University of Sydney

Masters in Biostatistics

# Workplace Project Portfolio (WPP)

**BSTA 5020**

Project 1

Comparison of pregnancy outcomes between planned homebirth and planned hospital birth in WA, 2002-2013.

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## Contents

# 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.

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

**Antenatal** – existing or occurring before birth.

**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.

**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.

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

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

**Cephalopelvic disproportion** – occurs when the baby's head or body is too large to fit through the mothers pelvis.

**Epidural 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.

**Fetal assessment** – assessing and monitoring the fetus during pregnancy.

**Fetal distress** –occurs if the fetus is not receiving enough oxygen.

**Fetal malpresentation** – anything except vertex as face, brow, breech, shoulder, cord and complex presentations.

**Fetus** – the unborn baby.

**Gestation (or gestational age)** – length of pregnancy measured in weeks

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

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

**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.

**Macrosomia** – large baby for gestational age, typically > 10$^{th}$ percentile

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

**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.

**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 mortality rate** – deaths within the first 28 days of life per 1,000 livebirths

**Non-vertex presentation -** the presenting part of the fetus or 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).

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

**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 Royal Australian and New Zealand College of Obstetricians and Gynaecologists (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.

**Occipito-posterior-** back of babies head is against mothers back.

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

**Perinatal mortality rate** – the sum of stillbirths and neonatal deaths per 1,000 births

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

**Placenta praevia –** when the placenta is located at the bottom of the uterus, close to or covering the cervix.

**Placental abruption-** separation of the placenta from the wall of the uterus.

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

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

**Precipitate delivery –** delivery accomplished with undue speed.

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

**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.

**Resuscitation** is intervention after a baby is born to help it breathe and to help its heart beat.

**Retained placenta -** a placenta that has not undergone placental expulsion within 30 minutes of the baby's birth.

**Small for gestational age** is defined as a weight below the 10th percentile for the gestational age

**Stillbirth** – a baby born dead after 20 completed weeks' gestation.

**Shoulder dystocia** - a specific case of obstructed labour whereby after the delivery of the head, the anterior shoulder of the infant cannot pass below, or requires significant manipulation to pass below, the pubic symphysis.

**Third or fourth degree perineal tear**- a tear in the vaginal tissue, perineal skin, and perineal muscles that extends into the anal sphincter.

**Threatened preterm labour-**the onset of labour before 37 weeks characterised by regular painful contractions.

# Abbreviations

**APH** – antepartum haemorrhage

**BBA** – born before arrival

**GDM** – gestational diabetes

**LGA** – large for gestational age

**MFM** – Maternal and Fetal Medicine specialist

**MNS** – Midwives Notification System

**PET** – pre-eclampsia

**PIMC** – Perinatal and Infant Mortality Committee

**PPH** – postpartum haemorrhage

**PPROM** – Prolonged Preterm Rupture of Membranes or Preterm Prelabour Rupture of Membranes

**PTB** – preterm birth

**SCN** – Special Care Nursery

**SGA** – small for gestation age

**TPL** – threatened preterm labour

**WIRF** – Women and Infants Research Foundation

## PART A: Preface

### Introduction

The projects presented in this portfolio were conducted as part of my role as a biostatistician at the Biostatistics and Research Design Unit, Women and Infants Research Foundation (WIRF) in Western Australia (WA). WIRF is a community-based, not for profit research organisation dedicated to the fields of obstetrics, gynaecology and neonatal medicine, and works in collaboration with King Edward Memorial Hospital for Women in Perth (KEMH) (http://wirf.com.au/). KEMH is the sole tertiary level perinatal centre for the state, and home to the School of Women's and Infants' Health at the University of Western Australia (UWA). WIRF conducts research independently as well as in partnership with other organisations to fund, support and advocate for high quality scientific studies. The main areas of research include the prevention of preterm birth, improved pregnancy for mothers and babies, improved care for sick newborns, gynaecologic oncology and women's health. Projects such as the WA Preterm Birth Prevention Initiative and the Fetal Futures program are two of many projects currently underway. Further projects are listed on the WIRF website. The role of the Biostatistics Unit is to provide consultation and collaboration in the design, conduct, analysis, interpretation and reporting of research conducted at KEMH and affiliated institutions.

The WPP projects form part of the Homebirth Study; a large research project conducted at WIRF to compare perinatal morbidity and mortality between planned hospital and planned homebirths in WA. Planned homebirth refers to births that are intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife [1]. Less than 1% of women choose to have homebirths in WA, however, there has been ongoing controversy over the safety of homebirth in recent years with evidence of increased perinatal mortality in some studies. Planned homebirth is thought to be a safe alternative for women determined to be at low risk of pregnancy complications by established screening criteria, however, for women who are not determined to be at low risk, particularly at the onset of labour, there

appears to be an excess of neonatal morbidity and mortality in homebirth [1]. Additionally, published studies show that 7.4%-30% of women planning a homebirth will be transferred during the antenatal period, and of more concern for many women, 1.5%-13% will require a transfer after the onset of labour due to the development of labour complications [2].

Two consecutive reports published by the Perinatal and Infant Mortality Committee of Western Australia (PIMC) in 2007 and 2010 found evidence of increased perinatal mortality in homebirths in the 2002-2004 and 2005-2007 triennia. The 13th PIMC Report (2010) recommended priority should be given to an independently performed prospective cohort study to assess mortality and morbidity outcomes for women planning homebirths in WA [3].

The Homebirth Study was designed in response to the 'directed research' theme intended to address the recommendation of the 13th PIMC Report and to shed light on morbidity and mortality associated with homebirth in WA.

The aims of the homebirth study were:

(1) To conduct a detailed prospective audit of planned homebirths in WA (2012-2013)
(2) To compare perinatal morbidity and mortality between planned homebirth and planned hospital birth in WA (2002-2013)
(3) To develop a benchmarking model for transfers of care, morbidity and mortality in planned homebirth in WA
(4) To recommend a detailed process for ongoing evaluation of safety of homebirth in WA

Professor Dorota Doherty, Head Biostatistician at WIRF and Adjunct Professor at the School of Women's and Infants' Health, UWA is the principal investigator on the homebirth study and was responsible for obtaining the targeted research grant awarded by WA Health. Other Clinical Investigators on the team included a Maternal and Fetal Medicine specialist, a Research Midwife, a Clinical Psychologist and the Custodian of the Maternal and Child

Health database. The Homebirth Study commenced in mid-2012 and completed recruitment in mid-2014. The final report to WA Health is currently in preparation.

Previous studies have been limited by small sample sizes, the lack of an appropriate comparison group and differences between levels of risk at onset of labour. To overcome these limitations, this study incorporated twelve years of pregnancy data for home and hospital births (2002-2013) and included well defined risk levels assigned to each pregnancy at the onset of labour.

To our knowledge the Homebirth Study is the largest Australian study collecting data on all aspects of planned homebirth with the ability to comprehensively compare the outcomes of planned homebirth to planned hospital birth. The results provide evidence on outcomes for planned homebirth in WA, and the findings will inform policy on homebirth Australia wide.

The WPP projects covered two distinct components of the Homebirth Study and were conducted under the supervision of Professor Doherty.

**WPP Project 1**

This project addresses Aim (2) and was designed to compare morbidity and mortality between planned homebirth and planned hospital birth in WA, 2002-2013, while accounting for patient characteristics, levels of risk at onset of labour and changes in policy and governance. Evidence suggests homebirth is a safe model of maternity care for women considered low risk at the onset of labour. To account for the increase in adverse outcomes associated with increased obstetric risk at the onset of labour, four levels of obstetric risk were created and assigned to each birth. Risk levels were defined according to the presence or absence of medical conditions (pre-existing or during pregnancy) or obstetric complications that could influence pregnancy outcomes. Confounding factors were established apriori and adjusted for in the analysis of all maternal and neonatal outcomes. Unadjusted and adjusted logistic regression modelling was performed on maternal and neonatal outcomes and compared between planned hospital and planned homebirths at

each risk level. Low medical and obstetric risk hospital births were used as the reference level in all models.

**WPP Project 2**

This project addresses Aim (3) and was designed to estimate antenatal, intrapartum and postpartum transfer rates based on the population of low risk women who planned hospital birth and who were eligible for planned homebirth. Decision analytic modelling was used to construct a pregnancy model using data for low risk planned metropolitan hospital births from 2011 to 2013, in accordance with changes in guidelines for homebirth released by WA Health in 2011 [2]. The pregnancy model previously developed by Doherty *et al*. (2009) was constructed to model pregnancy outcomes using maternal characteristics and pregnancy complications predictive of adverse maternal and neonatal outcomes. The accuracy of the simulated pregnancy outcomes were evaluated by comparison with observed data. A large hypothetical dataset was generated with characteristics and events that reflected the homebirth population [4]. The model facilitated the evaluation of pregnancy outcomes and transfers in homebirth women and will enable future comparisons of observed and expected rates of obstetric interventions, adverse outcomes and transfers.

**My role**

I completed both projects during 2015 as part of my employment as a full time biostatistician at WIRF, under the direction of Professor Doherty. Both projects were part of a larger study to further investigate the safety of homebirths in WA. The theme of the projects was an extension of my previous work involvement on the Review of Evidence into the Safety of Homebirth in WA conducted by WIRF in collaboration with the School of Women's and Infants' Health in 2011 [1].

The second project required the use of Tree Age Pro statistical software for decision analytic modelling. To learn how to use the software for the purposes of the project, I travelled to Sydney for a two day Healthcare Modelling Training course at the end of 2014. The course

provided useful instruction on the Tree Age Pro interface and various modelling techniques used in the construction and implementation of the pregnancy model in Project 2, including bootstrapping methods, Markov modelling and microsimulation analysis.

