Women's and Newborns' Health Network

# Models of Maternity Care: Updated Evidence on Outcomes and Safety of Planned Home Birth

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Government of **Western Australia**
Department of **Health**

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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).

**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.

**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.

**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 internal 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.

**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 car 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.

**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.

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

**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.

**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 usually provided by a qualified health professional.

**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.

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

**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.

**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 registered to practice midwifery and who provides care, advice and assistance during pregnancy, labour and birth, and after the baby is born.

**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.

**Obstetrician** – a doctor who specialises in the management and care of pregnant women and childbirth. An obstetrician has specialist education, training and experience and is a fellow of the RANZGOG. Obstetricians provide care in secondary, tertiary and private hospitals.

**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.

**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).

**Preterm labour** – labour occurring at less than 37 completed weeks of pregnancy.

**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.

***P*-value** – 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 (*see also* statistically significant 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.

**RANZCOG** – Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

**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 set of individuals or items selected from the study's target population so that the hypotheses about the population can be tested.

**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.

**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.

**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.

## Abbreviations

**APH** – antepartum haemorrhage

**CI** – confidence interval

**CTG** – cardiotocography

**gm** – grams

**ITT** – Intention to treat

**IPPM** – Intrapartum-related Perinatal Mortality

**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

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

## Executive Summary

This evidence-based literature review was undertaken to update the evidence on the safety of planned home birth. The project updated and re-evaluated the evidence regarding community-based midwifery-led care with planned home birth assisted by a qualified practitioner, usually a registered midwife.

The debate on safety of planned home birth continues in literature, policy and practice across the developed world. Difficulty in the evaluation of safety of home birth primarily relates to the limitations of evidence that exists in the literature. The evidence consists of observational studies of variable quality which are limited by the lack of appropriate comparison groups, non-representative samples of pregnancies, voluntary reporting of outcomes, small sample sizes and differences between the maternity care models. Since the last review (Henderson, Hornbuckle *et al.* 2007) several higher quality studies on the safety of planned home birth have been published. These studies involved large cohorts of pregnant women who at the onset of labour were assessed to be at low level of obstetric risk according to standard clinical guidelines.

This literature review considered the evidence on planned home birth compared with planned hospital birth. The outcomes examined included characteristics of women electing to have a home birth, maternal satisfaction, antenatal referrals to hospital care, intrapartum and postpartum transfers to hospital, interventions in labour, and neonatal outcomes. The most important outcome considered was perinatal mortality, often reported separately as intrapartum mortality, stillbirth and neonatal death.

With no evidence of adverse outcomes associated with planned home birth in low risk pregnancy, this updated review shows that planned home birth with a qualified home birth practitioner is a safe alternative for women determined to be at low risk pregnancy complications 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 a smooth transition to hospital care in the case of complications. For women who are **not** determined to be **at low risk**, particularly at the onset of labour, there appears to be an excess neonatal morbidity and mortality associated with actual home birth.

Level of evidence: III-2 to IV

# 1 Review Aims

We have previously reviewed the evidence on models of maternity care including homebirth (Henderson, Hornbuckle *et al.* 2007). The original review was undertaken to assist with evidence-based planning for *Improving Maternity Services: Working Together Across Western Australia* (Department of Health 2007). 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. The review evaluated the evidence on community-based midwifery with planned home birth as one of the models of care, and concluded that it is a safe model of care for women at low obstetric risk by established screening criteria.

The debate about the safety of home birth continues in literature, professional policy and practice. Difficulty in the assessment of safety of home birth primarily relates to the limitations of evidence that exists in the literature. Robust and unbiased safety comparisons between the planned home births and planned hospital births require representative samples of appropriately selected women and who received appropriate level of care, for example pregnant women who planned for home or hospital birth should be at low risk of pregnancy complications determined by established obstetric management guidelines. Pregnancy care in women who planned home birth should be provided by registered midwife practitioners operating within clearly defined clinical guidelines, with links for referrals and transfers of care at any stage of pregnancy and birth should the pregnancy no longer be considered at low risk. Women with planned hospital birth may receive hospital or community based antenatal care with the expectation that the birth will occur in either a birth centre or hospital setting. Outcome comparisons between planned home birth and planned hospital birth should be performed according to the planned, not actual, birth setting. The failure to exclude any unplanned home births will overestimate the risk of adverse outcomes (Declercq, Paine *at al.* 1995), while the failure to exclude planned home births that occurred in hospital after intrapartum transfer will underestimate the risk of adverse outcomes in the planned home birth. Prospective studies that compare planned home and hospital births are often based on small samples of pregnancies and too small to detect any differences in rare adverse outcomes such as perinatal mortality, while several reported large sample size studies that used birth registry data are likely to have a limited ability to completely distinguish between planned, unplanned and actual home births.

Several new studies have reported comparisons between planned home and planned hospital births since the last review. The current update of the evidence was conducted to re-evaluate the evidence of safety of planned home birth intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife. With the international debate on safety of planned home birth ongoing along with the desire to provide quality evidence on the planned birth setting, more recent studies involve large pregnancy cohorts more precisely assessed for low level of obstetric risk at onset of labour, where care is provided by qualified health practitioners.

This update of the literature follows the same format as the original review. The evidence includes reports from developed countries with comparable obstetric populations and outcomes (Canada, Netherlands, Sweden, UK, USA and Australia). The report combines the data from both reviews and covers the time period between

1996 and January 2011. Several research studies published prior to 1996 and recent small descriptive studies of home birth were also reviewed since they report on home births in Australia.

## 1.1 Literature search strategy

A comprehensive search of the electronic databases MEDLINE, EMBASE and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) was conducted to identify relevant articles published from January 2007 to December 2010. The search was limited to keywords including 'home childbirth', 'home birth', 'home delivery', 'booked/intended/planned home birth' and 'perinatal mortality'. Additional limits to English language publications and human studies were imposed on the keyword search.

A total of 57 citations were identified in the initial search. Studies were excluded after review of title and/or abstract if they were not conducted in developed Western countries, did not use a quantitative methodology in order to evaluate maternal and perinatal outcomes associated with home births and were not published in peer-reviewed literature. Reference lists from each reviewed article were also manually scanned for additional relevant research studies. A total of 13 papers were eligible, a further 4 studies were excluded after detailed evaluation, leaving 9 studies for final review in this report. All research studies included in this review were peer-reviewed quantitative comparisons of pregnancy outcomes between planned home and planned hospital births. All studies differentiated between planned and unplanned home births, although several studies also reported their inability to precisely distinguish between planned and unplanned home births as one of the study limitations and possible source for bias. All articles deemed to be relevant were reviewed independently by a minimum of two of the reviewers.

In the original review of evidence (Henderson, Hornbuckle *et al.* 2007), a total of 48 studies identified evaluating home birth were identified, 28 studies were excluded after initial review and 20 studies were retained for final review. The current update includes the review of 9 further studies giving a total of 29 studies that evaluated safety of planned home birth.

### 1.1.1 Study exclusion criteria

In the current literature review 57 research articles on home birth were published between January 2007 and December 2010, and 48 manuscripts identified in the literature search were excluded from the review. These articles were excluded if they were non-English, non-research articles, not published in peer-reviewed journals, available as abstracts only, qualitative assessments of home birth only, or if they were limited to descriptive data on home births and lacking comparisons with hospital births. Studies with major methodological flaws were also excluded from the review.

Articles published only in abstract form, such as 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. Publications that used a qualitative study design were excluded from the review.

While it is acknowledged that qualitative research studies offer valuable insight into the experience of women planning home birth, these studies provide information regarding reasons for planning home birth but not evidence for evaluation of safety of home birth.

### 1.1.2 Studies included in the review

The review update included studies that evaluated the outcomes of planned home births, irrespective of the actual place of birth, and included a comparison group in which the birth was planned in a hospital. Planned home and planned hospital birth groups were as comparable as possible, that is, the majority of women in both groups were at low obstetric risk at booking. Studies that controlled for differences between the comparison groups in the statistical analysis were also included. The recently published articles for review included five retrospective cohort studies, one retrospective case series, and one prospective comparative study.

In the original review of evidence (Henderson, Hornbuckle *et al.* 2007), the majority of studies were retrospective, observational studies with three prospective cohort studies. There was 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).

