

**Review of evidence about
clinical, psychosocial and economic outcomes for women with
straightforward pregnancies who plan to give birth in a
midwife-led birth centre, and outcomes for their babies.**

**Report of a structured review of birth centre outcomes
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Commissioned by:

The Maternity Research Group
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1. Summary

1.0 Background

1.0.0 Over the past twenty years there has been policy emphasis on increasing choice in relation to place of birth and as a result women in England and Wales should be able to choose between giving birth at home or in hospital. In addition to those options women in some parts of the two countries also have the choice of giving birth in a birth centre which may be geographically separate from, or adjacent to, a hospital obstetric unit.

1.0.2 This structured review was commissioned by the Maternity Research Group of the National Service Framework (NSF) for Children, Young People and Maternity Services in June 2004.

1.1 Methods

1.1.0 This review set out to achieve a broad overview of the evidence base from published reports about clinical, psychosocial and economic outcomes in developed country settings about women who plan to give birth, or had given birth, in birth centres and their babies. We sought to collect unpublished audit/survey information from NHS Trusts. The main aim was to highlight important gaps and make recommendations about priorities for research on these issues in the UK.

1.1.1 There is no standard definition of the term 'birth centre'; we therefore agreed a definition which included both centres which were freestanding and those which were alongside hospital obstetric units.

1.1.2 A search strategy was developed and applied to relevant electronic databases. Published reports were included that described at least one clinical, psychological or economic outcome for women and/or their babies who planned to give birth in a birth centre. No restriction was applied in terms of methodology or date of publication. Non-English language papers were excluded as were those that described data from developing countries. In total, 297 papers were retrieved, and 34 of these were included in the final report.

1.2 Results

1.2.0 Overall, data were of poor quality, and derived mainly from small scale observational studies. Outcomes were inconsistently defined and reported with a high likelihood of bias. It was likely that there was disproportionate publication of positive or negative results. Given these limitations, we have not made comparisons of results between studies.

1.3 Conclusions

1.3.0 Birth centre care can offer the possibility of accessible, appropriate, personal maternity care for women and their families. There is substantial support from women accessing care, their families, maternity care health professionals, and service managers for care in birth centre settings which are clearly differentiated from obstetric-led maternity services.

1.3.1 No reliable evidence about clear benefit or harm associated with birth centre care compared with any other type of intrapartum care offered in the NHS was identified in this review. This gap in the evidence-base for care (birth centre or standard) should be addressed urgently as an integral part of the drive to modernise, reconfigure and develop sustainable maternity services.

1.3.2 Implementation of the National Service Framework for Children, Young People and Maternity Services provides a window of opportunity to carry our primary research to generate reliable evidence about outcomes important to service users and health care providers. Development and introduction of national standards for routine data collection in maternity care, and strategies for audit would also be key components to understanding the outcomes of care, improving services, and ensuring highest quality care for women, their babies and families.

1.4 Recommendations

1.4.0 A standard baseline definition of the term ‘birth centre’ should be developed and implemented. Additional information, for example about proximity of a birth centre from maternity services which offer medical care, including obstetric and neonatal care, should be collected in a standard way. This would allow grouping of centres with similar levels of service provision and provide a basis on which to develop comparison studies. (See section 5.1)

1.4.1 Evaluation of factors which influence women to make personally appropriate decisions about location of care for birth should be carried out to identify the best ways to support women to make such choices (section 5.4).

1.4.2 A large scale pragmatic randomised controlled trial is required to evaluate whether the rate of spontaneous vaginal birth is significantly different amongst women who plan to give birth in a birth centre compared to those who plan to give birth in a standard care setting (section 5.6). Other important outcomes which could be evaluated in the context of such a study include:

- analgesia use (section 5.7)
- perineal and genital tract trauma (section 5.8)
- neonatal wellbeing (sections 5.11 and 5.12)
- infant feeding (section 5.12)
- psychosocial wellbeing (section 5.13)

1.4.3 Standardised evidence-based criteria in terms of likely benefits and harms should be developed and implemented to support women to make decisions about place for birth, whether in a birth centre, at home, obstetric-led care or other setting (section 5.10)

1.4.4 An international data-sharing network should be developed and implemented to facilitate sharing data collection among different but comparable developed countries. This could be modelled on the Vermont Oxford Network (<http://www.vtoxford.org/home.aspx?p=/eds/enicq/index.htm>) which currently provides a means of pooling data about neonatal care (section 5.10).

1.4.5 Valid and reliable methods for evaluating data on psychosocial outcomes should be developed and implemented. A large scale, national survey, using these outcome measures, should be developed to explore the psychosocial experiences of women who use birth centres. This should include in-depth study of the experiences of women who need to be transferred from birth centre care (section 5.13).

1.4.6 Research is required to estimate the cost and resource use attributable to birth centre care. Future research should investigate the long term health service costs and the costs that arise outside the health service, which are likely to vary according to mode of birth (section 5.14).

1.4.7 A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate (section 5.15)

- why women are transferred from birth centres to obstetric care and the processes of transfer. This should include data collection to audit women's experiences of care (section 5.5)
- levels of postpartum maternal blood loss and rates of postpartum haemorrhage (PPH) using an agreed definition of PPH (section 5.9)
- Apgar scores and other measures of neonatal wellbeing (section 5.12)
- rare maternal and neonatal outcomes (mortality and major morbidity) (section 5.10).

2. Background

2.0.0 Over the past twenty years there has been policy emphasis on increasing choice in relation to place of birth and as a result women in England and Wales should be able to choose between giving birth at home or in hospital. In addition to those options women in some parts of the two countries also have the choice of giving birth in a birth centre which may be geographically separate from, or adjacent to, a hospital obstetric unit.

2.0.1 The recent publication of the National Service Framework (NSF) for Children, Young People and Maternity Services states explicitly that women should be able to 'choose the most appropriate place to give birth from a range of local options including ... delivery in midwife-led units' (DH 2004: 27). There is currently no standard definition of either a midwife-led unit or a birth centre and this will be discussed in section 5.1. For the purposes of this review, the terms 'midwife-led unit' and 'midwife-led birth centre' will be used interchangeably. Such units may be located in the same building or 'alongside' a hospital maternity unit, or freestanding, that is, geographically separate. There is considerable political, service and policy interest in the concept of birth centres. Service providers, managers of the maternity services, health care professionals, parents and user representatives from childbirth organisations are all involved in debating the benefits of birth centres as part of integrated, consumer-focused and effective maternity services. National policy documents such as Changing Childbirth (DH 1993), the NHS Plan (DH 2000), and subsequent regional strategic planning (for example HealthFit 2004) have focused on the importance of services which achieve choice, accessibility, locality provision, acceptability and cost-effectiveness.

2.0.2 Despite provision of alternative locations for intrapartum care within existing NHS maternity services, policy reports suggest that women are not always offered a choice of where to give birth. For example, the report of the Audit Commission (1997) concluded that although maternity services have become more woman-centred since the publication of Changing Childbirth (DH 1993), further improvements are possible. In particular, the report recommends that women should receive better information about options for care, including where to give birth. Similarly, work undertaken on behalf of the Department of Health suggests that relatively few women are offered choice in deciding on their place of birth (DH 2003). To explore this issue further, the Department of Health funded the ongoing Birth Place Choices Project (BPCP) (Jane Rogers, personal communication 2004). This collaborative project is being carried out in the Southampton and Portsmouth areas and will describe women's choices about place of birth. BPCP is due to report in spring 2005.

2.0.3 Despite the finding that many women are not offered choices about where to give birth (Page 2000, Walsh 2004a), there is a perception that both midwives and women are enthusiastic about offering and accessing care in a range of

settings, including birth centres (Davies 2004, Hundley et al 1995, Katz Rothman 1983, Kirkham 2003). The National Childbirth Trust (NCT) recently completed two surveys for primary care trusts to explore what women want from the maternity services (NCT 2004). The results indicate that around 75% of the women surveyed would consider giving birth in a birth centre, and that they prioritise small birth centres and home births over both local hospitals without specialist facilities and specialist hospitals further from home. Similarly, a survey of Canadian women in 1994 suggests that almost one-third of respondents would rather have their baby in a birth centre than a hospital (Wu Wen et al 1999).

2.0.4 Proponents consider that birth centres offer considerable advantages when compared with traditional care in an obstetric-led unit. Almost thirty years ago, Rice and Carty (1977) suggested that some women choose a birth centre because they feel constrained by the rules and regulations of hospitals, as well as the more stark and sterile environment. More recently, Rosser (2001) suggested that birth centres 'fit' the national agenda for public health, as care can be tailored and responsive to social needs, particularly with regard to health inequalities and social exclusion. Walsh (2000) has argued that birth centres may enable and empower women, as well as improving clinical outcomes, suggesting that they have the potential to have a profound effect on both individuals and the wider society. (See, for example, Davies et al 2003, Godfrey 2002, Gowers 2002, Nolan 2001).

2.0.5 One systematic review has been undertaken to compare outcomes for women giving birth in a home-like institutional birth environment with those giving birth in a conventional obstetric unit (Hodnett 2004). However, only six randomised and quasi-randomised trials were included, all conducted in alongside birth centres. A more recent review of five controlled studies set out to establish current evidence for freestanding, midwife-led birth centres (Walsh and Downe 2004), but did not include data about alongside birth centres. Both reviews suggest that little primary research has been done to compare outcomes experienced by women who give birth in a conventional labour ward setting with those who either plan to give birth or give birth in birth centres. Whilst these reviews are informative, their conclusions are limited by strict inclusion criteria.

2.0.6 Audit and other qualitative research has been carried out to explore outcomes for women who give birth in birth centres. Some of these projects have been reported in professional journals (Coyle et al 2001a, 2001b, Gould 2004, Walker et al 1995) and presented at conferences in the United Kingdom (Marchant 2003, MIDIRS 2004). However, there has been no review of these sources of information.

2.0.7 The report presented here builds on the results of the reviews by Hodnett (2004) and Walsh and Downe (2004) described above and draws on a wider body of published and unpublished sources, including a limited number of local audits.

2.0.8 A plan (Appendix A) was drawn up for the review, including aims and objectives, and agreed with the commissioners before the work began.

2.0.9 The purpose of this review is to give an overview of current evidence supporting the recommendations of the NSF, and to set the agenda for future research in this important area.

2.0.10 The aims are to:

1. Provide an overview of current evidence supporting the Maternity component of the National Service Framework for Children, Young People and Maternity Services about clinical, psychosocial and economic outcomes for women with straightforward pregnancies who plan to give birth in a birth centre, and outcomes for their babies
2. Identify gaps in evidence to inform the future research agenda

2.0.11 The objectives are to:

1. Define what is meant by a birth centre, both freestanding and alongside
2. Develop and apply a systematic search strategy to identify relevant evidence about the benefits and harms for women with straightforward pregnancies planning to give birth in freestanding or alongside birth centres
3. Extract, organise, analyse, evaluate and report relevant evidence

3. Methodology

3.0 Definition of a birth centre

3.0.0 For the purposes of this review it was decided that the focus would be on midwife-led birth centres, and the following definition was developed and used:

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.

Both freestanding and alongside birth centres are included in this definition.

3.1 Search strategy

3.1.0 The search terms used included birth centre/center, midwife-led unit; peripheral unit; general practitioner/GP unit; clinical outcomes; maternal outcomes; neonatal outcomes and outcomes for mothers/babies. An additional search, including the term 'economic outcomes' was conducted to assess whether a review (Henderson 2003), commissioned by the Maternity Research Group of the National Service Framework for Children, Young People and Maternity Services, needed to be updated.

3.1.1 The following databases were searched: British Nursing Index (BNI) 1985-September 2004; Cochrane database of systematic review to second quarter 2004; Cumulative Index to Nursing and Allied Health Literature (CINAHL) 1982-September week 3, 2004; Database of Abstracts of Reviews of Effectiveness (DARE) to September 2004; Embase 1980-September 2004; Medline 1980 to September 2004. In total, 297 papers were identified through electronic searching (see Section 3.3)

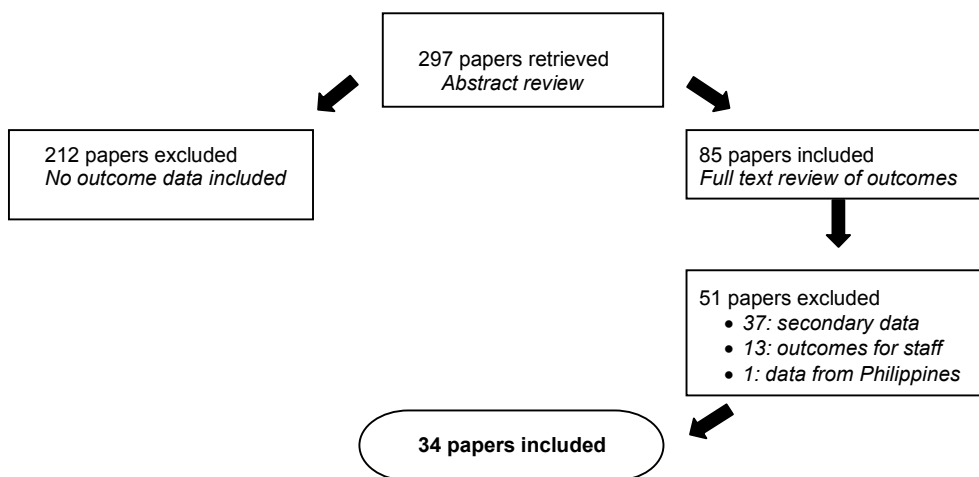
3.2 Unpublished data from local NHS Trusts

3.2.0 We also sought to collect unpublished data from local trusts. We were given permission by the Nursing and Midwifery Council (NMC) and Royal College of Midwives (RCM) to circulate an open letter via electronic distribution lists to all heads of midwifery and supervisors of midwives in the UK, who work in approximately 220 NHS Trusts throughout the UK (Appendix B). The letter asked for information on any locally published, unpublished or ongoing studies and was sent on 9 August 2004. A reminder letter was sent via the same lists three weeks later.