My role in both projects involved data preparation, statistical analysis, presentation and interpretation of results for the report. Professor Doherty provided direction and advice throughout the course of the study.

Results from both studies will form part of the final report to WA Health and will inform the development of guidelines for future practice. Results will be presented at the Australian Homebirth Conference in 2016 and will become published manuscripts in the near future.

**Teamwork**

*Communication with other team members*

Professor Doherty, James Humphreys (programmer) and I have worked together in the Biostatistics Unit at WIRF for the last ten years during which time we have built a solid working relationship based on good communication and a clear understanding of our roles. Most of our work is conducted independently, however, on this occasion we worked together due to the scope of the Homebirth Study. I liaised with Professor Doherty regarding the direction of the study and for advice on statistical issues and with James Humphreys regarding coding or data issues.

On occasion, it became necessary to meet with other Clinical Investigators on the study team to gain a clinical context; for example, advice was sought from the specialist obstetrician on conditions requiring transfer from home to hospital care, for implementation in the pregnancy model for project 2.

*Working with timelines*

The initial report was due to WA Health by mid-2015; however, flexibility was needed as data extracts from the Health Department were delayed. Timelines were changing throughout the study period as delays became inevitable. The final data extract was not received until July 2015 and the expected completion time for the final report has been extended to January 2016.

The proposed timeline was well within my own deadline for the end of semester 2, 2015, however, extract delays and extended timelines left limited time for writing up the projects.

*Negotiating roles and responsibilities*

Initially, my role for the study was clearly defined, but as the timelines tightened, it became clear we should utilise the skills of our programmer, James Humphreys, to continue building the pregnancy model, which enabled me to continue work on the statistical aspects of the study. This decision provided a good utilisation of skills and enabled the study to continue at a productive rate despite the delays.

**Reflections on Learning**

*Communication skills*

Communication skills, both verbal and written, were paramount throughout the course of the projects as the scope and duration of the Homebirth Study was large. It was essential to effectively summarise and communicate the progress of the analysis to Professor Doherty. Concerns with data coding or complex statistical issues needed to be recognised quickly, prioritised and clearly communicated. There were regular open discussions between Professor Doherty, James Humphreys and myself as we collaborated on various issues as they arose.

Clear and concise written communication was also vital for the study given the long time frame, additional data extracts, numerous recodes and definitions of new variables. The formation of risk levels was particularly important as it required the evaluation of many variables. It is our usual practice to conform to standard naming conventions and accurately date and label files for reproducibility of the results in future analyses. The importance of this practice was reinforced throughout the study while using a shared directory with Professor Doherty.

*Work patterns/planning*

Given the scope of the project and the changing timelines, setting work patterns and planning ahead were essential to maintaining a productive workflow. Both projects utilised one large dataset and were subject to delays in analysis while waiting on additional data extracts. Planning and implementing in a time effective manner while dealing with extract delays were paramount to workflow on the project. Initial work time was spent setting up the pregnancy model in Tree Age Pro for Project 2 to familiarise myself with the new software. Once this was achieved, the incomplete dataset was recoded into an analytic dataset and descriptive summaries and analyses were run to create syntax files for rerun several months later when the final extract arrived.

*Statistical principles, methods and computing*

The data extracts captured all births in WA from 2002 to 2013. A matched case control study was originally considered for Project 1 but could not be successfully implemented because it was impossible to adequately match the many characteristics/events that were rare in homebirths. A retrospective cohort study comparing morbidity and mortality in hospital and home births in term singleton births was eventually considered the best approach. Preterm and multiple births were excluded as they were rare among homebirth women and, in fact, ineligible for homebirth from 2011 onwards in accordance with the Homebirth Policy [2]. The benefit of prior knowledge and understanding of the research area and the importance of

being able to provide context to statistical approaches and ideas were valuable learning experiences.

Due to the vast amount of medical and obstetric information needed to statistically evaluate maternal and neonatal outcomes, we developed an overall obstetric risk status for each birth to use in the analysis, rather than including a multitude of individual conditions. The overall risk level incorporated the presence or absence of medical and obstetric conditions known to influence pregnancy outcomes. A considerable amount of time was spent discussing how to define risk, to align the limited data with the Home Birth Policy screening criteria [2]. The implementation of an overall risk status seemed reasonable as it also aligned with medical and clinical ascertainment where pregnancy is generally classified as low, medium or high risk. SPSS statistical software and TreeAge software were used for data analysis, with graphs produced in Excel.

**Ethical considerations**

*NHMRC ethics guidelines*

Ethical approval was obtained according to National Health and Medical Research Council (NHMRC) guidelines [5]. Approval from the Human Research Committee was obtained for data from the WA routine data collections. NHMRC guidelines were followed with respect to confidentiality and protection of identity.

*Professional responsibility*

Throughout the course of the projects I was aware of my professional responsibility to carry out my work with due diligence and care, to act with integrity in my dealings with others, to upgrade my professional knowledge and skills when relevant and to maintain the highest standard of professional conduct at all times, in accordance with the SSAI Code of Conduct [6].

**PART B: WPP Project 1**

## Comparison of pregnancy outcomes between planned homebirth and planned hospital birth in WA, 2002-2013

**Location and dates:** Women and Infants Research Foundation, King Edward Memorial Hospital for Women, Perth, Western Australia, January – November 2015.

**Context:** This project was part of a large targeted research study for WA Health to evaluate morbidity and mortality associated with homebirth in Western Australia. The 'targeted theme' for the large study was in response to evidence of increased perinatal mortality in homebirths reported by the Perinatal and Infant Mortality Committee (PIMC) in consecutive triennia, 2002-2004 and 2005-2007. Previous studies have been limited by small sample sizes, lack of an appropriate comparison group and differences between levels of risk at onset of labour. This project aimed to address these limitations by comparing morbidity and mortality between all planned home and hospital births in WA from 2002-2013, while accounting for levels of obstetric risk, patient characteristics and changes in policy and governance during this time.

**Contribution of student:**

- Data preparation and construction of analytic dataset
- Data analysis
- Presentation and interpretation of results
- Contribution to the writing of the report for the funding body

**Statistical issues involved:**

- Data manipulation - model development, selection of appropriate covariates.
- Multivariable logistic regression

**Declaration:**

I declare this project is evidence of my own work, with direction and assistance provided by my project supervisor. This work has not been previously submitted for academic credit.

**Signed:** 

**Supervisor's Statement:**

This project involved data preparation with construction of appropriate covariates to be considered in the data analysis, preliminary descriptive analysis and development of multivariable logistic regression models to meet the grant objectives. The timelines for project completions presented a considerable challenge. The majority of biostatistical work presented in this project has been completed by Liz and required a minimal supervision. Our interactions are best described as discussions about the analysis formulation and interpretation of the results that were conducted either with or without our clinical collaborators. Liz consistently works very well as a biostatistical consultant on various projects, and the project presented here is no exception. The challenge this project presented was working within the completion deadlines, and Liz performed exceptionally well under these circumstances.

**Signed:** 

## Comparison of pregnancy outcomes between planned homebirth and planned hospital birth in WA, 2002-2013.

This project addresses Aim (2) and is designed to compare morbidity and mortality between planned homebirth and planned hospital birth, while accounting for changes in policy and governance between 2002 and 2013, levels of risk and patient characteristics. Planned homebirth refers to births that are intended to occur at home with the assistance of a qualified practitioner, usually a registered midwife [2]. Less than 1% of women choose to homebirth in Australia where it has not been considered a mainstream option for childbirth for many decades. In some countries the incidence of homebirth is high, for example 30% of all births in the Netherlands and 3% of all births in the UK [1]. In these 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 homebirths continues to rise. Homebirth is explicitly endorsed in a number of countries, including Canada, the United Kingdom and the Netherlands, but is not endorsed by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) in Australia [7]. While the RANZCOG support the principle of personal autonomy, they do not support the practice of homebirth due to its inherent risks and the availability of safer options for labour and delivery [8]. There has been ongoing controversy over the safety of homebirth in recent years with evidence of increased perinatal morbidity and mortality in some studies.

A Review into the Safety of Homebirth in WA conducted in 2011 provided evidence for homebirth as a safe alternative for women determined to be at low risk of pregnancy complications by established screening criteria [1]. The screening criteria for eligibility to homebirth are set out in the WA Health Home Birth Policy (most recently updated in 2013) and include prerequisites for homebirth, such as, over 18 years of age, singleton pregnancy and free from pre-existing medical conditions or pregnancy complications among other

requirements (the complete Inclusion and Exclusion Criteria are listed in Appendix 1)[2]. For women who were not determined to be at low risk, particularly at the onset of labour, the review found evidence of an excess of neonatal morbidity and mortality in homebirth [1]. Additionally, an estimated 7.4% - 30% of low risk women planning a homebirth would require a transfer to hospital care during the antenatal period and 1.5%-13% would require a transfer after the onset of labour due to the development of labour complications [2]. Doherty et al. recommended women should be counselled about the potential for transfer to hospital during pregnancy or labour as it could be a major issue of concern for many women and may influence their decision to homebirth [1].

Previous studies into homebirth have been limited by small sample sizes, lack of an appropriate comparison group and differences between levels of risk at onset of labour. To overcome these limitations, this project incorporates twelve years of pregnancy data for home and hospital births and includes well defined risk levels assigned to each pregnancy at the onset of labour. Low risk hospital births were used as a reference level in the comparison of all outcomes between hospital and homebirth. Multiple births (twins, triplets, quadruplets) and preterm births (<37 weeks gestation) were excluded from the analysis. Multiple births and women at risk of preterm birth were ineligible for the homebirth model of care in accordance with Home Birth Policy guidelines from 2011 onwards and were rare among homebirths [2].

