

# Models of Maternity Care: A Review of the Evidence

*Towards Future Directions in  
Maternity Care*

## AUTHORS

This evidence-based review was conducted by a research team based at the Women and Infants Research Foundation, King Edward Memorial Hospital for Women. Members of the team are described as follows:

1. Midwifery Consultant: Jennifer J Henderson, *BSc, RN, RM, PostGrad Dip Adv Nurs (Maternal and Child Health), MPH*

Jennifer Henderson is a nurse and midwife with twenty years experience, including ten years conducting research at King Edward Memorial Hospital. She has experience with both qualitative and quantitative research methodologies. She has worked as a research assistant on a large number of clinical trials including a NHMRC funded trial of a debriefing intervention for postnatal women aiming to prevent postnatal depression. She has contributed to several multi-centre randomised controlled trials in the fields of obstetrics and neonatology and was a principal investigator on a Healthway funded randomised controlled trial of a midwifery home-visiting intervention aiming to improve breastfeeding rates.

Jennifer is the recipient of several academic awards. She has a Master of Public Health (with distinction) in which her research topic was the “Effect of Postnatal Depression on Breastfeeding”. She has recently completed her PhD at the University of Western Australia. This was accepted subject to minor revisions on 30<sup>th</sup> January 2007. Her PhD research topic was “The Effects of Antenatal Glucocorticoids on Lactogenesis in Ewes and Women”. She was awarded the Public Health Association Prize (WA branch) for academic excellence in 2000 and received the NHMRC Postgraduate Research Scholarship for her PhD research. Jennifer is the author of two research papers, with a further two articles under review. She has eighteen published abstracts and is also the co-author of five articles.

2. Obstetric Consultant: Janet Hornbuckle *MB ChB MRCOG FRANZCOG*

Janet Hornbuckle is a Maternal Fetal Medicine Specialist and Clinical Senior Lecturer in Obstetrics and Gynaecology (UWA) working at King Edward Memorial Hospital, Subiaco.

Her current clinical responsibilities include management of high-risk obstetric patients in the antenatal and postnatal period within the Maternal Fetal Medicine service as well as regular sessional commitments to the Labour and Birth Suite. She undertakes regular ultrasound sessions in prenatal diagnosis and is the lead obstetrician with responsibility for women with ‘Diabetes in Pregnancy’. In addition she is the lead clinician for the Maternal Fetal Assessment

Unit, a 24 hour integrated assessment unit for women presenting with pregnancy problems after 20 weeks gestational age. She was actively involved in establishing the unit including the development of evidence based protocols for the assessment of women presenting to the unit. Since its implementation both antenatal admission rates and length of antenatal stay have been significantly reduced. Although only involved in tertiary level services she participates in the MSOAP programme which visits rural and remote areas of Western Australia providing education to health practitioners involved in delivering maternity care.

Janet relocated from the UK to Western Australia in August 2004 and therefore has experience in other models of Maternity Care. Janet undertook a three year full-time post as Senior Clinical Research Fellow at the University of Leeds co-ordinating the MRC funded Growth Restriction Intervention Trial. She has considerable experience in reviewing clinical research and has just written an evidenced based chapter for the 'Use of Doppler Ultrasound in Pre-Eclampsia'. Other publications specifically involving evidence based reviews include 'Bayesian Interpretation of trials: the example of intrapartum electronic fetal monitoring. Hornbuckle et al., BJOG 2000 and Towards Evidenced Based Management In: Intrauterine Growth Restriction: Aetiology and Management. Springer-Verlag. London 2000. Janet is a regular referee for the BJOG: An International Journal of Obstetrics and Gynaecology and The Australian and New Zealand Journal of Obstetrics and Gynaecology.

3. **Biostatistical Consultant: Dorota A Doherty, BSc (hons) PhD (Medical Statistics)**

Dorota Doherty is a Senior Biostatistician and Head of the Biostatistics and Research Design Unit at the Women and Infants Research Foundation. She is also Adjunct Senior Lecturer at the School of Women's and Infants' Health, UWA, located at the King Edward Memorial Hospital campus. Since August 2001, she has provided biostatistical collaboration on research studies conducted at King Edward Memorial Hospital and affiliated institutions.

Apart from research study design, conduct and analysis, she also lectures on biostatistical methods in medical research (including levels of evidence and evidence based medicine) that are relevant to the area of obstetrics. As a biostatistical collaborator, she co-authored many research publications generating evidence in maternity care. In particular, Dorota has substantial experience in evaluation of complex epidemiological models that explore predictors of health outcomes in accordance with the principles of levels of

evidence. In this project, she contributed to the evaluation of the strength of the published evidence under review and presentation in the final report.

*Correspondence:*

Jennifer Henderson, Janet Hornbuckle or Dorota Doherty,  
Women and Infants Research Foundation  
King Edward Memorial Hospital for Women  
PO Box 134 SUBIACO 6904 WA



E-mail:

Jennifer Henderson [Jennifer.Henderson@uwa.edu.au](mailto:Jennifer.Henderson@uwa.edu.au)  
Janet Hornbuckle [janet.hornbuckle@health.wa.gov.au](mailto:janet.hornbuckle@health.wa.gov.au)  
Dorota Doherty [DDoherty@obsgyn.uwa.edu.au](mailto:DDoherty@obsgyn.uwa.edu.au)

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## GLOSSARY

**Adverse event** - a non-beneficial outcome measured in a study of an intervention that may or may not have been caused by the intervention.

**All or none** - all or none of a series of people (case series) with the risk factor(s) experience the outcome. For example, no smallpox develops in the absence of the specific virus; and clear proof of the causal link has come from the disappearance of small pox after large scale vaccination. This is a rare situation.

**Allocation (or assignment to groups in a study)** - the way that subjects are assigned to the different groups in a study (e.g. Drug treatment/placebo; usual treatment/no treatment). This may be by a random method (*see* randomised controlled trial) or a nonrandom method (*see* pseudorandomised controlled study).

**Ambulatory Care** - care not requiring an overnight stay in hospital or an admission to hospital.

**Anaesthetist** - a person who is medically qualified to deliver anaesthetics.

**Analgesia** - the relief of pain without causing unconsciousness.

**Antenatal** - existing or occurring before birth (also *prenatal*).

**Antenatal care** - care of women during pregnancy by doctors and midwives in order to predict and detect problems with the mother or the unborn child. Advice is also offered on other matters relevant to pregnancy and birth.

**Antenatal clinic** - a clinic in a maternity unit where care is provided by midwives, obstetricians and other health professionals.

**Antepartum haemorrhage** - bleeding from the birth canal in the second half of pregnancy.

**Apgar score** - system for assessing the physical condition of infants immediately after birth (a maximum of two points awarded for each of five categories: heart-rate, breathing effort, muscle tone, reflexes and colour).

**Augmentation of labour** - a medical (e.g. Intravenous oxytocin) or surgical (amniotomy) intervention in an attempt to increase the strength of uterine contractions.

**Best practice in maternity care** - care that provides for the best possible outcomes for women and babies in terms of clinical safety and effectiveness. It recognizes that different women have different risks in relation to pregnancy and childbirth.

**Bias** - influences on a study that can lead to invalid conclusions about a treatment or intervention. Bias in research can make a treatment look better or worse than it really is. Bias can even make it look as if the

treatment works when it actually doesn't. Bias can occur by chance or as a result of systematic errors in the design and execution of a study. Bias can occur at different stages in the research process, e.g. in the collection, analysis, interpretation, publication or review of research data.

**Birth centre - (freestanding)** a geographically separate from a maternity unit, where healthy women can give birth and receive midwifery-based care with continuity of care throughout pregnancy, birth and the early postnatal period.

**Birth Centre - (In-hospital)** a home like environment established within the grounds of or attached to a maternity care hospital where healthy women can give birth and receive midwifery-based care with continuity of care throughout pregnancy, birth and the early postnatal period

**Culturally and Linguistically Diverse-** usually refers to people from cultures and backgrounds which do not use English as their main language.

**Cardiotocography** - the electronic monitoring and recording of the fetal heart rate and uterine activity (CTG).

**Care giver** - a health professional providing services for a client or patient.

**Case-control study** - patients with a certain outcome or disease and an appropriate group of controls without the outcome or disease are selected (usually with careful consideration of appropriate choice of controls, matching, etc) and then information is obtained on whether the subjects have been exposed to the factor under investigation.

**Case series** - a single group of people exposed to the intervention (factor under study). **Post-test** - only outcomes after the intervention (factor under study) are recorded in the series of people, so no comparisons can be made. **Pre-test/post-test** - measures on an outcome are taken before and after the intervention is introduced to a series of people and are then compared (also known as a 'before-and-after study').

**Clinical outcome** - an outcome for a study that is defined on the basis of the clinical outcome being studied (e.g. fracture in osteoporosis, peptic ulcer healing and relapse rates).

**Clinically important effect** (*see also* statistically significant effect) - an outcome that improves the clinical outlook for the patient. The recommendations made in clinical outlook for the patient. The recommendations made in clinical practice guidelines should be both highly statistically significant *and* clinically important.

**Clinician** - a health professional directly involved in the care and treatment of patients - e.g. doctors, midwives, nurses etc.

**Cochrane Collaboration** -an international network that aims to prepare, maintain and disseminate high quality systematic reviews based on randomised controlled trials (RCTs) and when RCTs are not available, the

best available evidence from other sources. It promotes the use of explicit methods to minimize bias, and rigorous peer review.

**Cohort study** - an observational study that takes a group (cohort) of patients and follows their progress over time in order to measure outcomes such as disease or mortality rates and make comparisons according to the treatments or interventions that patients received. Thus within the study group, subgroups of patients are identified (from information collected about patients) and these groups are compared with respect to outcome, e.g. comparing mortality between one group that received a specific treatment and one group which did not (or between two groups that received different levels of treatment). Cohorts can be assembled in the present and followed into the future (a 'concurrent' or 'prospective' cohort study) or identified from past records and followed forward from that time up to the present (a 'historical' or 'retrospective' cohort study). Because patients are not randomly allocated to subgroups, these subgroups may be quite different in their characteristics and some adjustment must be made when analyzing the results to ensure that the comparison between groups is as fair as possible.

**Comparative study** - a study including a comparison or control group.

**Confidence interval (CI)** - a way of expressing certainty about the findings from a study or group of studies, using statistical techniques. A confidence interval describes a range of possible effects (of a treatment or intervention) that is consistent with the results of a study or group of studies. A wide confidence interval indicates a lack of certainty or precision about the true size of the clinical effect and is seen in studies with too few patients. Where confidence intervals are narrow they indicate more precise estimates of effects and a larger sample of patients studied. It is usual to interpret a '95%' confidence interval as the range of effects within which we are 95% confident that the true effect lies.

**Confounding** - the measure of a treatment effect is distorted because of differences in variables between the treatment and control groups that are also related to the outcome. For example, if the treatment (or new intervention) is trialed in younger patients then it may appear to be more effective than the comparator, not because it is better, but because the younger patients had better outcomes.

**Consumers** - users of maternity services, for example the pregnant woman and her family.

**Continuity of Care** - care that helps a woman develop a relationship with the same carer, or group of carers, throughout pregnancy, birth and after the birth. All carers share common ways of working and a common philosophy. The aim is to reduce conflicting advice experienced by women

and provide the same philosophy of care throughout the period of care. Continuity of care can be provided in different ways and to varying degrees.

**Continuous electronic fetal monitoring** - the electronic monitoring and recording of the fetal heart rate and uterine activity (CTG).

**Control group** - a group of patients recruited into a study that receives no treatment, a treatment of known effect, or a placebo (dummy treatment), in order to provide a comparison for a group receiving an experimental treatment, such as a new drug.

**Cost effectiveness** - a type of economic evaluation that assesses the additional costs and benefits of doing something different. In cost effectiveness analysis, the costs and benefits of different treatments are compared. When a new treatment is compared with current care, its additional costs divided by its additional benefits is called the cost effectiveness ratio. Benefits are measured in natural units, for example, cost per additional heart attack prevented.

**Cross-sectional study** - the observation of a defined set of people at a single point in time or time period - a snapshot. This type of study contrasts with a longitudinal study, which follows a set of people over a period of time.

**Delivery** - birth of the baby and the afterbirth.

**Delivery suite** - the ward, in a maternity unit, in which women experience labour and birth.

**Diabetes** - a disorder with high blood sugar levels caused by inappropriate levels of the hormone insulin.

**Domiciliary** - care in the home

**Early discharge** - discharge from a maternity unit within 48 hours of giving birth.

**Effectiveness** - the extent to which an intervention produces favourable outcomes under usual or everyday conditions.

**Efficacy** - the extent to which an intervention produces favourable outcomes under ideally controlled conditions such as in a randomised controlled trial.

**Epidural (anaesthetic or analgesia)** - a local anaesthetic injected around the spinal sac causing some numbness in the lower part of the body. It relieves labour pains effectively.

**Episiotomy** - surgical incision into the perineum and vagina to prevent traumatic tearing during childbirth.

**Evidence** - data about the effectiveness of a new treatment or intervention derived from studies comparing it with an appropriate alternative.

Preferably the evidence is derived from a good quality randomised controlled trial, but it may not be.

Evidence based - the process of systematically finding, appraising and using research findings as the basis for clinical decisions.

Evidence based clinical practice - evidence-based clinical practice involves making decisions about the care of individual patients based on the best research evidence available rather than basing decisions on personal opinions or common practice (which may not always be evidence based). Evidence-based clinical practice therefore involves integrating individual clinical expertise and patient preferences with the best available evidence from research.

Exclusion criteria - see Selection criteria.

Experimental study - a research study designed to test whether a treatment or intervention has an effect on the course or outcome of a condition or disease, where the conditions of testing are to some extent under the control of the investigator. Controlled clinical trial and randomised controlled trial are examples of experimental studies.

External validity - is the degree to which the results of a study can be applied to situations other than those under consideration by the study, for example, for routine clinical practice.

Fetal assessment - assessing and monitoring the fetus during pregnancy.

Fetal malpresentation - where the presenting part of the fetus (i.e. the part which is entering the birth canal first) is unusual (e.g. bottom, shoulder, face or brow, instead of the top of the head).

Fetus - the unborn baby. Fetal - of fetus.

General Practitioner (GP) - a doctor who works from a local surgery to provide medical advice and treatment to patients.

General practitioner obstetrician - a general practitioner registered to practice medicine by a State or Territory, usually with the Diploma of the Royal Australian College of Obstetricians and Gynaecologists, who provides maternity care. Part or all of antenatal, intrapartum and postnatal care may be provided by the general practitioner.

Gestation (or gestational age) - length of pregnancy

Guidelines - systematically developed statements that assist in decision-making about appropriate health care for specific clinical conditions.

Heterogeneity - or lack of homogeneity. The term is used in meta-analyses and systematic reviews when the results or estimates of effects of treatment from separate studies seem to be very different, in terms of the size of treatment effects, or even to the extent that some indicate beneficial and others suggest adverse treatment effects. Such results may occur as a result of differences between studies in terms of the patient populations, outcome measures, definition of variables or duration of follow up.

**High Risk** - a term used by clinicians to describe women who have a history of problems in a previous pregnancy or have an existing medical condition or have some potential risk of complications that might require speedy or specialist treatment.

**Historical controls** - data from either a previously published series or previously treated patients at an institution that are used for comparison with a prospectively collected group of patients exposed to the technology or intervention of interest at the same institution.

**Home Birth** - usually a planned event where the woman decides to give birth at home, with care provided by the midwife.

**Homogeneity** - the results of studies included in a systematic review or meta-analysis are similar and there is no evidence of heterogeneity. Results are usually regarded as homogeneous when differences between studies could reasonably be expected to occur by chance.

**Hypertension** - blood pressure which is higher than normal, also used for a disease which is characterized by high blood pressure.

**Incidence** - the number of new events (new cases of a disease) in a defined population, within a specified period of time.

**Inclusion criteria** - see Selection criteria.

**Independent midwife** - a midwife accredited by the Australian College of Midwives Inc to practice independently.

**Induction of labour** - starting labour artificially by using drugs or other methods.

**Integrated service** - a multi-disciplinary, multi-professional approach to service provision.

**Intention to treat (ITT)** - an analysis of a clinical trial where participants are analysed according to the group to which they were initially randomly allocated, regardless of whether or not they dropped out, fully complied with the treatment, or crossed over and received the other treatment. By preserving the original groups one can be more confident that they are comparable.

**Interrupted time series** - treatment effect is assessed by comparing the pattern of (multiple) pretest scores and (multiple) post-test scores (after the introduction of the intervention) in a group of patients. This design can be strengthened by the addition of a control group which is observed at the same points in time but the intervention is not introduced to that group. This type of study can also use multiple time series with staggered introduction of the intervention.

**Intervention** - clinical procedure in pregnancy or labour e.g. induction or labour, delivery of the fetus with forceps or by caesarean section.

**Intrapartum** - during labour.

**Labour ward** - a suite of rooms set aside in a maternity unit for care of women in labour.

**Level of evidence** - a hierarchy of study evidence that indicates the degree to which bias has been eliminated in the study design.

**Longitudinal study** - a study of the same group of people at more than one point in time. (This type of study contrasts with a cross-sectional study, which observes a defined set of people at a single point in time).

**Low risk** - is a term used by clinicians to describe a woman whose history and condition suggests there is little likelihood of complications.

**Maternal** - relates to the mother.

**Maternal and Fetal Medicine specialist (MFM)** - Obstetrician who specialises in the care of women with high risk pregnancy

**Meta-analysis** - results from a collection of independent studies (investigating the same treatment) are pooled, using statistical techniques to synthesise their findings into a single estimate of a treatment effect. Where studies are not compatible, e.g. because of differences in the study populations or in the outcomes measured, it may be inappropriate or even misleading to statistically pool results in this way. See also Systematic review and Heterogeneity.

**Midwife** - a person appropriately educated and licensed in a State or Territory to practice midwifery and who provides care, advice and assistance during pregnancy, labour and delivery and after the baby is born.

**Midwifery group practice** - a service where a woman's main contact through a pregnancy and delivery would be the local midwifery group practice with the skills of other health and social care professions available when necessary. Midwives would also provide pregnancy care, parenthood sessions, home visits, and support after the baby is born.

**Midwifery unit** - a group of midwives who provide midwifery services within a maternity unit.

**Miscarriage** - pregnancy loss during the first half of pregnancy.

**Morbidity** - being damaged or diseased.

**Mortality** - number or frequency of deaths.

**Multiparous** - having carried more than one pregnancy to a viable stage.

**Narcotic** - an agent that relieves pain; the term is applied especially to the opioids, i.e. natural or synthetic drugs with morphine-like actions.

**Neonatal** - refers to the first 28 days of life.

**Neonatal sepsis** - poisoning by micro-organisms growing in the baby.

**Non-randomised experimental trial** - the unit of experimentation (e.g. people, a cluster of people) is allocated to either an intervention group or a



control group, using a non-random method such as patient or clinician preference/availability) and the outcomes from each group are compared.

**Nulliparous** - having never given birth to a viable infant.

**Observational study** - in research about disease or treatments, this refers to a study in which nature is allowed to take its course. Changes or differences in one characteristic (e.g. whether or not people received a specific treatment or intervention) are studied in relation to changes or differences in others(s) (e.g. whether or not they died), without the intervention of the investigator. There is a greater risk of selection bias than in experimental studies.

**Obstetrics** - services relating to the management and care of pregnancy and childbirth, for example antenatal appointments, labour, delivery and care after the baby is born.

**Odds ratio (OR)** - ratio of the odds of the outcome in the treatment group to the corresponding odds in the control group.

**Operative vaginal delivery** - delivery of the baby with the help of forceps or ventouse (vacuum extractor).

**Paediatrics** - a branch of medicine dealing with the development, care and diseases of children.

**Parous** - having borne at least one viable offspring (usually more than 24 weeks of gestation).

**Peer review** - review of a study, service or recommendations by those with similar interests and expertise to the people who produced the study findings or recommendations. Peer reviewers can include professional, patient and carer representatives.

**Perinatal** - refers to the period from 20 weeks of pregnancy to 28 days after birth.

**Perineum** - the area between the vagina and the anus.

**Pethidine** - a narcotic analgesic drug, used in obstetrics and in preoperative and postoperative medication.

**Pilot study** - a small-scale 'test' of the research instrument. For example, testing out (piloting) a new questionnaire with people who are similar to the population of the study, in order to highlight any problems or areas of concern, which can then be addressed before the full-scale study begins.

**Postnatal (also postpartum)** - pertaining to the four weeks after birth.

**Postpartum haemorrhage** - excess bleeding from the birth canal after birth.

**Power** - see Statistical power.

**Precision** - a measure of how close the estimate is to the true value. It is defined as the inverse of the variance of a measurement or estimate. It is

related to the  $P$ -value (the smaller  $P$ -value, the greater the precision). (Also called statistical precision).

Pre-eclampsia - medical condition of pregnancy marked by high blood pressure, protein excretion in urine, abnormal blood components and water retention in the tissues. (Also called pregnancy induced hypertension)

Pregnancy record - the maternity record held by the woman and completed by the providers of care during her pregnancy.

Preterm labour - labour occurring more than 3 weeks before the due date.

Private patient - a person who elects to be responsible for fees charged by the hospital and care givers.

Prognostic model - a statistical model which estimates the patient's probability of developing the disease or outcome of interest from values of various characteristics (such as age, gender, risk factors).

Prolonged Preterm Rupture of Membranes or Preterm Prelabour Rupture of Membranes (PPROM) - bag of waters breaks or leaks well in advance of the due date and before the commencement of labour.

Prospective study - a study in which people are entered into the research and then followed up over a period of time with future events recorded as they happen. This contrasts with studies that are retrospective.

Protocols - an adaptation of a clinical guideline or a written statement to meet local conditions and constraints, and which have legal connotations.

Public patient - a person who elects to receive care as defined by the Medicare agreements.

Puerperium - the six weeks immediately after childbirth.

$P$ -value - (*see also* statistically significant effect) - the probability (obtained from a statistical test) that the null hypothesis (that there is no treatment effect) is incorrectly rejected. The  $P$ -value obtained from a statistical test corresponds to the probability of claiming that there is a treatment effect when in fact there is no real effect.

Qualitative research - is used to explore and understand people's beliefs, experiences, attitudes, behaviour and interactions. It generates non-numerical data, e.g. a patient's description of their pain rather than a measure of pain.

Quality of evidence (*see also* strength of evidence) - degree to which bias has been prevented through the design and conduct of research from which evidence is derived.

Quantitative research - research that generates numerical data or data that can be converted into numbers, for example clinical trials.

Randomisation - a process of allocating participants to treatment or control groups within a controlled trial by using a random mechanism, such as coin

toss, random number table, or computer-generated random numbers. Study subjects have an equal chance of being allocated to an intervention or control group thus the two groups are comparable.

Randomised controlled trial - a study to test a specific treatment in which people are randomly assigned to two (or more) groups: one (the experimental group) receiving the treatment that is being tested, and the other (the comparison or control group) receiving an alternative treatment, a placebo (dummy treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. (Through randomisation, the groups should be similar in all aspects apart from the treatment they receive during the study).

Relative risk or risk ratio (RR) - ratio of the proportions in the treatment and control groups with the outcome. This expresses the risk of the outcome in the treatment group relative to that in the control group.

Respiratory - relating to breathing.

Respiratory distress in the newborn - difficulty in breathing within a few hours of birth.

Retrospective study - deals with the present and past and does not involve studying future events. This contrasts with studies that are prospective.

Sample - a part of the study's target population from which the subjects of the study will be

Selection bias - error due to systematic differences in characteristics between those who are selected for study and those who are not. It invalidates conclusions and generalizations that might otherwise be drawn from such studies.

Selection criteria - explicit standards used by guideline development groups to decide which studies should be included and excluded from consideration as potential sources of evidence.

Shared Care - the provision of care that is shared between general practitioners, obstetricians, midwives and/or Aboriginal Health Workers and other specialist team members as required.

Specialist obstetrician - a doctor who has the Fellowship of the Royal Australian College of Obstetricians and Gynaecologists and is registered as a specialist obstetrician by a State or Territory and who specializes in the management and care of pregnant women and childbirth.

Stakeholder - any individual or organisation with an interest in maternity care, policies and decision-making.

Statistical power - the ability of a study to demonstrate an association or causal relationship between two variables, given that an association exists. For example, 80% power in a clinical trial means that the study has a 80%

chance of ending up with a *P* value of less than 5% in a statistical test (i.e. a statistically significant treatment effect) if there really was an important difference (e.g. 10% versus 5% mortality) between treatments. If the statistical power of a study is low, the study results will be questionable (the study might have been too small to detect any differences). By convention, 80% is an acceptable level of power. See also *p* value.

**Statistically significant effect** (see also clinically important effect) - an outcome for which the difference between the intervention and control groups is statistically significant (i.e. the *P*-value is less than 0.05). A statistically significant effect is not necessarily clinically important.

**Stillbirth** - a baby born dead after 20 or 22 completed weeks' gestation.

**Strength of evidence** - for an intervention effect includes the level (type of studies), quality (how well the studies were designed and performed to eliminate bias) and statistical precision (*P*-value and confidence interval).

**Systematic review** - a review in which evidence from scientific studies has been identified, appraised and synthesised in a methodical way according to predetermined criteria. May or may not include a meta-analysis.

**Team midwifery** - a small group of midwives who provide comprehensive midwifery care for their clients. The woman receives care in labour from a midwife known to her.

**Telehealth (or telemedicine)** - refers to any health services using information and communications technology that removes or mitigates the effect of distance in health care.