### 1.1.3 Studies reviewed but excluded from the review update

Research studies 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 often not recorded. 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). The inclusion of such studies would mask any putative positive outcomes of planned home births or worsen the apparent incidence of any adverse outcomes. Studies excluded because of the inability to distinguish between planned and unplanned home birth include a large US retrospective cohort of 745,690 births (Wax, Pinette *at al.* 2010), and a Swedish case-control study report (Hildingsson, Lingren *et al.* 2006).

A UK based study from Scotland that evaluated differences between pregnancy outcomes in planned home births among women who chose pregnancy care provided by independently practicing midwives and women who received the National Health Service (NHS) maternity care (Symon, Winter *at al.* 2009) was excluded after review. In this study, the outcomes for women under NHS maternity care included home and hospital births. Despite the limitation of this study, the clinical outcomes compared are of interest in our review. The outcomes concerning normal birth, spontaneous labour and perineal trauma were significantly better in the home birth pregnancies assisted by independently practising midwives. The perinatal mortality was similar between home birth with the independent midwives and NHS maternity care in low risk pregnancies. However, for planned home birth assisted by independent midwives, perinatal mortality was significantly worse in pregnancies that were at high risk (multiple pregnancy) or became high risk (breech presentation) compared to those considered low risk when cared for in the same model.

The recently published meta-analysis of observational studies comparing planned home birth versus planned hospital birth was excluded after review (Wax, Lucas *et al.* 2010). Wax *et al.* (2010) performed a meta-analysis of 12 studies reporting on pregnancy outcomes that occurred between 1976 and 2006. The meta-analysis concluded no differences in perinatal mortality, but significantly increased neonatal mortality for planned home birth.

This meta-analysis has several methodological flaws that are particularly important when combining results from observational studies where matching for confounders is not likely to be adequate. In such instances, a detailed evaluation of quality of all studies is essential; this was not sufficiently described in the manuscript. Moreover, not all studies were included in analyses of perinatal mortality as reporting of perinatal mortality differed across studies. Wax *et al.* (2010) evaluated neonatal deaths using 6 observational studies that reported neonatal deaths until 28 days of age (Woodcock, Read *et al.* 1994; Ackermann-Liebrich, Voegli *et al.* 1996; Janssen, Lee *et al.* 2002; Pang, Heffelfinger *et al.* 2002; Lindgren, Radestad *et al.* 2008). The authors also appear to have included another study that reported neonatal mortality (Hutton, Reitsma *et al.* 2009), but this was not explicitly stated in the review. The neonatal mortality data were available mainly from small studies, and one large retrospective study of birth registry data where unplanned home births may have been misclassified as planned births because birth certificates used in the study may have not distinguish between all planned and unplanned births, and where the qualification of birth attendant was not always known (Pang, Heffelfinger *et al.* 2002). Other large studies included in the meta-analysis of maternal and neonatal outcomes (de Jonge, van der Goes *et al.* 2009; Janssen, Saxell *et al.* 2009) were not included in the evaluation of neonatal mortality. De Jonge *et al.* (2009) only reported neonatal deaths within the first 24 hours and 7 days after birth, Janssen *et al.* (2009) only reported perinatal mortality. Both studies present the data on recent planned home birth outcomes within the Canadian and Dutch midwifery-led care for low risk women and provide best evidence for the Australian setting.

The publication of the meta-analysis by Wax *et al.* (2010) was followed with several editorials commenting on risks of home birth (such as the Lancet editorial: *'Home birth - proceed with caution'*, 2010) and critiques of the study limitations and validity of its conclusions (e.g. Gyte, Dowell *et al.* 2010; Keirse 2010). One of the crucial questions raised is whether meta-analysis is a correct tool for analysis of observational studies that describe planned home birth within very different healthcare systems (Keirse 2010).

The present review update excludes the meta-analysis by Wax *et al.* (2010) given its methodological limitations and questionable external validity; however, it includes 9 of the 12 studies used by Wax *et al.* (2010) with the exceptions of the US study conducted between 1976 and 1982 (Koehler, Solomon *et al.* 1984), the UK study conducted between 1976 and 1982 (Shearer 1985) both deemed not sufficiently recent even at the time of our original review (Henderson, Hornbuckle *et al.* 2007). The failed randomised trial attempted in 1995 in the UK abandoned after recruiting 11 women has also been excluded for this review (Dowswell, Thornton *et al.* 1996).

### 1.2 Assessment of methodological quality of included studies

Evidence published in peer-reviewed journals that evaluated home births was of mixed quality. There was considerable variability in the quality study designs and outcomes in the identified studies.

Evidence of planned home birth safety is based on observational studies. Randomised controlled trials of planned home birth versus planned hospital birth were shown to be unfeasible because of strong preferences for either a home or hospital birth by potential recruits which precluded the possibility of randomisation (Dowswell, Thornton *et al.* 1996). Since the last review, an attempt to conduct a randomised controlled failed in the Netherlands as the women were unwilling to be allocated place of birth at random because of strong preference for either home or hospital setting (Hendrix, Van Horck *et al.* 2009).

The initial review of home births included observational studies evaluating pregnancies that occurred until year 2000 and published until 2006. The current review adds research studies comparing outcomes in pregnancies that occurred between 2000 and 2006 and published until 2010.

All studies included in this review, non-randomised comparative studies and patient series, were assessed for their methodological quality. Assessment of research studies followed recommendations for developers of guidelines (NHMRC 2007) with modifications appropriate for a literature review. Three dimensions of the evidence strength were assessed:

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

### 1.2.1 Level of evidence

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

**Table 1. NHMRC 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:<br>▪ Non-randomised experimental trial<br>▪ Cohort study<br>▪ Case-control study<br>▪ Interrupted time series with a control group |
| III-3 | Comparative study without concurrent controls:<br>▪ Historical control group<br>▪ Two or more single arm study<br>▪ Interrupted time series without parallel control group |
| IV | Case series with either post-test or pre-test/post-test outcomes |

Based on NHMRC levels of evidence for intervention (NHMRC 2007).

### 1.2.2 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)
- Completeness of follow-up
- Any other feature of study designs that may have introduced bias.

### 1.2.3 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 and government reports on patient outcomes (level of evidence > IV) were included in the review without formal tabulation of quality assessments.

# 2 Summary of Evidence Evaluating Planned Home Birth

Less than 1% of women in Australia 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 3% 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 Canada and USA, the incidence of home births continues to rise. The controversy about the safety of births at home is ongoing. This review evaluates the evidence regarding the safety of planned home births.

## 2.1 Description of the home birth model of maternity care

Planned home birth refers to births that are intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife. Generally, women who plan home birth are at low risk of obstetric complications. The definition of low obstetric risk is often defined within established clinical management guidelines and most often includes women without medical complications, such as hypertension or diabetes, and with an uncomplicated pregnancy, gestational age 37 to 41 weeks at onset of labour, with a single fetus with a vertex presentation.

In countries where planned home births are endorsed, such as the Netherlands, the independent practising midwives only provide home birth care to women at low risk at onset of labour as defined by the Obstetric Manual of classification of referrals to secondary or tertiary care (Amelink-Verburg, Verloove-Vanhorick *et al.* 2007).

In Canada, the midwifery-led maternity care with an option for planned home or hospital birth is provided by the registered midwives that operate with a single-payer universal health care system within a province (British Columbia: Janssen, Saxell *et al.* 2009; Ontario: Hutton, Reitsma *et al.* 2009). For example in British Columbia and Ontario midwifery care is funded by the provincial Ministry of Health and is accessible to all women in the province who meet the eligibility criteria for low obstetric risk defined by the provincial Colleges of Midwives including descriptions of mandatory transfers to obstetric care.

In Western Australia, pregnant women can access community-led midwifery care with planned home birth through Community Midwifery WA (CMWA) that operates within the WA Public Health system or with a privately practising midwife (PPM). All practising midwives must be registered with the Australian Health Practitioners Regulatory Authority (AHPRA). PPMs who wish to supervise home births must give notification of their intention to practice to the WA Director of Public Health. CMWA midwives are employees of the WA Department of Health and follow clear guidelines with inclusion and exclusion criteria to ensure that home birth within the publically funded home birth program is only available to women at low risk of obstetric complications. There is no legislation that dictates that only women with low risk of complication may choose home birth with a PPM (referred to as IPMs, Independent Practicing Midwives, in the review of home births; Department of Health WA 2008).

## 2.2 Outcomes compared between planned home and hospital birth.

In this review, planned home births did not include births that were not attended by a qualified practitioner or unplanned births at home. Eligibility criteria for planned home birth in the reviewed studies 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. In several reviewed studies, no formal inclusion/exclusion criteria for planned home birth were defined and home births did not represent a homogenous group of pregnancies at low risk of complications (for example Kennare, Keirse *et al.* 2009).