3.3 Inclusion and exclusion criteria

3.3.0 Published reports were included that described at least one clinical, psychological or economic outcome for women and/or their babies who planned to, or had given birth, in a birth centre. Quantitative and qualitative studies and audits of local practice were included. No restriction on date of publication was applied. Non-English language papers were excluded as were those that described data from developing countries. Of the 297 papers identified initially, 34 were included in the final review; Figure 1 summarises the results of retrieval and inclusion/exclusion processes. The most common reason for excluding papers was that they did not include any original data, but were opinion pieces or commentaries, that reported on outcomes from birth centres that had been reported elsewhere.

Figure 1: Results of retrieval, inclusion and exclusion processes



3.4 Data extraction proforma

3.4.0 A data extraction proforma was devised and used for each of the papers included in the review (Appendix C). This allowed the reviewers to identify outcomes that had been measured and, where appropriate, to compare and contrast findings. Outcome measures included clinical outcomes for women and/or their babies, psychosocial outcomes and economic outcomes. A grading hierarchy was used to assess the level of evidence presented (Table 1): this was adapted from Eccles and Mason (2001).

Table 1: Evidence grading hierarchy

Evidence category	Source
Ia	Systematic review and meta-analysis of randomised controlled trials
Ib	At least one randomised controlled trial
IIa	At least one well-designed controlled study without randomisation
IIb	At least one other type of well-designed quasi-experimental study
III	Well-designed non-experimental descriptive studies, such as comparative studies, correlation studies
IV	Audit, case series, case studies
V	Expert committee reports or opinions and/or clinical experience of respected authorities

4. Results

4.0.0 In this section, we describe results extracted from included papers. For each pre-specified issue (e.g. admission criteria) or outcome (e.g. mode of birth) two tables are given. The first table describes data about freestanding birth centres, the second, data from alongside birth centres. Each table includes the bibliographic reference and the grade of evidence (see Table 1) assigned to each paper. For tables which relate to outcomes the study type, method of data collection, and the results are also given.

4.1 Criteria for admission to midwife-led birth centres

4.1.0 There was considerable variation in criteria used for admission to either freestanding or alongside birth centres. Some criteria related to assessment at time of booking, others were used to make assessment at another point during pregnancy, and others were only relevant during labour (Tables 2 and 3).

Table 2. Criteria for admission to freestanding birth centres

Bibliographic reference	Study type	Evidence level	Eligibility/exclusion criteria
David et al (1999) Berlin, Germany	Retrospective cohort study	III	Excluded at booking: diabetes, previous caesarean section or other uterine surgery, morbid obesity, severe debilitating illness, known cephalopelvic disproportion Excluded during pregnancy: multiple gestation, gestational hypertension, gestational diabetes, fetal growth restriction, non-cephalic presentation, placenta praevia, vaginal bleeding, polyhydramnios or oligohydramnios, genital herpes, smoking during pregnancy Excluded in labour: premature prolonged rupture of membranes (>24 hours), <37 weeks or >42 weeks gestation, meconium stained amniotic fluid, non-reassuring cardiotocographic recording (CTG), vaginal bleeding
Saunders et al (2000) London, UK	Retrospective cohort study	III	Excluded at booking: age <18 or >40, height <149cm, parity>4, multiple pregnancy, previous caesarean section, >3 previous miscarriages, previous baby >4500g, diabetes, epilepsy, hypertension, antenatal renal disease or cardiac disease, antenatal proteinuria or hypertension, smoking >20/day, BMI <20 or >25 Eligibility in labour: >37 weeks gestation, single pregnancy, cephalic presentation, spontaneous labour with clear liquor, normal blood pressure, reactive cardiotocographic tracings
Holz et al (1989) Maryland, USA	Case series	IV	Excluded at booking: diabetes, hypertension, cardiovascular disease, renal disease, obesity, smoking, substance abuse, poor nutritional habits

Table 3 Criteria for admission to alongside birth centres

Bibliographic reference	Study type	Evidence level	Eligibility/exclusion criteria
Hundley et al (1994) Aberdeen, UK	Randomised controlled trial	Ib	Excluded at booking: pre-existing maternal disease, infertility, complicated obstetric history (e.g. previous caesarean section, difficult vaginal birth, poor obstetric outcome), height <150cm, maternal age >35, multiple pregnancy
McVicar et al (1993) Leicester, UK	Randomised controlled trial	Ib	Excluded at booking: diabetes, epilepsy, renal disease, previous caesarean section or difficult vaginal birth, previous still birth or neonatal death, previous small for gestational age baby, multiple pregnancy, Rhesus antibodies
Waldenström et al (1997) Stockholm, Sweden	Randomised controlled trial	Ib	Excluded at booking: diabetes, hypertension, drug abusers, women who smoked during present pregnancy
Gottvall et al (2004) Stockholm, Sweden	Retrospective cohort study	III	Excluded at booking: women with high blood pressure, diabetes or gestational diabetes, multiple pregnancy, medication for epilepsy, alcohol abuse, drug abuse, smoking Excluded during pregnancy: labour before 37=0weeks or after 42+6 weeks
Webster et al (1989) Paddington, Australia	Retrospective cohort study	III	Excluded at booking: : poor obstetric history, grand multiparity, nulliparous women >38 years, previous caesarean section, multiple pregnancy, cardiac or renal disease, hypertension, anaemia, severe asthma, epilepsy, diabetes, rhesus iso-immunisation, relative skeletal deformities
Gould et al (2004) London, UK	Case series	IV	Eligibility: all healthy women with uncomplicated full-term pregnancy in spontaneous labour
Mahmood (2003) Kirkcaldy, UK	Case series	IV	Eligibility in labour: >37 weeks gestation, single pregnancy, cephalic presentation, spontaneous labour with clear liquor, normal blood pressure, reactive cardiotocographic tracings

4.2 Socio-demographic variables of women planning to give birth in a birth centre

4.2.0 There was a greater consistency shown in the socio-demographic characteristics of women who planned to give birth in birth centres. For example, four papers (Feldman and Hurst 1987, Eakins et al 1989, Homer et al 2000, Webster et al 1989) reported that women planning to use birth centres were more likely to be Caucasian (Tables 4 and 5).

Table 4. Socio-demographic variables of women planning to give birth in freestanding birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Method of data collection	Results
Feldman and Hurst (1987) New York City, USA	Retrospective cohort study	III	149	Review of medical records	Women in birth centre group (<i>n</i> 77) compared with standard care group (<i>n</i> 72) were more likely to have had college education (95% vs. 76%); more likely to be White (91% vs. 74%) and less likely to be Hispanic (3% vs. 15%)
Eakins et al (1989) California, USA	Case series	IV	690	Review of birth centre log books and medical records	97% Caucasian, 93% married, 57% had college degree Primiparous age range: 18-41 years (mean 33, median 30 years) Multiparous age range: 20-42 years (mean 32, median 32 years)

Table 5. Socio-demographic variables of women planning to give birth in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Method of data collection	Results
Hundley et al (1994) Aberdeen, UK	Randomised controlled trial	Ib	2734	Questionnaires, interviews, case note review, morbidity register forms	No statistically significant difference in social class for birth centre group (<i>n</i> 1819 women) compared with standard care group (<i>n</i> 915 women)
Homer et al (2000) Sydney, Australia	Retrospective cohort study	III	734	Review of medical records	Primary language spoken by women using birth centre (<i>n</i> 367) compared with women receiving standard hospital care (<i>n</i> 367): English 304 (83%) vs. 155 (42%); Chinese 3 (1%) vs. 63 (17%); Arabic 17 (5%) vs. 68 (19%); Other 43 (12%) vs. 81 (22%) <i>p</i> =0.001
Waldenström and Nilsson (1993) Stockholm, Sweden	Prospective cohort study	III	1716, 1086 booked for birth centre care and 630 receiving standard care	Structured questionnaire	57% of women in the birth centre group had received university education, compared with 48% in standard care group. Women in the birth centre group were also more likely to work in health care (22% vs. 17%) or in cultural professions (18% vs. 7%)
Webster et al (1989) New South Wales, Australia	Retrospective stratified sequential sample	III	843: 346 received admitted to birth centre and 497 admitted to labour ward	Data collected from hospital records	290/346 (93%) of women in birth centre group were Australian of Anglo-Saxon compared with 333/497 (75%) who received standard care. Women in birth centre group were less likely to be at extremes of reproductive age. 2 (1%) were <20 years and 19 (6%) were >36 years, compared with 19 (4%) and 48 (10%) in hospital care group.

4.3 Transfers from birth centres to obstetric care

4.3.0 Antepartum (before labour) transfer rates varied, from 8% (Feldman and Hurst 1987) to 38% (Hundley et al 1994). There was a wide variation in the intrapartum (in labour) transfer rate reported from 12% (Saunders et al 2000) to 30% (Gould et al 2004, Homer et al 2000). Postpartum (after birth) transfer rate was reported in one paper (Saunders et al 2000). Two papers gave a peri-partum (around birth) transfer rate that included all transfers in the antepartum, intrapartum or postpartum period. The reported transfer rates ranged from 15.8% (Rooks et al 1989) to 64% (Byrne et al 2000). (Tables 6 and 7).

Table 6. Transfers from freestanding birth centres to obstetric care

Bibliographic reference	Study type	Evidence level	Total number of women	Method of data collection	Results
David et al (1999) Berlin, Germany	Retrospective cohort study	III	801	Review of women's records over 2-year period (1992-94)	Intrapartum transfer rate: 146/801 women (18%). Primary indications: fetal compromise (33%); failure to progress (28%); inadequate labour (19%); prolonged labour (16%)
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	Review of medical records	Antepartum transfer rate: 8% Intrapartum transfer rate: 14%
Saunders et al (2000) London, UK	Retrospective cohort study	III	602	Computerised maternity information systems, birth registers, and birth centre records	Antenatal transfer rate: 144 (19%). Main reasons given for transfer: postmaturity (35%), prolonged prelabour rupture of membranes (10%), pregnancy-induced hypertension (8%) Intrapartum transfer rate: 54 (12%). Main reasons given for transfer: delay in first or second stage; meconium stained liquor; fetal compromise Postpartum transfer rate: 32 (7%). Main reasons given for transfer: postpartum haemorrhage, retained placenta, suturing
Scupholme et al (1986) Florida, USA	Cohort study	III	250	Medical records	Intrapartum transfer rate: 54 (22%) Main reasons given for transfer: premature rupture of membranes (n=17), secondary arrest in labour (15), and 2 nd stage >2 hours (7)
Bennetts and Lubic (1982) USA	Case series	IV	3852	Review of women's records over 7-year period (1972-79) from 11 birth centres	Intrapartum transfer rate 15% over 3-year period (n not given). Main reasons given for transfer: prolonged labour >18 hours (12%); obstructed labour (11%); premature rupture of membranes (10%)
Eakins et al (1989) California, USA	Case series	IV	690	Medical records and birth centre log books	Intrapartum transfer rate 127 (18%). Main reasons given for transfer: prolonged labour (56%); meconium staining (17%) Postpartum maternal transfers n=7 Neonatal transfers n=5
Rooks et al (1989) USA	Case series	IV	11814	Records from 84 freestanding birth centres	Peripartum transfer rate: 16% Main reasons given for transfer: failure to progress (58%); meconium liquor (13%); fetal compromise (10%)

Table 7. Transfers from alongside birth centres to obstetric care

Bibliographic reference	Study type	Evidence level	Total number of women	Method of data collection	Results
Byrne et al (2000)	RCT	Ib	100	Medical records and questionnaires	Peripartum transfer rate: 64%. Included 13 women transferred because of staffing problems
Hundley et al (1994) Aberdeen, UK	RCT	Ib	1900	Routine medical data, medical records, questionnaires	Antepartum transfer rate: 727 (38%). Main reasons given for transfer: induction for postmaturity, pregnancy induced hypertension, prolonged rupture of membranes Intrapartum transfer rate : 303 (16%). Main reasons given for transfer: meconium stained liquor (74, 24%), fetal heart irregularities (47, 16%), delay in first stage of labour (75, 25%)
MacVicar et al (1993) Leicester, UK	RCT	Ib	2304	Study data collection form	Antepartum transfer rate : 537 (23%). Main reasons given for transfer: hypertension, postmaturity, vaginal bleeding Intrapartum transfer rate : 505 (22%). Main reasons given for transfer: meconium stained liquor, failure to progress, prolonged rupture of membranes
Homer at al (2000) Sydney, Australia	Retrospective cohort study	III	367	Data collected from medical records	Intrapartum transfer rate : 111 (30%). Main reasons given for transfer: slow progress, request for epidural, meconium liquor, fetal compromise
Gould et al (2004) London, UK	Case series	IV	866	Information collected from birth register	Intrapartum transfer rate: 265 (30%). Main reasons given for transfer: request for epidural, slow progress, suspected fetal compromise
Mahmood (2003)	Case series	IV	3322	Medical records and study data collection form	Antepartum transfer rate for nulliparous women (n1786): 532 (30%) Antepartum transfer rate for multiparous women (n1536): 343 (22%) Main reasons given for transfer: prolonged pregnancy, pregnancy induced hypertension, preterm labour Intrapartum transfer rate for nulliparous women: 488 (27%) Intrapartum transfer rate for multiparous women: 158 (10%) Main reasons given for transfer: meconium stained liquor, prolonged labour, prolonged rupture of membranes with no contractions
Woodcock and Baston (1996)	Case series	IV	46	Medical records	Antepartum transfer rate : 11 (24%). Main reasons given for transfer: breech, post-dates, decreased fetal movements Intrapartum transfer rate : 8 (17%). Main reasons given for transfer: prolonged rupture of membranes, delay in 1 st or 2 nd stage

4.3.1 One paper reported transfer rates over a five-year period (1991-1995) (Waldenström and Lawson 1998). A total of 22 Australian birth centres contributed data at some point over the 5-year period; nineteen were alongside and 3 were freestanding. The proportion of antepartum transfers increased by 5% over the 5-year period, and the proportion of intrapartum transfers rose by 3% during the same period (Table 8).

Table 8. Transfers from freestanding birth centres to obstetric care

Bibliographic reference	Study type	Evidence level	Total number of women	Method of data collection	Results
Waldenström and Lawson (1998)	Case series	IV	23691	Study questionnaire	The number of birth centres with complete statistics increased from six in 1991 to eighteen in 1995. The number of women booking for care increased by approximately 1000 each year. The average antepartum transfer rate was 22%, and increased by 5% over the 5-year period. The average intrapartum transfer rate was 18% and increased by 3% over the same time.