**Time series** - a set of measurements taken over time. An interrupted time series is generated when a set of measurements is taken before the introduction of an intervention (or some other change in the system), followed by another set of measurements taken over time after the change.

**Ultrasound** - a diagnostic test which is performed by using ultrasonic waves used to examine the interior organs and structures of the mother and fetus.

**Uterus** - womb.

**Validity** - of measurement: An expression of the degree to which a measurement measures what it purports to measure; it includes construct and content validity.

**Variable** - a measurement that can vary within a study, e.g. the age of participants. Variability is present when differences can be seen between different people or within the same person over time, with respect to any characteristic or feature that can be assessed or measured.

**Ventouse (vacuum extractor)** - an instrument which applies suction to the baby's head, or bottom, to help the baby to be delivered.

Visiting midwife - a practicing midwife who is appropriately educated and accredited by the Australian College of Midwives Incorporated and also by the institution where she/he has been granted visiting rights (*see also* 'midwife').

## ABBREVIATIONS

APH - antepartum haemorrhage

CI - confidence interval

CTG - cardiotocography

GP - General Practitioner

ITT - Intention to treat

LBW - low birth weight

MFM - Maternal and Fetal Medicine specialist

N or n - Number of participants in a study sample

NHMRC - National Health and Medical Research Council

NICU - Neonatal Intensive Care Unit

OR - Odds Ratio

PE - pre-eclampsia

PPH - postpartum haemorrhage

PPROM - Prolonged Preterm Rupture of Membranes or Preterm Prelabour Rupture of Membranes

RCT - Randomised controlled trial

RR - Relative risk

VBAC - Vaginal Birth After Caesarean section

VLBW - Very low birth weight

vs - versus (as in comparison of proportion of women with a defined characteristic (a% vs b%))

## EXECUTIVE SUMMARY

Different models of care may be suitable for different populations of women during their pregnancy and birth. Even when considering women's preferences, their access to different models of care will be determined by their level of risk, place that they live, and location and availability of health care professionals and facilities.

This literature review considered the evidence about models of maternity care including home birth; birth centres, including freestanding and in-hospital; and continuity of care, including team midwifery, caseload midwifery and shared care. Programs for women assessed to be at high risk of complications were evaluated. In addition to traditional tertiary care, these models included augmented antenatal care, home care programs and antenatal day stay programs. The use of telemedicine in this area was also considered. Models of postnatal care were also examined, including home visiting programs after early postnatal discharge from hospital. The following findings resulted from this review. Definitions of levels of evidence are given in Table 1.

### *Home birth*

- Planned home birth with a qualified home birth practitioner is a safe alternative for women determined to be at low obstetric risk by established screening criteria. Women should be counseled about the potential for transfer to hospital if complications arise and systems should be put in place for smooth transition to hospital care in the case of complications.

Level of evidence: III-2 to IV

### *Birth centres*

- Freestanding or in-hospital birth centres where antenatal, intrapartum and postpartum care is provided to low-risk women by appropriately skilled midwives reduces intrapartum intervention rates without an increase in perinatal adverse outcome. In addition, women report higher levels of satisfaction compared with hospital based care.

Level of evidence - freestanding: III-2 to IV; in-hospital: I to III-3

Table 1 Levels of Evidence

Level	Intervention
I	Systematic review of level II studies
II	Randomised controlled trial
III-1	Pseudo-randomised controlled trial
III-2	Comparative study with concurrent controls: <ul style="list-style-type: none"> <li>• Non-randomised experimental trial</li> <li>• Cohort study</li> <li>• Case-control study</li> <li>• Interrupted time series with a control group</li> </ul>
III-3	Comparative study without concurrent controls: <ul style="list-style-type: none"> <li>• Historical control group</li> <li>• Two or more single arm study</li> <li>• Interrupted time series without parallel control group</li> </ul>
IV	Case series with either post-test or pre-test/post-test outcomes

Based on NHMRC levels of evidence for intervention (NHMRC)

### *Continuity of care*

- Continuity of midwifery care models are more acceptable to women, while being associated with fewer intrapartum interventions and no increase in adverse outcomes. Women with high-risk pregnancies may also safely access this model providing there is appropriate obstetric support. There are no associated increased costs and there may be small savings.

Level of evidence: I to III-3

- There is no evidence that personal caseloads offer improvements in outcomes compared with team midwifery, and they may have negative consequences for midwifery work patterns and their lifestyle.

Level of evidence: III-2 to III-3

### *Women assessed to be at high risk of complications*

- Women with high-risk pregnancies requiring frequent antenatal assessment, especially those of lower socioeconomic status, have improved perinatal outcomes and require fewer days in hospital when a significant proportion of their antenatal care is delivered in the home by advanced nurse practitioners. Significant cost benefits are associated with this model of care.

Level of evidence: II

- In-Home care programs undertaken by experienced health professionals and ‘home-maker services,’ with adherence to diagnostic criteria and managed according to defined protocols, safely provide antenatal care to high-risk women including those with preterm labour, preterm pre-labour rupture of membranes, multiple pregnancy and those with pre-eclampsia or essential hypertension.  
Level of evidence: II to III-3
- Antenatal Day Care or Day Assessment Units reduce the need for formal hospital admission for high-risk pregnancies and deliver safe care with no difference in maternal or neonatal outcomes. Women prefer day attendance, even on a daily basis, than admission to hospital.  
Level of evidence: II
- For high-risk pregnancies requiring frequent fetal heart rate surveillance domiciliary visits by experienced midwives and telephonic fetal heart rate monitoring reduces hospital visits and is cost-effective both for institution and the woman and her family.  
Level of evidence: II
- Aboriginal and Torres Strait Islanders have better antenatal attendance and greater satisfaction in integrated community-based antenatal care programs.  
Level of evidence: III-3

### *Telemedicine*

- Telemedicine programs enable women with medical and pregnancy complications, and their health providers to access tertiary level services not previously readily available due to their remote location. Benefits include reduced rates of transfer and reduced stay in the tertiary centre.  
Level of evidence: Not classified
- Electronic obstetric records improve communication between health professionals caring for pregnant women in a variety of locations.  
Level of evidence: Not classified

### *Home visiting following early postnatal discharge*

- In healthy women with term infants, early postnatal discharge within 48 hours of birth is not associated with any increase in adverse maternal or neonatal outcomes when women receive midwifery home visiting. There is no evidence of improvements in breastfeeding or maternal health outcomes after early discharge with home visiting programs. There are no additional benefits when compared to hospital-based postnatal follow-up programs.  
Level of Evidence: I to III-3



- A program of early postnatal discharge for women with gestational diabetes or pregnancy induced hypertension is not associated with any increase in adverse outcome providing the women are well educated about possible complications and they receive intensive home visiting by a qualified nurse or midwife. There are cost savings associated with this model of care.

Level of Evidence: II

## DESCRIPTION OF PROJECT

This evidence-based review of models of maternity care was undertaken to assist with planning *Future Directions in Maternity Care in Western Australia*. The project considered the following models of care: home birth; birth centres, including freestanding and in-hospital; continuity of care, including team midwifery, caseload midwifery and shared care; programs for women at high risk, including augmented antenatal care, home care programs and antenatal day stay programs; and home visiting programs after early postnatal discharge from hospital.

The project reviewed the strength of the existing evidence supporting the following Maternity Care models:

- Community-based Midwifery
  - *Planned home births*: births that were intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife.
- *Birth Centres*: places of birth that are independent from traditional hospital labour and delivery wards where healthy women can give birth and receive midwifery-based care with continuity of care throughout pregnancy, birth and the early postnatal period
  - *Freestanding Birth Centres*: birthing centres established in locations that are geographically separate from a maternity hospital
  - *In-hospital Birth Centres*: birth centres established within the grounds of or attached to a maternity hospital
- *Continuity of care*: options that provide consistency in the care and advice received by women during pregnancy, childbirth and in the postnatal period, through consistent policies and good communication.
  - *Team midwifery*: care during pregnancy, childbirth and the early postpartum period by a small team of usually 6-7 midwives. The philosophy is continuity of care rather than individual caregivers.
  - *Caseload midwifery*: women receive all their care from one principal midwife throughout pregnancy, labour and birth and postnatal period
  - *GP shared care*: a cooperative arrangement between a maternity hospital and community based general practitioners for providing care during pregnancy and after birth
- *Care of women at high obstetric risk*
  - *Augmented care*: care, particularly aimed at low socioeconomic groups or women with medical risk factors, that is case-managed

and offers additional allied health support services. This care is frequently provided in the woman's home

- *Domiciliary care*: Care provided in women's homes by Nurse Practitioners or experienced Midwives to women with pregnancy complications. Women are entered into the program according to strict criteria and managed according to agreed guidelines in collaboration with obstetricians.
- *Antenatal Day Stay Units*: Dedicated hospital units where women attend for a short period of observation whilst appropriate investigations are undertaken and results reviewed.
- *Telemedicine*: The use of telecommunication technology to provide medical information and services
- *Home visiting after early postnatal discharge*: Postnatal care in the woman's home provided by qualified Midwives or advanced Nurse Practitioners. For the purposes of this review, "early postnatal discharge" is defined as less than 48 hours after the birth.

In reviewing the evidence about the models of maternity care listed above, the following research questions were considered:

- What models of care provide best access to quality and safe care?
- What models of care provide efficient and effective service delivery?
- What models of care demonstrate best consumer choices?
- What is the best practice in the area of support services necessary to support sustainable service delivery for the models of care?

### Search Strategy

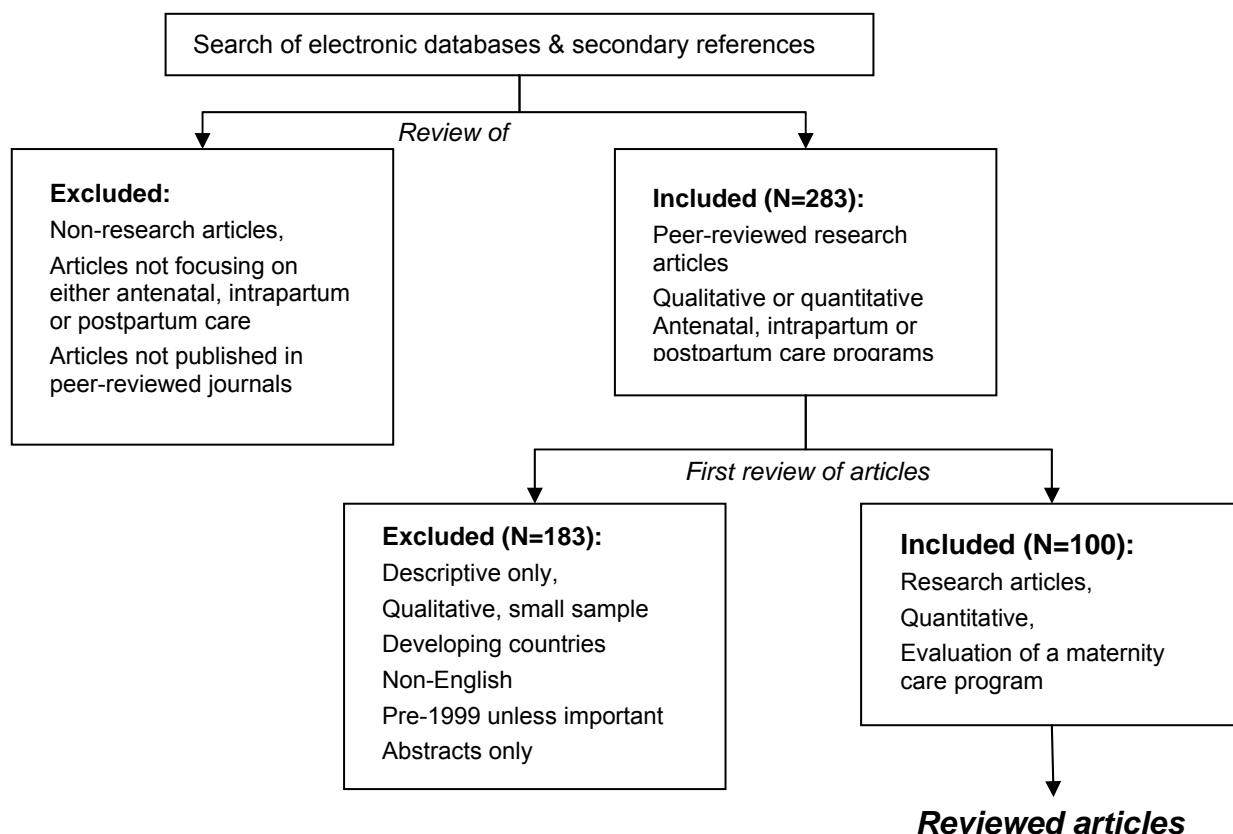
A comprehensive search of the electronic databases MEDLINE, the Cochrane Library, EMBASE, AustHealth, and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) was conducted to identify relevant articles. The search was limited to keywords which are detailed in Appendix 1. A flow chart of the search strategy with inclusion and exclusion criteria is presented in Figure 1.

Reference lists from each reviewed article were also manually scanned for additional relevant references. Abstracts were included in the first pass if they were qualitative or quantitative research articles programs about antenatal, intrapartum or postpartum care management and if they were published in a peer-reviewed journal.

A review of all selected papers was then conducted to determine whether they should be included in the review. Articles continued to be included if they used a quantitative methodology in order to evaluate aspects of a

maternity care program. In summary, a total of 100 papers finally remained eligible for review from 283 papers identified. All articles deemed to be relevant were reviewed independently by a minimum of two of the reviewers.

Figure 1. Flow chart of search strategy



## Exclusion criteria

Articles were excluded if they were descriptive only without a supporting statistical evaluation, articles that used a qualitative study design, or if the sample size was too small to come to a conclusion about the effectiveness of a program. While it is acknowledged that qualitative research studies may have offered valuable insight into the experience of women using the various models of care identified, it was decided *a priori* not to include these in the present review because they described small samples of purposely selected individuals. Hence it is not valid to generalise these findings to different contexts and settings such as those currently in practice in Western Australia.

Studies with major methodological flaws were also excluded from the review. Examples of these include population-based cross-sectional studies with poor response rates (less than 60%) or matched studies that excluded large numbers of cases because of an inability to locate controls with similar characteristics.

Because of a limited time frame it was necessary to exclude any articles that were not written in English. Preference was given to the most recent publications. Articles published before 1999 were only reviewed if they represented important additions to the literature or if the body of evidence was otherwise limited. For example, there were few recent articles evaluating home births, and hence articles published as early as 1995 in that area were included. The earliest paper reviewed was published in 1988.

Articles published only in abstract form, for example in conference proceedings, were not deemed to be suitable for this review.

Programs aimed at reducing maternal or perinatal mortality in developing countries were excluded because they are rare events in Western Australian maternity care facilities and general health care issues are not comparable to our population.

With the exception of Aboriginal and Torres Strait Islanders, studies that evaluated maternity care of sub-populations were not deliberately targeted because the women have special requirements beyond the scope of this review. Hence studies referring to individual cultural considerations, adolescent pregnancy and drug or alcohol abuse were not considered. Furthermore, studies whose primary objectives were either to increase breastfeeding rates or to reduce the incidence of postnatal depression were not evaluated because the limited timeframe available for this review would not have allowed a thorough review of the wide body of evidence existing on those topics.

Two topics were expected to be of great interest when assessing the introduction of new models of maternity care - impacts on workforce

requirements, and issues regarding indemnity. No peer-reviewed research-based articles were found, which addressed either of these topics, and hence it was not possible to include them in this review. There was also little evidence regarding the access and referral patterns to tertiary level maternity services.

Details of excluded articles are available by request.

### Description and methodological quality of included studies

Systematic reviews, randomised controlled studies, non-randomised comparative studies and patient series were assessed for their methodological quality. Assessment of research studies followed recommendations for developers of guidelines (NHMRC) with modifications appropriate for a literature review. Three dimensions of the evidence strength were assessed:

1. level of evidence, reflecting the effectiveness of study design in its ability to answer research question,
2. methodological quality, evaluating a likelihood of bias influencing results
3. quality of the statistical conduct of the study.

### *Level of evidence:*

Level of evidence was designated according to the NHMRC guidelines (NHMRC, Table 1). Levels of evidence for interventions were assigned when comparisons of standard maternity care against alternative models of care were made.

### *Assessment of study quality*

Quality of studies was rated as low, medium or high according to the following considerations:

- Patient selection and inclusion/exclusion criteria
- Comparability of the groups (i.e. obstetric risk and demographic profiles)
- Method of randomisation (in randomised controlled trials)
- Completeness of follow-up
- Any other feature of study designs that may have introduced bias.

### *Assessment of statistical conduct*

Rating of the conduct of statistical analysis as low, medium or high was given according the following criteria:

- Number of participants and statistical power for outcomes considered
- Adequacy of the study sample description

- Intention to treat analysis (in randomised controlled trials)
- Inclusion in the analysis of all selected cases (case-control studies)
- Appropriateness of the statistical analysis (i.e. adjustments for group differences when appropriate)
- External validity of the study results (do the results apply to populations other than the study sample?)

Several important surveys of either patients or health care givers (level of evidence > IV) were included in the review without formal tabulation of quality assessments. In addition, because telemedicine is an emerging field with limited evidence available, all relevant studies appraising telemedicine were included in the review without formal grading of methodological quality presented in summary tables.

Two types of cost evaluation studies were found. The majority comprised secondary analyses as part of studies with clinically-based primary outcomes (referred to as cost comparisons). A minority of cost evaluation studies were performed as formal cost effectiveness analyses according to health economic principles and relied on a number of assumptions that may not be transferable to another setting. These papers were included in the review without evaluation of the validity of the analysis because they would have required different methods of grading outside of the scope of this review.

# HOME BIRTHS

## Introduction

In Australia there have consistently been a small number of women who elect to have home births. In a few countries the incidence of home birth is high, for example 30% of all births in the Netherlands and 2% of all births in the UK. In those countries the infrastructure for safe home birthing is well established and outcomes are generally positive. In other countries such as USA and Canada, the incidence of home births continues to rise. There has been controversy about the safety of births at home. This review discusses the safety of planned home births by women of low obstetric risk.

## Description of the home birth model of maternity care

Planned home birth refers to births that were intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife. Planned home births do not include either births that were not attended by a qualified practitioner or unplanned births at home.

Eligibility criteria for home births were generally classed under the heading of low obstetric risk. The definition of “obstetric risk” varied between studies but most often included women with an uncomplicated pregnancy, gestational age 37 to 41 weeks at onset of labour, with a single fetus with a vertex presentation. If specified, exclusion criteria were usually, but not always, multiple pregnancy, breech presentation, previous caesarean section, medical complications such as hypertension or diabetes, and labour before 37 weeks of pregnancy.

Comparison groups in evaluation studies included women of similar low obstetric risk who planned to deliver in hospital. Most studies evaluated only women who remained eligible for home birth at the commencement of labour although some studies also evaluated rates of referrals to hospital care before the onset of labour.

## Studies included

This review included studies that evaluated the outcomes of planned home births irrespective of the actual place of birth. Inclusion criteria were studies, which included comparison groups in which the birth was planned in a hospital. Comparison groups were as comparable as possible (that is women of low obstetric risk). Studies that controlled for differences between the study and comparison group in the statistical analysis were also included.

There was a total of 48 studies identified, 28 studies were excluded after initial review, leaving 20 studies included in this review. There was only one attempted randomised controlled trial, which failed to recruit sufficient



subjects for a conclusive analysis and was abandoned as unfeasible (Dowswell, Thornton *et al.* 1996). The results of that trial are included in this review out of interest only. The majority of studies were retrospective, observational studies with three prospective cohort studies.

Table 2. Levels of Evidence: Home birth studies

Research publication	Evidence				
	Total N	Study design	Level	Quality of study*	Quality of analysis*
<b>Pregnancy outcomes</b>					
Wiegers <i>et al.</i> 1996	1836	P cohort	III-2	medium	medium
Janssen <i>et al.</i> 2002	2176	P cohort	III-2	medium	medium
Ackermann-Liebrich <i>et al.</i> 1996	874	P comparative	III-2	medium	low
Anthony <i>et al.</i> 2005	191,391	R cohort	III-3	high	high
Pang <i>et al.</i> 2002	17,086	R cohort	III-3	medium	medium
Johnson and Daviss 2005	5418	P case series	IV	high	high
Murphy and Fullerton 1998	1404	P case series	IV	high	medium
Crotty <i>et al.</i> 1990	799	R case series	IV	medium	medium
Woodcock <i>et al.</i> 1990	995	R case series	IV	medium	medium
Howe 1988	165	R case series	IV	low	low
<b>Perinatal mortality studies</b>					
Wolleswinkel-van den Bosch <i>et al.</i> 2002	342	R comparative	III-3	low	low
De Reu <i>et al.</i> 2000	8509	R case series	IV	high	medium
Bastian <i>et al.</i> 1998	7002	R case series	IV	medium	medium
Northern Region Perinatal Mortality Survey 1996	2888	R case series	IV	medium	medium

\* See page 9 for criteria for quality of study and analysis.

R – retrospective; P – prospective study.

### Studies excluded after review

1. Papers evaluating care by traditional birth attendants (otherwise known as lay midwives or apprentice-trained midwives) were not included in this review because most were old papers of poor quality. Furthermore, in WA unqualified birth attendants are not able to be registered as midwives.
2. Papers that did not distinguish between planned and unplanned home births were excluded from this review. This was a common limitation of large, population-based studies that relied on data from central

databases. Intended place of birth as opposed to actual place of birth was not often flagged on these databases. The reason for the exclusion of these studies is because unplanned home births, frequently occurring in women who had little or no antenatal care and who therefore were at higher obstetric risk, are known to have higher rates of adverse outcomes (Declercq, Paine *et al.* 1995). Inclusion of these studies would therefore mask any putative positive outcomes of planned home births or worsen the apparent incidence of any adverse outcomes.

## Outcomes

The following outcomes of home birth studies were assessed.

- Characteristics of women electing home birth
- Antenatal referrals to hospital care
- Intrapartum and postpartum transfer rates to hospital
- Intervention in labour such as analgesia, episiotomy, operative delivery
- Neonatal outcomes such as 5-minute Apgar scores, admission to the neonatal nursery
- Perinatal mortality
- Maternal satisfaction

## Overall summary

Limited quality evidence evaluating home births and published in peer-reviewed journals was identified. There was considerable variability in the quality and outcomes of the identified studies. Randomised controlled trials of planned home birth versus planned hospital birth were shown to be unfeasible because of resistance by potential recruits with strong preferences for either a home or hospital birth to be randomised (Dowswell, Thornton *et al.* 1996). Therefore we restricted this review to observational research. There were few recent studies. There were two identified studies conducted in 2000. The majority of studies reviewed were conducted in the late 1980s to 1999. Our findings were as follows (Tables 3.1-3.5):

- Women who planned births at home tended to have different demographic backgrounds from women who elected to have births in hospital. Women choosing home births were older, better educated and more likely to be Caucasian. In the Netherlands, where a high proportion of women deliver at home, they were also more likely to be living in regional towns or rural areas and less likely to have a non-Dutch origin. In all studies a higher proportion of women planning home births were multiparous.

- Only two studies evaluated the proportion of women who were referred to hospital care during pregnancy. Between 7.4% and 10% of women initially booked for home births were referred out of home care before the commencement of labour. Reasons for antenatal referral included preterm labour or PPRM, fetal malpresentation (breech), multiple gestation, antepartum haemorrhage (placenta praevia), and medical problems such as hypertension.
- Five studies reported the rates of transfer of women who had commenced to labour at home. The proportion of women transferring in labour varied between 1.5% and 13.3%. The most common reasons for transfer during labour were failure to progress, concern about fetal well-being (meconium, fetal heart rate irregularities), and maternal request for analgesia. The proportion of women who transferred to hospital after the birth was 0.7%-6.7%. The most common reasons for postnatal transfer were postpartum haemorrhage, retained placenta and suturing of perineal lacerations. Neonatal transfers occurred in between 0.06% to 1.1% of homebirths, with the most common reasons being respiratory problems or evaluation of anomalies.
- In all studies reviewed, lower rates of obstetric interventions during labour and birth were experienced by women who planned home births. Compared with low risk women with planned hospital births, women who planned home births were less likely to:
  - be induced (4.3%-5%) vs (16%-22.3%);
  - require analgesia (7.7%-14.1%) vs 27.6%-48.7%);
  - have a caesarean section (3.7%-6.4%) vs (13.6%-19%);
  - have an episiotomy (2.1%-15.8%) vs (15.3%-76.5%).
- There was some variation in the results of studies that evaluated neonatal morbidity. There was no difference in the number of neonates admitted to the neonatal intensive care unit (NICU). One study found no difference in 5-minute Apgar scores, one found home birth had higher Apgar scores and one study found more babies with low Apgar scores (Pang, Heffelfinger *et al.* 2002). Pang *et al.* found much higher rates of adverse neonatal outcomes in the home birth group than was found in other studies. Findings from this study should be viewed with caution because of the high likelihood of false classification of unplanned home births as planned. In this study, births were classified as home births from birth register entries although there was no section for planned place of birth. As the certifier did not have to be a medical or midwifery professional, there was no way of differentiating the type of attendant.

Consequently many of the adverse outcomes may have occurred in women who did not plan to deliver at home.

