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Physician-led, hospital-linked, birth care centers can decrease Cesarean section rates without increasing rates of adverse events

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Abstract

BACKGROUND—This study compares outcomes at a hospital-linked, physician-led, birthing center to a traditional hospital labor and delivery service.

METHODS—Using de-identified electronic medical records, a retrospective cohort design was employed to evaluate 32,174 singleton births during 1998–2005.

RESULTS—Compared to hospital service, birth care center delivery was associated with a lower rate of cesarean sections (adjusted Relative Risk =0.73, 95 percent confidence interval 0.59–0.91; $p<0.001$) without an increased rate of operative vaginal delivery (adjusted Relative Risk=1.04, 95 percent confidence interval 0.97–1.13; $p=0.25$) and a higher initiation of breast feeding (adjusted Relative Risk = 1.28, 95 percent confidence interval 1.25–1.30 ($p<0.001$)). A maternal length of

stay greater than 72 hours occurred less frequently in the birth care center (adjusted Relative Risk =0.60, 95 percent confidence interval 0.55–0.66; $p<0.001$). Comparing only women without major obstetrical risk factors, the differences in outcomes were reduced but not eliminated. Adverse maternal and infant outcomes were not increased at the birth care center.

CONCLUSION—A hospital-linked, physician-led, birth care center has the potential to lower rates of cesarean sections without increasing rates of operative vaginal delivery or other adverse maternal and infant outcomes.

Keywords

hospital-linked; birth care center; delivery; obstetric; pregnancy outcome; physician

INTRODUCTION

Birth care centers provide a more comfortable, less hospital-like, and more cost-effective setting for low risk pregnancies and deliveries. Since the 1970s, the number of birth care centers has increased as more women have opted for an environment that provides a family-oriented approach to childbirth, however the percentage of births in birthing centers has generally declined in the U.S. since 1990.(1) The efficacy of this approach in comparison with hospital-based delivery has been evaluated using randomized trials and large cohort studies in Europe, New Zealand, Australia, Canada, the United States and other countries. (2–4) To encourage the best use of resources, birth care centers are geared to the low-risk parturient who would generally be expected to require fewer obstetric interventions. The goal is to provide a safe vaginal birth for both the mother and her infant.

Many studies have demonstrated the efficacy of this approach for management of the low-risk parturient when compared to the more traditional hospital-based delivery.(2–9) In 1989 the National Birth Center Study examined the clinical outcomes for nearly 12,000 women in 84 birth care centers in the United States.(10) The researchers concluded that birth care centers were a safe alternative to hospital delivery. In the Stockholm Birth Center Trial, 1,860 low-risk women were randomly assigned to either birth care center or standard maternity care.(11, 12) Women in the birth care center had fewer interventions during labor, the labor was an average of one hour longer, and postpartum stays were shorter. Despite these factors, there were no significant differences in the episiotomy rate, infant Apgar scores or birth weight. However, they did report a higher rate of perinatal death and serious morbidity (Odds Ratio=3.55, $p<0.03$) among infants born at birth care center. A 10-year observational study was conducted by Gottvall et al.(5) among the same birth care centers included in the Stockholm Birth Center Trial to further investigate perinatal mortality. In this follow-up, the authors did not find the overall perinatal mortality rate to be elevated among births at the birth care center. When the findings were adjusted for maternal age and gestation in multivariate regression analysis, only the perinatal mortality of primiparas was significantly elevated (Odds Ratio=2.2, 95 percent confidence interval 1.3–3.9). More recently, the Birthplace in England Study compared births during 2008–2010 among healthy low-risk women in hospital obstetric services ($n=19,706$ births), midwifery birth centers located on a hospital site with an obstetric unit ($n=16,710$ births), free-standing birth care centers led by midwives ($n=11,282$) and at home ($n=16,840$). (13) The combined outcome of

perinatal mortality and intrapartum-related serious morbidity was increased among home births, but there was no difference in these adverse events when comparing either type of birth care center to hospital obstetric care regardless of parity.