Comparison groups in the evaluated studies included women of similar 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. Assessment of quality of studies included in this review is shown in Table 2 (page 11). Summaries of models of care compared in each study and definitions of obstetric populations under evaluation are summarised in Table 3 (page 20).

This review of evidence on home birth assessed the following pregnancy outcomes:

- Characteristics of women electing home birth
- Maternal satisfaction
- 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, often reported as intrapartum mortality, stillbirth and neonatal death.

**Table 2. Levels of evidence and obstetric risk assessed in the reviewed studies.**

| Research publication | Total N | Study design | Obstetric Risk | Level | Study Quality | Analysis Quality |
|---|---|---|---|---|---|---|
| **Pregnancy outcomes** | | | | | | |
| Hutton, Reitsma *et al.* 2009† | 13,384 | R cohort | L | III-2 | medium | medium |
| Janssen, Saxell *et al.* 2009† | 12,982 | R cohort | L | III-2 | high | high |
| Lindgren, Radestad *et al.* 2008† | 12,238 | R cohort | L | III-2 | medium | medium |
| Anthony, Buitendijk *et al.* 2005 | 191,471 | R cohort | L | III-3 | high | high |
| Johnson and Daviss 2005 | 5,418 | P case series | S | IV | high | high |
| Janssen, Lee *et al.* 2002† | 2,176 | P cohort | L | III-2 | medium | medium |
| Pang, Heffelfinger *et al.* 2002† | 17,086 | R cohort | L | III-3 | medium | medium |
| Murphy and Fullerton 1998 | 1,404 | P case series | A | IV | high | medium |
| Wiegers, van der Zee *et al.* 1996 | 1,836 | P cohort | L | III-2 | medium | medium |
| Ackermann-Liebrich, Voegli *et al.* 1996 | 874 | P comparative | A | III-2 | medium | low |
| Woodcock, Read *et al.* 1994† | 3,904 | R cohort | S | III-2 | high | medium |
| Woodcock, Read *et al.* 1990 | 995 | R case series | S | IV | medium | medium |
| Crotty, Ramsay *et al.* 1990 | 799 | R case series | A | IV | medium | medium |
| Howe 1988 | 165 | R case series | A | IV | low | low |
| **Perinatal mortality** | | | | | | |
| de Jonge, van der Goes 2009 | 529,688 | R cohort | L | III-2 | high | high |
| Kennare, Keirse *et al.* 2009 | 300,011 | R cohort | A | III-2 | high | medium |
| Mori, Dougherty *et al.* 2008 | 6,314,315 | R case series | A | IV | low | low |
| Wolleswinkel-van den Bosch, Vredevoogd *et al.* 2002 | 342 | R comparative | L | III-3 | low | low |
| De Reu, Hijhuis *et al.* 2000 | 8,509 | R case series | A | IV | high | medium |
| Bastian, Keirse *et al.* 1998 | 7,002 | R case series | A | IV | medium | medium |
| Northern Region Perinatal Mortality Survey 1996 | 2,888 | R case series | A | IV | medium | medium |

† Outcomes reported include perinatal mortality. R=retrospective; P=prospective.

Obstetric Risk: L= low risk defined by the local criteria; A=no definition of risk level; S=singleton pregnancies only, with or without additional criteria for term pregnancy or non-anomalous fetus or breech presentation.

Assessment of evidence quality was formally performed for two studies of maternal satisfaction (Wiegers 2009; and Christiaens and Bracke 2009), and one Australian descriptive study of the first 100 women booked for home birth (McMurtrie, Catling-Paul et al. 2009).

## 2.3 Maternal characteristics of women planning home birth

Women who planned home birth tended to have different demographic characteristics compared with women who elected hospital birth. Summary of the statistically significant differences between women who planned home birth and those who planned hospital birth is shown in Table 4 (page 25).

Multiparity was the single maternal characteristic reported by all studies that was more frequent in women with planned home birth with the exception of one small Australian study (Crotty, Ramsay *et al.* 1990). Women who planned for home birth were significantly older in the majority of reviewed studies although maternal age was not recorded in all studies. Other characteristics with statistically significant differences between women who elected home and hospital births included ethnicity, education level, socio-economic status, type of occupation, employment, smoking during pregnancy and BMI.

Women who planned home birth were more likely to be Caucasian, have higher socio-economic status, higher level of education attained, currently employed, have normal weight and be non-smokers. In studies from the Netherlands where 30% of women deliver at home (Anthony, Buitendijk *et al.* 2005; de Jonge, van der Goes 2009), the women who planned home birth were more likely to be of Dutch origin, and were also less likely to be living in large cities (Anthony, Buitendijk *et al.* 2005). In Sweden, where less than 1% women plan home birth, women who planned home birth were more likely to be born in a European country other than Sweden (Lindgren, Radestad *et al.* 2008).

## 2.4 Maternal satisfaction

Four studies evaluated maternal satisfaction with planned home compared to planned hospital birth (Table 5, page 27). For women who had uncomplicated births, women who had planned a home birth were found to have a higher level of satisfaction. Furthermore, unanticipated transfer to hospital did not lessen women's satisfaction with the experience (Wiegers, van der Zee *et al.* 1998). Another study found high levels of satisfaction in all groups, while 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 (Janssen, Carty *et al.* 2006). A recent study that investigated satisfaction with planned setting for childbirth in the context of two maternity care systems in Belgium and Netherlands, also found that women who planned home birth reported higher levels of satisfaction than women who planned hospital birth (Christiaens and Bracke 2009). In addition, Belgian women reported higher satisfaction with maternity care than Dutch women irrespective of planned birth setting. Evaluation of satisfaction with overall quality of care received in different settings by different care providers during pregnancy and birth in the Netherlands indicated high satisfaction levels reported for all pregnancy and birth care settings (Wiegers 2009). However, the most important factor that increased reported quality of care scores during labour and birth was being assisted by their own midwife and knowing their care provider.

## 2.5 Transfers of care

Most of the studies evaluated outcomes of planned home birth for pregnancies where the onset of labour occurred at home, and therefore very limited information was available on antenatal transfers of care. Summary of transfers reported by the seven reviewed studies is presented in Table 6 (page 28).

Three studies evaluated the proportion of women who were referred to hospital care during pregnancy with 7.4%, 10% and 30% of women initially booked for home birth referred out of home care before the commencement of labour (Murphy and Fullerton 1998; Woodcock, Read *et al.* 1990; McMurtrie, Catling-Paul *et al.* 2009). Reasons for antenatal referral included preterm labour or preterm prelabour rupture of membranes (PPROM), fetal malpresentation (breech), multiple gestation, antepartum haemorrhage (placenta praevia), and medical problems such as hypertension.

Seven studies reported the rates of transfer of women who had commenced labour at home. The proportion of women transferring during 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 ranged between 0.7% and 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 1.4% of home births, with the most common reasons being respiratory problems or evaluation of anomalies.

Three studies only reported the proportion of women who elected planned home birth and who successfully birthed at home, ranging between 69.4% and 78.8% (Kennare, Keirse *et al.* 2009*;* Janssen, Saxell *et al.* 2009; Crotty, Ramsay *et al.* 1990).

## 2.6 Obstetric interventions and adverse outcomes during labour and birth

Summaries of reported statistically significant differences between obstetric interventions in labour are shown in Table 7 (page 30). All studies reported fewer obstetric interventions during labour and birth for women who planned home birth. Compared with women who planned hospital birth, women who planned home birth were less likely to:

- require induction (4.3%-5% vs 16%-22.3%);
- require analgesia (7.7%-14.1% vs 27.6%-48.7%);
- have an assisted vaginal delivery (2.0%-4.4% vs 4.4%-13.8%);
- have a caesarean section (2.0%-6.4% vs 13.6%-19%);
- have an episiotomy (1.0%-15.8% vs 5.9%-76.5%).

Two recent studies also reported a significantly lower requirement for augmentation of labour either by the artificial rupture of membranes (ARM) or using oxytocin (ARM: 19.3%-22.4% vs 28.2%-39.6%; and oxytocin: 5.9%-8.2% vs 13.1%-18.4% for home births and hospital births respectively) (Hutton, Reitsma *et al.* 2009*;* Janssen, Saxell *et al.* 2009).

