Australian Government
Australian Institute of Health and Welfare

Peripartum hysterectomy in Australia

A working paper using the National Hospital Morbidity Database 2003–04 to 2013–14

Australian Government
Australian Institute of Health and Welfare

Authoritative information and statistics to promote better health and wellbeing

Peripartum hysterectomy in Australia

A working paper using the National Hospital Morbidity Database

2003–04 to 2013–14

Australian Institute of Health and Welfare
Canberra
Cat. no. PER 85

The Australian Institute of Health and Welfare is a major national agency that provides reliable, regular and relevant information and statistics on Australia's health and welfare. The Institute's purpose is to provide authoritative information and statistics to promote better health and wellbeing among Australians.

A complete list of the Institute's publications is available from the Institute's website <www.aihw.gov.au>.

ISBN 978-1-74249-944-4 (PDF)
ISBN 978-1-74249-945-1 (Print)

Suggested citation

Australian Institute of Health and Welfare 2016. Peripartum hysterectomy in Australia: a working paper using the National Hospital Morbidity Database 2003–04 to 2013–14. Cat. no. PER 85. Canberra: AIHW.

Any enquiries about copyright or comments on this publication should be directed to:
Digital and Media Communications Unit
Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601
Tel: (02) 6244 1000
Email: info@aihw.gov.au

Published by the Australian Institute of Health and Welfare

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au> for any amendments.

Contents

Acknowledgments

Charlotte Ramage and Mary Beneforti of the Australian Institute of Health and Welfare (AIHW) wrote this report. Fadwa Al-Yaman, George Bodilsen, Conan Liu, Jude Luzuriaga, Brooke McPherson and Lynelle Moon of the AIHW, and Jeremy Oats, chair of the National Maternity Data Development Project (NMDDP) Clinical and Data Reference Group are thanked for their guidance and assistance.

The AIHW would like to thank members of the NMDDP Clinical and Data Reference Group who provided invaluable advice and assistance to the data development work for this project. NMDDP Advisory Group members are also thanked for providing direction and advice.

The Australian Government Department of Health funded this project.

Abbreviations

ACHI	Australian Classification of Health Interventions
AIHW	Australian Institute of Health and Welfare
AMOSS	Australasian Maternity Outcomes Surveillance System
CDRG	Clinical and Data Reference Group
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
NHMD	National Hospital Morbidity Database
NMDDP	National Maternity Data Development Project
NMDS	National Minimum Data Set
NPDC	National Perinatal Data Collection
PDC	perinatal data collection
UKOSS	United Kingdom Obstetric Surveillance System

Symbols

n.p.	Not published due to confidentiality restrictions
.- (in ICD-10-AM coding)	The '.-' following an ICD code indicates that all codes within a range are included, for example Z37.- indicates that all codes in the range Z37.0 to Z37.9 are included.

Summary

Peripartum hysterectomy, or the surgical removal of the uterus after the birth of a baby, can be a life-saving procedure where other measures have failed to stop haemorrhage after giving birth. It is associated with considerable morbidity for mothers and their babies, and brings an end to a woman's fertility.

Although peripartum hysterectomy is rare (fewer than 300 per year), internationally, incidence appears to be increasing, and literature suggests that this may be linked to increasing maternal age and an increase in the rate of caesarean sections. However, to date, the national rate of peripartum hysterectomy in Australia has not been reported.

This paper forms part of the work of the National Maternity Data Development Project to develop national data standards for prioritised maternal morbidity items, such as peripartum hysterectomy. National hospitalisation data were used to derive the estimated rate of peripartum hysterectomy in Australia in recent years and examine the rates of diagnoses for particular conditions contributing to peripartum hysterectomy.

Using 11 years of data from the National Hospital Morbidity Database (NHMD) for the period 1 July 2003 to 30 June 2014, 2,781 records were extracted for episodes of care for women undergoing hysterectomy procedures that had a principal diagnosis of an obstetric code or a code indicating hospitalisation for circumstances related to reproduction ('pregnancy-associated hysterectomy'). Approximately 90% of these hysterectomies were estimated to have occurred in the peripartum period, while about 10% occurred in early pregnancy (before 20 weeks' gestation). Between 2003–04 and 2013–14, there were 16 deaths (0.6%) recorded among women undergoing peripartum hysterectomy, and 93 fetal deaths (3.7%).

The overall numbers of peripartum hysterectomies increased by 37% between 2003–04 and 2013–14; however, the rate remained relatively stable over this period (about 0.79 per 1,000 mothers giving birth). Older mothers, mothers who were Indigenous, and mothers with multiple births (for example, twins) were over-represented in women who had peripartum hysterectomy, compared with the total maternal population.

Women who had pregnancy-associated hysterectomies often also had a diagnosis of postpartum haemorrhage (69%), placenta accreta/percreta/increta (46%) or placenta praevia (34%). Overall, these associations remained unchanged across the 11 years.

The findings of the analysis are consistent with studies showing that peripartum hysterectomy is strongly associated with caesarean section delivery. Over the 11-year period, 0.6 per 1,000 women giving birth had a caesarean section and a peripartum hysterectomy in the same hospital admission. Caesarean section delivery ending with hysterectomy also occurred together with postpartum haemorrhage in 1.41 per 1,000, with placenta accreta/percreta/increta in 0.99 per 1,000, and with placenta praevia in 0.97 per 1,000 mothers giving birth by caesarean section.

Nationally consistent and regularly collected information on peripartum hysterectomy and its indications would allow further investigation and monitoring of its patterns and trends, and its association with caesarean section. Further, linking hospital and perinatal data would enable peripartum hysterectomy to be examined in the context of the mother's demographics, risk factors, medical history, and pregnancy and birth.

1 Introduction

Background

Peripartum hysterectomy is usually conducted as an emergency procedure for life-threatening haemorrhage after giving birth, and is 'one of the most devastating complications in obstetrics, particularly for women wanting to maintain their fertility' (Wills 2012). Hysterectomy is considered to be a measure of last resort, after other measures have failed (Haynes et al. 2004). It can be a life-saving procedure.

Peripartum hysterectomies occur after 20 weeks' gestation and up to 6 weeks after birth; however, hysterectomies can occasionally occur in early pregnancy (up to 20 weeks' gestation) (see Box 1.1). In some of these cases, the hysterectomy is performed for a reason unrelated to the pregnancy, such as for gynaecological reasons, or for uterine cancer management. In a few instances, the pregnancy is discovered on subsequent pathology investigation or dissection of the uterus.

Box 1.1: Definitions of pregnancy-associated hysterectomy and peripartum hysterectomy

The following definitions have been developed as part of the work on peripartum hysterectomy for the National Maternity Data Development Project.

Pregnancy-associated hysterectomy—a pregnancy-associated hysterectomy is the surgical removal of the uterus performed either:

- in pregnancy; for example, in association with an abortion or termination of pregnancy, including in early pregnancy
- immediately after a woman has given birth, or
- in the postpartum period, up to 6 weeks after birth.

It is usually an emergency life-saving procedure to arrest massive obstetric haemorrhage. Non-emergency indications for pregnancy-associated hysterectomy include sterilisation and cancer. Hysterectomy may include removal of the cervix and ovaries, fallopian tubes and lymph nodes and lymph channels. The uterus may be removed through the abdominal wall or through the vagina and, in some cases, the procedure may be performed laparoscopically. Menstruation ceases after hysterectomy.

Peripartum hysterectomy—when pregnancy-associated hysterectomy occurs immediately after the birth of a baby (alive or stillborn) of at least 20 weeks' gestation or weighing at least 400 grams at birth, or in the postpartum period; that is, up to 6 weeks after birth, it is also known as peripartum hysterectomy.

A hysterectomy that occurs in early pregnancy is identified as a pregnancy-associated hysterectomy, but not a peripartum hysterectomy. A hysterectomy occurring in the peripartum period is identified as both a pregnancy-associated hysterectomy and a peripartum hysterectomy.

Although peripartum hysterectomy is rare (0.6 per 1,000 of maternities in Victoria during the years 1999–2002, 0.7 per 1,000 of maternities in Queensland during the years 2000–01 and 2010–11) (Haynes et al. 2004; Howell et al. 2012), the incidence appears to be increasing, possibly due to an increase in the rate of caesarean sections. Peripartum hysterectomy is a

costly procedure, with these costs being associated with blood transfusion and intensive care management (Knight 2007).

Data collection in Australia

Studies of peripartum hysterectomy in Australia to date have used a number of different data sources. Haynes and others (2004) used Victorian perinatal data, while Howell and others (2012) and Hill and others (2010) used jurisdictional-level hospital data in their Queensland studies. The *Western Australia's mothers and babies, 2011* publication has also reported on peripartum hysterectomies, using data from the Hospital Morbidity Data Collection and the Midwives' Notification System (Hutchinson & Joyce 2014).

Other studies have used hospital records to report on hysterectomies performed at a single tertiary hospital (Awan et al. 2011; Lim et al. 2014; Shamsa et al. 2015).

Data on hysterectomy are not collected consistently by jurisdictions in their perinatal data collections (PDCs). The item is not routinely supplied to, or required by, the National Perinatal Data Collection (NPDC). On the perinatal data collection forms of some jurisdictions, there are free text fields for procedures and operations performed during pregnancy and for complications and events of labour and birth. However, it is not known whether all hysterectomy procedures are recorded in these data fields.

