

Maternal Outcomes in Birth Centers: An Integrative Review of the Literature

Jill Alliman, CNM, DNP, Julia C. Phillippi, CNM, PhD

Introduction: The birth center, a relatively recent innovation in maternity care, is an increasingly popular location of birth. The purpose of this integrative literature review is to assess the research on maternal outcomes from birth center care.

Methods: Using methods by Whittemore and Knafl, we conducted an integrative review of studies of birth centers published in English since 1980. Twenty-three quantitative sources and 9 qualitative sources describing maternal outcomes of birth center care were reviewed and synthesized.

Results: Outcomes for women receiving birth care were positive. Spontaneous vaginal birth rates and perineal integrity were higher for women beginning care in a birth center compared to women in hospital care. Rates of cesarean birth were also lower for women planning birth center care. Transfer rates are difficult to compare across studies, but antepartum transfer rates ranged from 13% to 27.2%. Intrapartum transfer rates ranged from 11.6% to 37.4%, and from 11.6% to 16.5% in studies published from 2011 to 2013. Nulliparous women had higher rates of transfer than multiparous women. Few severe maternal outcomes and no maternal deaths were reported in any studies. Women were satisfied with the comprehensive, personalized care that they received from birth centers.

Discussion: Quantitative studies reviewed included more than 84,300 women. The heterogeneity of the studies and variations of practice limit generalization of findings. However, even with multisite studies enrolling a variety of birth centers and practice changes over time, the consistency of positive outcomes supports this model of care. Policy makers in the United States should consider supporting the birth center model as a means of improving maternal outcomes.

J Midwifery Womens Health 2016;61:21–51 © 2016 by the American College of Nurse-Midwives.

Keywords: birthing centers, freestanding, birth, prenatal care, midwifery, integrative review

INTRODUCTION

The number of US births in freestanding birth centers grew by more than 75.8% from 9620 in 2004 to 16,913 in 2013, which is a 87% increase in the proportion of US births that take place in birth centers.^{1,2} As part of national and international calls to improve maternal health, the birth center model of care has gained widespread attention as a location of birth for low-risk women.^{3,4} Birth centers are a fairly recent location for birth, with the first studies on this model published in the 1980s.^{5,6} However, there is a growing body of useful literature on this model of care. The purpose of this integrative review is to assess and summarize the current literature on maternal outcomes in birth centers to provide clear information for clinicians, administrators, and policy makers.

Although birth centers exist across the globe, the definition of this model is not standardized. With a broad definition, *birth centers* are locations for birth. As described in the literature, a birth center can be a discrete floor, a set of rooms within the hospital environment,^{7,8} or a freestanding facility devoted solely to low-risk perinatal care.^{9–12} Nearly all birth centers identify as a place of birth for low-risk women that is integrated within the health care network.⁴

There are a variety of official definitions of birth centers within the United States. The federal definition of a freestanding birth center is “a health facility that is not a hospital or physician’s office, where childbirth is planned to occur away from the pregnant woman’s residence that is licensed or other-

wise approved by the state to provide prenatal labor and delivery or postpartum care and other ambulatory services that are included in the plan.”¹³ The American Association of Birth Centers (AABC) further defines a freestanding birth center as “a home-like facility existing within a health care system with a program of care designed in the wellness model of pregnancy and birth.”¹⁴ *Standards for Birth Centers* were developed in 1985 and are maintained by AABC to provide guidance for quality and safety in this model.¹⁵

Licensure and accreditation of birth centers varies. In the United States, freestanding birth centers are licensed or recognized by statute, regulation, or Medicaid in 42 states.¹⁴ In 7 states, birth centers may operate without licensure.¹⁴ Only in North Dakota are birth centers not a legal option for perinatal care.¹⁴ Currently, 2 organizations in the United States accredit birth centers: the Commission for the Accreditation of Birth Centers and The Joint Commission. The Commission for Accreditation of Birth Centers requires centers to adhere to the AABC standards.¹⁴ As of January 2015, there were 310 known birth centers in the United States, 82 of which were accredited by the Commission for the Accreditation of Birth Centers.¹⁶ In addition, there are many birth centers that adhere to the AABC standards but are not accredited.

The birth center model of care is increasing in popularity. Clear information on the maternal benefits and risks of this model are needed for women, clinicians, administrators, and policy makers as the United States and other countries work to improve maternal perinatal outcomes while maintaining a patient-centered and compassionate approach to care. This integrative review will provide a comprehensive assessment of

Address correspondence to Jill Alliman, CNM, DNP, 3123 Gottschall Rd., Perkiomenville, PA 18074. E-mail: jkalliman86@gmail.com



Quick Points

- ◆ The number of US births in freestanding birth centers grew by more than 75% from 9620 in 2004 to 16,913 in 2013.
- ◆ This integrative review of maternal outcomes in birth centers includes 23 quantitative and 9 qualitative articles from studies performed in the United States and internationally.
- ◆ The birth center model of care is associated with greater rates of spontaneous vaginal birth and lower rates of assisted vaginal and cesarean birth when compared to hospital care. Severe adverse maternal outcomes were very rare, and no maternal deaths were reported.
- ◆ These data, including outcomes from more than 84,000 women, clearly support that birth centers are a safe model of care for low-risk women when associated with a health system able to provide higher-level care.
- ◆ Policy makers in the United States should consider supporting the birth center model to improve local, state, and national maternal outcomes; and health plans should ensure that women have access to birth centers.

the literature on the birth center model of care for low-risk women.

METHODS

Integrative reviews are summaries of original research on a specific subject to provide a comprehensive understanding of the topic.¹⁷ The methodology outlined by Whittemore and Knafl was chosen for this review and includes: problem identification, literature search, data evaluation, data analysis, and presentation of review findings.¹⁷ In this review, we have combined data analysis and presentation of review findings in the Results section.

Problem Identification

Walsh and Downe published a systematic review of birth center care in 2004.¹⁸ Since this review was published, several data-based studies have been released. These new studies, especially the Stapleton et al study of more than 15,000 women, require reassessment of the literature on birth center care.¹² Although there is no recent integrative or systematic review of the literature of maternal outcomes in birth centers, there have been several recent studies of neonatal outcomes for out-of-hospital births that have generated controversy, and interested readers are referred directly to these articles.^{19–23} Therefore, we focused on maternal outcomes in recognized, accredited, or licensed birth centers in the developed world.

Literature Search

In November of 2014, we conducted a search in Google Scholar, PubMed, and CINAHL databases using the search terms: “birth center”/“birthing center” and “outcomes.” We limited the search to articles published in English after 1980. More than 2000 articles were located through Google Scholar; 22 articles through CINAHL, and 115 applicable publications through PubMed. The title and abstract of all articles in the CINAHL and PubMed searches were reviewed, and articles published in peer-reviewed journals containing data on maternal outcomes were obtained. Thirty-nine studies were obtained for full review. After obtaining articles, ancestry searches located 4 additional sources.

Data Evaluation

After an initial review, 11 studies were eliminated. Four were studies of in-hospital birth centers that did not define their birth center practice model,^{24–27} and 7 studies focused only on one aspect of care^{28,29} or cost^{30–32} and did not provide comprehensive data about maternal outcomes.^{28,29}

Not all studies provided clear information on the location of the birth center. We excluded studies that specifically stated the birth center was located within an obstetric hospital unit because this is not reflective of US standards, but we retained studies that did not clearly stipulate the birth center location. We retained 4 articles from 2 international studies set in birth centers nestled within clinics or very small hospitals that did not provide surgical obstetric services as these studies clearly stated the birth center was designed for low-risk women.^{8,33–35} We also included a series of articles from one randomized controlled trial conducted on a separate floor of a hospital because the birth center standards were clearly outlined and matched AABC standards.^{7,36,37} Qualitative studies were included if they reported the woman’s perspective of care in the birth center, antepartum or intrapartum.

RESULTS

Data Sets

After careful evaluation and screening, 23 quantitative publications representing 14 data sets (Table 1) and 9 qualitative publications (Table 2) were included in the integrative review. Data from one research study was often reported in several articles. Those with overlapping data sets include: 1) the Rooks et al articles,^{9,38–40} 2) Waldenström and Nilsson publications,^{7,36,37} 3) Jackson et al¹⁰ and Nguyen et al,⁴¹ 4) Brocklehurst et al¹¹ and Rowe et al,⁴² and 5) Overgaard et al.^{8,33,34}

Study Settings

Country

Of the 32 sources reviewed, 18 were from the United States^{5,9,10,12,20,38–41,43–51}; 3 from England^{11,42,52}; 3 from Sweden^{7,36,37}; 3 from Denmark^{8,33,34}; 2 from Australia^{53,54};

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Scupholme ⁵ 1986, 1982-1984 Florida, United States	Matched pair cohort Outcomes from an urban, FBC using CNMs to provide care were compared with a tertiary care hospital with obstetricians providing care. 250 women who were admitted to the birth center in labor matched after birth with 250 women in standard care with same risk factors and demographics. Birth center group was more educated than control group. Birth center group race/ethnicity: 52% white, 17% black, 31% Hispanic	Transfer rate after admission to FBC IP: 21% (women transferred intrapartum/women presenting in labor) PP: 1.5% (appears to be women transferred/women giving birth at FBC) Mode of birth SVB: FBC 92%; hospital 83% ^a AVB: FBC 2%; hospital 3% Cesarean: FBC 6%; hospital 14% Pharmacologic pain relief Narcotic analgesia: FBC 31%; hospital 41% ^a Length of labor: significantly longer labors in the FBC group ^a First stage: 13-24 hours: FBC 55%; hospital 69% >24 hrs: FBC 6%; hospital 2% ^a Second stage > 2 hours: FBC 5.4%; hospital 2.4% Oxytocin use in labor: FBC (after transfer) 12.4%; hospital 24% ^a Postpartum hemorrhage FBC 5%; BC hospital 1.4%
Scupholme ⁴³ 1987, 1984-1985 Florida, United States	Matched cohort Outcomes from an urban FBC using CNMs to provide care were compared with a tertiary care hospital with obstetricians providing care. 494 women gave birth in a FBC during the study period. Women who self-selected FBC care were matched with women who were assigned to the birth center related to relieve hospital overcrowding. Attempt was made to match groups for age, parity, financial status, and level of education. Sample was 148 women assigned to birth center care compared to 148 women who selected BC care. The assigned group had significantly younger and less educated women and more women who were black or of Hispanic ethnicity.	Transfer rate AP: 20% of women receiving prenatal care were transferred for medical reasons (women transferred/women in prenatal care) IP: assigned 24%; self-selected 26% (women transferred/women admitted to FBC in labor) Mode of birth SVB: assigned 93%; self-selected 90% Overall cesarean rate: 5% (assigned 5%; self-selected 5%) Pharmacologic pain relief Analgesia use: assigned 39%; self-selected 43%
Feldman ⁴⁴ 1987, 1981 New York City, United States	Retrospective matched cohorts from women who chose either FBC or hospital care Outcomes from an urban FBC in New York, United States, using CNMs to provide care were compared with a tertiary care hospital with obstetricians providing care.	Transfer rate for FBC group after 37 weeks' gestation AP: 8% (women transferred between 37 weeks' gestation and labor/number of women in study at 37 weeks' gestation) IP: 14% (number of women transferred at any point in labor/number of women in study at 37 weeks' gestation)

