and therefore frequently encounter patients with elevated BMIs. The midwifery model of care supports the physiologic progression of labor and studies have found an association between midwifery care and decreased rates of medical intervention and cesarean delivery in the general population. (Souter et al., 2019) However, there are only a few studies that examine the role of midwifery care in laboring people with obesity, limiting our ability to draw conclusions about the impact on outcomes in this population. The contributions of the midwifery model on reducing outcome disparities for people with obesity needs to be explored and described in order to better understand how to best care for this population.

Problem Statement

This project is a retrospective analysis of intrapartum management and outcomes among primiparous patients with obesity who delivered at the University of New Mexico Hospital (UNMH) in 2020-2021. Midwife-led care accounts for about 25% of deliveries at this institution. This practice setting provides the optimal location to examine factors associated with successful

vaginal birth because midwives care for a large proportion of patients with obesity (estimated at 40%). In addition, patients receiving midwifery care between 2014-2019 had a low primary cesarean rate (10.2%). As the literature indicates, primiparous people with obesity are at increased risk for cesarean delivery compared to their multiparous counterparts so this analysis will examine only primiparous subjects. In conjunction with evidence from the available literature on this topic, the results of this study will be compiled into evidence-based practice recommendations for the promotion of vaginal delivery in laboring patients with obesity with the intention that these recommendations can be utilized by all obstetric providers at this institution.

PICOT Question

In a population of non-high risk primiparous pregnant people with obesity between 37 and 42 weeks gestation, what intrapartum factors are associated with successful vaginal birth, and does midwifery care improve outcomes for this population? The patient sample was collected from laboring patients with BMI of 30.0 or greater, who delivered in 2020-2021 at UNMH.

Objectives and Aims

- Determine primary cesarean section rates among patients with BMI >30 across provider types (nurse midwife, obstetrician, family practice physician) and analyze for significant differences in cesarean section rates.
    - Secondary analysis comparing spontaneous versus induced labor
- Describe time in labor including time in early stage 1 labor (<6cm), active stage 1 labor (6-10cm), stage 2 labor (10cm- delivery), and total labor time across provider types and analyze for significant differences in labor timing based on provider type.

- Among a cohort of midwifery-managed patients: Examine the association between the number of physiologic labor interventions used during labor and successful vaginal birth. Interventions include ambulation/ upright laboring, intermittent auscultation, hydrotherapy, birth or peanut ball use, doula or professional labor support, squat bar use, breast pump use, nutrition (beyond clear liquids), rebozo use, hands on support such as massage or counterpressure, and TENS unit use.
- Using the available evidence on this topic in conjunction with results from this study, create evidence-based practice recommendations to be presented and utilized by obstetric providers in this practice setting

.

Chapter 2: Literature Review

Obesity is a condition affecting approximately 1 in 3 pregnancies in the United States and the literature to date has established that pregnant people with obesity have a unique set of risks and needs during labor and delivery. Obesity is defined by the Centers for Disease Control (CDC) as a Body Mass Index (BMI) over 30, calculated in kilograms per square meters. Obesity is further subdivided into Class 1 Obesity (BMI 30-35), Class 2 Obesity (BMI 35-40) and Class 3 Obesity (BMI >40). (CDC, 2020) Although there are other validated tools for measuring weight status, BMI is the measure used in all of the literature on obesity in pregnancy. This is likely because it is a commonly collected metric that can be easily extracted from charts, and many other tools such as waist circumference or techniques that rely on advanced imaging are not feasible in a pregnant population. It is worth noting that there are criticisms of BMI as a metric. It is a tool developed from the data of predominantly European men and some feel that it is inappropriate to extrapolate data from this population and apply it routinely to women and people of color. It is also commonly used as a reflection of body fat, which it does not always accurately reflect as it cannot distinguish between muscle and fat composition. For consistency with the literature to date on obesity in pregnancy, BMI is the metric used in this study but it is worth noting that studies using other metrics should be considered in the future.

BMI during pregnancy has been studied in two distinct ways, with BMI categorization based on pre-pregnancy weight or by weight at the time of delivery. The literature review on this topic includes studies using both time points because there is a lack of agreement on how to categorize the pregnant population according to BMI. While both methodologies have pros and cons, for the purposes of this project, BMI was collected at the time of delivery due to evidence that the labor process is likely to be affected by the hormonal and physiologic alterations present

at the time of delivery rather than during the pre-pregnancy state. The following literature review examines the intrapartum disparities experienced by laboring people with obesity and identifies gaps in our understanding of how to optimize outcomes for this patient population.

Cesarean Birth

Among the most notable risks of pregnancy with obesity is the increased risk for unplanned cesarean birth. A large body of literature demonstrates that pregnant people with BMIs above 30 have an increased risk of cesarean birth, and that this risk increases with increasing levels of obesity. In the early literature on this topic, a meta-analysis by Chu et al (2007) included 33 high quality studies and established an increasing odds ratio of cesarean delivery with increased maternal weight stratifications. Chu et al (2007) found that laboring people who are overweight, obese, and those with class 2 obesity have a 1.46, 2.05, and 2.89 odds ratio of cesarean delivery as compared to their normal weight counterparts. Numerous studies since then have augmented the understanding of this phenomenon. One large multi-site study found that for every 1 kg/m^2 increase in BMI, there was a 2-5% increase in risk for cesarean delivery, indicating that even small increases in weight can substantially impact delivery outcomes. (Kominiarek et al., 2010) A large French study that examined the entire country's birthing population within one week found that laboring people with obesity had a risk ratio of 1.64 for cesarean delivery, with the risk being higher for nulliparous versus multiparous people. (Hermann et al., 2015) Another study of nulliparous people with class 3 obesity found that the cesarean rate for patients with a BMI of 40-50 was 43%. Those with a BMI of 50-60 had a 63% risk of cesarean birth and the risk was 69% for those with a BMI over 60. (Teefey et al., 2018)

Labor Progress

One key factor affecting cesarean birth rates among people with obesity is the well-established change to labor progress norms. Conducted in 2011, one of the largest studies to study the impact of BMI on labor patterns examined the labor curves of over 118,000 laboring people who progressed from to 10 centimeters (cm). Researchers found that nulliparas in the highest BMI category took significantly longer to reach 10cm than their lower weight counterparts. The labor curves for nulliparas with obesity were also notable because they did not contain an inflection point, making it difficult to separate active labor from latent labor in this population. Multiparas with obesity also took longer to reach 10cm, and had a significantly longer early labor process, though they did enter a period of accelerated progress known as active labor. (Kominiarek et al., 2011) Another study by Norman et al in 2012 demonstrated that in a retrospective cohort of over 5000 deliveries, subjects with BMIs over 30 had a significantly longer first stage of labor, with especially slow labor progress from 4 to 6 cm. (Norman et al., 2012)