Information on a hospital-linked physician-led care in a birth care center setting has not been previously reported. This study examines the strengths and limitations of this alternate model for a birth care center compared with standard in-hospital care. This study is unique in the literature because on-site physician services were available to treat conditions, which required intrapartum and postpartum transfer in previous research involving midwife-led birth care centers. While a significantly different approach to the classic construct for birth care centers (14, 15) and the types of procedures normally associated with them, this alternative to hospital labor is an emerging construct. The hypothesis in this study was that maternal and neonatal outcomes are equivalent among comparable low-risk parturients at this type of birth care center and the hospital.

METHODS

A retrospective cohort study was conducted at a large hospital in Wichita, Kansas, (Wesley Medical Center), a privately-owned medical center and its affiliated birth care center. The medical center serves as a tertiary referral center for obstetrical and neonatal care and is located in Wichita, Kansas (population 350,000), and serves the city and the surrounding rural areas in south-central Kansas and northern Oklahoma. The medical center is the base for the only obstetrics and gynecology physician residency program in the region, which is affiliated with the University of Kansas School of Medicine-Wichita. The medical center provides approximately 5,000 to 8,000 deliveries annually. Although one other hospital system provides labor and delivery services in the region, Wesley Medical Center provides the only birth care center.

At Wesley Medical Center prenatal care occurs in a variety of outpatient centers and is not limited by intended delivery site. Labor and delivery care at the birth care center and hospital service is provided by private physicians, and obstetrics/gynecology and family practice residents, and their attending physicians. Approximately, one percent of the deliveries at the birth care center are managed by a certified nurse midwife. Each type of provider performs deliveries at both the birth care center and hospital service. The hospital service is located in the main hospital and is staffed to provide monitoring and care for high-risk patients. There are 20 hospital service suites with 6 triage rooms and 3 operating rooms. After a patient delivers and is stable, she is transferred to a postpartum unit located on floors directly above the hospital service suites.

The birth care center at Wesley Medical Center was opened in 1996 to provide a safe, cost-effective, family-centered birthing experience for the low-risk pregnant woman and her family. It houses 20 labor-delivery-recovery-postpartum suites and two operating rooms. While the concept of having a birth care center in close physical proximity to a hospital is not unique, the combination of staffing and care philosophy at this facility offers an alternative to either traditional hospital or birth care center by attempting to maximize the benefits of each. Physician-led and located across the street from the hospital, the birth care

center is connected by a service tunnel to the hospital for the convenience of the staff and for the transfer of patients as needed. Both the birth care center and hospital service have state of the art medical technology including electronic fetal monitoring equipment. Although a low-risk pregnancy can be managed at either location, the birth care center was designed to allow a parturient more flexibility to develop a birth care plan. The birth care center is equipped equivalent to a hospital service, but the décor makes this equipment less imposing for the woman and her family. Analgesia and neonatal infant care are promptly available at the birth care center and its two operating rooms are available, should the need arise.

There are few nurse midwives in south central Kansas and no local midwifery training programs existed during the study period. Physician care at the birth care center is provided by private physicians and the residents in the obstetrics/gynecology and family medicine training programs supervised by attending physicians. Prenatal care is not limited by intended delivery location, and most of the outpatient practices are owned independently of the medical center. Family physicians practice at the birth care center side-by-side with obstetricians who provide consultations for family medicine patients when requested. The hospital service is solely staffed by obstetricians. Nursing care is primarily site-based: outpatient nurses are members of prenatal teams, and the inpatient obstetrical nurses tend to work at the birth care center or the hospital service but not both. However, frequent medical center-based continuing education and quality improvement activities involving nurses, attending physicians and the residency training programs have a unifying influence on practice patterns across the two delivery sites.