A significant reduction in blood loss greater than 500 ml from 11.3% to 9.2% was associated with planned home birth (Hutton, Reitsma *et al.* 2009). Lower rates of 3rd or 4th degree perineal tears, vaginal tears, and sphincter or rectal ruptures were reported in two recent studies (Lindgren, Radestad *et al.* 2008; Janssen, Saxell *et al.* 2009).

## 2.7 Neonatal outcomes

Main neonatal outcomes considered in the reviewed studies included Apgar scores, requirement and/or methods of resuscitation, and admission to a neonatal intensive care unit (NICU). Several studies also evaluated the incidence of birthweight <2500 gm (Hutton, Reitsma *et al.* 2009; Janssen, Lee *et al.* 2002; Woodcock, Read *et al.* 1994). The birthweight<2500 gm was not interpreted as resulting of a birth setting, but an indicator of a failure to adequately screen for extremes of birthweight and to plan for appropriate birth setting (Hutton, Reitsma *et al.* 2009; Janssen, Lee *et al.* 2002).

Reported differences in neonatal outcomes varied between the review studies. Summaries of significant differences in neonatal outcomes reported are shown in Table 8 (page 32).

Several studies reported better neonatal outcomes in planned home birth including:

- lower rates of 1-minute Apgar scores <7 (Hutton, Reitsma et al. 2009; Janssen, Saxell et al. 2009),
- higher mean 5-minute Apgar scores (Ackermann-Liebrich, Voegli et al. 1996),
- lower rates of 5-minute Apgar scores<8 (Woodcock, Read et al. 1994),
- significantly lower incidence of birth trauma (Janssen, Saxell et al. 2009; Woodcock, Read et al. 1994),
- less resuscitation required at birth (Janssen, Saxell et al. 2009; Janssen, Lee et al. 2002; Woodcock, Read et al. 1994),
- lower rates of birthweight < 2500 gm (Janssen, Saxell et al. 2009; Janssen, Lee et al. 2002; Woodcock, Read et al. 1994).

No differences between the neonatal NICU admissions were found in any of the reviewed studies.

All studies except one (Pang, Heffelfinger *et al.* 2002) found no differences or found favourable neonatal outcomes for planned home birth. Pang *et al.* (2002) found higher rates of adverse neonatal outcomes in the home birth group (5-minute Apgar scores≤3: 0.4% vs 0.2%, and assisted ventilation for longer than 30 minutes: 0.3% vs 0.2% for home and hospital births respectively). 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 and some home births may have not been supervised by a qualified birth attendant. Consequently many of the adverse outcomes may have occurred in women who did not plan to deliver at home (detailed critique by Vedam 2003).

## 2.8 Perinatal mortality

Perinatal mortality was assessed overall or was reported as intrapartum mortality, stillbirth and neonatal death (Table 9, page 34). Different mortality indices were reported in different studies. Several studies only reported perinatal mortality either including neonatal deaths in the first 28 days (Janssen, Saxell *et al.* 2009; Murphy and Fullerton 1998) or including neonatal deaths within the first 24 hours or first 7 days of life (de Jonge, van der Goes *et al.* 2009). Some studies reported stillbirth and perinatal mortality (Janssen, Lee *et al.* 2002; Hutton, Reitsma *et al.* 2009; Lindgren, Radestad *et al.* 2008) while others concentrated on intrapartum deaths (Kennare, Keirse *et al.* 2009; Mori, Dougherty *et al.* 2008).

All reviewed studies found no differences in stillbirths (where compared) nor in perinatal mortality between planned home and hospital births.

Two studies reported significantly increased risk of intrapartum mortality associated with home birth (Kennare, Keirse *et al.* 2009; Mori, Dougherty *et al.* 2008). However, the strength of this evidence must be considered in the context of the limitations in both studies.

The increase in intrapartum deaths reported by Mori *et al.* (2008) was based on the evaluation of intrapartum deaths in pregnancies at varying levels of obstetric risk (detailed discussion reported by Gyte, Dodwell *et al.* 2009). The investigators were unable to distinguish between unplanned or planned home births, or to adjust for clinical risk factors and therefore the association between planned home birth and increased intrapartum mortality may have been spurious.

Kennare *et al.* (2009) found no difference in perinatal mortality overall (RR=1.38 95%CI 0.56-3.41), and planned home birth was associated with an increased risk of intrapartum death (RR=1.8, 95%CI 1.53-35.87). This increase in was found in a small number of cases only, therefore the estimate has a wide confidence interval limiting the interpretation of the data. The study evaluated planned home births between 1991 and 2006 before the introduction of the Policy for Planned Home Birth in South Australia, and all comparisons were based on pregnancies at all levels of obstetric risk.

The investigators reviewed all 9 perinatal deaths that occurred in planned home births. Out of 9 deaths in the planned home birth group, 4 deaths were considered unavoidable regardless of birth setting, 2 deaths occurred in pregnancies where the women were not low risk at booking and 2 deaths occurred in pregnancies where the woman declined intervention when their low risk status changed. Contributing factors such as post-term pregnancy, twin pregnancy, and inadequate surveillance during labour have been identified as responsible for excess mortality in other home birth studies (Bastian, Keirse *at al.* 1998). Kennare *et al.* (2009) concluded that adherence to the Policy for Birth at Home would most likely avoid such perinatal deaths. This study is a significant source of Australian data on home births, and it illustrates the importance of ongoing risk assessment and transfers to hospital care.

One study found a statistically significant increase in risk of neonatal death associated with home birth (Pang, Heffelfinger *et al.* 2002). As already discussed in the section on neonatal outcomes (page 14), the findings from this study should be viewed with caution because of the high likelihood of false classification of unplanned home births as planned, and the inability to differentiate the type of birth attendant, including unqualified birth attendants (discussed by Vedam 2003). The possibility that

many of the adverse outcomes may have occurred in women who did not plan to deliver at home needs to be considered while evaluating the strength of this evidence provided by this study.

The most recent large studies conducted in the Netherlands (de Jonge, van der Goes *et al.* 2009) and Canada (Janssen, Saxell *et al.* 2009; Janssen, Lee *et al.* 2002) found no excess perinatal mortality to be associated with planned home birth. In these studies, the pregnancy and birth care was offered to the women who plan home birth by practising midwives under the clearly defined management guidelines for screening of pregnancy. All women who planned home birth were at low risk of pregnancy complications at booking and all transfers of care followed standard guidelines.

## 2.9 Limitations of the evidence

Comprehensive comparisons of pregnancy outcomes between planned home birth and hospital birth are subject to many methodological limitations. All evidence is based on observational studies, as the randomisation of women was unfeasible. 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. Women who choose home birth are likely to have different characteristics to those low-risk women who deliver at a hospital, therefore definitive conclusions from any non-randomised studies require analyses that account for these differences in the background characteristics and events during pregnancy, and this is often difficult to achieve in practice.

Reviewed studies were conducted in several developed countries where different models of maternity care offered, and where the assessment of obstetric risk varied across studies. In some instances the pregnancies compared were all uniformly at low risk, with transfers of care instigated according to management guidelines, and with both groups, planned home and planned hospital births representing low risk pregnancies, while other studies used surrogate measures for low risk such as singleton term pregnancies.

In prospective studies with well selected controls that minimised selection bias, sample sizes were too small to fully assess morbidity and mortality associated with home birth. Larger comparative studies were retrospective, and some of these studies were limited by the inability to comprehensively distinguish between planned and unplanned place of birth or the inability to control for patient characteristics and level of obstetric risk. In studies without mandatory reporting of all births, the compared home and hospital births may have been non-representative of the true obstetric population. The considerable heterogeneity between studies in terms of operating health care models, comparison groups and compared outcomes limits the possibility of conducting meta-analyses of these studies. An important issue to consider is whether the evidence obtained from large sample studies conducted in a health care system that resembles the local circumstances will offer superior evidence over evidence from meta-analysis averaging over dissimilar systems of maternity care. As described in study inclusion/exclusion criteria (page 5), the recently performed meta-analysis that was rejected as a source of conclusive evidence due to the methodological limitations (Wax, Lucas *et al.* 2010).

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. As the evidence regarding planned home births accumulates and the quality of studies improves with more clearly defined levels of risk and use of clear guidelines for consultation and transfer, outcomes including intrapartum, neonatal or perinatal mortality will require re-evaluation.