**Data sources**

Identification of all births from 2002 to 2013 and extraction of pregnancy outcomes, hospitalisations, deaths and congenital anomalies was performed using several of the core health datasets (www.datalinkage-wa.org/data-linkage/data-collections) within the linked data from the WA Data-Linkage System.

The WA Data-Linkage System facilitates systematic record linkage from population-based administrative health datasets within WA encompassing all pregnancies beyond 20 weeks gestation recorded in the Midwives Notifications System (MNS) (since 1980), all hospitalizations at public and private hospitals recorded in the Hospital Morbidity Data System (since 1970), presentations to public hospital emergency departments recorded in the Emergency Department Care Database (since 2003), all births and deaths recorded in the WA Birth Registrations (since 1974) and WA Death Registrations (since 1969), and all structural or functional anomalies present at conception or in pregnancy and diagnosed up to six years of age from the WA Register of Developmental Anomalies (since 1980). This system also includes the WA Electoral Roll (since 1988) recording all Australian citizens who are WA residents aged 18 years and over eligible to vote.

Pregnancy data from the MNS included maternal age, ethnicity, parity, smoking in pregnancy; pre-existing medical conditions including asthma, hypertension, diabetes and others; pregnancy complications including threatened abortion, antepartum haemorrhages due to placenta praevia, placental abruption or other causes, preeclampsia, pregnancy induced hypertension, gestational diabetes, threatened preterm labour, urinary tract infections, and other complications; analgesia and anaesthesia during labour and birth; complications of labour such as prolonged second stage of labour and fetal distress; mode of delivery including spontaneous vaginal, assisted vaginal and caesarean section; and postpartum complications such as postpartum haemorrhage and retained placenta. Medical conditions and pregnancy complications are also recorded by the MNS using the International Classification of Diseases (ICD) diagnosis codes. Neonatal outcomes recorded include gestational age at delivery (recorded as number completed weeks), sex, birth weight, live/stillborn birth status, Apgar score, resuscitation, admission to Special Care Nursery and duration of hospital stay. Socio-Economic-Index-For-Areas (SEIFA) Advantage-Disadvantage Index scores based on local government area were recoded into

quintiles and the top two quintiles were combined and used as an indicator of high socioeconomic level.

Antenatal hospitalisations and admissions up to 6 months after birth for mother and baby were extracted from the Hospital Morbidity System including ICD codes for diagnoses at each admission, hospital type, duration of stay and sources of referral. Antenatal presentations to the Emergency Department and presentations up to 6 months after birth for mother and baby were obtained from the Emergency Department Database. Antenatal congenital anomalies and anomalies detected up to 3 months after birth were obtained from the WA Register of Developmental Anomalies. Neonatal and post-neonatal mortality was extracted from the WA Death Registry.

Ethical approval was obtained in accordance with the National Health and Medical Research Council (NHMRC) guidelines [5]. Approval from the Human Research Committee was obtained for data from the WA routine data collections. The ethics approval process took nine months to complete with the additional set of requirements to comply with state-wide data collections. NHMRC guidelines were followed with respect to confidentiality and protection of identity.

*Ascertainment of risk*

Due to the vast amount of medical and obstetric information needed to statistically evaluate maternal and neonatal outcomes, an overall obstetric risk status was assigned to each pregnancy, thus avoiding the need to include a multitude of individual conditions in the statistical models. The implementation of an overall risk status was considered a suitable approach as it also aligned with medical and clinical ascertainment where pregnancy is generally classified as low, medium or high risk.

The assessment of risk followed the Home Birth Policy criteria for referral to medical care [2], but assigning risk levels was difficult given the lack of data on the timing or severity of

conditions often defined in the screening criteria. The assignment of risk levels could only be based on the presence or absence of conditions resulting in a stricter definition of low risk in the analysis. An example is gestational diabetes, for which women were only deemed at increased risk by the screening criteria if medication was needed for glycaemic control. By our definition, all women with gestational diabetes, including those not requiring medication, were assigned to a higher risk level.

Medical and obstetric risk depended on the presence or absence of medical and/or obstetric conditions with the potential to adversely affect pregnancy outcomes.

Medical

*High risk* - any pre-existing medical condition treated in the current pregnancy but not deemed to adversely affect pregnancy outcomes. Medical conditions included a history of stillbirth, preterm birth, hypertension, diabetes, asthma, genital herpes, cancers, anaemia, obesity, mental conditions, endocrine disorders, heart disease, respiratory disease, renal/kidney conditions or caesarean section last delivery.

*Low risk* - absence of any conditions above.

Obstetric

*High risk* - medical conditions or obstetric complications in the current pregnancy with potential to adversely affect pregnancy outcomes. These included threatened preterm labour, urinary tract infection, preeclampsia, antepartum haemorrhage, placenta praevia, placental abruption, gestational diabetes, prelabour rupture of membranes and other complications of pregnancy.

*Low risk* - absence of any medical or obstetric complications.

One of four levels were assigned to each pregnancy, created by a combination of medical and obstetric high and low risk, and were defined as:

- Level 1 (L1) – medical and obstetric low risk.
- Level 2 (L2) – medical high risk and obstetric low risk.
- Level 3 (L3) – medical low risk and obstetric high risk
- Level 4 (L4) – medical and obstetric high risk

**Statistical method**

The large data extracts were merged by James Humphreys, the programmer, and exported to SPSS format for analysis. Some merges of smaller datasets were made when further extractions were received over the study period. Routine data cleaning was performed and data manipulation was carried out to create the dataset requirements for statistical analysis.

Descriptive summaries of maternal, obstetric and neonatal characteristics were presented as frequency distributions (number, percentage) and stratified by planned hospital and planned homebirth. Univariate comparisons were made using Chi-square or Fisher exact tests when expected cell frequencies were small (less than 5).

Unadjusted and adjusted logistic regression modelling was performed on maternal and neonatal outcomes and compared between planned hospital and planned homebirths at each risk level.

*Maternal and neonatal outcomes*

Maternal outcomes included:

- Non-vertex presentation
- Induction of labour
- Epidural analgesia
- Prolonged labour
- Fetal distress

- Shoulder dystocia
- Mode of delivery – spontaneous vaginal, assisted vaginal, caesarean section,
- Third or fourth degree perineal trauma
- Episiotomy
- Retained placenta
- Post-partum haemorrhage

Neonatal outcomes included:

- Small for gestational age (<10$^{th}$ percentile)
- Apgar <7 at 5 minutes
- Resuscitation – minor, major
- Admission to special care nursery

*Variables chosen for adjustment*

Confounding variables were identified apriori and adjusted for in all models. Previous research conducted in the unit demonstrated that the demographic characteristics of women choosing homebirth were quite different to those of the hospital birth population [4]. The selection of variables for adjustment in the modelling of maternal and neonatal outcomes included demographic characteristics known to differ between hospital and homebirth cohorts and also known to influence pregnancy outcomes. The reference level used in the analysis of each of these variables is underlined.

Variables for adjustment in the analysis were:

- Maternal age (<20y, 20-34y, >34y)
- Ethnicity (Caucasian, Aboriginal and Torres Strait Islanders, other)
- Smoking in pregnancy (no, yes)
- Parity (0, 1-4, 5+)
- Presentation (vertex, non-vertex)
- Fetal problems during pregnancy (no, yes)
- Residential location (metro, rural)
- Hospital level (non-tertiary, tertiary)
- PIMC reporting periods (2002-2010, 2011-2013)

The categories chosen for maternal age, parity and ethnicity are commonly used in obstetric research to reflect associated changes in obstetric risk. Previous evidence shows women choosing homebirth are more likely to be older and to have had at least one child (multiparous) than the hospital population. The risk of developing pregnancy or labour complications is reduced for women between 20 and 34 years of age and/or with 1 to 4 children than for women outside these parameters. In particular, nulliparous women (first pregnancy beyond 20 weeks gestation) are at increased risk of many complications of pregnancy and labour compared with women who have had at least one child. Low risk nulliparous women who planned homebirth were at increased risk of intrapartum transfer due to labour complications and adverse perinatal outcomes than multiparous women in a recent English national study [10]. Aboriginal and Torres Strait Islanders (ATSI) are not common among planned homebirths, but were modelled separately as they have significantly poorer pregnancy outcomes. The risk of developing pregnancy complications ranges between 28-45% in ATSI compared with 16-25% in non-Indigenous women in WA [11]. Women of other ethnicities are also less likely to homebirth, however, are predisposed to higher rates of adverse maternal outcomes such as severe perineal trauma [12].

Smoking during pregnancy is more common among the hospital population and is a well-known risk factor for preterm birth and other adverse pregnancy outcomes. Women with fetal problems during pregnancy and/or a non-vertex presentation at onset of labour are not eligible to homebirth under the current Home Birth Policy guidelines due to the increased risk of adverse pregnancy outcomes.

Rural location serves as an indicator for the level of available maternity care. Rural services in WA offer a community clinic based, midwifery-led care service or a private general practice service [15]. Rural women are only eligible for homebirth if they are within 30 minutes from a maternity service, in accordance with the Home Birth Policy, and more often plan hospital births.

KEMH is the sole tertiary obstetrics institution in WA and as such, it services women with high risk pregnancies who are more predisposed to obstetric complications and interventions than women attending secondary hospitals or midwifery-led models of care such as homebirth.

The PIMC began reporting of perinatal mortality in homebirths from the 12$^{th}$ report onward (2002-2004 triennium) which prompted changes to governance and management guidelines that continually evolved over the twelve year study period [13]. The PIMC publishes reports every three years and the reporting triennia were incorporated into the models to account for changes in policy and governance in response to these findings.