Induction of Labor

Many other studies have also demonstrated longer labors in subjects with obesity, especially in the context of induction of labor. One systematic review and meta- analysis found that, following induction of labor, obesity was associated with a longer time to birth as well as need for higher doses of induction medications. (Ellis et al., 2019) Multiple researchers have demonstrated that during induction of labor, people with obesity require higher doses of cervical ripening prostaglandins and are more likely to fail the cervical ripening process and not achieve active labor. (Ellis et al., 2019; Lassiter et al., 2015) Similarly, people with obesity have higher requirements for contraction stimulating synthetic oxytocin during labor induction or

augmentation, which has been demonstrated in several studies. (Lassiter et al., 2015; Hill et al., 2015; Roloff et al., 2015)

Physiologic Alterations

The reasons behind differences in labor progress and unplanned cesarean birth are not fully understood although research indicates that the increased cesarean risk is probably affected by a combination of physiologic alterations that decrease the efficiency of uterine contractions, longer stages of labor, and provider management decisions that do not facilitate the best possible chance for vaginal birth. A 2007 retrospective analysis of almost 4000 labors demonstrated an increased cesarean risk, prolonged first stage of labor, and increased postpartum hemorrhage risk among laboring people with obesity. The authors then performed a prospective analysis on myometrium from participants with obesity and demonstrated decreased muscle contractility related to decreased calcium influx into myometrial cells affected by obesity. (Zhang et al., 2007) Subsequent studies have demonstrated a complex interaction of physiologic mechanisms that are altered by obesity. A review of the literature on this topic published in 2015 concluded that alterations occur in three overarching ways: 1) Changes in cervical, placental and amnion preparation that decrease the propensity for entering spontaneous active labor 2) Changes in labor contraction and synchronization caused by changes in receptor expression, communication, and myocyte contractility 3) Decreased uterine endurance due to hormonal and pH changes. (Carlson et al., 2015)

Midwifery Management

Certified nurse midwives are perinatal providers with a special interest in reducing health disparities and promoting physiologic birth. There is relatively little literature regarding the contribution of the midwifery model care to management of labor affected by obesity. One study

that examined midwifery management practices based on self-report of a national sample of nurse midwives demonstrated that midwives feel discomfort with managing this population, observe increased rates of complications, and less frequently utilize physiologic birth guidelines for patients with extreme obesity. (Reither et al., 2018)

An early study on labor outcomes in a large midwifery cohort demonstrated similar outcomes to other studies in this population with significant increased risk of cesarean delivery among patients with elevated BMIs. (Graves et al., 2006) In a recent comparison of outcomes between nurse midwife and obstetrician patients with obesity, Carlson et al found that nulliparas with obesity who were cared for by nurse midwives were 87% less likely to have operative vaginal birth and 76.3% less likely to have a third or fourth degree laceration than obstetrician patients, although rates of cesarean delivery were not different between groups. Nurse midwifery patients were more likely to utilize physiologic labor interventions and less likely to have anesthesia, oxytocin augmentation, and internal contraction monitoring. (Carlson et al., 2017) Another study by Carlson published in 2019 examined differences in populations of patients with obesity cared for in centers with and without midwifery presence. Although midwifery presence was associated with an overall 16% lower odds of cesarean delivery, patients with BMIs over 35 had similar odds of cesarean delivery at both sites. (Carlson et al., 2019) Interestingly, a recently published study of nulliparas with obesity admitted to birth center care found that for subjects with obesity, cesarean rates were 12.5% compared to 8.3% for their normal-weight counterparts. This was significantly different but demonstrated dramatically lower cesarean rates than other studies of this population. Additionally, there were no significant differences in intrapartum complications between groups. (Jevitt et al., 2021)

Despite robust evidence indicating that people with obesity have unique challenges and norms during the labor process, there is currently a lack of guidance or consensus regarding how this evidence should be translated into intrapartum practice. In the United States, no guidelines for labor management exist specifically for the obese population. ACOG's only intrapartum guidance is found in the 2016 Practice Bulletin on obesity in pregnancy stating, "allowing a longer first stage of labor before performing a cesarean delivery for labor arrest should be considered in obese women". (American College of Obstetricians and Gynecologists [ACOG], 2015, p. E117) Given the dearth of guidelines and increasing number of pregnant people with obesity, it is imperative to accurately and precisely define the unique needs of laboring people with obesity and then tailor intrapartum management in order to facilitate optimal outcomes in this population.

Chapter 3: Theoretical Model and Methodology

Theoretical Model

This project was conducted using the Stetler Model as a guiding theoretical framework. The Stetler Model was first developed in 1976, refined in 1994, then further updated in 2001. The model focuses on how an individual can utilize research to facilitate evidence-based practice. The model consists of a series of critical-thinking and decision-making processes to determine the appropriateness of utilizing research findings to revise clinical practice. (Stetler, 2001) This updated model is summarized and illustrated below.

For this project, the decision-making steps of the Stetler Model were used as a guide to facilitate the formation of evidence- based labor management recommendations for women with obesity in this clinical setting. The table below illustrates the role of each phase of this model in the implementation of this scholarly project.

Table 1

Utilization of the Stetler Model

Phase I: Preparation	● Evaluation of practice setting & areas for improvement in labor management ● Consideration of both the patient and provider population ● Define the purpose for project and goals for improvement in provider knowledge/ attitudes/ practice norms as well as patient outcomes
Phase II: Validation	● Critical analysis of available evidence on the topic ● Literature review and appraisal of evidence available ● Review of current practice recommendations and areas of inconsistency between evidence and practice norms. ● Determination of the gaps in the literature and need for further evidence ● Design of the project in order to augment available literature

Phase III: Evaluation/ Decision Making	• Research is conducted and analyzed • Evaluation of key evidence from literature • Analysis and conclusions drawn from findings from scholarly project research • Determination of evidence which is applicable, high-quality and has potential to be impactful on care provided in this practice setting
Phase IV: Translation/ Application	• Translation of evidence into useable and applicable practice recommendations • Develop tools for dissemination of findings within the organization • Development of avenues for feedback and evaluation • Development of a plan for scale of dissemination beyond this organization
Phase V: Evaluation	• Completion of individual evaluation regarding the process • Establishment of tools and plans for evaluation of impact of practice recommendations on provider knowledge, practice, and patient outcomes

Setting

This project was conducted at the University of New Mexico Hospital (UNMH) labor and delivery (L&D) setting, a 12-bed unit located in Albuquerque, NM, that serves the greater Albuquerque area as well as surrounding small communities. Three provider teams deliver on this unit including the Certified Nurse Midwives (CNM), OB/GYN physicians (OB), and Family Practice physicians (FP). The unit volume is approximately 215 deliveries per month, of which about 25% are cared for by the CNM service, 25% by the FP service, and 50% by the OB service. This project was a retrospective chart review which was conducted using Cerner electronic medical record and Centricity fetal monitoring for labor admission. All chart reviews, data collection, and data analysis were completed by the author.