## 2.10 Evidence in context of WA Health

In the most recent large studies conducted in the Netherlands (de Jonge, van der Goes *et al.* 2009) and Canada (Janssen, Saxell *et al.* 2009; Janssen, Lee *et al.* 2002), pregnancy and birth care were offered to women who plan home birth by qualified, practising midwives under the clearly defined management guidelines for screening in pregnancy. All women who planned home birth were at low risk of pregnancy complications at booking and all transfers of care followed standard guidelines. These studies have been conducted within maternity services similar to that operating within WA Health. The findings of these studies can therefore be generalised to the setting currently in practice in Western Australia.

The studies reporting an increased risk of intrapartum mortality and neonatal mortality for planned home birth were not limited to low-risk pregnancies alone. They are therefore not directly applicable to the WA Health publicly funded home birth program where there are clear inclusion and exclusion criteria for women accessing the program along with clear transfer criteria should the woman's level of obstetric risk change during the pregnancy, labour or birth.

WA has a publicly funded model of planned home birth with community-based midwifery care that has clear guidelines of acceptance into the program and transfers for hospital based care where required. The present review shows that this model of care can be considered to be safe for women at low risk of adverse pregnancy outcomes. For this group of women the evidence shows high levels of satisfaction with care, low rate of obstetric interventions such as caesarean delivery, and comparable neonatal outcomes to similar low risk women having a planned hospital birth.

## Conclusions

In summary, women who planned a home birth were generally older, better educated, of more 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).

The evidence shows that for women who are not defined as at low risk, particularly at the onset of labour, there appears to be an excess neonatal morbidity and mortality associated with home birth.

*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.

The evidence shows that for women who are not determined at low obstetric risk, particularly at the onset of labour, there appears to be an excess neonatal morbidity and mortality associated with home birth.

Level of Evidence: III-2 to IV

**Table 3. Characteristics of maternity care model in the reviewed studies.**

| Country<br>Research publication | Model of care<br>Source of data | Home birth care provider | Hospital care provider | Inclusions/Exclusions |
|---|---|---|---|---|
| **The Netherlands** | Health care is free and access to the national health insurance system is universal. Independent primary care midwives provide care to low risk women who may choose to birth at home or in hospital. Home birth care is only provided to women deemed low risk at the onset of labour as defined by the Obstetric Manual of classification of referrals to secondary or tertiary care. If risk factors arise during pregnancy, labour or postpartum, women are referred to an obstetrician for secondary care. Women with normal pregnancies and births are not reimbursed for specialist care. | | | |
| de Jonge, van der Goes 2009 | Dutch national perinatal database (M) | Independent primary care midwife | Independent primary care midwife<br>Obstetrician | Excludes GA<37 and GA>42 wks, multiple births, pre-existing medical conditions or obstetric risk factors, prior CS, breech presentation.<br>Also excludes prolonged ROM >24 hrs without contractions, intrauterine death before onset of labour, and congenital abnormality. |
| Anthony, Buitendijk *et al.* 2005 | Dutch national perinatal registry (M) | Independent primary care midwife | Independent primary care midwife<br>Obstetrician | Includes all women deemed low risk at commencement of pregnancy.<br>Excludes multiparous women with obstetric problems in previous pregnancies. |
| Wolleswinkel-van den Bosch, Vredevoogd *et al.* 2002 | Medical records of perinatal deaths obtained from hospital and midwives' medical archives (V) | Independent primary care midwife | Independent primary care midwife<br>Obstetrician | Includes all women deemed low risk at commencement of pregnancy. |
| De Reu, Hijhuis *et al.* 2000 | Records from hospitals, midwives and GP's (M) | Independent primary care midwife<br>General practitioner | Independent primary care midwife<br>Physician | No exclusions |
| Wiegers, Keirse *et al.* 1996 | Midwifery practice records (V) | Independent primary care midwife | Independent primary care midwife | Includes low risk women only |

| Country<br>Research publication | Model of care<br>Source of data | Home birth care provider | Hospital care provider | Inclusions/Exclusions |
|---|---|---|---|---|
| (Source of data: M=mandatory reporting, V=voluntary reporting; Health practitioners described using terminology used in the research publications.) | | | | |
| **Canada** | Single payer universal health system. Midwifery care is funded by the provincial Ministry of Health and is accessible to all women who meet the standards for low obstetric risk. Registered midwives provide care for women who choose to home birth and meet eligibility criteria set by the provincial College of Midwives, including descriptions of mandatory transfers to obstetric care. Midwives are well integrated into the health care system, work in individual or group practices, have hospital admission privileges with good access to emergency services, consultation and transfer of care. They provide a model of continuity of care whereby a woman is attended by a small group of midwives throughout pregnancy, birth and the postpartum period. | | | |
| Hutton, Reitsma *et al.* 2009 | The Ontario Ministry of Health database of midwifery care (M) | Registered midwife | Registered midwife<br>Physician | Excludes GA<37 or GA>43 wks, multiple birth, pregnancy complications, >1 prior CS, breech presentation |
| Janssen, Saxell *et al.* 2009 | British Columbia Perinatal Database Registry (M) | Registered midwife | Registered midwife<br>Physician | Excludes GA<36 and GA>41 wks, multiple birth, pre-existing medical conditions, pregnancy complications, >1 prior CS cephalic presentation.<br>Home births include breech presentations determined after onset of labour. Women who had previous CS were not included in planned hospital births. |
| Janssen, Lee *et al.* 2002 | British Columbia Perinatal Database Registry (M) | Registered midwife | Registered midwife<br>Physician | Excludes GA<37 & GA>41 wks, multiple birth, pre-existing medical conditions, pregnancy complications, >1 prior CS, breech presentation |
| **Sweden** | Home birth is not endorsed by health authorities and is not financed or available within the health care system. Midwives are primary care givers for uncomplicated pregnancies, and care during labour and birth. In complicated cases, midwives cooperate with obstetricians. | | | |
| Lindgren, Radestad *et al.* 2008 | Swedish Medical Birth Register (M) | Licensed midwife | Obstetrician | Planned homebirth group includes pre- and post-term births and multiple births. These were not included in the planned hospital births. Breech presentations were included in both. |
| **Switzerland** | The Swiss health care system is private for all outpatient care. Fees are covered by health insurance, to which everybody subscribes. | | | |

| Country<br>Research publication | Model of care<br>Source of data | Home birth care provider | Hospital care provider | Inclusions/Exclusions |
|---|---|---|---|---|
| Ackermann-Liebrich, Voegli *et al.* 1996 | Hospital and home delivery records (V) | Midwife<br>GP | Midwife<br>Physician | No exclusions. The study group had no formal policy on accepting women for home birth. |
| (Source of data: M=mandatory reporting, V=voluntary reporting; Health practitioners described using terminology used in the research publications.) | | | | |
| **United Kingdom** | Home birth for low risk women is endorsed by the Royal College of Obstetricians and Gynaecologists and the Royal College of Midwives. NHS community midwives service the majority of women deemed eligible for home birth. Independent midwives are self-employed qualified practitioners working outside the NHS without professional indemnity insurance (since 1994). | | | |
| Mori, Dougherty *et al.* 2008 | Confidential Enquiry into Maternal and Child Health (CEMAH) and the Office for National Statistics (M) | No discussion of model of care | Not discussed | No exclusions<br>Includes all births in England and Wales during study period |
| Northern Region Perinatal Mortality Survey 1996 | Northern Regional Health Authority<br>Office of Population Censuses and Surveys (M) | Community midwife | Not discussed | No exclusions |
| **United States** | Home births are not endorsed by the American College of Obstetricians and Gynecologists. Certified professional midwives attend most home births and out-of-hospital birth centres providing care antenatally, during labour and delivery and post partum. Nurse-midwives are registered nurses who have graduated from a nurse-midwifery education program. They mostly attend hospital births, but also attend home and out-of-hospital births. | | | |
| Johnson and Daviss 2005 | National Centre for Health Statistics<br>North American Registry of Midwives (M) | Certified professional midwife | Not discussed | Excludes GA<37 wks, multiple birth |

| Country<br>Research publication | Model of care<br>Source of data | Home birth care provider | Hospital care provider | Inclusions/Exclusions |
|---|---|---|---|---|
| Pang, Heffelfinger *et al.* 2002 | Washington State birth registry (M) | Nurse<br>Midwife<br>Physician | Not discussed | Excludes GA<34 weeks, multiple birth, pre-existing medical conditions, pregnancy complications |
| Murphy and Fullerton 1998 | Nurse-midwifery practices (V) | Certified nurse-midwife | No comparison group | No exclusions |

