

Birth Centers in Australia: A National Population-Based Study of Perinatal Mortality Associated with Giving Birth in a Birth Center

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ABSTRACT: Background: Perinatal mortality is a rare outcome among babies born at term in developed countries after normal uncomplicated pregnancies; consequently, the numbers involved in large databases of routinely collected statistics provide a meaningful evaluation of these uncommon events. The National Perinatal Data Collection records the place of birth and information on the outcomes of pregnancy and childbirth for all women who give birth each year in Australia. Our objective was to describe the perinatal mortality associated with giving birth in “alongside hospital” birth centers in Australia during 1999 to 2002 using nationally collected data. **Methods:** This population-based study included all 1,001,249 women who gave birth in Australia during 1999 to 2002. Of these women, 21,800 (2.18%) gave birth in a birth center. Selected perinatal outcomes (including stillbirths and neonatal deaths) were described for the 4-year study period separately for first-time mothers and for women having a second or subsequent birth. A further comparison was made between deaths of low-risk term babies born in hospitals compared with deaths of term babies born in birth centers. **Results:** The total perinatal death rate attributed to birth centers was significantly lower than that attributed to hospitals (1.51/1,000 vs 10.03/1,000). The perinatal mortality rate among term births to primiparas in birth centers compared with term births among low-risk primiparas in hospitals was 1.4 versus 1.9 per 1,000; the perinatal mortality rate among term births to multiparas in birth centers compared with term births among low-risk multiparas in hospitals was 0.6 versus 1.6 per 1,000. **Conclusions:** This study using Australian national data showed that the overall rate of perinatal mortality was lower in alongside hospital birth centers than in hospitals irrespective of the mother’s parity. (BIRTH 34:3 September 2007)

Key words: alongside hospital birth center, perinatal mortality, population-based study

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Accepted December 21, 2006

Source of funding for this study was the National Health and Medical Research Council of Australia, Population Health Capacity Building

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Birth center care emerged in Australia 21 years ago as a major alternative to mainstream maternity services and in response to concerns over the medicalization of normal birth (1–3). Birth centers are designed to provide an intermediate option of care between home and hospital birth, where women are involved in planning their own care with advice and support from midwives (2,4–9). In Australia, birth centers are staffed and run by midwives. Although obstetricians and registrars (or general practitioners in some centers) may be on call, they do not assist at labor or birth unless requested by the midwives to do so. In some birth centers where a team approach has been adopted, midwives and general practitioners/obstetricians may both be present during labor and birth (2).

Australia has no nationally agreed definition of a “birth center.” The definition that most closely resembles birth center practice in Australia was proposed in the National Perinatal Epidemiology Unit review of birth centers undertaken in the United Kingdom (8, p 8).

A birth centre is an institution that offers care to women with a straightforward pregnancy and where midwives take primary professional responsibility for care. During labour and birth, medical services, including obstetric, neonatal and anaesthetic care are available should they be needed, but they may be on a separate site, or in a separate building, which may involve transfer by car or ambulance.

The full United Kingdom definition includes both “freestanding” and “alongside” birth centers. However, Australian birth centers represented in the data for this study are exclusively hospital based. They are situated in urban settings alongside a labor ward and integrated wholly within the public hospital structure in terms of funding, staffing, and regulation. In most Australian hospitals, the labor ward is situated adjacent to the birth center so that transfer arrangements involve moving women not more than 50 m from birth center to labor ward. Although no one single model of birth center care is used, it is generally agreed that the philosophy of birth center care includes a homelike, nonclinical environment, autonomous midwifery practice, woman- and family-centered care, and a commitment to and belief in normal, physiologic birth (1,3,6,8,10–12).

A large qualitative study undertaken in Western Australia of women who had given birth in both a hospital and a birth center provides an insight into women’s perceptions of birth center care compared with hospital care (1,3). The women perceived four key areas situated at each end of a continuum of care. The themes relating to birth center care included “understanding birth as a natural physiological process,” “developing a collaborative relationship between the woman and the midwife” (1), “individu-

alized continuity of care,” and “an assurance that the same midwife would attend to individual or personal needs” (3). At the other end of this continuum, hospital care was perceived to be “based on a belief that pregnancy and birth are pathological processes requiring a level of physical interference with the birth process.” Women felt “uninvolved in decision making” (1), and the “exposure to multiple carers” made women “anxious about constantly having to repeat information” (3).