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Rooks ^{a,b} 1989, 1985-1987 United States	<p>77 women planning birth center birth at 37 weeks' gestation matched to low-risk group of 72 women with hospital births</p> <p>FBC group had significantly more white and college-educated women. Hospital group had significantly more women of Hispanic ethnicity.</p> <p>Prospective cohort, observational study</p> <p>Women admitted for labor in 84 FBC birth centers in 35 states</p> <p>Care providers within the birth centers included CNMs, SNMs, obstetrician-gynecologists, licensed or lay midwives, and registered nurses. 1,1814 women admitted in labor to 84 FBCs</p> <p>Compared to 1986 birth certificate data, women choosing birth center care were more likely to be white and of Hispanic ethnicity than the general population. They were also more likely to have finished college.</p>	<p>Mode of birth</p> <p>SVB: FBC 93.5%; hospital 88.7%</p> <p>Forceps: FBC 5.6%; hospital 43.7%^a</p> <p>Cesarean: FBC 6.5%; hospital 11.3%</p> <p>Pharmacologic pain relief</p> <p>Epidural: FBC 2.7%; hospital 47.6% ($P < .0001$)</p> <p>Demerol: FBC 19.5%; hospital 26.8%</p> <p>Length of labor</p> <p>1st stage > 12 hours: FBC 26.1%; hospital 1.6%^a</p> <p>2nd stage > 2 hours: FBC 18.8%; hospital 4.8%^a</p> <p>Oxytocin use in labor</p> <p>Induction: FBC 1.3%; hospital 4.2%^a</p> <p>Augmentation: FBC 9.1%; hospital 59.5%^a</p> <p>Perineal integrity</p> <p>Episiotomy rate: FBC 47.2%; hospital 78.1%^a</p> <p>Intact perineum: FBC 25%; hospital 6.3%^a</p> <p>Third stage</p> <p>Manual removal of the placenta: FBC 1.4%; hospital 9.5%^a</p> <p>Postpartum hemorrhage: FBC 2.7%; hospital 1.6%</p> <p>Transfer rate</p> <p>AP (including medical and nonmedical reasons): 33.8% (number of women transferred prior to admission to FBC in labor/number of women enrolled in study</p> <p>IP: 11.9% (number of women transferred prior to birth/number of women admitted in labor)</p> <p>PP: 0.8% (number of women transferred after birth but prior to discharge/women admitted to birth center in labor)</p> <p>Timing after admission to center unknown: 1.4%</p> <p>Mode of birth</p> <p>SVB: not clearly reported for women admitted in labor</p> <p>AVB: not clearly reported for all admitted women; forceps and vacuum were applied within the birth center in 0.6% of births</p> <p>Cesarean: 4.4% overall; 9.9% for nulliparous women</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Rooks ^{38, b} 1992, 1985-1987 35 states in the United States	Prospective cohort, observational study Women seeking prenatal care or admitted for labor in 84 FBCs in 35 states within the United States. Care providers within the FBCs included CNMs, SNMs, obstetrician/gynecologists, other licensed or lay midwives, and registered nurses. 1,7856 women who received care from 84 birth centers 1,1814 women admitted in labor to FBC.	<p>Pharmacologic pain relief Analgesia or sedative IP: 24% of nulliparas; 6.2% of multiparas PP analgesia beyond local lidocaine: 3%</p> <p>Oxytocin use in labor Augmentation with oxytocin at the birth center: 1.4% (not acceptable by current standards)</p> <p>Perineal integrity Episiotomy rate: 17.6% Intact perineum: 34%</p> <p>Third stage Postpartum hemorrhage requiring transfer: 0.5%</p> <p>Severe adverse maternal outcomes 0.01% PP eclampsia satisfaction: 94% would use center again 98.9% would recommend to a friend Of women transferred: 83.3% would use center again 96.9% would recommend BC</p> <p>Transfer rates AP (including medical and nonmedical reasons): 28.8% (women transferred prior to admission/women enrolled in study who had complete information) Prenatal complication: 13.8% Nonmedical reason: 4.2% Desired hospital birth: 4.1% Spontaneous or induced abortion: 2.08% Fetal death: 0.3% Lost to follow-up/other: 3.2%</p> <p>Characteristics of women admitted in labor to the FBC 92% married or living with partner 90% of women aged 18-35 years 69.1% of midlevel socioeconomic status 39.3% nulliparous</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Rooks ^{a,b} 1992, 1985-1987 35 states in the United States	Prospective cohort, observational study Women admitted for labor in 84 FBC in 35 states Care providers for labor within the FBCs included CNMs (76% of admitted women), registered nurses (7.7% of admitted women), obstetrician/gynecologists (7.4% of admitted women), licensed or lay midwives (3.8% of admitted women), SNMs (3% of admitted women), family practice physicians (2.5% of admitted women). 1,1814 women admitted in labor to FBCs.	Transfer rate for women admitted for intrapartum care IP: 12.4% (number of women transferred after admission/women admitted to birth centers for intrapartum care) PP: 3.4% (number of women transferred after birth/number of women admitted to birth center) Mode of birth for women giving birth within the FBC SVB: 99.4% AVB: Vacuum 0.4%; low forceps 0.2% Pharmacologic pain relief Central nervous system (CNS) depressants including narcotics: 13.1% Nulliparous women 3 times more likely than multiparous women to use CNS depressants for pain Anesthesia (only stated for women giving birth within the FBC, not all admitted women): None: 44% Local anesthesia only: 52.9% Paracervical block: 1.7% Pudendal block: 1.3% Inhalation anesthesia: 0.02% Epidural, caudal, or spinal anesthesia: 0.01% 39 women were transferred solely for inadequate pain relief Induction of labor for those admitted for intrapartum care Castor oil: 8.7% Amniotomy prior to contractions: 1% Oxytocin: 0.4% Augmentation of labor for those admitted to birth center Amniotomy: 51% Nipple stimulation: 12.7% Oxytocin: 1.5% Perineal integrity for women giving birth in the FBC Intact perineum: 34% Episiotomy rate: 23%

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Rooks ^{a,b} 1992, 1985-1987 35 states in the United States	Prospective cohort, observational study Women seeking prenatal care or admitted for labor in 84 FBCs in 35 states within the United States. Care providers within the FBCs included CNMs, SNMs, obstetrician/gynecologists, licensed or lay midwives, and registered nurses. 1,7856 women who received care from 84 birth centers 1,1814 women admitted in labor to FBCs with a focus on women and newborns experiencing complications within the birth center itself. Maternal complications following transfer were not included.	Antepartum transfer: 1/3 of women seeking care were transferred. More than half of antepartum transfers were nonmedical. 14% of women seeing birth center care were referred prior to labor. 90% of referrals were during the third trimester, and postterm pregnancy was most frequent reason (number of women transferred prior to admission in labor/women enrolled in study). Transfers after admission to the FBC 12.4% of women admitted to the FBC (women transferred before birth/women admitted to birth center) 78% of transfers occurred intrapartum First stage: 9.5% of all women admitted for FBC in labor 59.8% of all transfers Second stage: 2.2% of all women admitted for FBC in labor 14.1% of all transfers 22% of maternal transfers occurred postpartum 0.9% of all women admitted for FBC in labor 5.4% of all transfers Intrapartum complications at the FBCs Failure to progress in the first stage of labor: 8.3% of women admitted in labor 43.2% of transfers after intrapartum admission Fetal distress in first stage: 7.8% of women admitted in labor 2.9% of transfers after intrapartum admission Postpartum hemorrhage: 6.2% of women giving birth in the FBC Women experiencing complications: authors categorized complications as none, minor, intermediate, and serious. However, the perceived seriousness of complications may be different than current perceptions. Therefore, only the categories of no and serious complications are reported. Labor complications for women admitted to FBC: none 60.8%; serious 5.7%

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Waldenström ^{7,c} 1993, 1989-1992 Sweden	Randomized, controlled trial 1230 nonsmoking, Swedish-speaking women without complications randomly assigned to in-hospital birth center care (n = 617) or the control group of standard care in the hospital (n = 613) The same team of midwives were the primary care provider for both groups.	Birth complications for women birthing in FBC: none 76.1%; serious 0.2% Immediate postpartum complications for women who gave birth in FBC: none 48.3%; serious 0.5% Main outcome measure was satisfaction with care. Transfer rates for birth center group AP including medical and nonmedical reasons: 17% (women leaving birth center care before labor/women in study group) IP: 37.3% (women transferred in labor/women in study group) PP: 1.1% (women transferred after birth/women in study group) Satisfaction Women assigned birth center care were more satisfied ($P < .001$) with their prenatal, intrapartum, and postpartum care than the control group of standard hospital care. More women in the birth center group felt AP care raised self-esteem (63% BC; 18% hospital; $P < .001$) More women assigned to the birth center group would use the same model in the future ^a (88% BC; 46% hospital). Main outcome measures were use of labor analgesia and experience of pain in labor. Groups were analyzed as intent-to-treat beginning with group allocation. Transfer rates for birth center group Withdrawal from study: primiparas 2.3%; multiparas 4.5% AP (medical reasons): primiparas 1.8%; multiparas 9.4% IP: primiparas 27.3%; multiparas 4.5% PP: primiparas 1.1%; multiparas 1.1% Pharmacologic pain relief Epidural: Primiparas: BC 16.9%; hospital 22.5% ^a Multiparas: BC 1.6%; hospital 2.3% Pethidine: Primiparas: BC 4.2%; hospital 20.1% ^a Multiparas: BC 1.6%; hospital 7.0% ^a
Waldenström ^{36,c} 1994, 1989-1992 Sweden	Randomized controlled trial 1230 nonsmoking, Swedish-speaking women without complications randomly assigned to in-hospital birth center care (n = 617) or the control group of standard care in the hospital (n = 613) The same team of midwives were the primary care provider for both groups.	

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
	Nitrous oxide:	
	Primiparas: BC 18.4%; hospital 54.4% ^a	
	Multiparas: BC 3.5%; hospital 32.9% ^a	
	Pudendal block:	
	Primiparas: BC 0.3%; hospital 2.15% ^a	
	Multiparas: BC 0.4%; hospital 4.3% ^a	
	Paracervical block:	
	Primiparas: BC 0.3%; hospital 2.1% ^a	
	Multiparas: BC 0%; hospital 0.4% ^a	
	Sterile water:	
	Primiparas: BC 16%; hospital 11.7% ^a	
	Multiparas: BC 5.5%; hospital 5%	
	Experience of pain at 2 months postpartum	
	Rating of pain intensity: no significant difference between BC and hospital groups	
	Women's attitudes to labor pain as positive or negative: no significant difference between BC and hospital groups	
	Experiences of birth at 2 months postpartum	
	Women's overall experience of childbirth: no difference between BC and hospital groups	
	Anxiety during birth: no statistically significant difference between BC and hospital groups	
	Support from husband: no statistically significant difference between BC and hospital groups	