4.4 Mode of birth in for women planning to give birth in a birth centre

4.4.0 Three papers that reported findings for freestanding birth centres found statistically significant differences in the level of spontaneous vaginal birth (David et al 1999, Saunders et al 2000, Scupholme et al 1986) (Table 9). This finding was not apparent in the alongside birth centres (Table 10).

Table 9. Mode of birth for women who gave planned to give birth in a freestanding birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
David et al (1999) Berlin, Germany	Retrospective cohort study	III	4072	All women who have birth in two birth centres between 1992 and 1994, compared with matched sample of women who gave birth in same area over same time period and who planned to give birth in a standard setting	Data obtained from midwives' charts and computerised hospital data	Rate of spontaneous vaginal birth: 91 in birth centre group, compared with 84% in hospital group. $p < 0.001$ Rate of caesarean section: 3% vs. 5% Rate of instrumental birth: 11% vs. 5% $p < 0.001$	Women who planned to give birth in birth centre but were referred to hospital before or at onset of labour were excluded from analysis
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks and who planned to give birth in a standard setting	Data obtained from medical records	There were no statistically significant differences between rates of vaginal birth (94% for birth centre group vs. 89% for control group) or caesarean section (7% vs. 11%). Women in the birth centre group were statistically less likely to have instrumental birth (3% vs. 10%) $p = 0.0001$	Women who planned to give birth in birth centre but were transferred before 37 weeks were excluded from analysis
Saunders et al (2000) London, UK	Retrospective cohort study	III	20118 women: 589 booked to give birth at freestanding birth centre and 19529 who received standard care or had home birth	All women booked for care in birth centre over a 2-year period, compared with women who gave birth over the same time period, in hospital or at home, and fulfilled birth centre criteria	Data obtained from birth centre records, computerised maternity information systems, and birth registers	Women in birth centre group were more likely to have vaginal birth (86% vs. 72%) (Difference 13.3 95% CI 10.2-16.2) less likely to have instrumental birth (4% vs. 15%) and less likely to have caesarean section (6% vs. 13%)	Data analysed by intention-to-treat
Scupholme et al (1986) Miami, USA	Cohort study	III	500 women	Women who commenced labour at birth centre over 15-month period, compared with women who gave birth during same period and met same booking criteria and who planned to give birth in a standard setting	Data obtained from electronic medical records	Women in birth centre group were more likely to have vaginal birth (92% vs. 83%); less likely to have instrumental birth (2% vs. 3%) and less likely to have caesarean section (6% vs. 14%)	Women who planned to give birth in birth centre but developed complications during pregnancy were excluded from analysis

Table10. Mode of birth in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED Home-like versus conventional institutional settings for birth (Cochrane review) In: The Cochrane Library Issue 3, 2004. Chichester, UK	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	Allocation to home-like setting was associated with lower rates of operative (abdominal or vaginal) birth (OR 0.85, CI 0.70-0.96).	Analysis by intention to treat
Gottvall et al (2004) Stockholm, Sweden	Retrospective cohort study	III	183636: 3256 admitted to alongside birth centre, 126818 received standard care	All women who gave birth in birth centre over 10-year period compared with women who gave birth during same period in a standard setting and met same medical inclusion criteria as in birth centre	Data collected from Swedish Medical Birth Register	4% of women in birth centre group (BCG) had instrumental birth compared with 8% in standard care group (SCG) $p=0.001$. 6% women in BCG had caesarean section compared with 10% in SCG	Analysis by intention to treat
Homer et al (2000) Sydney, Australia	Retrospective cohort study	III	734 women: 367 admitted to alongside birth centre and 367 received standard care	All women who presented in labour to birth centre in 1995, compared with women who gave birth in a standard setting during same period and met same low risk criteria	Data collected from medical records	There was no statistically significant difference in rates of vaginal birth, instrumental birth or caesarean section for the two groups	Women who developed problems during pregnancy were excluded from analysis
Gould et al (2004) London, UK	Case series	IV	866 women admitted to alongside birth centre over 12-month period	Healthy women with uncomplicated full-term pregnancy in spontaneous labour are offered option of labouring and giving birth in birth centre	Information collected from birth register	737 (85%) had spontaneous vaginal birth; 73 (9%) had instrumental birth and 53 (6%) had caesarean section	Antenatal care not provided in birth centre: analysis only included women who attended birth centre in established labour

4.5 Analgesia use in birth centres

4.5.0 One systematic review (Hodnett 2004) and three level III reports were identified and showed a generally low level of analgesia use for women who plan to give birth in a birth centre (Tables 11 and 12).

Table 11. Analgesia use for women who plan to give birth in freestanding birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks and gave birth in standard setting	Data obtained from medical records	There was a statistically significant difference in the number of women who had an epidural for pain relief: 31% of birth centre group vs. 75% of control group $p < 0.01$	Women who planned to give birth in birth centre but were transferred before 37 weeks were excluded from analysis
Saunders et al (2000) London, UK	Retrospective cohort study	III	20118 women: 589 booked to give birth at freestanding birth centre and 19529 who received standard care or had home birth	All women booked for care in birth centre over a 2-year period, compared with women who gave birth over the same time period, in hospital or at home, and fulfilled birth centre criteria	Data obtained from birth centre records, computerised maternity information systems, and birth registers	Women in the birth centre group were less likely to use epidural (11% of birth centre group vs. 31% of comparison group difference 19.3% 95% CI 16.5-22); less likely to use pethidine (8% vs. 26%. Difference 17.7 95% CI 15.4-20)), less likely to use Entonox (53% vs. 67% Difference 14.3% 95% CI 10.1-18.5)), and more likely to use TENS (67% vs. 4%. Difference 2.9% 95% CI 1-5)	Data analysed on intention-to-treat principle

Table 12. Analgesia use in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED (2004)	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	Women in birth centre group were significantly less likely to use pharmacological pain relief during labour (OR 0.72, 95% CI 0.63- 0.81)	Analysis by intention to treat
Homer et al (2000) Sydney, Australia	Retrospective cohort study	III	734 women: 367 admitted to alongside birth centre and 367 received standard care	All women who presented in labour to birth centre in 1995, compared with women who gave birth during same period and met same low risk criteria	Data collected from medical records	Women in the birth centre group were significantly more likely to use no pharmacological analgesia (53% vs. 21% p=0.001), and less likely to use an epidural for pain relief, (16% vs. 20%)	Women who developed problems during pregnancy were excluded from analysis

4.6 Perineal trauma for women who plan to give birth in a birth centre

4.6.0 Three papers (Stone et al 1998, Feldman and Hurst 1987, Homer et al 2000) reported observational studies based in freestanding centres and indicated a statistically significant increase in levels of intact perineum among women who planned to give birth in a birth centre (Table 13). The systematic review by Hodnett (2004) of data from alongside birth centres describes a statistically lower use of episiotomy and increased rate of tears, with no difference in the rate of intact perineum (Table 14).

Table 13. Perineal trauma for women who planned to give birth in a freestanding birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Stone (1998) USA	Prospective cohort study	III	146	All women met same low-risk birth centre eligibility criteria (not described) and had themselves selected either midwife or physician led care	Self-report questionnaires at 34-36 weeks gestation and 6 weeks postpartum. Data also retrieved from medical records	Women in the birth centre group were more likely to have an intact perineum (12/54, 22%) than women receiving standard care (4/52, 8%) p <0.01	Women who planned to give birth in birth centre but were referred to hospital before or at onset of labour were excluded from analysis
David et al (1999) Berlin, Germany	Retrospective cohort study	III	4072	All women who have birth in two birth centres between 1992 and 1994, compared with matched sample of women who gave birth in same area over same time period and received standard care	Data obtained from midwives' charts and computerised hospital data	Women in the birth centre group were less likely to have an episiotomy (16% vs. 55% for standard care group p<0.001). There was no significant difference in levels of third and fourth degree perineal tears	Women who planned to give birth in birth centre but were transferred before 37 weeks were excluded from analysis
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks and received standard care	Data obtained from medical records	Women in the birth centre group were significantly more likely to have an intact perineum (25% vs. 6% in standard care group p<0.01); less likely to have an episiotomy (47% vs. 78%, p<0.0001); and more likely to have a tear not involving the anal sphincter (26% vs. 6% p<0.01)	Women who planned to give birth in birth centre but developed complications during pregnancy were excluded from analysis
Saunders et al (2000) London, UK	Retrospective cohort study	III	20118 women: 589 booked to give birth at freestanding birth centre and 19529 who received standard care or had home birth	All women booked for care in birth centre over a 2-year period, compared with women who gave birth over the same time period, in hospital or at home, and fulfilled birth centre criteria	Data obtained from birth centre records, computerised maternity information systems, and birth registers	Women in the birth centre group were less likely to have an episiotomy (5% vs. 19% in comparison group p<0.001), but there were no significant differences in levels of intact perineum, or perineal tears	Analysis by intention to treat

Table 13 cont...

Rooks et al (1989) USA	Case series	IV	11814	Women admitted in labour to 84 birth centres from mid-1985 to 1986	Study data collection form	34% of women had intact perineum; 46% had 1 st or 2 nd degree tears, 2% had 3 rd degree tear; 1% had 4 th degree tear and 18% had episiotomy	Women who transferred to standard care during pregnancy were excluded from analysis
Eakins et al (1989) California, USA	Case series	IV	690	Women who met screening criteria and were admitted to birth centre in labour over a seven-year period (1979-1985)	Birth centre log books and medical records	185/690 women (27%) had intact perineum; 338 (49%) had tear (type not specified); 114 (17%) had episiotomy	Women who developed problems before, or at onset of labour were excluded from analysis

Table 14. Perineal trauma for women who planned to give birth in an alongside birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED Home-like versus conventional institutional settings for birth (Cochrane review) In: The Cochrane Library Issue 3, 2004. Chichester, UK	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	Women allocated to home-like setting were less likely to have an episiotomy (Odds Ratio 0.78, 95% CI 0.70- 0.87), but more likely to have vaginal/perineal tears (Odds Ratio 1.15, 95% CI 1.05-1.26). There was no difference in the likelihood of a non-intact perineum (Odds Ratio 1.07, 95% CI 0.95-1.20)	Analysis by intention to treat
Homer et al (2000) Sydney, Australia	Retrospective cohort study	III	734 women: 367 admitted to alongside birth centre and 367 received standard care	All women who presented in labour to birth centre in 1995, compared with women who gave birth during same period and met same low risk criteria and received standard care	Data collected from medical records	Women in birth centre group were more likely to have an intact perineum than women in comparison group (36% vs. 27%) and less likely to have an episiotomy (13% vs. 17%).	Women who developed problems during pregnancy were excluded from analysis
Gould et al (2004) London, UK	Case series	IV	866 women admitted to alongside birth centre over 12-month period	Healthy women with uncomplicated full-term pregnancy in spontaneous labour are offered option of labouring and giving birth in birth centre	Information collected from birth register	282 (47%) women had intact perineum; 125 (21%) has 1st degree tear; 164 (27%) had 2 nd degree tear; 3 (1%) had 3 rd degree tear and 7 (3%) had episiotomy	Data only includes women admitted to birth centre in established labour

4.7 Blood loss/postpartum haemorrhage for women who gave planned to give birth in a birth centre

4.7.0 There were no statistically significant differences reported in the rate of postpartum haemorrhage or blood loss (Tables 15 and 16).

Table 15. Blood loss/postpartum haemorrhage(PPH) for women who planned to give birth in a freestanding birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks and received standard care	Data obtained from medical records	There was no statistically significant difference in the number of women who had postpartum haemorrhage (3% in birth centre group vs. 2% in standard care group)	Postpartum haemorrhage not defined
Saunders et al (2000) London, UK	Retrospective cohort study	III	20118 women: 589 booked to give birth at freestanding birth centre and 19529 who received standard care or had home birth	All women booked for care in birth centre over a 2-year period, compared with women who gave birth over the same time period, in hospital or at home, and fulfilled birth centre criteria	Data obtained from birth centre records, computerised maternity information systems, and birth registers	There was no difference in the rate of women who had a PPH (7% in birth centre group vs. 7% in comparison group)	PPH defined as blood loss >500 mls
Rooks et al (1989) USA	Case series	IV	11814	Women admitted in labour to 84 birth centres from mid-1985 to 1986	Study data collection form	50 women (1%) experienced postpartum haemorrhage	PPH not defined
Eakins et al (1989) California, USA	Case series	IV	690	Women who met screening criteria and were admitted to birth centre in labour over a seven-year period (1979-1985)	Birth centre log books and medical records	2 women experienced postpartum haemorrhage	PPH not defined

Table 16. Blood loss/postpartum haemorrhage (PPH) for women who gave birth in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hundley et al (1994) Aberdeen, UK	RCT	Ib	2734	All women defined as low-risk according to booking criteria. 1900 randomised to birth centre care and 944 to standard care	Questionnaire and medical records	Mean estimated blood loss was 156 mls (95% CI 151mls-161mls) in birth centre group and 163 mls (95% CI 156mls - 172mls) in standard care group p=0.1	PPH rate not stated
MacVicar et al (1993) Leicester, UK	RCT	Ib	3510	Women who met screening criteria. 2304 randomised to receive birth centre care and 1206 to receive standard care	Data collection forms and medical records	118 women (6%) in birth centre group and 63 (6%) in standard care group experienced postpartum haemorrhage	PPH defined as blood loss >500 mls
Waldenström et al (1997) Stockholm, Sweden	RCT	Ib	1860	Women who met same screening criteria. 928 assigned to birth centre care and 932 to standard care	Medical records and questionnaires	106 women (13%) in birth centre group experienced PPH, compared with 106 (13%) in standard care group p=0.96	PPH defined as blood loss >600 mls
Gould et al (2004) London, UK	Case series	IV	601	Healthy women with uncomplicated full-term pregnancy in spontaneous labour are offered option of labouring and giving birth in birth centre	Data collected from birth register	24 (4%) women experienced PPH (range: 500-3000 mls)	PPH defined as >500 mls

4.8 Clinical outcomes for babies

4.8.0 A limited range of clinical outcomes for babies was reported. The following aspects of mortality, morbidity and other data were described.