- Perinatal mortality tended to decrease with time and the overall rate was low. Consequently, despite large numbers in some studies, no study found excess perinatal mortality in planned home births compared with hospital births.
- Two studies evaluated maternal satisfaction with planned home versus hospital birth. Of women who had uncomplicated births, women who had planned a home birth were found to have a higher level of satisfaction (Wiegers, T A, van der Zee *et al.* 1998). Unanticipated transfer to hospital did not lessen women's satisfaction with the experience. High levels of satisfaction were found in all groups in the other study (Janssen, Carty *et al.* 2006). Women who had planned a home birth were more likely to feel competent, responsible, secure and more able to deal with the labour compared with planned hospital births.

In summary, women who planned a home birth were generally older, better educated and of affluent socioeconomic backgrounds and consequently may have been at lower risk than women who delivered in hospital. These differences may have influenced the observed beneficial outcomes of home births. On the evidence available, planned home births by women at low obstetric risk were associated with significant reductions in obstetric interventions of labour and delivery, while demonstrating no increases in perinatal morbidity or mortality. Women should be counselled about the potential for transfer to hospital if complications arise and systems should be put in place for smooth transition to hospital care in the case of complications (Davis-Floyd 2003).

### Limitations of the evidence

Comprehensive comparisons of pregnancy outcomes between home birth and standard hospital birth are subject to many methodological limitations. Women who choose home birth are likely to have different characteristics to those low-risk women who deliver at a hospital. Firm conclusions from any non-randomised studies require analyses that account for confounding, and this is often difficult to achieve in practice. In the majority of studies, analysis of the results was not performed by intended place of delivery biasing the spectrum of clinical outcomes compared/observed. In prospective studies with well selected controls that minimized selection bias, sample sizes were too small to fully assess morbidity and mortality associated with home birth. Larger comparative studies were retrospective, however, these studies were associated either with the inability to compare

outcomes by intended place of birth or the inability to control for patient characteristics resulted.

The findings of no differences in perinatal mortality must be viewed with caution because fetal or neonatal death is a rare outcome and very large numbers are needed to confidently detect differences between groups.

*Evidence Based Summary Point*

Planned home birth with a qualified home birth practitioner is a safe alternative for women determined to be at low obstetric risk by established screening criteria. Women should be counselled about the potential for transfer to hospital if complications arise and systems should be put in place for smooth transition to hospital care in the case of complications.

Level of Evidence: III-2 to IV

Table 3.1 Home birth studies: maternal characteristics

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Maternal characteristics of women planning home births</b>					
	(Anthony, Buitendijk <i>et al.</i> 2005)	2000	Netherlands	50,314	Multiparous women under the care of a midwife deliver at home more often than nulliparous women (43% vs 24%) Fewer women younger than 25 years Fewer non-Dutch women (17% vs 37%) Fewer women living in large cities (31%) vs regional towns (36%) vs rural areas (36%)
	<i>Level of evidence III-3</i> (Johnson, K C and Daviss 2005)	2000	USA and Canada	7,623	Compared with all hospital births, women choosing home birth were older, lower socioeconomic status, better educated, less likely to be African-American or Hispanic
	<i>Level of evidence IV</i> (Janssen, Lee <i>et al.</i> 2002)	1998-1999	Canada	Home birth: 862 Doctor-led hospital birth: 743 Midwife-led hospital birth: 571	Compared with women planning hospital births with either a doctor or a midwife, women planning home births were more often multiparous (53% vs 52% vs 42%)
	<i>Level of evidence III-2</i> (Pang, Heffelfinger <i>et al.</i> 2002)	1989-1996	USA	6133	Compared with women planning hospital births, women planning home births were more often older (30+ years: 49% vs 33%) More often white (92% vs 81%) Less often smokers (10% vs 18%) More often multiparous (76% vs 57%)
	<i>Level of evidence III-3</i> (Crotty, Ramsay <i>et al.</i> 1990)	1976-1987	South Australia	799	Compared with hospital births, women planning home births were more often older (30+ years: 38.3% vs 25.1%) More often high socioeconomic status (39% vs 31%) More often multiparous (61% vs 59%)
	<i>Level of evidence IV</i> (Woodcock, Read <i>et al.</i> 1990)	1981-1987	Western Australia	995	Most women choosing home birth were Caucasian Parity was similar to all Caucasian women having singleton births Slightly older
	<i>Level of evidence IV</i>				

Table 3.2 Home birth studies: antepartum and intrapartum transfer

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Transfer before labour</b>					
	(Murphy and Fullerton 1998) <i>Level of evidence IV</i>	1994-1995	USA	1404	7.4%
	(Woodcock, Read <i>et al.</i> 1990) <i>Level of evidence IV</i>	1981-1987	Western Australia	995	10%
<b>Transfer to hospital during or after labour</b>					
	(Johnson, K C and Daviss 2005) <i>Level of evidence IV</i>	2000	USA and Canada	7,623	10.1% transferred in labour 1.3% maternal transfer after birth 0.7% neonatal transfer
	(Janssen, Lee <i>et al.</i> 2002)  <i>Level of evidence III-2</i>	1998-1999	Canada	Home birth: 862 Doctor-led hospital birth: 743 Midwife-led hospital birth: 571	1.5% transferred in labour 0.9% maternal transfer after birth 0.9% neonatal transfer
	(Murphy and Fullerton 1998) <i>Level of evidence IV</i>	1994-1995	USA	1404	7.7% transferred in labour 0.7% maternal transfer after birth 1.1% neonatal transfer
	(Howe 1988)  <i>Level of evidence IV</i>	1983-1986	South Western Australia	165	13.3% transferred in labour 6.7% transferred after birth 0.06% neonatal transfer
	(Woodcock, Read <i>et al.</i> 1990) <i>Level of evidence IV</i>	1981-1987	Western Australia	995	14.2% transferred in labour or after birth

Table 3.3 Home birth studies: labour interventions

Outcome	Study	Years of study	Country	N	Results <i>Statistically significant differences only are reported</i>
<b>Interventions during labour and birth</b>					
	(Johnson, K C and Daviss 2005)	2000	USA and Canada	7,623	Compared with hospital births there were lower rates of: Continuous electronic fetal monitoring (9.6% vs 84.3%) Episiotomy (2.1% vs 33%) Caesarean section 3.7% vs 19%
	<i>Level of evidence IV</i> (Janssen, Lee et al. 2002)	1998-1999	Canada	Home birth: 862 Doctor-led hospital birth: 743 Midwife-led hospital birth: 571	Compared with doctor-attended and midwife-attended hospital births, women who had home births had fewer epidurals (7.7% vs 27.6% vs 26.3%) Fewer inductions (4.3% vs 22.3% vs 12.0%) Fewer caesarean sections (6.4% vs 18.2% vs 11.9%) Fewer episiotomies (3.8% vs 15.3% vs 10.9%)
	<i>Level of evidence III-2</i> (Wiegers, T A , Keirse et al. 1996)	1990-1992	Netherlands	2301	Compared with hospital births, multiparous women who had home births were less likely to have episiotomies (15.8% vs 25.1%)
	<i>Level of evidence III-2</i> (Ackermann-Liebrich, Voegli et al. 1996)	1989-1991	Switzerland	Home birth: 489 Hospital birth: 385	Compared with planned hospital births, women with planned home births had fewer inductions (5% vs 16%) Less analgesia (17.1% vs 48.7%) Fewer instrumental deliveries (4.4 vs 13%) Fewer caesarean sections (5.2% vs 13.6%) Fewer episiotomies (26% vs 76.5%)
	<i>Level of evidence III-2</i>				



Table 3.4 Home birth studies: neonatal morbidity and maternal satisfaction

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Neonatal morbidity</b>					
	(Johnson, K C and Daviss 2005) <i>Level of evidence IV</i>	2000	USA and Canada	7,623	1.3% 5-minute Apgar scores < 7 2.4% babies admitted to the NICU
	(Janssen, Lee et al. 2002)  <i>Level of evidence III-2</i>	1998-1999	Canada	Home birth: 862 Doctor-led hospital birth: 743 Midwife-led hospital birth: 571	No difference in neonatal outcomes 5-minute Apgar scores < 7 (0.9% vs 1.2% vs 0.5%) No difference in admission to NICU
	(Pang, Heffelfinger et al. 2002)  <i>Level of evidence III-3</i>	1989-1996	USA	6133	Compared with women with hospital births, women planning home births had more low 5-minute Apgar scores ( $\leq 3$ , 0.41% vs 0.2%) More babies requiring assisted ventilation > 30 minutes (0.3% vs 0.2%)
	(Ackermann-Liebrich, Voegli et al. 1996) <i>Level of evidence III-2</i>	1989-1991	Switzerland	Home birth: 489 Hospital birth: 385	Compared with planned hospital births, infants of mothers who planned home births had higher mean 5-minute Apgar scores (9.3 vs 9.0)
<b>Maternal satisfaction</b>					
	(Wiegers, T A, van der Zee et al. 1998)  <i>Level of evidence III-2</i>	1990-1992	Netherlands	2301	Of women who had uncomplicated births, women who had planned a home birth had a higher Level of evidence of satisfaction Unanticipated transfer to hospital did not lessen women's satisfaction with the experience
	(Janssen, Carty et al. 2006)  <i>Level of evidence III-2</i>	1998-1999	Canada	Home birth: 862 Doctor-led hospital birth: 743 Midwife-led hospital birth: 571	All groups had high Level of evidences of satisfaction but women who had planned a home birth more often felt competent, responsible, secure, adequate, relaxed, and more able to deal with the labour

Table 3.5 Home birth studies: perinatal mortality

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Perinatal mortality</b>					
	(Johnson, K C and Daviss 2005) <i>Level of evidence IV</i>	2000	USA and Canada	7,623	No excess perinatal mortality among home births: 2.0/1000
	(Janssen, Lee et al. 2002)  <i>Level of evidence III-2</i>	1998-1999	Canada	Home birth: 862 Doctor-led birth: 743 Midwife-led hospital birth: 571	No excess perinatal mortality home birth compared with doctor-led hospital birth vs midwife-led hospital birth: 3.4/1000 vs 1.3/1000 vs 0
	(Wolleswinkel-van den Bosch, Vredevoogd et al. 2002) <i>Level of evidence III-3</i>	1996-1997	Netherlands	319 deaths from all places of birth	No evidence that sub-standard factors related to place of birth caused differences in perinatal mortality
	(De Reu, Hijhuis et al. 2000) <i>Level of evidence IV</i>	1994-1995	Netherlands	73 deaths from all places of birth	Perinatal mortality was not higher in home births
	(Murphy and Fullerton 1998) <i>Level of evidence IV</i>	1994-1995	USA	1404	2.5 per 1000
	(Bastian, Keirse et al. 1998) <i>Level of evidence IV</i>	1985-1990	Australia	50 deaths from home births	7.1 per 1000 compared with all Australian births 10.8 per 1000 The majority of deaths occurred in women with obstetric risk factors
	(Woodcock, Read et al. 1990)  <i>Level of evidence IV</i>	1981-1987	Western Australia	995	No difference in mortality. Compared with all singleton Caucasian births, planned homebirths had a: Stillbirth rate of 2.0/1000 vs 4.8/1000 Neonatal death rate of 3.0/1000 vs 2.9/1000
	(Northern Region Perinatal Mortality Survey Coordinating Group 1996) <i>Level of evidence IV</i>	1981-1984	UK	14 deaths from planned home births	Perinatal mortality rate was lower in home births compared with all births in the region 4.8/1000 vs 9.7/1000

## BIRTH CENTRES

### Introduction

Birth centres offer an alternative place to birth to the traditional labour and birth suite setting. Care is provided in a home-like environment by midwives with a non-interventionist philosophy of care and many also have the provision to provide antenatal care and a short postnatal stay. Birth centres are well established in the USA, Canada, UK, Germany and Norway.

### Description of the birth centre models of maternity care

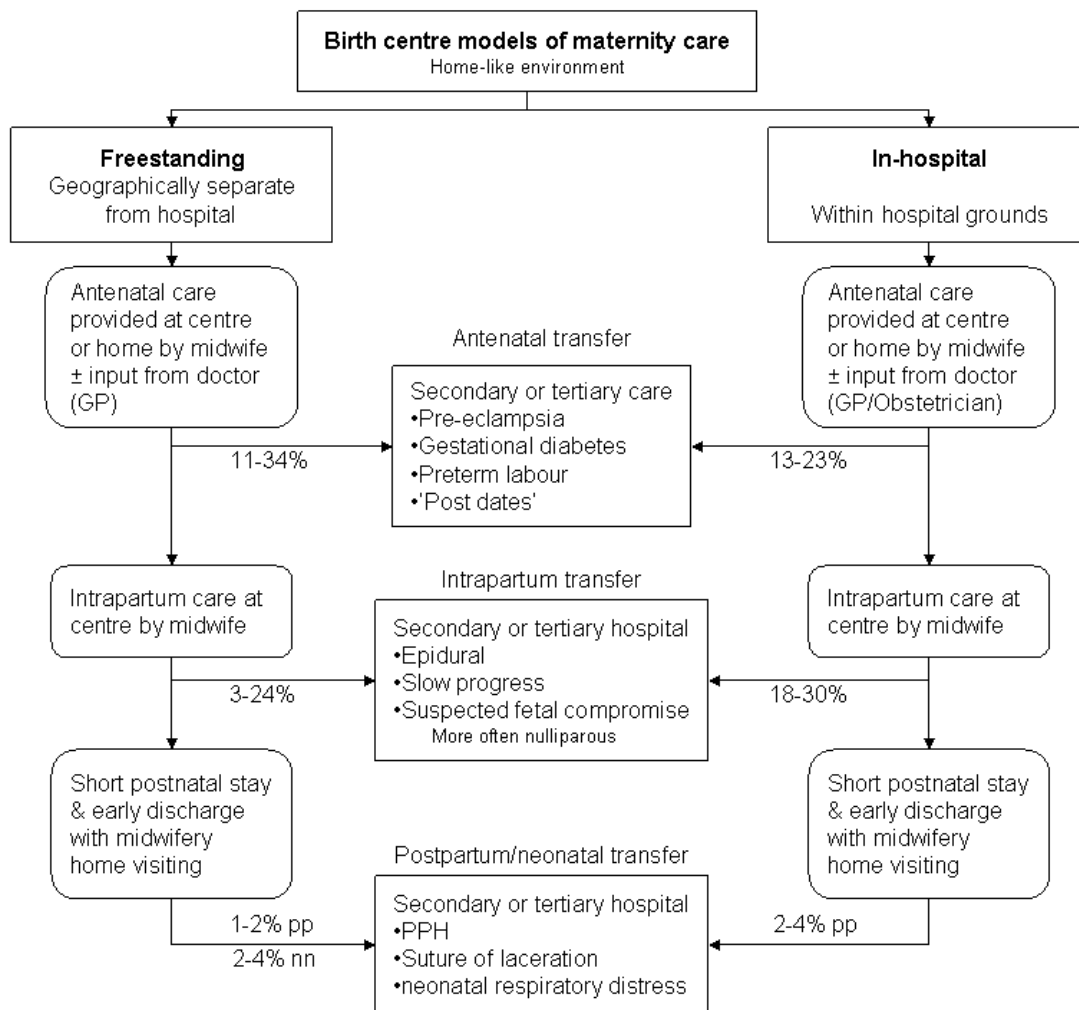
Two distinct models of birth centre care are described (Figure 2): birthing centres established in locations that are geographically separate from a maternity hospital (*freestanding birth centres*) and birth centres established within the grounds of a maternity care hospital (*in-hospital birth centres*). Rooms with pleasant furnishings within conventional labour wards and in which standard hospital-based maternity care is provided by hospital-based doctors and midwives have been described as birth centres but are not considered as such for the purposes of this review.

Freestanding birth centres are home-like environments often attached to community health centres but may also be located separately from any health facility. The defining philosophy of freestanding birth centres is that independence from a hospital enhances the normality of birth and reduces the likelihood of routine hospital practices influencing care of low risk women.

In-hospital birth centres are low-technology, homely centres situated within, or attached to a maternity hospital. The advantage of the close proximity to a hospital is the ease with which antenatal, intrapartum or postnatal transfer can occur in the event of complications. More commonly, in-hospital birth centres are separate units within hospitals but nearby to labour wards, as well as ready access to anaesthetic, obstetric and neonatal services.

In the majority of both freestanding and in-hospital birth centres, the model of maternity care can be broadly described as care of healthy women by midwives who have a philosophical commitment to the normality of pregnancy and birth (Byrne, Crowther *et al.* 2000). Women usually receive all their antenatal and intrapartum care at the birth centre. Continuity of care throughout pregnancy, labour and birth and limiting the number of caregivers seen by individual women are guiding principles of most birth centres. This is usually provided by teams of midwives although some institutions support midwifery-led caseload models of care. Further discussion of these models of midwifery care can be found in the section on “Continuity of Care”.

Figure 2. Examples of models of birth centre care as reported in the literature



Note - Percentages refer to proportions of women transferred based on the initial numbers booked for birth centre care in pregnancy. pp – postpartum, nn – neonatal.

Similar to home birth care, birth centres usually only accept women of low obstetric risk, however there is a wide variability in eligibility criteria. For example, some only include multipara who have had a previous complication-free birth while others will accept a woman who has had a previous caesarean section, provided she has also had a previous normal vaginal delivery (Albers 2005).

Organisational models vary between different centres. The majority of birth centres are managed and staffed by midwives although a small number of centres (for example in USA, UK and Norway) have input from medical practitioners (GPs or obstetricians) either on boards of management or as advisors or providers of maternity care. Although core staff is usually midwives, a small number of centres may also have non-professional support

staff (doulas). Australian studies of birth centres refer only to midwife-managed and staffed birth centres, situated within hospital grounds.

### Studies included

Studies included in this review evaluated the outcomes of births planned to occur in either freestanding or in-hospital birth centres. Comparison groups commonly comprised women of similar low obstetric risk who had standard hospital care during pregnancy, labour and the postnatal period. Most studies evaluated only women who remained eligible for birth centre care at the commencement of labour although some studies also evaluated rates of referrals to hospital care before the onset of labour.

A total of 48 papers were identified comprising 27 research studies. Twelve studies were excluded after initial review, leaving 15 studies included in this review. There were seven studies that evaluated outcomes of freestanding birth centres and eight studies that evaluated in-hospital birth centres. One large US study appears to have included both freestanding and in-hospital birth centres (Rooks, Weatherby *et al.* 1989): this study is included in the review of freestanding centres.

No RCTs of freestanding birth centres were identified. The majority of freestanding birth centre studies were retrospective, observational studies with four prospective cohort studies. There were three randomised controlled trials identified, which assessed the outcomes of in-hospital birth centres. One Australian RCT failed to recruit its projected sample size and reported satisfaction data only (Byrne, Crowther *et al.* 2000). A Cochrane systematic review is also discussed (Hodnett, Downe *et al.* 2005). This Cochrane review included six RCTs published between 1984 and 2000. Two of the trials are also independently reviewed below (MacVicar, Dobbie *et al.* 1993; Byrne, Crowther *et al.* 2000).

### Studies excluded after review

Studies were excluded from this review if they used a qualitative methodology and/or they had small sample sizes with no comparison groups.

### Outcomes

The following outcomes of birth centre studies were assessed.

- Characteristics of women electing birth centre care
- Antenatal referrals to hospital care
- Intrapartum and postpartum transfer rates to hospital
- Intervention in labour such as analgesia, episiotomy, operative delivery
- Neonatal outcomes such as 5-minute Apgar scores, admission to the neonatal nursery

- Perinatal mortality
- Maternal satisfaction
- Cost comparison

### Overall summary

There was a wide variation in the quality and levels of evidence of studies evaluating outcomes of birth centres. Two of the three randomised controlled trials were of reasonable quality but sample sizes were too small to assess differences in rare outcomes such as perinatal mortality. While there were some very large studies, most controlled studies were limited by control groups that were not well-matched with the low risk populations attending birth centres. The largest study, conducted in the USA in 1985-1987 (N=17,856) was limited by the lack of a suitable comparison group and the failure to distinguish between in-hospital and freestanding birth centres or to account for different professional groups that managed care in the centres (Rooks, Weatherby *et al.* 1989).

Table 4. Levels of Evidence: Birth Centre Studies

Research publication	Evidence				
	Total N	Study design	Level	Quality of study*	Quality of analysis*
<b>Freestanding</b>					
Holt <i>et al.</i> 2001	587	P cohort	III-2	medium	low
Fraser <i>et al.</i> 2000	1922	case control	III-2	low	low
David <i>et al.</i> 2006	4072	R comparative	III-3	medium	medium
Reddy <i>et al.</i> 2004	5468	R case series	IV	high	medium
Garite <i>et al.</i> 1995	1830	P case series	IV	medium	medium
Rooks <i>et al.</i> 1989	11,814	P case series	IV	medium	medium
David <i>et al.</i> 1999	411	R case series	IV	medium	medium
Lieberman <i>et al.</i> 2004	1453	P case series	IV	medium	low
<b>In-hospital</b>					
Hodnett <i>et al.</i> 2005	8677	Systematic Review	I	high	high
Waldenstrom <i>et al.</i> 1997	1860	RCT	II	high	high
Waldenstrom and Nilsson 1993	1235	RCT	II	high	high
MacVicar <i>et al.</i> 1993	3510	RCT	II	medium	medium
Byrne <i>et al.</i> 2000	201	RCT	II	high	low
Gottvall <i>et al.</i> 2004	183,636	R comparative	III-3	high	medium
Ryan and Roberts 2005	3683	R cohort	III-3	medium	medium
Homer <i>et al.</i> 2000	734	R comparative	III-3	medium	medium
Janssen <i>et al.</i> 2000	309	R comparative	III-3	medium	medium
Gould, Lupton <i>et al.</i> 2004	866	R case series	IV	medium	low

\* See page 9 for criteria for quality of study and analysis.

RCT: randomised controlled trial, R: retrospective; P: prospective study

### Freestanding birth centres

The findings for freestanding birth centres are presented in Tables 5.1 to 5.6. In summary:

- The women choosing freestanding birth centre care differed in background characteristics from women electing for traditional hospital care. Compared with women giving birth in hospitals, women who chose to birth in a freestanding birth centre were more likely to be white, well educated, older and of higher socioeconomic status. Furthermore they were less likely to smoke cigarettes suggesting a healthier lifestyle (Fraser, Hatem-Asmar *et al.* 2000). This was confirmed by a small comparative study in rural New York state, USA,

which found significantly more women from a freestanding birth centre were still breastfeeding six weeks after the birth (73% versus 38%) (Stone, Zwanziger *et al.* 2000). This suggests that women who chose a birth centre model of care had different health-related behaviours associated with their philosophy for childbirth, and may possibly explain the apparent benefits of birth centre care.

- Five studies reported on the likelihood of low risk women attending a birth centre for antenatal care being transferred to conventional hospital care before the onset of labour. The proportion of women who transferred to hospital care during pregnancy ranged from 10.7% to 34% (Figure 2). Common reasons for antenatal transfer included post 42 weeks' gestational age, pre-eclampsia, preterm labour, gestational diabetes and other medical conditions (Garite, Snell *et al.* 1995).
- The proportion of women who transferred after the onset of labour from the birth centre to hospital ranged from 2.7% to 24.2% (Figure 2). A higher proportion of women transferred from birth centres during labour were nulliparous and the most common reasons for intrapartum transfer were prolonged rupture of the membranes, failure to progress in labour, request for epidural or fetal heart rate anomalies (Holt, Vold *et al.* 2001; David, Berg *et al.* 2006).
- Few studies reported on the frequency of interventions in labour. There were no excess interventions in birth centre attendees. Where reported, intention to deliver at a freestanding birth centre, including transfer to hospital during labour, was associated with fewer interventions during labour. Compared to women with low obstetric risk who were booked to deliver in a hospital, women who planned to deliver in a freestanding birth centre were less likely to have:
  - an induction of labour ((1.4%-5.5%) vs 23.6%)
  - continuous electronic fetal monitoring ((7.5%-21.8%) vs 42.2%)
  - an epidural (11.3% vs 49.1%)
  - an episiotomy ((6.9%-17.6%) vs (36.5%-54.8%))
  - a caesarean section ((3%-6%) vs (4.6%-13.2%))
  - an operative vaginal delivery ((5%-7.8%) vs (11%-43%))
- Neonatal outcomes were similar between freestanding birth centre and hospital births. No study found a difference in newborns with 5-minute Apgar scores below seven. Where a difference was found, fewer neonates were admitted to NICU in the birth centre group ((3.7%-4.7%) vs (15%-19.7%)). One study found more newborns in the birth centre group required ventilation for more than 5 minutes (1.5%



vs 0.7%) although, as shown, the frequency was low (Fraser, Hatem-Asmar *et al.* 2000). In contrast, another study found infants in the birth centre group were less likely to “deviate from normal” (6.9% vs 38%) (Holt, Vold *et al.* 2001).