A hysterectomy procedure would normally be recorded on the woman's hospital separation record. A hysterectomy procedure is a major intervention and it is likely that all such procedures are recorded in the hospital morbidity system. However, Haynes and others (2004) compared data on hysterectomy cases associated with postpartum haemorrhage from the Victorian PDC with data from the Victorian Admitted Episodes Database and found neither data source to be complete when checked against hospital medical records and data collection forms. It is possible that recording has improved since this 2004 study. A new validation study would need to be undertaken to confirm this.

Peripartum hysterectomy has been the subject of one study by the Australasian Maternity Outcomes Surveillance System (AMOSS), a series of studies of population-based research that describe the burden of rare and severe events in pregnancy, childbirth and the postnatal phase. The study collected case forms from clinicians and midwives at maternity services across Australia (AMOSS 2013). However, final results have not yet been published.

Aim of the study

This paper forms part of the work of the National Maternity Data Development Project (NMDDP) to develop data standards for the National Health Data Dictionary for a number of maternity care–related data items, including peripartum hysterectomy, to ensure data are comparable across jurisdictions. *Peripartum hysterectomy* and *Indications for peripartum hysterectomy* are on the NMDDP's priority data item list for national standardisation, as there are currently no national data standards for these items. See *Enhancing maternity data collection and reporting in Australia: National Maternity Data Development Project Stage 2* for more information on the NMDDP priority data list <http://www.aihw.gov.au/publication-detail/?id=60129554606>.

The aim of the NMDDP is for priority agreed data items to have national data standards, and to progressively move into the Perinatal National Minimum Data Set (NMDS) as part of the National Perinatal Data Collection (NPDC). However, as peripartum hysterectomy is a rare

event (fewer than 300 cases among the 300,000 births in Australia each year), it is expected that hospital morbidity data will be used as the main data source for the new national standards once developed, instead of the NPDC.

This paper uses national hospital morbidity data to:

- derive the estimated rate of peripartum hysterectomy in Australia and determine whether rates are increasing
- determine whether Australia's rates of peripartum hysterectomy are in line with other countries
- explore the rate of change of peripartum hysterectomy and whether rates vary across different population subgroups
- confirm the related conditions contributing to peripartum hysterectomy in the Australian context
- explore the value of the NHMD as a robust data source for peripartum hysterectomy.

Structure of the paper

This working paper is structured as follows:

- Chapter 2 highlights the current evidence on peripartum hysterectomy and its associated risk factors
- Chapter 3 describes the data source used for the study, the NHMD, and outlines the methods used to obtain and analyse the data on peripartum hysterectomy
- Chapter 4 presents the findings from the NHMD, including the rates of peripartum hysterectomy in Australia from 2003–04 to 2013–14
- Chapter 5 discusses the implications of the findings and the limitations to the study

2 Current evidence

Peripartum hysterectomy is a life-saving procedure used when control of uterine haemorrhage through conservative measures has failed. There is evidence to suggest that rates of peripartum hysterectomy are increasing, both internationally and in Australia (Bateman et al. 2012; Haynes et al. 2004; Joseph et al. 2007).

The number of women who experience a 'near-miss' event (severe maternal morbidity not resulting in death) is greater than the number of women who die. This means that these 'near-miss' cases enable greater power to investigate the role of risk factors for, and management of, events such as peripartum hysterectomy (Knight 2007). Cases of severe maternal morbidity act as a marker for quality of care, and may help to improve obstetric care (Jakobsson et al. 2015; Shamsa et al. 2015). It is therefore important to examine and investigate the causes of severe maternal morbidity, such as peripartum hysterectomy and its risk factors.

Incidence

A national incidence rate of peripartum hysterectomy in Australia has not previously been reported; however, incidence appears to be between 0.4 and 0.8 per 1,000 women giving birth—that is, fewer than 300 women giving birth annually. Preliminary analysis for one study using data from the AMOSS in Australia and New Zealand in 2010 and 2011 estimated the incidence of peripartum hysterectomy to control haemorrhage to be 0.6 per 1,000 women giving birth (at 20 weeks or more gestation) (AIHW: Johnson et al. 2014).

A Queensland study published the rate of peripartum hysterectomy as 0.7 per 1,000 births between 2000 and 2011, based on 419 mothers (Wills 2012). Eight of these mothers (2%) died. Hutchinson and Joyce (2014) reported an incidence rate for mothers giving birth in Western Australia in 2011 of 0.4 per 1,000 women (14 hysterectomies). This was the lowest rate in 7 years, with the highest of 0.8 per 1,000 reported for women giving birth in 2006.

These rates are comparable internationally. Machado (2011) reviewed international literature over the last 2 decades on emergency peripartum hysterectomy and found that the incidence ranged from 0.24 to 8.70 per 1,000 births. Incidence was reported to be 0.33 in the Netherlands, 0.2 in Norway, 0.3 in Ireland, 0.5 in Israel, 0.63 in Saudi Arabia and 1.2–2.7 per 1000 births in the United States of America. Mortality ranged from 0 to 12.5% with a mean of 4.8% (Machado 2011). Further, a United Kingdom Obstetric Surveillance System (UKOSS) study using data from February 2005 to February 2006 produced an estimate of 0.4 per 1,000 births (at 24 weeks or more gestation) (Knight et al. 2008). Less than 1% of the women who had a hysterectomy died. (AMOSS is the Australasian equivalent of UKOSS.)

Several studies have shown that the rates of peripartum hysterectomy have increased since the mid-1990s. The Victorian study by Haynes and others (2004) used validated perinatal data to show that rates of peripartum hysterectomy increased significantly from 0.3 per 1,000 maternities in 1999 to 0.8 per 1,000 maternities in 2002, though this increase should be interpreted with caution as it covers only a short time period.

A literature review examining time trends in emergency peripartum hysterectomy reported that increases in peripartum hysterectomy over time were found in 8 out of 10 studies, from the United States of America, the United Kingdom, Canada, Denmark and Israel (de la Cruz et al. 2015). One of the United States' studies used hospitalisation data to report a 15%

increase in peripartum hysterectomies from 0.72 per 1,000 births in 1994–95 to 0.83 per 1,000 births in 2006–07 (Bateman et al. 2012).

Comparisons between studies should, however, be made with caution. Different studies have used different inclusion and exclusion criteria relating to the definition of 'peripartum'. Some studies have defined 'peripartum' as after 24 weeks' gestation (Ossola et al. 2011) or after 20 weeks' gestation and within 6 weeks postpartum (Awan et al. 2011; Shamsa et al. 2015); however, other studies have used definitions that limit analysis to the same hospitalisation (Knight 2007), within 24–72 hours of giving birth (Ferreira Carvalho et al. 2012; Lee et al. 2012; Kastner et al. 2002; Turgut et al. 2013), within 7 days of giving birth (Jakobsson et al. 2015) and within 30 days postpartum (Bodelon et al. 2009).

Rates of postpartum haemorrhage—the main risk factor for peripartum hysterectomy—in high resource countries, including Australia, Canada, the United Kingdom and the United Kingdom are equally said to be increasing, primarily due to uterine atony (Joseph et al. 2007; Knight et al. 2009).

In a comparison of peripartum hysterectomy across 3 hospitals in Dublin, Flood and others (2009) found a decrease in the number of peripartum hysterectomy cases from 0.9 per 1,000 births in 1966–1975 to 0.2 of 1,000 births in 1996–2005. However, the authors noted that the main indication for peripartum hysterectomy changed over time, from uterine atony to placenta accreta.

It is possible that there may be an association between placenta accreta and previous caesarean section delivery. The study of Bateman and others (2012) attributed most of the increase in peripartum hysterectomy to rising rates of caesarean section delivery, after analysing by primary and previous caesarean section delivery.

Similarly, the Machado review revealed a difference in the incidence following vaginal delivery compared with caesarean section. The incidence of emergency peripartum hysterectomy following vaginal delivery varied from 0.1 to 0.3 per 1,000 births and this was fairly stable across both European and United States' studies. However, the incidence following caesarean section varied widely between 0.17 and 8.7 per 1,000 births. This was attributed to the proportion of women who had a previous caesarean section and had concurrent risk of placenta praevia and accreta (Machado 2011).

The rate of caesarean section delivery has increased in many middle- and high-income countries in recent years (Betrán et al. 2007; D'Souza & Arulkumaran 2013). This may be due to changes in clinical practices, an ageing maternal population or because of social and cultural factors, which have increased maternal requests for caesarean section delivery. There is concern that the rising rates of caesarean section in Australia, from 18% in 1991 to 32% in 2011 (AIHW 2014), will lead to a marked increase in the rate of peripartum hysterectomies.

Rates of placenta accreta/increta/percreta are also thought to be increasing, due to increasing maternal age and previous caesarean section delivery (Fitzpatrick et al. 2014; Khong 2008). Preliminary results from AMOSS demonstrate an incidence of 0.42 per 1,000 maternities in Australia (AIHW: Johnson et al. 2014). UKOSS has estimated the rate of placenta accreta/increta/percreta to be around 0.17 per 1,000 births, or around 1 in 20 women with both a previous caesarean section and placenta praevia (Fitzpatrick et al. 2014).