Several of these themes are well supported in the literature on continuity of midwifery care (13) and the emerging evidence on the benefits of one-to-one midwifery care (14). They are also supported by qualitative studies reporting the nature of birth center care perceived by midwives who work there (6,11,12). In the United States, a large prospective cohort study of an integrated collaborative management/birth center program (freestanding) found that the program was safe and reported a substantial reduction in the use of resources and procedures, such as operative deliveries and hospital stays, compared with the traditional United States model of perinatal care (15).

In Australia, a National Senate Inquiry into childbirth procedures in 1999 received over 200 public submissions and held public hearings over 6 days in six state capital cities (2). It found the “polarisation of views in the community was reflected in the polarisation of views among the professionals” and reported that “many women and many medical and midwife professionals recognise that an intermediate position is likely to prove most beneficial and most acceptable to women.” The inquiry found that the “most concrete and the most successful examples of the intermediate position are the birth centres, where women at low risk give birth in home like surroundings attended by midwives but with specialist back up should unexpected complications develop during birth.” The inquiry also found that “birth centres are oversubscribed everywhere” and that “they fulfill women’s desire for a less medicalised approach to childbirth without sacrificing the benefits which medical advances have made possible” (2, p 3). The inquiry summarized by stating that “When the demand for low intervention birth centres cannot be met, it is both disappointing and uneconomic that little effort is being made to shift resources from expensive interventions like Caesarean section to birth centres.” The committee recommended “the expansion of birth centres as part of (the) mainstream health system, with funding from hospital budgets” (2, p 3).

Notwithstanding the findings of this National Senate Inquiry, policymakers in Australia are reluctant to establish new birth centers while any doubt exists with respect to their safety. The National Perinatal

Epidemiology Unit's review of birth center care concluded that no reliable evidence about the clear benefit or harm associated with birth center care compared with any other type of intrapartum care exists (8). A small Australian trial of 201 women showed no differences between the hospital and the birth center groups relating to clinical outcomes or costs (4). However, the Swedish review of the safety of birth center care concluded that birth center care might be less safe for infants of primiparous women in terms of perinatal mortality (5). Such a significant finding has had a serious effect on the sustainability of birth centers in many countries, including Australia, where professional bodies have criticized both midwifery-led maternity care and birth center care (16).

Australia is in an enviable position in that it maintains a national health reporting system where a core set of data variables is collected and reported by the midwife in attendance at each woman's birth. The maternity system in Australia is also notable for the fact that in every state and territory, it is mandatory for every woman to be attended by a midwife when she gives birth. So far, no national study of perinatal mortality statistics attributable to birth in a birth center in Australia has been conducted. Our aim was to describe the rates of perinatal mortality among women who were reported as having given birth in birth centers in Australia during the years between 1999 and 2002 inclusive.

Methods

All women who gave birth in Australia in a hospital or a birth center from January 1, 1999, to December 31, 2002, were included in the study. Data were obtained from a national database, the National Perinatal Data Collection, which is an annual collection of cross-sectional data on all births in Australia. It is collated by the Australian Institute of Health and Welfare National Perinatal Statistics Unit from Perinatal or Midwives' Data Collections in each state and territory. The Midwives' Data Collections are population-based surveillance systems covering all births. They rely on midwives to record information on every birth. We examined data for primiparas (first birth \geq 20 wk gestation) and multiparas (previous births) separately. Women who elected to be treated as private patients (i.e., paying for the services of a private obstetrician) and who gave birth in a hospital or in a birth center were included in the study.

Data were extracted using the data item "actual place of birth" as reported in the National Perinatal Data Collection. This data item is reported by the midwife in attendance. When women are transferred from the birth center *during labor* and give birth in hospital,

some state data collections record the place of birth as "hospital," whereas other states record place of birth as the birth center from which the woman transferred. No woman who transferred out of the birth center *before her labor commenced* is recorded in this study as having given birth in a birth center.

We described the rates of perinatal mortality among women who were recorded as having given birth in a birth center. We adjusted for variables such as maternal age, maternal indigenous status, and maternal accommodation status (private or public), which are known to influence infant outcomes separately in Australia. We also compared deaths of "term" infants in a selected group of low-risk women who gave birth in a hospital compared with deaths of term infants in birth centers. At term was defined as 37 to 41 completed weeks' gestation and birthweight greater than or equal to 2,500 g. The low-risk hospital group consisted of women who were between 20 and 34 years of age, had no preexisting hypertension or diabetes, had no pregnancy-induced hypertension or gestational diabetes, and gave birth to a single baby in a vertex presentation between 37 and 41 completed weeks' gestation with a birthweight greater than or equal to 2,500 g.