*Logistic regression analysis*

The common approach to statistical model building is the minimisation of variables until the most parsimonious model is found that best describes the data while also exhibiting numerical stability and generalisability of the results [14]. This approach is often used for exploratory or predictive regression analysis, and involves the forward, backward or stepwise methods of variable selection. These methods were not used in this analysis as we wanted to retain the risk levels and adjust for all the preselected confounding variables in

the models. Thus, each variable was entered and retained during the selection process of the analysis. The four risk levels (L1-L4) assigned to hospital and homebirths, creating eight levels in total, were entered into the first block of modelling and the factors chosen for adjustment were entered into the second block of modelling for each maternal and neonatal outcome. The hospital medical and obstetric low risk level (L1) was the reference level in all models.

The effects of each risk level for hospital and homebirths on the specified maternal and neonatal outcomes were the main parameters of interest in the study, so all levels were retained and presented in the tables to provide a complete clinical picture, despite the small numbers in the higher risk levels for homebirths which would normally be collapsed to improve statistical power.

The unadjusted odds ratio (OR), adjusted odds ratio (aOR) and corresponding 95% confidence intervals (CI) were summarised in tables to illustrate the association of hospital and homebirth risk levels with maternal and neonatal outcomes. While adjustments were made in all models for the preselected variables, the estimates for the adjusted variables were not presented in the tables.

SPSS statistical software, Version 20.0, was used for data analysis [15].

## Results

There were 2,729 (0.9%) planned homebirths and 343,078 planned hospital births recorded in the Midwives Notification System (MNS) from 2002 to 2013. Twenty four homebirths and 34,073 hospital births were preterm and/or multiple pregnancies and were excluded from analysis. Term singleton births were analysed for 2,705 planned homebirths and 309,005 planned hospital births (Figure 1). Transfers to hospital care after the onset of labour due to the development of labour complications (intrapartum transfer) were required for 325 (12%) planned home births.

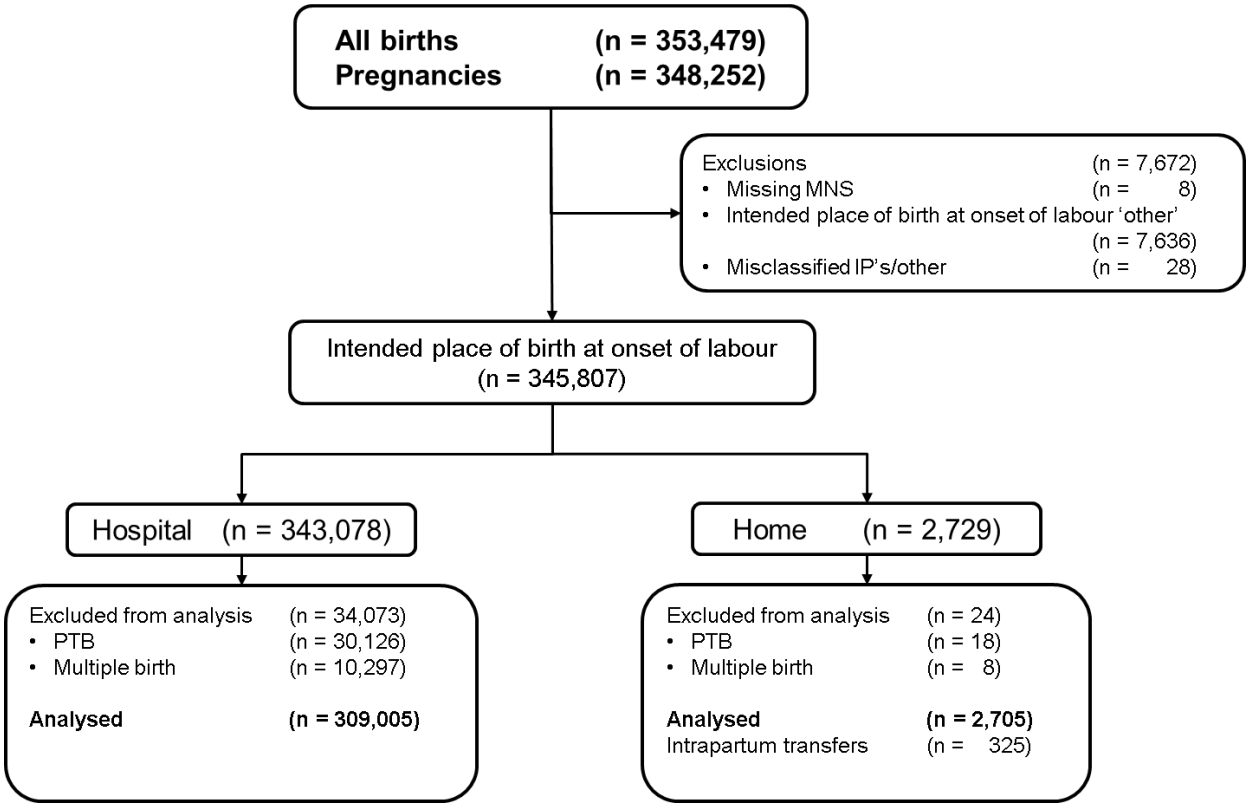


**Figure 1.** Births from 2002-2013 used in the comparison of outcomes between planned home and hospital births

*Maternal demographics and obstetric risk*

The characteristics of women planning homebirth differed greatly to those of women planning hospital birth (Table 1). Women planning home birth were more likely to be older, Caucasian, multiparous, non-smokers, living in the metropolitan area, of higher socioeconomic background, choose publicly funded care; and less likely to have a previous history of medical conditions such as hypertension, asthma, genital herpes, depression and diabetes.

At the onset of labour, there were 76.6% home and 41.2% hospital births identified as low risk for developing adverse pregnancy outcomes using the study criteria; 23.4% (n=632) of home births were identified with some medical or obstetric risk including 8.6% (n=233) with high obstetric risk and 2.0% (n=54) with high medical and obstetric risk.

Women planning homebirth had lower prevalence of threatened abortion (0.7% *vs* 3.6%), threatened preterm labour (0.8% *vs* 1.3%), urinary tract infection (0.9% *vs* 3.3%), antepartum haemorrhage (1.6% *vs* 2.2%), prelabour rupture of membranes (1.9% *vs* 2.7%), gestational diabetes (0.9% *vs* 5.2%) and fetal problems (0.2% *vs* 2.0%) during pregnancy compared with planned hospital births (Table 2). Fetal problems included signs of poor fetal growth, excessive growth, hypoxia or intrauterine death.

Babies born before arrival (BBA) occurred in home births if the midwife did not arrive in time to attend the birth, or if women delivered on route during transfer to hospital. BBA was more prevalent among planned homebirth than hospital birth (3.2% *vs* 0.5%).

**Table 1.** Demographic and medical/obstetric history for planned hospital and planned home births, 2002-2013.

| | Planned hospital birth N=309,005 | | Planned home birth N=2,705 | | |
|---|---|---|---|---|---|
| | N | % | N | % | p-value |
| **Demographics** | | | | | |
| Age (y) | | | | | |
| <20 | 15000 | 4.9 | 22 | 0.8 | <0.001 |
| 20-34 | 233049 | 75.4 | 1946 | 71.9 | |
| ≥35 | 60956 | 19.7 | 737 | 27.2 | |
| Ethnicity | | | | | |
| Caucasian | 245501 | 79.4 | 2454 | 90.7 | <0.001 |
| ATSI | 15563 | 5.0 | 13 | 0.5 | |
| Other | 47941 | 15.5 | 238 | 8.8 | |
| Parity | | | | | |
| 0 | 128562 | 41.6 | 871 | 32.2 | <0.001 |
| 1-4 | 175160 | 56.7 | 1762 | 65.1 | |
| ≥5 | 5283 | 1.7 | 72 | 2.7 | |
| Smoker | 45722 | 14.8 | 97 | 3.6 | <0.001 |
| SEIFA high (n=302,993) | 115986 | 38.6 | 1293 | 50.0 | <0.001 |
| HACC region | | | | | |
| Metro | 232618 | 75.6 | 2358 | 87.2 | <0.001 |
| South West | 21127 | 6.9 | 228 | 8.4 | |
| Great Southern | 7774 | 2.5 | 36 | 1.3 | |
| Remote | 46067 | 15.0 | 83 | 3.1 | |
| **Medical history** | | | | | |
| Essential hypertension | 3146 | 1.0 | 3 | 0.1 | <0.001 |
| Diabetes mellitus | 1581 | 0.5 | 1 | 0.04 | 0.001 |
| Asthma | 32852 | 10.6 | 86 | 3.2 | <0.001 |
| Anaemia | 7977 | 2.6 | 69 | 2.6 | |
| Genital herpes | 5685 | 1.8 | 32 | 1.2 | 0.012 |
| Depression | 13839 | 4.5 | 37 | 1.4 | |
| Anxiety/stress | 3416 | 1.1 | 26 | 1.0 | |
| Other | 43784 | 14.2 | 106 | 3.9 | <0.001 |
| **Obstetric history** | | | | | |
| Stillbirth | 3773 | 1.2 | 16 | 0.6 | 0.003 |
| Multiple birth | 2820 | 0.9 | 25 | 0.9 | 0.950 |
| CS | 50637 | 16.4 | 130 | 4.8 | <0.001 |
| CS last delivery | 47604 | 15.4 | 89 | 3.3 | <0.001 |
| **Model of care** | | | | | |
| Private | 86534 | 28.0 | 629 | 23.3 | <0.001 |
| Public | 222471 | 72.0 | 2076 | 76.7 | |
| Intrapartum transfers | - | - | 325 | 12.0 | |
| **Level of risk** | | | | | |
| L1 | 127383 | 41.2 | 2073 | 76.6 | <0.001 |
| L2 | 92995 | 30.1 | 399 | 14.8 | |
| L3 | 45593 | 14.8 | 179 | 6.6 | |
| L4 | 43034 | 13.9 | 54 | 2.0 | |

SEIFA-socioeconomic index for areas (high represents the top two quintiles), HACC-home and community care, CS-caesarean section, L1- medical and obstetric low risk , L2 -medical high risk, L3- obstetric high risk, L4-medical and obstetric high risk.