There is further concern that conservative management of abnormal placentation, where the placenta is left in situ for resorption, may increase the risk of peripartum hysterectomy on readmission, due to an increased risk of postpartum infection (Bodelon et al. 2009; Clausen et al. 2014; Grace Tan et al. 2012; Kayem et al. 2004). Clausen et al. (2014) found that 58% of

cases where conservative management had been performed required a hysterectomy up to 9 months after giving birth. The current guidelines of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG 2014) suggest that conservative management may be performed for cases of placenta accreta, but may result in hysterectomy in a third of cases due to uncontrollable bleeding, which may be delayed several weeks after giving birth. The guidelines highlight that this may have serious implications if a woman is returning to a remote area with little facility to cope with sudden severe haemorrhage (RANZCOG 2014).

Risk factors

The main risk factor for peripartum hysterectomy is uncontrollable haemorrhage, most commonly associated with uterine rupture, retained placenta, morbidly adherent placenta (placenta accreta, increta or percreta) or uterine atony (Bodelon et al. 2009; Howell et al. 2012). (Note the term 'placenta accreta' is widely used to refer to all cases of placenta accreta/increta/percreta (unless specified), and will be used this way in this paper.) Significant risk factors for postpartum haemorrhage include increased maternal age (over 35 years), multiple pregnancy, fibroids, preeclampsia, amnionitis, placenta praevia or abruption, cervical laceration, uterine rupture, instrumental vaginal delivery and caesarean section delivery (Kramer et al. 2013).

Bodelon et al. (2009) studied 867 cases of peripartum hysterectomy occurring in 1987–2006 in the United Kingdom. Of these, 29% had uterine atony, 25% retained placenta (including placenta accreta, percreta and increta), 22% placenta praevia, 9% rupture, 8% abruption, 5% chorioamnionitis and 12% other infection-related factors (note women may have had more than one of these conditions). Women with retained placenta, including placenta accreta, percreta and increta (these could not be separately identified from other forms of retained placenta), had a 43-fold increased risk of peripartum hysterectomy. Uterine atony was associated with a 21-fold increased risk of peripartum hysterectomy (Bodelon et al. 2009). Women with placenta praevia were nearly 8 times as likely, and women with placental abruption about 3 times as likely, to have a peripartum hysterectomy compared with women with normal placentation.

Uterine atony—the failure of the uterine muscles to contract normally after giving birth—is a common cause of haemorrhage, and was the most common cause of peripartum hysterectomy in the 1980s (Awan et al. 2011; Haynes et al. 2004; Selo-Ojeme et al. 2005). While still a common risk factor for peripartum hysterectomy, particularly in primiparous women, recent improvements in conservative and pharmacologic management have helped to reduce the number of cases of hysterectomy due to uterine atony (Awan et al. 2011; Flood et al. 2009; Haynes et al. 2004; Jakobsson et al. 2015; Selo-Ojeme et al. 2005). The most common indication for uncontrollable haemorrhage necessitating emergency peripartum hysterectomy is now thought to be abnormal placentation. Though definitions vary, 'abnormal placentation' may refer to some or all of placenta praevia, abruptio placentae and placenta accreta, percreta and increta (Awan et al. 2011; Machado 2011; Umezurike & Adisa 2012).

It is possible that changes in clinical practices and behaviour are increasing the risk of abnormal placentation. Abnormal placentation may occur more readily in the presence of a uterine scar, such as that from a previous caesarean section delivery (Awan et al. 2011; Sholapurkar 2013; Yang et al. 2007) or previous surgical abortion (Ossola et al. 2011). The scar may impair placental attachment in future pregnancies, leading to abnormal placentation,

increasing risk of haemorrhage and, subsequently, hysterectomy (Sholapurkar 2013; Yang et al. 2007). Placenta accreta can be difficult to diagnose, but may be suspected when a woman has placenta praevia or a history of caesarean section (Armstrong et al. 2004). Other factors, including surgical technique or in vitro fertilisation (IVF), may also increase the risk of abnormal placentation (Fitzpatrick et al. 2014; Higgins et al. 2013; Kaser et al. 2015; Sholapurkar et al. 2013).

The risk of hysterectomy in women attempting vaginal birth after caesarean (VBAC) was found to be twice that of women without prior caesarean delivery (Bodelon et al. 2009), possibly due to an increased risk of uterine rupture, due to the presence of a uterine scar (Tahseen & Griffiths 2010). Other risk factors for uterine rupture include malpresentation, second stage dystocia, labour induction, or giving birth after 42 weeks' gestation (Charach & Sheiner 2013).

A caesarean section delivery in the current pregnancy may also increase the risk of peripartum hysterectomy. In a study of 46 emergency hysterectomies occurring between 2008 and 2010, Lee et al. (2012) reported that the rate of emergency hysterectomy with caesarean section delivery was 13 times the rate with vaginal delivery. Caesarean sections are said to be more likely to result in severe postpartum haemorrhage (compared with vaginal delivery), and are generally associated with higher risk pregnancies (Howell et al. 2012). A caesarean section may also make the uterus more accessible for removal, compared with a vaginal delivery, where practitioners may be more likely to try to control haemorrhage through other methods before resorting to hysterectomy (de la Cruz et al. 2015). The risk of hysterectomy is higher with repeat caesarean sections (Bodelon et al. 2009).

Assisted vaginal delivery or augmentation of labour may increase the risk of hysterectomy, due to the increased risk of haemorrhage due to damage to cervical or vaginal tissues (Bodelon et al. 2009; Knight et al. 2008).

Hysterectomy case rates have also been found to be higher among older women, multiparous women and overweight and obese women (Bodelon et al 2009; Howell et al. 2012). Women who have peripartum hysterectomies are also more likely to have given birth to their babies at an early gestational age, before 37 weeks (Awan et al. 2011), or at a late gestational age, after 41 weeks (Al-Zirqi et al. 2010). It is also possible that the risk of peripartum hysterectomy is increased in women of non-Western origin (born outside Europe, North America or Australia) (Al-Zirqi et al. 2010; Yoong et al. 2006).

Multiple pregnancies may increase the risk of emergency peripartum hysterectomy (Jakobsson et al. 2015); however, Bodelon and others (2009) did not find this result in their large population-based case–control study.

The study from Queensland indicated that hysterectomies are most likely to take place at larger hospital facilities (Howell et al. 2012); however, this may reflect early diagnosis or early identification of risk factors and appropriate multidisciplinary planning and preparation for delivery (Lim et al. 2014).

Significance to maternal mortality and morbidity

Peripartum hysterectomy has a decisive impact on future fertility, and is associated with significant morbidity. Morbidity can arise because of technical, operative difficulties resulting from the physical changes associated with pregnancy, such as enlarged uterine and ovarian vessels, friable pelvic tissue, distortion of the anatomy around the site of uterine

rupture, intrusion of the placenta into other organs in placenta percreta, and scarring from previous caesarean sections. In an emergency situation, the patient is also likely to be seriously ill (Umezurike & Adisa 2012).

Complications of hysterectomy include intraoperative complications (blood loss and need for transfusion, bladder injury, ureteral injury, intestinal injury, vascular injury, other operative injury); perioperative surgical complications (reoperation, postoperative haemorrhage, wound complication, venous thromboembolism); and postoperative medical complications (cardiovascular, pulmonary, gastrointestinal, renal, infectious) (Shamsa et al. 2015; Umezurike & Adisa 2012; Wright et al. 2010). Many of these complications are more common for peripartum hysterectomy compared with non-obstetric hysterectomy (Wright et al. 2010). Peripartum hysterectomy is also associated with increased mortality, primarily due to haemorrhage, renal failure or sepsis (Umezurike & Adisa 2012; Wright et al. 2010). The risk of mortality in obstetric hysterectomy patients was more than 25 times that of non-obstetric hysterectomy patients (Wright et al. 2010).

Women who had a peripartum hysterectomy were also more likely to receive a transfusion (46% compared with 4% of women who had non-obstetric hysterectomies) and stay in hospital for longer (mean of 8.7 days compared with 2.9 days for non-obstetric hysterectomy) (Wright et al. 2010).

Complications during delivery have been shown to impact on the mother's ability to bond with their newborn (Hinton et al. 2015). All 15 women surveyed who underwent an emergency peripartum hysterectomy reported prolonged separation from their baby due to their health issues (de la Cruz et al. 2013). The women also experienced emotional distress or symptoms of post-traumatic stress disorder soon after the hysterectomy event, or up to many months later (de la Cruz et al. 2013). Women reported feelings of fear and severe pain at the time of hospitalisation, and sadness, guilt or anger after finding out about their hysterectomy (de la Cruz et al. 2013). Factors that helped women accept their situation more readily included excellent communication and provision of adequate information by clinicians (de la Cruz et al. 2013).

Newborns of women who undergo hysterectomy can be more likely to be born prematurely, be of lower birthweight, have lower Apgar scores and be at higher risk of respiratory distress than babies of women who do not undergo hysterectomy (Orbach et al. 2011; Wills 2012). These problems may be due to antenatal hypoxia and blood loss (Tikkanen 2010). Rates of stillbirth, neonatal death and admission to the neonatal intensive care unit are also higher in babies of women who undergo hysterectomy (Orbach 2011; Wills 2012). Both placental abruption and prematurity can cause fetal death, due to a lack of oxygen and nourishment provided by the placenta (Sahin et al. 2014; Tikkanen 2010). Jones et al. (2013) found one neonatal death due to severe hypoxic ischaemic encephalopathy following uterine rupture.

3 Methodology

This chapter describes the data source that was used in this paper, and the methods that were used to extract and analyse the data.