The study was reviewed and approved by the institutional review board (Human Subjects Committee number 220060965). Data was reviewed, entered, and verified by a Registered Nurse prior to analysis. A de-identified extract of the records was analyzed using the Statistical Package for Social Sciences, Version 15.0. (16) Antenatal transfers from the birth care center to hospital service for intrapartum risk-related reasons were analyzed separately. Subgroup analyses were conducted among low-risk parturients in the study population. Low risk was defined according to literature criteria(17) as spontaneous labor between 37–41.9 weeks gestation, maternal age 20–34 years, pre-pregnancy body mass index $<35 \text{ kg/m}^2$, parity <5 , afebrile on arrival, vertex fetal presentation, no placenta previa or abruption, no other contraindication to vaginal delivery, no preeclampsia or eclampsia and no prior history of cesarean delivery, pregestational or gestational diabetes, chronic hypertension or preterm birth.

The dataset consisted of 37,455 deliveries, which occurred between January 1998 through June 2005. We excluded multiple-gestation deliveries and elective cesareans because these deliveries are not permitted in the birth care center. Also excluded were pre-viable fetuses (<20 weeks gestation or $<500 \text{ g}$), fetal deaths before admission and deliveries lacking usable information on the site to which the mother presented or delivered. This yielded a study population of 32,174 deliveries (98.9 percent of the medical center's 32,524 singleton births, which had delivery modes other than elective cesarean section).

An intention-to-treat analysis was conducted by comparing maternal and neonatal outcomes according to the site at which the mother presented. Univariate comparisons for categorical

variables were made using Pearson's Chi-square tests and by Mann-Whitney U tests for continuous variables. Binary logistic regression (18) was used to adjust for confounding by maternal age, race, parity (0, 1–2 or more than 2 births), pre-pregnancy body mass index, pre-gestational or gestational diabetes, preeclampsia or eclampsia, malpresentation, type of labor (induced, augmented or spontaneous) and prematurity (< 37 weeks estimated gestational age). Models comparing the risk of infant admission to the high-risk nursery and prolonged maternal length of stay additionally adjusted for presence of fetal intolerance during labor and slow or failed progress in labor. To derive approximate relative risks conveyed by predictors when outcomes occurred at prevalence of 10 percent or greater in the unexposed group, the adjusted odds ratios were corrected using the formula, Adjusted Relative Risk = Adjusted Odds Ratio/[$(1-PO) + (Adjusted\ Odds\ Ratio \times PO)$] (19). All statistical tests were two-tailed and used an alpha of 0.05.

RESULTS

There were 14,326 deliveries among women who presented to the birth care center and 17,838 deliveries among women who presented to the hospital service. Over the study period, the proportion of deliveries has ranged from approximately 40 to 52 percent in the birth care center. Based on an intention-to-treat analysis, birth care center deliveries had fewer risk factors, such as maternal age <20 years, obesity, diabetes or gestational age <37 weeks, and were less likely to have preeclampsia or eclampsia (Table 1). Labor induction, artificial rupture of membranes and direct fetal monitoring were less common among the birth care center deliveries. Intrapartum events requiring a higher level of surgical intervention were less common, but not absent at the birth care center. There was a need for general anesthesia in 51 cases during the 6.5 year study period (average: 8 cases per year) and emergent cesarean section in 134 cases (average: 21 cases per year). Regional or intrathecal analgesia was commonly provided (Table 1) and in most of these cases, epidural analgesia was administered. Cesarean sections were less likely to be performed at the birth care center (7.4 percent versus 17.4 percent at the hospital service).

Because of the differences in age, race, and parity in the birth care center group versus the hospital service group, risk-adjusted outcomes are shown in Table 2. Adjusted analysis found no increase in assisted vaginal deliveries at the birth care center. There was also no significant difference in the risk for shoulder dystocia between the two delivery sites. Location of delivery did not influence the adjusted relative risk for having an operative vaginal delivery, but cesarean section remained significantly less likely at the birth care center. Because fewer neonates delivered in the birth care center had low Apgar scores, the rate of those requiring transfer to the high-risk nursery was less than for hospital service births.