**Table 2.** Pregnancy and birth outcomes for planned hospital and planned home births, 2002-2013

| | Planned hospital birth N=309,005 | | Planned home birth N=2,705 | | |
|---|---|---|---|---|---|
| | N | % | N | % | p-value |
| **Pregnancy complications** | | | | | |
| Threatened abortion | 11184 | 3.6 | 19 | 0.7 | <0.001 |
| Threatened preterm labour | 3942 | 1.3 | 22 | 0.8 | 0.033 |
| Urinary tract infection | 10338 | 3.3 | 23 | 0.9 | <0.001 |
| Pre-eclampsia | 7524 | 2.4 | 1 | 0.0 | <0.001 |
| Placenta praevia | 1146 | 0.4 | 2 | 0.1 | 0.011 |
| Placental abruption | 545 | 0.2 | 1 | 0.0 | 0.084 |
| Antepartum haemorrhage | 6655 | 2.2 | 42 | 1.6 | 0.032 |
| Prelabour rupture of membranes | 8207 | 2.7 | 52 | 1.9 | 0.018 |
| Gestational diabetes | 16008 | 5.2 | 25 | 0.9 | <0.001 |
| Fetal problems | 6139 | 2.0 | 5 | 0.2 | <0.001 |
| Congenital anomalies | 2107 | 0.7 | 4 | 0.1 | 0.001 |
| Other | 46886 | 15.2 | 80 | 3.0 | <0.001 |
| **Obstetric intervention** | | | | | |
| Onset of labour | | | | | |
| Spontaneous | 89280 | 28.9 | 2412 | 89.2 | <0.001 |
| Augmented | 65852 | 21.3 | 263 | 9.7 | <0.001 |
| Induced | 91430 | 29.6 | 30 | 1.1 | <0.001 |
| No labour | 62443 | 20.2 | 0 | 0.0 | <0.001 |
| Analgesia during labour[1] | | | | | |
| None | 106932 | 43.0 | 2532 | 94.5 | <0.001 |
| Narcotic | 33164 | 13.3 | 14 | 0.5 | <0.001 |
| Spinal/epidural | 108661 | 43.7 | 133 | 5.0 | <0.001 |
| Non-vertex presentation | 13000 | 4.2 | 34 | 1.3 | <0.001 |
| Mode of delivery | | | | | |
| Spontaneous | 164468 | 53.2 | 2500 | 92.4 | <0.001 |
| Assisted vaginal | 44036 | 14.3 | 97 | 3.6 | |
| Emergency CS | 42766 | 13.8 | 108 | 4.0 | |
| Elective CS | 57735 | 18.7 | 0 | 0 | |
| **Maternal outcomes** | | | | | |
| Labour complications[1] | | | | | |
| Precipitate delivery | 12889 | 5.1 | 179 | 6.6 | <0.001 |
| Fetal distress | 37034 | 14.7 | 81 | 3.0 | <0.001 |
| Cord problems | 10562 | 4.2 | 69 | 2.5 | <0.001 |
| Cephalopelvic disproportion | 3357 | 1.3 | 7 | 0.3 | <0.001 |
| Occipito-posterior | 6963 | 2.8 | 36 | 1.3 | <0.001 |
| Shoulder dystocia | 5099 | 2.0 | 26 | 1.0 | <0.001 |
| Failure to progress | 27478 | 10.9 | 191 | 7.1 | <0.001 |
| Other | 54949 | 21.9 | 383 | 14.2 | <0.001 |
| Severe perineal tear[2] | 3590 | 1.7 | 32 | 1.2 | 0.056 |
| Episiotomy[2] | 40308 | 19.3 | 75 | 2.9 | <0.001 |
| Retained placenta[2] | 3223 | 1.5 | 30 | 1.2 | 0.108 |
| PPH (≥500mls) | 37641 | 12.2 | 265 | 9.8 | 0.001 |
| Born before arrival[3] | 979 | 0.5 | 83 | 3.2 | <0.001 |
| First 6 months | | | | | |
| Emergency presentations | 1785 | 0.6 | 9 | 0.3 | 0.094 |
| Hospital admissions | 22459 | 7.3 | 115 | 4.3 | <0.001 |

[1]labour only [2]vaginal delivery only [3]in homebirths, either the midwife did not arrive to attend birth before it occurred, or if women had a transfer they may have delivered on route.

*Obstetric interventions and maternal outcomes*

Obstetric interventions and maternal outcomes for home and hospital births at assigned risk levels are presented in Table 3. Compared with the low risk planned hospital births, low risk planned homebirths had significantly less induction of labour (0.7% *vs* 31.1%; aOR 0.01, CI 0.01-0.02), epidural analgesia (3.8% *vs* 41.5%; aOR 0.05, CI 0.04-0.06), prolonged second stage of labour (5.3% *vs* 9.1%; aOR 0.66, CI 0.54-0.81), fetal distress (2.2% *vs* 12.6%; aOR 0.17, CI 0.13-0.23) and shoulder dystocia (0.8% *vs* 2.0%; aOR 0.38, CI 0.23-0.62). They were more likely to have spontaneous vaginal births (94.8% *vs* 70.7%; aOR 8.20, CI 6.70-10.03), but assisted vaginal birth (2.6% vs 17.9%; aOR 0.13, CI 0.10-0.17), emergency caesarean section (2.6% vs 11.5%; aOR 0.22, CI 0.17-0.29) and episiotomy (2.3% vs 19.2%; aOR 0.09, CI 0.07-0.21) occurred less often. No significant difference was observed with respect to severe perineal tears, retained placenta, or postpartum haemorrhage.

Women planning homebirth who were not at low risk at onset of labour (L2-L4 collapsed) were significantly more likely to have a prolonged second stage of labour (13.0% *vs* 9.1%; aOR 1.63, CI 1.27-2.10) and postpartum haemorrhage (16.3% *vs* 8.8%; aOR 1.43, CI 1.39-1.47) than low risk planned hospital births (data not shown).

**Table 3.** Obstetric interventions and maternal outcomes by level of risk, 2002-2013.

| | | Total n | Events n | % | Unadjusted OR[1] (95% CI) | Adjusted OR[1,2] (95% CI) |
|---|---|---|---|---|---|---|
| **Non-vertex present** | | | | | | |
| Hospital | L1 | 127383 | 4628 | 3.6 | 1.00 | 1.00 |
| | L2 | 92995 | 3489 | 3.8 | 1.03 (0.99-1.08) | 1.12 (1.07-1.17) |
| | L3 | 45593 | 2394 | 5.3 | 1.47 (1.39-1.54) | 1.44 (1.37-1.52) |
| | L4 | 43034 | 2489 | 5.8 | 1.62 (1.54-1.71) | 1.70 (1.61-1.79) |
| Home | L1 | 2073 | 25 | 1.2 | 0.32 (0.22-0.48) | 0.34 (0.23-0.50) |
| | L2 | 399 | 5 | 1.3 | 0.34 (0.14-0.81) | 0.35 (0.15-0.86) |
| | L3 | 179 | 4 | 2.2 | 0.60 (0.22-1.63) | 0.58 (0.22-1.57) |
| | L4 | 54 | 0 | - | - | - |
| **Induction of labour[3]** | | | | | | |
| Hospital | L1 | 117789 | 36663 | 31.1 | 1.00 | 1.00 |
| | L2 | 60933 | 19072 | 31.3 | 1.01 (0.99-1.03) | 1.01 (0.99-1.04) |
| | L3 | 41250 | 20519 | 49.7 | 2.19 (2.14-2.24) | 2.17 (2.12-2.22) |
| | L4 | 31298 | 15176 | 48.5 | 2.08 (2.03-2.13) | 2.02 (1.97-2.08) |
| Home | L1 | 2073 | 15 | 0.7 | 0.02 (0.01-0.03) | 0.01 (0.01-0.02) |
| | L2 | 399 | 4 | 1.0 | 0.02 (0.01-0.06) | 0.02 (0.01-0.05) |
| | L3 | 179 | 10 | 5.6 | 0.13 (0.07-0.25 | 0.11 (0.06-0.20) |
| | L4 | 54 | 1 | 1.9 | 0.04 (0.01-0.31) | 0.04 (0.01-0.26) |
| **Epidural/spinal analgesia[3]** | | | | | | |
| Hospital | L1 | 117789 | 48885 | 41.5 | 1.00 | 1.00 |
| | L2 | 60933 | 26183 | 43.0 | 1.06 (1.04-1.08) | 1.16 (1.13-1.18) |
| | L3 | 41250 | 19088 | 46.3 | 1.21 (1.18-1.24) | 1.24 (1.21-1.27) |
| | L4 | 31298 | 14507 | 46.4 | 1.22 (1.19-1.25) | 1.37 (1.33-1.41) |
| Home | L1 | 2073 | 79 | 3.8 | 0.05 (0.04-0.07) | 0.05 (0.04-0.06) |
| | L2 | 399 | 34 | 8.5 | 0.13 (0.09-0.19) | 0.12 (0.08-0.17) |
| | L3 | 179 | 12 | 6.7 | 0.10 (0.06-0.18) | 0.07 (0.04-0.13) |
| | L4 | 54 | 8 | 14.8 | 0.25 (0.12-0.53) | 0.22 (0.10-0.48) |
| **Prolonged labour[3]** | | | | | | |
| Hospital | L1 | 117789 | 10680 | 9.1 | 1.00 | 1.00 |
| | L2 | 60933 | 7904 | 13.0 | 1.49 (1.45-1.54) | 1.48 (1.43-1.53) |
| | L3 | 41250 | 4500 | 10.9 | 1.23 (1.18-1.27) | 1.07 (1.02-1.11) |
| | L4 | 31298 | 4395 | 14.0 | 1.64 (1.58-1.70) | 1.42 (1.36-1.48) |
| Home | L1 | 2073 | 109 | 5.3 | 0.56 (0.46-0.68) | 0.66 (0.54-0.81) |
| | L2 | 399 | 54 | 13.5 | 1.57 (1.18-2.09) | 1.92 (1.41-2.62) |
| | L3 | 179 | 20 | 11.2 | 1.26 (0.79-2.01) | 1.11 (0.68-1.82) |
| | L4 | 54 | 8 | 14.8 | 1.78 (0.84-3.78) | 1.91 (0.85-4.27) |
| **Fetal distress[3]** | | | | | | |
| Hospital | L1 | 117789 | 14832 | 12.6 | 1.00 | 1.00 |
| | L2 | 60933 | 8872 | 14.6 | 1.18 (1.15-1.22) | 1.23 (1.20-1.27) |
| | L3 | 41250 | 7407 | 18.0 | 1.52 (1.47-1.57) | 1.33 (1.29-1.37) |
| | L4 | 31298 | 5923 | 18.9 | 1.62 (1.57-1.67) | 1.46 (1.41-1.51) |
| Home | L1 | 2073 | 45 | 2.2 | 0.15 (0.12-0.21) | 0.17 (0.13-0.23) |
| | L2 | 399 | 19 | 4.8 | 0.35 (0.22-0.55) | 0.41 (0.26-0.66) |
| | L3 | 179 | 13 | 7.3 | 0.54 (0.31-0.96) | 0.48 (0.27-0.85) |
| | L4 | 54 | 4 | 7.4 | 0.57 (0.20-1.57) | 0.58 (0.20-1.63) |