- No studies with comparison groups had sufficient numbers to test for differences in perinatal mortality.
- Only one study reported on maternal satisfaction with freestanding birth centres. Rooks *et al* reported that the vast majority of women would recommend birth centres to other women (>97%) (Rooks, Weatherby *et al.* 1989). Most would return for a subsequent birth although women who were transferred in labour were less likely to say they would return (83% vs 94%). There was a low response rate for women who were transferred to hospital (54%) suggesting fewer women who were transferred in labour were satisfied with the experience.
- Two studies evaluated the costs of freestanding birth centre care. One study found lower costs compared with physician-led hospital care (Fraser, Hatem-Asmar *et al.* 2000). The other study found no overall difference in costs between birth centre and hospital-based care (Stone, Zwanziger *et al.* 2000).
- One study described a model of care within a free standing birth centre for low-risk women in a remote location in Norway (Holt, Vold *et al.* 2001). Women received antenatal care from a community midwife or from a local GP. Transport times from the birth centre to the nearest central hospital were 30 minutes by fixed wing aircraft or 4 to 5 hours by car and ferry. This study found no excess adverse outcomes compared with hospital births demonstrating that skilled midwives and/or GPs are capable of screening high risk pregnant women and providing safe, acceptable care at a remote low risk birthing centre. This finding has implications for many remote Western Australian communities that have a similar degree of geographical isolation and limited numbers of medical practitioners.
- A large US prospective study of planned vaginal birth after caesarean section (VBAC) in birth centres conducted from 1990 to 2000 (N=1453) found that 87% progressed to a vaginal delivery with 94.4% women who had at least one previous vaginal birth being successful (Lieberman, Ernst *et al.* 2004). Adverse outcomes included 6 uterine ruptures (0.4%) one hysterectomy (0.1%), and seven perinatal deaths (0.5%). The risk of adverse outcomes was significantly higher in women with more than one previous caesarean delivery and gestational age greater than 42 weeks. Post-dates women and those with more than one caesarean are not suitable for ‘out of hospital

care'. The rate of uterine rupture and perinatal death was 0.2% each in women with neither of these risks. Women with one previous CS choosing *birth centre* care are more likely to achieve a vaginal birth and no more likely to suffer an adverse outcome than those managed in hospital. However, one quarter will be transferred during labour and 1 in 10 transfers will be urgent suggesting that these women should consider hospital care rather than birth centre care for VBAC.

In summary, women who planned to give birth at a freestanding birth centre were older, better educated, of higher socioeconomic status and hence more likely to have healthier lifestyles than women who deliver in hospitals. There were fewer interventions in labour but neonatal outcomes were similar. There was insufficient evidence to find differences in perinatal mortality. Freestanding birth centres were no more costly to manage compared with care of low risk women in hospitals.

The high rate of transfer to hospitals before and during labour may be interpreted as evidence that appropriately trained midwives are skilled at detecting potential complications and referring women to specialist care. The low rate of adverse outcomes after transfer to hospital suggests that in most cases the transfer was timely and justified.

Table 5.1 Freestanding birth centre studies: Maternal characteristics

Outcome	Study	Years of study	Country	N	Results
	<b>Maternal characteristics of women planning births in freestanding birth centres</b>				
	(Holt, Vold et al. 2001)	1997-1998	Norway	628 Midwife-led unit: 476 Standard hospital care: 152	68.5% of women booked at the birth centre were multiparous compared with 57.5% of women booked at the central hospital
	<i>Level of evidence III-2</i> (Fraser, Hatem-Asmar et al. 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	Compared to women delivered at the hospital under physician care, women booked in the birth centre were: Better educated (>16 years of education 46% vs 32%) More likely to speak English (14% vs 9.5%) Less likely to smoke cigarettes (10% vs 15%)
	<i>Level of evidence III-2</i> (Rooks, Weatherby et al. 1989; Rooks, Weatherby et al. 1992a, b, c)	1985-1987	USA	11,814 at 84 birth centres	Compared with all US births, women planning to give birth in a birth centre were: Less often under 18 years of age (2.3% vs 4.7%) Better educated (> 15 years 31.8% vs 18.7%) Less likely to be unmarried (12.3% vs 23.4%) Less likely to have low socioeconomic status (24.9% vs 27%) More likely to be non-Hispanic Caucasian (78.4% vs 68.1%) Less likely to be nulliparous (39.3% vs 41.6%)
	<i>Level of evidence IV</i>				

Table 5.2 Freestanding birth centre studies: antenatal transfer

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Transfer before labour</b>					
	(Holt, Vold et al. 2001)	1997-1998	Norway	628 Midwife-led unit: 476 Standard hospital care: 152	24% of women giving birth on the island were ineligible for delivery at the birth centre
	<i>Level of evidence III-2</i> (Reddy, Reginald et al. 2004)	1995-2001	UK	7418	23% antenatal transfer
	<i>Level of evidence IV</i> (Fraser, Hatem-Asmar et al. 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	10.7% antenatal transfer
	<i>Level of evidence III-2</i> (Garite, Snell et al. 1995)	Not specified	California USA	1830	12%
	<i>Level of evidence IV</i> (Rooks, Weatherby et al. 1992a)	1985-1987	USA	11,814 at 84 birth centres	34%
	<i>Level of evidence IV</i>				

Table 5.3 Freestanding birth centre studies: intrapartum transfer

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Transfer to hospital during or after labour</b>					
	(Holt, Vold et al. 2001)	1997-1998	Norway	628 Midwife-led unit: 476 Standard hospital care: 152	8.6% transfer in labour
	<i>Level of evidence III-2</i> (Reddy, Reginald et al. 2004)	1995-2001	UK	7418	2.7 % transfer in labour
	<i>Level of evidence IV</i> (Fraser, Hatem-Asmar et al. 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	14.2% transfer in labour (15.8% of those who started labour in birth centre)
	<i>Level of evidence III-2</i> (David, Kraker von Schwarzenfeld et al. 1999)	1992-1994	Germany	Birth centres: 801 Hospital care: 3271	18.2% transfer in labour.
	<i>Level of evidence IV</i> (Garite, Snell et al. 1995)	Not specified	California USA	1830	18.6% transfer in labour (24.2% of those who started labour in birth centre 1.3% transfer postpartum, 2.4% neonatal transfer (2.2% and 4% respectively of those who started labour in birth centre)
	<i>Level of evidence IV</i> (Rooks, Weatherby et al. 1992a)	1985-1987	USA	11,814 at 84 birth centres	11.9% transferred during labour 0.8% women transferred postpartum 1.7% neonates transferred More nulliparous women were transferred (28.9% vs 7.3% multiparous women)
	<i>Level of evidence IV</i>				

Table 5.4 Freestanding birth centre studies: labour interventions

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Interventions during labour and birth</b>					
	(Holt, Vold et al. 2001)	1997-1998	Norway	628 Midwife-led unit: 476 Standard hospital care: 152	Compared with women booked to deliver at the central hospital, there were fewer operative deliveries in women intended to deliver at the remote birth centre (7.8% vs 43%)
	<i>Level of evidence III-2</i>				
	(Fraser, Hatem-Asmar et al. 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	Compared with women delivered at the hospital under physician care, women booked in the birth centre were less likely to: be induced (5.5% vs 23.6%) have continuous electronic fetal monitoring (21.8% vs 42.2%) have an epidural (11.3% vs 49.1%) have a caesarean section (6.0% vs 13.2%) have an episiotomy (6.9% vs 36.5%)
	<i>Level of evidence III-2</i>				
	(David, Kraker von Schwarzenfeld et al. 1999)	1992-1994	Germany	Birth centres: 801 Hospital care: 3271	Compared with women who delivered in the hospital, women booked to deliver at the birth centre had: Fewer operative vaginal deliveries (5% vs 11%) but no difference for caesarean section rate (3.0% vs 4.6%) Fewer episiotomies (15.7% vs 54.8%)
	<i>Level of evidence IV</i>				
	(Rooks, Weatherby et al. 1992a)	1985-1987	USA	11,814 at 84 birth centres	7.5% had continuous electronic fetal monitoring 1.4% had induction of labour 4.4% caesarean sections 17.6% episiotomy, 34% intact perineum
	<i>Level of evidence IV</i>				

Table 5.5 Freestanding birth centre studies: perinatal morbidity and mortality

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Neonatal morbidity</b>					
	(Holt, Vold et al. 2001)	1997-1998	Norway	628 Midwife-led unit: 476 Standard hospital care: 152	Compared with women booked to deliver at the central hospital, infants of women intended to deliver at the remote birth centre were less likely to be admitted to NICU (3.7% vs 19.7%)
	<i>Level of evidence III-2</i> (Fraser, Hatem-Asmar et al. 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	No difference between hospital and birth centre groups for: 5-minute Apgar score < 7 & Admission to NICU More newborns in the birth centre group required ventilation > 5-minutes (1.5% vs 0.7%)
	<i>Level of evidence III-2</i> (David, Kraker von Schwarzenfeld et al. 1999)	1992-1994	Germany	Birth centres: 801 Hospital care: 3271	Compared with women who delivered in the hospital, infants of women booked to deliver at the birth centre had: Less need for immediate resuscitation after birth (1.6% vs 3.3%) No difference for 5-minute Apgar scores or admission to NICU
	<i>Level of evidence IV</i> (Garite, Snell et al. 1995)	Not specified	California USA	1830	4.7% admitted to NICU compared with 15% of standard hospital deliveries
	<i>Level of evidence IV</i> (Rooks, Weatherby et al. 1992a)	1985-1987	USA	11,814 at 84 birth centres	0.6% had 5-minute Apgar scores <7
	<i>Level of evidence IV</i>				
<b>Perinatal mortality</b>					
	(Rooks, Weatherby et al. 1992a)	1985-1987	USA	11,814 at 84 birth centres	Excluding congenital anomalies the stillbirth rate was 0.3/1000 Neonatal mortality was 0.3/1000
	<i>Level of evidence IV</i>				

Table 5.6 Freestanding birth centre studies: satisfaction and cost comparison

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal Satisfaction</b>					
	(Rooks, Weatherby <i>et al.</i> 1992a)	1985-1987	USA	11,814 at 84 birth centres	98.8% of women who delivered at a birth centre and 96.9% of women who were transferred would recommend the centre to others 94% of women who delivered at a birth centre and 83.3% of women who were transferred would return to the centre for a subsequent birth. Low response rate (54%) for transferred women.
	<i>Level of evidence IV</i>				
<b>Cost comparison</b>					
	(Reinharz, Blais <i>et al.</i> 2000)	1995-1996	Quebec, Canada	Birth centre:961 Matched hospital care: 961	Overall the birth centre group was more cost-effective than birth in a hospital attended by a physician: \$2,294 (\$2,062-\$2,930) vs \$3,020 (\$3,016-\$3,027)
	(Stone, Zwanziger <i>et al.</i> 2000)	Not specified	Rural NY, USA	146 Birth centre: 69 Hospital care: 77	Antenatal costs were higher in birth centres compared with hospital care (\$751 mean difference) Intrapartum costs were lower in birth centres compared with hospital care (\$1472 mean difference) Overall there was no difference in costs (\$6087 vs \$6803)



## In-hospital birth centres

The Cochrane systematic review comprised six trials involving 8677 women. That review found that a high proportion of women allocated to in-hospital birth centres were transferred to standard hospital care before or during labour (29%-69%). The meta-analysis found that allocation to birth centres significantly increased the likelihood of:

- Not having intrapartum analgesia or epidural
- Spontaneous vaginal birth
- Perineal lacerations with decreased likelihood of episiotomies
- Satisfaction with care
- Breastfeeding initiation
- A trend towards higher perinatal mortality (RR 1.83, 95% CI 0.99-3.38)

Findings from the present independent review were as follows (Tables 6.1 to 6.5):

- Women planning to attend an in-hospital birth centre were also likely to be of higher socioeconomic groups compared with women receiving hospital care. Two studies found that women attending in-hospital birth centres were older, but one Australian study found no difference in maternal age. Australian studies found that women attending in-hospital birth centres were better educated, higher socioeconomic status and Australian born of English-speaking background.
- Two RCTs reported antenatal transfer rates of 13% and 23% (Figure 2).
- There was a wide variation in transfer rates during labour. The Australian attempted RCT had a 77% transfer rate, including 13% transferred because of staffing issues. This finding was unique and indicated possible organisational issues specific to the hospital in which the study was conducted.  
The other studies had transfer rates, which varied from a low of 18% to 30% of all women commencing labour in the birth centre (Figure 2). The main reasons for intrapartum transfer were maternal request for epidural, slow progress in labour, and suspected fetal compromise.
- Rates of obstetric interventions in labour were either similar or reduced in women who had booked for birth centre care.
  - The RCTs found no differences in rates of caesarean section or instrumental vaginal births although the observational studies found reductions in the birth centre group. Compared with standard labour ward care, in observational studies, women

- who intended to deliver at an in-hospital birth centre were less likely to have a caesarean section (3.3%-5.9% vs 8.7%-10.2%) or an instrumental vaginal birth (4.1%-8.3% vs 8.1%-12.5%)
  - Compared with women receiving standard hospital care, there were lower rates of inductions in the birth centre group (4%-9% vs 6.7%-20.7%)
  - For pain relief in labour, birth centre women were less likely to have an epidural (15.5%-16.4% vs 19.6%-32%) or narcotics (3.7%-39% vs 13.4%-45%). However two RCTs found no difference in the rate of epidurals between groups.
  - Where reported, women booked for birth centre care also had lower rates of continuous electronic fetal monitoring (30.7%-50% vs 85%-89%)
- Neonatal outcomes were not different between birth centre and hospital groups
  - Most studies found no differences in frequency of admission to NICU although one Australian study found fewer birth centre infants were admitted to NICU (5.7% vs 9.9%). The Swedish RCT found more neonates of first-time mothers in the birth centre group were admitted for neonatal care compared with first-time mothers in the hospital group (15.6% vs 9.5%) but this did not occur in infants of multiparas.
- There was no difference in perinatal mortality rates, although sample sizes were generally too small to detect a difference (range 1.4 to 5.5 per 1000 compared with 3 to 4.8 per 1000 hospital births)
- Two out of three RCTs found that women who received birth centre care were more likely to have been satisfied with their antenatal and intrapartum care than women receiving standard hospital care; the other was too small to show a difference.
- No cost comparison studies were identified.

In summary, women receiving in-hospital birth centre care were more likely to be of higher socio-economic group and higher levels of education, but the age difference found in home birth and freestanding birth centre studies was no longer as marked. High transfer rates, both before and during labour, continued to occur in in-hospital birth centre studies. Rates of intervention in labour were lower compared with standard hospital care with similar perinatal outcomes.

Women who were booked into birth centre programs were more likely to be satisfied with their care than women receiving conventional hospital care. If only RCTs were considered there remained a reduction in intrapartum

intervention rates though the size of the effect was smaller, with again no difference in perinatal outcomes. The Cochrane systematic review found a trend towards higher perinatal mortality rates in women allocated to birth centre care. This finding was not statistically significant and further research is required to clarify this.

Efficient and timely transfer mechanisms should be readily accessible as antenatal and intrapartum transfer rates associated with the birth-centre model of care are significant. In addition good inter-professional relationships with hospitals, specialists and tertiary referral services should be maintained (Muthu and Fischbacher 2004).

#### Limitations of the evidence

The evidence is limited by the low frequency of good quality studies. All available evidence on freestanding birth centers is subject to the methodological limitations associated with the evidence on home birth. No RCTs assessed outcomes of freestanding birth centres, while only three RCTs evaluated in-hospital birth centres. The single Australian attempted RCT had a flawed study design and was marked by a very low recruitment rate (only 23% of eligible women, with the refusals due to decided preferences for either birth centre care or the flexibility to have an epidural in labour ward).

Other prospective or retrospective studies were limited by the potential for selection bias often not addressed during the statistical analysis. There was a high likelihood that comparison groups were not representative of the birth centre study population. This suggests the possibility that birth centre groups had fewer obstetric risk factors than comparison groups.

#### *Evidence Based Summary Point*

Free standing or in-hospital birth centres where antenatal, intrapartum and postpartum care is provided to low-risk women by appropriately skilled midwives reduces intrapartum intervention rates without an increase in perinatal adverse outcome. In addition, women report higher levels of satisfaction compared with hospital based care.

Level of Evidence: III-2 to IV (freestanding), I to III-3 (in-hospital)

Table 6.1 In-hospital birth centre studies: characteristics and antenatal transfer

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Maternal characteristics of women planning in-hospital birth centre births</b>					
	(Gottvall, Grunewald et al. 2004) <i>Level of evidence III-3</i>	1989-2000	Sweden	Birth centre: 2,534	Compared with standard care, women booked for birth centre care were older (>25 years, 91.7% vs 83.4%) Were less likely to be overweight or obese (15.1% vs 23.8%)
	(Ryan and Roberts 2005)  <i>Level of evidence III-3</i>	1995-1996	Sydney, Australia	Birth centre: 185 Hospital care: 2,963	Compared with women delivering in the labour ward, women booked for birth centre care were older (>30 years 68.3% vs 50.3%) More likely to have a tertiary education (67.8% vs 43.4%) More likely to be Australian-born (70.1% vs 43.7%) Less likely to have low socioeconomic status (7.5% vs 21.2%) Less likely to smoke cigarettes (7.4% vs 12%)
	(Homer, Davis, Petocz et al. 2000)  <i>Level of evidence III-3</i>	1995	NSW, Australia	Birth centre: 367 Hospital care: 367	Compared with women delivering in the labour ward, women booked for birth centre delivery were more likely to have an English-speaking background (82.8% vs 42.2%) No difference for maternal age.
<b>Transfer before labour</b>					
	(Waldenstrom and Nilsson 1997; Waldenstrom, Nilsson et al. 1997) <i>Level of evidence II</i>	1989-1993	Sweden	1,860 Birth centre: 928 Hospital care: 932	13% antenatal transfer
	(MacVicar, Dobbie et al. 1993)  <i>Level of evidence II</i>	1989-1990	UK	3,510 Birth centre: 2,304 Hospital care: 1,206	23% antenatal transfer

Table 6.2 In-hospital birth centre studies: intrapartum transfer

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Transfer to hospital during or after labour</b>	(Gould, Lupton et al. 2004) <i>Level of evidence IV</i>	2002-2003	London UK	855	30% transferred during labour
	(Ryan and Roberts 2005) <i>Level of evidence III-3</i>	1995-1996	Sydney, Australia	Birth centre: 185 Hospital care: 2,963	24% transferred during labour
	(Homer, Davis, Petocz et al. 2000) <i>Level of evidence III-3</i>	1995	NSW, Australia	Birth centre: 367 Hospital care: 367	30% transferred during labour
	(Byrne, Crowther et al. 2000) <i>Level of evidence II</i>	1993-1995	South Australia	201 Birth centre: 100 Hospital care: 101	77% transferred during labour
	(Waldenstrom and Nilsson 1997; Waldenstrom, Nilsson et al. 1997) <i>Level of evidence II</i>	1989-1993	Sweden	1,860 Birth centre: 928 Hospital care: 932	19% transferred during labour 1.8% women transferred postpartum
	(MacVicar, Dobbie et al. 1993) <i>Level of evidence II</i>	1989-1990	UK	3,510 Birth centre: 2,304 Hospital care: 1,206	18% transferred during labour 4% transferred after birth

Table 6.3 In-hospital birth centre studies: labour interventions

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Interventions during labour and birth</b>					
	(Gottvall, Grunewald et al. 2004)	1989-2000	Sweden	Birth centre: 2,534	Compared with low risk women receiving standard care, women booked for birth centre care had: Fewer inductions (4.0% vs 6.7%) Fewer caesarean sections (5.9% vs 10.2%) Fewer instrumental deliveries (4.1% vs 8.1%)
	<i>Level of evidence III-3</i> (Ryan and Roberts 2005)	1995-1996	Sydney, Australia	Birth centre: 185 Hospital care: 2,963	Compared with low risk women delivering in the labour ward, women booked for birth centre care were Less likely to be induced (7.7% vs 20.7%) Less likely to have an epidural (16.4% vs 32%) Less likely to have pethidine (9.9% vs 29.4%) Less likely to have an instrumental delivery (8.3% vs 12.5%) Less likely to have a caesarean section (3.3% vs 8.7%)
	<i>Level of evidence III-3</i> (Homer, Davis, Petocz et al. 2000)	1995	NSW, Australia	Birth centre: 367 Hospital care: 367	Compared with women delivering in the labour ward, women booked for delivery at the birth centre were less likely to receive an epidural (15.5% vs 19.6%) less likely to have an episiotomy (13% vs 17%)
	<i>Level of evidence III-3</i> (Byrne, Crowther et al. 2000)	1993-1995	South Australia	201	No difference in rates of instrumental or caesarean section delivery No differences for intrapartum outcomes. Insufficient sample size
	<i>Level of evidence II</i> (Waldenstrom and Nilsson 1997; Waldenstrom, Nilsson et al. 1997)	1989-1993	Sweden	1,860 Birth centre: 928 Hospital care: 932	No differences between groups for induction or epidural. Compared to women receiving standard obstetric care, birth centre women were less likely to receive pethidine (3.7% vs 13.4%) Less likely to have continuous electronic fetal monitoring (30.7% vs 84.9%)
	<i>Level of evidence II</i> (MacVicar, Dobbie et al. 1993)	1989-1990	UK	3,510 Birth centre: 2,304 Hospital care: 1,206	No differences for caesarean section or instrumental delivery Compared with women receiving consultant-led labour ward care, birth centre women were Less likely to be induced (9% vs 11%) Less likely to have continuous fetal monitoring (50% vs 89%) Less likely to have epidural (16% vs 20%) Less likely to have pethidine (39% vs 45%) Less likely to have an episiotomy (23% vs 31%)
	<i>Level of evidence II</i>				No differences for caesarean section (7%) or instrumental births (8%)

Table 6.4 In-hospital birth centre studies: perinatal morbidity and mortality

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Neonatal morbidity</b>					
	(Ryan and Roberts 2005)	1995-1996	Sydney, Australia	Birth centre: 185 Hospital care: 2,963	Compared with standard labour ward care, babies of women booked for the birth centre were Less likely to be admitted to NICU (5.7% vs 9.9%) No difference for 5-minute Apgar scores <7 Less likely to be below the 5 <sup>th</sup> centile for birthweight to gestational age (17.1% vs 25.9%)
	<i>Level of evidence III-3</i> (Homer, Davis, Petocz <i>et al.</i> 2000)	1995	NSW, Australia	Birth centre: 367 Hospital care: 367	No differences in Apgar scores
	<i>Level of evidence III-3</i> (Waldenstrom and Nilsson 1997; Waldenstrom, Nilsson <i>et al.</i> 1997)	1989-1993	Sweden	1,860 Birth centre: 928 Hospital care: 932	No differences in Apgar scores For first time mothers, more newborns were admitted for neonatal care in the birth centre group compared with standard hospital care (15.6% vs 9.5%) but for multiparas fewer newborns were admitted for neonatal care in the birth centre group compared with standard hospital care (4.7% vs 8.4%)
	<i>Level of evidence II</i> (MacVicar, Dobbie <i>et al.</i> 1993)	1989-1990	UK	3,510 Birth centre: 2,304 Hospital care: 1,206	No differences in Apgar scores. No differences in NICU admission
	<i>Level of evidence II</i>				
<b>Perinatal mortality</b>					
	(Gottvall, Grunewald <i>et al.</i> 2004; Gottvall, Winbladh <i>et al.</i> 2005) <i>Level of evidence III-3</i>	1989-2000	Sweden	Birth centre: 2,534	No difference in overall perinatal mortality between women booked for birth centre care and low risk women who delivered in hospitals (0.55% vs 0.48%)
	(Ryan and Roberts 2005) <i>Level of evidence III-3</i>	1995-1996	Sydney, Australia	Birth centre: 185 Hospital care: 2,963	No differences in overall perinatal mortality rates between women booked for birth centre care and low risk women who delivered in the labour ward 1.4/1000 vs 3/1000

Table 6.5 In-hospital birth centre studies: satisfaction

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Satisfaction</b>	(Janssen, Klein et al. 2000)		Canada	Birth centre: 205 Historical controls: 221 Concurrent controls: 193	Women remaining in a single maternity room throughout their total hospital admission (intrapartum and postpartum) were more satisfied with their care compared with low risk women delivering in a standard labour ward.
	<i>Level of evidence III-3</i> (Byrne, Crowther et al. 2000)	1993-1995	South Australia	201 Birth centre: 100 Hospital care: 101	No differences for maternal satisfaction. Insufficient sample size
	<i>Level of evidence II</i> (Waldenstrom and Nilsson 1993)	1989-1992	Sweden		Compared with women receiving standard hospital care, women allocated to birth centres expressed greater satisfaction with antenatal, intrapartum and postpartum care.
	<i>Level of evidence II</i> (MacVicar, Dobbie et al. 1993)	1989-1990	UK	3,510 Birth centre: 2,304 Hospital care: 1,206	Significantly greater levels of satisfaction with antenatal and intrapartum care in women who received birth centre care
	<i>Level of evidence II</i>				



## CONTINUITY OF CARE

### Introduction

Continuity of Care and/or Carer is described as one or more of the following:

- Commitment to a philosophy of care
- Adherence to a common protocol
- Provision of care by the same caregiver or small group of care givers

Continuity of care for childbearing women refers to consistency in the care and advice received by women during pregnancy, childbirth and in the postnatal period, through consistent policies and good communication. With this model of care, in any encounter with her maternity care providers, a woman should be confident that she can trust her caregivers and that she will not be given conflicting advice (Green, Renfrew *et al.* 2000).

This is usually in contrast with conventional or 'standard' hospital maternity care where women more commonly receive their care from a variety of different staff including obstetricians, general practitioners, and midwives based either in the community or hospital, resulting in minimal continuity of care. Hospital based midwives frequently work in designated areas, i.e. in the antenatal clinic, or on the labour and birth suite, or on the in-patient wards with a different group of midwives providing antenatal visits or postnatal support in the community as required, where clearly there will be little if any continuity of care and/or carer.

### Description of continuity models of maternity care

The literature describes several models providing continuity of care which fall into two broad categories: *team care* usually led and staffed by midwives either based at the hospital or within the community, and *caseload midwifery care* which is delivered more generally in the community or the woman's home but can be provided in a hospital or birth centre (Figure 3). An additional model offering continuity of care is 'shared care' usually between the women's General Practitioner and the hospital of intended birth.