4.9 Perinatal mortality for babies of women who intended to give birth in a birth centre

4.9.0 Three papers described perinatal mortality for babies, of which two level III papers (Moster et al 2001, Gottvall et al 2004) reported data about freestanding birth centres and observed a small but statistically significant increase in perinatal mortality (Table 17). Gottvall et al observed this rise only amongst babies of primiparous women. Moster et al did not present their data according to parity. The systematic review (Hodnett 2004) found a trend towards greater perinatal mortality but this did not reach statistical significance (Table 18).

Table 17. Perinatal mortality for babies of women who planned to give birth in a freestanding centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Moster et al (2001) Norway	Population-based study	III	1.7 million births	All births in Norway from 1967 to 1996	Data extracted from Medical Birth Registry of Norway	Women living in areas where most frequently used place of birth has <2000 births per annum had 1.2 (95%CI 1.1-1.3) times risk of experiencing neonatal death compared with women living in areas where most frequently used place of birth had >2000 births per annum	Data analysed by intention to treat

Table 18. Perinatal mortality for babies of women who planned to give birth in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED (2004)	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	There was a trend towards greater perinatal mortality in the birth centre group (Odds Ratio = 1.74, 95% CI 0.98-3.10).	Analysis by intention to treat. Six trials were included of which three reported that, antenatal care for the birth centre group differed from antenatal care for control group
Gottvall et al (2004) Stockholm, Sweden	Retrospective cohort study	III	183636	3256 births of women admitted to alongside birth centre over 10-year period (1989-2000) and 180380 births of women admitted to standard care during same period	Data collected from Swedish Medical Birth register	There was no difference in overall mortality between the two groups (5.5 per 1000 in birth centre group compared with 4.8 in control group). Analysis by parity demonstrated a statistically significant increase among primiparas in birth centre group: 9.4/1000 compared with 5.2/1000 in standard care group (Relative Risk 1.8, 95%CI 1.06-3.00). Amongst multiparous women there was a non-significant decrease in the birth centre group 2.2/1000 vs 4.5/1000 in the standard care group	Analysis by intention to treat

4.9.1 One paper (Waldenström et al 1997) found no statistically significant difference in levels of perinatal mortality in a randomised controlled trial in an alongside birth centre. However, the authors reported six cases of serious perinatal morbidity in the birth centre group, compared with only two in the standard care group (Table 19).

Table 19. Serious perinatal morbidity for babies of women who planned to give birth in an alongside birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Waldenström et al (1997) Stockholm, Sweden	RCT	1b	1860	Women who met same screening criteria. 928 assigned to birth centre care and 932 to standard care	Medical records and questionnaires	Six babies in the birth centre group had some form of serious morbidity not caused by malformations of preterm birth, compared with two in the standard care group. All of these were first-born infants.	Analysis by intention to treat

4.10 Apgar scores for babies of women who planned to give birth in a birth centre

4.10.0 None of the papers reported any statistically significant differences between assessment of babies' condition in the immediate postpartum period, as measured by Apgar scores at 5- or 10-minutes (Tables 20 and 21).

Table 20. Apgar scores for babies of women who planned to give birth in a freestanding birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
David et al (1999) Berlin, Germany	Retrospective cohort study	III	4072	All women who have birth in two birth centres between 1992 and 1994, compared with matched sample of women who gave birth in same area over same time period	Data obtained from midwives' charts and computerised hospital data	There were a statistically significant number of babies in the birth centre group with a 1-minute Apgar score <7 (2% vs. 4% p=0.002). However, Apgar scores at 5 and 10-minutes showed no differences.	Women who planned to give birth in the birth centre but were referred to hospital before or at onset of labour were excluded from analysis
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks	Data obtained from medical records	There were no statistically significant differences in Apgar scores between the two groups	Women who planned to give birth in the birth centre but were transferred before 37 weeks were excluded from analysis
Rooks et al (1989) USA	Case series	IV	11814	Women admitted in labour to 84 birth centres from mid-1985 to 1986	Study data collection form	55 babies (1%) Apgar score <7 at 5 minutes after birth	Women who transferred to standard care during pregnancy were excluded from analysis
Eakins et al (1989) California, USA	Case series	IV	690	Women who met screening criteria and were admitted to birth centre in labour over a seven-year period (1979-1985)	Birth centre log books and medical records	Apgar scores ranged from 2-10 at 1 minute after birth, and from 3-10 at 5 minutes. 526/ 563 (93%) of babies born in birth centre had 1-minute Apgar score of 7-10; 553/563 (98%) had Apgar score of 7-10 at 5 minutes after birth	Women who developed problems before, or at onset of labour were excluded from analysis

Table 21. Apgar scores for babies of women who planned to give birth in an alongside birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED (2004)	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	There were no statistically significant differences in Apgar scores <7 at 1-minute, Odds Ratio 0.37 (95%CI 0.05- 2.71) or 5-minutes after birth (Odds Ratio 1.19 (95%CI 0.53- 2.66)	Analysis by intention to treat
Rowley and Kostrzewa (1994) New South Wales, Australia	Case series	IV	1221	All women who would like an active birth and chose to give birth in the birth centre	Medical records	16 babies (2%) had Apgar score <4 at 1-minute, and 13 (2%) had Apgar score <7 at 5-minutes after birth	Women transferred to standard care were excluded from analysis

4.11 Birth weights for babies of women who planned to give birth in a birth centre

4.11.0 All the papers which reported findings for babies whose mothers planned to give birth in a freestanding birth centre demonstrated that these babies were less likely to be classified as low birthweight (Table 22). However, the papers that reported findings for alongside birth centres did not show this difference (Table 23).

Table 22. Birth weights for babies of women who planned give birth in a freestanding birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Feldman & Hurst (1987) New York City, USA	Retrospective cohort study	III	149	All women booked to give birth in birth centre over a 3-month period during 1981, compared with control group who met same low-risk criteria at 37 weeks	Data obtained from medical records	3% of babies in birth centre group weighed <2500g, compared with none in comparison group: 1% of babies weighed >4000g, compared with none in comparison group	Women who planned to give birth in a birth centre but were transferred before 37 weeks were excluded from analysis
Scupholme et al (1986) Florida, USA	Cohort study	III	500	Low-risk women who gave birth in birth centre matched with similar group who received standard care	Medical records	No babies in the birth centre group weighed <2500g, compared with 1% in standard care group. 87% of birth centre babies (BCB) and 93% of standard care group (SCG) weighed 2500-3999g. 12% of BCB and 7% of SCG weighed >4000g	Women who planned to give birth in birth centre but developed complications in pregnancy were excluded from analysis
Rooks et al (1989) USA	Case series	IV	11814	Women admitted in labour to 84 birth centres from mid-1985 to 1986	Study data collection form	6 babies weighed less than 2001g at birth	Women who transferred to standard care during pregnancy were excluded from analysis
Eakins et al (1989) California, USA	Case series	IV	690	Women who met screening criteria and were admitted to birth centre in labour over a seven-year period (1979-1985)	Birth centre log books and medical records	Infants born at birth centre ranged in weight from 2044g - 5292g (mean 3416g)	Women who developed problems before, or at onset of labour were excluded from analysis

Table 23. Birth weights for babies of women who gave birth in alongside birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hundley et al (1994) Aberdeen, UK	RCT	lb	2844	Low risk women, as defined by existing booking criteria: 1900 randomised to birth centre care and 944 to receive standard care	Questionnaire and medical records	There was a non-significant difference in mean (SD) birth weight: 3427g (519) for babies whose mothers were assigned to birth centre group vs. 3420g (493) for babies born in control group	Analysis by intention to treat
MacVicar et al (1993) Leicester, UK	RCT	lb	3510	2304 low-risk women randomised to birth centre care, and 1206 who met same booking criteria assigned to standard care	Study data collection forms and medical records	There was no significant difference in birthweight between the two groups	Analysis by intention to treat
Waldenström et al (1997) Stockholm, Sweden	RCT	lb	1860	Low-risk women interested in birth centre care: 928 randomly allocated to birth centre care and 932 to standard care	Medical records and questionnaires	The mean (SD) birthweight for babies of mothers assigned to birth centre care was 3563g (532), compared with 3531g (529) for control group p= 0.20	Analysis by intention to treat

Table 24. Psychosocial outcomes for women who gave birth in freestanding birth centres

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Rooks et al (1989) USA	Case series	IV	11814	Women admitted in labour to 84 birth centres from mid-1985 to 1986	Study data collection form	76% of women completed evaluations of their care. Of these, 99% stated that they would recommend the centre to friends, and 94% indicated that they would choose the birth centre for a future pregnancy. Of the 1869 (16%) women who were transferred, 54% completed evaluations. 97% said they would recommend the birth centre, and 83% said they would choose the birth centre in the future	Women who transferred to standard care during pregnancy were excluded from analysis
Saunders et al (2000) London, UK	Retrospective cohort study	III	481	All women who had booked for care in birth centre	Questionnaires and interviews	248 (52%) women responded. 88% agreed that the birth centre had considerable advantages over a hospital birth. 96% said they would recommend the birth centre to a friend. Women commented positively on the home-like environment of the birth centre, on the confidence they had in their midwives on the fact that they felt treated as an individual, and on their sense of control over the labour and birth	Questionnaires were not sent to women who had booked for standard care or home birth
Fraser et al (2003) Grantham, UK	Case series	IV	109	59 women who gave birth in birth centre, compared with 38 women who had home births and 12 women who had hospital births, who all met same booking criteria	Questionnaires and interviews	Over 90% of women in all three groups reported they were satisfied with their care, with 66% saying they would not change anything. Ten women who had been transferred from the freestanding birth centre said they were dissatisfied with aspects of their care, even if there had been a safe outcome for them and their babies	Only 12 women who received standard care were included in analysis
Walker et al (1995) UK	Case studies	IV	32 and 6 partners	Women who received any aspect of care in a midwife-led birth centre	In-depth, focused interviews	The core category to emerge was the balance of perceived control and perceived support. Women felt informed, and felt they had options and choices. Women who needed to be transferred in labour expressed a desire for continuity of carer, which was not an option	No comparison group was sought

4.12 Psychosocial outcomes for women who planned to give birth in a birth centre

4.12.0 Seven papers reported psychosocial outcomes for women. Of these, five (Rooks et al 1989, Saunders et al 2000, Hodnett 2004, Gould et al 2004, Coyle et al 2001a, Coyle et al 2001b) reported that women were satisfied with their experience but two (Fraser et al 2003, Walker et al 1995) reported dissatisfaction from women who had been transferred from freestanding birth centre care (Tables 24 and 25).

Table 25. Psychosocial outcomes for women who planned to give birth an alongside birth centre

Bibliographic reference	Study type	Evidence level	Total number of women	Characteristics of women	Method of data collection	Results	Notes
Hodnett ED (2004)	Systematic review	Ia	8646	Pregnant women at low risk of obstetric complications	Systematic review	Women allocated to birth centre care were less likely to express dissatisfaction with their care (Odds Ratio = 0.62, 95%CI 0.55-0.70)	Analysis by intention to treat
Gould et al (2004) London, UK	Case series	IV	20	Women who had given birth in the birth centre	Questionnaire	19/20 women said they would choose to have another baby in the birth centre, with one non-response. Women commented that they felt their wishes were respected.	Antenatal care not provided in birth centre: analysis only included women who attended birth centre in established labour
Coyle et al (2001a, 2001 b) Australia	Case studies	IV	17	Women recruited from three birth centres	In-depth interviews	Four key themes emerged: beliefs about pregnancy and birth; nature of the care relationship; care interactions; and care structures. The women's comments suggested differences in philosophy between hospital and birth centre settings. Women valued the normality of the birth centre approach and ongoing, cumulative contact with midwives in the birth centre.	No comparison group was sought

4.13 Unpublished audit and survey data from NHS Trusts

4.13.0 In response to the request for information sent to Heads of Midwifery and Supervisors of Midwives (see Section 3.2) six documents were returned. Five were internal audits, using data collected from maternity and hospital records; one was a survey questionnaire completed by women who used the birth centre service and by midwives who worked in that birth centre. The table below describes the type of information collected and indicates areas of similarity (Table 26).

Table 26. Internal, unpublished NHS Trusts data *

Name of birth centre	Caerphilly Birth Centre	Helme Chase Maternity Unit	Wantage Maternity Unit	Princess Anne Hospital, Southampton	Queen Charlotte's and Chelsea, London	Royal Berkshire Birth Centre
Type of data collection	Audit	Audit	Audit	Questionnaire	Audit	Audit
Period covered by report	Jan-July 2004	Jan-Dec 2003	2003-2004	End of March-beginning August 2002	April 2003-April 2004	September-December 2003
Type of birth centre	Freestanding	Freestanding	Freestanding	Alongside	Alongside	Alongside
Number of women	245	306	307	69	769	228
Criteria for admission	x	x	x	x	✓	✓
Socio-demographic variables	x	x	x	x	x	x
Transfer rate	✓	✓	✓	✓	✓	✓
Mode of birth	x	✓	x	✓	✓	✓
Analgesia use	✓	x	✓	✓		✓
Perineal trauma	✓	✓	✓	✓	✓	✓
PPH rate/blood loss	x	✓	x	✓	✓	✓
Perinatal mortality	x	x	x	x	✓	x
Apgar score	x	x	x	✓	x	✓
Birth weight	x	✓	x	x	x	x
Psychosocial outcomes	x	x	x	✓	x	x

* Tick (✓) = data supplied; cross (x) = data not supplied

5. Discussion

5.0.0 This structured review sought to achieve a broad overview of the evidence base from published reports about clinical, psychosocial and economic outcomes in developed country settings about women who plan to give birth in birth centres and their babies. We also aimed to collect unpublished audit/survey information from NHS Trusts. The main aim was to highlight important gaps and make recommendations about priorities for research on these issues in the UK.

5.0.1 The timescale for data collection and analysis was 12 weeks, therefore pragmatic decisions were made to limit the scope of the search strategy to generate manageable and meaningful output. We did not include, for example the term 'midwife-managed care' and therefore it may be that relevant reports were not retrieved which have been classified solely using that term. However, we are confident that the search strategy identified relevant key reports, including systematic reviews and large scale population based studies.