Live birth is defined in the National Perinatal Data Collection as an infant with signs of life after pregnancy of at least 20 weeks' gestation and/or a birthweight of 400 g. A stillbirth is a birth resulting from a viable pregnancy in which the fetus does not exhibit any sign of life when completely removed from the birth canal, which includes antepartum and intrapartum stillbirth. A live birth/neonatal death included infants who were live born but died within the first 28 days of life. Perinatal mortality rate refers to the sum of the fetal and early and late neonatal deaths in 1,000 total births (both live and stillbirths). (A fetal death is known as a stillbirth; an early neonatal death is the death of a liveborn infant within 7 completed days after birth; and a late neonatal death is the death of a liveborn infant after 7 completed days and before 28 completed days after birth.)

The Perinatal Society of Australia and New Zealand Perinatal Death Classification (17) was available for the years 2001/2002 and was used to identify the single most important factor which resulted in the death.

All data were analyzed with Statistical Package for Social Sciences version 12.0 (18). Ethical approval was conferred by the University of New South Wales Human Ethics Committee.

Data Quality

In Australia, the data received from states and territories are checked for format and coding consistencies

before being compiled into the National Perinatal Data Collection at the Australian Institute of Health and Welfare National Perinatal Statistics Unit. The data go through a process of intensive validation (19) and improvement, including consultations with all state and territory perinatal data providers.

Results

In Australia, 1,001,249 women gave birth to 1,011,099 infants between January 1, 1999, and December 31, 2002. We excluded 6,785 (0.68%) women who gave birth in other places or where place-of-birth data were missing. A total of 21,800 (2.18%) women were recorded as having given birth in a birth center and 972,664 (97.14%) were recorded as having given birth in a hospital. Of women who gave birth in birth centers, 7,602 (34.87%) were primiparas and 14,198 (65.13%) were multiparas. In the population of Australian women who gave birth during 1999 to 2002, rates of preexisting medical conditions, such as hypertension and diabetes, were similar; a similar age demographic and lower rates of obstetric complications occurred among women who gave birth in birth centers (Table 1).

Table 1. Selected Maternal Characteristics for Women Who Gave Birth in a Birth Center or a Hospital, Australia, 1999–2002

<i>Maternal Characteristic</i>	<i>All Hospitals (n = 972,664) No. (%)</i>	<i>Birth Centers (n = 21,800) No. (%)</i>
Maternal age (yr)		
< 20	48,335 (4.97)	622 (2.85)
20–24	150,742 (15.50)	3,158 (14.49)
25–29	295,340 (30.36)	6,947 (31.87)
30–34	308,783 (31.75)	7,151 (32.80)
≥ 35	169,268 (17.40)	3,921 (17.99)
Not stated	196 (0.02)	1 (0.00)
Parity		
Primiparas	402,035 (41.33)	7,602 (34.87)
Multiparas	570,629 (58.67)	14,198 (65.13)
Preexisting medical condition		
None	948,496 (97.52)	21,192 (97.21)
Yes	15,385 (1.58)	59 (0.27)
Not stated	8,783 (0.90)	549 (2.52)
Obstetric complications		
None	851,127 (87.51)	20,400 (93.58)
Yes	108,775 (11.18)	568 (2.60)
Not stated	12,762 (1.31)	832 (3.82)
Presentation		
Vertex	922,086 (94.80)	21,696 (99.52)
Breech	43,567 (4.48)	59 (0.27)
Other	5,838 (0.60)	41 (0.19)
Not stated	1,173 (0.12)	4 (0.02)