Data source

The National Hospital Morbidity Database (NHMD) is the data source for the analysis presented in this paper. The NHMD is a comprehensive data set that has records for all separations of admitted patients from essentially all public and private hospitals in Australia (AIHW 2015a).

'Separation' is the term used to refer to the episode of admitted patient care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute care to rehabilitation). 'Separation' also means the process by which an admitted patient completes an episode of care by being discharged, dying, transferring to another hospital or changing type of care (AIHW 2015a).

A record is included for each separation, not for each patient, so patients who separated more than once in the year have more than one record in the NHMD. However, as a woman cannot have more than one hysterectomy in a lifetime, the term 'separation' has been used interchangeably with 'woman' and 'case' in this paper. Records in the NHMD where care type was recorded as 'newborn', 'posthumous organ procurement' or 'hospital boarder' were excluded as they do not represent admitted patient care (AIHW 2015a).

The hospital database contains records identifying the principal diagnosis—the diagnosis chiefly responsible for the patient's admission into hospital—as well as any additional diagnosis—any condition or complaint that either coexists with the principal diagnosis or arises during the episode of care. An additional diagnosis is reported if the condition affects patient management (AIHW 2015a).

These diagnoses are coded using the *International statistical classification of diseases and related health problems, tenth revision, Australian modification* (ICD-10-AM). The eighth edition of the ICD-10-AM (NCCC 2012) is used for 2013–14 data, the most recent year of data for the 11-year period examined in this study. Earlier editions are referred to in this paper where relevant; for example, where there was a change in coding practice that impacted on the analysis of peripartum hysterectomy.

Hysterectomy procedures are coded using the Australian Classification of Health Interventions (ACHI). In 2013–14, procedures were recorded using the eighth edition of the ACHI (NCCC 2012).

The NHMD includes records in the data set for a reference year based on separation date. For each reference year, the NHMD includes records for admitted patient separations between 1 July and 30 June (AIHW 2015a).

Data from the NPDC were used as the denominator when a comparison with the total maternal population was made. Each year, small numbers of births occur at home, in free-standing birth centres, in the community and before arrival at hospital. The NPDC includes all mothers in Australia giving birth to a live or stillborn baby of at least 20 weeks' gestation or at least 400 grams birthweight, whereas the scope of the NHMD is births that

occur in hospital. Further, some of the analysis undertaken for this paper requires other pregnancy information (such as caesarean section in a previous pregnancy), which may not be recorded in the NHMD, but is generally thought to be coded well in the NPDC.

The NPDC is recorded in calendar years, from 1 January to 31 December, while the NHMD is recorded in financial years, from 1 July to 30 June. For the analysis in this paper, data from the NPDC are made comparable to the NHMD by calculating the average of the 2 relevant calendar years. For example, NHMD data from 2012–13 are analysed against the average of the NPDC data from the calendar years 2012 and 2013.

Alternative denominators could have included the NHMD, which records all births in hospital in Australia, or one based on a financial year analysis of the NPDC (rather than using the average over 2 calendar years). In practice, the use of any of these denominator sets makes little difference to the estimated rates of peripartum hysterectomy and the consistent use of one series is the more important factor in the analysis. For example, a comparison of estimated peripartum hysterectomy rates by year using the NHMD and the NPDC showed that the rates differed by less than 0.01 percentage points.

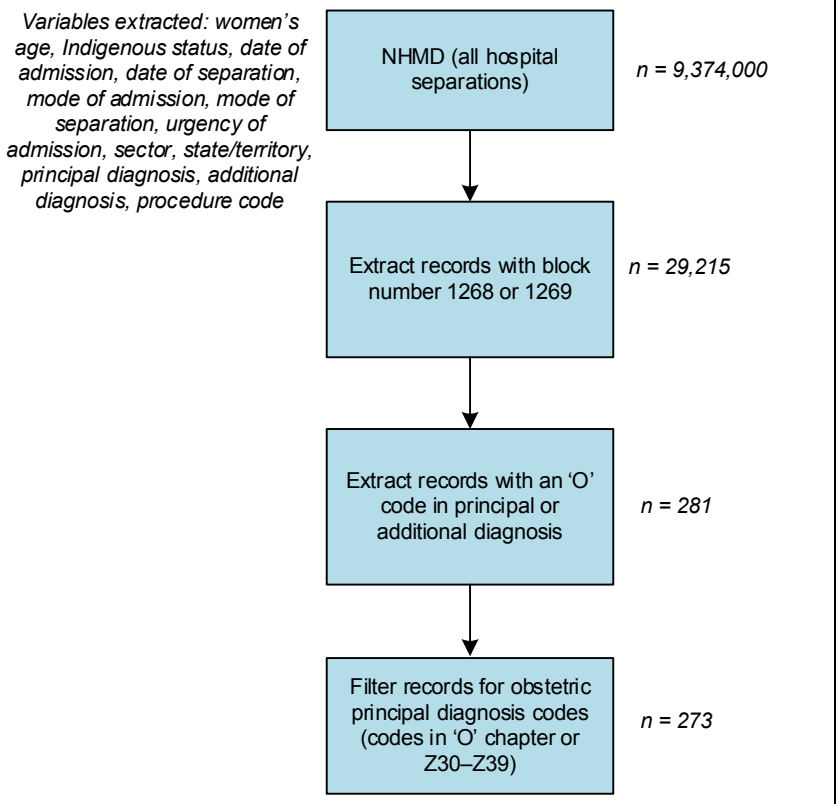
The reference year 2012–13 is used in the 'Overview' section of Chapter 3 in this report to compare women who had a peripartum hysterectomy with women from the general maternal population in the NPDC. The most recent year of NPDC data available is for 2013, therefore NHMD data from 2013–14 are compared to NPDC 2013 data where needed (for example for calculation of rates). The specific tables to which this refers are footnoted with this information.

This report describes the rate of peripartum hysterectomy using hospital separation records from the NHMD. These rates should be interpreted with caution and should not be immediately identified as 'incidence rates', due to the limitations outlined in Chapter 5.

Data linkage to perinatal data collections was outside the scope of this paper.

Data extraction

For 11 years from 1 July 2003 to 30 June 2014 in the NHMD, separation records were extracted for episodes of care for women undergoing abdominal or vaginal hysterectomy procedures (blocks 1268 and 1269), which had a principal or additional diagnosis code in the O chapter (Chapter 15 Pregnancy, childbirth and the puerperium ICD-10-AM) (see Figure 3.1).



Note: '*n*' represents 2012–13 data. This year is used as an example for this figure.

Source: AIHW National Hospital Morbidity Database.

Figure 3.1: Extraction of pregnancy-associated hysterectomy cases from the NHMD

The woman's age, Indigenous status, date of admission and date of separation, mode of admission and mode of separation, urgency of admission, sector, state/territory, principal diagnosis, additional diagnoses and procedure code were also analysed.

A small number of pregnancy-associated hysterectomy separation records that were extracted from the NHMD had a principal diagnosis of non-obstetric origin (that is, not in Chapter 15 of the ICD-10-AM manual or without a delivery outcome code in the range Z30.- and Z39.-), as shown in Table 3.1. The principal diagnosis of a separation record refers to the diagnosis 'chiefly responsible for occasioning the patient's episode of care in hospital' (AIHW 2015a). Therefore, in records with a non-obstetric principal diagnosis code, it is assumed that pregnancy was not the key initiator of the series of events that led to the hysterectomy procedure, and is secondary to another condition. Just over half (52%) of the separation records with a non-obstetric principal diagnosis had a principal diagnosis within Chapter 14 of the ICD-10-AM for diseases of the genitourinary system, while about a third (36%) had a principal diagnosis within Chapter 2 for neoplasms. The remaining records had principal diagnoses within the following chapters: injury, poisoning and certain other consequences of external causes (Chapter 19); diseases of the digestive system (Chapter 11); symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (Chapter 18); certain infectious and parasitic diseases (Chapter 1); and factors influencing health status and contact with health services (Chapter 21).

As it is assumed that pregnancy was not a key contributor to the reason for hysterectomy, these separation records were excluded from the total count of pregnancy-associated hysterectomies in Table 3.1, and were excluded from further analysis.

Table 3.1: Pregnancy-associated hysterectomies by obstetric and non-obstetric principal diagnosis, 2003–04 to 2013–14

	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	Total
Obstetric principal diagnosis codes only (no.)[(a)]	210	214	256	245	254	248	243	270	288	273	280	2,781
Non-obstetric principal diagnosis codes only (no.)	7	17	10	10	12	10	10	9	8	8	7	108
Total pregnancy-associated hysterectomies (no.)[(b)]	**217**	**231**	**266**	**255**	**266**	**258**	**253**	**279**	**296**	**281**	**287**	**2,889**

(a) Excludes separation records for hysterectomy with non-obstetric principal diagnosis codes. Includes records with a principal diagnosis in the 'O' chapter of ICD-10-AM codes, or a principal diagnosis between Z30.- and Z39.-.

(b) Includes separation records for hysterectomy with non-obstetric principal diagnosis codes.

Source: AIHW National Hospital Morbidity Database.

Analysis

Analysis was performed using SAS Enterprise Guide 5.1 and Microsoft Excel.

As outlined above, the reference year 2012–13 is used for many specific analyses, primarily for its comparability to the NPDC (the most recent year of NPDC data is 2013).