*Team midwifery care* refers to care given during pregnancy, childbirth and the early postpartum period by a small team of usually 6-7 midwives. The philosophy is continuity of care rather than individual caregivers, although by meeting most of the team members during pregnancy it is likely that women will have previously met their caregiver during labour. The philosophy of care commonly held by teams is that their role is to promote the normality of childbirth by providing consistent psychosocial support. Some of the reported studies include an obstetrician review at booking, mid pregnancy, and post term with a review by their team midwife at the same

visit to maintain continuity. Other studies also report a model of community based team midwifery where the midwives, linked to the maternity unit and a specific General Practitioner provide antenatal and postnatal care whilst labour and birth care is provided by a larger team of midwives which includes the community midwife.

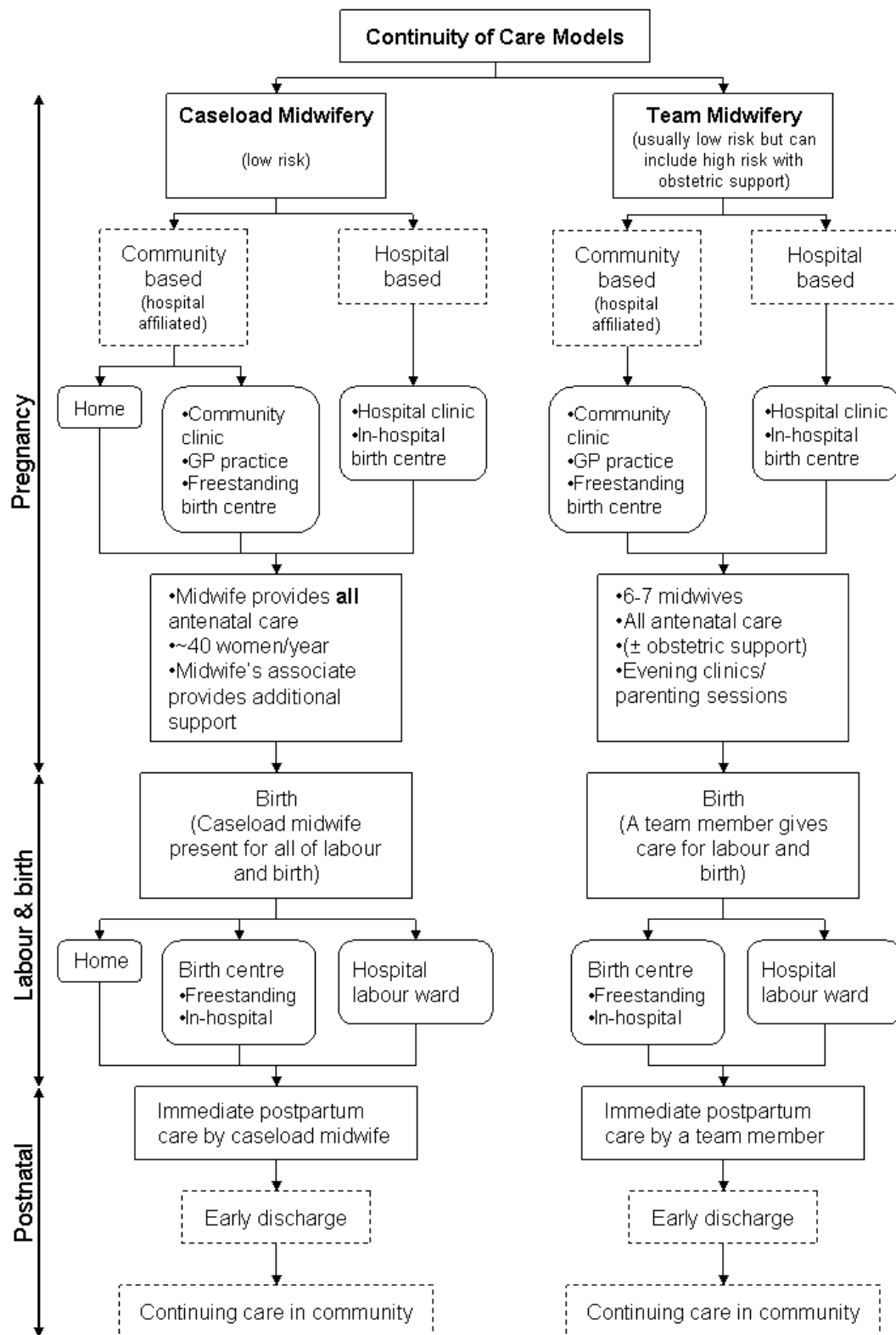
The *caseload midwifery* model of care is designed such that the woman receives all her care from the same midwife throughout her pregnancy, labour and birth and postnatal period. The midwife's caseload is normally shared with one alternative midwife in the event that the midwife is unavoidably unable to attend the woman. This model of care allows women to get to know their midwife and her associate during pregnancy and thus be confident that her midwife during labour and delivery is familiar with her, and that her labour preferences are understood.

Earlier models of continuity of care excluded women with obstetric risk factors. However the more recent studies have included women with mixed obstetric risk status. In the case of women at high risk, care was directed by a specialist obstetrician but the women continued to receive the majority of care from either their team or caseload midwives.

One study reported Community based Team Midwifery with Obstetrician Care which was also provided in the community (Homer, Davis *et al.* 2001). Antenatal care was provided in 'community clinics' with a team of visiting midwives and an obstetrician which allowed continuity of carer that is not usually possible in a busy hospital-based clinic. Intrapartum care was provided by the same team of midwives but not necessarily the same obstetrician and postnatal care was either provided in the hospital or the home again by the same team of midwives.

*Shared care* has been defined as 'a formalized cooperative arrangement between a maternity hospital and community based practitioners in the provision of ante and postnatal care to women' (Carberry and Carey 1996). Community based practitioners refer to either General Practitioners (GPs) or community midwives. Potential benefits of shared care programs are greater continuity of care, care provided at locations that are closer to home, and better services for culturally and linguistically diverse groups, while simultaneously reducing the workload of hospital based antenatal clinics.

Figure 3. Continuity of Care Models as reported in the literature



## Studies included

Studies included in the review of continuity of care evaluated the pregnancy and birth outcomes of women who received either team midwifery or caseload midwifery. In most cases these models of care were compared with standard, consultant-led, hospital-based maternity care. Two studies compared team midwifery with caseload midwifery (Morgan, Fenwick *et al.* 1998; Spurgeon, Hicks *et al.* 2001).

A total of 44 papers were short-listed, comprising 32 research studies. Nineteen studies were excluded after initial review, leaving 13 studies included in this review.

Eight RCTs were identified. Two UK RCTs evaluated caseload midwifery. Six RCTs evaluated team midwifery with the majority (n=4) being conducted in Australia (Melbourne or Sydney); one RCT was conducted in Canada and one in the UK. There was one Cochrane systematic review, which addressed team midwifery (Hodnett 2000). One of the two studies evaluated in the Cochrane review was also independently evaluated in this report (Rowley, Hensley *et al.* 1995). The remainder of studies comprised prospective cohort studies with only one retrospective study comparing team midwifery with caseload midwifery. There were several anonymous postal surveys conducted on women's satisfaction with, and preferences for maternity care and with the exception of two of these papers, most were poor quality and will only be reported informally in this review.

There were few papers identified which evaluated shared care as a model of maternity care. There were no studies that compared shared care with a GP with hospital-based models of care. Similarly there were no reasonable quality studies that evaluated rural maternity care. There was one RCT assessing 'shared care' with 'community team care.' (Tucker, Hall *et al.* 1996).

## Studies excluded after review

Studies were excluded from this review if they used a qualitative methodology and/or they had small sample sizes with no comparison groups.

## Outcomes

The following outcomes of continuity of care studies were assessed.

- Antenatal and intrapartum referrals to obstetrician-led care
- Intervention in labour such as analgesia, episiotomy, operative delivery
- Neonatal outcomes such as 5-minute Apgar scores, admission to the neonatal nursery
- Perinatal mortality

- Maternal satisfaction
- Cost comparison

Table 7. Levels of Evidence: Continuity of Care Studies

Research publication	Evidence				
	Total N	Study design	Level	Quality of study*	Quality of analysis*
<b>Team midwifery</b>					
Hodnett 2000	1815	Systematic review	I	high	high
Homer <i>et al.</i> 2002	1089	RCT	II	high	high
Biro <i>et al.</i> 2000	1000	RCT	II	high	high
Waldenstrom <i>et al.</i> 2000	1000	RCT	II	high	high
Tucker <i>et al.</i> 1996	1674	RCT	II	high	high
Rowley <i>et al.</i> 1995	814	RCT	II	high	medium
Harvey <i>et al.</i> 1996	194	RCT	II	medium	low
Waldenstrom 1998	410	RCT	II	medium	medium
<b>Caseload midwifery</b>					
Waldenstrom 1998	1860	RCT	II	high	high
Turnbull <i>et al.</i> 1996	1278	RCT	II	high	medium
North Staffordshire <i>Changing Childbirth</i> Research Team 2000	1505	RCT	II	medium	medium
Benjamin <i>et al.</i> 2001	611	P cohort	III-2	high	high
Johnson <i>et al.</i> 2005	1952	R comparative	III-3	medium	low
<b>Team vs caseload midwifery</b>					
Morgan <i>et al.</i> 1998	259	P cohort	III-2	medium	low
Spurgeon <i>et al.</i> 2001	333	R comparative	III-3	medium	low

\* See page 9 for criteria for quality of study and analysis.

RCT: randomised controlled trial, R: retrospective; P: prospective study

### Overall summary

Overall the standard of papers evaluating continuity of care was mixed. However several RCTs and descriptive studies were of good quality.

## GP shared care

Because of the limited quantity and quality of shared care papers, a formal review was not conducted. A brief summary of the findings of GP shared care follows:

One concern that was expressed was that shared care between the GP and the hospital, though designed to offer a degree of continuity of care, actually resulted in rushed appointments, long waiting times and concerns by women about not being taken seriously. One study also found poor levels of communication between shared care providers and maternity hospitals (Dawson, D, Brown *et al.* 2000).

One study, conducted in metropolitan areas of Melbourne, evaluated the effect of the introduction of initiatives to improve communication between hospitals and GPs (Nicolson, Pirotta *et al.* 2005). This study found that improved communication can only occur if adequate time and resources, including IT support, are provided by hospitals. The authors concluded that the standard of integration of shared maternity care was unacceptably low (Nicolson, Pirotta *et al.* 2005).

A Cochrane review was conducted into antenatal care programs for low-risk women (Villar, Carroli *et al.* 2001). This review evaluated trials published prior to 1997 and found no differences in the effectiveness of antenatal care programs for healthy low-risk women provided either by midwives, GPs or obstetricians. A separate Cochrane review examined the benefits of giving women their own case notes to carry during their pregnancy (Brown, H C and Smith 2004). This review did not report on any changes in communication between GPs and hospitals, but it did find that the risk of women losing their case notes was negligible. The trials were small and of limited quality but there was a suggestion that women were more satisfied and had greater feelings of being in control of their pregnancy outcomes.

## Team midwifery

A Cochrane systematic review of two RCTs involving 1815 women compared continuity of care by midwife teams with non-continuity by a combination of doctors and midwives (Hodnett 2000). The most recent trial in that review was published in 1995 and is also independently evaluated below (Rowley, Hensley *et al.* 1995). In summary, the Cochrane meta-analysis found that compared to standard hospital care, women who had continuity of care from a team of midwives were:

- Less likely to have an antenatal admission
- More likely to attend antenatal classes
- Less likely to have intrapartum medications or epidural for pain relief

- Less likely to have an episiotomy
- No difference in operative vaginal deliveries or caesarean sections
- Newborns were less likely to require resuscitation
- No difference in perinatal mortality
- No difference in breastfeeding rates.

The findings of the present independent review of trials conducted more recently than the Cochrane review were consistent with the Cochrane findings (Tables 8.1-8.4):

- Five RCTs evaluated differences in obstetric interventions, with two studies including both high and low risk patients and the remainder including low risk patients only. Overall there were fewer interventions in labour and birth in the team midwifery groups. Compared with women allocated to conventional obstetrician-led hospital care, women allocated to team midwifery were:
  - Less likely to be induced (range 8%-18% vs 16%-24.5%)
  - Less likely to have an epidural in labour (range 13%-24% vs 24%-33%)
  - Less likely to have a caesarean section (range 4%-13% vs 15%-17.8%) although 3 studies found no difference
  - Less likely to have an episiotomy (15.5%-25.5% vs 33%-35%)

Similar results were found when the review was restricted to trials of low risk women only.

- No differences were found on any measures of neonatal morbidity. In particular, there were no differences in either 5-minute Apgar scores or frequency of admission to a neonatal unit. Studies that included high risk women were no more likely to find excess neonatal morbidity than studies of only low risk women.
- No differences were found for perinatal mortality, although there were only small numbers of stillbirths or neonatal deaths.
- Women in the team midwifery groups were more likely to have met the midwife who cared for them in labour previously and to have seen fewer professionals overall than women receiving standard hospital care. High rates of satisfaction were reported by all women who responded to questionnaires, including women who received standard care. Women receiving team midwifery were more likely to be satisfied with their antenatal and intrapartum care. Information-giving, the ability to participate in decision-making, feeling in control, and good relationships with caregivers were rated highly by women in team midwifery groups.

- Overall costs were marginally lower in the team midwifery groups.
- The 'community clinic' model, where antenatal care was delivered in community clinics by a team of 6 midwives and an obstetrician with intrapartum care and postnatal care given by the same team of midwives was cost effective. Sensitivity analysis showed that team antenatal care in a community clinic began to demonstrate cost savings when a minimum of 5 women were seen in each of the twice weekly clinics.



Table 8.1 Team midwifery studies: labour interventions

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Interventions during labour and birth</b>					
	(Homer, Davis <i>et al.</i> 2001)	1997-1998	Sydney Australia	1089 Standard care: 539 Team care: 550	Compared with women who received standard hospital care, women allocated to team midwifery had a lower rate of caesarean section (13.3% vs 17.8%) No difference for other labour and birth outcomes
	<i>Level of evidence II</i> (Biro, Waldenstrom <i>et al.</i> 2000)	1996-1998	Melbourne, Australia	1000 Standard care: 498 Team care: 502	Compared with women in the standard hospital care group, women allocated to team midwifery were: Less likely to have pethidine in labour (45.6% vs 53.2%) Less likely to have an epidural in labour (24.3% vs 33%) Less likely to have continuous electronic fetal monitoring (54.3% vs 62.2%) Less likely to have augmentation of labour (26.3% vs 35.2%) Less likely to have an episiotomy (25.5% vs 34.9%) No differences for mode of delivery
	<i>Level of evidence II</i>				
	(Tucker, Hall <i>et al.</i> 1996)	1993-1994	Scotland, UK	1674 Standard care: 840 Team care: 834	Compared with low risk women in the obstetrician shared-care group, women whose maternity care was led by a GP or midwife had fewer antenatal admissions (27% vs 32%) fewer inductions of labour (18.1% vs 24.5%) no differences in mode of delivery or other labour outcomes
	<i>Level of evidence II</i> (Harvey, Jarrell <i>et al.</i> 1996)	1992-1994	Canada	194 Standard care: 93 Team care: 101	Compared with women who received physician-led care, women who received midwifery team care had: Fewer inductions (8% vs 16%) Fewer epidurals (13% vs 24%) Fewer caesarean sections (4% vs 15%) Fewer episiotomies (15.5% vs 33%)
	<i>Level of evidence II</i> (Rowley, Hensley <i>et al.</i> 1995)	1991-1992	NSW Australia	814 Standard care: 409 Team care: 405	There was a tendency towards fewer adverse antenatal or intrapartum outcomes in the team midwifery group. Compared with multiparas allocated to the traditional hospital care group, multiparas randomised to team care were less likely to be induced (9.95% vs 17.4%)
	<i>Level of evidence II</i>				No differences for mode of delivery

Table 8.2 Team midwifery studies: perinatal morbidity and mortality

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Neonatal morbidity</b>					
	(Homer, Davis <i>et al.</i> 2001)	1997-1998	Sydney Australia	1089 Standard care: 539 Team care: 550	There were no differences for neonatal outcomes
	<i>Level of evidence II</i> (Biro, Waldenstrom <i>et al.</i> 2000)	1996-1998	Melbourne, Australia	1000 Standard care: 498 Team care: 502	No differences in the frequency of admission to NICU more than 5 days, or number of low birth weight babies
	(Tucker, Hall <i>et al.</i> 1996)	1993-1994	Scotland, UK	1674 Standard care: 840 Team care: 834	No differences in neonatal outcomes (5.9% vs 7.7% admitted to NICU > 48 hours)
	<i>Level of evidence II</i> (Harvey, Jarrell <i>et al.</i> 1996)	1992-1994	Canada	194 Standard care: 93 Team care: 101	Compared with physician-led care, there was no difference in frequency of 5-minute Apgar scores <7 or transfer to NICU
	(Rowley, Hensley <i>et al.</i> 1995)	1991-1992	NSW Australia	814 Standard care: 409 Team care: 405	Compared with standard hospital care, infants of mothers allocated to team midwifery care were more likely to have a 1 minute Apgar score <7 but no differences for the 5-minute Apgar score
	<i>Level of evidence II</i>				No differences for admission to NICU
<b>Perinatal mortality</b>					
	(Homer, Davis <i>et al.</i> 2001)	1997-1998	Sydney Australia	1089 Standard care: 539 Team care: 550	Sample size too small to show a difference
	<i>Level of evidence II</i> (Biro, Waldenstrom <i>et al.</i> 2000)	1996-1998	Melbourne, Australia	1000 Standard care: 498 Team care: 502	Sample size too small to show a difference
	<i>Level of evidence II</i>				

Table 8.3 Team midwifery studies: satisfaction

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal Satisfaction</b>					
	(Homer, Davis and Brodie 2000)	1997-1998	Sydney Australia	1089 Standard care: 539 Team care: 550	Women in the team midwifery group were more likely to Wait for shorter times for appointments Feel that they were remembered Feel that they could ask questions Have met the midwife who cared for them in labour (63% vs 21%) Report a higher sense of control during labour and birth
	<i>Level of evidence II</i> (Biro, Waldenstrom <i>et al.</i> 2000)	1996-1998	Melbourne, Australia	1000 Standard care: 498 Team care: 502	Women allocated to team midwifery were more likely to: Have met the midwife who cared for them in labour and birth (80% vs 0.3%) Be more satisfied with their antenatal, intrapartum and postpartum care
	<i>Level of evidence II</i> (Waldenstrom, Brown <i>et al.</i> 2000)	1996-1997	Royal Women's Hospital, Melbourne, Australia	1000 Standard care: 505 Team care: 495	Women allocated to team midwifery were more likely to: Have met the midwife who cared for them in labour and birth (65% vs 8.5%) Be satisfied with antenatal and intrapartum care. No difference for postpartum care
	<i>Level of evidence II</i> (Tucker, Hall <i>et al.</i> 1996)	1993-1994	Scotland, UK	1674 Standard care: 840 Team care: 834	Women whose principal antenatal caregiver was a GP or community midwife saw fewer professionals in pregnancy (5 vs 7) and missed fewer appointments. A high proportion of women in all care models were very satisfied with their care with no differences between groups More women in the GP or midwife group valued having continuity of carer
	<i>Level of evidence II</i> (Waldenstrom 1998)	1989-1993	Sweden	410	Among women who received birth centre care, there was no difference in satisfaction scores between women who knew their midwives and those who saw more than 2 caregivers in a pregnancy, had intrapartum care by an unknown midwife, or had postpartum care by an unknown midwife
	<i>Level of evidence II</i> (Rowley, Hensley <i>et al.</i> 1995)	1991-1992	NSW Australia	814 Standard care: 409 Team care: 405	Compared with women allocated to standard hospital care, women who were allocated to team midwifery were more satisfied with their experience, with higher scores for information-giving, participation in decision-making and relationship with care-givers
	<i>Level of evidence II</i>				

Table 8.4 Team midwifery studies: cost comparison

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Cost comparison</b>					
	(Homer, Matha <i>et al.</i> 2001)	1997-1998	Sydney Australia	1089 Standard care: 539 Team care: 550	Overall the mean cost of providing maternity care per woman was lower in the team midwifery group (\$2579 vs \$3483).
	<i>Level of evidence II</i> (Rowley, Hensley <i>et al.</i> 1995)	1991-1992	NSW Australia	814 Standard care: 409 Team care: 405	Overall there were lower costs in the team midwifery group compared with standard care ( \$1,087,965 vs \$1,145,837) but NICU admission costs were more costly for team care \$175,339 vs \$167,881
	<i>Level of evidence II</i>				

## Caseload midwifery

The findings of studies investigating caseload midwifery are presented in Tables 9.1 to 9.3. In summary:

- The UK RCT found that overall 33% of women transferred from caseload midwife-managed care, 29% for clinical reasons. Transfer from care was not assessed by the other studies
- Compared with standard obstetrician-led hospital-based care, women who received one-to-one caseload midwifery care were:
  - Less likely to be induced (range 16%-30% vs 23%-41%)
  - Less likely to have an epidural in labour (range 10%-21% vs 15%-32%)
  - The RCTs found no difference in mode of delivery but the observational studies found either more spontaneous vaginal deliveries (74% vs 66%) or fewer caesarean sections among multiparas.
- No differences were found in neonatal outcomes
- No differences were found in perinatal mortality
- No cost comparison studies were identified.

## Caseload versus team midwifery

The findings of the two studies that compared caseload with team midwifery are presented in Table 10. In summary:

- No differences were found for interventions during labour and birth between caseload and team midwifery models of care.
- Low risk women receiving either midwifery-led continuity model of care reported higher levels of satisfaction than women who received standard hospital care. Women rated more highly the information and choice they were given and the feeling that the midwives were acting as partners with them in the birth process. There were no differences in satisfaction levels between caseload or team midwifery care.

Overall, midwifery-led continuity of care, either as caseload midwifery or team midwifery, is associated with reduced frequency of many obstetric interventions, chiefly induction of labour and epidural anaesthesia during labour, without compromising neonatal outcomes. Furthermore, extension of these models to include women of high obstetric risk did not result in any excess adverse outcomes, providing a specialist obstetrician was responsible for overall care. Caesarean section rates were low overall, reflecting the

low risk status of most of the participants in these trials, and most studies found no difference between models of 'continuity of care'.

Women receiving a continuity model of care were more likely to express high levels of satisfaction with their care compared with standard obstetrician-led models of care. However, both team and personal caseload midwifery models are equally acceptable to women.

Providing women were given a continuity of philosophy of care, they rated their care no more highly if they only one or two known caregivers than those who saw a small team of midwives (Waldenstrom 1998). More importantly, women reported that quality interactions with their doctors and midwives were more important than seeing the same caregiver for their either their pregnancy care or care in labour (Fellowes, Horsley et al. 1999; Davey, Brown et al. 2005).

The provision of one-on-one caseload care entails radical changes for traditional maternity care organisations. Caseload midwives need to be on call for extended hours at a time and this disruption to lifestyles can be unpopular to midwives and can possibly result in burnout (Benjamin, Walsh et al. 2001). The studies reviewed here demonstrate that caseload midwifery care does not provide any greater benefits to childbearing women than team midwifery, which can be conducted within traditional midwifery workforce arrangements. Philosophies of care that emphasised friendliness and support, consistency of care, good communication and ability to participate in decision-making are more important determinants of maternal satisfaction with care than continuity of caregiver (Morgan, Fenwick et al. 1998).

### Limitations of the evidence

High quality evidence comparing midwifery and medical care have been presented. However, even the well-designed RCT's were subject to small sample sizes for comprehensive comparisons of morbidity and mortality. In non-randomised studies, differences in baseline characteristics between women receiving medical and midwifery care may lead to difficulties in interpretation of results.

#### *Evidence Summary Statement*

Continuity of midwifery care models are more acceptable to women, while being associated with fewer intrapartum interventions and no increase in adverse outcomes. Women with high-risk pregnancies may also safely access this model providing there is appropriate obstetric support. There are no associated increased costs and there may be small savings. There is no evidence that personal caseloads offer improvements in outcomes, and they may have negative consequences for midwifery work patterns and their lifestyle.