Table 2. Frequency of Selected Infant Outcomes, Australia, 1999–2002

<i>Infant Outcome</i>	<i>All Hospitals No. (%)</i>	<i>Birth Centers No. (%)</i>
Primiparas	<i>n</i> = 409,286	<i>n</i> = 7,606
Gestational age (wk)		
< 37	36,391 (8.89)	79 (1.04)
37–41	364,060 (88.95)	7,316 (96.19)
42–45	8,737 (2.13)	210 (2.76)
Birthweight (g)		
< 1,500	6,590 (1.61)	6 (0.08)
1,500–2,499	25,570 (6.25)	89 (1.17)
2,500–4,499	370,943 (90.63)	7,436 (97.76)
≥ 4,500	5,224 (1.28)	72 (0.95)
Apgar 5 score		
< 7	9,836 (2.40)	81 (1.06)
7–10	398,668 (97.41)	7,525 (98.94)
Admit to NICU/SCN		
No	338,876 (82.80)	7,200 (94.66)
Yes	70,376 (17.19)	405 (5.32)
Multiparas	<i>n</i> = 580,004	<i>n</i> = 14,203
Gestational age (wk)		
< 37	41,976 (7.24)	81 (0.57)
37–41	530,104 (91.40)	13,753 (96.83)
42–45	7,843 (1.35)	368 (2.59)
Birthweight (g)		
< 1,500	6,520 (1.12)	3 (0.02)
1,500–2,499	27,473 (4.74)	94 (0.66)
2,500–4,499	532,145 (91.75)	13,631 (95.97)
≥ 4,500	12,699 (2.19)	470 (3.31)
Apgar 5 score		
< 7	10,120 (1.74)	86 (0.61)
7–10	568,994 (98.10)	14,115 (99.38)
Admit to NICU/SCN		
No	502,261 (86.60)	13,767 (96.93)
Yes	77,682 (13.39)	435 (3.06)

NICU/SCN = neonatal intensive care unit/special care nursery.

The infants born in birth centers were predominantly between 37 and 41 weeks' gestation and between 2,500 and 4,499 g in birthweight (Table 2). These infants were less likely to be admitted to the neonatal intensive care unit or the special care nursery after birth than infants born in hospitals during the same time period. Of the 21,809 infants born in birth centers, 12 were less than 32 weeks' gestation. The overall rate of perinatal death was significantly lower in birth centers compared with that in hospitals regardless of the mother's parity (Table 3). The odds of stillbirth and neonatal death after a live birth were significantly lower among women who gave birth in a birth center compared with women who gave birth in a hospital. After adjusting for the known confounders such as maternal age, ethnicity, and accommodation status, these ratios did not differ noticeably (Table 3).

The overall perinatal death rate for birth center infants versus all hospital births was 1.51 per 1,000 births versus 10.03 per 1,000 births (data not shown).

Table 3. Adjusted Risk of Death for Those Born in a Birth Center Compared with All Hospital Births, Australia, 1999–2002†

Infant Outcome	All Hospitals No. (%)	All Birth Centers		
		No. (%)	OR (99% CI)	AOR (99% CI)
Primiparas				
Liveborn/survived	401,760 (98.16)	7,588 (99.76)	1.00	1.00
Stillborn	3,078 (0.75)	10 (0.13)	0.17 (0.08–0.39)*	0.17 (0.08–0.39)*
Liveborn/neonatal death	1,411 (0.34)	7 (0.09)	0.26 (0.10–0.70)*	0.25 (0.09–0.65)*
Perinatal death	4,489 (1.09)	17 (0.22)	0.20 (0.11–0.38)*	0.20 (0.11–0.37)*
Multiparas				
Liveborn/survived	569,948 (98.27)	14,187 (99.89)	1.00	1.00
Stillborn	3,700 (0.64)	12 (0.08)	0.13 (0.06–0.27)*	0.13 (0.06–0.26)*
Liveborn/neonatal death	1,733 (0.30)	4 (0.03)	0.09 (0.03–0.34)*	0.09 (0.02–0.31)*
Perinatal death	5,433 (0.94)	16 (0.11)	0.12 (0.06–0.23)*	0.11 (0.06–0.21)*

Note: Data are unavailable for transfers from birth centers to labor wards.

* $p < 0.01$.

† Sum of percentage of each variable was not equal to 100 because not all categories were presented. Adjusted Odds Ratio (AOR): adjusted for maternal age, maternal Aboriginal or Torres Strait Islander status, and private patient accommodation status.

Further analysis of the perinatal deaths to women who gave birth in birth centers revealed that of the 33 deaths that occurred over the 4-year study period, 15 stillbirths were induced; of these stillbirths, 12 were less than 32 weeks' gestation and an additional 3 stillbirths were induced at term (Fig. 1). Of the 20 term infants who died, 8 were born to women older than 35 years, and no deaths occurred among those born in birth centers at 42 to 45 weeks' gestation. The single most important factor that resulted in death was available through the Perinatal Society of Australia and New Zealand Perinatal Death Classification (16) for the years 2001 to 2002. For the 8 deaths for which a classification was available, 3 fetal deaths were due to unexplained antepartum death, 3 neonatal deaths were due to congenital anomaly, 1 neonatal death was due to a "hypoxic peripartum death," and 1 fetal death was due to "specific perinatal conditions" (16).