Length of stay for vaginal deliveries was a median of 39 hours in the birth care center and 47 hours in hospital service ($p < 0.001$). For women who had non-elective cesarean sections, the median length of stay was 77 and 80 hours in the birth care center and hospital service, respectively ($p < 0.001$). The risk for maternal length of stay >72 hours among all patients admitted to the birth care center was lower than that at hospital service when differences in risk were controlled (Table 2).

Most deliveries occurred at the site to which the mother presented. For the 501 cases (1.6 percent of all deliveries) in which hospital service-presenting women were transferred antenatally to birth care center, the primary reason for transfer was listed as “at capacity” (58.3 percent) or “patient request” (40.9 percent). For the 698 cases (2.2 percent of all deliveries) in which the mother was transferred from the birth care center to hospital service antenatally, the primary reason for transfer was listed as “high risk” (63.3 percent), “induction” (21.1 percent), “therapeutic rest” (7.2 percent) or “at capacity” (4.9 percent). For the remaining 0.8 percent of transfers from hospital service to birth care center and the 3.5 percent of transfers from birth care center to hospital service, another reason for transfer was listed or the reason was missing.

If the mother was transferred from the birth care center to hospital service, there was no greater risk that the infant needed care in the high-risk nursery (multivariate Relative Risk= 1.08, 95 percent Confidence Interval 0.74–1.57) adjusted for maternal age, race, parity, pre-pregnancy body mass index, pre-gestational or gestational diabetes, preeclampsia, malpresentation, prematurity, fetal intolerance and slow or failed progress in labor). Maternal length of stay was not increased if the mother was transferred from the birth care center to hospital service (Relative Risk for maternal length of stay >72 hours, adjusted for the above risk factors, 0.78, 95 percent Confidence Interval 0.53–1.16). The strongest risk factors for transfer from the birth care center to hospital service were characteristics identifiable shortly after admission (preeclampsia, prematurity, diabetes, requirement for labor induction, obesity and previous cesarean section (Table 3). No association was observed between transfer from the birth care center to hospital service and intrapartum characteristics such as slow progress in labor or fetal intolerance.

Breastfeeding was initiated by 72.8 percent of women admitted to the birth care center compared to 53.7 percent of women admitted to the hospital service ($p<0.001$, Table 1). Length of stay for vaginal deliveries was a median of 39 hours in birth care center group and 47 hours in the hospital service group ($p<0.001$). For non-elective cesarean sections, the median lengths of stay were 77 and 80 hours in the birth care center and hospital service groups, respectively ($P<0.001$).

DISCUSSION

While other studies have been published on birth care centers located in close proximity to delivery hospitals(20) to our knowledge, no published studies have compared a physician-led, hospital-linked birthing center with the standard hospital based delivery. This model for a birth care center is different from more classic constructs for such facilities.(14, 15) by offering augmentation and analgesia, thus eliminating two common reasons for initiating mid-delivery transfers. In 2003 Jackson et al.(21) published a prospective cohort study of low-risk, low-income women who received care in either a birth care center or a traditional hospital setting. Although some of the care was provided by a certified nurse midwives, some patients may also have been seen by obstetricians. A breakdown for the services provided by each type of health care provider was not given. In a 2004 study data from a birth care center was evaluated, but there was no comparison group presented.(6) In that study, obstetricians were involved in 15 percent of the cases. A study by Garite et al. (22)

reported their experience with a certified nurse midwife-led birth care center. In that study, physicians did not have direct patient contact, but were available for phone consultation with the nurse midwives. There was also no comparison group in the report.(22) A Missouri study evaluated home, hospital and birth care center deliveries, but did not provide separate analyses for the hospital and birth care center outcomes.(23)

Alternative delivery settings have been attractive to low-risk parturients for many years. The use of birth care centers remains prevalent in some countries (6–8, 13, 24, 25), but in the United States, fewer than one percent of deliveries occur in birthing centers(1). Our center experienced a modest downward trend in use of our birth care center during the study period. This is consistent with trends in the United States where the small percentage of births in birthing centers has declined somewhat since 1990.(1) Local dynamics in our catchment area during recent years may also have played a role, including physicians with different preferences joining the medical staff, managed care contracts requiring hospital delivery and other factors.