Study Population

All research subjects are primiparous pregnant people who delivered a singleton term baby at UNMH between March 2020 and October 2021. It is estimated, based on unit data, that approximately 40% of the unit's total patient population has a BMI greater than 30 at the time of labor. In 2020, the unit primary cesarean section rate was 27% while the cesarean section rate for patients who were admitted to the CNM service was 11%. Study inclusion/ exclusion criteria are listed below in Table 2.

Table 2

Study Inclusion/ Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
● Pregnant person 37.0- 41.6 weeks gestational age admitted to UNMH Labor and Delivery ● Parity = 0 ● Planning vaginal delivery ● Singleton, cephalic fetus ● BMI greater than or equal to 30.0 at the time of labor or last prenatal visit (after 36 weeks gestation)	● Breech presentation, placenta previa, or other contraindication to vaginal delivery ● Diabetes on medication (GDMA2) ● Preeclampsia with severe features ● Major fetal anomalies ● No records of prenatal care available ● COVID positive

Study Design and Data Collection

This project was a retrospective review of de-identified health data. A systematic approach to data collection was used to avoid selection bias. Unit delivery logs were first used to identify all primiparous deliveries starting from the time of data collection in October 2021 and working backwards in time. All primiparous deliveries were screened for delivery BMI and, if

within the inclusion criteria range, a full chart review was completed for inclusion and exclusion criteria. All subjects who met inclusion/ exclusion criteria were included, up to 100 per provider type. Subjects were de-identified at the time of data collection. Included subjects delivered between March 2020 and October 2021. A single reviewer, this author, completed all chart reviews to avoid inconsistencies in abstraction of data techniques.

Data Protection

De-identified subject data was stored securely in RedCap software. No patient identifiers were collected at the time of chart review and all subjects were randomly assigned a subject number in RedCap. Access to the data set was restricted to the author and scholarly project chair. For statistical analysis, data was exported into SPSS.

Data Collection Tool

Tables 3 & 4 identify all data that was collected per subject. Subjects with missing data were not included except in the case of some labor times which were limited by the hospital setting and number of cervical exams performed, and could not be calculated for labor that occurred outside of the hospital setting. Times in stages of labor were manually calculated by the author based on recorded cervical exams, beginning with the first cervical exam performed at the time of labor admission. Times were calculated and recorded in minutes. Active labor onset was characterized as a cervical exam of 6cm. If no cervical exam of 6cm was available, an exam of 5-7cm was used to characterize active labor onset. If no cervical exam of 5-7cm was available, then early and active stage 1 labor were not calculated for that subject. Physiologic labor interventions (Table 4) were counted if they were documented by either the nurse or midwife during the subject's labor course. Each intervention was only counted once per subject if documented multiple times over a labor course.

Table 3

Data Collection Tool

Demographics	**Labor Characteristics**	**Time in Labor**	**Physiologic Interventions**
• Age • Race/ Ethnicity • Payment Type • Gravida/ Para • Gestational Age • BMI • Provider Type	• Labor onset type • If spontaneous, was Pitocin used? • If induction, state the indication • If medical induction, state the indication • Delivery route • If cesarean, state the indication • Use of epidural	• Early Stage 1 • Active Stage 1 • Stage 2 • Total	• Number of interventions used • Note which interventions (see table 4)

Table 4

Data Collection Tool for Physiologic Labor Interventions

Physiologic Labor Interventions	
• Ambulation/ upright laboring • Intermittent auscultation • Hydrotherapy • Birth or peanut ball use • Professional labor support • Squat bar	• TENS unit • Breast pump • Oral nutrition • Belly sifting • Hands-on support (counterpressure, massage)

Statistical Analysis

All data was securely stored in REDCap then exported to SPSS for analysis. The statistical methods used to analyze the data are outlined below. The threshold of statistical significance is $p = 0.05$.

Cesarean Rates

In order to compare significant differences in primary cesarean rates across provider type, descriptive statistics was first used to describe the frequency and proportion of cesareans for each provider type. A one-way ANOVA was used to assess whether there is a significant difference between the three groups, with the provider type as the independent variable and cesarean delivery rate as the dependent variable. A Pearson's chi-square test was then run for each provider group to examine whether there was an association between the two categorical variables- labor onset (spontaneous or induced) and delivery type (c-section or vaginal).

Time in Labor

Analysis for time in labor focused on comparing mean overall labor time then mean time in each stage of labor across provider type.This analysis was completed using a one-way ANOVA, run for each labor time frame (overall time in labor, early labor, active labor, and stage 2 labor). Mean time in each phase of labor was described, then statistically significant differences in time across provider type was compared. Post-hoc pairwise comparisons were not run, as no pairs had statistically significant differences in labor times.

Physiologic Labor Interventions

The final statistical analysis tested whether there was any association between vaginal delivery and the number of physiologic labor interventions experienced during labor. An

independent samples *t*-test was used to compare the mean number of physiologic interventions between patients who had a vaginal and cesarean delivery.

Ethics and Human Subjects Protection

This study was a retrospective chart review and did not involve any alterations to patient care during the process of data collection. There is no risk of harm nor is there any direct benefit to the human subjects whose data was included in the study. Minors under the age of 18 were not included in this study.

Chapter 4: Results and Discussion

Results

Subject Demographics

One hundred subjects were included in this study per provider type with a total of 300 subjects included. Key demographic features are visually illustrated in the Appendix (Figure 4-7) and categorized by provider type. The demographic breakdown of subjects was similar between all provider types. Fifty-eight percent of the subjects identified as Hispanic, 20% as White non-Hispanic, and 13% as Native American, with a small number of others (see Figure 4). Inclusion of high numbers of minority subjects is reflective of this community population and may represent a more diverse patient population than other studies on this subject. Age of subjects ranged from 18-42yo, and mean age was around 26yo for all provider groups. Subject payment status was similar across all provider groups, except for self-pay (uninsured) subjects which was higher in the OB and FP groups (17 and 12 subjects respectively) than in the CNM group (2 subjects). Forty five percent of the subjects had Medicaid and 43% had commercial insurance or a managed care plan (see Figure 6). Gestational age at the time of delivery ranged from 37w0d to 41w6d and mean gestational age at delivery was similar across provider groups with average gestational age ranging from 39w2d (OB) to 39w6d (FP) (see Figure 5). Subject BMI ranged from 30-56 and had a very similar mean of approximately 36 across all three provider types, which supports the assumption that these are comparable samples (see Figure 7). For detailed graphic representation of this demographic data, see Appendix, Figures 4-7.

Labor Characteristics

Characteristics of labor including induction and augmentation of labor were examined. Table 5 illustrates the percent of subjects experiencing each type of labor onset within each provider group.