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Waldenström ^{37,c} 1997, 1989-1993 Sweden	Randomized controlled trial 928 Swedish-speaking women without complications randomly assigned to in-hospital birth center care and 932 to standard care in hospital The same team of midwives were the primary care provider for both groups.	<p>Experiences of care at 2 months postpartum</p> <p>Support from midwife: significantly greater for BC group</p> <p>Freedom to express feelings in labor: significantly greater for BC group</p> <p>Satisfied with achievement during birth: significantly greater for BC group</p> <p>Main outcome measures were medical interventions and outcomes. Groups were analyzed as intent-to-treat beginning with group allocation. Women were permitted to have birth center care with a previous cesarean if their last birth was vaginal.</p> <p>Transfer rates</p> <p>AP: 13% (women transferred before labor/women in study group)</p> <p>IP: 19% (significantly different between primiparous women and multiparous women)</p> <p>(51% of primiparous women assigned to the BC group gave birth in the BC)</p> <p>PP: 1.8%</p> <p>Length of labor from start of contractions to birth^a</p> <p>BC 15 hours; hospital 14 hours^a</p> <p>Pain relief</p> <p>Epidural: BC 12.1%; hospital 15.1%^a</p> <p>Pethidine: BC 3.7%; hospital 13.4%^a</p> <p>Nitrous oxide: BC 14.3%; hospital 46.6%^a</p> <p>Pudendal block: BC 3.4%; hospital 5.6%^a</p> <p>Local analgesia postpartum: BC 4.2%; hospital 20.1%^a</p> <p>Mode of birth</p> <p>SVB: not reported</p> <p>Vacuum: BC 3.9%; hospital 4.4%</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Fullerton ⁵¹ 1997 1993-1994 & 1985-1987 California, United States	<p>Comparison of transfer data from 2 birth centers (women enrolled prospectively) is compared with data from a large, multi-site prospective trial.</p> <p>Data from women admitted to 2 FBCs were compared with the National Birth Center Study.^{9,38-40} The Birthplace had 1698 admitted women, and the Irvine center had 515 participants. The Irvine center allowed low-dose oxytocin to be administered, which is not consistent with current national standards.</p> <p>CNMs were the intrapartum care provider in the 2 California birth centers, and the National Birth Center Study had diverse providers as described above.</p>	<p>Forceps: BC 3.9%; hospital 4.4%</p> <p>Cesarean: BC 7.1%; hospital 8.9%</p> <p>(Author noted that low baseline cesarean rate decreased power to see group differences)</p> <p>Oxytocin use in labor</p> <p>Induction of labor: BC 2.7%; hospital 4.6%^a</p> <p>Augmentation with oxytocin</p> <p>1st stage: BC 15.6%; hospital 39.3%^a</p> <p>2st stage: BC 17.9%; hospital 29.5%^a</p> <p>Perineal integrity</p> <p>Episiotomy rate: BC 7.8%; hospital 8.3%</p> <p>Third stage</p> <p>Postpartum hemorrhage > 600 mL: BC 12.5%; hospital 12.7%</p> <p>Postpartum hemorrhage with transfusion: BC 0.7%; hospital 0.6%</p> <p>Severe adverse maternal outcomes</p> <p>One in each group with no residual effects</p> <p>Transfer rates</p> <p>AP: (women transferred antepartum/women enrolling in prenatal care)</p> <p>Total: birthplace 28.3%; Irvine 19.1%; national study 28.8%</p> <p>Nonmedical reasons: birthplace 10.2%; Irvine 8.6%; national study 15.1%</p> <p>Medical reasons: birthplace 18.1%; Irvine 10.5%; national study 13.8%</p> <p>IP: 19% (women transferred intrapartum/women admitted in labor)</p> <p>birthplace 25.1%; Irvine 20%; national study 12.4%</p> <p>Percent of women transferred IP who were nulliparous:</p> <p>birthplace 75%; Irvine 71.8%; national study 79.1%</p> <p>Most common reasons for IP transport across studies: failure to progress, prolonged rupture of membranes, thick meconium, elevated blood pressure</p> <p>PP (women transferred after birth/women giving birth in the FBC):</p> <p>birthplace 1.1%; Irvine .97%; national study 1%</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
David ⁵⁶ 1999, 1992-1994 Berlin, Germany	Retrospective cohort with hospital comparison group selected from women with no risk factors and spontaneous labor. The birth center group consisted of women admitted into labor (n = 801) at 2 Berlin birth centers compared with a control group of hospital births in Berlin meeting birth center admission criteria (n = 3271). All women were citizens of Germany, the US, or Northern and Central European countries. Midwives (of unspecified type) were the care provider for the birth centers, and midwives and obstetricians were care providers at hospital births. No data on the percent of midwife-attended births in hospital was reported.	The birth center group was formed on admission to the birth center in labor and then analyzed using an intent-to-treat approach. Transfer rates IP: 18.2% (women transferred intrapartum/women admitted in labor) PP: 3.6% (women transferred after birth/women admitted in labor) Mode of birth SVB: FBC 91.4%; hospital 84.3% ^a AVB: FBC 5%; hospital 11% ^a Cesarean: FBC 3%; hospital 4.6% Primiparous cesarean rate: FBC 4%; hospital 6.6% ^a Perineal integrity Episiotomy rate: FBC 15.7%; hospital 54.8% ^a Intact perineum: FBC 30%; hospital 22% ^a Third stage No significant differences in complications Serious adverse maternal outcomes FBC, none; hospital, one maternal death The birth center group was formed on admission to the FBC and an intent-to-treat approach was used for data analysis. Transfer rates IP: 2% admitted to hospital after initial evaluation. 8.2% transfer rate after admission in labor PP: 0.5% (women transferred after birth/women admitted in labor) Mode of birth for women admitted to the birth center SVB: not clearly stated; appears to be 97% AVB: 1% vacuum; 1% forceps Cesarean: 1% Pharmacologic pain relief Narcotics: IP 16% Epidural: not clearly stated, but 1.8% of women were transferred due to desire for epidural
Roberts ⁴⁵ 2001, 1997-1999 Utah, United States	Retrospective cohort of women admitted to FBC 231 women evaluated at FBC over 2 years, 220 admitted in labor. Nurses or CNMs perform the initial labor evaluation and CNMs are the primary care provider for laboring women. 96% of admitted women were white and non-Hispanic.	

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Jackson ^{10,d} 2003, 1994-1996 California, United States	Prospective cohort with concurrent comparison group Birth center group self-selected to FBC care (n = 1808). The comparison group was recruited from local prenatal care clinics. Low-income women were the target population; women with private or military insurance were excluded. 86.3% of the FBC group was white, Hispanic compared with 61.2% of the hospital group. The FBC group had a significantly lower proportion of white, African American women. Care providers at the birth center were CNMs and obstetricians. The hospital group was cared for by obstetricians or obstetric residents.	<p>Oxytocin use in labor: stated as 0.5% in one location, but 4.5% of admitted women were transferred due to arrest of labor</p> <p>The birth center group formed at the beginning of prenatal care and outcomes analyzed using an intent-to-treat approach. Women attempted a trial of labor after one cesarean were permitted in the FBC group. (Adjusted Wald estimates of 95% CIs are used to determine significant differences between groups because <i>P</i> values were not presented.)</p> <p>Transfer rates Prior to study admission 6.6% of women choosing FBC care were excluded from study; and 14.7% of women choosing hospital care were excluded from the study. AP: medical 27.2%; nonmedical 8.5% IP: 18.5% (women transferred after admission in labor/women in study group) Of women choosing FBC care; 45.3% of women remained low risk to give birth at the FBC.</p> <p>Mode of birth SVB: FBC 80.9%; hospital 62.9%^a AVB: FBC 8.4%; hospital 18.1%^a Cesarean: FBC 10.7%; hospital 19.1%</p> <p>Pharmacologic pain relief Narcotic: FBC 29.2%; hospital 33.2% Epidural: FBC 29.8%; hospital 68.6%^f</p> <p>Oxytocin use in labor Induction with oxytocin/prostaglandin FBC 8.4%; hospital 14.7%^a Augmentation with oxytocin: FBC 15.8%; hospital 26.5%^a</p> <p>Perineal integrity Episiotomy rate: FBC 13.1%; hospital 37.8%</p> <p>Postpartum maternal readmission: FBC 0.4%; hospital 1% Of women choosing FBC care, 45.7% of women remained low risk to give birth at the FBC.</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Transfer rates	Results
Nguyen ^{41,d} 2009, 1994-1996 California, United States	Targeted multivariate predictive analysis of transfer data from a prospective longitudinal study This study used the dataset described in Jackson et al, 2003, but only analyzed information from the subset of women planning to give birth within the FBC (n = 1808). Of these, only women who were low risk with complete chart data were included in the analysis (n = 1028). Only antepartum and intrapartum transfers were studied. Care providers at the birth center were CNMs and obstetricians. Women with a previous cesarean birth were accepted into birth center care.	AP: 37.6% of women desiring birth center birth (defined as women presenting to the hospital in labor) Of AP transfers: medical 66.6%; nonmedical 23%; unknown 10% IP: 19.6% of women desiring birth center birth (defined as women who present to the birth center in labor but give birth at the hospital and women with preterm labor or rupture of membranes) Of IP transfers: medical 96.9%; maternal choice 2.3%; unknown 0.8% Of women choosing FBC care: 45.3% of women remained low risk to give birth at the FBC.	
Wax ²⁰ 2010 2006 birth certificate data 19 states in United States	Retrospective cohort-based study of 2006 birth certificate data from low-risk births from the 19 states using the 2003 revised birth certificate 745,690 births: 97% in hospital (n = 733143); 0.6% in a birth center (n = 4661), and 0.9% at home (n = 7427). This sample represents 49% of US births in 2006.	Risk factors associated with overall (medical and nonmedical) transfer History of cesarean birth (2.2 times greater risk) Nulliparity (1.8 times greater risk) History of previous hospital birth (1.5 times greater risk) Data were analyzed by location of birth with FBC births and home births being compared (as one group) with hospital births. Women having out-of-hospital births are more likely to be older, ^a multiparous, ^a and white ^f than mothers giving birth in the hospital in these states. FBC and home births had less frequent chorioamnionitis, fetal intolerance of labor, and meconium staining. ^a	

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Overgaard ^{g, f} 2011 2004-2008 Rural Denmark	Physicians, CNMS, “other midwives” and “not stated” were care providers. Data was analyzed by location of birth, not care provider. Prospective cohort with matched control group 839 women admitted to 2 midwifery units within a hospital that had an intensive care unit but no obstetric service (due to the rural hospital location) were matched with 839 low-risk women receiving care at an urban obstetric unit who had similar demographic characteristics. ^e 96% of the women were Nordic or of Western European ancestry in both groups. Care in the BC was provided by midwives with 2 years of experience and advanced training in vacuum birth.	Women giving birth in FBC and at home more often had prolonged ^a and precipitous ^a labors than women giving birth in the hospital. The birth center (a midwifery unit within a rural hospital without an obstetric service) and hospital cohorts were formed on admission to the units in labor and then analyzed with an intent-to-treat approach. Transfer rate Transfers intrapartum and up to 2 hours postpartum: 14.8% (number of women transferred/women admitted in labor) Primipara: 36.7% of primiparous women admitted were transferred Multipara: 7.2% of multiparous women admitted were transferred IP: 11.6% (women transferred intrapartum/women admitted in labor) PP: 4.7% (number of women transferred to the hospital prior to discharge/women admitted in labor) Mode of birth SVB: BC 94.9%; hospital 89.5% ^a AVB: BC 3.0%; hospital 7.8% ^a Cesarean: BC 2.3%; hospital 4% ^a Pharmacologic pain relief Epidural: BC 4.2%; hospital 10.3% ^a Oxytocin use in labor Augmentation: BC 8.2%; hospital 18.6% ^a Perineal integrity Intact perineum: BC 61.3%; hospital 55.5% ^a Perineal suturing: BC 35%; hospital 43.6% ^a 3 rd - and 4 th -degree lacerations: BC 2.3%; hospital 2.9% Third Stage Postpartum hemorrhage >500 mL: BC 3.5%; hospital 8.1% ^a Readmission or outpatient visit within 28 days: BC 2.9%; hospital 4.8% Severe adverse maternal outcomes: none in the BC group, one in the hospital group; low numbers preclude significance testing