5.0.2 Overall, data were of poor quality, and derived mainly from small scale observational studies in which outcomes were inconsistently defined and reported. For example, in some reports the transfer rate of women from care in a birth centre to standard care was a combined measure which described all women transferred at any point in maternity care. In other reports, transfer was classified as taking place either antenatally (before labour) or during labour (intrapartum). Clinical outcomes, such as the estimated amount of maternal blood loss during birth, were also subject to considerable variation in definition. Therefore, there was a high likelihood of bias in the results reported. Given such limitations, we have not made comparisons of results between studies.

5.0.3 The current evidence base for birth centres relies heavily on descriptive and observational studies, and therefore is likely to be subject to significant bias. This is likely to include publication of positive or negative results and non-publication of results which show no difference. It would therefore be appropriate to carry out randomised controlled trials which are sufficiently large to evaluate outcomes of importance to women and families accessing care, service providers and policy makers.

5.0.4 Questions of safety for women and babies cannot be addressed in even a very large multi-centre randomised study. We therefore recommend establishment of effective national routine collection of standard data in all NHS Trusts for all women accessing maternity care and their babies. This is the basis for adequately resourced population-based studies, and is essential. Such national standard data could allow evaluation within and between maternity units over time.

5.1 Terminology

5.1.0 There is no standard definition of the term 'birth centre'. Some authors make a clear distinction between freestanding birth centres that are geographically separate from hospital-based maternity units, and adjacent birth centres that are within, or next to, this unit. Whilst these distinctions can be helpful, there is potential for confusion as it is not usually clear whether a birth centre which is located on the same geographic site as the obstetric unit, but in a separate building, should be defined as freestanding or alongside. For example, Walker et al (1995) state that the birth centre they describe is based in a district general hospital, nine miles away from the nearest consultant unit, and that a 24-hour emergency obstetric service is available within the hospital where the birth centre is located. It is hard to know whether this should be classified as a freestanding or alongside birth centre. For our analysis we classified this report as freestanding, which is consistent with the approach taken by Walsh and Downe (2004) in their review of freestanding birth centres .

5.1.1 For the purposes of this review we decided that the focus would be on midwife-led birth centres, and we developed and used the following definition to inform our analysis:

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.

Both freestanding and adjacent birth centres are included in this definition.

5.1.2 One published systematic review of evidence about alongside birth centres (Hodnett 2004) and one structured review about freestanding birth centres (Walsh and Downe 2004) compared data between studies. The lack of a standard definition of the term 'birth centre' meant that we did not attempt to draw comparisons between other studies identified in this review.

5.1.3 Recommendation

A standard baseline definition of the term 'birth centre' should be developed and implemented. Additional information, for example, about proximity of a birth centre from maternity services which offer medical care, including obstetric and neonatal care, should be collected in a standard way. This would allow grouping of centres which have similar levels of service provision, and provide a basis on which to develop comparison studies.

5.2 Philosophies of care

5.2.0 Some practitioners have argued that the concept of a birth centre carries with it an implicit philosophy of woman-centred, family-friendly care. This may be true for some birth centres. Indeed, several papers made explicit the philosophy that was used by their unit. However, such philosophies can also be applied to birth at home and, some would argue, to birth in an obstetric-led unit. We are aware that some consultant-led units, such as Guys and St Thomas' NHS Trust in London, have recently adopted the title of birth centre, possibly in an attempt to align themselves with a philosophy of woman-centred care. Whilst the possible reasons behind this development are interesting in that such obstetric-led centres may be aspiring to achieve a particular kind of context and culture of care, it adds further imprecision to the meaning of the term 'birth centre'. As Wickham (2003: 23) points out: 'it depends on whether one sees 'birth centre' as simply another term for a place where babies are born, or as a concept which is intensely political, grounded in the normalcy of birth and autonomous midwifery and needing careful valuing by those who value this'.

5.2.1 Midwives working in some birth centres provide the full range of antepartum and intrapartum care, whereas others offer only an intrapartum service. It is not clear what, if any, impact this may have on outcomes as no studies have been done to compare outcomes for birth centres where antenatal care as well as intrapartum is provided, with those where this is not available. Provision of postnatal services such as breastfeeding support in a birth centre setting compared to any other has not been rigorously evaluated.

5.2.2 Smith (1995) points out, the difference between birth centres and traditional labour wards is more than one of attitude, but includes a homelike, non-clinical environment, autonomous midwifery practice, woman and family-centred care, as well as a commitment to and belief in normal, physiological birth. This supports the work of Khoury et al (1997) who described birth centres operating in the United States of America in 1993-1994 and concluded birth centres do not all share the same philosophy and service mix.

5.3 Criteria for admission to midwife-led birth centres (Tables 2 and 3)

5.3.0 Criteria for admission to both freestanding and alongside birth centres varied widely. In freestanding centres, there was no one criterion used consistently by all centres at booking. In some, a clear definition of a particular criterion was reported. However, in another centre a similar criterion was used with less precision. An example of this was women's weight at booking. Holz et al (1989) stated that obese women were excluded at booking, whereas Saunders et al (2000) excluded women whose body mass index (BMI) was less than 20 or greater than 25. Inconsistency was also noticeable in criteria regarding parity.

Webster et al (1989) excluded nulliparous women over 38 years of age, whereas all the other centres included this latter group of women.

5.3.1 Further exclusion criteria were applied when women were in labour. Two of the freestanding birth centres (David et al 1999, Saunders et al 2000) had a lower limit of gestation (37 weeks) but demonstrated inconsistency with regard to prolonged gestation. Only one (David et al 1999) stated an upper limit (42 weeks).

5.3.2 In reports describing alongside birth centres there was no consensus on booking criteria for women. Some, such as Gould et al (2004) had very broad eligibility criteria. Similarly, whilst Rowley and Kostrzewa (1994: 31) did not specify eligibility or exclusion criteria, they did state that midwives working in the birth centre had *'a strongly held belief that all women desirous of an active birth should be given an opportunity to use the Birth Centre facilities'*. Others had lengthy lists of exclusion criteria of very specific groups of women who would not always be classified as 'at risk'. For example, the two Swedish studies (Gottvall et al 2004 and Waldenström et al 1997) both excluded women who smoked.

5.3.3 No exclusion criteria were stated for both freestanding and alongside birth centres. In reports describing alongside birth centres, there was no standard definition of booking criteria for women.

5.3.4 The exclusion criteria that appeared most frequently related to gestational age. All four birth centres with gestational criteria excluded women who were less than 37 weeks. However, only two of these centres stated an upper limit. One of these was a freestanding centre (David et al 1999) and excluded women beyond 42 weeks gestation. The other was an alongside centre (Gottvall et al 2004) and excluded women beyond 42+6 weeks. Such discrepancies were also noted by Waldenström and Lawson (1998), who carried out a review of birth centre practices in Australia over a five-year period (1991-1995), which included data from both alongside and freestanding birth centre, and demonstrated that inclusion and exclusion criteria varied widely. Generally, they found that criteria became less restrictive over time, suggesting that those working in a birth centre may have become more confident to offer care to a wider range of women. The results of this study should be considered with caution. Although data were collected from 22 centres in all, a maximum of 18 centres reported in any one year. This major inconsistency in the study method was not addressed in the statistical analysis of the data. The researchers chose to present crude rates rather than adjusting for the change in the number of centres contributing data to the study; therefore there is a high likelihood of bias in the results and of chance findings.

5.3.5 Recommendation

A standardised system of inclusion and exclusion criteria in relation to birth centre services should be developed and implemented in NHS Trusts

5.4 Socio-demographic variables of women planning to give birth in birth centres (Tables 4 and 5)

5.4.0 The two studies that provide socio-demographic data for women who plan to give birth in freestanding birth centres indicated that these women were more likely to be Caucasian and are more likely to be better educated than women birthing in standard settings. In their review of a freestanding birth centre over a seven-year period, Eakins et al (1989) also noted that women who used the birth centre appeared to be highly motivated. They illustrated this by noting that only one woman, out of a total of 690, had failed to take part in childbirth education classes during pregnancy.

5.4.1 Of four studies that reported socio-economic data in alongside birth centres, three (Homer et al 2000, Waldenström and Nilsson 1993, Webster et al 1989) indicated that women were also more likely to be Caucasian and better educated than women who receive standard care. A fourth study (Hundley et al 1994) did not demonstrate any differences in socio-demographic data, but this may be explained by the fact that the study was a randomised controlled trial carried out in the Aberdeen area of Scotland where there are relatively few non-Caucasian women, compared to the other studies which were carried out in non-UK settings.

5.4.2 From the published evidence it is not possible to say whether women who use an alternative to birth centre care actively opted out of birth centre care, or are unaware of the choices that are available to them, or are discouraged from choosing to use a birth centre. Results of the DH funded Birth Place Choices Project (BPCP) (Jane Rogers, Personal communication 2004) should provide further information about these issues for women in Hampshire, an area where currently 25% of women give birth in birth centres. However, the BPCP will not explore *why* women make particular choices about places of birth. It may be that factors such as maternity staff competence, knowledge and understanding of the benefits and risks associated with alternative options for care are key to providing a culture in which women can choose freely. However, such issues have not been evaluated.

5.4.3 Recommendation

Evaluation of factors which influence women to make personally appropriate decisions about location of care for birth should be carried out to identify the best ways to support women to make such choices.

5.5 Clinical outcomes for women planning to give birth in a birth centre. Transfers to obstetric care (Tables 6 and 7)

5.5.0 Intrapartum transfer rates in the freestanding birth centres varied from 12% (Saunders et al 2000) to 21.6% (Scupholme et al 1986). This difference may reflect local transfer policies or, given that the reports were published 14 years apart, changes in services or in the population of women using the services over time.

5.5.1 Saunders et al (2000) included women with prolonged prelabour rupture of membranes in their reported antenatal transfer rates, whereas other authors include such women in their intrapartum figures. Reasons for transfer were not always stated but, where this information was given, prolonged labour and meconium staining of the liquor were the most common reasons for transfer.

5.5.2 Intrapartum transfer rates for women in alongside birth centres ranged from 16% (Hundley et al 1994) to 30% (Gould et al 2004, Homer et al 2000). Gould et al (2004) suggest that their transfer rate may be high because women do not need to book for the birth centre in advance, and all healthy women with an uncomplicated full-term pregnancy in spontaneous labour are offered the choice of giving birth there. In Homer et al's study(2000), which reports a similar transfer rate, women have to book for the birth centre during pregnancy.

5.5.3 As in the freestanding birth centres, the centre with the lowest intrapartum transfer rate (Hundley et al 1994) included women with prolonged rupture of membranes in their antepartum figures whereas other authors in the review included these women in their intrapartum data. Reasons given in some reports for intrapartum transfer included suspected fetal compromise, slow progress and meconium stained liquor. Two reports of alongside birth centre data state 'request for epidural' as a reason for intrapartum transfer (Gould et al 2004, Homer et al 2000). This did not feature as a reason among reports of women booked for care in a freestanding birth centre, suggesting that women who book for care in these centres may have made a clear decision to avoid the use of pharmacological analgesia, or else were aware that it would be difficult or even impossible to access such analgesia if they chose to labour in a birth centre. Clearly, there will be a difference in distance to the nearest obstetric unit between freestanding and alongside birth centres. Transfer time to the nearest obstetric unit has been reported as being ≥ 30 minutes for freestanding centres, whereas in alongside centres the transfer time is likely to be ≤ 5 minutes.

5.5.4 Proximity to an obstetric unit may affect the proportion of women who are transferred. In a review of birth centre practices in Australia (Waldenström and Lawson 1998) (Table 8) and including data from 19 alongside and 3 freestanding birth centres, average transfer rates over the review period (1991-1995) were 22% antepartum and 18% intrapartum. There was no consistency in the way the data were collected between birth centres, over different time periods (see section 5.3.4). The reported rate of transfer increased over the 5-year period (by 4.8% antenatally and 2.5% intrapartum). The estimated transfer time for all freestanding birth centres in this study was less than 15 minutes. However,

Waldenström and Lawson did not separately analyse the data for the different types of birth centre.

5.5.5 The process of transfer may be qualitatively different depending on the location of the birth centre and there is some evidence to suggest that this may have an effect on women's experience of transfer. A study of an alongside birth centre, Waldenström and Nilsson (1994) explored women's reaction to transfer in labour and described no significant effect on women's experience. Women expressed greater satisfaction than those booked for hospital care, even when they had to be transferred to consultant care.

5.5.6 However, two studies that explored the experiences of women in freestanding centres suggest that the experience of transfer from that setting may be different. Walker et al (1995) found that women who began labour in the birth centre but subsequently needed to be transferred, reported feelings of loss of control, loss of choice, and loss of support. In a questionnaire survey of 59 women who had used a freestanding birth centre (Fraser et al 2003), ten who responded had been transferred from the birth centre to the consultant unit. These women were not as satisfied with aspects of their care, even though there had been a safe outcome for themselves and their babies. This may reflect the fact that women in Fraser et al's study had to be transferred by ambulance, whereas those in Waldenström and Nilsson's study only had to be moved from one floor of the hospital to the other.

5.5.7 It has been suggested that midwives working in freestanding units may be reluctant to transfer women to obstetric care, as this would conflict with a belief in the normality of birth. Alternatively, it may be that midwives working in freestanding birth centres may set more appropriate criteria for women choosing to give birth there, and may be more skilled and confident in providing care and avoiding transfer unless really necessary.

5.5.8 No direct comparisons can be made between reported transfer rates in freestanding and alongside birth centres, given the inconsistency in data collection and classification of timing and reasons for transfer. We do not know whether factors such as ease of the transfer process, competence and confidence of staff to provide full midwifery care, influence transfer rates.

5.5.9 Recommendation

A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate why women are transferred from birth centres to obstetric care, and the processes of transfer. This should include data collection to allow audit of women's experiences of care.