Table 5

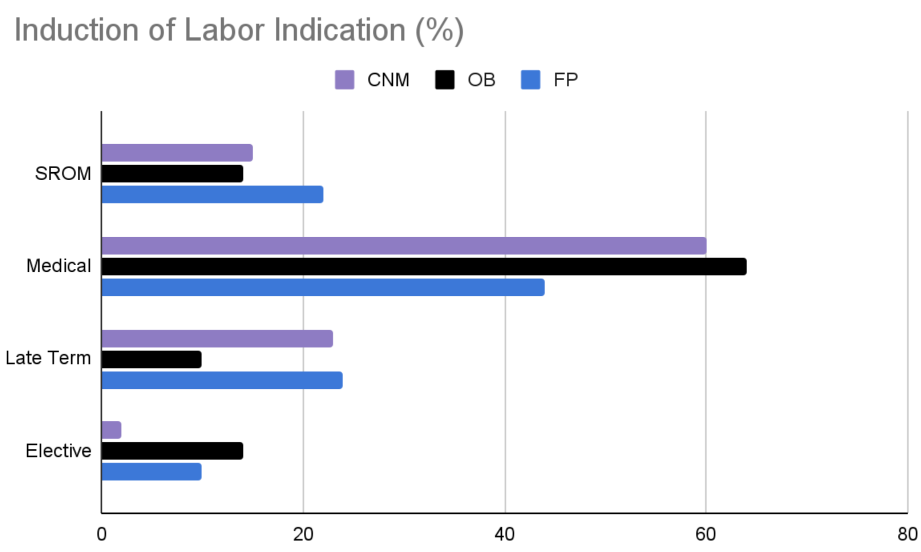
Labor Onset Characteristics

	Induced Labor	**Spontaneous + Pitocin Augmentation**	**Spontaneous Labor without Augmentation**
CNM	52%	26%	22%
OB	74%	19%	7%
FP	59%	23%	18%

This data indicates that OB providers have higher rates of labor induction than midwives or Family Practice MDs, with two thirds of their patients in this sample undergoing induction as compared to just over one half of midwifery patients. Though 19% of patients experienced onset of spontaneous labor with OB care, only 7% delivered spontaneously without Pitocin augmentation whereas about one quarter of midwifery patients delivered without labor augmentation. Reasons for induction of labor are represented below.

Figure 1

Induction of Labor Indication

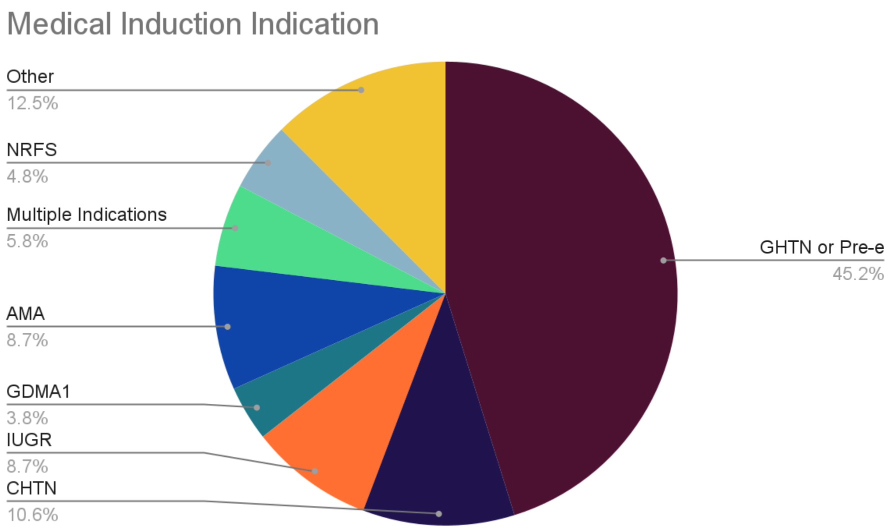


Spontaneous rupture of membranes (SROM) without onset of spontaneous labor accounted for 17% of inductions overall with slightly more occurring in the FP group (22%). Late term inductions occuring after 41 weeks gestation were more common among midwife (23%) and FP (24%) patients than OB patients (10%). This may be because fewer OB patients reached 41 weeks gestation due to more common practice of inducing labor prior to reaching this gestational age. Elective inductions of labor without any medical indication were much less common among midwifery patients accounting for only 1 delivery compared to 14 (OB) and 10 (FP). In all provider groups, the majority of inductions (mean 56%) occurred for a medical indication.

Further examination of the listed medical indications revealed that close to half (45%) were noted to be related to a hypertension disorder of pregnancy, either gestational hypertension (GHTN) or preeclampsia without severe features, as illustrated in Figure 2 .

Figure 2

Medical Induction Indication



Pre-eclampsia and GHTN are characterized by acute onset hypertension after 20 weeks gestation and guidelines recommend induction of labor for this population at the time of diagnosis after 37 weeks gestation because of the risk for severe maternal and fetal complications with worsening hypertension. Patients with severe preeclampsia who would have risked out of midwifery care were not included in this sample. In the total subject population, there were 47 inductions for pregnancy induced hypertension disorders, accounting for 16% of the 300 subjects, which represents a higher proportion than what literature indicates is the national average of 10%. (Lai et al, 2017) This may represent a high prevalence among this demographic population and/or an institutional culture that strictly adheres to diagnosis guidelines and therefore has a higher propensity to diagnose hypertension disorders. The second most common indication for induction was chronic hypertension (CHTN) (11%), which is defined as hypertension diagnosed prior to 20 weeks gestation. This was followed by 9% for both advanced maternal age over 35yo (AMA) and intrauterine growth restriction (IUGR) respectively. All other induction indications, including non-reassuring fetal surveillance (NRFS) accounted for only a few subjects each.

Objectives Outcomes

Cesarean Delivery.

Table 6 illustrates primary cesarean rates across the three provider groups. CNMs had the lowest cesarean rate at 20% and OBs had the highest at 30% with FP MDs in the middle. A one-way ANOVA was run to compare for significant differences in these rates and the difference was not statistically significant (*p=0.26*).

A subgroup analysis of spontaneous versus induced labor was then performed using a Pearson's chi-square test for each provider group to look for associations between induction of labor and cesarean delivery. Among the CNM cohort of subjects, 60% of the subjects who delivered via cesarean had had an induction of labor, whereas among OB patients 93% of cesareans had been induced.

Table 6

Cesarean Rates Across Provider Groups

	C/S Rate	**% of C/S that were Induced**
CNM	20% (n=20)	60% (n= 12)
OB	30% (n=30)	93% (n=28)
FP	24% (n=24)	75% (n=18)
	p= 0.26	

Table 7 shows the results of a Pearson's chi-square test for each provider group. Among the midwife patients, there was no statistically significant association between labor onset type and cesarean delivery (*p=0.42)*. Among FP patients, the c-section rate was double for induced labor, although that difference was not quite statistically significant (*p=0.068*). However, among OB patients there was statistically significant (*p=0.003*) difference between c-section rates in

patients with induced versus spontaneous labor, this had a medium effect size (*Cramer's V = 0.3).*