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author	Design/Setting/Sample	Results
<p>Publication Date, Data Collection, Location</p> <p>Brocklehurst^{11,6} 2011, 2008-2010 England</p>	<p>Prospective national cohort study commonly known as the Birthplace Study Data were collected from: 142 home birth practices (97% of the total in England), 53 birth centers (95% of the total in England), 43 alongside midwifery units within the hospital (84% of the total in England), and 31 hospital obstetric units. 64,538 low-risk women were included in one of 3 groups by their planned location of birth at the beginning of labor: home, freestanding midwifery unit (noted here as BC for birth center), alongside midwifery unit in hospital, or obstetric unit in hospital. Midwives were the primary care provider in all settings except the hospital obstetric units.</p>	<p>Groups for analysis formed by the woman's choice of birth location at the beginning of labor: home, freestanding midwifery unit (BC), alongside midwifery unit within the hospital, or within obstetric unit within the hospital. All groups were compared with the obstetric hospital unit to determine statistical differences. (Adjusted Wald 99% CIs were used to determine statistical significance.) Women planning to give birth in freestanding midwifery units were 3 times more likely to have no complicating conditions at the start of labor when compared with women planning hospital births.^a Transfer rate for freestanding midwifery units IP: 16.5%; nulliparous women 29.6%; multiparous women 5.3% (women transferred in labor/women planning to birth in BC) PP: 4.8%; nulliparous women 5.9%; multiparous women 3.9% (women transferred postpartum/women planning to birth in BC) Timing after transfer unknown: 0.5% Mode of birth for women planning birth in freestanding midwifery units Spontaneous vertex birth: BC 90.7%; hospital 73.8%^a Vacuum: BC 2.7%; hospital 8.1%^a Forceps: BC 2.9%; hospital 6.8%^a Cesarean: BC 3.5%; hospital 11.1%^a Pharmacologic pain relief Epidural anesthesia: BC 10.6%; hospital 30.7%^a General anesthesia: BC 0.5%; hospital 1.5%^a Oxytocin use in labor: Augmentation with oxytocin: BC 7.1%; hospital 23.5% Perineal integrity Episiotomy rate: BC 8.6%; hospital 19.3%^a 3rd- and 4th-degree lacerations: BC 2.3%; hospital 3.2% No active management of third stage: BC 22.1%; hospital 6.1%^a Blood transfusion: BC 0.5%; hospital 1.2%^a Transfer to a higher level of care: BC 0.2%; hospital 0.6%^a</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Overgaard ^{33,f} 2012, 2004-2008 Rural Denmark	Mailed questionnaire to a subset of a larger prospective cohort with matched control group study Women who were admitted to one of 2 midwifery units within a hospital that had an intensive care unit but no obstetric service (due to the rural hospital location) (n = 185) completed questionnaires along with an equal number of low-risk women with planned hospital births (n = 190) who had been matched to BC participants by demographic characteristics. Midwives are the primary care providers in the BCs. The primary hospital care provider was not specified, though midwifery care of women across birth centers was reported as common in Denmark.	Women were included in the BC group as long as they had been admitted to a BC in labor, regardless of eventual birth location. The questionnaire used had been pilot tested by the authors and had sufficient internal reliability scores, but had not been previously validated. The level of significance difference between questionnaire scores was set at $P < .0025$ after the Bonferroni correction. Response rates: BC 85%; hospital 87% Women admitted to BCs had significantly more positive assessment of: Overall birth experience ^a Satisfaction with care ^a Support from midwife ^a Midwife present when wanted ^a Attention to psychosocial needs ^a Feeling listened to ^a Level of information provided ^a Participation in decision making ^a Consideration of birth wishes ^a Staff support for partner ^a The was no significance difference between the BC and hospital groups in: Suggestions for pain relief Undisturbed contact with newborn Support provided by partner Loss of control over labor or staff actions
Overgaard ^{34,f} 2012, 2004-2005 Rural Denmark	Secondary analysis of data from a prospective cohort with matched control group 839 women admitted to 2 midwifery units within a hospital that had an intensive care unit but no obstetric service (due to the rural hospital location) were matched with 839 low-risk women receiving care at an urban obstetric unit who had similar demographic characteristics.	The primary outcome measure was whether birth interventions, pain relief, upright position for birth, and perinatal outcomes differed by level of social disadvantage as operationalized as no college education. The birth center (a midwifery unit within a rural hospital without an obstetric service) and hospital cohorts were formed on admission to the units in labor and then analyzed with an intent-to-treat approach. Combined IP and PP transfer rate of participants admitted to the BC in labor: 14.8%

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Stapleton ¹² 2013, 2007-2010 33 states in the United States	<p>Secondary analysis of data from a prospective cohort with matched control group</p> <p>96% of the women were Nordic or of Western European ancestry in both groups.</p> <p>Care in the BC was provided by midwives with 2 years of experience and advanced training in vacuum birth. When women were transferred the BC midwife remained with the woman and continued to assist in her care in conjunction with an obstetrician. Midwives were the primary care provider for low-risk women giving birth in the hospital.</p> <p>Prospective cohort</p> <p>15,574 women planning birth in one of 79 FBCs and eligible for FBC care at onset of labor</p> <p>Participating women were:</p> <p>77.4% white, non-Hispanic; 11.2% white, Hispanic</p> <p>80% were married</p> <p>53.5% had private insurance</p> <p>71.8% had some amount of college education with 51.8% having 16 or more years of education.</p> <p>Women attempting a trial of labor after previous cesarean were included in some FBCs.</p> <p>Two types of midwives provided intrapartum care including CNMs (80%), licensed midwives (14%), and teams consisting of a variety of types of midwives (6%).</p> <p>The majority (63%) of participating FBCs were accredited by the Commission for Accreditation of Birth Centers</p>	<p>There were significant differences between the birth center and hospital groups as reported above in Overgaard.⁸ However, no measures showed significant differences by educational level of the mother.</p>
	<p>Data were collected on 22,403 women seeking care at 79 FBCs and the antepartum transfer rates noted below. Women seeking FBC care at the onset of labor (n = 15,575) formed the sample for the remainder of the study and data on their outcomes analyzed in various ways, such as outcomes of women admitted to the birth center or giving birth in the center.</p>	<p>Data were collected on 22,403 women seeking care at 79 FBCs and the antepartum transfer rates noted below. Women seeking FBC care at the onset of labor (n = 15,575) formed the sample for the remainder of the study and data on their outcomes analyzed in various ways, such as outcomes of women admitted to the birth center or giving birth in the center.</p>
	<p>Transfer rates</p>	<p>Transfer rates</p>
	<p>AP</p>	<p>AP</p>
	<p>Nonmedical: 15.1% (women leaving FBC/women entering prenatal care at FBCs)</p>	<p>Nonmedical: 15.1% (women leaving FBC/women entering prenatal care at FBCs)</p>
	<p>First trimester pregnancy loss: 4.2% (women having loss/women entering prenatal care at FBCs)</p>	<p>First trimester pregnancy loss: 4.2% (women having loss/women entering prenatal care at FBCs)</p>
	<p>Medical: 13.7% (women requiring antepartum referral/women establishing care at FBCs)</p>	<p>Medical: 13.7% (women requiring antepartum referral/women establishing care at FBCs)</p>
	<p>IP</p>	<p>IP</p>
	<p>Transfer during labor but prior to FBC admission: 4.5% (women transferred after initial evaluation on labor but prior to admission/women planning FBC birth at the beginning of labor)</p>	<p>Transfer during labor but prior to FBC admission: 4.5% (women transferred after initial evaluation on labor but prior to admission/women planning FBC birth at the beginning of labor)</p>
	<p>Transfer rate for women admitted to the FBC: 12.4% (women transferred after admission/women admitted)</p>	<p>Transfer rate for women admitted to the FBC: 12.4% (women transferred after admission/women admitted)</p>
	<p>Nulliparas accounted for 81.6% of the intrapartum transfers</p>	<p>Nulliparas accounted for 81.6% of the intrapartum transfers</p>
	<p>PP transfer rate for women giving birth at the FBC: 2.4% (women transferred after birth but prior to discharge/giving birth in FBC)</p>	<p>PP transfer rate for women giving birth at the FBC: 2.4% (women transferred after birth but prior to discharge/giving birth in FBC)</p>

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
Benatar ⁴⁶ 2013 2005-2008 birth certificates Washington, DC United States	Retrospective cohort comparison using propensity score modeling and instrumental variable analysis Women who had at least 2 prenatal visits at one FBC and gave birth to a singleton newborn at ≥ 24 weeks' gestation ($n = 872$) are compared with women who gave birth in the District of Columbia between 2005-2008 and who meet propensity score analysis to match with birth center risk factors ($n = 42,987$). Intended birth site was not a study consideration. Approximately 70% of women seeking care at this FBC choose hospital birth. 85% of women included were of black, non-Hispanic race/ethnicity. GNMs provided prenatal, intrapartum, and postpartum care at the FBC. Women in the control group had a variety of provider-types. Secondary analysis of data from national prospective cohort study, known as the Birthplace Study Women planning to birth at home or in an FBC at the beginning of labor ($n = 27,842$) as described in the National Perinatal Epidemiology Unit study or Birthplace study FBC participants were 91% white and 97% fluent in English. Midwives were the primary intrapartum care provider.	Mode of birth for all women planning a FBC birth at labor onset ($n = 15,575$) SVB: 92.8% (including 0.3% VBACs) AVB: 1.2% Cesarean: 6.1% Third stage: Postpartum hemorrhage requiring transfer: 36/67 emergency transfers Postpartum hemorrhage was 68% of postpartum complications. Severe adverse maternal outcomes: no maternal deaths Women who received at least 2 prenatal visits at one FBC are compared with all women giving birth in Washington, DC, during the study time frame who meet propensity score analysis to match the low-risk criteria of the FBC. Groups were set by the presence of 2 visits at the birth center (regardless of intended birth location) and analyzed with an intent-to-treat approach. Transfer rates: unavailable related to study design Mode of birth AVB: FBC 2.1%; hospital 4.4% ^a Cesarean: FBC 19.7%; hospital 29.4% ^a Vaginal birth after cesarean: FBC 26.7%; hospital 9.4% ^a Preterm birth rate (≤ 36 weeks' gestation): FBC 7.9%; hospital 11% ^a
Rowe ^{42,c} 2013, 2008-2010 England	Primary analysis of data from national prospective cohort study, known as the Birthplace Study Women planning to birth at home or in an FBC at the beginning of labor ($n = 27,842$) as described in the National Perinatal Epidemiology Unit study or Birthplace study FBC participants were 91% white and 97% fluent in English. Midwives were the primary intrapartum care provider.	Primary outcome measures were transfer time from FBCs and homes and reasons for transfer, reported by parity Characteristics of women transferred from FBCs Nulliparous: 78% of women transferred one previous pregnancy: 16.6% 2 previous pregnancies: 4.8% 3 or more previous pregnancies: 1.8% Timing of transfer from FBC for all women admitted (statistics separate nulliparous and multiparous women, but the denominator is all women planning FBC birth at beginning of labor regardless of parity): IP: nulliparous 26.9%; multiparous 4.9%

(Continued)

Table 1. Quantitative Studies of Birth Center Care Published in Peer-Reviewed Articles

First Author, Publication Date, Data Collection, Location	Design/Setting/Sample	Results
	<p>PP: nulliparous 6.0%; multiparous 3.9%</p> <p>Timing after admission to center unknown: nulliparous 1.5%; multiparous 0.5%</p> <p>Reasons for transfer</p> <p>Nulliparous: Failure to progress in the 1st stage Meconium staining Failure to progress in the 2nd stage</p> <p>Multiparous: Retained placenta Failure to progress in the 1st stage Postpartum hemorrhage</p> <p>Urgency of Transfer (statistics separate nulliparous and multiparous women, but the denominator is all women planning FBC birth regardless of parity)</p> <p>Potentially urgent intrapartum: nulliparous 9.5%; multiparous 1.5%</p> <p>Nonurgent intrapartum: nulliparous 10.3%; multiparous 1.5%</p> <p>Potentially urgent postpartum: nulliparous 0.7%; multiparous 0.9%</p> <p>Urgency unknown: nulliparous 14%; multiparous 5.3%</p> <p>Overall transfer time (time from decision until evaluation by a provider at the receiving hospital)</p> <p>Overall transfer time regardless of indication: 60 minutes</p> <p>Potentially urgent IP transfers: 50 minutes</p> <p>Nonurgent IP transfers: 60 minutes</p> <p>Potentially urgent PP transfers: 60 minutes</p> <p>Increasing distance to the transferring hospital unit was associated with increased transport time, although statistical correlation was not performed.</p>	

Abbreviations: AP, antepartum; AVB, assisted AVB vaginal birth; BC, in-hospital birth center meeting criteria; CI, confidence interval; CNM, certified nurse-midwife; FBC, freestanding birth center; IP, intrapartum; PP, postpartum; SVB, spontaneous vaginal birth.
^a $P < .05$.