(Source of data: M=mandatory reporting, V=voluntary reporting; Health practitioners described using terminology used in the research publications.)

| | | | | |
|---|---|---|---|---|
| **Australia** | Until the late 1990's, the system in Australia did not provide for planned home births and there were no community midwifery services. Women planning home birth received care from an independent midwife (registered or unregistered) with no formal support from the national health care system or professional indemnity insurance.<br>In South Australia, a publicly funded Community Midwife Project started in 1998. In 2002, Bachelor of Midwifery courses were introduced. Since the introduction of the Policy for Planned Birth at Home in 2007, some hospitals have introduced midwifery group practice models of care with the option for home birth.<br>In Western Australia, the Community Midwifery Program started as a pilot program in 1996, to provide primary midwifery services for home and hospital births. In 2000, the increasing cost of professional indemnity led to the midwives being employed by the Department of Health to allow indemnity through the government insurer. Privately practising midwives continue to practise outside the Community Midwifery Program without professional indemnity insurance for intrapartum care in the home. Since October 2010, professional indemnity insurance is a requirement of registration for all privately practising midwives. This indemnity insurance covers for the provision of antenatal and postnatal care in the community or in a hospital. | | | |
| Kennare, Keirse *et al.* 2009 | Pregnancy Outcome Unit of South Australian Health: the collection of perinatal statistics for all births and deaths (M) | Registered midwife | Physician | No exclusions |

| Country<br>Research publication | Model of care<br>Source of data | Home birth care provider | Hospital care provider | Inclusions/Exclusions |
|---|---|---|---|---|
| Bastian, Keirse *et al.* 1998 | Homebirth Australia (V) and national perinatal mortality data (M) | Independent registered midwife<br>General practitioner<br>Unregistered midwife | Physician | No exclusions<br>Home births included pre and post-term, multiple births and breech presentations |
| Woodcock, Read *et al.* 1994 | Midwives' Notification System, Maternal and Child Health Research Data Base and the Health Department of Western Australia (M) | Independent registered midwife<br>General practitioner | Physician | Excluded multiple births, congenital anomalies |
| Woodcock, Read *et al.* 1990 | Home birth midwives' records (V), Midwives Notification System, Western Australia (M) | Independent registered midwife<br>General practitioner | Physician | No exclusions<br>Hospital births include only singleton, Caucasian births |
| Crotty, Ramsay *et al.* 1990 | South Australian perinatal data collection and medical practice case records (V) | Independent registered midwife<br>General practitioner | Physician | No exclusions |
| Howe 1988 | Midwives Registry Western Australia (M) | Independent registered midwife | No comparison group | No exclusions |

(Source of data: M=mandatory reporting, V=voluntary reporting; Health practitioners described using terminology used in the research publications.)

**Table 4. Maternal characteristics of women planning home birth.**

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| de Jonge, van der Goes *et al.* 2009<br>*Level of evidence III-2* | 2000-2006 | Netherlands | Home birth:321,303<br>Hospital birth:163,261 | Compared with planned hospital birth, women planning home birth were more likely to be:<br>to be ≥25 years (91% vs 82%),<br>of Dutch origin (91% vs 65%),<br>multiparous (59% vs 55%),<br>medium-high socio-economic status (81% vs 67%). |
| Kennare, Kierse *et al.* 2009<br>*Level of evidence III-2* | 1991-2006 | South Australia | Home birth: 1,141<br>Hospital birth: 297,192 | Compared with planned hospital birth, women planning home birth were more likely to be:<br>older (31.3 vs 29.2 yrs), higher occupational status,<br>live in metro area (79.8% vs 76.0%);<br>and less likely to be nulliparous (31.2% vs 41.0%) and Indigenous (1.0% vs 2.2%). |
| Janssen, Saxell *et al.* 2009<br>*Level of evidence III-2* | 2000-2004 | British Columbia, Canada | Home birth: 2,889<br>Midwife-led hospital birth: 4,752<br>Physician-led hospital birth: 5,331 | Compared to planned midwife-led hospital birth women who planned home birth were less likely:<br>to be a single parent (3.1% vs 5.3% vs 3.1%),<br>nulliparous (41.9% vs 51.1% vs 41.3%),<br>to attend an ultrasound before 20 pregnancy weeks (58.9% vs 70.9% vs 75.5%). |
| Christiaens and Bracke 2009<br>*Level of evidence III-2* | 2004-2005 | Belgium, Netherlands | Home birth: 230<br>Hospital birth: 381 | Compared to Dutch women Belgian women were more likely to have higher education (76% vs 41%) and to be primigravid (51% vs 41%).<br>No comparisons between planned home and hospital births. |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Lindgren, Radestad *et al.* 2008<br>*Level of evidence III-2* | 1992-2004 | Sweden | Home birth: 897<br>Hospital birth:11,341 | Women planning home birth were <u>more likely</u> to be:<br>>35 years (26% vs 14%), a non-smoker,<br>be born in a European country outside Sweden (9% vs 5%),<br>more likely having 2nd or 3rd (57% vs 34%) or having ≥4th child (17% vs 4%), having BMI<25,<br>to be educationally qualified, to be employed;<br>and were <u>less likely</u> to be:<br><25 years of age (10% vs 19%),<br>non-European born (1% vs 10%). |
| Anthony, Buitendijk *et al.* 2005<br>*Level of evidence III-3* | 2000 | Netherlands | Home birth: 160,329 | Multiparous women under the care of a midwife deliver at home more often than nulliparous women (43% vs 24%)<br>Fewer women younger than 25 years<br>Fewer non-Dutch women (17% vs 37%)<br>Fewer women living in large cities (31%) vs regional towns (36%) vs rural areas (36%) |
| Johnson and Daviss 2005<br>*Level of evidence IV* | 2000 | USA and Canada | Home birth: 5,418 | Compared with all hospital births, women choosing home birth were older, lower socioeconomic status, better educated, less likely to be African-American or Hispanic |
| Janssen, Lee *et al.* 2002<br>*Level of evidence III-2* | 1998-1999 | Canada | Home birth: 862<br>Doctor-led hospital birth: 743<br>Midwife-led hospital birth: 571 | Compared with women planning hospital births with a doctor, women planning home births were more often multiparous (53% vs 42%).<br>Women who planned birth with a midwife were more often multiparous (53% and 52% for planned home and hospital births respectively). |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Pang, Heffelfinger *et al.* 2002<br>*Level of evidence III-3* | 1989-1996 | USA | Home birth: 6,133<br>Hospital birth: 10,593 | Compared with women planning hospital births, women planning home births were more often:<br>older (≥30 years: 49% vs 33%),<br>white (92% vs 81%),<br>multiparous (76% vs 57%), and<br>less often smokers (10% vs 18%). |
| Woodcock, Read *et al.* 1990<br>*Level of evidence IV* | 1981-1987 | Western Australia | Home birth: 995 | Most women choosing home birth were Caucasian and slightly older. Parity was similar to all Caucasian women having singleton births. |
| Crotty, Ramsay *et al.* 1990<br>*Level of evidence IV* | 1976-1987 | South Australia | Home birth: 799 | Compared with hospital births, women planning home births were more often:<br>older (≥30 years: 38.3% vs 25.1%),<br>with high socioeconomic status (67% vs 38%). |

**Table 5. Maternal satisfaction reported by women planning home birth.**

| Study | Years of study | Country | N | Results |
|---|---|---|---|---|
| Wiegers 2009<br>*Level of evidence III-3* | 2007 | Netherlands | 793 | High level of satisfaction with planned home and hospital birth was reported.<br>Birth assisted by known midwife or knowing care provider increased satisfaction. |
| Christiaens and Bracke 2009<br>*Level of evidence III-2* | 2004-2005 | Belgium, Netherlands | 580 | Belgian women more satisfied than Dutch women irrespective of birth setting.<br>Women who planned homebirth were more satisfied than those who planned hospital birth. |
| Janssen, Carty *et al.* 2006<br>*Level of evidence III-2* | 1998-1999 | Canada | Home birth: 862<br>Physician-led Hospital birth: 743<br>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. |
| Wiegers, van der Zee *et al.* 1998<br>*Level of evidence III-2* | 1990-1992 | Netherlands | 2,301 | Of women who had uncomplicated births, women who had planned a home birth had a higher level of evidence of satisfaction.<br>Unanticipated transfer to hospital did not lessen women's satisfaction with the experience. |