Table 7

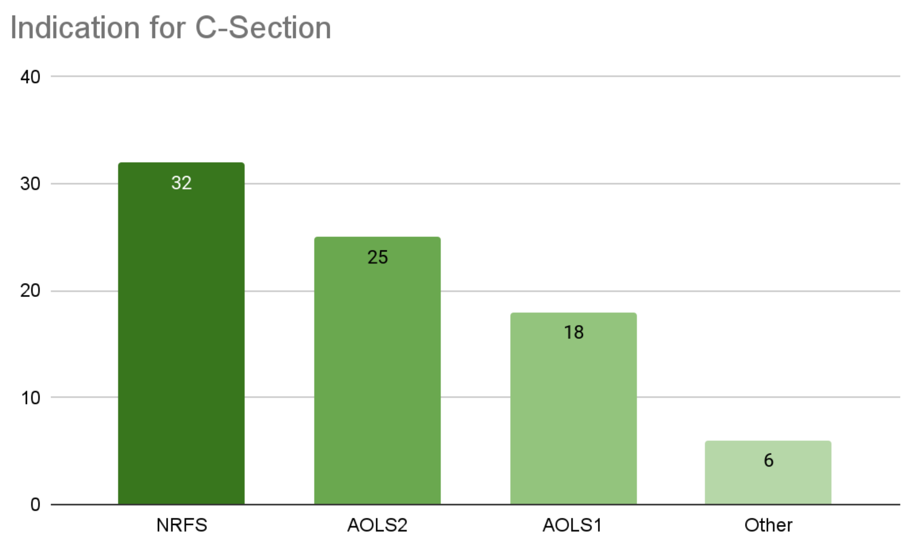
Cesarean Rates for Spontaneous vs Induced Labor by Provider Group

	C/S Rate Spontaneous Labor	C/S Rate Induced Labor	*p*=
CNM	17%	23 %	0.42
OB	**7%**	**38%**	**0.003, Med Effect Size**
FP	15%	30%	0.068

An evaluation of indications for cesarean delivery revealed the most common indication was non-reassuring fetal surveillance (NRFS) followed by arrest of second stage labor (AOLS2) and then arrest of stage 1 labor (AOLS1), see Figure 3. NRFS refers to fetal heart rate tracing that is not reassuring for fetal wellbeing necessitating a cesarean delivery to avoid further fetal distress. AOLS2 is the lack of descent during the pushing phase of labor, while AOLS1 is lack of cervical dilation during the first stage of labor. Criteria for AOLS1 & 2 are strictly defined by ACOG, while NRFS is a more subject assessment of multiple fetal heart rate tracing criteria.

Figure 3

Indication for Cesarean Delivery



Note. Y-axis = number of cesareans. X-axis = Indication

Time in Labor.

Table 8 illustrates findings for mean times in various stages of labor across provider groups. A one-way ANOVA was performed for each stage of labor to assess for differences across provider groups. Homogeneity of variance could not be assumed for early or active labor so Welch's statistic was used to calculate statistical significance for these two stages of labor. There were no statistically significant differences in labor times across provider types in any of the stages of labor analyzed. Although not statistically significant ($p=0.32$), mean total time in labor for CNM patients was noted to be 3 hours longer than either physician group.

Table 8

Mean Time in Each Stage of Labor by Provider Group

HOURS	CNM	OB	FP	p=
Early Stage 1 (0-5cm)	20.6	18.6	20.7	*0.52*
Active Stage 1 (6-10cm)	7.7	6.0	6.9	*0.09*
Stage 2 (Pushing)	1.6	2.0	1.7	*0.34*
Total Labor	25.9	23.4	23.0	*0.32*

Physiologic Labor Interventions.

Physiologic labor interventions were examined among the CNM cohort of subjects. CNM patients were chosen for this portion of analysis because the midwifery approach focuses on support of physiologic labor and little is known about midwifery interventions in this patient population. Table 9 demonstrates the number of subjects receiving each intervention. Use of a birth or peanut ball was the most commonly recorded intervention followed closely by ambulation and then hands on support like massage and counterpressure. Mean number of interventions was almost exactly the same between subjects who delivered vaginally (2.6) versus by cesarean (2.5), as illustrated in Table 10. This was not statistically significantly different ($p=0.3$).

Table 9

Number of CNM Subjects who Received Each Physiologic Intervention

Peanut or Birth Ball	67
Ambulation	62
Massage/ Counterpressure	44
Hydrotherapy	32
Nutrition	31
Doula	8
Squat Bar	7
Belly Sifting	3
Intermittent Auscultation	2
TENS	2

Table 10

Mean Number of Physiologic Interventions by Delivery Type

Mean # Interventions	
Vaginal	2.6
Cesarean	2.5

Interpretation of Findings

The findings of this project indicate that, in our practice setting, like others documented in the literature, people with obesity have non-optimal cesarean outcomes regardless of provider group. Cesarean rates ranged from 20% in the midwifery cohort to 30% in the OB cohort, all of

which are above the World Health Organization's recommendation of 10-15% safe cesarean rate. However, the results of this study did demonstrate that patients cared for by nurse midwives had fewer c-sections as well as slightly longer times in labor, though these results were not statistically significant. The midwifery model of care was evident in the examination of labor characteristics as 52% of subjects experienced induction of labor and one quarter delivered without Pitocin augmentation as opposed to 75% induced and 7% delivered without Pitocin among OB patients. Statistically significantly increased equity of birth outcomes was noted between induction and spontaneous labor patients when cared for by midwives, whereas in OB patients, induction of labor was significantly associated with cesarean delivery. In most outcomes examined, care from Family Practice MDs showed outcomes that were intermediate between midwifery and OB care.

The three provider groups did not have statistically significantly different mean times in any stage of labor, which is likely reflective of a unit culture that adheres rather strictly to ACOG labor progress guidelines. Mean times in early stage 1 labor averaged around 20 hours, which is consistent with what is known about long latent stages of labor among primiparous patients with obesity. Among midwife patients, mean time in active labor was 1-2 hours longer and mean total labor time was 3 hours longer than patients in physician groups, although these differences were not statistically significantly different.

A mean of 2-3 physiologic labor interventions were documented for midwife patients regardless of delivery outcome. This small number demonstrates that there is a need to optimize the support of physiological interventions during labor in this patient population. This is consistent with previous literature that has demonstrated that midwives feel less comfort following physiologic birth recommendations when managing labors affected by obesity.

(Reither et al., 2018) Other factors that certainly affected these rates are under documentation by nurses and providers. Interventions like oral nutrition and ambulation may not have been viewed by staff as worthy of documentation. This data was also collected during the first two years of the COVID pandemic, and although no COVID positive patients were included in this sample, practices of spending time in close proximity to patients supporting labor were likely altered in this time, and patients had greater restrictions on support people and ambulation that prior to the pandemic.

Implications for Practice

Utilizing the available evidence in the existing literature as well as findings from this study, I have compiled the below summary of practice recommendations for use within the UNMH Labor and Delivery practice setting (Table 11). These recommendations are intended to augment our knowledge base and to stimulate critical thinking among healthcare providers in this setting about how to optimize birth outcomes for primiparous patients with obesity. Though many of these recommendations may be generalizable to obstetric care, they were created with intention for use within UNMH.