We found that the women who chose to use the birth care center were more likely to be older, primiparas, and more likely to be white. These findings are similar to that found in the Australian study by Laws et al.(8) In a German study women selecting a birth care center were found to have come from a higher socioeconomic background, were older, and better educated.(7) Socioeconomic status was not directly available from our database. Our birth care center is hospital-linked in a separate building from the hospital, but connected to it by a service tunnel. This type of facility may attract slightly different populations than wholly freestanding sites or centers. (5, 11, 12)

Episiotomy rates in the birth care center were slightly higher than in the hospital service, but were half the national rate of 24.5%.(26) The reason for our low rate can not be determined from this study, but is likely due to practice patterns, which adapted to contemporaneous publications and recommendations for limiting the use of episiotomy.(27)

Our birth care center is equipped to provide augmentation, analgesia as well as cesarean sections when necessary. Only small statistical differences by delivery site were found in pain management (Table 1, Table 2). The use of epidural analgesia was more common at our medical center than in large birth care center studies in other countries,(6–9, 13, 24, 25) consistent with higher background rates of epidural use in the United States.(28) However, the availability of analgesia is likely to be a significant factor in the low rate of transfer we observed from our birth care center to the hospital. As Law (20) reported in their study of birth care centers in Australia, need for analgesia in their study was universally considered a reason to transfer. So while women may initially choose birth care center deliveries to avoid analgesia, the model employed in this facility allows that option without physically moving the patient and altering the setting. Additionally, while it offers many of amenities of a hospital it is still quite different from even a single room setting located within a hospital. (29) Univariate analyses in this study demonstrated that women in our birth care center were slightly more likely to have an assisted vaginal delivery (vacuum extraction or forceps) than women in the hospital group. However, after controlling for confounders with multivariate

regression, location was no longer a risk factor for these procedures (adjusted Relative Risk=1.04, 95% Confidence Interval 0.97–1.13).

The explanation for these differences between studies is puzzling. The physicians in our birth care center were not obligated to transfer the patient if a regional analgesia or an operative vaginal delivery was needed. Therefore, the actual site of delivery did not create a need for change in obstetrical management and is reflected by the low transfer rate of 2.2 percent from the birth care center to the hospital service.(21) However, the birth care center in Jackson et al.(21) did not administer epidural analgesia, and the patients needing regional analgesia or an operative delivery of any kind were transferred by ambulance to their hospital facility three miles away. One could surmise that there may have been a different threshold for the need of an operative vaginal delivery than that utilized in our study. Although the transfer rate was not given in the Jackson study(21), there is a wide variation in transfers between facilities reported in the literature. In the study in the United Kingdom by Reddy et al.(6), an intrapartum transfer rate of 2.7 percent was noted which was near the overall transfer rate of 2.2 percent reported at our facility. However, the antepartum transfer rate in that same study was reported at 23 percent. A review by Walsh and Downe (3) of 5 international free-standing midwife-led birth care centers that did not provide epidural analgesia or cesarean section, had a transfer rate of between 14.6 and 22 percent for the 3 centers that provided data on intrapartum transfer rates. In a study in the United Kingdom by Rowe et al. (30) an overall rate of transfer during delivery for free-standing midwifery units was 25% and even in such units located alongside hospitals it remained 21%. By providing patients at a hospital-linked birth care center access to augmentation, the need for transfer by ambulance and significant disruption of the birthing process is avoided. While some may feel augmentation during delivery is not consistent with birth care center philosophy, by having a coherent low-risk philosophy in place within this type of facility patients who may require alteration of their delivery plan face less disruption of the birthing process with this type of service being readily available.