Level of Evidence: I to III-3

Table 9.1 Caseload midwifery studies: labour interventions

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Interventions during labour and birth</b>					
	(Johnson, M, Stewart <i>et al.</i> 2005)	1997-2000	Sydney Australia	1952 Standard care: 976 Midwife care: 976	Compared with women who received standard hospital care, women who had a caseload midwife: Fewer multiparas were induced (30% vs 40.9%). No difference for nulliparas. No difference for epidural in labour but more use of pethidine in labour (39% vs 27.6%) Fewer multiparas had a caesarean section (5.6% vs 9.6%) but no difference in mode of delivery for nulliparas. No difference for episiotomy rates.
	<i>Level of evidence III-3</i> (Benjamin, Walsh <i>et al.</i> 2001)	1998	UK	611 Standard care: 308 Midwife care: 303	Compared with conventional midwifery care, women who received caseload midwifery were Less likely to have an epidural in labour (21% vs 32%) Less likely to have an induction of labour (16% vs 23%) More likely to have a normal vaginal birth (74% vs 66%) More likely to have an intact perineum (40% vs 30%) More likely to have a home birth or use the midwife-led birth centre.
	<i>Level of evidence III-2</i> (North Staffordshire <i>Changing Childbirth</i> Research Team 2000)	Not specified	UK	1505 Standard care: 735 Midwife care: 770	Compared with traditional care women in the caseload midwifery group had fewer epidurals (10% vs 15%) Less oxytocin augmentation (46% vs 53%) No difference in mode of delivery
	<i>Level of evidence II</i> (Turnbull, D, Holmes <i>et al.</i> 1996)	1993-1994	UK	1299 Standard care: 651 Midwife care: 648	High rates of interventions. Compared with standard shared care, women with caseload midwifery were less likely to Have an induction of labour (24% vs 33.3%) Have continuous electronic fetal heart rate monitoring (79% vs 87%) Have an episiotomy (28% vs 34%) No difference in mode of delivery (caesarean 11.9% vs 12.9%) No difference for antenatal, intrapartum or postpartum complications
	<i>Level of evidence II</i>				



Table 9.2 Caseload midwifery studies: Transfer, perinatal morbidity and mortality

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Transfer in pregnancy or labour</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996)	1993-1994	UK	1299 Standard care: 651 Midwife care: 648	Overall, 33% of women transferred from midwife-managed care, 29% for clinical reasons
	<i>Level of evidence II</i>				
<b>Neonatal morbidity</b>					
	(Johnson, M, Stewart <i>et al.</i> 2005)	1997-2000	Sydney Australia	1952	No differences in any neonatal outcome
	<i>Level of evidence III-3</i>				
	(Benjamin, Walsh <i>et al.</i> 2001)	1998	UK	611	No differences in any neonatal outcome
	<i>Level of evidence III-2</i>				
<b>Perinatal mortality</b>					
	(North Staffordshire <i>Changing Childbirth</i> Research Team 2000)	Not specified	UK	1505 Standard care: 735 Midwife care: 770	No significant differences in perinatal mortality: 7.8/1000 perinatal deaths in the caseload group compared with 15/1000 in the standard hospital group. No avoidable factors related to care model
	<i>Level of evidence II</i>				
	(Turnbull, D, Holmes <i>et al.</i> 1996)	1993-1994	UK	1299 Standard care: 651 Midwife care: 648	No differences in fetal loss >24 weeks gestational age (0.7% vs 0.2%) No differences in neonatal deaths (0.8% vs 0.5%)
	<i>Level of evidence II</i>				

Table 9.3 Caseload midwifery studies: satisfaction

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal Satisfaction</b>					
	(Johnson, M, Stewart <i>et al.</i> 2005)	1997-2000	Sydney Australia	Standard care: 976 Midwife care: 976	Compared with women who had standard hospital care, women who had a caseload midwife were more likely to report satisfaction with their pregnancy, labour and delivery care No differences in satisfaction with postnatal care
	<i>Level of evidence III-3</i> (North Staffordshire <i>Changing Childbirth</i> Research Team 2000)	Not specified	UK	1505 Standard care: 735 Midwife care: 770	Compared with women who had standard care, women in the caseload group were more likely to have intrapartum care by a midwife they had met before (95% vs 7%)
	<i>Level of evidence II</i> (Turnbull, D, Holmes <i>et al.</i> 1996)	1993-1994	UK	1299 Standard care: 651 Midwife care: 648	Women in both shared care and caseload midwifery care were satisfied with their care but women in the caseload group were more likely to express satisfaction with antenatal, intrapartum, and postnatal care.
	<i>Level of evidence II</i>				

Table 10. Continuity of care studies: Team versus caseload midwifery

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Interventions during labour and birth</b>	(Spurgeon, Hicks et al. 2001) <i>Level of evidence III-3</i>	1997	UK	333	There were no differences in any clinical outcome between low risk women cared for either by conventional obstetrician-led hospital care, one-to-one caseload midwifery care, or by team midwifery care.
<b>Maternal Satisfaction</b>	(Spurgeon, Hicks et al. 2001)  <i>Level of evidence III-3</i>	1997	UK	333 Caseload care: 112 Team care: 103 Standard care: 118	Women in all groups were satisfied with their care but those in the obstetrician-led hospital care group were significantly less satisfied than either the women who received caseload midwifery or team midwifery care. Women in both midwifery-care groups rated more highly the information and choice they were given and the feeling that the midwives were acting as partners with them in the birth process
	(Morgan, Fenwick et al. 1998)  <i>Level of evidence III-2</i>	1995-1996	UK	340 Caseload care: 164 Team care: 176	Women with greater continuity of care in the antenatal period (caseload midwifery group) were less likely to have met their midwife during labour, compared with women who received their antenatal care from a small team of midwives. There was no difference in satisfaction with care expressed by women in either maternity care group.

# HIGH RISK PREGNANCY

## Introduction

Health care practitioners believe that adverse pregnancy outcomes, particularly for women considered to be at increased risk, can be minimised by undertaking frequent maternal and fetal assessment. Women at 'high-risk' include those with pre-existing health problems (e.g. hypertension, diabetes mellitus, cardiac, respiratory or renal disease, psychiatric illness, substance abuse), previous pregnancy complications (e.g. previous preterm birth, low birth weight (LBW) or very low birth weight (VLBW) births, severe pre-eclampsia, perinatal loss), and current pregnancy problems (e.g. threatened preterm labour, prolonged preterm rupture of membranes (PPROM), pregnancy induced hypertension/pre-eclampsia, gestational diabetes, multiple pregnancy).

High risk women frequently come from low-socioeconomic backgrounds and these may receive inadequate prenatal care because of problems with transportation, lack of childcare at hospital, maternal anxiety over medical procedures and attendances, and long-waiting times in the clinics. Other personal, financial and organisational issues associated with a chaotic lifestyle is also a factor for these women not receiving adequate prenatal care to monitor their physical health and health behaviours including smoking, substance abuse, and inadequate nutrition.

Alternatives to the traditional frequent antenatal clinic review and/or hospitalisation of women at high risk for adverse maternal and neonatal outcome have been introduced in other parts of the world, especially in the USA and Canada within the public health sector and Medicaid Program. The aim of these enhanced programs is to minimise the cost both to the health sector and families associated with hospital admission and ensure disadvantaged groups in particular are able to access effective antenatal care.

This review discusses the safety and effectiveness of managing high-risk pregnancies 'in the home' as an adjunct to conventional tertiary 'in hospital' care.

## Investigated models of care for women with high-risk pregnancies

Models of antenatal care that have integrated tertiary care with community support for women with complications of pregnancy are shown in Figure 4. These models have been identified as augmented antenatal care, home visiting or domiciliary programs and antenatal day stay units.

*Augmented care*, particularly for low socioeconomic groups where care is case-managed and offers additional support services such as nutritional advice, health education, after hours appointments and home visiting. Another variation of augmented care is provided to women with pre-existing medical problems including diabetes, hypertension or women at high-risk of preterm labour who instead of attending the hospital antenatal clinic frequently undergo a significant proportion of planned antenatal assessments in their own home. This care is provided by experienced Midwives or Nurse Practitioners who are also accessible by telephone.

*Home visiting programs* by experienced Midwives or Nurse Practitioners once pregnancy complications actually develop e.g. pregnancy-induced hypertension, threatened preterm labour, PPRM, silent cervical dilatation and/or to undertake home fetal heart rate monitoring. Women are entered into the program according to strict criteria and managed according to agreed guidelines in collaboration with obstetricians. Women are also advised to contact the hospital or the midwife in between visits if they are concerned about their pregnancy and health.

*Antenatal Day Care Units* where women who traditionally have been admitted to hospital for assessment and observation attend a dedicated unit for a shorter period of observation whilst appropriate investigations are undertaken and results reviewed. Care is directed by established guidelines and women are formally admitted to hospital as the need arises. Continuity of care including case managed care for high-risk women is discussed in the section 'Continuity of Care'.

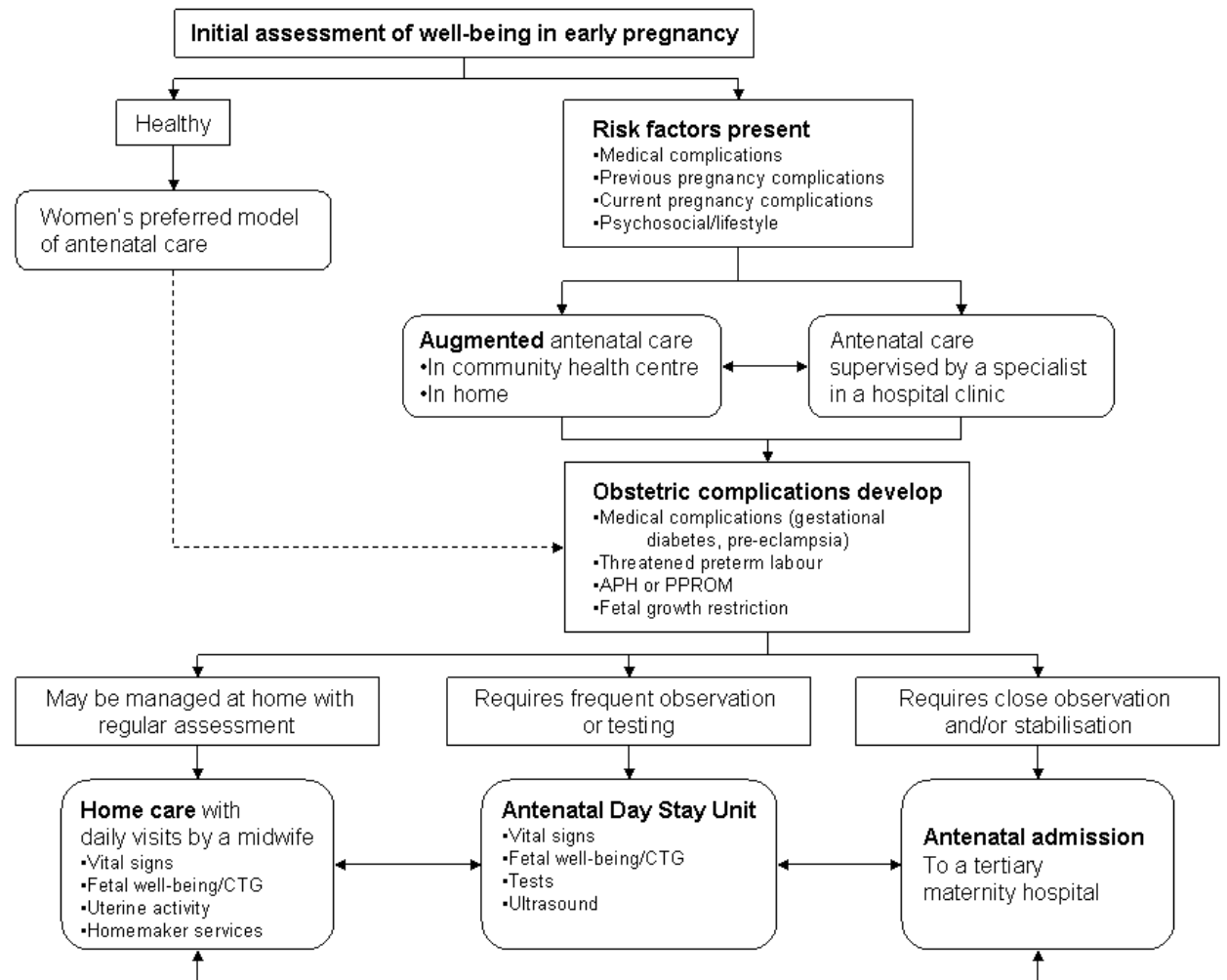
### Studies included

There was considerable variation in the scope and quality of papers about high risk women. Very few non-randomised studies were considered to be of satisfactory standard to include in this review. A total of 39 articles were identified, comprising 34 research studies. Twenty-three studies were excluded after initial review, and 11 studies included. Four RCTs from North America addressed augmented care for low socioeconomic women. Three studies addressed antenatal home visiting programs, a Canadian RCT, a Canadian retrospective study and a small UK RCT. Two RCTs evaluated antenatal day care units, an Australian study and a small UK study. Two retrospective studies were also identified that evaluated programs for high risk Australian Aboriginal populations.

### Studies excluded after review

Quantitative studies were excluded from this review if they were poor quality and/or small sample sizes with inappropriate or no comparison groups. Qualitative studies were not included.

Figure 4. Women with complications of pregnancy: examples of the integration of tertiary care with community support in the antenatal period as reported in the literature



## Outcomes

The following outcomes were assessed:

- Length of antenatal hospitalisation
- Length of postnatal hospitalisation
- Maternal birth events such as onset of labour, mode of birth
- Preterm birth rates
- Neonatal outcomes including Apgar Scores, birth weights, admission and duration of stay in NICU
- Maternal Satisfaction
- Cost comparison

Table 11: Levels of Evidence: High Risk

Research publication	Total N	Study design	Evidence		
			Level	Assessment of study	
				Quality of study*	Quality of analysis*
<b>Socioeconomic disadvantaged groups</b>					
Tough <i>et al.</i> 2006	1737	RCT	II	high	medium
Kitzman <i>et al.</i> 1997	1139	RCT	II	medium	medium
Klerman <i>et al.</i> 2001	619	RCT	II	medium	medium
Brooten <i>et al.</i> 2001	175	RCT	II	medium	low
<b>Home care programs</b>					
Goulet <i>et al.</i> 2001	250	RCT	II	high	medium
Dawson <i>et al.</i> 1999	81	RCT	II	low	low
Harrison <i>et al.</i> 2001	874	R comparative	III-3	medium	low
<b>Day stay in hospital</b>					
Turnbull <i>et al.</i> 2004	395	RCT	II	high	high
Tuffnell <i>et al.</i> 1992	54	RCT	II	medium	low
<b>Aboriginal and Torres Strait Islanders</b>					
Panaretto <i>et al.</i> 2005	1080	R comparative	III-3	medium	medium
Jan <i>et al.</i> 2004	1018	R comparative	III-3	medium	low

\* See page 9 for criteria for quality of study and analysis.

RCT: randomised controlled trial, R: retrospective; P: prospective study

### Overall Summary

Overall the standard of papers evaluating continuity of care comprised mainly level II studies although the quality of the research varied. The findings were as follows:

#### Augmented care

Three RCT's of augmented care for high-risk pregnant women, all from North America were available for review (Tables 12.1-12.5). One was based in an African-American population from a low socioeconomic background where care was given by nurses in a specifically designed centre (Klerman, Ramey *et al.* 2001). A second, also of disadvantaged, predominantly African American women compared home visitation programs either antenatally and / or after birth until the age of two with traditional hospital delivered care (Kitzman, Olds *et al.* 1997). The third study included women with 'medically' high-risk pregnancies where half of their planned care was provided in the home (Brooten, Youngblut *et al.* 2001).

Compared to standard hospital care, women of lower socio-economic class receiving *augmented care*:

- Were more likely to quit smoking
- Were more likely to attend prenatal classes (79% vs 17%)
- Rated all aspects of their care more highly
- More likely to perceive degree of control over their own lives postnatally
- There were no differences in maternal or perinatal outcome

Compared to standard hospital care, women determined to be high risk due to medical complications, such as diabetes mellitus or hypertension, who received *augmented care*

- Were less likely to be admitted to hospital in the antenatal period and had a shorter antenatal duration of stay
- Had fewer 'acute' antenatal attendances
- Had lower perinatal mortality rates
- Had heavier mean birth weight where births were preterm
- Reported higher levels of satisfaction
- There was no difference in reported maternal outcomes.

In addition there were

- fewer infants bed days after birth
- fewer infants rehospitalised within the first year of life.
- Cost comparisons showed significant savings with the home visiting model compared to the standard model. These savings were due to fewer maternal and infant bed days.

One RCT assessed the impact of *augmented care* on antenatal resource use (Tough, Johnston *et al.* 2006). Compared with standard hospital antenatal care, women receiving augmented care were more likely to access existing resources including written guides, nutrition counselling, parenting classes and agencies that provide lists of child care facilities. Of women who received nurse care at the hospital 81% indicated benefit and 43% indicated need. A second group, where the nurse visited women in their homes, reported 43% benefit and 22% need for the service. Women having a first birth, low income, maternal age <25, non-Caucasian ethnicity, smoking, abuse and low-self esteem were more likely to report the need for either the nurse or home visitor.



Table 12.1 Augmented Care for Groups with Socioeconomic Disadvantage: maternal characteristics

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal characteristics of women</b>					
	(Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	Participants were primarily African-American. Risk factors include previous history of preterm delivery or term low birth weight infant, low pre-pregnancy weight, lack of car, smokers.
	<i>Level of evidence II</i> (Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	High-risk pregnancies including hypertension, diabetes, preterm labour or high-risk of preterm labour Participants were primarily African-American (93%)
	(Kitzman, Olds <i>et al.</i> 1997)	1990-1991	USA	1139 Standard care: 681 Home visits: 458	Participants were primarily African-American (92%), unmarried (98%), with household incomes below the poverty line (85%)
	<i>Level of evidence II</i>				

Table 12.2 Augmented Care for Groups with Socioeconomic Disadvantage: psychosocial outcomes and antenatal hospitalisation

Outcome	Study	Years of study	Country	N	Results <i>Statistically significant differences only are reported</i>
<b>Pregnancy related psychosocial outcomes</b>					
	(Tough, Johnston <i>et al.</i> 2006)	2001-2004	Canada	1737 Standard care: 582 Public health nurse: 578 Home visitor: 577	Compared with standard hospital antenatal care, women who received home-based peer social support and/or regular consultations with a public health nurse: Were more likely to make use of antenatal classes, written resources and nutrition counselling No differences in smoking or alcohol use
	<i>Level of evidence II</i> (Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	Compared with standard hospital antenatal care, high risk women who received a range of augmented care programs were: More likely to attend antenatal education classes (79% vs 15%) More likely to quit smoking (50% vs 27%)
	<i>Level of evidence II</i> (Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	Compared with standard hospital antenatal & postnatal care, women who received half of their planned antenatal care in the home showed no differences in anxiety, depression or hostility
	<i>Level of evidence II</i> (Kitzman, Olds <i>et al.</i> 1997)	1990-1991	USA	1139 Standard care: 681 Home visits: 458	Compared with standard hospital care, women who received home visits were: more likely to access other community services more likely to be working
	<i>Level of evidence II</i>				
<b>Antenatal hospitalisation</b>					
	(Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	Compared with standard hospital antenatal care, women who had home visits by a nurse had: Fewer hospitalisations in pregnancy (48% vs 56%) and shorter antenatal stays More likely to carry a multiple pregnancy to term
	<i>Level of evidence II</i>				

Table 12.3 Augmented Care for Groups with Socioeconomic Disadvantage: obstetric outcomes

Outcome	Study	Years of study	Country	N	Results
<i>Statistically significant differences only are reported</i>					
<b>Obstetric outcomes</b>					
	(Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	No difference for caesarean sections (13.8% vs 17.2%)
	<i>Level of evidence II</i> (Kitzman, Olds <i>et al.</i> 1997)	1990-1991	USA	1139 Standard care: 681 Home visits: 458	Compared with women who received standard hospital care, women who had antenatal home visits by a nurse : Were less likely to have pregnancy induced hypertension (13% vs 20%) Were less likely to have Candida infections
	<i>Level of evidence II</i>				

Table 12.4 Augmented Care for Groups with Socioeconomic Disadvantage: perinatal outcomes

Outcome	Study	Years of study	Country	N	Results <i>Statistically significant differences only are reported</i>
<b>Neonatal outcomes</b>					
	(Tough, Johnston <i>et al.</i> 2006)	2001-2004	Canada	1737 Standard care: 582 Public health nurse: 578 Home visitor: 577	No difference in neonatal outcomes including preterm delivery (7%) or low birth weight (4.8%)
	<i>Level of evidence II</i>				
	(Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	Compared with standard hospital antenatal & postnatal care, women who had home visits by a nurse had: Heavier mean birth weight for preterm infants (2263±711 vs 1960±748) but no difference in weight for term infants No difference for mean gestational age at birth Fewer days of infant hospitalisation and fewer infants were re-hospitalised (19% vs 24%)
	<i>Level of evidence II</i>				
	(Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	No differences for NICU admission or 5-minute Apgar scores
	<i>Level of evidence II</i>				
	(Kitzman, Olds <i>et al.</i> 1997)	1990-1991	USA	1139 Standard care: 681 Home visits: 458	There were no differences in any neonatal outcome including birth weight, preterm delivery or Apgar scores, between women who received standard hospital care, and women who had antenatal home visits by a nurse
	<i>Level of evidence II</i>				
<b>Perinatal mortality</b>					
	(Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	No differences were found in perinatal mortality rates

Table 12.5 Augmented Care for Groups with Socioeconomic Disadvantage: satisfaction and cost comparison

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal Satisfaction</b>					
	(Klerman, Ramey <i>et al.</i> 2001)	1994-1996	USA	619 Standard care: 301 Augmented care: 318	Compared with standard hospital antenatal care, high risk women who received a range of augmented care programs were: More likely to rate their pregnancy care as very helpful (94% vs 80%)
	<i>Level of evidence II</i>				
	(Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	Compared with standard hospital antenatal & postnatal care, women who received half of their planned antenatal care in the home were more satisfied with their care
	<i>Level of evidence II</i>				
<b>Cost comparison</b>					
	(Brooten, Youngblut <i>et al.</i> 2001)	1992-1996	USA	173 Standard care: 88 Home visits: 85	Compared with standard hospital antenatal & postnatal care, costs for all hospitalisations were reduced in women who had home visits by a nurse including: Reduced antenatal hospitalisation costs (39% reduction) Reduced postpartum hospitalisation costs Reduced subsequent infant readmission up to 1 year of age Intervention cost was small relative to the cost savings
	<i>Level of evidence II</i>				

### In-Home care for 'complications of pregnancy'

Hospitalisation during pregnancy has detrimental effects on maternal psychological status and family functioning. Home-monitoring programs for certain high-risk pregnancy conditions, where monitoring has traditionally been undertaken in hospital should be considered where there is no measurable increase in maternal or perinatal morbidity.

Two studies (Goulet, Gevry *et al.* 2001; Harrison, Kushner *et al.* 2001) investigated in-home care for complications of pregnancy, such as PPRM, pregnancy induced hypertension and threatened preterm labour. Women were recruited to the program of care according to strict diagnostic criteria. Home monitoring was undertaken by experienced midwives, who were more appropriately allied to the 'acute obstetric service' rather than those used to delivering routine antenatal care within the community. In addition one study provided 'home maker' services to assist with home duties and family care.

Compared to in-patient observation, women receiving in-home monitoring (Tables 13.1-13.3)

- showed no difference in maternal outcomes
- showed a reduction in the duration of neonatal intensive care
- were more satisfied with the support they received from their partners
- reported similar levels of stress which reduced over time

Infants of women receiving in-home care for threatened preterm birth

- delivered at more advanced gestational ages
- weighed more
- less likely to be admitted to NICU for >48 hours.
- Cost comparisons showed no difference between providing in-home care or in-hospital.

One small RCT in Wales (UK) of women with high-risk pregnancies compared conventional care with domiciliary midwifery support which included the availability of telephonic fetal heart rate monitoring (Dawson, A, Cohen *et al.* 1999). The aim was to reduce the frequency of hospital attendances which tend to be disruptive, stressful and costly to the family. More women in the domiciliary group went into spontaneous labour than in the conventional group. There were no other significant differences in maternal or neonatal outcome between the two groups. This may be due to the small sample size. There was similarly no difference in maternal satisfaction, anxiety or levels of depression. Economic analysis showed the domiciliary model to be cost-effective with reduction in inpatient admission explaining most of the cost benefit.

Table 13.1 Home care programs: characteristics and psychosocial outcomes

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal characteristics of women</b>					
	(Harrison, Kushner <i>et al.</i> 2001)	1996-1997	Canada	Preterm: 437 In-hospital: 209 In-home: 228	Women at high risk of preterm birth (threatened preterm labour, PPROM, multiple pregnancy) Women with hypertension. Compared to the in-hospital group, women in the home care group had slightly higher family incomes
				Hypertension: 308 In-hospital 153 In-home 155	were more likely to be nulliparous with hypertension (66% vs 45%) were admitted to the in-home program at earlier gestations (31.0 weeks vs 34.0 weeks) Had a lower incidence of PPROM Had a lower incidence of multiple pregnancy
	<i>Level of evidence III-3</i>				Women with preterm labour
	(Goulet, Gevry <i>et al.</i> 2001)		Canada	250	
	<i>Level of evidence II</i>				
	(Dawson, A, Cohen <i>et al.</i> 1999)		Wales, UK	81 Standard care: 38 In-home: 43	Women with pregnancy complications not thought to require acute intervention including previous stillbirth or neonatal death, previous or current mild PE, previous or current growth restriction, previous preterm delivery, twin pregnancy, maternal medical conditions
	<i>Level of evidence II</i>				
<b>Pregnancy related psychosocial outcomes</b>					
	(Goulet, Gevry <i>et al.</i> 2001)		Canada	250	Compared with women receiving in-hospital care, women receiving home care were more likely to be satisfied with social support from their partner No differences in stress scores
	<i>Level of evidence II</i>				
	(Dawson, A, Cohen <i>et al.</i> 1999)		Wales, UK	81 Standard care: 38 In-home: 43	There were no differences for depression or anxiety between women receiving standard hospital-based antenatal care and women receiving home care and domiciliary fetal heart rate monitoring
	<i>Level of evidence II</i>				

Table 13.2 Home care programs: pregnancy and neonatal outcomes

Outcome	Study	Years of study	Country	N	Results <i>Statistically significant differences only are reported</i>
<b>Obstetric outcomes</b>					
	(Harrison, Kushner <i>et al.</i> 2001) <i>Level of evidence III-3</i>	1996-1997	Canada	Preterm: 437 In-hospital: 209 In-home: 228	Compared with the in-hospital group, women in the home care group at risk of preterm labour were: Less likely to have chorioamnionitis (7.5% vs 14.8%) There were no differences in maternal outcome in women with hypertension having in-home or in-hospital care. Postnatal length of stay was shorter for women in the home care group (2 days vs 4 days for high risk of preterm birth) and (3 days vs 4 days for those with hypertension)
	(Goulet, Gevry <i>et al.</i> 2001) <i>Level of evidence II</i>		Canada	250	No differences in mode of delivery between women receiving in-hospital care and women receiving home care
	(Dawson, A, Cohen <i>et al.</i> 1999) <i>Level of evidence II</i>		Wales, UK	81 Standard care: 38 In-home: 43	Compared with women receiving standard hospital-based antenatal care, women receiving home care and domiciliary fetal heart rate monitoring were more likely to have a spontaneous onset of labour. No differences for mode of delivery or other obstetric outcomes
<b>Neonatal outcomes</b>					
	(Harrison, Kushner <i>et al.</i> 2001) <i>Level of evidence III-3</i>	1996-1997	Canada	Preterm: 437 In-hospital: 209 In-home: 228	Compared with the in-hospital group, women in the home care group at risk of preterm labour were: Less likely to have their infant cared for in NICU >48 hours (36% vs 55%) More likely for their baby to be older at birth (36.1 weeks vs 34.0 weeks) More likely to have a heavier baby (2742g vs 2342g)
	(Goulet, Gevry <i>et al.</i> 2001) <i>Level of evidence II</i>		Canada	250	There were no differences in neonatal outcome in women with hypertension having in-home or in-hospital care. No differences in gestational age at birth or birth weights between neonates of women receiving in-hospital care and women receiving home care
	(Dawson, A, Cohen <i>et al.</i> 1999) <i>Level of evidence II</i>		Wales, UK	81 Standard care: 38 In-home: 43	No differences for neonatal outcomes including gestational age at birth, birth weight between women receiving standard hospital-based antenatal care and women receiving home care and domiciliary fetal heart rate monitoring.