Among birth center infants born at term compared with infants of low-risk hospital births born at term, the perinatal death rate was 1.4 per 1,000 births versus 1.9 per 1,000 births, respectively, for primiparas and 0.6 per 1,000 births versus 1.6 per 1,000 births, respectively, for multiparas (Table 4). The overall perinatal death rate among birth center infants born at term compared with infants of low-risk hospital births at term was 1.51 per 1,000 births compared with 1.69 per 1,000 births.

Discussion

Perinatal mortality is a rare outcome among infants born at term in developed countries after normal uncomplicated pregnancies; consequently, the numbers involved in large databases of routinely collected

Table 4. Deaths Among Term Infants in Birth Centers Compared with Term Infants Born in Hospital among Low-Risk Women,* Australia, 1999–2002

Term Infant Outcome	Low-Risk and Term Infant in Hospital* No. (%)	Term Infant in Birth Center No. (%)
Primiparas		
Liveborn/survived	185,342 (99.82)	7,305 (99.86)
Stillborn	235 (0.13)	4 (0.05)
Liveborn/neonatal death	105 (0.06)	7 (0.09)
Perinatal death	340 (0.19)	11 (0.14)
Perinatal mortality rate/1,000 births†	1.9	1.4
Multiparas		
Liveborn/survived	276,041 (99.84)	13,744 (99.94)
Stillborn	300 (0.11)	6 (0.04)
Liveborn/neonatal death	136 (0.05)	3 (0.02)
Perinatal death	436 (0.16)	9 (0.06)
Perinatal mortality rate/1,000 births†	1.6	0.6

*Low-risk and term infant in hospital: women who were 20 to 34 years of age had no preexisting hypertension and diabetes, had no pregnancy-induced hypertension and gestational diabetes, and gave birth to a single baby in a vertex presentation at gestational age 37 to 41 completed weeks, with a birthweight greater than or equal to 2,500 g. At term babies were 37 to 41 completed weeks' gestation and greater than or equal to 2,500 g in birthweight.

† Perinatal mortality rates refer to the sum of the fetal and early and late neonatal deaths in 1,000 total births (both live births and stillbirths).

statistics provide meaningful evaluation of these uncommon events. The overall rate of perinatal mortality was significantly lower for infants born in a birth center, and among term births, the rate was lower than for infants of low-risk term births in hospital regardless of the mother's parity.

The Cochrane systematic review of care allocated to a homelike setting or hospital examined six trials of alongside hospital care for 8,677 women from the United Kingdom, Canada, Sweden, and Australia (7). The review found a nonstatistically significant trend toward higher perinatal mortality in the homelike setting (7). Although the analysis was correctly undertaken on an intention-to-treat basis, a closer scrutiny of the baby deaths based on the published reports of the six underlying studies reveals that 29 of the 41 deaths among women allocated to a homelike setting did not receive any labor care in the homelike setting group to which they were allocated. In terms of efficacy, the high rate of noncompliance prevents researchers from establishing the potential outcome of an intervention according to the intervention actually received. Although our study had a larger sample size than the systematic review with which to assess perinatal mortality, we are unable to show the outcomes of those women who intended to give birth in a birth center but were transferred to a hospital. We can only show the perinatal mortality associated with those infants recorded as having been born in a birth center.

Although other large studies have been conducted of freestanding birth centers in the United States (15,20), the fact that the sample in our study included all birth centers and all births in these centers in Australia is a unique feature. Because of the heterogeneity of risk factors among the birth center women, a true comparison is not possible. However, comparing the birth center cohort with a predetermined low-risk cohort of women who gave birth in hospital to term infants acted as a proxy for a comparable low-risk group.

We are aware of several limitations in our study. Although the need to record the intended place of birth reliably at the onset of labor has been recognized, our study could not account for the effect of transfer in labor. This factor is a potentially major confounder in an evaluation to determine significant differences in outcomes between birth centers and consultant-led units. In addition, data are lacking on transfers out of the birth center to the labor ward for interventions such as induction of labor and operative birth. We are aware of inconsistencies in reporting by some birth centers on interventions for women who labored in the birth center and subsequently transferred to hospital care for operative intervention such as an instrumental birth or a cesarean section. Most centers code these interventions as occurring at an alongside birth center if the woman labored in the birth center before being transferred out. However, since we believe these operative interventions were underreported, we did not include them in this study.

Selection bias is another potential concern. First, because birth centers are both popular and relatively scarce in Australia, women have to be highly motivated and persistent in their effort to be offered a place. Second, the medical risk factors identified in the database do not exclude serious medical conditions other than hypertension and diabetes. Women with other medical conditions would not deliver in birth centers, thus contributing to a more favorable result in the birth center data.