Our lower rate of cesarean section is unlikely to be due to confounding because the finding persisted when risk factors were controlled in multivariable analysis and when the low risk subgroup was evaluated separately. The patients themselves who chose to go to the birth care center may have indicated more assertively that a cesarean or obstetric intervention is not wanted unless it is the last resort. Similar to midwife-led centers, the philosophy of care at the birth care center and support provided by the dedicated nursing staff may have influenced our cesarean rate despite the fact that many of the physicians were the same at both delivery sites. (2–4) Therefore while the ability to provide augmentation, analgesia and procedures is similar to a hospital setting the philosophy of care in this hospital linked birth center is to minimize their use.

Importantly, the differences in obstetrical interventions in the birth care center group did not compromise maternal and infant well-being. Infants in the birth care center group overall required care in the high risk nursery less often than did infants in the hospital group, whereas Apgar scores and high-risk nursery care were equivalent when low risk women were compared (Table 1, Table 2). Maternal length of stay, a proxy for maternal complications, was slightly shorter in the birth care center.

Infant outcomes have been evaluated in most of the birth care center studies. Employing univariate analysis, we found that there was no statistically significant difference between Apgar scores of <7 at 1 and 10 minutes in the birth care center and hospital service, but there was a slightly higher risk of having lower Apgar scores at 5 minutes in the hospital service. Infants in the hospital service required a higher rate of transfer to the high risk nursery than did infants in the birth care center (Relative Risk=1.28, $p=0.022$). Association of delivery location with these adverse outcomes resolved when multivariate regression was utilized. Our data also suggested that obtaining prenatal care and gaining the appropriate amount of weight during pregnancy decreased the risk that the infant would be transferred to a high-risk neonatal nursery.

Oakley et al.(31) also reported no difference in 1 and 5 minute Apgar scores when looking at the outcomes for nurse midwives versus obstetricians. However, they also found that neonatal intensive care admissions were 6.4 percent for the nurse midwives compared to 4.6 percent for the obstetricians. Waldenstrom et al.(12) reported no difference in Apgar scores or infant admissions to neonatal care. David et al.(7) found that Apgar scores of < 7 at one minute were higher at the birth care center than in the hospital (3.6 percent vs. 1.9 percent $p=0.002$), but that the difference went away looking at 5 and 10 minute Apgar scores and no increase in neonatal intensive care unit admissions between the two groups. A possible birth care center-related philosophy of fewer obstetric interventions does not appear to lead to a compromise in neonatal well-being.

The present study has a number of limitations. The retrospective design relied on surveillance data. Although our demographic data and clinical outcomes maintained in the database were extensive, the information could not account for all indications for obstetric interventions and risks for both maternal and neonatal adverse outcomes. However, the data appeared to be of good quality as evidenced by the few missing values and the reassuring results of logic checks, which revealed few obviously erroneous values. The low error rate observed in the data, may have been assisted by having a single registered nurse, responsible for the database. The study assessed only one birth care center and one hospital service, so this may limit generalizability. The large sample size at each site, however, reflects the practices of a very large number of attending and resident physicians. One nurse-midwife provided obstetric care during delivery for women in the study, but her patients accounted for less than one percent of all deliveries.

Another limitation was that even with this exceptionally large number of deliveries, there was insufficient power to evaluate the rare adverse outcomes in the low-risk obstetric population such as postpartum hemorrhage, the need for postpartum hysterectomy, general anesthesia or fetal death. However, we had excellent power to study highly important outcomes such as cesarean section, operative vaginal delivery and neonatal requirement for specialized nursery care. The large number of deliveries and the extensive set of patient characteristics in the database allowed us not only to select comparable groups of low-risk women in each location, but also to further adjust for case mix by variables associated with each outcome, such as weight gain during pregnancy and year of delivery.