**Table 3 cont.**

| | | Total n | Events n | % | Unadjusted OR[1] (95% CI) | Adjusted OR[1,2] (95% CI) |
|---|---|---|---|---|---|---|
| **Shoulder dystocia[3]** | | | | | | |
| Hospital | L1 | 117789 | 2356 | 2.0 | 1.00 | 1.00 |
| | L2 | 60933 | 1248 | 2.0 | 1.02 (0.95-1.10) | 1.00 (0.93-1.08) |
| | L3 | 41250 | 885 | 2.1 | 1.07 (0.99-1.16) | 1.11 (1.03-1.20) |
| | L4 | 31298 | 610 | 1.9 | 0.97 (0.89-1.06) | 0.99 (0.90-1.09) |
| Home | L1 | 2073 | 16 | 0.8 | 0.38 (0.23-0.62) | 0.38 (0.23-0.62) |
| | L2 | 399 | 6 | 1.5 | 0.75 (0.33-1.67) | 0.72 (0.32-1.62) |
| | L3 | 179 | 3 | 1.7 | 0.83 (0.27-2.61) | 0.85 (0.27-2.67) |
| | L4 | 54 | 1 | 1.9 | 0.94 (0.13-6.80) | 0.88 (0.12-6.39) |
| **Spontaneous VD[4]** | | | | | | |
| Hospital | L1 | 115803 | 81844 | 70.7 | 1.00 | 1.00 |
| | L2 | 59736 | 37851 | 63.4 | 0.72 (0.71-0.74) | 0.57 (0.56-0.59) |
| | L3 | 40299 | 26118 | 64.8 | 0.75 (0.74-0.77) | 0.80 (0.78-0.82) |
| | L4 | 30382 | 17815 | 58.6 | 0.58 (0.56-0.59) | 0.49 (0.47-0.50) |
| Home | L1 | 2048 | 1942 | 94.8 | 7.01 (5.83-8.43) | 8.20 (6.70-10.03) |
| | L2 | 394 | 339 | 86.0 | 2.64 (1.99-3.50) | 2.18 (1.61-2.95) |
| | L3 | 175 | 160 | 91.4 | 3.86 (2.37-6.28) | 5.91 (3.42-10.22) |
| | L4 | 54 | 44 | 81.5 | 1.85 (0.93-3.69) | 1.69 (0.81-3.54) |
| **Assisted VD[4]** | | | | | | |
| Hospital | L1 | 115803 | 20721 | 17.9 | 1.00 | 1.00 |
| | L2 | 59736 | 10023 | 16.8 | 0.92 (0.90-0.95) | 1.06 (1.03-1.09) |
| | L3 | 40299 | 7487 | 18.6 | 1.05 (1.02-1.08) | 1.00 (0.97-1.03) |
| | L4 | 30382 | 5159 | 17.0 | 0.94 (0.91-0.97) | 1.03 (1.00-1.07) |
| Home | L1 | 2048 | 53 | 2.6 | 0.12 (0.09-0.16) | 0.13 (0.10-0.17) |
| | L2 | 394 | 23 | 5.8 | 0.28 (0.19-0.43) | 0.34 (0.22-0.52) |
| | L3 | 175 | 7 | 4.0 | 0.19 (0.09-0.41) | 0.16 (0.08-0.35) |
| | L4 | 54 | 4 | 7.4 | 0.37 (0.14-1.04) | 0.41 (0.14-1.16) |
| **Emergency CS[4]** | | | | | | |
| Hospital | L1 | 115803 | 13344 | 11.5 | 1.00 | 1.00 |
| | L2 | 59736 | 11905 | 19.9 | 1.91 (1.86-1.96) | 2.15 (2.09-2.22) |
| | L3 | 40299 | 6732 | 16.7 | 1.54 (1.49-1.59) | 1.44 (1.40-1.49) |
| | L4 | 30382 | 7431 | 24.5 | 2.49 (2.41-2.57) | 2.63 (2.55-2.73) |
| Home | L1 | 2048 | 53 | 2.6 | 0.20 (0.15-0.26) | 0.22 (0.17-0.29) |
| | L2 | 394 | 32 | 8.1 | 0.68 (0.47-0.97) | 0.81 (0.56-1.17) |
| | L3 | 175 | 8 | 4.6 | 0.37 (0.18-0.75) | 0.33 (0.16-0.70) |
| | L4 | 54 | 6 | 11.1 | 0.98 (0.42-2.29) | 1.05 (0.44-2.50) |
| **Perineal Trauma (3rd/4th deg) [5]** | | | | | | |
| Hospital | L1 | 103208 | 1665 | 1.6 | 1.00 | 1.00 |
| | L2 | 48290 | 952 | 2.0 | 1.23 (1.13-1.33) | 1.24 (1.14-1.35) |
| | L3 | 33777 | 613 | 1.8 | 1.13 (1.03-1.24) | 1.06 (0.96-1.16) |
| | L4 | 23138 | 360 | 1.6 | 0.96 (0.86-1.08) | 0.93 (0.83-1.05) |
| Home | L1 | 2014 | 22 | 1.1 | 0.67 (0.44-1.03) | 0.83 (0.54-1.27) |
| | L2 | 366 | 6 | 1.6 | 1.02 (0.45-2.28) | 1.30 (0.58-2.95) |
| | L3 | 169 | 3 | 1.8 | 1.10 (0.35-3.45) | 1.11 (0.35-3.50) |
| | L4 | 48 | 1 | 2.1 | 1.32 (0.18-9.60) | 1.52 (0.21-11.20) |

**Table 3 cont.**

| | | Total n | Events n | % | Unadjusted OR[1] (95% CI) | Adjusted OR[1,2] (95% CI) |
|---|---|---|---|---|---|---|
| **Episiotomy**[5] | | | | | | |
| Hospital | L1 | 103208 | 19832 | 19.2 | 1.00 | 1.00 |
| | L2 | 48290 | 9127 | 18.9 | 0.98 (0.95-1.01) | 1.10 (1.07-1.13) |
| | L3 | 33777 | 6875 | 20.4 | 1.07 (1.04-1.11) | 1.06 (1.02-1.09) |
| | L4 | 23138 | 4474 | 19.3 | 1.01 (0.97-1.04) | 1.13 (1.09-1.18) |
| Home | L1 | 2014 | 46 | 2.3 | 0.10 (0.07-0.13) | 0.09 (0.07-0.12) |
| | L2 | 366 | 18 | 4.9 | 0.22 (0.14-0.35) | 0.25 (0.15-0.40) |
| | L3 | 169 | 6 | 3.6 | 0.15 (0.07-0.35) | 0.12 (0.05-0.27) |
| | L4 | 48 | 5 | 10.6 | 0.50 (0.20-1.26) | 0.49 (0.19-1.28) |
| **Retained placenta**[5] | | | | | | |
| Hospital | L1 | 103255 | 1399 | 1.4 | 1.00 | 1.00 |
| | L2 | 48318 | 784 | 1.6 | 1.20 (1.10-1.31) | 1.15 (1.05-1.26) |
| | L3 | 33788 | 585 | 1.7 | 1.28 (1.61-1.41) | 1.19 (1.08-1.32) |
| | L4 | 23143 | 455 | 2.0 | 1.46 (1.31-1.62) | 1.27 (1.14-1.42) |
| Home | L1 | 2014 | 19 | 0.9 | 0.69 (0.44-1.09) | 0.73 (0.46-1.15) |
| | L2 | 366 | 4 | 1.1 | 0.80 (0.30-2.16) | 0.85 (0.32-2.27) |
| | L3 | 169 | 7 | 4.1 | 3.14 (1.47-6.71) | 3.11 (1.46-6.65) |
| | L4 | 48 | 0 | - | - | - |
| **PPH** | | | | | | |
| Hospital | L1 | 127383 | 11216 | 8.8 | 1.00 | 1.00 |
| | L2 | 92995 | 12827 | 13.8 | 1.66 (1.61-1.70) | 1.43 (1.39-1.47) |
| | L3 | 45593 | 5725 | 12.6 | 1.49 (1.44-1.54) | 1.22 (1.18-1.27) |
| | L4 | 43034 | 7874 | 18.3 | 2.31 (2.24-2.39) | 1.59 (1.53-1.64) |
| Home | L1 | 2073 | 162 | 7.8 | 0.87 (0.74-1.03) | 1.08 (0.91-1.28) |
| | L2 | 399 | 63 | 15.8 | 1.94 (1.48-2.54) | 1.83 (1.37-2.44) |
| | L3 | 179 | 30 | 16.8 | 2.08 (1.41-3.09) | 1.99 (1.29-3.05) |
| | L4 | 54 | 10 | 18.5 | 2.41 (1.21-4.79) | 2.06 (0.99-4.31) |