5.6 Mode of birth (Tables 9 and 10)

5.6.0 Four papers (David et al 1999, Feldman and Hurst 1987, Saunders et al 2000, Scupholme et al 1986) reported findings for women who plan to give birth in a freestanding birth centres and suggest that they are less likely to have an instrumental (forceps or ventouse) birth. Three reports (David et al 1999, Saunders et al 2000 and Scupholme et al 1986) also suggest that women are more likely to have a spontaneous vaginal birth, and two (Saunders et al 2000 and Scupholme et al 1986) that they are less likely to have a caesarean section. However, the results presented by Scupholme et al (1986) are also subject to clear bias. The researchers matched controls for age, parity, ethnic background and financial assistance. Despite this, there was a marked difference in the educational levels of their two comparison groups. For example, 52% of the women who received standard care had not finished high school, compared with 11% in the birth centre group; 46.8% of the birth centre group had had between 1 and 4 years of college education, compared with 14% of the standard care group.

5.6.1 Results of the systematic review of alongside birth centres (Hodnett 2004) demonstrates that women were less likely to have an operative birth, whether instrumental vaginal birth or caesarean section. These findings are supported by the data from Gottvall et al's study (2004). Homer et al (2000) found no statistically significant difference between the two groups; however, data in this study were collected retrospectively and the sample size is relatively small, limiting the validity of the findings.

5.6.2 The most reliable data indicates that women who plan to give birth in alongside birth centres are more likely to have a spontaneous vaginal birth than women who receive standard hospital care (Hodnett 2004). Data from freestanding birth centres also supports these findings but more robust evidence is needed from large-scale well controlled prospective studies.

5.6.3 Recommendation

A large scale pragmatic randomised controlled trial is required to evaluate whether the rate of spontaneous vaginal birth is significantly different amongst women who plan to give birth in a birth centre compared to those who plan to give birth in a standard care setting.

5.7 Analgesia use (Tables 11 and 12)

5.7.0 Two papers reported findings of level III studies which described comparative data on analgesia use in freestanding birth centres and standard care. Feldman and Hurst (1987) found a small but statistically significant reduction in the rate of epidural for pain relief, amongst women who planned to give birth in a birth centre.

5.7.1 However, data from alongside birth centres suggests that women are significantly less likely to use pharmacological pain relief than women who plan to give birth in hospital. The systematic review by Hodnett (2004) suggests that any reduction in use of analgesia does not depend solely on women's motivation to forego its use. However, it is currently not possible to determine whether there are aspects of birth centre care which may contribute to a change in the rate of analgesia use. Factors proposed include the physical environment of the birth centre, which is usually described as more relaxed and informal (Shallow 2003:13) and the level of support offered by midwives. It is important that a low level of analgesia use should not be considered a positive outcome unless it is also associated with maternal satisfaction and positive memories of the labour and birth.

5.7.2 Recommendation

A large scale pragmatic randomised controlled trial is required to include an evaluation of whether the rate of analgesia use is significantly different amongst women who plan to give birth in a birth centre compared to those who plan birth in standard care setting.

5.8 Levels of perineal trauma (Tables 13 and 14)

5.8.0 Six papers described rates of perineal trauma for women who planned to give birth in a freestanding birth centre (Stone 1998, David et al 1999, Feldman and Hurst 1987, Saunders et al 2000, Rooks et al 1989, Eakins et al 1989). Two (Eakins et al 1989 and Rooks et al 1989) do not include a comparison group. The remaining four papers all indicate that women who plan to give birth in these centres are significantly less likely to have an episiotomy than women who receive standard care. Feldman and Hurst (1987) and Saunders et al (2000) suggest that women are also more likely to have an intact perineum, but the former is limited by its small sample size. 5.8.1 The most reliable data are described in the systematic review of women who plan to give birth in an alongside birth centre (Hodnett 2004). This also demonstrates that rates of episiotomy are lower, when compared with women who receive standard care, with no statistically significant difference in levels of intact perineum.

5.8.2 The benefits for women of eliminating routine use of episiotomy are well documented (Carroli and Belizan 1999) and universal routine episiotomy is no longer policy in any NHS Trust in the UK.

5.8.3 Recommendation

A large scale pragmatic randomised controlled trial is required to include an evaluation of whether the rate of perineal trauma is significantly different amongst women who plan to give birth in a birth centre compared to those who plan birth in standard care setting.

5.9 Blood loss/postpartum haemorrhage (Tables 15 and 16)

5.9.0 There were no statistically significant differences in levels of postpartum haemorrhage, or mean blood loss (where reported) among women who planned to give birth in a freestanding or alongside birth centre. However, not every report provided a definition of postpartum haemorrhage (PPH) and there was no consistent definition adopted amongst those who did. It is therefore not possible to compare results of this important outcome

5.9.1 Recommendation

A large scale pragmatic randomised controlled trial is required to include an evaluation of whether the rate of mean blood loss or postpartum haemorrhage is significantly different amongst women who plan to give birth in a birth centre compared to those who plan birth in standard care setting.

5.10 Clinical outcomes for babies

Perinatal mortality and serious morbidity (Tables 17, 18 and 19)

5.10.0 Relatively few studies were identified which considered these important but infrequent outcomes. Moster et al (2001) reported levels of perinatal mortality for babies of women who intended to give birth in a freestanding birth centre. They suggest an increased risk (1.2) of experiencing neonatal death amongst these women when compared with women who gave birth in a larger obstetric-led unit. This level III study analysed routine data collected in Norway over a 29-year period (1967-1996). Given the extended period of data collection there is a high probability of misclassification bias, and of confounding due to changes in clinical practice over time.

5.10.1 Gottvall et al's level III study (2004) analysed data routinely collected in Sweden over 10 years. It suggests that the risk of perinatal death is 1.8 times higher for primiparous women who give birth in an alongside birth centre, compared to multiparous women. As with the Moster et al (2001) study there is a high likelihood that bias such as changes in selection of women who are eligible to access birth centre care, and in clinical care offered, for example changes in management of obstetric emergencies such as shoulder dystocia, over time.

5.10.2 One paper (Waldenström et al 1997) (Table 19) found no statistically significant difference in levels of perinatal mortality in an RCT comparing alongside birth centre care with standard maternity care. However, six babies in the birth centre group had some form of serious morbidity not caused by malformations or preterm birth, compared with only two in the standard care group. All these were first-born infants. Three of the cases of morbidity in the birth centre group were thought to have been possibly avoidable, but this decision was made in retrospect, after review of the case notes by a paediatrician and obstetrician. As Walsh (2004b) points out, retrospective reviews are prone

to bias, and review by medical personnel was not balanced by similar input from a midwife. As Walsh (2004b) also notes, morbidity may be related to the interventions that were instigated after transfer to the obstetric-led labour ward.

5.10.3 Hodnett's systematic review (2004) demonstrates a trend towards greater perinatal mortality in the birth centre group, but this did not reach statistical significance. This is, in part, because perinatal mortality is relatively rare in developed countries.

5.10.4 It is crucial to evaluate the safety of any clinical service. However, given the infrequency of perinatal mortality (infant or maternal) it is inappropriate to rely on evaluating such outcomes in a randomised controlled trial and therefore an effective surveillance system is required

5.10.5 Recommendations

A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate rare maternal and neonatal outcomes (mortality and major morbidity).

An international data-sharing network should be developed and implemented, to facilitate sharing data collection among different but comparable developed countries. This could be modelled on the Vermont Oxford Network (<http://www.vtoxford.org/home.aspx?p=/eds/enicq/index.htm>) which currently provides a means of pooling data to describe neonatal care.

5.11 Apgar scores (Tables 20 and 21)

5.11.0 Data relating to Apgar scores were limited. Evidence from both the freestanding and alongside birth centres suggests that there was little difference between Apgar scores for either group of babies.

5.11.1 Recommendation

A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate Apgar scores and other measures of neonatal wellbeing.

5.12 Birth weight (Tables 22 and 23)

5.12.0 Two of four papers that report birth weights for babies whose mothers planned to give birth in an alongside birth centre used comparison groups (Feldman and Hurst 1987, Scupholme et al 1986). Both papers are now somewhat dated but suggest that these infants are less likely to be low birthweight (<2500g) and more likely to weigh >4000g.

5.12.1 In contrast, three randomised controlled trials (Hundley et al 1994, MacVicar et al 1993, Waldenström et al 1997) of women allocated to care in an alongside birth centre demonstrated no statistically significant difference in birth weight between the two groups. This suggests that the overall increase in birth weight reported in the observational reports reflects the higher socio-economic status of women who were eligible to use/choose birth centre care.

5.12.2 It is implausible that care in labour would be reflected in a significant difference in birthweight.

5.12.3 Breastfeeding rates were evaluated in two studies reported by Hodnett (2004). The results indicated no difference in discontinuation rates at six weeks after birth between birth centre and standard care. Evaluation is clearly needed of such an important outcome for babies and mothers.

5.12.4. Recommendation

A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate birthweight and other measures of neonatal wellbeing.

5.13 Psychosocial outcomes (Tables 24 and 25)

5.13.0 Four papers reported psychosocial outcomes for women who gave birth in a freestanding birth centre (Rooks et al 1989, Saunders et al 2000, Fraser et al 2003, Walker et al 1995). Women in all four studies indicated that they were highly satisfied with their care. However, in the one paper to include a control group (Fraser et al 2003), women who planned and had a hospital birth were equally satisfied with their care. Women in this study who had to be transferred from the birth centre to the hospital were the least satisfied with their care.

5.13.1 The systematic review of alongside birth centres (Hodnett 2004) also demonstrates that women in the birth centre group were more satisfied with their care than those who received standard hospital care. This review highlighted that women comment on the respect, perceived control and support that they experienced in the birth centres, concepts which mirror the recommendations of the Changing Childbirth report (DH 1993). It seems that birth centres may offer women who use them a greater sense of autonomy. The long-term implications of this may be significant for the emotional and physical health of women, their babies and families, and society in general but, as yet, no data have been gathered to test this theory.

5.13.2 Recommendation

Valid and reliable measures for evaluating data on psychosocial outcomes should be developed and implemented. A large scale, national survey, using these outcomes measures, should be developed to explore the psychosocial

experiences of women who use birth centres. This should include in-depth study of the experiences of women who need to be transferred from birth centre care.

5.14 Economic data

5.14.0 No new data have been identified; therefore the conclusions of the systematic review carried out in 2003 (Appendix D) remain valid.

5.14.1 Recommendation

Research is required to estimate the cost and resource use attributable to birth centre care. Future research should investigate the long term health service costs and the costs that arise outside the health service, which are likely to vary according to mode of birth.

5.15 Unpublished NHS Trust data (audit and survey) (Table 26)

5.15.0 Given the strict limitations of time to achieve this project we were unable to support intensive communication with potential collaborators in NHS Trusts who might have been able to contribute unpublished audits or reports. We have therefore chosen to indicate the range of issues captured in the reports submitted to us rather than to carry out a full analysis of the data in terms of outcomes. However this demonstrates that there is inconsistency in data and information collected and that it is therefore inappropriate to compare results between NHS Trusts. It also indicates that within-Trust evaluation may be limited because data were not collected which could allow comparison of birth centre with standard care.

5.15.1 Recommendation

A standardised system of data collection should be developed and implemented in NHS Trusts to record and evaluate

- why women are transferred from birth centres to obstetric care and the processes of transfer. This should include data collection to audit women's experiences of care
- levels of postpartum maternal blood loss and rates of postpartum haemorrhage (PPH) using an agreed definition of PPH
- Apgar scores and other measures of neonatal wellbeing
- rare maternal and neonatal outcomes (mortality and major morbidity)

5.16 Conclusions

5.16.0 Birth centre care can offer the possibility of accessible, appropriate, personal maternity care for women and their families. There is substantial support from women accessing care, their families, maternity care health professionals, and service managers for care in birth centre settings which are clearly differentiated from obstetric-led maternity services.

5.16.1 No reliable evidence about clear benefit or harm associated with birth centre care, compared with any other type of intrapartum care offered in the NHS was identified in this review. This gap in the evidence-base for care (birth centre or standard) should be addressed urgently as an integral part of the drive to modernise, reconfigure and develop sustainable maternity services.

5.16.2 More than 25 years ago Eakins (1988: 29), writing about freestanding birth centres in the United States of America, said: 'Only with the accumulation of continuing, systematically collected data will we be able to examine the medical outcomes at [birth centres] in other than a political context'. Implementation of the National Service Framework for Children, Young People and Maternity Services provides a window of opportunity to carry out primary research which will generate reliable evidence about outcomes important to service users and health care providers. Development and introduction of national standards for routine data collection in maternity care, and strategies for audit would also be key components to understanding the outcomes of care, improving services, and ensuring highest quality care for women, their babies and families.

6. Recommendations

6.0.0 A standard baseline definition of the term 'birth centre' should be developed and implemented. Additional information, for example about proximity of a birth centre from maternity services which offer medical care, including obstetric and neonatal care, should be collected in a standard way. This would allow grouping of centres which have similar levels of service provision and provide a basis on which to develop comparison studies. (See section 5.1)

6.1.0 Evaluation of factors which influence women to make personally appropriate decisions about location of care for birth should be carried out to identify the best ways to support women to make such choices (section 5.4).

6.2.0 A large scale pragmatic randomised controlled trial is required to evaluate whether the rate of spontaneous vaginal birth is significantly different amongst women who plan to give birth in a birth centre compared to those who plan to give birth in a standard care setting (section 5.6). Other important outcomes which could be evaluated in the context of such a study include:

- analgesia use (section 5.7)
- perineal and genital tract trauma (section 5.8)
- neonatal wellbeing (sections 5.11 and 5.12)
- infant feeding (section 5.12)
- psychosocial wellbeing (section 5.13)

6.3.0 Standardised evidence-based criteria in terms of likely benefits and harms should be developed and implemented to support women to make decisions about place for birth, whether in a birth centre, at home, obstetric-led care or other setting (section 5.10)

6.4.0 An international data-sharing network should be developed and implemented, to facilitate sharing data collection among different but comparable developed countries. This could be modelled on the Vermont Oxford Network (<http://www.vtoxford.org/home.aspx?p=/eds/enicq/index.htm>) which currently provides a means of pooling data to describe neonatal care (section 5.10).

6.5.0 Valid and reliable measures for evaluating data on psychosocial outcomes should be developed and implemented. A large scale, national survey, using these outcome measures, should be developed to explore the psychosocial experiences of women who use birth centres. This should include in-depth study of the experiences of women who need to be transferred from birth centre care (section 5.13).