Several articles use the same data set or participants:

^b Report on data from The National Birth Center Study.

^c Report on data from the Stockholm Birth Center Trial.

^d Data from the San Diego Birth Center Study.

^e Report on data from the Birthplace Study.

^f Report on data collected in one geographic area as part of a multifaceted study.

Table 2. Qualitative Studies of Birth Center Care Published in Peer-Reviewed Articles

Author, Publication Date, Data Collection	Study Design	Participants and Research Context	Themes
Annandale ⁵⁵ 1987	Longitudinal qualitative research, involving 18 months of participant observation, repeated focused participant interviews, attendance at prenatal visits, and association of data with quantitative information from the medical record Exploration of patient desires for control and the extent and meaning of patient control	46 pregnant and postpartum women getting care at a FBC The birth center was located “on the campus of a community hospital.” And nurse-midwives were the primary care providers. Obstetricians provided care at the hospital following transfer. Scotland	Women made a deliberate decision to choose birth center care for reasons including: a reaction against hospitals, hospital practice, and reaction against the lack of control in the hospital environment. Women had some ambivalence about the birth setting due to concerns of health risks and conflict between the birth center and the hospital, especially over the management of post-date pregnancies. The meaning of control during birth was also a theme and included facets of balance, health maintenance, and control of self.
Chamberlain ³⁵ 1997	Semi-structured interviews assessed perceptions of the birth center on the community. Only preliminary results reported, no subsequent publication with full results	45 individuals including women who had been consumers of birth center care: male consumers, nurses, midwives, community health workers, regional health staff, and community members The birth center is housed within a health center with an onsite laboratory and basic blood bank. It was created to provide local care to birthing women to decrease women leaving the community to birth Care in the birth center was provided by midwives and a maternity worker. Rural Northwest Territories, Canada	Women who gave birth in the birth center were satisfied with their birth and midwifery care. Women who received midwifery care but gave birth in hospital, away from the community, were satisfied with midwifery care but not with hospital. Women who gave birth outside the community, in the hospital, were dissatisfied with being away and felt they had few choices at the time of birth.
Esposito ⁴⁷ 1999	Ethnography with open-ended interviews and participant observation of the immediate neighborhood, birth center daily activities, and births	29 women receiving care at the FBC, 5 midwives, and 6 staff members participated in interviews. Only comments from interviews of women who had previous hospital births are included in the article. Nurse-midwives were the care providers at the center which is located in an inner-city neighborhood where residents are 50% African American, 21% of European American, and 12.4% of Hispanic ethnicity. The racial identification of participants is not identified. Washington DC, United States	Women mentioned the accessibility of the center and the intimacy of the connections developed with the CNMs. At the beginning of care, not all of their perceptions of the center were positive. However, women who had a previous hospital birth disliked the hospital setting even more, especially the lack of control and racial stereotyping. Over time, the women learned more about the centers and became very comfortable with the people and the model of birth center care and valued their intimate connection with the staff.
1991 - 1992			

(Continued)

Table 2. Qualitative Studies of Birth Center Care Published in Peer-Reviewed Articles

Author, Publication Date, Data Collection	Study Design	Participants and Research Context	Themes
Coyle ^{53,54} 2001 1996-1997	Qualitative semi-structured interviews analyzed with a modified Straus & Corbin grounded theory method	17 women (16 Caucasian and one Maori) who gave birth at one of 3 FBCs in Australia. Inclusion criteria included continuity of care components and at least one previous hospital birth. Care at the birth centers were provided by midwives. Western Australia	<p>Beliefs about pregnancy and birth Birth as a normal life event including birth as a natural process, carer's non-interventionist approach</p> <p>Birth as a disease process in the hospital including birth being viewed as an illness and the carer's interventionist approach that results in physical interference with birth processes</p> <p>Nature of the care relationship Collaborative relationship in the birth center including equality with carers and pregnant women as the primary decision-makers</p> <p>Provider dominated relationship in previous hospital care that included health professional superiority and pregnant women as passive participants</p> <p>Care interactions Cumulative interactions including the women feeling comfortable with the carers and being known as individuals was compared with</p> <p>Noncumulative interactions that result in a lack of rapport with providers and women being unknown to the care provider</p> <p>Care structures Woman-tailored care was provided in the birth center. Personalized care was provided by the midwives.</p>

(Continued)

Table 2. Qualitative Studies of Birth Center Care Published in Peer-Reviewed Articles

Author, Publication Date, Data Collection	Study Design	Participants and Research Context	Themes
Pewitt ⁴⁸ 2008 (Data collection dates not provided)	Semi-structured interviews analyzed with Sandelowski's qualitative descriptive method	7 adult, primiparous Caucasian postpartum women with insurance who gave birth in one FBC Rural Tennessee, United States	Empowerment – the women felt their experienced increased their confidence in their capacity to handle challenges. Sense of motherhood – although the women had anxieties about parenthood, the care improved their confidence. Establishing and strengthening relationships – Participants stated they grew new connections and relationships throughout their perinatal care. Participants attributed their satisfactory experiences to close, caring relationships to care providers.
Walsh ⁵² 2006 (No dates of data collection provided)	Ethnographic study using unstructured interviews and participant observation of births and the clinic environment	Interviews were conducted with 10 midwives, 5 maternity care assistants, and 30 women who had given birth in the birth center. The birth center was located within a small hospital that did not have an obstetric service. Midwives were the care providers within the birth center and obstetricians and midwives provided care at the referral hospital. England	The turn to birth environment and setting – women used previous experiences and the recommendation of family and friends to find the birth center. Effect of the first visit – women enjoyed the friendliness of the staff. Nesting responses – women felt the staff created an emotional environment that made them feel safe. Vicarious nesting – staff worked to create a physical environment that comforted the woman. Care as mothering – the staff cared for patients as individuals and provided care tailored to their needs, as a mother would.

(Continued)

Table 2. Qualitative Studies of Birth Center Care Published in Peer-Reviewed Articles

Author, Publication Date, Data Collection	Study Design	Participants and Research Context	Themes
Palmer ⁴⁹ 2009 2007	Comparative case studies from 3 models of care delivery using semi-structured interviews, structured observation, and focus groups	Interviews of 9 women receiving prenatal care in an obstetric clinic associated with a large teaching hospital, 7 women in FBC care; 9 women in federally-qualified health center. Focus groups were conducted with women receiving care in the birth center and the health center. Structured observation was also conducted at the FBC and the health center. District of Columbia, United States	Compared with other groups, women receiving care at the birth center perceived care as very comprehensive that included more personal attention compared to previous care experiences in other locations (eg, CNMs called them to check on them). Participants' suggestions for improvement focused on improvements in clinical care and space for the 2 clinics, whereas comments for the FBC focused on administrative concerns.
Phillippi ⁵⁰ 2014 2011	Qualitative descriptive study using semi-structured interviews and demographic questionnaires	29 women receiving prenatal care in an FBC were interviewed about facilitators of prenatal care access. Nurse-midwives were the care providers in the birth center. Rural Tennessee, United States	Facilitators of prenatal care Access to Medicaid and other insurance coverage Provider attributes Provision of personalized care in an unrushed prenatal visit, having questions answered, birth center setting, family friendly and relaxing atmosphere Clinic attributes Participants commented that the clinic had an alternative approach to care, a relaxing, family-friendly environment, a wide range of appointment times, and short waits for appointments.

Abbreviations: CNM, certified nurse-midwife; FBC, freestanding birth center.

and one each was from Canada,³⁵ Scotland,⁵⁵ and Germany.⁵⁶ Eight of the studies specified locations in rural settings^{8,33–35,48,50,52}; 9 in urban settings^{5,41,43,44,46,47,49,51,56}; and 15 were not specified, or they included multiple sites.

Providers of Care

There was a diversity of providers in the studies. Twelve of the articles stated that certified nurse-midwives (CNMs) were the primary providers of intrapartum care.^{5,43–51,55,56} Thirteen articles stipulated that midwives provided intrapartum care within the birth center but did not specifically outline the midwife's prior education.^{7,8,11,33–37,42,52–54} A mix of intrapartum providers including physicians, CNMs, and other legally practicing midwives were reported in 7 articles drawing from 4 datasets.^{9,10,20,38–41}

Differences in Practice (Time and Geography)

Data for the studies were collected from the early 1980s through 2011, and maternity care varied greatly over time. For example, baseline rates of episiotomy decreased in all locations over time, whereas epidural analgesia and cesarean rates increased. Geographic location also affected results; the Waldenström and Nilsson study was one of the few without significantly lower rates of cesarean birth for women in the birth center, in part because of low statistical power to detect differences from the hospital's 8.9% cesarean rate, which is a typical rate in Sweden.³⁷ This heterogeneity makes rigid statistical comparisons difficult but provides insight into larger trends in maternity care.

Samples

Race/Ethnicity

Thirteen of the quantitative articles and 4 qualitative articles included information on race, ethnicity, or cultural identity of participants.^{7,8,12,20,33–40,42–46,49,53,54} These sources varied in the populations served, but the majority of women receiving care in birth centers were identified as white or Caucasian.^{7,8,12,20,33,34,36–40,42–44,53,54} A large number of participants in 4 studies were white women with Hispanic ethnicity.^{9,10,12,43} The majority of participants in 2 studies were black women,^{46,49} and a single study involved Inuit women.³⁵

Educational Level

Women in birth center care were typically more educated than the general population.^{5,9,12,43,44} The multisite study of Stapleton et al found that 71.8% of women admitted to freestanding birth centers had attended college, and 51.8% were college graduates.¹²

Socioeconomic Status

Three studies targeted women with lower socioeconomic status and compared women in birth center care to women in hospital care.^{10,34,47}

Study Design

The most common study design was a matched cohort comparison. Eleven of the reviewed articles compared a cohort of women planning or beginning labor in the birth center with a similar group of women in the hospital.^{5,8,10–12,20,33,34,42–46,56} Six articles (4 from analyzing a single dataset) reported cohort studies of freestanding birth center care that did not employ a matched comparison group.^{9,38–40} Cohort studies used a prospective design in 13 articles based on 7 datasets.^{5,8,10–12,33,34,38–40,43} There were 5 retrospective cohort studies.^{20,44–46,56} Although a Scupholme study allocated women to the birth center due to hospital overcrowding,⁴³ only Waldenström and Nilsson randomized participants to the birth center or hospital care.^{7,36,37}

Study Samples and Statistical Analysis

The number of women entering and establishing care at a birth center is related to the centers' clinical practice guidelines and when initial screening for low-risk status takes place. For instance, at some birth centers all women are seen for an initial visit, whereas at others a receptionist is asked to perform a basic screening for risk factors prior to booking an appointment. Once women enter care, birth centers use varying guidelines to determine if a center birth is appropriate, and they refer women who need a higher level of care. At the beginning of labor, care providers again determine if a woman is an appropriate candidate to give birth out of the hospital, and women who need additional care are referred. Once admitted, care providers closely monitor the mother and newborn and transport women or newborns if they no longer meet low-risk criteria. Over time, these referrals gradually reduce the number of women receiving birth center care. Researchers handle this attrition in a variety of ways. Researchers can use an intent-to-treat analysis that allocates groups at a fixed point and retains the original groups throughout the study. The intent-to-treat approach has limitations, especially when there is a large amount of crossover from one group to another prior to the event of interest. For instance, it is minimally helpful to know the postpartum referral rate for all women entering birth center prenatal care because nearly half of those women would have been referred to the hospital prior to giving birth. With fairly high transfer rates from one group to another, it can be useful to know outcomes for women in smaller subsets of the original group, for instance, the postpartum transfer rate for women who gave birth in the center. This approach provides more clinically applicable information and greater statistical power to detect differences between groups. Therefore, many researchers perform subgroup analyses to provide more relevant information. However, subgroup analyses can be problematic because they increase the influence of confounding variables, and the lack of standardized approaches to group formation makes comparison across studies difficult. For clarity, we have noted the denominator for all transfer rates in Table 1.