All these identified limitations could skew the results toward a favorable outcome in birth centers. Each state and territory in Australia records the intended place of birth, but no overall agreement

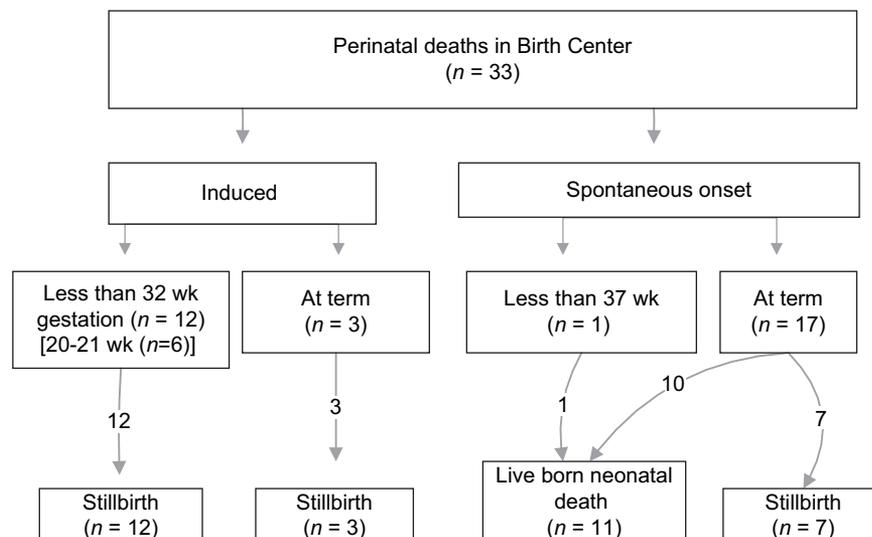


Fig. 1. Perinatal deaths in birth centers, Australia, 1999–2002.

exists about whether this fact should be recorded at “booking in” or at the time of the “onset of labor.” For this reason, our study can only reliably provide the perinatal mortality associated with women who were reported as having given birth in a birth center or at least to have begun to labor in the birth center. The deaths in birth centers are known to be consistently and well reported in Australia. Although we are currently unable to identify all those infants who died of a lethal congenital anomaly, in an event where any infant was transferred to standard hospital care after birth and died, the death is recorded next to the place of birth in the national data set.

Our primary objective was to report the perinatal mortality associated with actually giving birth in a birth center. We did not observe any deaths in the 578 infants born in birth centers with a gestational age greater than 41 completed weeks. We observed that 10 perinatal deaths reported in the birth centers (8 of them to infants at term) were among women who were 35 years or older. In this study, the low-risk, hospital population only included women 20 to 34 years of age, whereas the birth center population included women over 34 years of age. Since perinatal mortality is known to be higher among older women, the perinatal deaths from the hospital population studied may be underrepresented. We also observed that some induced stillbirths occurred in the birth centers. Twelve of the 15 induced stillbirths were less than 32 weeks, 6 of which were 20 to 21 weeks’ gestation (Fig. 1). It is apparent that these induced stillbirths were not considered viable at the outset. We speculate that women with a known stillbirth may have chosen the less medicalized environment to give birth to their infant if birth center care was available to them. This explanation is plausible for the comparatively high rate of induced stillbirths of less than 32 weeks’ gestation in the birth center population. In addition, these induced stillborn infants represented most infants born at less than 32 weeks’ gestation in the birth centers. One other contributing factor to the induced stillbirth phenomenon may be the fact that many women who accessed low intervention birth center care may have been less likely to have had screening and other invasive prenatal diagnosis that would have led to early termination of pregnancy compared with women who gave birth in a hospital.

Conclusions

This national Australian study of birth center births showed that the overall rate of perinatal mortality was significantly lower in a birth center than in a hospital

irrespective of the mother’s parity. Further studies should delineate not only intention to give birth in a birth center but also the underlying reasons or indications for not doing so. We support the recommendations of the National Perinatal Epidemiology Unit’s review of birth centers for further inductive research to evaluate “whether the rate of spontaneous vaginal birth is significantly different amongst women who plan to give birth in a birth center compared to those who plan to give birth in a standard care setting” and “evaluation of factors which influence women to make personally appropriate decisions about location of care for birth” (8, p 4). Above all, we agree that “a standard baseline definition of the term ‘birth centre’ should be developed and implemented” (8, p 4).

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