6.6.0 Research is required to estimate the cost and resource use attributable to birth centre care. Future research should investigate the long term health service costs and the costs that arise outside the health service, which are likely to vary according to mode of birth (section 5.14).

6.7.0 A standardised system of data collection should be developed and implemented in NHS Trusts (section 5.15) to record and evaluate

- why women are transferred from birth centres to obstetric care and the processes of transfer. This should include data collection to audit women's experiences of care (section 5.5)
- levels of postpartum maternal blood loss and rates of postpartum haemorrhage (PPH) using an agreed definition of PPH (section 5.9)
- Apgar scores and other measures of neonatal wellbeing (section 5.12)
- rare maternal and neonatal outcomes (mortality and major morbidity) (section 5.10)

7. Acknowledgements

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9. Appendices

9.0 Appendix A

**Project plan: Review of evidence about
clinical, psychosocial and economic outcomes for women with
straightforward pregnancies who plan to give birth in a birth centre,
and outcomes for their babies**

Short title: Report of a structured review of birth centre outcomes

Background

The National Service Framework (NSF) maternity research group requested this review in July 2004. Urgent drivers for the review include the political context. In a speech on 15 May 2004, Stephen Ladyman, minister with responsibility for the maternity services, stated that the NSF would promote normality and choice to improve maternity experiences of women and their families, thereby improving their clinical and psychological outcomes.

Other drivers include the policy context, service reconfiguration, and European Union working time directives (EU WTD). This is all set within the context of Changing Childbirth (DH 1993) and notions of choice, the NHS Plan (DH 2000), accessibility (local provision of services), and affordability.

Some work has already been done in this area, for example:

First Class Delivery (Audit Commission 1997)

Tina Lavender's DH report (Maternity and Neonatal Workforce Group 2003)

BirthPlace Choices Project (an ongoing 2-year DH funded project exploring women's awareness of choices of place of birth)

BirthPlace study (ongoing: part of preparation for RCT protocol comparing birth planned in birth centre with usual care)

NHS federation survey of models of maternity care (June 2004)

The purpose of this review is to provide an overview of current evidence supporting the recommendations of the NSF, and to set the agenda for future research in this important area.

Aims

By 31st October 2004 the NPEU will produce a written report for the maternity research group of the NSF for Children, Young People and Maternity Services which will:

3. Provide an overview of current evidence supporting the Maternity component of the National Service Framework for Children, Young People and Maternity Services about clinical, psychosocial and economic outcomes for women with straightforward pregnancies who plan to give birth in a birth centre, and outcomes for their babies
4. Identify gaps in evidence to inform the future research agenda

Objectives:

- ◆ Define what is meant by a birth centre, both freestanding and alongside
- ◆ Develop and apply a systematic search strategy to identify relevant evidence about the benefits and harms of women with straightforward pregnancies giving birth in free standing or alongside birth centres
- ◆ Develop and apply a systematic search strategy to identify relevant evidence about the benefits and harms for babies who are born in free standing or alongside birth centres
- ◆ Extract, organise, analyse, evaluate and report relevant evidence

Outcomes to include:

Clinical:

safety for woman (for example, rate of haemorrhage, pre-eclampsia, eclampsia, infection)
safety for baby (need for resuscitation, transfer to higher level care)
mode of delivery
infant feeding method

Psychosocial:

women's experience of transfer from birth centre to consultant care (pre-labour, in-labour, postnatal)
satisfaction with care

Economic:

- length of stay
- staffing levels
- skill mix
- resource use
- cost to women
- who is providing care

In addition, the review will seek evidence about who benefits and who does not from giving birth in a birth centre, and evidence about positive outcomes

Timetable for project:

July 2004

NPEU agree specification for project with Jane Sandall (JS) and Mary Newburn (MN) as representatives of the NSF maternity research group

Appoint reviewer

Convene external reference group

Late July : telephone conference call involving core members of the project team (see below) to finalise timetable and activities (and project staff)

August

Develop and conduct search strategies

Develop and test abstraction forms

Contact researchers and clinical leaders in NHS Trusts to solicit unpublished evidence/identify ongoing research/unpublished evidence

September

Search for, abstract and organise evidence

Follow-up researchers/clinical leaders contacted in August to solicit unpublished evidence/identify ongoing research/unpublished evidence

First draft of report circulated to core group by end of September

September: 2x telephone conference calls involving core group and project staff

October

Final retrieval of evidence

Draft report finalised

1x conference call involving core and project staff mid-October

31st October: Final report submitted to JS and MN

Project management

Core group

Governance will be the responsibility of the following core members of the project team:

Jane Sandall (JS) NSF maternity research group member and NSF research group member

Mary Newburn (MN) NSF maternity research group member

Peter Brocklehurst (PB) NPEU

Jane Henderson (JH) NPEU

Rona McCandlish (RM) NPEU

Stavros Petrou (SP) NPEU

RM will be the project leader in the NPEU and will be accountable for the conduct of the project and management of project staff

Project staff

The following project staff employed by the NPEU will carry out day-to-day work:

Mary Stewart (MS) Reviewer x 1 (0.6FTE)

Administrator/secretary x 1 (0.2 FTE)

Expert peer reviewers

Expert peer reviewers who have particular experience and skills in this topic area will be contacted to ask if they are willing to share any published or unpublished evidence of which they are aware.

Those who might be approached include:

Jane Rogers (SUHT), Denis Walsh/Soo Downe (Uclan), Mags Maguire (Scottish Executive), Andrew Symon (Dundee)

Resources

Staffing

Reviewer 0.6 FTE: 26 July – 31 October 2004

Administrator/secretarial support: 0.2 per week: 26 July – October 31st 2004

Output

The main output of this project will be a report for the NSF maternity research group.

It is anticipated that the systematic reviewer (MS) employed on the project will be the primary author of that report

Subsequently the NPEU may seek to publish/disseminate (e.g. in a conference presentation) some aspect of this work.



9.1 Appendix B

Letter sent to heads of midwifery and supervisors of midwives

2 February 2005

Dear colleague

Can you help? I am currently working with colleagues at the National Perinatal Epidemiology Unit (NPEU) where we are conducting a review of evidence about clinical, economic and psychosocial outcomes for women with straightforward pregnancies who plan to give birth in a birth centre. We will also, of course, consider outcomes for babies. The review has been requested by the National Service Framework (NSF) Research Group. The main objectives are to provide evidence about these important issues and help define the future research agenda. We have been asked to submit our report, not intended for publication, to the research group by the end of October 2004.

Would you be willing to share any published or unpublished work around birth centres that could contribute this review? If you know of any work that you consider might be useful I would be very grateful if you would send this to me by Friday 3 September 2004. Any information that you share will be credited to you, if appropriate or, if you prefer, will be treated in the utmost confidence. As I said above, the report of the review is not for publication and should you contribute information we will contact you to discuss your wishes regarding confidentiality.

If you would like to discuss any aspect of the review please do not hesitate to get in touch either by telephone (0117 328 8524) or e-mail (mary.stewart@uwe.ac.uk).

With best wishes

Mary Stewart
Project researcher

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9.2 Appendix C

NSF maternity research group review 2004

Data extraction form Page 1

Reference:

Date of extraction:

Name of reviewer:

Type of report/method:

- Internal
- Editorial
- Narrative review
- Structured review
- Systematic review
- Case series
- Survey
- Cohort study
- Case control
- RCT
- Other

Evidence grading:

Location of birth centre:
Stand-alone/alongside

Definition of birth centre: Yes/No

Stated criteria for women able to give birth in birth centre: Yes/No

Socio-demographic data for women using birth centre: Yes/No

Total number of women in birth centre group:

Total number of women in standard care group:

Total number of babies in birth centre group:

Total number of babies in standard care group:

NSF maternity research group review 2004

Data extraction form Page 2

Clinical outcomes	Birth centre	Standard care
Maternal: Mode of birth: Spontaneous Instrumental Caesarean Analgesia Perineal trauma PPH rate Transfer: Prenatal Intrapartum Postpartum		
Baby: Mortality/morbidity Apgar Weight		

Psychosocial outcomes	Birth centre	Standard care
Maternal satisfaction		

Economic outcomes	Birth centre	Standard care

9.3 Appendix D

**What evidence do we have about
the cost-effectiveness of
different models of maternity care?**

**Jane Henderson
Researcher in Health Economics
National Perinatal Epidemiology Unit**

Summary

Antenatal care – Two aspects of antenatal care have been examined from an economic perspective: staff leading care and number of antenatal visits. A RCT carried out in Scotland concluded that there is no benefit to women or their babies of routinely having specialist antenatal care. This was supported by the economic evaluation which found GP/midwife led care significantly less costly. The trials of reduced number of antenatal visits have been subjected to systematic review. This concluded that the current pattern of care (between 12 and 14 visits) was not clinically or economically justified. The two economic evaluations did not find significant reductions in cost associated with reduced number of visits, moreover, women were dissatisfied with the reduced number of visits in some cases.

Home birth – Home births declined steadily through the latter half of the 20th century until the mid-1980's. Since then there has been a slow increase to about 2% in England and Wales. Two costing studies, one in the UK, the other in the USA, both found home birth to be a less costly option than hospital birth except when more than two thirds of women were transferred in labour. However, both these studies may have suffered from selection bias and the favourable outcomes and, hence, the cost effectiveness of home birth may not be generalisable to a wider population.

Birth centres – The literature relating to the economics of birth centres is mixed. Some studies examined free standing birth centres, others facilities attached to a hospital. All birth centres were midwife managed but some also had medical staff. The costs included in the analysis varied enormously. Direct resource use was always included but capital costs such as equipment and building conversion costs were rarely included. Consequently, the results of these studies varied. The more comprehensive the costing, the less cost effective the birth centre appeared.

Postnatal care – Duration of postnatal stay has declined significantly over the last forty years and a number of RCTs have shown no adverse effect. Two economic

evaluations alongside RCTs have demonstrated decreased costs even when additional support is provided in the community.

Continuity of care – Although birth centres aimed to improve continuity of carer, some studies had this as their principal objective. They all used midwifery teams so the comparison is also between staff groups. Different studies found team care to be more or less costly than traditional care depending on what was included in the costs and on the caseload each midwife was expected to manage.

Introduction

Changing Childbirth (Expert Maternity Group 1993) reflected many women's perceptions of the medicalisation of childbirth and recommended that women be offered a greater choice and flexibility of care. Partly as a result of this, a variety of different options for care were developed. These included, amongst others, birth centres, domino schemes (domiciliary in and out), caseload midwifery and midwifery units. Some of these schemes only modified care in labour or postnatally, such as the domino schemes, others models of care also changed the way women were cared for in pregnancy. These different schemes generally attempted to increase both the continuity of carer and care, decrease medical intervention rates and increase women's satisfaction with care (Green et al 1998).

Home births declined steadily through the latter half of the 20th century until the mid-1980's. Since then there has been a slow increase to about 2% in England and Wales (Macfarlane et al 2000). The duration of maternal postnatal stay has also declined (Macfarlane et al 2000) and there has been discussion about reducing the number of antenatal visits (Hall 2001; Villar et al 2003). The resource consequences of these changes have been investigated to a limited degree.

This report was commissioned to aid development of the National Service Framework for Children and the Maternity Services.

Methods

A structured review of the literature in this area was conducted in June 2003 using Medline and an 'in house' database 'Econ2' which is a compilation of perinatal health economic literature (including unpublished material) accumulated over several decades. The search terms are given in the Appendix. For pragmatic reasons searches were limited to English language literature but not only to UK studies. The applicability of non-UK literature to the UK setting must be borne in mind in interpreting the findings. The titles, MeSH terms and abstracts of the 201 papers resulting from the Medline search were read and 18 relevant papers retrieved. The bibliographies of papers were also scanned for relevant material.

Results

Antenatal care

Two aspects of antenatal care have been examined from an economic perspective: a single study about staff leading care, and two economic evaluations of a reduced schedule of antenatal visits. A costing study examined alternative types of routine antenatal care for low risk women. The study was based on a randomised controlled trial (RCT) comparing shared care led by a consultant, with GP and midwife led care. The results of the RCT found no benefit from routine specialist antenatal visits (Tucker et al 1994) and total societal costs were significantly less for GP/midwife led care. This suggests that it is unnecessary for obstetricians to see low risk women routinely at antenatal clinics.

The number of antenatal visits in an uncomplicated pregnancy has been between 12 and 14 since the early part of the 20th century. The usual pattern is monthly visits until 30 weeks, fortnightly until 36 weeks, then weekly until delivery (Hall 2001). Since 1992 there have been seven RCTs investigating the effect of reducing the number of visits. These have been included in a Cochrane Review (Villar et al 2003) which found that a reduction in number of visits was not associated with any maternal or perinatal adverse outcome. However, some studies found that women were less satisfied with a reduced visit schedule. Only two of these RCTs included an economic evaluation. One was based on data collected in a RCT carried out in London (Henderson et al 2000). In this trial the actual difference in number of visits was small, 8.6 visits in the intervention group compared to 10.8 in the control group. Although there were small reductions in resource use in the intervention group, such as fewer ultrasound scans, this was outbalanced by a non-significant but very costly increase in baby admissions to special care. Overall there was no significant difference in costs.

The other economic evaluation was carried out alongside the WHO antenatal care trial which compared a schedule of four carefully programmed antenatal visits, to usual care (Villar et al 2001). This trial was conducted in four middle income countries although the economic evaluation was only done in Cuba and Thailand. The trial found no evidence of adverse outcome for mother or infant; there was no increase in cost and, in some settings, costs decreased.

Home birth

There have been no RCTs of home birth and only two observational studies which included an economic element. Both these studies were limited to women at low risk of complications. One of these was based on data collected for the 1994 National Birthday Trust Fund survey in the UK (Henderson & Mugford 1997). This included data on 4191 planned home births, 3470 planned hospital births and 806 women who were booked for home birth but delivered in hospital. Costs from the literature were applied to antenatal, intrapartum and postnatal

resource use. Health service costs were £205, £332 and £405 per delivery for the three groups respectively, differences being due mainly to the daily hospital costs and transfer costs (Henderson & Mugford 1997).