Peripartum hysterectomy is thought to occur rarely in the maternal population in Australia (fewer than 300 per year in total). In addition to annual and total rates, changes in rates over time have been reported in 4-year totals, to take account of small numbers and possible random variation. The 4-year blocks used are 2005–06 to 2008–09, and 2009–10 to 2012–13. The latest year, 2013–14, is omitted in these calculations as comparable data from the NPDC for 2014 are not yet available. The earliest 2 years, 2003–04 and 2004–05, are also excluded in 4-year totals, as the numbers in these years are lower than in other years, for no obvious reason. Analysis of years before 1 July 2003 was outside the scope of this paper.

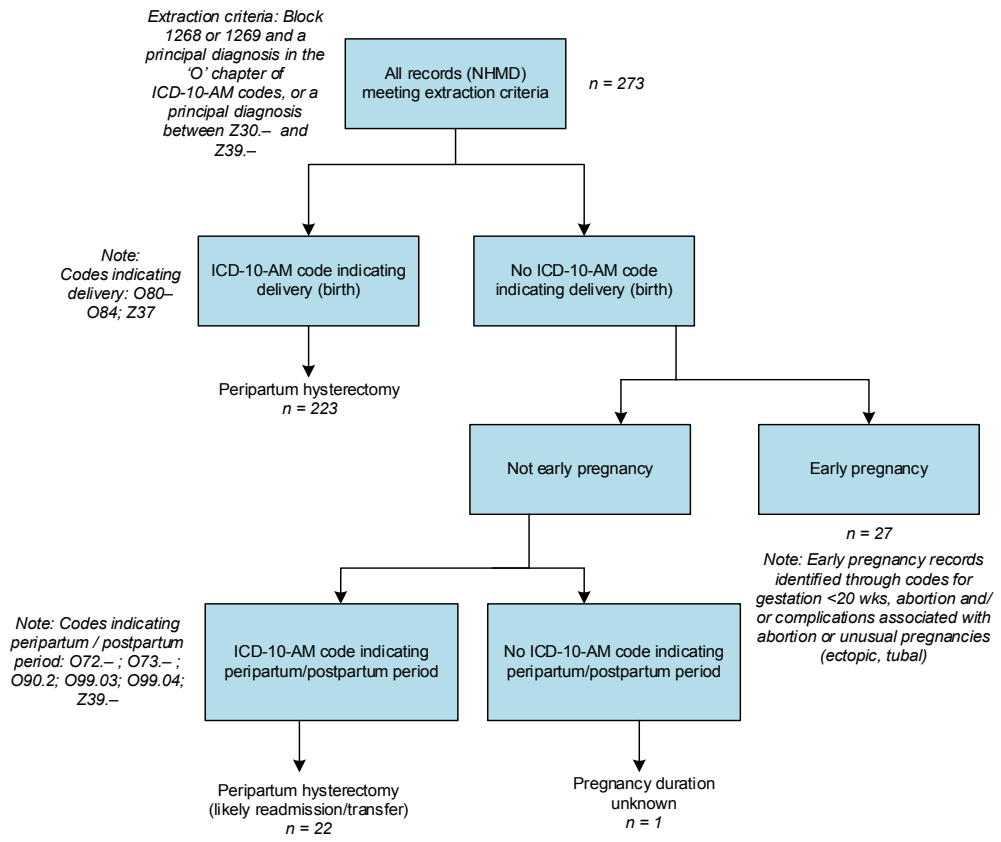
Several assumptions are made in distinguishing peripartum hysterectomy cases from early pregnancy cases of hysterectomy (see Figure 3.2).

While most peripartum hysterectomies can be identified with a reported delivery code as either the principal or an additional diagnosis (O80–O84, or delivery outcome code Z37.-), some peripartum hysterectomies will not have a delivery code reported as the woman was either transferred to another hospital after birth for the procedure or was re-admitted to hospital following discharge from the birth episode. These episodes were identified by exclusion of the early pregnancy (that is, not peripartum) episodes, which also do not have a delivery outcome code. The mode of admission variable in the NHMD to identify transfers was also used where possible.

Early pregnancy episodes were identified by one or more of the following: no ICD-10-AM code for delivery and an ICD-10-AM code for gestational age less than 20 weeks; or an ICD-10-AM code indicating abortion, or unusual pregnancy (for example ectopic); or an ICD-10-AM code indicating a complication of haemorrhage associated with abortion or unusual pregnancy (for example ectopic) (see Appendix, Table A1, for specific ICD-10-AM codes).

Remaining separation records without an associated delivery code, but with ICD-10-AM codes indicating the postpartum or puerperium period, were assumed to be peripartum hysterectomies, occurring as possible transfers or readmissions (see Table A1 for specific ICD-10-AM codes). Admission mode was also used to identify women who had been transferred in. However, it should be noted that readmissions for hysterectomies cannot be identified without data linkage and, additionally, may have occurred more than 6 weeks after birth, and therefore may technically not be 'peripartum'. The number of peripartum hysterectomies is therefore an estimate.

Remaining separation records without ICD-10-AM codes indicating the postpartum or peripartum period were classified as 'pregnancy duration unknown'.



Note: '*n*' represents 2012–13 data. This year is used as an example in this figure.

Source: AIHW National Hospital Morbidity Database.

Figure 3.2: Analysis to determine hysterectomy type (peripartum, readmission/transfer or early pregnancy)

Indications for pregnancy-associated hysterectomy

The Clinical and Data Reference Group (CDRG) of the NMDDP developed the list of related contributory conditions to pregnancy-associated hysterectomy (and their associated ICD-10-AM codes), as shown in Table 3.2, for the data element *Female – related condition contributing to pregnancy-associated hysterectomy, code N[N]*.

The list of related contributory conditions was originally intended to represent the indications for peripartum hysterectomy; that is, conditions that primarily led to the sequence of events that resulted in a hysterectomy. However, the CDRG later agreed that it would be difficult to attribute a single condition as being responsible for the hysterectomy procedure, simply by analysis of principal and additional diagnoses in the NHMD (some women's separation records may be coded with more than one suspected indication, while others may have none). Table 3.2 therefore represents conditions that are recognised as being related and contributory to the need for hysterectomy, but may not be solely responsible for the hysterectomy procedure being performed.

The principal and additional diagnosis codes for each separation record were analysed using this list (see Appendix, Table A2, for full descriptions of ICD-10-AM codes).

Table 3.2: ICD-10-AM eighth edition codes for related conditions/reason for hospitalisation contributing to pregnancy-associated hysterectomy

Related condition/procedure	ICD-10-AM codes
Placenta accreta/percreta/increta	O43.2
Placenta praevia	O44.0; O44.1
Placental abruption	O45.0; O45.8; O45.9
Uterine rupture	O71.00; O71.01; O71.02; O71.10; O71.11; O71.12
Early pregnancy haemorrhage	O03.1; O03.6; O04.1; O04.6; O05.1; O05.6; O06.1; O06.6; O07.1; O07.6; O08.1; O20.0; O20.8; O20.9
Antepartum or intrapartum haemorrhage	O46.0; O46.8; O46.9; O67.0; O67.8; O67.9
Postpartum haemorrhage	N83.7; O71.7; O72.0; O72.1; O72.2; O72.3; O90.2
Cancer	C53.-; C54.-; C55; C58; D39.0; D39.2
Leiomyoma of uterus	D25.-
Uterine atony	O62.2
Puerperal Infection	O85; O86.-
Sterilisation	Z30.2

Note: New ICD-10-AM editions were implemented in the analysis period, 2003–04 to 2013–14, with specific changes made to O03.–; O07.–; O08.–; O43.2; O71.–; and O85. The impact of these changes (if any) is discussed in Chapter 4 of this paper.

Caesarean section

The evidence of a connection between a caesarean section and increased risk of peripartum hysterectomy, as discussed in Chapter 2, is explored in this report. Caesarean sections (in the current pregnancy) are able to be ascertained in the NHMD in two ways; through ACHI procedure codes and through ICD-10-AM delivery codes. ACHI block 1340 was used for this analysis as there were changes to the ICD-10-AM 'delivery' codes and coding standards for the years of the analysis period which complicated the use of these codes for the identification of caesarean section procedures. Table 3.3 shows the number of procedures for

caesarean section over the 11-year period for pregnancy-associated hysterectomy separations.

Table 3.3: Caesarean sections as identified by ACHI block 1340 for pregnancy-associated hysterectomy separations, 2003–04 to 2013–14

	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	Total
Caesarean sections (no.)	125	130	182	157	176	165	167	196	197	189	195	1,879

Source: AIHW National Hospital Morbidity Database.

The principal and additional diagnoses codes in Table 3.4 were used for analysis of previous caesarean section with or without current caesarean section.

Table 3.4: ICD-10-AM eighth edition codes for previous caesarean sections

Related caesarean section code	ICD-10-AM codes
Caesarean section delivery (current pregnancy)	O82; O84.2
Maternal care for uterine scar	O34.2
Vaginal delivery following previous caesarean section	O75.7

Note: New ICD-10-AM editions were implemented in the analysis period, 2003–04 to 2013–14, with specific changes made to O34.2 and O75.7. The impact of these changes is likely to be minor.

The ICD-10-AM codes O34.2 and O75.7 have been used previously to ascertain previous caesarean sections (Lutomski et al. 2014) and, in one study from Queensland, the numbers obtained using O34.2 are comparable to the number of previous caesarean sections collected in the Queensland Perinatal Data Collections (Queensland Health Statistics Centre 2009). Over time, both O34.2 and O75.7 have been subject to minor coding changes. In ICD-10-AM seventh edition (implemented 1 July 2010), the term 'any' was added to the inclusion term to clarify that 'previous caesarean section' was not limited to the immediately preceding delivery episode of care. The implications of this are minor.