Table 11

Clinical Practice Recommendations

Clinical Practice Recommendations	
❖ People with obesity have different physiologic norms in labor ❖ Labor may progress slower than established norms especially in early labor - ACOG labor guidelines were not based on this population ❖ Consider using more cervical ripening and labor stimulating medications than is standard ❖ If the laboring diad is doing well, allow more time in Stage 1 Labor ❖ Discuss this time flexibility openly with the patient and the team ❖ Think critically about progress in the second stage- overestimation of macrosomia and challenges assessing station through maternal tissue may bias us towards AOLS2	❖ C-section rates are higher during inductions of labor ❖ Strongly consider what is medically necessary for induction ❖ Discourage elective inductions ❖ Inform patients of the association between induction and c-section ❖ Midwifery care decreases c-sections during IOL- incorporate the midwifery model of care when possible ❖ Physiologic labor interventions are underutilized in this population- encourage intentional use ❖ Bias impacts how we care for people with obesity and it must be acknowledged, examined, and dismantled

Optimal care for laboring people with obesity begins in the prenatal period. Sharing available evidence with our patients helps to set expectations for labor progress and empowers patients to make decisions regarding their labor that may ultimately affect labor outcomes. Specifically, I recommend that prenatal providers speak clearly with patients about expectations regarding time in labor, reinforce the normalcy of long labor, discuss how an individual's unique physiology affects how the uterus contracts, and normalize the need for patience and sometimes the need for high doses of labor stimulating medication. This conversation is increasingly

important for patients with the highest BMIs as literature has clearly established cesarean rates increasing with increasing BMIs. People with obesity who are planning an induction of labor for any reason should be informed that there may be an association between induction of labor and cesarean delivery and shared decision making should be utilized to decide whether the benefits of induction outweigh the benefits of spontaneous labor. Based on the literature on this topic, I recommend avoiding induction except in the setting of strong medical necessity. Inductions for indications such as advanced maternal age or history of chronic hypertension in a currently normotensive patient should be critically examined by providers with consideration for informed patient preferences. This study demonstrated that during induction of labor, midwifery care facilitated more equitable cesarean outcomes that care from a physician. Efforts should be made by all providers to understand differences in the midwifery approach to induction of labor and to emulate that model when possible.

In the labor and delivery setting, providers should first, and constantly, examine their own bias. Bias about fatness and about what larger bodies can and cannot do certainly affects the way that providers view and interact with patients with obesity. Without an awareness of our own existing prejudice, we cannot dismantle it. I recommend that expectations about the physiologic norms of laboring people with obesity be routinely incorporated into how we frame labor progress and the need for labor stimulating medications. Providers should use their knowledge of the physiologic changes associated with obesity to inform their understanding that patients, especially at higher levels of obesity, may need more cervical ripening and more contraction stimulating medications and consider giving higher doses than unit standards in the setting of maternal and fetal wellbeing.

When assessing labor progress for this population, I encourage providers to remember that ACOG labor progress guidelines were not developed based on this population and likely do not reflect the normal physiologic progress of a person with obesity. If the laboring diad is doing well and the patient desires to continue labor, I highly recommend providers allow more time in stage 1 labor and think critically about whether a compelling indication for cesarean delivery exists even if the patient meets ACOG criteria for arrest of labor. This decision making process should be transparent among the healthcare team and with the patient and family. Providers should consider the increased risks of surgical delivery among these patients in their decision making process. Results of this study at UNMH indicate that arrest of labor during pushing is the second most common indication for cesarean for cesarean delivery in our setting, which is not a trend that is supported by national literature. While many studies have established that people with obesity have higher cesareans for arrest of stage 1 labor, obesity is not thought to significantly impact the ability of the fetus to descend through the maternal pelvis during pushing. If a cesarean is being considered for stage 2 arrest of labor, I encourage providers to consider what information is informing that decision and examine whether the same decision might be made in a patient who did not have obesity. Obesity makes estimation of fetal size more difficult and may bias providers towards overestimating fetal macrosomia and approaching the second stage of labor with underlying trepidation about birth complications. Assessment of fetal descent may also be more difficult in the context of more maternal pelvic adiposity, and I encourage providers to seek an assessment from another provider during pushing if true arrest of descent is suspected.

Finally, the findings of this study and the lack of national literature on physiologic labor in people with obesity, indicate that we all have work to do in supporting physiologic labor in

this population. I recommend approaching these patients with a conscious intention to support physiologic labor whenever possible and to communicate this intention with the whole healthcare team. Informing the patient of their options for things such as ambulation, intermittent auscultation, nutrition, professional labor support, and use of labor balls should happen both prenatally and in the labor setting.

Suggestions for Further Research

This study represents a start to understanding how we can optimize outcomes for patients with obesity within our practice setting. Further analysis with stratification by obesity class would augment our understanding of how levels of obesity affect outcomes in this setting, especially as other studies have demonstrated increasing cesarean rates with increasing obesity class. Further research is also needed to understand why the midwifery model of care produced significantly more equitable delivery outcomes during induction of labor. My hypothesis that midwives allow significantly more time in labor did not prove to be true on analysis of labor times, necessitating investigation of what other differences in care can be found during induction of labor.

Importantly, this project did not examine maternal or neonatal morbidity outcomes. Vaginal birth outcomes are important but improved morbidity for parents and babies is the ultimate goal so further investigation including outcome data such as APGAR scores, infection rates, postpartum hemorrhage, and surgical complications is needed in the future. Finally, the goal of this project was to create recommendations that will lead to practice change. Demonstration of that change and of subsequent outcomes after implementation of these recommendations would be of great interest in the future.

Strengths and Limitations

This project was designed to have findings that are directly applicable to guiding practice change at UNMH as well as to contribute to the body of national literature on this topic. One strength is that it included a total of 300 subjects and was powered to have significant findings. Moreover, the patient population at UMMH is more demographically diverse with more Hispanic and Native patients than many other research settings, so findings are expected to be more specific to this patient population than generalized results from other studies. Additionally, given the lack of literature on midwifery management of laboring people with obesity, this study has potential to add important information to the knowledge base and increase understanding of the role of midwives in caring for this population.

It is important to acknowledge that conclusions drawn from this study cannot definitively imply causality due to the retrospective nature of the study. Results from this single setting study, although important for the institution concerned, may not be generalizable to other institutions or patient populations. The study aimed to only include low to moderate risk laboring patients in order to eliminate significant differences in risk factors among provider groups, but it is possible that some differences in risk factors remained. For example, patients with substance use disorder, who are not cared for by midwives in this setting, were not excluded from this study. Additionally, data was all collected during the COVID pandemic, and it is possible that practice norms during this time were somewhat different than "normal" unit practice due to pandemic -related changes. Moreover, as with any retrospective study, under documentation and incorrect documentation is likely to have occurred in this sample and could not be controlled for. Finally, as previously noted, morbidity outcomes were not examined in this study.