The other study, published in 1999, was from the USA (Anderson & Anderson 1999). In this 11,788 planned home births occurring between 1987-91 were compared with 11,592 hospital births from another study. Using charges as a proxy for costs, they found mean costs of home births in 1998 of \$1823 per delivery and mean hospital costs in 1991 of \$5382.

Both these studies may have suffered from selection bias and interpretation therefore must be cautious. However, it is probable that health service resource use is less in home births than hospital births, certainly in terms of 'hotel' costs. Nevertheless, if the limiting factor is staffing, midwife time may be more efficiently used in a hospital setting.

A further consideration is family costs. Henderson & Mugford (1997) noted that partners of women having home births took more time off work (this was before the introduction of paternity leave). If partner's time off work was included in the analysis, this could amount to several hundred pounds. The same applies to early postnatal discharge schemes such as domino in which the family take on many of the caring roles traditionally done in hospital.

Birth centres

There have been six studies which have conducted economic evaluations of birth centres, four of them based on observational studies or modelling and two alongside RCTs. All studies were restricted to women at low risk of complications. The four observational / modelling studies were all from North America, the two RCTs were done in Scotland and Australia.

The first, an observational study published in 1995, examined the cost-effectiveness of a freestanding birth centre compared to hospital care (Stone & Walker 1995). Birth centres provide antenatal and intrapartum diagnostic and treatment facilities for women who require a postnatal stay of less than 24 hours. Care was mostly provided by certified nurse midwives (CNMs). The authors used a decision analysis framework using outcome data from the literature and charges from their health corporation. Birth centres were found to be a cost-effective option with mean cost per woman for labour and delivery \$3385 for birth centre care and \$4673 for hospital care. This mainly reflected the higher 'hotel' costs in hospital. The authors found the findings sensitive to variations in transfer rates with birth centre care being cost effective with transfer rates of up to 62%.

The same authors also carried out an observational study in Rochester, New York comparing structures, processes and outcomes in a birth centre, a women's clinic with hospital care, and traditional obstetric practice with hospital care (total sample size 75 women) (Walker & Stone 1996). They found no difference in outcomes but birth centre costs were 60% less than both other groups due to staffing differences and shorter duration of postnatal stay.

A further observational study by Stone & Walker (1996; 2000) compared the cost effectiveness of a freestanding birth centre with traditional hospital care. The birth centre was predominantly staffed by CNMs. The number of women in this study was 146. Charges were used as proxy for costs. Clinical outcomes were similar except for significantly increased rates of intact perineum, breast feeding and satisfaction in the birth centre. Costs were not significantly different at \$6087 per delivery in the birth centre and \$6803 in hospital, but the sensitivity analysis suggests that the birth centre could be more cost effective with a higher throughput (Stone et al 2000).

A Canadian observational study of the cost effectiveness of midwifery services in a birth centre compared to medical services in Quebec recruited 1000 women in

1995-96 (Reinharz et al 2000). Midwife clients were matched according to several socio-demographic characteristics after delivery with 1000 women delivered in hospital. Midwifery care was associated with significantly lower rates of caesarean section, perineal tears, and neonatal ventilation. Women also considered their care more 'individualized'. Resource use data were from medical records, questionnaires and budget allocation supplemented by expert opinion. Unit costs were from a variety of official sources. Baseline costs were \$2294 per delivery for midwifery care compared to \$3020 for physician care. The costs almost overlapped in sensitivity analysis. This project was part of a series of pilot projects, summarised in this paper. Three of the pilot projects had results similar to the above while four found no difference in costs. Where differences in cost were found they were mainly due to differences in staffing and length of stay.

The two RCTs in this area were conducted in Scotland (Hundley et al 1995) and Australia (Byrne et al 2000). In the first, the costs of intrapartum care in a midwife managed delivery unit and a consultant led labour ward were compared (Hundley et al 1995). This was not a freestanding birth centre but consisted of five 'homely' rooms 20 yards from the delivery suite. It was staffed by hospital midwives who circulated from the delivery suite but additional higher grade midwives were employed to manage it. The costing was done from a hospital perspective and included capital costs and costs of the building conversion. The study included 2844 women and found no difference in maternal or fetal outcome. Lengths of labour and length of postnatal stay were the same but there was a small reduction in costs of equipment and consumables. Overall the midwifery unit increased costs by £41 per woman. In a range of sensitivity analyses, the only scenarios that showed the midwifery unit being cost saving were when additional staff and building conversion costs were excluded.

The other RCT recruited 201 women who were randomised between birth centre care and delivery suite care (Byrne et al 2000). The birth centre consisted of two

rooms close to the delivery suite with a 'home like' environment. Of the 100 women randomised to birth centre care 67 were transferred to the delivery suite. There was no significant difference in outcomes although women felt that breastfeeding was more encouraged in the birth centre. Costs were derived from case note review and did not include capital or overheads. There was no significant difference in costs.

The difficulty in summarising the economic literature on birth centres falls into two areas: the differences in interventions being examined, and the differences in the costs included. The four North American observational studies all examined the cost effectiveness of freestanding birth centres. The Scottish and Australian RCTs were looking at birth centres or delivery rooms in hospital. The North American studies generally reported improved outcomes with birth centre care whereas the delivery rooms in the two RCTs reported no difference in major outcomes. The North American studies had the potential to be affected by selection bias despite matching in one (Reinharz et al 2000). The factor with the greatest impact on the cost effectiveness results was the disparity in what was included in the costs. All the studies included direct resource use but some included equipment costs, and one, building conversion costs (Hundley et al 1995). The more comprehensive the costing, the less cost effective the birth centre appeared.

Continuity of carer

There have been three studies which examined the cost implications of adopting changes aimed at improving continuity of carer, two of them based on RCTs. They all used midwifery teams to provide the continuity so the comparisons were also between staff groups.

In an Australian RCT, 814 women were randomised between continuity of care provided by a team of six midwives and routine care in pregnancy and birth

(Rowley et al 1995). Unusually, this study was not restricted to women at low risk of complications. Women receiving team midwifery care had fewer interventions, slightly better neonatal outcomes and women's satisfaction with care was increased. Costs were based on Diagnosis Related Groups (DRGs) and are therefore not very detailed. Mean costs per delivery were \$3324 for team midwifery compared to \$3475 for routine care.

A second RCT including 1299 women examined the costs of midwifery managed care compared to shared care in Scotland (Young et al 1997). In the midwifery managed arm, women received all their antenatal, intrapartum and postnatal care from a team of 20 midwives, a named midwife provided the majority of care for any individual. Delivery took place in designated rooms in hospital. Costs included resource use and overheads but, except for electronic fetal monitors, not capital or equipment. Resource use data were extracted from case notes. It was assumed that each midwife would care for an average of 29 women per year and this was varied in a sensitivity analysis. A third of women were transferred to shared care and a further third were temporarily transferred. Analysis was by intention to treat, that is, according to treatment allocation. There was no difference in clinical outcomes but women's satisfaction with care was increased in the midwifery managed arm. Women in the midwifery managed arm had fewer antenatal clinic visits and admissions, fewer postnatal day care checks but more inductions than the shared care arm. Antenatal and intrapartum costs were similar but postnatal costs were £471 in with midwifery managed care compared to £352 for shared care. The differences in cost were due to midwives in the midwifery managed arm being on a higher grade, using women's homes and hospital for checks rather than the cheaper GP surgeries, and the postnatal ward in the midwifery managed arm being small and homely. Increasing midwives' caseloads from 29 to 39 women per year decreased the mean cost of antenatal care but postnatal costs were still greater than for shared care. The authors suggest, however, that there may be potential for economies of scale if more women received midwife managed care.

Another Australian study conducted a cost analysis of community based continuity of midwife care compared to standard hospital care (Homer et al 2001). In this study, which was not restricted to low risk women, there were two teams of six midwives which cared for 600 women per year representing a caseload of 50 women per midwife per year. Antenatal care was provided in community centres with two midwives and an obstetrician attending. Intrapartum and some postnatal care were in hospital but with the team midwives providing care. Costs included resource use, clinicians' travel costs and neonatal care but not capital or equipment costs or costs associated with developing the programme. The caesarean section rate for women receiving community care was 13% compared to 18% for women receiving standard care, but it was not clear whether data were analysed by intention to treat. Transfer rates were not reported. Mean costs per woman, excluding neonatal costs, were \$1504 (95% CI 1449-1559) in the community care group compared to \$1643 (95% CI 1563-1729) in standard hospital care.

Continuity of carer appears to increase women's satisfaction with care and may reduce intervention rates and resource use. Overall costs may be increased or decreased depending on organisational factors such as the location of care and the grade of midwives involved. Of key importance with team midwifery is the caseload midwives are expected to carry. From the economic evaluations reviewed here, it is not possible to say what caseload is optimal. Clearly, the greater the caseload the more cost effective the scheme appears. But this must be balanced against the costs of burnout and non-sustainability.

Postnatal stay

Duration of postnatal stay has declined over time in most developed countries. For example, in England, the percentage of women discharged in less than three days increased from about 5% in 1960 to about 60% in the late 1990s (Macfarlane et al 2000). The safety of early discharge, with and without additional

home support, has been evaluated in eight RCTs and several cohort studies. They have demonstrated that early discharge has no major adverse effects. An economic evaluation was conducted alongside one of the RCTs. This study involved women who had had an unplanned caesarean section in the USA and compared early discharge followed by a minimum of two home visits and ten telephone calls, with standard hospital care without further support (Brooten et al 1994). The early discharge policy resulted in substantial savings. A number of economic analyses based on observational data supported this conclusion that increased costs out of hospital were outweighed by the savings to the hospital. A further economic evaluation alongside a RCT in Switzerland (Petrou et al, submitted for publication) also concluded that community costs incurred through a policy of early discharge are outweighed by the savings to the hospital. If postnatal care can be reorganised to allow midwives to work in the community, and to reduce the number of postnatal hospital beds, then early postnatal discharge has the potential to reduce costs.

Community postnatal support

The costs and effectiveness of community postnatal support workers has been evaluated in a RCT in the UK (Morrell et al 2000). In addition to midwives, support workers visited women in the intervention group up to 10 times in the first month postnatally. The intervention was not targeted at women in particular need of support. Follow up was at 6 months. Outcomes, including depression and the SF36, did not differ between the groups. Costs were higher for women receiving the extra postnatal support at £815 per woman compared to £639 per woman receiving routine care.

Discussion

This review has pointed to some consistent findings. A reduced antenatal visit schedule does not have adverse clinical outcomes although satisfaction with care was adversely affected in some studies. It has the potential to reduce costs. Home birth is also likely to be a cost effective option although the literature on

this was of poorer quality. Difficulties in interpretation of the clinical findings arise because of the probability of selection bias.

The literature relating to birth centre care is of mixed quality and produced somewhat contradictory results. Some of the birth centres were freestanding, others had dedicated rooms or wards in the hospital which may have been given a 'homely' appearance. All the schemes were managed by midwives but some also included doctors. Rates of transfer from the birth centre to routine care were not always reported and it was not always clear that the analysis was by intention to treat. The different studies included different costs. They all included direct resource use and staff time, but equipment costs, capital and conversion costs and overheads were often not included. This was probably the main reason for the different findings. Studies such as Hundley et al (1995) that did a more complete costing did not find the midwifery managed unit to be so cost effective. In studies where only running costs were included such as Stone et al (1995) the birth centre option was found to be dominant, that is, birth centre care led to improved outcomes at the same time as reducing costs.

It is likely that where midwife led schemes have been successful, key enthusiastic individuals have been important factors. If such schemes were widely adopted, this level of innovative enthusiasm may become diluted. Furthermore, there is some evidence that midwives working in new schemes experience higher rates of occupational burnout (Sandall 1998).

It has been suggested that practices which reduce intervention rates in labour, such as continuous support, may be cost neutral or saving (Tracy & Tracy 2003). However, the latest Cochrane review of continuous support in labour (Hodnett 2003) found that for women who were accompanied, continuous support did not significantly reduce caesarean section rates and only produced modest reductions in operative vaginal delivery rates. Costs thus averted would not be sufficient to pay for the increased staff necessary to provide continuous support.

Both home birth and midwife managed schemes require more midwives and higher grade midwives. With midwives already in short supply it is difficult to envisage such types of care being made more widely available. Transfer of midwives from hospital to community care would not be possible on any great scale because, generally, only low risk women are considered eligible for these forms of care. Nevertheless, at the margins, it may be possible to increase the availability of alternative forms of care. Given the lack of adverse effect clinically and improved satisfaction with care, women may welcome these opportunities where they arise.

Conclusion

The majority of the different models of maternity care have not been submitted to rigorous economic evaluation. Most of the economic evaluations reviewed here are limited by narrow, short term perspective, incomplete cost data and, often, poor data on effects of the new model of care. This has led to inconclusive or contradictory findings. Furthermore, many studies varied several factors at once, such as location of care and staffing, making interpretation difficult.

Two aspects of antenatal care have been demonstrated to be cost effective. Reduced number of antenatal visits, and routine care of women at low risk of complications by midwives rather than by obstetricians. Most studies that compared some form of midwifery care to care provided by doctors found that women preferred midwives and that outcomes were not adversely affected. Since midwives are less costly to employ than doctors, such schemes have the potential to reduce costs. However, where midwives are employed on a higher grade to reflect their increased responsibility, or where new building or building conversion is needed, there may be little difference in costs or costs may increase. Reduced duration of postnatal stay has been shown to be cost effective.

Almost all of the economic evaluations reviewed have been limited to women at low risk of complications. Different models of care for women at high risk are unevaluated from an economic perspective.

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Appendix

Search terms used in Medline

- #1 explode 'Birthing-Centres' / all subheadings in MIME, MJME
- #2 explode 'Delivery-Rooms' / all subheadings in MIME, MJME
- #3 explode 'Midwifery' / all subheadings in MIME, MJME
- #4 explode 'Home-Childbirth' / all subheadings in MIME, MJME
- #5 explode 'Hospitals-Maternity' / all subheadings in MIME, MJME
- #6 #1 or #2 or #3 or #4 or #5
- #7 explode 'Economics-' / all subheadings in MIME, MJME
- #8 #6 and #7
- #9 #8 and (English in la)