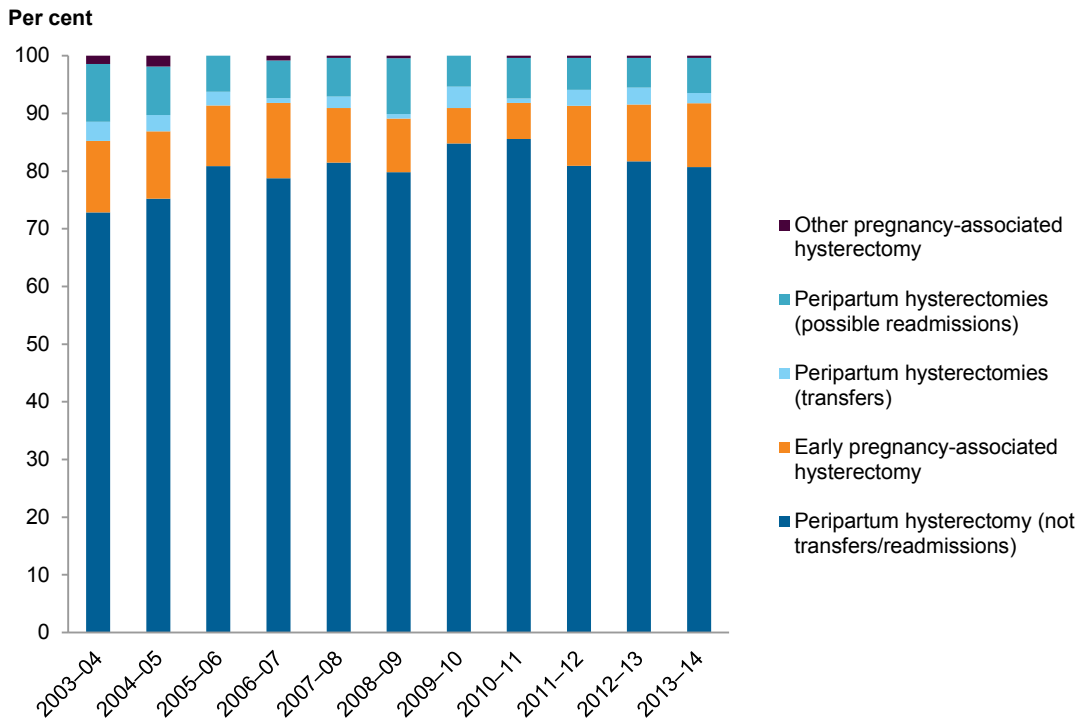
4 Results

Overview

There were 2,781 unique separation records of pregnancy-associated hysterectomy extracted for the 11-year period from 2003–04 to 2013–14. Table 4.1 shows that approximately 90% of pregnancy-associated hysterectomies are estimated to occur in the peripartum period, while about 10% occur in early pregnancy. The duration of pregnancy was unable to be determined in less than 1% of records.

Nine per cent of peripartum hysterectomy separation records were identified as possible readmissions or transfers. These records did not have an associated ICD-10-AM code for birth, but had additional ICD-10-AM codes to indicate clinical conditions of the postpartum period. It is assumed that the birth episode occurred in an earlier separation to the hysterectomy episode separation in these records. Analysis of the variable 'Admission mode' shows that almost a quarter (24%; 60) of these separation records over the 11 years were 'Admitted patients transferred from another hospital'. Without record linkage, it is not possible to confirm that the remaining 76% of separations (191) were readmissions, and that these definitely occurred within the peripartum period.

Figure 4.1 represents peripartum hysterectomy graphically. Note that transfers and possible re-admissions are subsets of peripartum hysterectomies.



Note: See Table 4.1 for ascertainment of separation records.

Source: AIHW National Hospital Morbidity Database.

Figure 4.1: Type of pregnancy-associated hysterectomy, 2003–04 to 2013–14

Table 4.1: Types of pregnancy-associated hysterectomy[a], 2003–04 to 2013–14

Type of hysterectomy	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years
Peripartum hysterectomy[b] (no.)	181	185	229	211	229	224	228	252	257	245	248	2,489
Transfers/ possible readmissions[c] (no.)	*28*	*24*	*22*	*18*	*22*	*26*	*22*	*21*	*24*	*22*	*22*	*251*
Early pregnancy–associated hysterectomy[d] (no.)	26	25	27	32	24	23	15	17	30	27	31	277
Other pregnancy-associated hysterectomy (pregnancy duration unknown)[e] (no.)	3	4	0	2	1	1	0	1	1	1	1	15
Total pregnancy-associated hysterectomy (no.)	**210**	**214**	**256**	**245**	**254**	**248**	**243**	**270**	**288**	**273**	**280**	**2,781**
Peripartum hysterectomy[b] (%)	86.2	86.4	89.5	86.1	90.2	90.3	93.8	93.3	89.2	89.7	88.6	89.5
Transfers/ possible readmissions[c] (%)	*13.3*	*11.2*	*8.6*	*7.3*	*8.7*	*10.5*	*9.1*	*7.8*	*8.3*	*8.1*	*7.9*	*9.0*
Early pregnancy–associated hysterectomy[d] (%)	12.4	11.7	10.5	13.1	9.4	9.3	6.2	6.3	10.4	9.9	11.1	10.0
Other pregnancy-associated hysterectomy (pregnancy duration unknown)[e] (%)	1.4	1.9	0.0	0.8	0.4	0.4	0.0	0.4	0.3	0.4	0.4	0.5
Total pregnancy-associated hysterectomy (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Includes all hysterectomy records with a principal diagnosis in the 'O' chapter of ICD-10-AM codes, or a principal diagnosis between Z30.- and Z39.-.

(b) Peripartum hysterectomies are identified by an associated delivery code (ICD-10-AM code/s O80–O84 or Z37.-), or are recognised as being a possible transfer or readmission (see footnote below (c)).

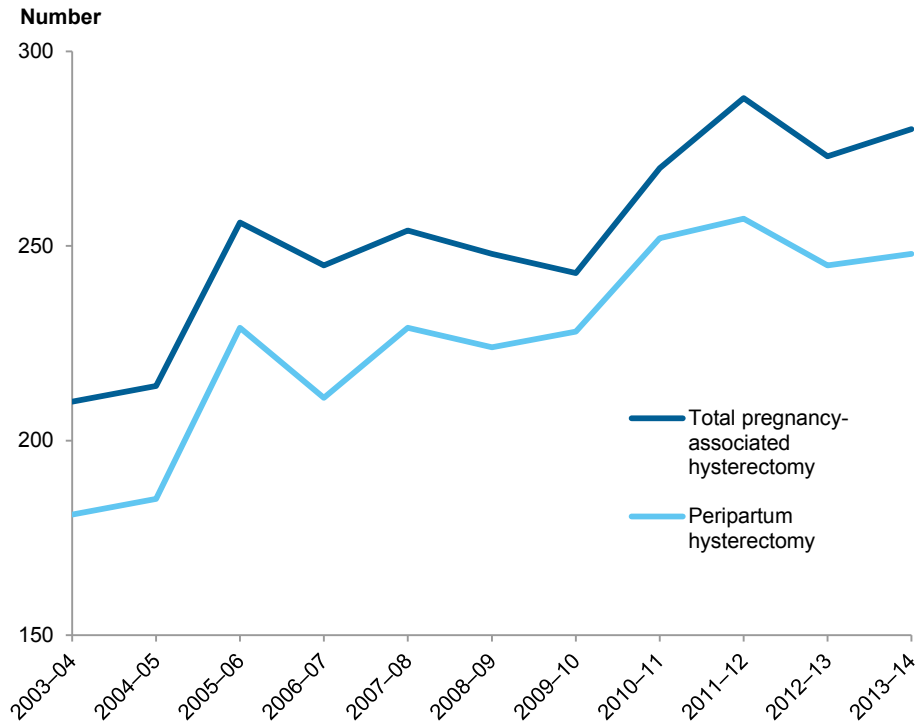
(c) Transfers/possible readmissions that occurred during the puerperium period were identified through (1) the absence of any codes on the patient's separation record indicating a birth episode (Z37.- or a procedure code from block 1340) **and** (2) the assignment of at least one of the following ICD-10-AM codes on the patient's record: O72.- (postpartum haemorrhage), O73.- (retained placenta and membranes without haemorrhage), O75.7 (vaginal delivery following previous caesarean section), O85 (puerperal sepsis), O86.- (other puerperal infections), O90.2 (haematoma of obstetric wound), O90.8 (other complications of the puerperium, not elsewhere classified), O99.03, O99.04 (anaemia complicating childbirth and the puerperium) and Z39.- (postpartum care and examination). These cases are a subset of peripartum hysterectomies. In addition, the variable 'Admission mode' was used to identify records for admitted patients transferred in from another hospital. Sixty of the total 251 possible transfers/readmissions were confirmed transfers.

(d) Early pregnancies do not have a delivery code, and are identified through ICD-10-AM codes for duration of pregnancy <20 weeks (O09.0; O09.1; O09.2) and/or ICD-10-AM codes indicating abortion or complications of abortion (O00–O08; O20.-).