Outcomes of Care

Mode of Birth

Mode of birth was an outcome variable in 13 articles, and the majority of these categorized the mode of birth as

spontaneous vaginal, assisted vaginal, or cesarean.^{5,8-12,37,40,43-46,56} In 4 studies, assisted births were further divided into forceps and vacuum.^{11,37,40,45} Spontaneous vaginal birth rates were higher for women beginning care in a birth center when compared with women receiving care in hospitals in all studies. Five studies with groups of women in birth center care matched with low-risk women in hospital care had significantly higher rates of spontaneous vaginal birth.^{5,8,10,11,56} Studies without comparison groups examined vaginal birth rates in birth center cohorts compared to national averages.^{9,12,38-40}

Although forceps and vacuum devices cannot be used within birth centers accredited by the Commission for the Accreditation of Birth Centers, they can be used following transfer to a hospital. Women who begin care at a birth center had significantly lower rates of assisted vaginal births when compared with women initially admitted to hospitals in 6 studies.^{8,10,11,44,46,56} One additional study also found a lower rate of assisted birth that failed to reach statistical significance.⁵

Corresponding to higher rates of spontaneous vaginal birth, rates of cesarean birth were decreased in women planning birth center care. All of the studies with comparison groups found lower rates of cesarean births among women in birth center care compared to women in standard hospital care.^{5,10,37,44,56} Three of the studies found significantly lower cesarean birth rates for women beginning labor at a birth center as compared to a hospital.^{8,11,46} Low baseline hospital cesarean rates in 2 European studies decreased the statistical power to detect a significant change, but the women beginning labor in birth centers did have a lower cesarean rate.^{37,56} In cohort (observational) studies without comparison groups, cesarean birth rates for women seeking birth center care were low compared to national rates for low-risk women.^{9,12,43}

Pain Relief

Common methods of intrapartum pain relief and their frequency of use varied over time, providing chronologic information about intrapartum interventions and physiologic birth. Two of the earlier studies found significantly lower rates of narcotic analgesia in birth center groups when compared with hospital groups.^{5,36} This variable was not reported in later studies. In 1994, Waldenström and Nilsson identified significantly higher utilization of pharmacologic pain relief methods in the hospital setting, including nitrous oxide, pudendal, and paracervical block contrasted with significantly higher rates of sterile water papule use in the birth center.³⁶

Rates of epidural analgesia use for all women varied greatly over time and with study location. Although epidural analgesia is not available in a freestanding birth center, it is used by women after transfer. When reported, epidural analgesia rates for women planning or beginning birth center care were significantly lower than for women planning hospital care.^{8,10,11,36,37,44} However, women planning hospital birth may have different preferences for labor coping than women planning birth center birth.

Perineal Integrity

Episiotomy rates decreased over time throughout the studies and in all sites. Three studies found significantly lower rates

of episiotomy in birth center groups as compared to hospital groups.^{11,44,56} In a 1987 study by Feldman and Hurst, the episiotomy rate in the birth center was 47.2%, and in the hospital it was 78.1%.⁴⁴ In 1999, David et al found that freestanding birth centers in Berlin had a 15.7% episiotomy rate compared to a rate 54.8% at hospitals in the same city.⁵⁶ In a 2011 study, the episiotomy rate in freestanding birth centers (8.6%) was still significantly less than within the hospital (19.3%).¹¹

In 3 studies, rates of women having an intact perineum following vaginal birth were significantly higher in the birth center group when compared with a hospital group.^{8,44,56} Intact perineum rates in the birth centers, when reported, ranged from 25%⁴⁴ to 61.3%.⁸ Although the rates of episiotomy were lower in the birth center groups and the rates of perineal integrity were higher, there was not a significant difference in the rate of third- and fourth-degree lacerations between groups in the 2 studies reporting this measure.^{8,11}

Oxytocin Use in Labor

Whereas oxytocin is not used prior to birth at freestanding birth centers following AABC standards, studies using intent-to-treat analysis provide insight on the rates of women needing oxytocin induction or augmentation. Oxytocin use during labor was significantly lower among intended birth center groups in all 6 studies reporting this variable.^{5,8,10,11,37,44}

Length of Labor

Three sources measured length of labor and found that women beginning labor in birth centers had significantly longer labors than women beginning labor in the hospital.^{5,37,44} An analysis of more than 745,000 births in a variety of settings in the United States found that 4661 women who gave birth in freestanding birth centers were significantly more likely than women who gave birth within the hospital to have prolonged or precipitous labors, although a definition of *prolonged labor* was not provided.²⁰

Transfers

Transfer rates during antepartum, intrapartum, and postpartum care were reported in 18 studies. However, definitions were not uniform across studies, making comparisons difficult. For instance, some studies separated antepartum transfers into medical and nonmedical,^{10,12,36,38,42,43} whereas other studies did not differentiate.^{7,44} In addition, one study had a unique category for women experiencing a first trimester loss.¹² Rates of antepartum transfer for medical reasons during pregnancy ranged from 13%³⁷ to 27.2%.¹⁰ The most recent antepartum medical transfer rate, which was reported by Stapleton et al, was 13.7%.¹² Waldenström and Nilsson were the only authors to differentiate antepartum transfer rates by parity, and multiparous women were transferred in the antepartum period at a rate 5 times greater than that of nulliparous women.³⁶

Intrapartum transfer rates ranged from 11.6%⁸ to 37.4%.⁷ In studies from the past 5 years, intrapartum transfer rates ranged from 11.6%⁸ to 16.5%.¹¹ Researchers did not have a uniform approach to defining this variable and calculated rates using a variety of denominators ranging from

all women entering birth center care prenatally to women admitted to the birth center in labor. For example, birth centers assess laboring women and determine if they meet admission criteria. Women who are transferred after this initial intrapartum assessment but prior to admission (known as a *preadmit intrapartum transfer* in 2 studies^{12,45}), are included in the intrapartum transfer data of some but not all studies, affecting the ability to compare rates across studies. Twelve articles reported intrapartum transfer rates as a ratio of women transferred following admission in labor to all women admitted.^{8,9,12,34,39,40,43,45,51,56} Four articles calculated intrapartum transfer rates from a denominator of women planning birth center birth at the beginning of labor.^{5,11,41,42} Three studies, published in 5 articles, calculated intrapartum transfer ratios by dividing the number of women transferred intrapartum by the number of women in prenatal care or the study group.^{7,10,36,37,44} These discrepancies in denominators, combined with differences across countries, make it difficult to make conclusive statements about transport rates.

Transfer from freestanding birth centers during labor and postpartum was the focus of 4 articles.^{39,41,42,51} The most common reasons for intrapartum transfer were failure to progress, rupture of membranes without labor, and prolonged labor.^{12,41,42,51} In all studies reporting transfer data, the leading reasons for transfer were nonemergency conditions. Rowe et al reported on transfer time and reported that average time from decision to transfer to being assessed at the hospital was 60 minutes, but the transfer time was significantly decreased for emergency transfers.⁴² Nonreassuring fetal heart rate was the leading indication for emergency intrapartum transport.^{12,41,51}

Intrapartum transfer rates for nulliparous women were at least 5 times higher than for multiparous women.^{8,11,36,42} When reported, intrapartum transfer rates for nulliparous women ranged from 27.3%³⁶ to 29.6%^{11,42} and for multiparous women from 4.9%⁴² to 5.3%.¹¹ In a large study from England, 78% of women transferred from freestanding birth centers were nulliparous.⁴² In the Stapleton et al study in the United States, nulliparous women accounted for 81.6% of intrapartum transfers.¹²

Postpartum transfer rates were reported in 11 studies^{5,8,11,12,36,37,39,42,44,45,56} and ranged from 0.5%⁴⁵ to 4.8%,¹¹ with postpartum hemorrhage and retained placenta as the most common reasons.^{9,11,12} Three sources calculated postpartum transfer rates by dividing the number of women needing postpartum transport by the total number of women giving birth in the center.^{9,12,39} Other studies used the larger denominator of women admitted to the birth center^{5,8,11,42,45,56} or planning birth center birth.^{7,36,37}

Women transfer from birth center care due to medical or nonmedical reasons at any point in pregnancy, labor, or postpartum, resulting in gradual attrition from the birth center group. Two studies provided data on the percent of women who began care in a freestanding birth center and remained low risk and gave birth within the center. In 1992, Rooks et al reported that of women who had at least one prenatal visit, 52.5% of them gave birth in the birth center.³⁹ Of women who had regular antepartum care, 56.5% gave birth at the birth center.³⁸ In 2003, Jackson et al reported that 45% of women who entered antepartum care gave birth at the center.¹⁰ No

articles provided data on the percent of women who began prenatal care at a birth center and completed their entire peripartum care through to postpartum at the birth center.

Three studies examined the rate of emergency (emergent) transfers in comparison to nonemergency (nonemergent) transfers.^{12,39,42} Rooks et al reported 7.9% of women or newborns experience emergency complications, but half were managed at the birth centers and half transferred to hospitals.^{9,39} In Stapleton et al, of the 12.4% intrapartum transfers, 1.9% were reported as emergencies.¹² Rowe et al analyzed transfer data from the Birthplace study¹¹ and found that nulliparous women had a 9.5% “potentially urgent” transfer rate in labor, whereas multiparous women had only a 1.5% “potentially urgent” transfer rate.⁴² In all studies examining transport, the majority of intrapartum transfers involved nonemergency conditions.^{9,12,39,42}

Serious Maternal Outcomes

The incidence of serious maternal morbidity and mortality is low in the developed world, resulting in low statistical power to see differences between hospital and birth center groups. Nearly all studies collected data on the incidence of serious maternal complications, although the definition of this variable was not well defined, and few reported any serious complications for women planning birth center or hospital care. The Waldenström and Nilsson 1997 study reported one case of severe maternal morbidity requiring admission to the intensive care unit in each group.³⁷ (One woman in the birth center had water poisoning with electrolyte imbalance, and one in the hospital group had severe toxemia.) Both women fully recovered.³⁷ Overgaard et al reported no severe adverse maternal outcomes in either group.⁸ David et al had one maternal death in the hospital group and none in the birth center group, but they did not elaborate on the circumstances.⁵⁶ A large 2011 study of birth in all settings in the United Kingdom reported a significantly lower rate of blood transfusions and transfer to a higher level of care when comparing women who planned freestanding birth center care at the beginning of labor to hospital care.¹¹