Conclusion

In conclusion, this scholarly project focused on factors associated with vaginal delivery in a population of primiparous people with obesity who delivered at UNMH in 2020-2021. Cesarean rates were found to range from 20-30% and were lower among midwifery patients than OB patients, though differences across the three provider types were not statistically significantly different. Induction of labor was found to occur in about half of CNM patients compared to 75% of OB patients and midwifery care was associated with significantly more equitable outcomes during induction of labor, while in OB patients induction of labor was associated with risk for cesarean delivery. Mean times in labor were not statistically significantly different among provider groups and are consistent with other literature that indicate that primiparous people with obesity often have long labors. Physiologic labor interventions were under-utilized among midwifery patients and were not associated with vaginal delivery. These findings as well as the existing body of literature were used to inform clinical practice recommendations that will hopefully contribute to improved outcomes for this unique patient population at UNMH labor and delivery.

References

American College of Obstetricians and Gynecologists. (2015). *Obesity in pregnancy* (Number 156, reaffirmed 2018) [Practice Bulletin]. Wolters Kluwer Health, Inc.

Carlson, N. S., Breman, R., Neal, J. L., & Phillippi, J. C. (2019). Preventing cesarean birth in women with obesity: Influence of unit‐level midwifery presence on use of cesarean among women in the consortium on safe labor data set. *Journal of Midwifery & Women's Health*, *65*(1), 22–32. https://doi.org/10.1111/jmwh.13022

Carlson, N. S., Corwin, E. J., & Lowe, N. K. (2017a). Labor intervention and outcomes in women who are nulliparous and obese: Comparison of nurse‐midwife to obstetrician intrapartum care. *Journal of Midwifery & Women's Health*, *62*(1), 29–39. https://doi.org/10.1111/jmwh.12579

Carlson, N. S., Corwin, E. J., & Lowe, N. K. (2017b). Oxytocin augmentation in spontaneously laboring, nulliparous women: Multilevel assessment of maternal bmi and oxytocin dose. *Biological Research For Nursing*, *19*(4), 382–392. https://doi.org/10.1177/1099800417701831

Carlson, N. S., Hernandez, T. L., & Hurt, K. (2015). Parturition dysfunction in obesity: Time to target the pathobiology. *Reproductive Biology and Endocrinology*, *13*(1). https://doi.org/10.1186/s12958-015-0129-6

CDC. (2018). *Behavioral Risk Factor Surveillance System (BRFSS)* (Obesity among women of childbearing age). https://doi.org/https://www.cdc.gov/obesity/data/surveillance.html

Centers for Disease Control and Prevention. (2020). *Defining Adult Overweight and Obesity* (Updated September 17, 2020). CDC.

https://doi.org/https://www.cdc.gov/obesity/adult/defining.html

Chu, S. Y., Kim, S. Y., Schmid, C. H., Dietz, P. M., Callaghan, W. M., Lau, J., & Curtis, K. M. (2007). Maternal obesity and risk of cesarean delivery: A meta-analysis. *Obesity Reviews*, *8*(5), 385–394. https://doi.org/10.1111/j.1467-789x.2007.00397.x

Ellis, J. A., Brown, C. M., Barger, B., & Carlson, N. S. (2019). Influence of maternal obesity on labor induction: A systematic review and meta-analysis. *Journal of Midwifery & Women's Health*, *64*(1), 55–67. https://doi.org/10.1111/jmwh.12935

Graves, B. W., DeJoy, S. A., Heath, A., & Pekow, P. (2006). Maternal body mass index, delivery route, and induction of labor in a midwifery caseload. *Journal of Midwifery & Women's Health*, *51*(4), 254–259. https://doi.org/10.1016/j.jmwh.2005.11.008

Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2020). *Prevalence of obesity and severe obesity among adults: United States, 2017-2018*. NCHS Data Brief No. 3. https://www.cdc.gov/nchs/products/databriefs/db360.htm

Hermann, M., Le Ray, C., Blondel, B., Goffinet, F., & Zeitlin, J. (2015). The risk of prelabor and intrapartum cesarean delivery among overweight and obese women: Possible preventive actions. *American Journal of Obstetrics and Gynecology*, *212*(2), 241.e1–241.e9.

Hill, M., Reed, K. L., & Cohen, W. R. (2015). Oxytocin utilization for labor induction in obese and lean women. *Journal of Perinatal Medicine*, *43*(6). https://doi.org/10.1515/jpm-2014-0134

Jevitt, C. M., Stapleton, S., Deng, Y., Song, X., Wang, K., & Jolles, D. R. (2021). Birth outcomes of women with obesity enrolled for care at freestanding birth centers in the United States. *Journal of Midwifery and Women's Health*, *66*, 14–23.

Kominiarek, M. A., VanVeldhuisen, P., Hibbard, J., Landy, H., Haberman, S., Learman, L.,

Wilkins, I., Bailit, J., Branch, W., Burkman, R., Gonzalez-Quintero, V., Gregory, K., Hatjis, C., Hoffman, M., Ramirez, M., Reddy, U. M., Troendle, J., & Zhang, J. (2010). The maternal body mass index: A strong association with delivery route. *American Journal of Obstetrics and Gynecology*, *203*(3), 264.e1–264.e7. https://doi.org/10.1016/j.ajog.2010.06.024

Kominiarek, M. A., Zhang, J., VanVeldhuisen, P., Troendle, J., Beaver, J., & Hibbard, J. U. (2011). Contemporary labor patterns: The impact of maternal body mass index. *American Journal of Obstetrics and Gynecology*, *205*(3), 244.e1–244.e8. https://doi.org/10.1016/j.ajog.2011.06.014

Lai, C., Coulter, S. A., & Woodruff, A. (2017). Hypertension and pregnancy. *Texas Heart Institute Journal*, *44*(5), 350–351. https://doi.org/10.14503/thij-17-6359

Lassiter, J. R., Holliday, N., Lewis, D. F., Mulekar, M., Abshire, J., & Brocato, B. (2015). Induction of labor with an unfavorable cervix: How does bmi affect success? *The Journal of Maternal-Fetal & Neonatal Medicine*, *29*(18), 3000–3002. https://doi.org/10.3109/14767058.2015.1112371

Norman, S. M., Tuuli, M. G., Odibo, A. O., Caughey, A. B., Roehl, K. A., & Cahill, A. G. (2012). The effects of obesity on the first stage of labor. *Obstetrics & Gynecology*, *120*(1), 130–135. https://doi.org/10.1097/aog.0b013e318259589c

Reither, M., Germano, E., & DeGrazia, M. (2018). Midwifery management of pregnant women who are obese. *Journal of Midwifery & Women's Health*, *63*(3), 273–282. https://doi.org/10.1111/jmwh.12760

Roloff, K., Peng, S., Sanchez-Ramos, L., & Valenzuela, G. J. (2015). Cumulative oxytocin dose during induction of labor according to maternal body mass index. *International Journal*

of Gynecology & Obstetrics, *131*(1), 54–58. https://doi.org/10.1016/j.ijgo.2015.04.038