CONCLUSIONS

This investigation suggests that the use of a physician-led, hospital-linked, birth care centers have the potential to provide care comparable to hospital-based care and has the potential to lower rates of cesarean section without increasing rates of operative vaginal delivery. While different from the classic view of a birth care center, this model offers many of the benefits of both hospitals and birth care centers, while minimizing the risk to the mother and child. It also had the salutary effect of increasing the adoption of breast-feeding by mothers in the birth care center. Given the need to control health care cost in the United States and many other countries without jeopardizing the quality of patient care, this information may be relevant for creating a different model for obstetrical care.

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Table 1

Characteristics and health outcomes of the total study population.

Maternal Characteristics and Health Outcomes		Birth Care Center (n=14,326)		Hospital Service (n=17,848)		p-Value
		N	%	N	%	
Maternal age (yrs)						
<20		1670	(11.7)	2556	(14.3)	<.001
25–29.9		8570	(59.9)	10,627	(59.6)	
30–34.9		2860	(20.0)	3132	(17.6)	
35		1216	(8.5)	1530	(8.6)	
Maternal race/ethnicity						
White		10,633	(77.6)	11,307	(67.0)	<.001
Black		928	(6.8)	1519	(9.0)	
Hispanic		1275	(9.3)	3333	(19.8)	
Asian		593	(4.3)	442	(2.6)	
Other		270	(2.0)	272	(1.6)	
Parity						
0		5821	(40.7)	6959	(39.0)	<.001
1–2		7140	(49.9)	8356	(46.8)	
3+		1358	(9.5)	2531	(14.2)	
Pre-pregnancy BMI, mg/m²						
Lean (<18.5)		984	(7.0)	1047	(6.1)	<.001
Normal (18.5–24.9)		8139	(58.2)	8256	(48.1)	
Overweight (25–29.9)		3085	(22.1)	4034	(23.5)	
Obese (30–34.9)		1228	(8.8)	2142	(12.5)	
Very obese (≥ 35)		538	(3.9)	1669	(9.7)	
Estimated gestational age						
<37 weeks		163	(1.1)	3101	(17.4)	<.001
37–40 weeks 6 days		12,970	(90.5)	12,290	(68.9)	
41 weeks		1193	(8.3)	2457	(13.8)	
Diabetes (pregestational or gestational)		66	(0.5)	707	(4.0)	<.001
Chronic hypertension		15	(0.1)	186	(1.0)	<.001

Maternal Characteristics and Health Outcomes	Birth Care Center (n=14,326)		Hospital Service (n=17,848)		p-Value
	N	%	N	%	
Preeclampsia or eclampsia	169	(1.2)	1542	(8.6)	<.001
Fetal malpresentation	170	(1.2)	572	(3.2)	<.001
Type of labor					<.001
Augmented	4563	(31.9)	3215	(18.0)	
Induced	1253	(8.7)	8816	(49.4)	
Spontaneous	8510	(59.4)	5817	(32.6)	
Artificial rupture of membranes	6425	(47.3)	10,830	(65.0)	<.001
Direct fetal monitoring	880	(6.1)	2072	(11.6)	<.001
Fetal heart rate decelerations	1419	(9.9)	2315	(13.0)	<.001
Slow or failed progress in labor	1567	(10.9)	2094	(11.7)	.026
Episiotomy	1794	(12.5)	1789	(10.0)	<.001
Laceration	9182	(64.1)	9592	(53.7)	<.001
Delivery mode					<.001
Spontaneous vaginal	11,399	(79.6)	12,707	(71.2)	
Operative vaginal	1871	(13.1)	2028	(11.4)	
Cesarean	1056	(7.4)	3113	(17.4)	
Shoulder dystocia	509	(3.6)	630	(3.5)	.991
Emergent cesarean	134	(0.9)	356	(2.0)	<.001
Anesthesia					<.001
Nonmedical comfort measures	1673	(11.7)	1855	(10.4)	
Local or pudendal	1474	(10.3)	1119	(6.3)	
Regional or intrathecal	11,126	(77.7)	14,665	(82.2)	
General	51	(0.4)	200	(1.1)	
Uterine rupture	5	(0.0)	22	(0.1)	.007
Postpartum hemorrhage	55	(0.4)	124	(0.7)	<.001
Birthweight					<.001
<2500 g	188	(1.3)	2162	(12.1)	
2500–3500 g	8075	(56.4)	9226	(51.7)	
>3500 g	6063	(42.3)	6460	(36.2)	
Apgar <7 at 5 min.	120	(0.8)	569	(3.2)	<.001