Hosp – planned hospital birth, Home-planned homebirth, L1- medical and obstetric low risk , L2 -medical high risk, L3- obstetric high risk, L4- medical and obstetric high risk, VD-vaginal delivery, CS-caesarean section, PPH-postpartum haemorrhage.
[1]The reference for all comparisons is medical and obstetric low risk hospital birth.
[2]Adjustment has been made for maternal age, nulliparity, Caucasian, ATSI, smoking, rural, tertiary hospital, PIMC year, fetal problems during pregnancy and non-vertex presentation.
[3]labour only, [4]labour and vertex presentation only, [5]vaginal births only

Nulliparous women were at increased risk of developing antenatal complications, labour complications and adverse maternal outcomes compared with multiparous women (data not shown).

The number of hospital admissions in the first 6 months after birth were lower for home births (4.3% *vs* 7.3%), while the number of presentations to Emergency Department in the same time period were similar. Reasons for hospital admissions during the first 6 months after planned homebirth were delivery related (1.1%) and for other follow up care (1.9%).

*Neonatal outcomes*

Post-term pregnancies with gestations ≥42 weeks (5.5% *vs* 0.6%) and large for gestational age babies (>90$^{th}$ centile) (11.2% *vs* 7.5%) were more common among planned homebirths (Table 4). Congenital anomalies diagnosed at birth or during the first 3 months of life were less frequent among homebirths (1.9% *vs* 3.5%). Presentations to Emergency Departments (0.3% *vs* 0.8%) and admissions to hospital (5.2% *vs* 9.1%) during the first 6 months after birth were also less frequent among homebirths. The main reasons for hospital admission were respiratory problems (1.7%) and other infectious/parasitic conditions (1.1%).

**Table 4.** Neonatal outcomes for planned hospital and planned home births 2002-2013

| | **Planned hospital birth Livebirths N=308,602** | | **Planned home birth Livebirths N=2,701** | | |
|---|---|---|---|---|---|
| **Neonatal outcomes** | **N** | **%** | **N** | **%** | **p-value** |
| Male[1] | 157427 | 50.9 | 1364 | 50.4 | 0.849 |
| GA ≥42 weeks[1] | 1758 | 0.6 | 149 | 5.5 | <0.001 |
| Apgar <7 at 5 minutes | 2771 | 0.9 | 15 | 0.6 | 0.060 |
| Resuscitation | | | | | |
| Minor[2] | 67779 | 22.0 | 179 | 6.6 | <0.001 |
| Major[3] | 18895 | 6.1 | 104 | 3.9 | <0.001 |
| SGA (<10$^{th}$ centile) | 21663 | 7.0 | 111 | 4.1 | <0.001 |
| LGA (>90$^{th}$ centile) | 23211 | 7.5 | 303 | 11.2 | <0.001 |
| SCN admission | 17311 | 5.6 | 35 | 1.3 | <0.001 |
| Congenital anomalies | | | | | |
| At birth | 6308 | 2.0 | 25 | 0.9 | <0.001 |
| 3 months | 4542 | 1.5 | 26 | 1.0 | 0.028 |
| First 6 months | | | | | |
| Emergency presentations | 2552 | 0.8 | 8 | 0.3 | 0.002 |
| Hospital admissions | 28033 | 9.1 | 141 | 5.2 | <0.001 |

[1]all births, [2] includes suction, oxygen, bag and mask, [3] includes intubation, external cardiac massage, ventilation. GA-gestational age, SGA-small for gestational age, LGA-large for gestational age, SCN-special care nursery.

Compared with low risk hospital births, the need for neonatal resuscitation (major: 3.2% *vs* 5.3%; aOR 0.67, CI 0.53-0.86, and minor: 5.6% *vs* 20.7%; aOR 0.23, CI 0.19-0.28) and admissions to special care nursery (0.9% *vs* 4.2%; aOR 0.20, CI 0.13-0.32) were less prevalent among low risk home births (Table 5). No evidence of difference was observed with respect to babies born small for gestational age (<10$^{th}$ centile) or with Apgar score less

than 7 at 5 minutes. Neonatal outcomes did not differ between nulliparous and multiparous women.

**Table 5.** Neonatal outcomes by level of risk, 2002-2013.

| | | Total n | Events n | % | Unadjusted OR[1] (95% CI) | Adjusted OR[1,2] (95% CI) |
|---|---|---|---|---|---|---|
| **Neonatal outcomes[3]** | | | | | | |
| **SGA** | | | | | | |
| Hospital | L1 | 127287 | 8597 | 6.8 | 1.00 | 1.00 |
| | L2 | 92930 | 5075 | 5.5 | 0.80 (0.77-0.83) | 0.90 (0.87-0.93) |
| | L3 | 45473 | 4364 | 9.6 | 1.47 (1.41-1.52) | 1.02 (0.98-1.07) |
| | L4 | 42906 | 3627 | 8.5 | 1.27 (1.22-1.33) | 0.90 (0.86-0.95) |
| Home | L1 | 2070 | 88 | 4.3 | 0.61 (0.50-0.76) | 0.84 (0.68-1.05) |
| | L2 | 399 | 14 | 3.5 | 0.50 (0.29-0.86) | 0.74 (0.43-1.26) |
| | L3 | 178 | 7 | 3.9 | 0.57 (0.27-1.20) | 0.62 (0.28-1.34) |
| | L4 | 54 | 2 | 3.7 | 0.27 (0.04-1.92) | 0.35 (0.05-2.57) |
| **Apgar<7 at 5 minutes** | | | | | | |
| Hospital | L1 | 127290 | 995 | 0.8 | 1.00 | 1.00 |
| | L2 | 92931 | 795 | 0.9 | 1.09 (1.00-1.20) | 1.11 (1.01-1.22) |
| | L3 | 45473 | 466 | 1.0 | 1.30 (1.17-1.46) | 1.17 (1.05-1.31) |
| | L4 | 42906 | 515 | 1.2 | 1.55 (1.39-1.72) | 1.35 (1.20-1.51) |
| Home | L1 | 2070 | 7 | 0.3 | 0.37 (0.17-0.83) | 0.45 (0.20-1.01) |
| | L2 | 399 | 5 | 1.3 | 1.61 (0.67-3.90) | 1.75 (0.72-4.24) |
| | L3 | 178 | 3 | 1.7 | 2.18 (0.70-6.83) | 2.23 (0.71-7.01) |
| | L4 | 54 | 0 | - | - | - |
| **Minor resuscitation** | | | | | | |
| Hospital | L1 | 127080 | 26296 | 20.7 | 1.00 | 1.00 |
| | L2 | 92801 | 20642 | 22.2 | 1.10 (1.07-1.12) | 1.18 (1.16-1.21) |
| | L3 | 45372 | 10553 | 23.3 | 1.16 (1.13-1.19) | 1.10 (1.07-1.13) |
| | L4 | 42826 | 10288 | 24.0 | 1.21 (1.18-1.24) | 1.22 (1.19-1.25) |
| Home | L1 | 2066 | 116 | 5.6 | 0.23 (0.19-0.27) | 0.23 (0.19-0.28) |
| | L2 | 398 | 30 | 7.5 | 0.31 (0.22-0.45) | 0.37 (0.25-0.54) |
| | L3 | 176 | 22 | 12.5 | 0.55 (0.35-0.85) | 0.53 (0.34-0.83) |
| | L4 | 52 | 11 | 21.2 | 0.93 (0.47-1.86) | 0.98 (0.49-1.98) |
| **Major resuscitation** | | | | | | |
| Hospital | L1 | 127080 | 6778 | 5.3 | 1.00 | 1.00 |
| | L2 | 92801 | 5393 | 5.8 | 1.09 (1.05-1.14) | 1.14 (1.10-1.18) |
| | L3 | 45372 | 3242 | 7.1 | 1.37 (1.31-1.43) | 1.25 (1.20-1.31) |
| | L4 | 42826 | 3482 | 8.1 | 1.57 (1.51-1.64) | 1.45 (1.38-1.51) |
| Home | L1 | 2066 | 67 | 3.2 | 0.60 (0.47-0.76) | 0.67 (0.53-0.86) |
| | L2 | 398 | 21 | 5.3 | 0.99 (0.64-1.54) | 1.09 (0.70-1.70) |
| | L3 | 176 | 10 | 5.7 | 1.07 (0.57-2.03) | 1.07 (0.56-2.02) |
| | L4 | 52 | 6 | 11.5 | 2.37 (1.01-5.55) | 2.43 (1.03-5.73) |
| **SCN admission** | | | | | | |
| Hospital | L1 | 127290 | 5349 | 4.2 | 1.00 | 1.00 |
| | L2 | 92931 | 4980 | 5.4 | 1.29 (1.24-1.34) | 1.21 (1.17-1.26) |
| | L3 | 45473 | 3132 | 6.9 | 1.69 (1.61-1.76) | 1.49 (1.42-1.56) |
| | L4 | 42906 | 3850 | 9.0 | 2.24 (2.15-2.34) | 1.81 (1.73-1.89) |
| Home | L1 | 2069 | 18 | 0.9 | 0.20 (0.13-0.32) | 0.20 (0.13-0.32) |
| | L2 | 399 | 8 | 2.0 | 0.47 (0.23-0.94) | 0.41 (0.20-0.83) |
| | L3 | 178 | 5 | 2.8 | 0.66 (0.27-1.60) | 0.56 (0.23-1.36) |
| | L4 | 54 | 4 | 7.4 | 1.86 (0.67-5.14) | 1.57 (0.56-4.39) |

[1]The reference for all comparisons is medical and obstetric low risk hospital birth.
[2]Adjustment has been made for maternal age, nulliparity, Caucasian, ATSI, smoking, rural, tertiary hospital, PIMC year, fetal problems during pregnancy and non-vertex presentation, [3]livebirths only
SGA-small for gestational age (<10$^{th}$ centile), SCN-special care nursery.