Table 13.3 Home care programs: satisfaction and cost comparison

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Maternal Satisfaction</b>					
	(Goulet, Gevry <i>et al.</i> 2001) <i>Level of evidence II</i>		Canada	250	No differences in reports of satisfaction with care between women receiving in-hospital care and women receiving home care
	(Dawson, A, Cohen <i>et al.</i> 1999) <i>Level of evidence II</i>		Wales, UK	81 Standard care: 38 In-home: 43	No differences for satisfaction with care between women receiving standard hospital-based antenatal care and women receiving home care and domiciliary fetal heart rate monitoring.
<b>Cost comparison</b>					
	(Harrison, Kushner <i>et al.</i> 2001)  <i>Level of evidence III-3</i>	1996-1997	Canada	Preterm: 437 In-hospital: 209 In-home: 228  Hypertension: 308 In-hospital 153 In-home 155	There were no differences in overall cost between in-home and in-hospital care for women at risk of preterm birth and/or hypertension.
	(Dawson, A, Cohen <i>et al.</i> 1999)  <i>Level of evidence II</i>		Wales, UK	81 Standard care: 38 In-home: 43	Domiciliary fetal heart rate monitoring was cost effective when compared to conventional hospital care

## Antenatal Day Care Units

Women are frequently admitted to hospital for observation during the antenatal period due to complications including hypertension, threatened preterm labour and antepartum haemorrhage, with between 20 to 30 admissions per 100 births. Monitoring, assessment and investigations can frequently be undertaken over a few hours and where no immediate management change is required the women may not require formal admission. Antenatal Day Care assessment units offer a model of care which aims to reduce the need for formal inpatient admission.

There were two published trials of Antenatal Day Care Units comparing this model of care with conventional in-patient admission for observation (Tuffnell, Lilford *et al.* 1992; Turnbull, D A, Wilkinson *et al.* 2004) (Table 14.1-14.2). One of these trials ceased recruitment early as obstetricians preferred their patients to be managed through the antenatal day care unit.

For women with hypertension and/ or preterm pre-labour rupture of membranes, planned care through the antenatal day unit:

- Reduced the duration of antenatal episodes
- reduced antenatal length of stay
- reduced overall admission.
- There were no differences in maternal or neonatal outcomes.
- Women also reported higher levels of satisfaction (one trial) with attendance at the day care unit rather with admission. One study (Tuffnell, Lilford *et al.* 1992) reported that the majority of women in the study would prefer to attend the antenatal day care unit, even on a daily basis, to avoid admission to hospital.
- There were no differences in costs between day care units and in-patient delivered care.

## Aboriginals and Torres Strait Islanders

Programs specifically devised for high risk Australian Aboriginal populations  
Aboriginals and Torres Strait Islanders represent a group of women at high risk of perinatal adverse events. Despite improvements in overall morbidity and mortality, aboriginal perinatal and maternal outcomes remain poor, with high rates of preterm birth, low birth weight and perinatal mortality twice that of the non-Indigenous population (Panaretto, Muller *et al.* 2002). Late antenatal attendance, maternal malnutrition and high rates of sexually transmitted diseases and substance abuse are all associated with poor perinatal outcomes.

Only two studies were identified that evaluated programs directed at Aboriginal and Torres Strait Islanders and were of reasonable quality

(Panaretto, Muller *et al.* 2002; Jan, Conaty *et al.* 2004). One program was based in a regional city in Queensland; the other was based in outer metropolitan Sydney (Tables 15.1-15.2).

Overall the studies found that Aboriginal women who received integrated community care models of antenatal care attended antenatal visits earlier and more frequently and were more likely to attend for antenatal screening compared with Aboriginal women attending standard hospital clinics for antenatal care. In addition, one study found that augmented community care was associated with fewer preterm births although neither study found any differences in birth weight or perinatal mortality. Aboriginal women were strongly positive about the integrated midwifery services, suggesting the need for the establishment of similar community-based programs and more high quality evaluation studies.

#### Limitations of the evidence

The majority of evidence about models of care for high risk pregnancy has been obtained as a result of RCT's of at least moderate design quality. Conclusions of these studies are very likely to be affected by sample size limitations, as they have limited the ability to detect clinically meaningful differences in pregnancy outcomes between the standard and newly tested models of care. The largest studies included (level II and level III-3) in the review consisted of three parallel arms, effectively leading to lower statistical power than would be expected for the overall sample size.

Changes in clinical practice during the conduct of some RCT's (Turnbull, D A, Wilkinson *et al.* 2004) may have biased the overall results, while the selection biases associated with non-randomised studies may have influenced the results.

#### *Evidence Based Summary Point*

Women with high-risk pregnancies requiring frequent antenatal assessment, especially those of lower socioeconomic status, have improved perinatal outcomes and require fewer days in hospital when a significant proportion of their antenatal care is delivered in the home by advanced nurse practitioners. Significant cost benefits are associated with this model of care.

Level of Evidence: II

*Evidence Based Summary Point*

In-Home care programs undertaken by experienced health professionals and 'home-maker services,' with adherence to diagnostic criteria and managed according to defined protocols, safely provide antenatal care to high-risk women including those with preterm labour, preterm pre-labour rupture of membranes, multiple pregnancy and those with pre-eclampsia or essential hypertension.

Level of Evidence: II to III-3

*Evidence Based Summary Point*

Antenatal Day Care or Day Assessment Units reduce the need for formal hospital admission for high-risk pregnancies and deliver safe care with no difference in maternal or neonatal outcomes. Women prefer day attendance, even on a daily basis, compared with admission to hospital.

Level of Evidence: II

*Evidence Based Summary Point*

For high-risk pregnancies requiring frequent fetal heart rate surveillance domiciliary visits by experienced midwives and telephonic fetal heart rate monitoring reduces hospital visits and is cost-effective both for the institution, and the woman and her family.

Level of Evidence: II

*Evidence Based Summary Point*

Aboriginal and Torres Strait Islanders have better antenatal attendance and greater satisfaction in integrated community-based antenatal care programs.

Level of Evidence: III-3

Table 14.1 Antenatal Day Stay hospital programs: characteristics and pregnancy outcomes

Outcome	Study	Years of study	Country	N	Results
<i>Statistically significant differences only are reported</i>					
<b>Maternal characteristics of women</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Women with non-proteinuric or proteinuric hypertension, PPRM $\geq$ 28 weeks' gestational age
	(Tuffnell, Lilford <i>et al.</i> 1992) <i>Level of evidence II</i>	1989	UK	54 In-hospital: 24 Day care: 30	Women with non-proteinuric hypertension diagnosed after 26 weeks' gestational age
<b>Pregnancy related psychosocial outcomes</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had no difference in rates of depression
<b>Antenatal hospitalisation</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had fewer antenatal admissions (0 (0-1) vs 1 (1-2)) shorter length of antenatal stay (17 hours vs 57 (35-123) hours)
	(Tuffnell, Lilford <i>et al.</i> 1992) <i>Level of evidence II</i>	1989	UK	54 In-hospital: 24 Day care: 30	Compared with women randomised to receive standard hospital care $\pm$ hospital admission, women randomised to day care had a reduced length of stay (mean difference 4 days)
<b>Obstetric outcomes</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had no difference in antenatal or intrapartum complications
	(Tuffnell, Lilford <i>et al.</i> 1992) <i>Level of evidence II</i>	1989	UK	54 In-hospital: 24 Day care: 30	Compared with women randomised to receive standard hospital care $\pm$ hospital admission, women randomised to day care had a decreased rate of induction (27% vs 65%) No differences for mode of delivery

Table 14.2 Antenatal Day Stay hospital programs: neonatal outcomes, satisfaction and cost comparison

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Neonatal outcomes</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had no difference in neonatal outcomes
	(Tuffnell, Lilford <i>et al.</i> 1992) <i>Level of evidence II</i>	1989	UK	54 In-hospital: 24 Day care: 30	Compared with women randomised to receive standard hospital care ± hospital admission, women randomised to day care had no differences in any neonatal outcome (mean birth weight, Apgar scores)
<b>Maternal Satisfaction</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had no difference in satisfaction with care
	(Tuffnell, Lilford <i>et al.</i> 1992) <i>Level of evidence II</i>	1989	UK	54 In-hospital: 24 Day care: 30	Compared with women randomised to receive standard hospital care ± hospital admission, women randomised to day care had no difference in satisfaction with care
<b>Cost comparison</b>					
	(Turnbull, D, Holmes <i>et al.</i> 1996) <i>Level of evidence II</i>		South Australia	395 In-hospital: 132 Day care: 263	Compared with women who received in-hospital care, woman who received day care had: shorter overall stay for mother and baby no differences in overall costs

Table 15.1 Aboriginal and Torres Strait Islanders: characteristics and antenatal health care

Outcome	Study	Years of study	Country	N	Results <i>Statistically significant differences only are reported</i>
<b>Maternal characteristics of women</b>					
	(Panaretto, Lee <i>et al.</i> 2005)	2000-2003	Townsville, Queensland	Historic Controls A: 84 Contemporary Controls B: 540 Integrated care: 459	Aboriginal women with single pregnancy Compared with women using standard antenatal care in either the historical or contemporary control groups, aboriginal women using the integrated shared care model: Had lower parity (1 (0-3) vs 2.6 (1-4))
	<i>Level of evidence III-3</i> (Jan, Conaty <i>et al.</i> 2004)	1990-1996	Sydney, NSW	Controls A: 387 Controls B: 292 Community midwifery service: 339 pregnancies	Aboriginal women
	<i>Level of evidence III-3</i>				
<b>Antenatal health care</b>					
	(Panaretto, Lee <i>et al.</i> 2005)	2000-2003	Townsville, Queensland	Historic Controls A: 84 Contemporary Controls B: 540 Integrated care: 459	Compared with women using standard antenatal care in either the historical or contemporary control groups, aboriginal women using the integrated shared care model: Had more antenatal visits (7 (4-10) vs 3 (2-6)) Had at least one antenatal ultrasound Were screened for sexually transmitted diseases
	<i>Level of evidence III-3</i> (Jan, Conaty <i>et al.</i> 2004)	1990-1996	Sydney, NSW	Controls A: 387 Controls B: 292 Community midwifery service: 339 pregnancies	Compared with women using one of two regional hospitals, women who received their antenatal care from a community midwife: Attended their first antenatal visit earlier in the pregnancy (17 vs 21 or 20 weeks) Had more antenatal visits (10.5 vs 5.5 or 9.5) Had better attendance for routine tests (94% vs 71% or 84%)
	<i>Level of evidence III-3</i>				

Table 15.2 Aboriginal and Torres Strait Islanders: neonatal outcomes and satisfaction

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Neonatal outcomes</b>					
	(Panaretto, Lee <i>et al.</i> 2005)	2000-2003	Townsville, Queensland	Historic Controls A: 84 Contemporary Controls B: 540 Integrated care: 459	Compared with women using standard antenatal care in either the historical or contemporary control groups, aboriginal women using the integrated shared care model: Had fewer preterm births (8.7% vs 14.3%) No differences for low birth weight or perinatal mortality
	<i>Level of evidence III-3</i>				
	(Jan, Conaty <i>et al.</i> 2004)	1990-1996	Sydney, NSW	Controls A: 387 Controls B: 292 Community midwifery service: 339 pregnancies	There was no difference in the incidence of low birth weight or perinatal mortality between women who received the integrated midwifery service and women who received their antenatal care in the hospital
	<i>Level of evidence III-3</i>				
<b>Maternal Satisfaction</b>					
	(Jan, Conaty <i>et al.</i> 2004)	1990-1996	Sydney, NSW	Controls A: 387 Controls B: 292 Community midwifery service: 339 pregnancies	Aboriginal women were strongly positive about the integrated midwifery service.
	<i>Level of evidence III-3</i>				



# TELEMEDICINE

## Introduction

Telemedicine refers to the use of telecommunication technology to provide medical information and services. Access to technologies such as the Internet can provide not only solutions to the problems associated with delivery of service in rural and remote areas, but also alternative methods of service delivery to pregnant women in metropolitan areas.

## Studies included

Studies reporting the use of telemedicine in pregnancy care were identified. A total of 11 studies were identified and 6 studies evaluating the use of telemedicine in prenatal care were included in the report. Telemedicine is an evolving model for delivery of care without well established assessment methods, thus the included studies were mainly pilot or feasibility studies evaluating the development of services and its potential impact on delivery of care. There was one small RCT of in-home telephonic fetal heart rate monitoring which is also included in the section 'in-home monitoring for high-risk pregnancy'.

## Outcomes

Outcomes used in the assessment of telemedicine:

- Volume of consultations between telemedical service providers and patients and their health care providers
- Impact and potential benefits to patient care
- Attitudes of patients and staff to telemedicine
- Organisational changes resulting from the introduction of telemedicine
- Cost savings

## Overall summary

Studies retained in this report cover mainly the use of telemedical programs in high risk pregnancy and electronic medical record keeping in a prenatal care network.

The overall volume and impact of telemedical consultations with Maternal Fetal Medicine (MFM) specialists via a live link with real time fetal ultrasound performed by a suitably trained sonographer, has been investigated in several reviewed studies. These consultations resulted with modifications of diagnosis (41-46%) or changes in management (33-40%) (Chan, Soong *et al.* 2000; Chan, Soong *et al.* 2001). Patients and staff commonly reported a high degree of satisfaction with the provided care (Chan, Soong *et al.* 2000; Chan, Soong *et al.* 2001; Smith and Brebner 2002).

Another study observed the impact of a statewide high-risk pregnancy telemedicine program in the USA and noted a trend towards a reduction in maternal transfers and significant reduction in hospital stay at the tertiary centre (Britt, Norton *et al.* 2006).

Potential benefits of keeping electronic medical records in obstetric care were demonstrated in a study of record keeping via Intranet (Bernstein, Farinelli *et al.* 2005). Forty three sets of records before and after the introduction of electronic record keeping were evaluated, and an improvement in the communication between the 'out of hospital' antenatal care providers and 'hospital based' intrapartum care providers health care providers was evident.

The RCT of telephonic fetal heart rate monitoring was part of an 'in-home high-risk pregnancy' monitoring study using remote recording units in women's homes reporting to a central computer station. Analysis of the fetal heart rate pattern was undertaken at the central unit within the hospital which also used computerised analysis of the CTG for some of the cases. There was a reduction in the number of antenatal visits and antenatal in-patient stay compared to those receiving their care in the hospital. Although the study was too small to comment on neonatal outcomes, cost savings were demonstrated with the in-home pregnancy care (Dawson, A, Cohen *et al.* 1999).

#### Limitation of Evidence

The evidence available for telemedicine programs consists primarily of pilot studies with small sample sizes.

#### *Evidence Based Summary Point*

Telemedicine programs enable women with medical and pregnancy complications, and their health providers to access tertiary level services not previously readily available due to their remote location. Benefits include reduced rates of transfer and reduced stay in the tertiary centre.

Level of Evidence: Not classified

#### *Evidence Based Summary Point*

Electronic obstetric records improve communication between health professionals caring for pregnant women in a variety of locations.

Level of Evidence: Not classified

Table 16.1 Telemedicine studies: organisational changes

Outcome	Study	Years of study	Country	N	Results
<b>Organisational changes</b>					
	(Britt, Norton <i>et al.</i> 2006)	2002-2004	Arkansas, USA	not stated	Compared with a 6 month period before introduction of a state-wide telemedicine program: telemedicine consultations after introduction increased (after: 269 vs before: 108) Number of participating doctors increased (36 vs 22) More doctors took part in weekly case discussions (98 vs 33) More telephone consultations (107 vs 55)
	(Bernstein, Farinelli <i>et al.</i> 2005)	August 2002 vs August 2003	New York, USA	43 pre 43 post	Compared with charts before the introduction of an intranet-based computerized prenatal record, charts after introduction had: Fewer absent prenatal records ((2% vs 16%) Length of time between last documented prenatal visit and delivery was shorter (4 vs 36 days) Fewer absent documented ultrasound reports (0 vs 16%)
	(Smith and Brebner 2002)	November 2000- April 2001	Scotland, UK	85 video-conferences	22 clinical, 53 educational videoconferences Videoconferences found clinically usefull and educationally beneficial
	(Chan, Soong <i>et al.</i> 2000)	Not stated	Townsville, Queensland	24	Consultation with MFM subspecialists via a live link with realtime ultrasound transmission resulted in: Modification of diagnosis in 46% cases Modification of management plan in 33% although half of the modifications were only minor
	(Chan, Soong <i>et al.</i> 2001)	Not stated	Townsville, Queensland	90 consultations 71 patients	Consultation with MFM subspecialists via a live link with realtime ultrasound transmission resulted in: Modification of diagnosis in 41% cases Modification of management plan in 40% although half of the modifications were only minor Accuracy of diagnoses was confirmed for all cases

Table 16.2 Telemedicine studies: effects on rates on inter-hospital transfer, satisfaction and costs

Outcome	Study	Years of study	Country	N	Results
<b>Transfer to Level III hospital</b>					
	(Britt, Norton <i>et al.</i> 2006)	2002-2004	Arkansas, USA		Compared with a 6 month period before and after introduction of a state-wide telemedicine program: No difference for maternal transports to level III hospital Fewer hospital days per maternal transport (6.1±7.3 vs 8.0±10.4) Consultations prevented 24/71 cases being transferred to Brisbane
	(Chan, Soong <i>et al.</i> 2001)		Townsville, Queensland	90 consultations 71 patients	
<b>Satisfaction</b>					
	(Chan, Soong <i>et al.</i> 2000)		Townsville, Queensland	24	Consultation with MFM subspecialists via a live link with realtime ultrasound transmission resulted in: Sub-specialists were confident/very confident in all their diagnoses Referral clinicians rated all consultations as useful/very useful Compared with before the consultation, all women were positive/very positive about seeing a specialist in Brisbane after the consultation (100% vs 80%) 95% of women agreed/strongly agreed that their privacy had been maintained 95% of women indicated they would recommend videoconferencing to others
	(Chan, Soong <i>et al.</i> 2001)		Townsville, Queensland	90 consultations 71 patients	Consultation with MFM subspecialists via a live link with realtime ultrasound transmission resulted in: Sub-specialists were remained confident/very confident in all their diagnoses. Referral clinicians rated all consultations as useful/very useful
	Smith and Brebner 2002	November 2000- April 2001	Scotland, UK	85 video-conferences	78% of staff very satisfied/satisfied with the its use (met expectations, value of second opinion, interaction with specialist, usefulness)
<b>Cost comparison</b>					
	(Chan, Soong <i>et al.</i> 2001)		Townsville, Queensland	90 consultations 71 patients	Overall crude cost savings were estimated as \$6340 for 71 patients

## HOME VISITING AFTER EARLY POSTNATAL DISCHARGE

### Introduction

In recent years, postnatal length of stay has been greatly reduced. This occurred without any conclusive evidence about the safest length of hospital stay after childbirth. While much has been written about the safety of early postnatal discharge, the literature has been generally of poor to medium quality and considerable heterogeneity between studies (variation in settings and contexts, in the timing of “early discharge” and in the scope of follow-up care) has led to inconclusive findings.

Potential adverse outcomes of early discharge are delays in detecting maternal or neonatal health problems, earlier cessation of breastfeeding due to unresolved problems, or decreased confidence with parenting skills. It is believed that these problems are magnified if no midwifery follow-up is provided. Interestingly, early discharge (<24 hours, with daily home visiting) is promoted as being a more family-centred approach to postnatal care in settings that promote the normality of childbirth (eg birth centres or continuity of care models). Potential advantages of early discharge that are cited are more rest for mothers at home, decreased exposure to hospital-based infections, enhanced maternal confidence, fewer breastfeeding problems because conflicting advice is avoided.

### Descriptions of Models of Care for Early Postnatal Discharge programs

In many countries (e.g. USA, some European countries), earlier discharge from hospital was traditionally not accompanied by any follow-up care after discharge. This contrasts dramatically with the UK, where midwives provide community based postnatal care for usually 7 visits up to 10 days postpartum when care is transferred to the health visitor. Similarly Australian maternity care services have usually aimed to provide some domiciliary care, at least until the infant is 5 days old, before the mother and child are contacted by the community child health service.

The scope of novel home visiting interventions likewise varies considerably between different countries or even between different settings within the same country. For example, two US studies compared a single home visit within 48 hours of discharge with a routine hospital attendance within 48 hours of discharge (Lieu, Braveman *et al.* 2000; Escobar, Braveman *et al.* 2001). More commonly, the frequency of home visiting was greater than two, or was at the discretion of the home visitor.

Midwives are the usual health care providers for home visiting, however in some countries nurse practitioners trained in postpartum and neonatal care visit women in their homes after hospital discharge.

### Studies included

There was a wide selection of papers referring to early postnatal discharge with or without home visiting. Because of time constraints, the present review was restricted to a Cochrane systematic review last updated in 2002, and all other papers published since 2000 not included in that review.

A total of 33 studies were short-listed, comprising 28 research studies. Nineteen studies were excluded after initial review, leaving nine studies. Only one study investigated postnatal outcomes in a high-risk population. The remainder included only healthy mothers and infants with no complications. The studies were conducted in a range of countries, although no Australian studies were identified.

For the purposes of the present review, evidence pertaining to early postnatal discharge programs predominantly consisted of level II evidence with a single systematic review comprising of level I evidence.

### Studies excluded after review

Studies were excluded from this review if they used a cross-sectional survey methodology or they had small sample sizes with no comparison groups. Because of the limited time frame, it was not possible to evaluate the wide body of evidence focusing specifically on support for breastfeeding with either peer or lactation consultant counsellors. Similarly, programs directed specifically at reducing rates of postnatal depression were beyond the scope of this review. However, breastfeeding and maternal psychological health were considered as outcomes in most studies of general home visiting by midwives or qualified nurse practitioners.

### Outcomes

The following outcomes were assessed in studies of home visiting after early postnatal discharge

- Maternal readmission or emergency outpatients visit
- Neonatal readmission or emergency outpatients visit
- Breastfeeding rates
- Maternal health
- Maternal satisfaction
- Cost comparison

Table 17. Levels of Evidence: Home Visiting after Early Postnatal Discharge

Research publication	Evidence				
	Total N	Study design	Assessment of study		
			Level	Quality of study*	Quality of analysis*
Brown <i>et al.</i> 2002	3600	Systematic review	I	high	medium
Lieu <i>et al.</i> 2000	1163	RCT	II	high	high
Escobar <i>et al.</i> 2001	1016	RCT	II	high	medium
Boulvain <i>et al.</i> 2004	459	RCT	II	high	medium
MacArthur <i>et al.</i> 2002	2064	RCT	II	medium	medium
Morrell <i>et al.</i> 2000	623	RCT	II	high	medium
Sainz Bueno <i>et al.</i> 2005	430	RCT	II	medium	medium
Steel O'Connor <i>et al.</i> 2003	733	RCT	II	medium	low
York, Brown <i>et al.</i> 1997	96	RCT	II	medium	low

\* See page 9 for criteria for quality of study and analysis.

RCT: randomised controlled trial.

### Overall summary

The Cochrane systematic review of early postnatal discharge from hospital for healthy mothers and term babies reviewed eight trials involving 3600 women (Brown, S J, Small *et al.* 2002). The reviewers found substantial variation between studies for the timing of discharge, and that the trials were all of poor quality with protocol violations in all studies. The results of the meta-analysis were mixed, with no statistically significant differences in maternal and neonatal hospital readmissions or breastfeeding. However, no conclusions could be made about the safety of early discharge because of the limitations of the trials.