(e) Other pregnancy-associated hysterectomies do not have delivery codes, and also do not have ICD-10-AM codes to indicate the length of pregnancy. Pregnancy duration is therefore unknown.

Source: AIHW National Hospital Morbidity Database.

While the numbers are small, the overall number of peripartum hysterectomies increased by 37% from 2003–04 to 2013–14, compared with the overall number of mothers, which increased by 21% from 2003 to 2013. Since 2005–06, however, the percentage increase was much lower at 8.3% (compared with 13.8% for all mothers). The largest increases in mothers who had a peripartum hysterectomy occurred in 2005–06 and 2010–11 (Figure 4.2). Although the total numbers of peripartum hysterectomies have increased, the rate has remained relatively stable over time (see the section on 'Rates over time', for further discussion).



Note: See Table 4.1 for ascertainment of separation records for different types of hysterectomy.

Source: AIHW National Hospital Morbidity Database.

Figure 4.2: Frequency of peripartum hysterectomy and total pregnancy-associated hysterectomies, 2003–04 to 2013–14

Characteristics of women undergoing peripartum hysterectomy

Tables 4.2 to 4.7 present characteristics of the women who underwent peripartum hysterectomy in 2012–13. Comparisons are made with all mothers who gave birth (using the average of NPDC data for 2012 and 2013). Women who had a hysterectomy in early pregnancy are excluded, as these hysterectomies may occur for different reasons to those occurring around the time of birth. NPDC data are for women who gave birth to a baby of at least 20 weeks' gestation or 400 grams birthweight.

Maternal age

Data for 2012–13 indicate that older mothers are over-represented in the peripartum hysterectomy group when compared with all mothers. Three out of 4 peripartum hysterectomy procedures were performed for women aged 25–39 (76.0%) and 1 in 5 were among women aged 40 and over. Table 4.2 shows that the most common age group

for women having a peripartum hysterectomy was 30–34 (33.1%) followed by 35–39 (28.6%). This pattern was consistent over the 11-year period (see Appendix, Figure A1). Women undergoing peripartum hysterectomy were over-represented in the 35–39 and 40 and over age groups, compared with the respective age groups for the total maternal population (Figure 4.3).

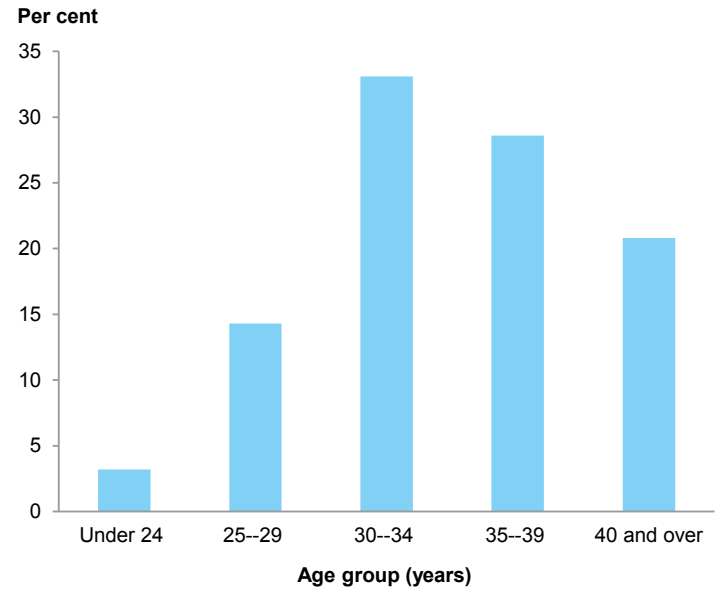
Table 4.2: Peripartum hysterectomy[(a)] by age group, 2012–13

Age group (years)	Women who had peripartum hysterectomy		Total maternal population[(b)]	
	Frequency	%	Frequency	%
Under 24	8	3.3	52,104	17.0
25–29	35	14.3	84,717	27.7
30–34	81	33.1	100,834	32.9
35–39	70	28.6	55,053	18.0
40 and over	51	20.8	13,354	4.4
Not stated	0	0.0	64	0.0
Total	**245**	**100.0**	**306,126**	**100.0**

(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

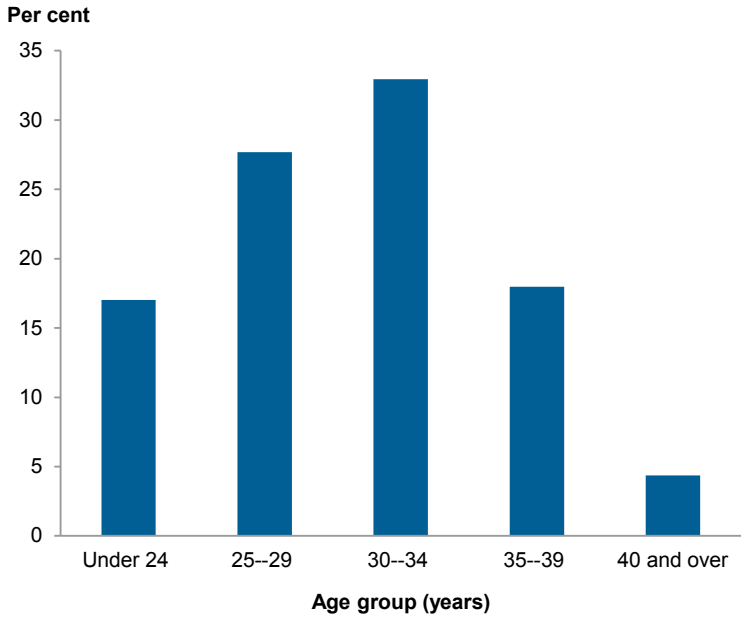
(b) Sourced from the NPDC 2012 and 2013.

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.



(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

Source: AIHW National Hospital Morbidity Database.



(b) Total maternal population sourced from the NPDC 2012 and 2013.

Source: AIHW National Perinatal Data Collection (NPDC).

Figure 4.3: Peripartum hysterectomy[(a)] (top chart) and total maternal population[(b)] (bottom chart) by age group, 2012–13

Hospital sector

Table 4.3 shows that the majority of peripartum hysterectomy procedures in 2012–13 were undertaken in the public sector rather than the private sector (80.4% compared with 19.6%, respectively). A higher proportion of peripartum hysterectomies occurred in

public hospitals (80.4%) compared with the number of women who gave birth in public hospitals (71.9%). This result is not unexpected given that emergency procedures are more likely to be undertaken in public hospitals than in private hospitals.

Table 4.3: Peripartum hysterectomy[a] by hospital sector, 2012–13

	Women who had peripartum hysterectomy		Total maternal population[b]	
Hospital sector	**Frequency**	**%**	**Frequency**	**%**
Public hospital	197	80.4	219,959	71.9
Private hospital	48	19.6	85,188	27.8
Not applicable/not stated[c]	0	0.0	979	0.3
Total	**245**	**100.0**	**306,126**	**100.0**

(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(b) Sourced from the NPDC 2012 and 2013.

(c) Includes births outside hospital as well as 'not stated' values.

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Mother's Indigenous status

Analysis by Indigenous status for 2012–13 data shows that Indigenous mothers were over-represented in the peripartum hysterectomy group (6.5% of women with peripartum hysterectomy) compared with the total maternal population (4.0%) (Table 4.4). The quality of Indigenous status identification in hospital morbidity data over the 11-year period is likely to be variable, therefore trends are not presented for this population group. These figures have also not been adjusted for under-reporting of Indigenous identification (see AIHW 2013 for more information) and have not been age-standardised. Were the Indigenous population to have the same age profile (i.e. older) as 'Other Australians', it is likely that the proportion of Indigenous women having a peripartum hysterectomy would be higher than the crude rate. Small numbers and variability in Indigenous identification over time, however, mean that any results of age standardisation would not be robust.

Table 4.4: Peripartum hysterectomy[a] by Indigenous status, 2012–13

	Women who had peripartum hysterectomy		Total maternal population[b]	
Indigenous status	**Frequency**	**%[c]**	**Frequency**	**%[c]**
Indigenous	16	6.5	12,332	4.0
Other Australians[d]	229	93.5	293,794	96.0
Total	**245**	**100.0**	**306,126**	**100.0**

(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(b) Sourced from the NPDC 2012 and 2013.

(c) Proportions are not age-standardised. Small numbers and variability in Indigenous identification over time mean that any results of age standardisation would not be robust.

(d) Includes episodes of care for patients who did not declared whether they were of Aboriginal and/or Torres Strait Islander descent

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Multiple births

Comparisons between women who had peripartum hysterectomy and the total maternal population suggest that multiple births (such as twins) are over-represented in women with peripartum hysterectomy (Table 4.5). About 4.5% of women with peripartum hysterectomy had a multiple birth compared with 1.6% of mothers in the general population.

Table 4.5: Association of multiple births[a] with peripartum hysterectomy[b]

	Women who had peripartum hysterectomy			Total maternal population[c]		
	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Multiple births (no.)	113	44	44	50,309	18,526	18,507
Multiple births (%)	4.5	4.9	4.5	1.6	1.6	1.5

(a) Identified by ICD-10-AM code/s Z37.2 (twins, both liveborn); Z37.3 (twins, one liveborn and one stillborn); Z37.4 (twins, both stillborn); Z37.5 (other multiple births, all liveborn); Z37.6 (other multiple births, some liveborn); Z37.7 (other multiple births, all stillborn).