*Perinatal mortality*

There were 3 stillbirths and 2 neonatal deaths in low risk homebirths (n=2,073) from 2002 to 2013. The perinatal mortality rate did not statistically differ to the rate observed in low risk hospital births (2.4 *vs* 1.2 per 1,000 births; OR 2.24, CI 0.92-5.47) (Table 6).

Among pregnancies in homebirths not considered low risk at onset of labour (L2-L4 collapsed, n=632), there was 1 stillbirth and 6 neonatal deaths, and significantly increased perinatal mortality (11.1 per 1,000 births; OR 9.61, CI 4.46-20.71). There were 325 intrapartum transfers (12.0%) among planned home births, of which 5 resulted in perinatal death.

**Table 6.** Mortality by risk level for hospital and homebirths, 2002-2013.

| | | **Total n** | **Event n** | **Rate per 1000** | **Unadjusted OR[1] (95% CI)** | **Adjusted OR[1,2] (95% CI)** |
|---|---|---|---|---|---|---|
| **Stillbirths** | | | | | | |
| Hospital | L1 | 127383 | 93 | 0.73 | 1.00 | 1.00 |
| | L2 | 92995 | 64 | 0.69 | 0.94 (0.69-1.30) | 1.01 (0.73-1.39) |
| | L3 | 45593 | 120 | 2.63 | 3.61 (2.75-4.73) | 1.64 (1.21-2.22) |
| | L4 | 43034 | 128 | 2.97 | 4.08 (3.12-5.33) | 1.71 (1.25-2.35) |
| Home | L1 | 2073 | 3 | 1.45 | 1.98 (0.63-6.24) | 2.13 (0.67-6.74) |
| | L2 | 399 | 0 | - | - | - |
| | L3 | 179 | 1 | 5.59 | 7.65 (1.06-55.19) | 5.52 (0.75-40.62) |
| | L4 | 54 | 0 | - | - | - |
| **Neonatal deaths[3]** | | | | | | |
| Hospital | L1 | 127284 | 61 | 0.48 | 1.00 | 1.00 |
| | L2 | 92930 | 31 | 0.33 | 0.70 (0.45-1.07) | 0.62 (0.40-0.97) |
| | L3 | 45468 | 56 | 1.23 | 2.52 (1.75-3.64) | 1.88 (1.29-2.75) |
| | L4 | 42904 | 46 | 1.07 | 2.19 (1.49-3.22) | 1.35 (0.89-2.05) |
| Home | L1 | 2070 | 2 | 0.97 | 2.01 (0.49-8.22) | 2.58 (0.63-10.59) |
| | L2 | 399 | 2 | 5.01 | 10.45 (2.55-42.90) | 12.72 (3.08-52.62) |
| | L3 | 178 | 2 | 11.24 | 23.58 (5.72-97.18) | 25.52 (6.14-106.1) |
| | L4 | 54 | 2 | 37.04 | 81.37 (19.38-341.72) | 87.96 (20.59-375.77) |
| **Perinatal death** | | | | | | |
| Hospital | L1 | 127383 | 154 | 1.21 | 1.00 | 1.00 |
| | L2 | 92995 | 95 | 1.02 | 0.84 (0.65-1.09) | 0.86 (0.66-1.11) |
| | L3 | 45593 | 176 | 3.86 | 3.18 (2.56-3.95) | 1.75 (1.38-2.22) |
| | L4 | 43034 | 174 | 4.04 | 3.33 (2.68-4.14) | 1.62 (1.26-2.08) |
| Home | L1 | 2073 | 5 | 2.41 | 1.99 (0.82-4.85) | 2.24 (0.92-5.47) |
| | L2 | 399 | 2 | 5.01 | 4.14 (1.02-16.76) | 4.88 (1.20-19.80) |
| | L3 | 179 | 3 | 16.76 | 14.01 (4.43-44.34) | 11.76 (3.65-37.89) |
| | L4 | 54 | 2 | 37.04 | 32.23 (7.78-133.57) | 33.68 (8.08-140.33) |

[1]The reference for all comparisons is medical and obstetric low risk hospital birth.
[2]Adjustment has been made for maternal age, nulliparity, Caucasian, ATSI, smoking, rural, tertiary hospital, PIMC year, fetal problems during pregnancy and non-vertex presentation.
[3]livebirths only

## Discussion

While concerns about increased perinatal mortality in WA homebirth persist, results from this project confirm previous evidence that planned homebirth is a safe option for women at low obstetric risk at the onset of labour. In fact, benefits conferred for low risk women choosing homebirth include reduced rates of obstetric interventions, such as augmentation of labour, epidural analgesia, episiotomy and caesarean section, and at least comparable rates of perinatal morbidity.

The results support previous evidence suggesting women not considered low risk at the onset of labour have increased risk of neonatal morbidity and mortality associated with homebirth. Mortality was rare among all births and although the point estimates were higher for neonatal and perinatal death among homebirths not at low risk at onset of labour, large standard errors and wide confidence intervals demonstrate that arguments about sample size are still valid.

Although outside the scope of the WPP project, one of the major findings of the larger Homebirth Study became evident during the audit of intrapartum transfers. A large number of cases were miscoded; many incorrectly coded as homebirth that were either unattended by a midwife or never intended as homebirths. The increased risk of perinatal morbidity and mortality associated with some of the miscoded cases were previously included in the calculation of mortality rates reported by the PIMC. This finding will prompt improvements in the reporting of hospital transfers and make provision for more accurate estimates of perinatal mortality in the future.

### *Limitations of the study*

We believe the proportion of women analysed in the low obstetric risk group only represents a lower limit of the true low risk population. Our risk boundaries are indistinct where women who may have been clinically at low risk were assigned higher risk levels due to data

limitations on timing and severity of conditions. There is also the possibility that some low risk homebirths could have been considered as such due to the lack of detection of antenatal conditions.

There were no measures of body mass index (BMI) in the data. Being underweight or obese are well known risk factors for adverse pregnancy events, and to be considered for homebirth, women must have a pre-pregnancy BMI between 18 and 35 kg/$m^2$. BMI is a confounding factor that we were unable to adjust for in the analysis. To partially account for this, obesity identified by MNS ICD code, was used in the determination of risk levels assigned to each pregnancy. The small percentage of underweight women who had hospital births, in the absence of other risk factors, were not assigned a high risk level with the effect that adverse outcomes may have been slightly overestimated for the hospital low risk group.

**Conclusions**

This project confirms previous evidence that planned homebirth is a safe option for women at low risk at the onset of labour resulting in reduced rates of obstetric interventions and at least comparable rates of perinatal morbidity.

Concerns about increased perinatal mortality in WA home birth persist and this project provided further evidence that women who were not considered low risk at the onset of labour were at increased risk of neonatal morbidity and mortality associated with actual homebirth.

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Appendix I

Homebirth Policy Screening Criteria for Eligibility to Homebirth (2013)

**Inclusion criteria**

- is over the age of 18
- has the capacity to give informed consent.
- live within a geographical boundary no further than 30 minutes from a maternity service
- has received regular antenatal care in line with recognised guidelines
- has booked into the home birth program by 35 weeks of pregnancy
- have a singleton pregnancy
- at the time of labour has a cephalic presentation of gestational age between 37-42 weeks
- is free from pre-existing medical or pregnancy complications
- has current Ambulance Cover
- has a suitable home environment including but not limited to:
- clean running water and electricity
- has easy vehicular access
- general home cleanliness with ability to provide hygienic sanitation
- a working phone (landline or mobile with adequate reception)

**Exclusion criteria for planning a home birth**

**Previous obstetric history**

- Caesarean section
- Postpartum haemorrhage in excess of 1000 ml
- Shoulder dystocia
- Retained placenta requiring manual removal
- Perinatal death at term of a normally formed infant.

**Medical history**

- Pre-pregnancy BMI <18 and > 35
- Any significant medical condition
- Uncorrected female genital mutilation

**Social determinants of health**

- Domestic violence
- Alcohol and/or drug dependency of woman and/or family member

**Other factors for consideration**

Where the following conditions apply to either the woman or the baby they should be referred for consultation with an obstetrician/neonatologist/allied health professional to determine the appropriate clinical pathway:

- Will not accept blood and blood products if required
- Previous baby with Group B Streptococcus (GBS) neonatal sepsis
- Newborn or child at risk of harm