Since the Cochrane review was published, there have been a further eight studies of low risk women published. Overall the standard of papers was medium to high quality but there continued to be considerable heterogeneity between studies. Few studies found significant differences between groups. In all of these studies, early discharge was defined as discharge from hospital of healthy women and term infants within 48 hours of a vaginal birth. In all but one randomised controlled study, the interventions were home visiting conducted by either a midwife or trained nurse practitioner. The exception was an English trial that assessed the effect of postnatal support by a trained community support worker in

addition to the standard English practice of postnatal care at home by a community midwife (Morrell, Spiby *et al.* 2000).

There was considerable variation in the period of home visiting, ranging from one visit to two or higher, at the discretion of the professional home visitor. A UK study compared traditional community midwifery led programs with intensive protocol-based midwifery visits for up to 12 weeks (MacArthur, Winter *et al.* 2002).

The comparison group also varied between studies. In the two European RCTs, women randomised to the control group were discharged after 2-5 days with no follow-up at home (Boulvain, Perneger *et al.* 2004; Sainz Bueno, Romano *et al.* 2005). In the North American studies, either no postnatal care was provided at all, or the control group received a variety of hospital-based care programs (Lieu, Braveman *et al.* 2000; Escobar, Braveman *et al.* 2001; Malkin, Keeler *et al.* 2003; Steel O'Connor, Mowat *et al.* 2003; Paul, Phillips *et al.* 2004).

The findings of our review of those studies were as follows (Tables 18.1-18.6):

#### Women and Infants with no complications

- None of the four RCTs that investigated the frequency of maternal readmission to hospital or emergency outpatients visits found any differences between professional postnatal home visiting and traditional postpartum care.
- Three studies found no differences in the frequency of neonatal readmission to hospital or emergency outpatients visits. An American cost comparison study, which used retrospective data (Paul, Phillips *et al.* 2004) found infants of women who received at least one home visit were less likely to be readmitted or have an emergency visit with jaundice and/or dehydration. In contrast, a Swiss RCT found increased infant hospital admissions in the first six months of life in women who had received early discharge with home visiting by a midwife (Boulvain, Perneger *et al.* 2004). This finding is of negligible clinical significance, however, as there were no differences in readmissions in the first month postpartum.
- There was no difference in breastfeeding rates associated with early discharge and postnatal home visiting. The breastfeeding rate was generally high at 70-85% at 6 weeks postpartum.
- With the exception of one study, no differences were found in maternal physical or psychological health. However, the measures used to determine these outcomes may not have been appropriate or sensitive enough to detect differences in postpartum populations. One UK study investigated the impact of the introduction of an



enhanced protocol-based model of midwifery-led postnatal care in the home (MacArthur, Winter *et al.* 2002). Compared with traditional GP-led postpartum care, women who received enhanced postnatal care for up to 3 months postpartum were less likely to have symptoms of postnatal depression although there was no difference in physical health.

- In three studies, women who received home visiting by a qualified nurse were more likely to report high levels of satisfaction with their care. Two studies found no difference in reported satisfaction. Women randomised to receive home support in the UK were more satisfied with their additional support.
- Overall cost comparison findings were mixed. The two European studies found cost savings for women who received home visiting compared with later discharge and no home visits. The retrospective US trial found similar savings. In contrast, three North American studies found that home visiting was more costly than established hospital-based programs. This is probably explained by the significant variations in the models investigated.

Since the most recent Cochrane systematic review in 2002, there continued to be poor homogeneity between published studies, although in the recent studies, there was a common cut-off point for early discharge (48 hours after the birth). However the variation in findings persists.

When discharge occurred before 48 hours after birth, implementation of a home visiting program was not associated with any benefits in either maternal or neonatal outcomes compared with other hospital-based programs. The only study that found a benefit to maternal health investigated an intensive program of up to three months postpartum and hence may not be readily generalisable (MacArthur, Winter *et al.* 2002). Satisfaction findings were mixed. Women were either more satisfied with aspects of home visiting programs compared with control groups, or there was no difference in reported satisfaction with care. Cost comparison studies were inconclusive.

Table 18.1 Postnatal home visiting studies: maternal readmission or outpatients visit

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal readmission or outpatients visit</b>					
	(Sainz Bueno, Romano <i>et al.</i> 2005)	1999-2001	Spain	430 Standard care: 217 Home visiting: 213	There were no differences in maternal readmission between healthy women discharged >48 hours with no home visits, and women discharged <48 hours with home visiting
	<i>Level of evidence II</i>				
	(Boulvain, Perneger <i>et al.</i> 2004)	1998-2000	Switzerland	459 Hospital care: 231 Home care: 228	There were no differences in maternal readmission between healthy women who had hospital-based postnatal care for 4-5 days and women who were discharged <48 hours and received home visits by a midwife
	<i>Level of evidence II</i>				
	(Escobar, Braveman <i>et al.</i> 2001)	1998-1999	California, USA	1016 Outpatient care: 506 Home visit: 508	Among healthy women discharged <48 hours, there were no differences in maternal readmission or emergency outpatients visits between women who received a package of outpatient services, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				
	(Lieu, Braveman <i>et al.</i> 2000)	1996-1997	California, USA	1163 Outpatient care: 583 Home visit: 580	Among healthy women discharged <48 hours, there were no differences in maternal readmission or emergency outpatients visits between women who received a paediatric outpatient appointment, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				

Table 18.2 Postnatal home visiting studies: neonatal readmission or outpatients visit

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Neonatal readmission or outpatients visit</b>					
	(Paul, Phillips <i>et al.</i> 2004)	2000-2002	USA	2967 newborns Standard care: 2641 Home visit: 326	Compared with women who did not have home visiting, infants of women who received at least one home visit were less likely to: be readmitted with jaundice and/or dehydration (0.6% vs 2.8%) have an emergency outpatient visit (0 vs 3.5%)
	<i>Ungraded</i> (Sainz Bueno, Romano <i>et al.</i> 2005)	1999-2001	Spain	430 Standard care: 217 Home visiting: 213	There were no differences in neonatal readmission between healthy women discharged >48 hours with no home visits, and women discharged <48 hours with home visiting
	<i>Level of evidence II</i>				
	(Boulvain, Perneger <i>et al.</i> 2004)	1998-2000	Switzerland	459 Hospital care: 231 Home care: 228	Compared with women who had hospital-based postnatal care for 4-5 days, infants of women who were discharged <48 hours and received home visits by a midwife were more likely to be readmitted to hospital in the first 6 months (12% vs 4.8%) But no differences in readmissions to hospital in the first month postpartum
	<i>Level of evidence II</i>				
	(Escobar, Braveman <i>et al.</i> 2001)	1998-1999	California, USA	1016 Outpatient care: 506 Home visit: 508	Among healthy infants discharged <48 hours, there were no differences in neonatal readmission or emergency outpatients visits between infants of women who received a package of outpatient services, and infants of women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				
	(Lieu, Braveman <i>et al.</i> 2000)	1996-1997	California, USA	1163 Outpatient care: 583 Home visit: 580	Among healthy women discharged <48 hours, there were no differences in neonatal readmission or emergency outpatients visits between women who received a paediatric outpatient appointment, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				

Table 18.3 Postnatal home visiting studies: breastfeeding

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Breastfeeding</b>					
	(Sainz Bueno, Romano <i>et al.</i> 2005)	1999-2001	Spain	430 Standard care: 217 Home visiting: 213	Compared with healthy women discharged $\geq 48$ hours with no home visits, women discharged $< 48$ hours with home visiting had slightly increased breastfeeding rates at 3 months but no differences at all other timepoints
	<i>Level of evidence II</i>				
	(Boulvain, Perneger <i>et al.</i> 2004)	1998-2000	Switzerland	459 Hospital care: 231 Home care: 228	There were no differences in breastfeeding rates at 28 days, but women reported fewer problems and greater satisfaction with the help received
	<i>Level of evidence II</i>				
	(Escobar, Braveman <i>et al.</i> 2001)	1998-1999	California, USA	1016 Outpatient care: 506 Home visit: 508	Among healthy women discharged $< 48$ hours, there were no differences in breastfeeding rates between women who received a package of outpatient services, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				
	(Steel O'Connor, Mowat <i>et al.</i> 2003)	1997-1999	Canada	733 Group numbers not specified	Among healthy women discharged $< 48$ hours, there were no differences in breastfeeding rates between women who received a postnatal telephone call and women who received home visits by a public health nurse
	<i>Level of evidence II</i>				
	(Lieu, Braveman <i>et al.</i> 2000)	1996-1997	California, USA	1163 Outpatient care: 583 Home visit: 580	Among healthy women discharged $< 48$ hours, there were no differences in breastfeeding cessation between women who received a paediatric outpatient appointment, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>				
	(Morrell, Spiby <i>et al.</i> 2000)	1996-1997	UK	623 Standard care: 312 Home support: 311	There was no difference in breastfeeding rates between women who received standard postnatal care by a community midwife and women who also received support in the home by a community support worker.
	<i>Level of evidence II</i>				

Table 18.4 Postnatal home visiting studies: maternal health

Outcome	Study	Years of study	Country	N	Results
	<i>Statistically significant differences only are reported</i>				
<b>Maternal health</b>					
	(Sainz Bueno, Romano <i>et al.</i> 2005)	1999-2001	Spain	430	Compared with healthy women discharged >48 hours with no home visits, women discharged <48 hours with home visiting had no differences in anxiety and depression scores
	<i>Level of evidence II</i>			Standard care: 217 Home visiting: 213	no differences in “maternal fatigue”
	(Boulvain, Perneger <i>et al.</i> 2004)	1998-2000	Switzerland	459	No difference between groups for postnatal depression or physical health
	<i>Level of evidence II</i>			Hospital care: 231 Home care: 228	
	(Escobar, Braveman <i>et al.</i> 2001)	1998-1999	California, USA	1016	Among healthy women discharged <48 hours, there were no differences in maternal symptoms of depression between women who received a package of outpatient services, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>			Outpatient care: 506 Home visit: 508	
	(MacArthur, Winter <i>et al.</i> 2002)	1997-1999	UK	2064	Compared with women who received the standard home visiting regime, women who received the enhanced protocol-led home visiting by a midwife had lower EPDS and higher SF-36 mental health scores suggesting lower rates of postnatal depression.
	<i>Level of evidence II</i>			Standard home visiting: 977 Enhanced home visiting: 1087	
	(Lieu, Braveman <i>et al.</i> 2000)	1996-1997	California, USA	1163	Among healthy women discharged <48 hours, there were no differences in maternal depression symptoms between women who received a paediatric outpatient appointment, and women who received home visiting by a qualified nurse
	<i>Level of evidence II</i>			Outpatient care: 583 Home visit: 580	
	(Morrell, Spiby <i>et al.</i> 2000)	1996-1997	UK	623	There was no difference in physical functioning (SF-36 subscales) or postnatal depression symptoms between women who received standard postnatal care by a community midwife and women who also received support in the home by a community support worker.
	<i>Level of evidence II</i>			Standard care: 312 Home support: 311	

Table 18.5 Postnatal home visiting studies: satisfaction

Outcome	Study	Years of study	Country	N	Results
					<i>Statistically significant differences only are reported</i>
<b>Maternal satisfaction</b>					
	(Sainz Bueno, Romano <i>et al.</i> 2005) <i>Level of evidence II</i>	1999-2001	Spain	430 Standard care: 217 Home visiting: 213	Compared with healthy women discharged >48 hours with no home visits, women discharged <48 hours with home visiting were more likely to report they were "very satisfied" with their care (42.4% vs 11.2%)
	(Boulvain, Perneger <i>et al.</i> 2004) <i>Level of evidence II</i>	1998-2000	Switzerland	459 Hospital care: 231 Home care: 228	No difference between groups for satisfaction with care
	(Escobar, Braveman <i>et al.</i> 2001) <i>Level of evidence II</i>	1998-1999	California, USA	1016 Outpatient care: 506 Home visit: 508	Among healthy women discharged <48 hours, compared with women who received a package of outpatient services, women who received home visiting by a qualified nurse were more likely to rate all aspects of their postnatal care as excellent or very good
	(Steel O'Connor, Mowat <i>et al.</i> 2003) <i>Level of evidence II</i>	1997-1999	Canada	733 Group numbers not specified	Among healthy women discharged <48 hours, there were no differences in maternal parenting confidence between women who received a postnatal telephone call and women who received home visits by a public health nurse
	(Lieu, Braveman <i>et al.</i> 2000) <i>Level of evidence II</i>	1996-1997	California, USA	1163 Outpatient care: 583 Home visit: 580	Among healthy women discharged <48 hours, compared with women who received a paediatric outpatient appointment, women who received home visiting by a qualified nurse were more likely to rate their care as excellent or very good (80% vs 68%)
	(Morrell, Spiby <i>et al.</i> 2000) <i>Level of evidence II</i>	1996-1997	UK	623 Standard care: 312 Home support: 311	Compared with women who received standard postnatal care by a community midwife, women who also received support in the home by a community support worker were more likely to be satisfied with their support.

Table 18.6 Postnatal home visiting studies: cost comparison

Outcome	Study	Years of study	Country	N	Results
-					<i>Statistically significant differences only are reported</i>
<b>Cost comparison</b>					
	(Paul, Phillips <i>et al.</i> 2004)	2000-2002	USA	2967 newborns Standard care: 2641 Home visit: 326	Compared with infants who did not have home visiting, the average costs per infant of women who received at least one home visit were lower (\$109.80 vs \$118.70)
	<i>Ungraded</i> (Sainz Bueno, Romano <i>et al.</i> 2005)	1999-2001	Spain	430 Standard care: 217 Home visiting: 213	Compared with costs for healthy women discharged >48 hours with no home visits, costs for women discharged <48 hours with home visiting had a saving of 18.3%
	<i>Level of evidence II</i> (Petrou, Boulvain <i>et al.</i> 2004)	1998-2000	Switzerland	459 Hospital care: 231 Home care: 228	Overall early postnatal discharge combined with home midwifery support resulted in significant cost saving of 1221 Swiss francs per mother-infant dyad
	(Escobar, Braveman <i>et al.</i> 2001)	1998-1999	California, USA	1016 Outpatient care: 506 Home visit: 508	Among healthy women discharged <48 hours, compared with women who received a package of outpatient services, the home visiting program was more costly
	<i>Level of evidence II</i> (Steel O'Connor, Mowat <i>et al.</i> 2003)	1997-1999	Canada	733 Group numbers not specified	Among healthy women discharged <48 hours, compared with women who received a postnatal telephone call only, the home visiting program was more costly overall
	<i>Level of evidence II</i> (Lieu, Braveman <i>et al.</i> 2000)	1996-1997	California, USA	1163 Outpatient care: 583 Home visit: 580	Among healthy women discharged <48 hours, compared with a paediatric outpatient appointment, the home visiting program was more costly overall (\$255 per home visit vs \$120 per clinic visit)
	<i>Level of evidence II</i> (Morrell, Spiby <i>et al.</i> 2000)	1996-1997	UK	623 Standard care: 312 Home support: 311	Compared with standard postnatal care by a community midwife, additional support in the home by a community support worker was more costly but the increase was solely due to the cost of the support worker (£178.61)
	<i>Level of evidence II</i> (Malkin, Keeler <i>et al.</i> 2003)	1989-1990	USA	113,147 newborns	Among all newborns discharged <2 nights (vaginal delivery) or 4 nights (caesarean section), increasing the length of stay to at least 48 hours (vaginal births) and 96 hours (caesarean) was associated with significant savings because of newborn deaths averted
	<i>Ungraded</i>				

## Women with obstetric complications

There was only one study that assessed the effect of early postnatal discharge and home visiting on women with health complications (York, Brown *et al.* 1997). In that study, women who had been diagnosed in pregnancy with either diabetes or hypertension were randomly allocated to a control group in which women were given routine discharge programs or an early discharge/home visiting by nurse specialists. The nurse specialist also co-ordinated care with various support agencies and was available on-call to respond to the woman's and families concerns.

Early discharge was conditional upon women meeting protocol-driven medical criteria as well as demonstrating the ability to undertake self- and infant-health checks. That study also included an arm which received an antenatal intervention of early discharge with antenatal home visiting.

There were no differences between groups for functional status, with personal and social function improving with time in both groups (Table 19). There were no significant differences in the number of maternal or neonatal readmissions to hospital or emergency visits to outpatients. In addition, there was no difference in infant blood glucose levels for infants of diabetic mothers. There was however, a significant reduction in overall costs for the home visited group.

## Limitations of Evidence

Efficacy of postnatal discharge programs was confounded by a considerable heterogeneity of the postnatal care provided for study controls. Furthermore, the heterogeneity of standard care is likely to be a factor in the contradictory findings on cost-effectiveness. A comprehensive assessment of benefits of postnatal discharge was often not possible due to sample size limitations. When statistical power was sufficient to compare the overall number of adverse outcomes between the study groups, however, comparisons of individual adverse outcomes (i.e. maternal or neonatal readmissions) were inconclusive. Interpretation of disparate results between groups in maternal satisfaction requires further study.

The evidence on the efficacy of postnatal discharge programs in high-risk pregnancy is limited to one small RCT. Further studies are required to inform of the risks and benefits of this model of care for women with pre-existing medical and/or pregnancy complications.



*Evidence Based Summary Point*

In healthy women with term infants, early postnatal discharge within 48 hours of birth is not associated with any increase in adverse maternal or neonatal outcomes when women receive midwifery home visiting.

There is no evidence of improvements in breastfeeding or maternal health outcomes after early discharge with home visiting programs.

There are no additional benefits when compared to hospital-based postnatal follow-up programs.

Level of Evidence: I to III-3

*Evidence Based Summary Point*

A program of early postnatal discharge for women with gestational diabetes or pregnancy induced hypertension is not associated with any increase in adverse outcome providing the women are well educated about possible complications and they receive intensive home visiting by a qualified nurse or midwife. There are cost savings associated with this model of care:

Level of Evidence: II

Table 19 Postnatal home visiting study - high risk mothers and babies

Outcome	Study	Years of study	Country	N	Results
<i>Statistically significant differences only are reported</i>					
<b>Maternal readmission or outpatients visit</b>					
	(York, Brown <i>et al.</i> 1997)	Not specified	USA	96 Standard care: 52 Home visiting: 44	There were no differences in maternal readmission or emergency outpatients visits between women allocated to routine discharge and women allocated to receive early discharge with home visits and follow-up telephone calls
	<i>Level of evidence II</i>				
<b>Neonatal readmission or outpatients visit</b>					
	(York, Brown <i>et al.</i> 1997)	Not specified	USA	96 Standard care: 52 Home visiting: 44	There were no differences in neonatal readmission or emergency outpatients visits between women allocated to routine discharge and women allocated to receive early discharge with home visits and follow-up telephone calls No differences in infant blood glucose levels
	<i>Level of evidence II</i>				
<b>Maternal health</b>					
	(York, Brown <i>et al.</i> 1997)	Not specified	USA	96 Standard care: 52 Home visiting: 44	There were no differences in maternal physical and psychosocial health between women allocated to routine discharge and women allocated to receive early discharge with home visits and follow-up telephone calls
	<i>Level of evidence II</i>				
<b>Cost comparison</b>					
	(York, Brown <i>et al.</i> 1997)	Not specified	USA	96 Standard care: 52 Home visiting: 44	Compared with routine discharge, the costs for early discharge with home visits were significantly reduced by 44%.
	<i>Level of evidence II</i>				

## CONCLUSIONS

This evidence-based literature review was conducted in order to evaluate the evidence for models of maternity care that may be considered applicable to Western Australia. In general, for healthy women with low obstetric risk, compared with conventional hospital care, no additional adverse outcomes were identified for either community midwife-led, planned home birth; freestanding or in-hospital birth centres; continuity of care models such as team or caseload midwifery; or GP shared care. Where reported, women were generally more satisfied with any of these models compared with hospital care. Studies of cost effectiveness were inconclusive.

For carefully-selected women assessed to be at high risk of pregnancy complications, alternatives to conventional antenatal hospital clinic and/or admission such as either augmented, community-based antenatal care; in-home care with midwifery home visiting; or antenatal day stay hospital units were found to have no excess of maternal or neonatal adverse outcomes.

Studies of home visiting after early postnatal discharge were difficult to compare due to their heterogeneity. There were no adverse outcomes, nor were there any associated benefits.

### Overall limitations of the evidence

The evidence is limited by considerable shortfalls in the existing knowledge base, chiefly because of methodological problems. Uncontrolled studies were limited by a marked potential for selection bias, where women who chose alternative models of care such as home birth or birth centre care were inherently less likely to have pregnancy or birth complications due to their better background health.

On the other hand, randomised controlled trials were frequently compromised by small sample sizes. It was not possible to determine differences in rare outcomes such as perinatal mortality, and therefore primary outcomes of these studies were frequently limited to maternal satisfaction or labour outcomes. Furthermore, the considerable heterogeneity between studies for either interventions, comparison groups, or outcomes limits the possibility of conducting meta-analyses of studies.

In conclusion, this summary of the evidence published in peer-reviewed journals has identified substantial gaps in knowledge about models of maternity care. Future research preferably based in the local context may be necessary in order to formulate resolutions about the appropriateness of new models of maternity care.

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## APPENDIX 1. KEYWORDS USED IN LITERATURE SEARCH

Specific keywords entered into individual databases include the following. Keywords were entered singly or in combination as required.

### *MEDLINE*

Pregnancy/  
Pregnancy Outcome/  
Obstetrics/  
Midwifery/ or Nurse Midwives/  
Physicians, Family/  
Medical Staff, Hospital/  
Prenatal Care/  
Case Management/ or Community Health Nursing/ or Community Health Services/  
Comprehensive Health Care/  
"Continuity of Patient Care"/  
Pregnancy Complications/ or Pregnancy, High-Risk/  
Birthing Centers/  
Home Childbirth/  
Delivery Rooms/  
Hospitals/ or Hospitals, Maternity/ or Hospitals, Teaching/ or Hospitals, State/ or Hospitals, District/ or Hospitals, Rural/ or Hospitals, Public/ or Hospitals, County/ or Hospitals, Municipal/ or Hospitals, Community/ or Hospitals, General/  
Academic Medical Centers/  
"Obstetrics and Gynecology Department, Hospital".mp  
Ambulatory Care Facilities/ or Ambulatory Care/  
Outpatient Clinics, Hospital/  
Delivery, Obstetric/  
Infant, Newborn/ or Infant/  
Mothers/  
Maternal Health Services/ or Maternal-Child Nursing/ or Child Health Services/  
Postpartum Period/  
House Calls/ or Home Care Services/  
Remote Consultation/

Efficiency, Organisational/  
Cost-Benefit Analysis/  
health care costs/  
economics, medical/  
"Quality of Health Care"/ or Quality Assurance, Health Care/  
Safety/  
Consumer Satisfaction/ or Patient Satisfaction/  
Patient-Centred Care/  
Preconception Care/  
Risk Assessment/  
Practice Guidelines/

*EMBASE*

PREGNANCY/  
obstetrics/  
CHILDBIRTH/  
POSTNATAL CARE/  
Prenatal Care/  
COMMUNITY HEALTH NURSING/  
COMMUNITY MEDICINE/  
COMMUNITY CARE/  
Case Management/  
Health Care/  
Newborn/  
General Practice/  
Patient Care/  
Maternal Care/  
Primary Medical Care/  
MIDWIFE/ OR NURSE MIDWIFE/  
Medical Staff/  
High Risk Pregnancy/ or PREGNANCY DISORDER/ or PREGNANCY  
COMPLICATION/  
MATERNITY WARD/  
Home Delivery/  
NATURAL CHILDBIRTH/  
Outpatient Department/

Delivery Room/  
COMMUNITY HOSPITAL/ or GENERAL HOSPITAL/ or TEACHING  
HOSPITAL/ or HOSPITAL/  
Newborn/  
Child Health/  
MOTHER/  
MATERNAL WELFARE/ or MATERNAL CARE/  
Home Care/  
telehealth/ or telemedicine/ or teleconsultation/ or teletherapy/  
productivity/  
workload/  
economic evaluation/ or "cost benefit analysis"/ or "cost effectiveness  
analysis"/ or "cost minimization analysis"/  
health care quality/  
PATIENT SAFETY/ or SAFETY/  
SATISFACTION/ or PATIENT SATISFACTION/  
consumer/

#### *CINAHL*

PREGNANCY/  
CHILDBIRTH/  
OBSTETRICS/  
Outpatient Service/  
Obstetric Care/ or Maternal Health Services/  
Obstetric Nursing/  
Perinatal Nursing/  
NURSE-MIDWIFERY SERVICE/ or MIDWIFERY SERVICE/ or NURSE  
MIDWIFERY/ or MIDWIFERY/  
Physicians, Family/  
Primary Health Care/  
Maternal Health Services/  
Ambulatory Care/ or Ambulatory Care Nursing/  
Alternative Birth Centers/  
Community Health Nursing/ or Community Health Centers/ or  
Community Health Services/  
Case Management/

"CONTINUITY OF PATIENT CARE"/  
Pregnancy, High Risk/ or Pregnancy Complications/  
Obstetric Care/  
Delivery Rooms/  
Home Childbirth/  
Hospitals/ (obstetrics and gynecology).mp. [mp=title, subject heading  
word, abstract, instrumentation]  
Maternal-Child Nursing/  
Postnatal Period/  
Home Nursing, Professional/ or Home Health Care/  
Maternal-Child Care/  
Remote Consultation/  
Productivity/  
Health Care Costs/ or "Cost Benefit Analysis"/  
"QUALITY OF CARE RESEARCH"/ or "QUALITY OF HEALTH CARE"/  
Safety/  
Consumer Satisfaction/ or Patient Satisfaction/





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