**Table 6. Antenatal, intrapartum and postpartum transfers from planned home birth into obstetric care.**

| Study | Years of study | Country | N | Results |
|---|---|---|---|---|
| **Transfer before labour** | | | | |
| McMurtrie, Catling-Paul *et al.* 2009 | 2005-2009 | Australia (NSW) | 100 | 30% transferred antenatally |
| Murphy and Fullerton 1998<br>*Level of evidence IV* | 1994-1995 | USA | 1,404 | 7.4% transferred antenatally |
| Woodcock, Read *et al.* 1990<br>*Level of evidence IV* | 1981-1987 | Western Australia | 995 | 10% transferred antenatally |
| **Transfer to hospital during or after labour** | | | | |
| McMurtrie, Catling-Paul *et al.* 2009 | 2005-2009 | Australia (NSW) | 100 | 10.0% intrapartum transfer of care<br>2.9% maternal transfer after birth<br>1.4% neonatal transfer |
| Hutton, Reitsma *et al.* 2009<br>*Level of evidence III-2* | 2003-2006 | Ontario, Canada | 6,692 | 78.6% delivered at home without transfers of care<br>5.4% transferred during or immediately after birth |
| Johnson, K C and Daviss 2005<br>*Level of evidence IV* | 2000 | USA and Canada | 5,418 | 10.1% transferred in labour<br>1.3% maternal transfer after birth<br>0.7% neonatal transfer |
| Janssen, Lee *et al.* 2002<br>*Level of evidence III-2* | 1998-1999 | Canada | 862 | 1.5% transferred in labour<br>0.9% maternal transfer after birth<br>0.9% neonatal transfer |
| Murphy and Fullerton 1998<br>*Level of evidence IV* | 1994-1995 | USA | 1,404 | 7.7% transferred in labour<br>0.7% maternal transfer after birth<br>1.1% neonatal transfer |

| Study | Years of study | Country | N | Results |
|---|---|---|---|---|
| Woodcock, Read *et al.* 1990<br>*Level of evidence IV* | 1981-1987 | Western Australia | 995 | 14.2% transferred in labour or after birth |
| Howe 1988<br>*Level of evidence IV* | 1983-1986 | Western Australia | 165 | 13.3% transferred in labour<br>6.7% transferred after birth<br>0.06% neonatal transfer |
| **No transfers of care*** | | | | |
| Kennare, Keirse *et al.* 2009<br>*Level of evidence III-2* | 1991-2006 | South Australia | 1,141 | 69.4% of planned home births occurred at home |
| Janssen, Saxell *et al.* 2009<br>*Level of evidence III-2* | 2000-2004 | British Columbia, Canada | 2,889 | 78.8% of women who planned home birth delivered at home. |
| Crotty, Ramsay *et al.* 1990<br>*Level of evidence IV* | 1976-1987 | South Australia | 799 | 78.2% of women delivered at home<br>63.8% nulliparous women<br>87.5% multiparous women |

* only proportions of women who remained in the planned birth setting were reported.

**Table 7. Interventions and outcomes during labour and birth.**

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Hutton, Reitsma *et al.* 2009<br>*Level of evidence III-2* | 2003-2006 | Ontario, Canada | Planned home birth: 6,692<br>Planned hospital birth: 6,692 | Compared with women who delivered in hospital, women who planned home birth had lower rates of:<br>Augmentation:<br>ARM (22.4% vs 28.2%) and oxytocin (8.2% vs 13.1%),<br>pharmaceutical pain relief (16.8% vs 54.8%)<br>nitrous oxide (3.3% vs 18.0%),<br>narcotic (1.7% vs 6.3%),<br>epidural (9.8% vs 21.0%);<br>episiotomies (4.3% vs 5.9%),<br>assisted vaginal deliveries (2.9% vs 4.4%),<br>caesarean sections (5.2% vs 8.1%),<br>blood loss>500ml (9.2% vs 11.3%). |
| Janssen, Saxell *et al.* 2009<br>*Level of evidence III-2* | 2000-2004 | British Columbia, Canada | Planned home birth: 2,889<br>Planned midwife-led hospital birth: 4,752<br>Planned physician-led hospital birth: 5,331 | Compared to midwife-led planned hospital birth and physician-led planned hospital birth, women who planned home birth had lower rates of:<br>electronic fetal monitoring (13.6% vs 41.9% vs 78.8%),<br>labour augmentation ARM/oxytocin (23.7% vs 39.9% vs 50.4%),<br>ARM (19.3% vs 31.9% vs 39.6%)<br>oxytocin (5.9% vs 12.7% vs 18.4%),<br>assisted vaginal deliveries (3.0% vs 7.2% vs 13.8%),<br>caesarean sections (7.2% vs 10.5% vs 11.0%);<br>nulliparous women (13.0% vs 18.7% vs 21.8%)<br>multiparous (3.0% vs 1.9% vs 3.4%),<br>episiotomies (3.1% vs 6.8% vs 16.9%),<br>3rd and 4th degree tears (1.2% vs 2.9% vs 3.4%). |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Lindgren, Radestad *et al.* 2008<br>*Level of evidence III-2* | 1992-2004 | Sweden | Planned home birth: 897<br>Planned hospital birth:11,341 | Compared to women who planned hospital birth, women who planned home birth had fewer:<br>assisted vaginal deliveries (2.2% vs 9.6%),<br>cesarean sections (2.4% vs 6.8%),<br>episiotomies (0.8% vs 7.2%), vaginal tears (17.9% vs 31.5%),<br>sphincter/rectal ruptures (0.3% vs 2.7%). |
| Johnson and Daviss 2005<br>*Level of evidence IV* | 2000 | USA and Canada | Planned home birth: 5,418 | Compared with hospital births there were lower rates of:<br>continuous electronic fetal monitoring (9.6% vs 84.3%),<br>episiotomies (2.1% vs 33%),<br>caesarean sections (3.7% vs 19%). |
| Janssen, Lee *et al.* 2002<br>*Level of evidence III-2* | 1998-1999 | Canada | Planned home birth: 862<br>Planned doctor-led hospital birth: 743<br>Planned midwife-led hospital birth: 571 | Compared with doctor-attended and midwife-attended hospital births, women who had home births had fewer:<br>epidurals (7.7% vs 27.6% vs 26.3%),<br>inductions (4.3% vs 22.3% vs 12.0%),<br>caesarean sections (6.4% vs 18.2% vs 11.9%),<br>episiotomies (3.8% vs 15.3% vs 10.9%). |
| Wiegers, Keirse *et al.* 1996<br>*Level of evidence III-2* | 1990-1993 | Netherlands | 2,301 | Compared with hospital births, multiparous women who had home births were less likely to have episiotomies (15.8% vs 25.1%) |
| Ackermann-Liebrich, Voegli *et al.* 1996<br>*Level of evidence III-2* | 1989-1991 | Switzerland | Planned home birth: 489<br>Planned hospital birth: 385 | Compared with planned hospital births, women with planned home births had less:<br>inductions (4.6% vs 16.0%),<br>analgesia (17.1% vs 48.7%),<br>instrumental deliveries (4.4 vs 13%),<br>caesarean sections (5.2% vs 13.6%),<br>episiotomies (26% vs 76.5%). |