Satisfaction

Four quantitative and 2 qualitative studies reported measures of maternal satisfaction. Two studies with comparison groups found significant differences in satisfaction with prenatal, intrapartum, and postpartum care compared to the control groups of standard hospital care.^{7,9,36} Women beginning labor in a birth center had significantly improved quantitative measures of satisfaction when compared with women planning hospital births.³³ Significantly more women in the birth center group felt that antepartum care raised their self-esteem and that they would use the same model in the future.⁷

Two of the 8 qualitative studies included findings specifically about satisfaction,^{35,48} and all other qualitative studies had results loosely related to this concept.^{47,49,50,52} Women in birth center care were satisfied with the comprehensive, personalized care that they received⁴⁹ and the overall environment of the center.^{47,48,50,52} Positive relationships with midwife caregivers were a theme in 4 qualitative

studies.^{47,48,52-54} Participants valued the connections with midwives.⁴⁷ Women stated that their relationships with birth-center midwives were more egalitarian than with previous hospital providers,⁵³ and this personal connection enabled them to be active participants in health care decisions.⁵³ Participants in the Pewitt study felt that the close relationship with the birth center midwives care increased their confidence, and that their birth experiences demonstrated their capacity to handle life challenges.⁴⁸ As a result of these experiences, they felt more confident as parents.⁴⁸ Satisfaction with the relaxing birth center environment was a theme in 3 qualitative studies.^{47,50,52} Women were also pleased with the birth center physiologic approach to care in comparison with previous hospital experiences.^{53,54}

DISCUSSION

This is the first integrative review of maternal outcomes in birth centers and clearly supports that birth centers are safe locations of birth for low-risk women as part of a leveled approach to maternity services.^{3,4} The quantitative studies reviewed included more than 84,300 women seeking birth center care, and few severe adverse maternal outcomes and no maternal deaths were reported in the birth center groups. Rates of spontaneous vaginal births were high compared with hospital groups or national averages,^{5,8-12,44,56} and the cesarean birth rates were lower than similar hospital comparison groups.^{5,10,37,44,56} In addition, qualitative reports support that birth centers provide patient-centered care, consistent with current goals for patient engagement in health care decisions.

Summary of Maternal Outcomes

Maternal outcomes for birth centers were equivalent or improved when compared with hospital groups or national averages in all studies. Serious maternal outcomes were exceedingly rare, and no maternal deaths occurred following admission to the birth center in any of the studies. The rates of cesarean birth were lower for women admitted to a birth center in labor when compared with women admitted to hospitals in all studies, and larger studies with adequate statistical power found statistically significant differences between the groups.^{5,10,37,44,56} The rate of assisted birth was also less for women who started labor at the birth center. Correspondingly, rates of vaginal birth were higher, or significantly higher, for women receiving intrapartum birth center care in all studies.^{5,8-12,44,56}

Use of pharmacologic pain relief was significantly decreased for women beginning labor in birth centers when compared with women laboring in hospitals,^{5,8,10,11,44} even in studies that randomized women to birth location.^{36,37,43} Length of labor was significantly increased in birth centers when compared with hospital groups.^{5,20,37,44} However, use of oxytocin was significantly decreased for women starting labor in the birth center when compared with their hospital counterparts.^{5,8,10,11,37,44} Birth center care in labor and during birth was associated with lower rates of episiotomy^{8,10,11,44,56} and higher rates of perineal integrity^{8,44,56} when compared with hospital care.

Women, including those transferred to other facilities, reported satisfaction with the birth center model in both quantitative and qualitative studies.^{7,33,36,47,48,52,53} Women were pleased not only with the environment, services, and providers, but also reported a new sense of self-confidence and empowerment following birth. Engagement in ongoing decision making was mentioned in qualitative studies.⁵³⁻⁵⁵

However, whereas birth centers have positive maternal outcomes, not all women are appropriate candidates for birth center birth. Total transfer rates of women from entry into prenatal care to birth range as high as 54.7%.¹⁰ Multiparous women were more likely to be transferred antepartum,³⁶ and nulliparous women were more likely to be transferred intrapartum.^{11,12,39,42} Emergent transfers from birth centers were a small percentage of all transfers, and the most common reason for intrapartum transfer was lack of progress.^{12,42}

These results provide information that birth centers are a safe option for low-risk women who chose an out-of-hospital model of care. However, there are caveats to the generalizability of the findings. For example, in all but one study, participants were women who specifically wanted a birth center birth; pregnant women are a vulnerable research population, and assigning them to give birth in a specific location has ethical implications. Only the 1986 Scupholme et al study had a forced allocation to the birth center related to hospital overcrowding.⁵ Even the randomized controlled trial conducted by Waldenström and Nilsson enrolled only women desiring the birth center; therefore, the sample may have been different than the general population of pregnant women.^{7,36,37}

The population of women seeking birth center care often had characteristics associated with positive perinatal outcomes. In the majority of studies, women who sought birth center care were more educated and from ethnic or racial groups associated with improved maternal outcomes in comparison with hospital cohorts.^{2,7-9,12,33,34,36,37,45,56} However, improved perinatal outcomes were found even in studies that included or targeted women from marginalized racial groups.^{43,46}

The heterogeneity of the studies and the variations of practice also limit generalization of findings. Maternity care practices change over time and vary dramatically by country. Even when the country and time were held fairly constant, there were still variations in practice within multisite trials. The 2 large studies of birth center care in the United States, led by Rooks et al and Stapleton et al, enrolled a variety of accredited and unaccredited centers.^{9,12,38-40} However, even with this diversity of sites, these studies had outcomes similar to research from more uniform datasets. Although there are limitations to the literature on birth center care, the consistency of positive maternal outcomes across studies supports this model.

High rates of transfer may contribute to the positive birth outcomes in birth centers due to selection bias. However, when studies used an intent-to-treat analysis, the risk of intrapartum interventions, including cesarean, was consistently lower for women who were admitted to birth centers in labor.^{5,8-12,44} Taken as a whole, the data supports that birth centers are appropriate for low-risk women who want this approach to maternity care.

Practice Implications

Maternal outcomes following birth have received increased attention because the United States and other developed nations have experienced a rise in maternal morbidity and mortality.⁵⁷ Allowing or even encouraging low-risk women to choose birth center care could reduce cesarean rates, an important goal in improving maternal outcomes immediately and with subsequent pregnancies.^{3,58,59} In 2015, a statement endorsed by the American College of Obstetricians & Gynecologists, AABC, and the American College of Nurse-Midwives acknowledged the birth center as an appropriate location of birth as part of a leveled approach to maternity services based on maternal risk status. A British organization, the National Collaborating Centre for Women's and Children's Health, went even further in supporting birth center care by stating that all low-risk women should be encouraged to choose out-of-hospital models for birth to increase their likelihood of positive perinatal outcomes.³

However, the literature does not support that all low-risk women should be required to use birth center care. All but one study included only women who wanted birth center care, creating allocation bias within the studies. In this research, women who wanted to give birth in birth centers had superior maternal outcomes. However, this positive effect may not remain if women were required to begin their labor in this location. Although allocation bias is problematic for research generalization, patient autonomy and patient-centered care put the woman's priorities for care as a paramount consideration. Whereas the positive aspects of birth center care may not remain if all low-risk women were required to utilize birth centers, women should be allowed to choose their location of birth.

Based on this integrative literature review, a woman who desires birth center care should be encouraged to find a birth center operating under the AABC standards that meets her needs. Although the birth center model has clear benefits for low-risk women, information on the likelihood of transfer needs to be included as part of a larger patient-centered conversation about informed choice.

Research and Policy Implications

Whereas this review demonstrates that high-quality studies performed across time and in a variety of locations support the birth center model, further research is needed. Although it would be ideal to have comparative effectiveness research with hospital comparison groups carefully matched to birth center groups for risk status, educational level, and race/ethnicity, women who opt for birth center care may have a different philosophy or approach to birth, as stated in qualitative studies, that acts as a confounding variable. Instead, more research with large datasets would increase the strength of the evidence. Ideally, these data sets could be gathered from birth centers providing care according to the AABC standards.

Currently, the lack of standardized definitions of key measures of birth center care, including intrapartum transfer, limits the generalizability of studies. Researchers should strive toward uniform definitions of these concepts, such as those

in the AABC Perinatal Data Registry.⁶⁰ In addition, authors should also present the denominator of all subgroup analyses for clarity and to allow outcome comparisons across studies.

This integrative review focused solely on maternal outcomes. Many of the reviewed studies include information on neonatal outcomes in birth centers, and other publications study solely neonatal outcomes. Clinicians could benefit from a comprehensive appraisal of the literature on neonatal outcomes to provide information to women considering birth center care.

Although the birth center model results in fewer intrapartum interventions and positive maternal outcomes, cost savings of this model, when compared to hospital care, has not been established. Cost analyses should include fees associated with transfer and savings from prevention of first and subsequent cesarean births to provide a comprehensive estimate of the cost of birth center care. Cost comparisons would provide valuable information to understand if this model, even with high rates of consultation and transfer, provides an overall financial benefit that is consistent with current initiatives to encourage evidence-based, efficient care.⁶¹

Transfer is a relatively common event for women admitted to birth centers. Researchers should assess women's experience of transfer to provide information on best practices for this vulnerable moment. Information from the literature on home birth may have applicability to this population, but this needs further exploration.⁶²

Birth center care is consistent with current national priorities for health promotion, shared decision making, and appropriate use of medical technology and services. To increase access to freestanding birth centers, barriers to operations and sustainability need to be addressed at the local, state, and national levels. Recent national and international reports support birth centers as a vital component of a comprehensive maternity care system.^{3,4} Ideally, local providers, state regulators, and insurance companies will review the evidence and support the birth center model of care.

CONCLUSION

Birth centers are a maternity care model for low-risk women leading to positive outcomes. Women who receive birth center care have higher rates of spontaneous vaginal birth and postpartum perineal integrity when compared with matched hospital cohorts. Using intent-to-treat analysis, intrapartum birth center care was also associated with lower rates of medical interventions and procedures including oxytocin augmentation, episiotomy, assisted vaginal birth, and use of pain medication. Quantitative and qualitative studies found that women were very satisfied with birth center care. Overall transfer rates from the birth center ranged up to 54.7% of women beginning prenatal care, but the majority of transfers were for nonemergency conditions. This data clearly supports that birth centers are a safe model of care for low-risk women when associated with a health system able to provide higher-level care. Although more research is needed, birth centers should be supported by clinicians, policy makers, and health insurance carriers to enable low-risk women to access this evidence-based model of care.

AUTHORS

Jill Alliman, CNM, DNP, is Project Director for the American Association of Birth Centers (AABC) Strong Start Program and Chair of the AABC Legislative Committee. She teaches masters and doctoral students in the nurse-midwifery program at Frontier Nursing University in Hyden, Kentucky.

Julia C. Phillippi, CNM, PhD, FACNM, is Assistant Professor at Vanderbilt University School of Nursing in Nashville, Tennessee, where she performs research, teaches masters and doctoral students, and practices midwifery.

CONFLICT OF INTEREST

Jill Alliman, CNM, DNP, is an employee of the American Association of Birth Centers. Julia Phillippi, CNM, PhD, FACNM, has no conflicts of interest to disclose.