Souter, V., Nethery, E., Kopas, M., Wurz, H., Sitcov, K., & Caughey, A. B. (2019). Comparison of midwifery and obstetric care in low-risk hospital births. *Obstetrics & Gynecology*, *134*(5), 1056–1065. https://doi.org/10.1097/aog.0000000000003521

Stamilio, D. M., & Scifres, C. M. (2014). Extreme obesity and postcesarean maternal complications. *Obstetrics & Gynecology*, *124*(2, PART 1), 227–232. https://doi.org/10.1097/aog.0000000000000384

Stetler, C. B. (2001). Updating the stetler model of research utilization to facilitate evidence-based practice. *Nursing Outlook*, *49*(6), 272–279. https://doi.org/10.1067/mno.2001.120517

Teefey, C. P., Reforma, L., Levine, L. D., Srinivas, S. K., & Durnwald, C. P. (2018). 411: Risk factors associated with cesarean delivery after induction of labor in women with class iii obesity. *American Journal of Obstetrics and Gynecology*, *218*(1), S251. https://doi.org/10.1016/j.ajog.2017.10.347

Wispelwey, B. P., & Sheiner, E. (2012). Cesarean delivery in obese women: A comprehensive review. *The Journal of Maternal-Fetal & Neonatal Medicine*, *26*(6), 547–551. https://doi.org/10.3109/14767058.2012.745506

Zhang, J., Bricker, L., Wray, S., & Quenby, S. (2007). Poor uterine contractility in obese women. *BJOG: An International Journal of Obstetrics & Gynaecology*, *114*(3), 343–348. https://doi.org/10.1111/j.1471-0528.2006.01233.x

Appendix

Study Population Demographics

Figure 4

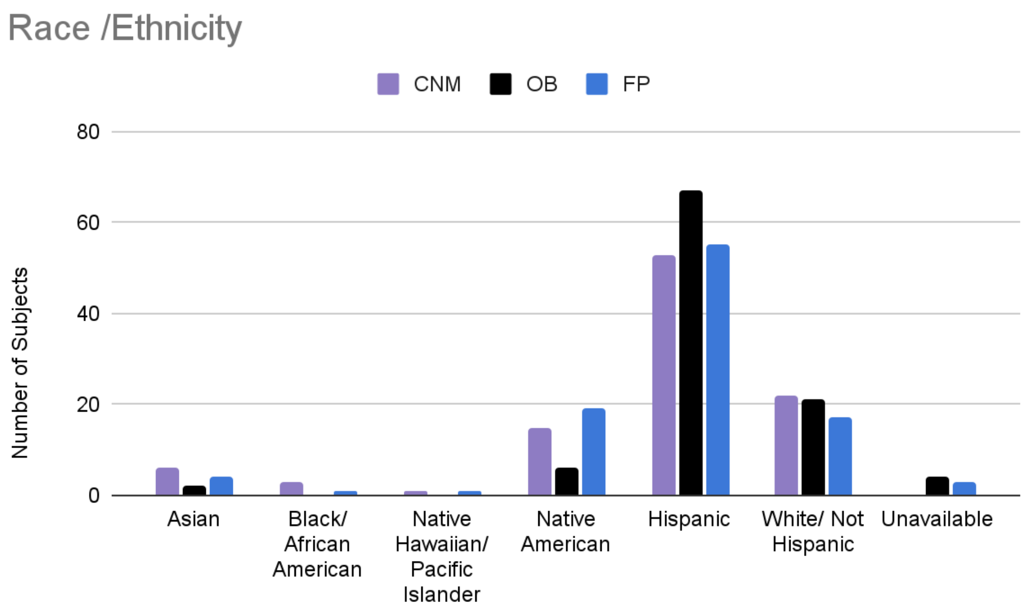


Figure 5

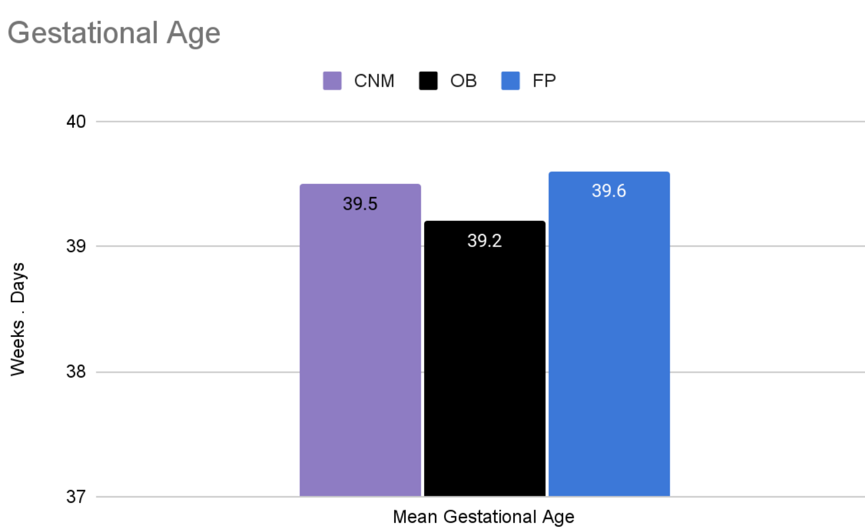


Figure 6

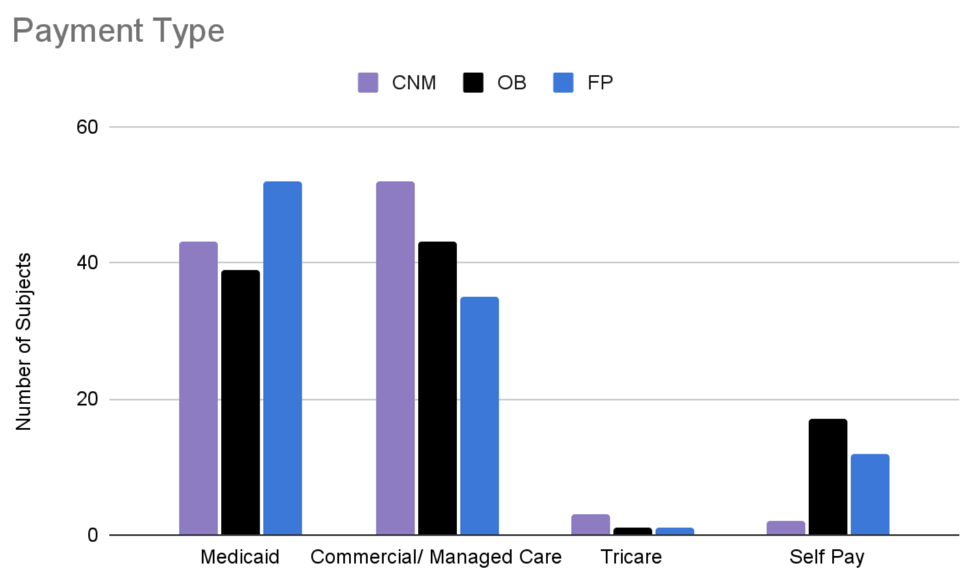


Figure 7