Maternal Characteristics and Health Outcomes	Birth Care Center (n=14,326)		Hospital Service (n=17,848)		p-Value
	N	%	N	%	
High-risk nursery care	566	(4.0)	2491	(14.0)	<.001
Fetal demise	1	(0.0)	95	(0.5)	<.001
Initiated breastfeeding	8089	(72.8)	6938	(53.7)	<.001
Maternal length of stay > 72 hours	841	(5.9)	3002	(17.0)	<.001

Data are n (% of total deliveries at site). Regional or intrathecal anesthesia was primarily delivered by epidural. Deliveries were analyzed according to admission site (intention-to-treat). Total number of patients differs slightly for some variables due to missing values. Percents may not equal 100 due to rounding.

BMI, body mass index

Table 2

Intrapartum and postpartum outcomes among low risk women.

Procedures and Outcomes	Birth Care Center (n=7911)		Hospital Labor and Delivery (n=3057)		p-Value
	N	%	N	%	
Artificial rupture of membranes	3320	(44.2)	1537	(55.3)	<.001
Direct fetal monitoring	398	(5.0)	186	(6.1)	.027
Fetal heart rate decelerations	706	(8.9)	334	(10.9)	.001
Slow or failed progress in labor	795	(10.0)	253	(8.3)	.005
Episiotomy	1008	(12.7)	299	(9.8)	<.001
Laceration	5150	(65.1)	1869	(61.1)	<.001
Delivery mode					<.001
Spontaneous vaginal	6509	(82.3)	2522	(82.5)	
Operative vaginal	1020	(12.9)	344	(10.9)	
Cesarean	382	(4.8)	201	(6.6)	
Shoulder dystocia	242	(3.1)	85	(2.8)	.442
Emergent cesarean	51	(0.6)	31	(1.0)	.044
General anesthesia	14	(0.2)	10	(0.3)	.131
Uterine rupture	0		0		
Postpartum hemorrhage	21	(0.3)	12	(0.4)	.276
Birthweight					<.001
<2500 g	73	(0.9)	67	(2.2)	
2500–3500 g	4607	(58.2)	1931	(63.2)	
>3500 g	3231	(40.8)	1059	(34.6)	
Apgar <7 at 5 min.	48	(0.6)	23	(0.8)	.384
High-risk nursery care	246	(3.1)	115	(3.8)	.086
Fetal demise	0		0		
Initiated breastfeeding	4607	(75.2)	1161	(56.9)	<.001
Maternal length of stay > 72 hours	146	(1.9)	93	(3.1)	<.001

For definition of low risk, see text. Deliveries were analyzed according to admission site (intention-to-treat). Data are n (% of total low risk deliveries at site). Total number of patients differs slightly for each variable due to missing values. *BMI*, body mass index

Table 3

Proportion of deliveries with selected risk factors or conditions in which there was an antenatal transfer from the birth care center to the hospital.

Selected Risk Factors and Conditions	Total (N) with Risk Factor or Condition	Transferred to Hospital for Delivery N (%)
Preeclampsia	169	128 (75.7)
Estimated gestational age <37 weeks	163	103 (63.2)
Pre-gestational or gestational diabetes	66	16 (24.2)
Labor induction	1253	190 (15.2)
Pre-pregnancy BMI ≥ 35 kg/m ³	538	70 (13.0)
Slow progress 2 nd stage of labor	364	20 (5.5)
Fetal intolerance	1753	95 (5.4)
Slow progress 1 st stage of labor	662	31 (4.7)