**Table 8. Neonatal outcomes.**

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Hutton, Reitsma *et al.* 2009<br>*Level of evidence III-2* | 2003-2006 | Ontario, Canada | Planned home birth: 6,692<br>Planned hospital birth: 6,692 | No differences in neonatal outcomes: 5-minute Apgar<7, requirement for positive pressure ventilation, NICU>4 days, birthweight<2500g. |
| Janssen, Saxell *et al.* 2009<br>*Level of evidence III-2* | 2000-2004 | British Columbia, Canada | Planned home birth: 2,889<br>Planned midwife-led hospital birth: 4,752<br>Planned physician-led hospital birth: 5,331 | Compared to midwife-led planned hospital birth and physician-led planned hospital birth, women who planned home birth had lower rates of:<br>1-minute Apgar score <7 (RR=0.76 95%CI 0.66-0.88 and RR=0.74 95%CI 0.64-0.86),<br>birth trauma* (RR 0.26 95%CI 0.11-0.58 and RR=0.33 95%CI 0.15-0.74),<br>resuscitation at birth** (RR=0.23 95%CI 0.14-0.37 and RR=0.56 95%CI 0.32-0.96),<br>oxygen therapy>24hrs (RR 0.37 95%CI 0.24-0.59 and RR=0.38 95%CI 0.24-0.61). |
| Johnson and Daviss 2005<br>*Level of evidence IV* | 2000 | USA and Canada | Planned home birth: 5,418 | 1.3% 5-minute Apgar scores < 7<br>2.4% babies admitted to the NICU |
| Janssen, Lee *et al.* 2002<br>*Level of evidence III-2* | 1998-1999 | Canada | Planned home birth: 862<br>Planned doctor-led hospital birth: 743<br>Planned midwife-led hospital birth: 571 | Compared with physician-led planned hospital birth, women who planned home birth had lower rates of:<br>1-minute Apgar scores<7 (10.4% vs 14.5%),<br>tracheal suction (2.8% vs 5.7%),<br>IPPV*** by mask (5.1% vs 8.5%),<br>drugs for resuscitation (0.5% vs 2.7%),<br>birthweight <2,500g (0.8% vs 2.0%),<br>Compared with midwife-led planned hospital birth, women who planned home birth had fewer tracheal suctions (2.8% vs 7.1%). |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Pang, Heffelfinger *et al.* 2002<br>*Level of evidence III-3* | 1989-1996 | USA | Planned home birth: 6,133<br>Planned hospital birth:10,593 | Compared with women planning hospital births, women planning home births had more:<br>low 5-minute Apgar scores≤ 3 (0.41% vs 0.20%)<br>neonates requiring assisted ventilation > 30 minutes (0.3% vs 0.2%). |
| Ackermann-Liebrich, Voegli *et al.* 1996<br>*Level of evidence III-2* | 1989-1991 | Switzerland | Planned home birth: 489<br>Planned 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). |
| Woodcock, Read *et al.* 1994<br>*Level of evidence III-2* | 1981-1987 | Australia | Planned home birth: 976<br>Planned hospital birth: 2,928 | Compared with planned hospital births, fewer infants of mothers who planned home births had:<br>birthweight <2,500g (OR=0.47, 95% CI 0.25-0.88),<br>5-minute Apgar score <8 (OR=0.44, 95% CI 0.25-0.79),<br>oxygen alone (OR=0.32, 95% CI 0.25-0.42),<br>other resuscitation methods (OR=0.16, 95% CI 0.09-0.27),<br>time to spontaneous respiration >1 minute (OR=0.45, 95% CI 0.32-0.63),<br>birth trauma (OR=0.28, 95% CI 0.18-0.44),<br>and were more likely to be post-term ≥42 weeks (OR=2.46, 95% CI 1.91-3.15). |

* birth trauma=subdural or cerebral hemorrhage, fracture of clavicle, long bones or skull, facial nerve injury, Erb palsy, or unspecified.

** resuscitation at birth = intermittent positive airway pressure via endotracheal tube or chest compression, or use drugs for resuscitation.

*** IPPV = intermittent positive pressure ventilation.

**Table 9. Perinatal mortality.**

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Hutton, Reitsma *et al.* 2009<br>*Level of evidence III-2* | 2003-2006 | Ontario, Canada | Planned home birth: 6,692<br>Planned hospital birth: 6,692 | No increased risk of perinatal and neonatal mortality among home births (1/1,000 births in both groups). |
| de Jonge, van der Goes *et al.* 2009<br>*Level of evidence III-2* | 2000-2006 | Netherlands | Planned home birth:321,303<br>Planned hospital birth:163,261 | No increased risk of perinatal mortality among planned home compared with planned hospital birth.<br>Intrapartum death: RR=0.97 (95% CI 0.69-1.37)<br>Intrapartum death and neonatal death ≤24hours: RR=1.02 (95% CI 0.77-1.36)<br>Intrapartum death and neonatal death ≤7 days: RR=1.00 (95% CI 0.78-1.27) |
| Kennare, Keirse *et al.* 2009<br>*Level of evidence III-2* | 1991-2006 | South Australia | Planned home birth: 1,141<br>Planned hospital birth: 297,192 | Compared with planned hospital birth, planned home birth had:<br>increased risk of intrapartum death (1.8/1,000 vs 0.8/1,000)<br>increased risk of death from intrapartum asphyxia (2.6/1,000 vs 0.3/1,000),<br>No increase in risk of perinatal mortality: 7.9/1,000 vs 8.2/1,000 for home and hospital births. |
| Janssen, Saxell *et al.* 2009<br>*Level of evidence III-2* | 2000-2004 | British Columbia, Canada | Planned home birth: 2,889<br>Planned midwife-led hospital birth: 4,752<br>Planned physician-led hospital birth: 5,331 | No increased risk of perinatal mortality among homebirths compared with midwife-led hospital birth and physician-led hospital birth: 0.35/1,000 vs 0.57/1,000 births vs 0.64/1,000 |
| Lindgren, Radestad *et al.* 2008<br>*Level of evidence III-2* | 1992-2004 | Sweden | Planned home birth: 897<br>Planned hospital birth:11,341 | No increase in risk of intrapartum and neonatal mortality among home compared with hospital birth: 2.2/1,000 vs 0.7/1,000. |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Mori, Dougherty and Whittle 2008<br>*Level of evidence IV* | 1994-2003 | England and Wales | 4,991 intrapartum perinatal deaths from 6,314,315 births | No difference in intrapartum perinatal mortality (IPPM) for booked home births compared with overall IPPM.<br>Women booked for home birth but requiring transfer were at highest risk.<br>Overall IPPM 0.79/1,000<br>Booked home birth IPPM 1.28/1,000<br>Completed home birth IPPM 0.48/1,000<br>Unintended home birth IPPM 1.42/1,000<br>Transferred IPPM 6.05/1,000 |
| Johnson and Daviss 2005<br>*Level of evidence IV* | 2000 | USA and Canada | Planned home birth: 5,418 | No excess perinatal mortality among home births: 2.0/1,000. |
| Janssen, Lee *et al.* 2002<br>*Level of evidence III-2* | 1998-1999 | Canada | Planned home birth: 862<br>Planned doctor-led birth: 743<br>Planned midwife-led hospital birth: 571 | No excess perinatal mortality home birth compared with doctor-led hospital birth vs midwife-led hospital birth:<br>3.4/1,000 vs 1.3/1,000 vs 0 births. |
| Wolleswinkel-van den Bosch, Vredevoogd *et al.* 2002<br>*Level of evidence III-3* | 1996-1997 | Netherlands | 319 deaths in all birth settings | No evidence that sub-standard factors related to place of birth caused differences in perinatal mortality. |
| Pang, Heffelfinger *et al.* 2002<br>*Level of evidence III-3* | 1989-1996 | USA | Planned home birth: 6,133<br>Planned hospital birth:10,593 | Increased risk of neonatal death among planned home compared with planned hospital births:<br>RR 1.99 (95%CI 1.06-3.73).<br>Neonatal mortality 3.5/1,000 vs 1.7/1,000 live births. |
| De Reu, Hijhuis *et al.* 2000<br>*Level of evidence IV* | 1994-1995 | Netherlands | 73 deaths from all places of birth | Perinatal mortality was not higher in home births. |

| Study | Years of study | Country | N | Results<br>*Statistically significant differences only are reported* |
|---|---|---|---|---|
| Murphy and Fullerton 1998<br>*Level of evidence IV* | 1994-1995 | USA | Planned home birth: 1,404 | 2.5/1,000 |
| Bastian, Keirse *et al.* 1998<br>*Level of evidence IV* | 1985-1990 | Australia | 50 deaths from home births | 7.1/1,000 compared with all Australian births 10.8/1,000<br>The majority of deaths occurred in women with obstetric risk factors. |
| Northern Region Perinatal Mortality Survey Coordinating Group 1996<br>*Level of evidence IV* | 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. |
| Woodcock, Read *et al.* 1994<br>*Level of evidence III-2* | 1981-1987 | Western Australia | Planned home birth: 976<br>Planned hospital birth: 2,928 | No increased risk of perinatal mortality among planned home home birth compared with hospital birth: 5.1/1,000 vs 4.1/1,000. |
| Woodcock, Read *et al.* 1990<br>*Level of evidence IV* | 1981-1987 | Western Australia | Planned home birth: 995 | Compared with all singleton Caucasian WA births, planned homebirths had:<br>stillbirth rate of 2.0/1,000 vs 4.8/1,000<br>neonatal death rate of 3.0/1,000 vs 2.9/1,000<br>no difference in mortality. |

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