REFERENCES

1. MacDorman MF, Mathews TJ, Declercq E. Trends in out-of-hospital births in the United States, 1990–2012. NCHS data brief, no 144. Hyattsville, MD: National Center for Health Statistics. 2014.
2. Martin JA, Hamilton BE, Osterman M, Curtin SC, Matthews T. Births: Final data for 2013. *Natl Vital Stat Rep*. 2015;64(1):1-65. Hyattsville, MD: National Center for Health Statistics.
3. National Collaborating Centre for Women's and Children's Health. Intrapartum Care: Care of healthy women and their babies during childbirth: National Collaborating Centre for Women's and Children's Health London: National Institute for Health and Care Excellence; 2014.
4. American College of Obstetricians and Gynecologists, Society for Maternal-Fetal Medicine. Obstetric Care Consensus No. 2: Levels of Maternal Care. *Obstet Gynecol*. 2015;125(2):502-515. doi: 10.1097/01.AOG.0000460770.99574.9f.
5. Scupholme A, McLeod AG, Robertson EG. A birth center affiliated with the tertiary care center: Comparison of outcome. *Obstet Gynecol*. 1986;67(4):598-603.
6. Phillippi JC, Alliman JA, Bauer K. The American Association of Birth Centers: History, membership, and current initiatives. *J Midwifery Womens Health*. 2009;54(5):387-392. doi: 10.1016/j.jmwh.2008.12.009.
7. Waldenström U, Nilsson CA. Women's satisfaction with birth center care: A randomized, controlled study. *Birth*. 1993;20(1):3-13.
8. Overgaard C, Møller AM, Fenger-Grøn M, Knudsen LB, Sandall J. Freestanding midwifery unit versus obstetric unit: A matched cohort study of outcomes in low-risk women. *BMJ Open*. 2011;1(2).
9. Rooks JP, Weatherby NL, Ernst EKM, Stapleton S, Rosen D, Rosenfield A. Outcomes of care in birth centers: The National Birth Center Study. *N Engl J Med*. 1989;321(26):1804-1811.
10. Jackson DJ, Lang JM, Swartz WH, Ganiats TG, Fullerton J, Ecker J, et al. Outcomes, safety, and resource utilization in a collaborative care birth center program compared with traditional physician-based perinatal care. *Am J Public Health*. 2003;93(6):999-1006.
11. Brocklehurst P, Hardy P, Hollowell J, Linsell L, Macfarlane A, McCourt C, et al. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: The Birthplace in England national prospective cohort study. *BMJ*. 2011;343(7840):d7400.
12. Stapleton SR, Osborne C, Illuzzi J. Outcomes of care in birth centers: Demonstration of a durable model. *J Midwifery Womens Health*. 2013;58(1):3-14.
13. United States Government. Social Security Act. 42 USC § 1396d(l)(3)(B); 2010.
14. American Association of Birth Centers. Birth Center Regulations. 2015. Available at: <http://www.birthcenters.org/open-a-birth-center/birth-center-regulations>. Accessed January 20, 2015.
15. American Association of Birth Centers. *Standards for Birth Centers*. Perkiomenville, PA: American Association of Birth Centers; 2014.
16. Commission for the Accreditation of Birth Centers. Accredited Birth Centers. 2015. <http://www.birthcenteraccreditation.org/find-accredited-birth-centers/> Accessed January 5, 2015.
17. Whittemore R, Knafelz K. The integrative review: Updated methodology. *J Adv Nurs*. 2005;52(5):546-553.
18. Walsh D, Downe SM. Outcomes of free-standing, midwife-led birth centers: A structured review. *Birth*. 2004;31(3):222-229.
19. Grünebaum A, McCullough LB, Sapra KJ, et al. Apgar score of 0 at 5 minutes and neonatal seizures or serious neurologic dysfunction in relation to birth setting. *Am J Obstet Gynecol*. 2013;209(4):323.e1-323.e6.
20. Wax JR, Pinette MG, Cartin A, Blackstone J. Maternal and newborn morbidity by birth facility among selected United States 2006 low-risk births. *Am J Obstet Gynecol*. 2010;202(2):152.e1-152.e5.
21. Cheng YW, Snowden JM, King TL, Caughey AB. Selected perinatal outcomes associated with planned home births in the United States. *Am J Obstet Gynecol*. 2013;209(4):325.e1-325.e8.
22. Illuzzi JL, Stapleton SR, Rathbun L. Early and total neonatal mortality in relation to birth setting in the United States, 2006-2009. *Am J Obstet Gynecol*. 2014.
23. Grünebaum A, McCullough LB, Sapra KJ, et al. Early and total neonatal mortality in relation to birth setting in the United States, 2006-2009. *Am J Obstet Gynecol*. 2014;211(4):390.e1-390.e7.
24. Laws PJ, Tracy SK, Sullivan EA. Perinatal outcomes of women intending to give birth in birth centers in Australia. *Birth*. 2010;37(1):28-36.
25. Tracy SK, Dahlen H, Caplice S, et al. Birth centers in Australia: A national population-based study of perinatal mortality associated with giving birth in a birth center. *Birth*. 2007;34(3):194-201.
26. Morano S, Cerutti F, Mistrangelo E, et al. Outcomes of the first midwife-led birth centre in Italy: 5 years' experience. *Arch Gynecol Obstet*. 2007;276(4):333-337.
27. Douglas VK. The Inuulitsivik Maternities: Culturally appropriate midwifery and epistemological accommodation. *Nurs Inq*. 2010;17(2):111-117.
28. da Silva F, de Oliveira SM, Bick D, Osava RH, Tuesta EF, Riesco ML. Risk factors for birth-related perineal trauma: A cross-sectional study in a birth centre. *J Clin Nurs*. 2012;21(15-16):2209-2218.
29. Gilson GJ, O'Brien ME, Vera RW, Mays ME, Smith DR, Ross CY. Prolonged pregnancy and the biophysical profile. A birthing center perspective. *J Nurse Midwifery*. 1988;33(4):171-177.
30. Stone PW, Zwanziger J, Walker PH, Buenting J. Economic analysis of two models of low-risk maternity care: A freestanding birth center compared to traditional care. *Res Nurs Health*. 2000;23(4):279-289.
31. Howell E, Palmer A, Benatar S, Garrett B. Potential Medicaid cost savings from maternity care based at a freestanding birth center. *Medicare Medicaid Res Rev*. 2014;4(3):pii: mmrr2014-004-03-a06. doi: 10.5600/mmrr.004.03.a06.
32. Henderson J, Petrou S. Economic implications of home births and birth centers: A structured review. *Birth*. 2008;35(2):136-146.
33. Overgaard C, Fenger-Grøn M, Sandall J. The impact of birthplace on women's birth experiences and perceptions of care. *Soc Sci Med*. 2012;74(7):973-981.
34. Overgaard C, Fenger-Grøn M, Sandall J. Freestanding midwifery units versus obstetric units: Does the effect of place of birth differ with level of social disadvantage? *BMC Public Health*. 2012;12(1):478.
35. Chamberlain M, Nair R, Nimrod C, Moyer A, England J. Evaluation of a midwifery birthing center in the Canadian north. *Int J Circumpolar Health*. 1997;57:116-120.
36. Waldenström U, Nilsson CA. Experience of childbirth in birth center care. *Acta Obstet Gynecol Scand*. 1994;73(7):547-554.
37. Waldenström U, Nilsson CA. A randomized controlled study of birth center care versus standard maternity care: effects on women's health. *Birth*. 1997;24(1):17-26.
38. Rooks JP, Weatherby NL, Ernst EKM. The National Birth Center Study. Part I: Methodology and prenatal care and referrals. *J Nurse Midwifery*. 1992;37(4):222-253.

39. Rooks JP, Weatherby NL, Ernst EK. The National Birth Center Study. Part III: Intrapartum and immediate postpartum and neonatal complications and transfers, postpartum and neonatal care, outcomes, and client satisfaction. *J Nurse Midwifery*. 1992;37(6):361-397.
40. Rooks JP, Weatherby NL, Ernst EK. The National Birth Center Study. Part II: Intrapartum and immediate postpartum and neonatal care. *J Nurse Midwifery*. 1992;37(5):301-313.
41. Nguyen USD, Rothman KJ, Demissie S, Jackson DJ, Lang JM, Ecker JL. Transfers among women intending a birth center delivery in the San Diego birth center study. *J Midwifery Womens Health*. 2009;54(2):104-110.
42. Rowe RE, Townend J, Brocklehurst P, et al. Duration and urgency of transfer in births planned at home and in freestanding midwifery units in England: Secondary analysis of the birthplace national prospective cohort study. *BMC Pregnancy Childbirth*. 2013;13(1):224.
43. Scupholme A, Kamons AS. Are outcomes compromised when mothers are assigned to birth centers for care? *J Nurse Midwifery*. 1987;32(4):211-215.
44. Feldman E, Hurst M. Outcomes and procedures in low risk birth: A comparison of hospital and birth center settings. *Birth*. 1987;14(1):18-24.
45. Roberts L, Sward K. Birth center outcomes reported through automated technology. *J Obstet Gynecol Neonatal Nurs*. 2001;30(1):110-120.
46. Benatar S, Garrett AB, Howell E, Palmer A. Midwifery care at a freestanding birth center: A safe and effective alternative to conventional maternity care. *Health Serv Res*. 2013;48(5):1750-1768.
47. Esposito NW. Marginalized women's comparisons of their hospital and freestanding birth center experiences: A contrast of inner-city birthing systems. *Health Care Women Int*. 1999;20(2):111-126.
48. Pewitt AT. The experience of perinatal care at a birthing center: A qualitative pilot study. *J Perinat Educ*. 2008;17(3):42.
49. Palmer L, Cook A, Courtot B. Comparing models of maternity care serving women at risk of poor birth outcomes in Washington, DC. *Altern Ther Health Med*. 2009;16(5):48-56.
50. Phillippi JC, Myers CR, Schorn MN. Facilitators of prenatal care access in rural Appalachia. *Women Birth*. 2014;27(4):e28-e35.
51. Fullerton JT, Jackson D, Snell B, Besser M, Dickinson C, Garite T. Transfer rates from freestanding birth centers: A comparison with the National Birth Center Study. *J Nurse Midwifery*. 1997;42(1):9-16.
52. Walsh DJ. 'Nesting' and 'Matrescence' as distinctive features of a freestanding birth centre in the UK. *Midwifery*. 2006;22(3):228-239.
53. Coyle KL, Hauck Y, Percival P, Kristjanson LJ. Normality and collaboration: Mothers' perceptions of birth centre versus hospital care. *Midwifery*. 2001;17(3):182-193.
54. Coyle KL, Hauck Y, Percival P, Kristjanson LJ. Ongoing relationships with a personal focus: Mothers' perceptions of birth centre versus hospital care. *Midwifery*. 2001;17(3):171-181.
55. Annandale EC. Dimensions of patient control in a free-standing birth center. *Soc Sci Med*. 1987;25(11):1235-1248.
56. David M, von Schwarzenfeld HK, Dimer J, Kantenich H. Perinatal outcome in hospital and birth center obstetric care. *Int J Gynaecol Obstet*. 1999;65(2):149-156.
57. Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol*. 2012;120(5):1029-1036.
58. Spong CY, Berghella V, Wenstrom KD, Mercer BM, Saade GR. Preventing the first cesarean delivery: Summary of a joint Eunice Kennedy Shriver National Institute of Child Health and Human Development, Society for Maternal-Fetal Medicine, and American College of Obstetricians and Gynecologists workshop. *Obstet Gynecol*. 2012;120(5):1181.
59. American College of Obstetricians & Gynecologists; Society for Maternal-Fetal Medicine. Obstetric care consensus no. 1: safe prevention of the primary cesarean delivery. *Obstet Gynecol*. 2014;123(3):693-711.
60. American Association of Birth Centers. AABC Perinatal Data Registry. 2014. www.birthcenters.org/?PDR. Accessed December 14, 2014.
61. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academy Press; 2001.
62. Vedam S, Leeman L, Cheyney M, et al. Transfer from planned home birth to hospital: Improving interprofessional collaboration. *J Midwifery Womens Health*. 2014;59(6):624-634.