(b) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(c) Sourced from the NPDC, calculated as the average of total number of mothers for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown). A 'mother' refers to a woman who gave birth (to a liveborn or stillborn).

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Principal diagnosis

As identified earlier, the principal diagnosis of a separation record refers to the diagnosis 'chiefly responsible for occasioning the patient's episode of care in hospital' (AIHW 2015a). Each record has one principal diagnosis, identified by an ICD-10-AM code. Table 4.6 identifies the top 5 most common principal diagnoses for the 245 women who had a peripartum hysterectomy in 2012–13.

Table 4.6: Top 5 most common principal diagnoses[a] for peripartum hysterectomy[b], 2012–13

ICD-10-AM code	Definition	Frequency	%
O82	Single delivery by caesarean section	129	52.7
O44.1	Placenta praevia with haemorrhage	32	13.1
O80	Single spontaneous delivery	21	8.6
O43.2	Morbidly adherent placenta	12	4.9
O72.2	Delayed and secondary postpartum haemorrhage	10	4.1
Other[c]		41	16.7
Total		**245**	**100.0**

(a) Each separation record has 1 principal diagnosis code. In total, there were 28 different principal diagnosis codes for the 245 records.

(b) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(c) 'Other' is made up of the remaining 23 principal diagnosis codes. Frequency ranged from 1 to 8 for these codes.

Source: AIHW National Hospital Morbidity Database.

Almost 67% of the 245 separation records (163 records) had a principal diagnosis of *Delivery* (ICD-10-AM codes O80–O84). The current relevant coding standard, *ACS 0001 Principal diagnosis*, states:

> Where the patient is admitted for delivery such as 'in labour', 'for induction', 'for caesarean', and the outcome is delivery, assign a code from category O80–O84 *Delivery* as the principal diagnosis, followed by the reason for any intervention and then any other conditions and/or complications that meet the criteria for assignment as per *ACS 0002 Additional diagnoses*.
>
> Where the patient is admitted for management of an antepartum condition, assign the antepartum condition as the principal diagnosis. If the patient delivers during the episode of care, assign a code from O80–O84 *Delivery* as an additional diagnosis.
>
> Where there is difficulty in determining the principal diagnosis in obstetric cases with an outcome of delivery, assign a code from category O80–O84 *Delivery* as the principal diagnosis.

It would therefore be expected that a high proportion of all women giving birth, including those who go on to have a peripartum hysterectomy, would have a delivery code as their principal diagnosis.

Of the total 245 peripartum hysterectomy separation records, 59 (24%) had a delivery code O80–O84 as an additional diagnosis, rather than a principal diagnosis. *ACS 0001* suggests that these 59 women were admitted to hospital for management of an antepartum condition (instead of for delivery) and subsequently gave birth in the same hospital episode. Of these 59 records, *Placenta praevia with haemorrhage* was the most common principal diagnosis.

Additional diagnosis

The 10 most common additional diagnoses for the women who had a peripartum hysterectomy are listed in Table 4.7. The most common additional diagnosis was *Single live birth* (209 records; 85.3%). The ICD-10-AM seventh edition stipulates that separation records coded with delivery (O80–O84) must also be coded with the outcome of delivery (Z37.-). The high number of single live births recorded as an additional diagnosis is therefore to be expected.

Other common additional diagnoses were *Anaemia complicating childbirth and the puerperium* (122 records; 49.8%), *Morbidly adherent placenta* (placenta accreta, percreta and increta) (109 records; 44.5%) and *Maternal care due to uterine scar from previous surgery*, including any previous caesarean section (104 records; 42.4%).

Table 4.7: Top 10 most common additional diagnoses[a] for peripartum hysterectomy[b], 2012–13

ICD-10-AM code	Definition	Frequency	% of 245 total peripartum hysterectomy records
Z37.0	Single live birth	209	85.3
O99.03	Anaemia complicating childbirth and the puerperium	122	49.8
O43.2	Morbidly adherent placenta	109	44.5
O34.2	Maternal care due to uterine scar from previous surgery	104	42.4
O72.1	Other immediate postpartum haemorrhage	92	37.6
D62	Acute posthaemorrhagic anaemia	89	36.3
O60.3	Preterm delivery with spontaneous labour	70	28.6
O72.0	Third-stage haemorrhage	70	28.6
O44.1	Placenta praevia with haemorrhage	55	22.4
O82	Single delivery by caesarean section	52	21.2

(a) There were 418 individual additional diagnosis codes assigned in the sample, with a total of 2,542 additional diagnosis codes assigned. The number of additional diagnosis codes assigned per separation record was between 1 and 47.

(b) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

Source: AIHW National Hospital Morbidity Database.

Hysterectomy procedures

The majority of peripartum hysterectomies were performed abdominally (98.8% in 2012–13) rather than vaginally (1.2% in 2012–13).

Abdominal hysterectomies are often performed at the time of caesarean section delivery (Banks et al. 2011).

Rates over time

The rate per 1,000 of peripartum hysterectomy over the 11-year period is shown in Table 4.8. Note that the denominator of total mothers is sourced from the NPDC, which is reported in calendar years, rather than financial years as in the NHMD. The NPDC denominator is calculated as the average of the total number of mothers for the 2 years, except for 2013–14, where the denominator reported is the NPDC total for 2013 (as this is the most recent year of NPDC data available).

The overall rate of peripartum hysterectomy from 2003–04 to 2013–14 is 0.79 per 1,000 mothers (Table 4.8). The rate is lower in 2003–04 and 2004–05 than the other years (0.72 and 0.71 per 1,000, respectively), while the rate was highest in 2010–11 and 2011–12 at 0.85 per 1,000. The lower rate in the earlier years is not readily explained—it may be a real change or may simply reflect variability due to the small numbers of peripartum hysterectomies performed each year.

The rate of peripartum hysterectomy increases with age (Table 4.9). The rate is lowest in women aged under 24, with an overall rate of 0.16 per 1,000 women for 2003–04 to 2013–14. The rate is highest in women aged 40 and over, with an overall rate of 2.86 per 1,000 for all years combined, though it is important to note that the numerators are small and are subject to variability (numerators are less than 10 in some age groups for some years).

There is an increase in rates over time for the two oldest age groups, from 0.43 per 1,000 in 2005–06 to 2008–09 to 0.66 per 1,000 in 2009–10 to 2012–13 for women aged 35–39 and from 2.51 to 3.21 per 1,000 over the 2 time periods for women aged 40 and over. The only age group with a notable decrease in rate is women aged under 24, from 0.26 to 0.15 per 1,000 women over the 2 time periods.

Table 4.8: Peripartum hysterectomy[(a)] (rate per 1,000 mothers[(b)(c)]), 2003–04 to 2013–14

	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4 year block (2005–06 to 2008–09)	4 year block (2009–10 to 2012–13)
Peripartum hysterectomy (no.)	181	185	229	211	229	224	228	252	257	245	248	2,489	893	982
Total no. of mothers	252,728	260,333	272,618	283,470	290,829	293,353	295,002	296,400	302,457	306,174	304,777	3,158,138	1,140,269	1,200,031
Rate (per 1,000)	0.72	0.71	0.84	0.74	0.79	0.76	0.77	0.85	0.85	0.80	0.81	0.79	0.78	0.82

(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(b) Sourced from the NPDC, calculated as the average of total number of mothers for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown). A 'mother' refers to a woman who gave birth (to a liveborn or stillborn) of at least 20 weeks' gestation or 400 grams birthweight. Note that the year denominators are rounded, therefore small discrepancies may occur between the sum of individual years and aggregate totals displayed in the table.

(c) Rates are not age-standardised. The average age of mothers has been increasing over time. Changes in total rates may to some extent reflect this changing age profile of mothers.

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Table 4.9: Peripartum hysterectomy[(a)] by age group (rate per 1,000 mothers[(b)]), by 2003–04 to 2013–14

Age group	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Frequency														
Less than 24 years	8	11	14	14	16	11	6	11	6	8	14	119	55	31
25–29 years	23	29	45	35	27	31	38	38	35	35	37	373	138	146
30–34 years	59	76	71	71	70	78	59	84	92	81	80	821	290	316
35–39 years	61	54	80	65	81	81	89	79	88	70	79	827	307	326
40 years and over	30	15	19	26	35	23	36	40	36	51	38	349	103	163
Total	181	185	229	211	229	224	228	252	257	245	248	2,489	893	982
Rate (per 1,000)														
Less than 24 years	0.16	0.22	0.27	0.26	0.29	0.20	0.11	0.21	0.11	0.15	0.27	0.21	0.26	0.15
25–29 years	0.33	0.41	0.62	0.46	0.35	0.39	0.47	0.46	0.41	0.41	0.44	0.43	0.95	0.95
30–34 years	0.69	0.86	0.78	0.77	0.75	0.84	0.64	0.90	0.95	0.80	0.79	0.80	0.83	0.85
35–39 years	1.51	1.24	1.67	1.25	1.47	1.45	1.60	1.43	1.60	1.27	1.45	1.45	0.43	0.66
40 years and over	3.68	1.74	2.06	2.63	3.28	2.02	3.03	3.22	2.76	3.82	2.84	2.86	2.51	3.21
Total rate (per 1,000)	**0.72**	**0.71**	**0.84**	**0.74**	**0.79**	**0.76**	**0.77**	**0.85**	**0.85**	**0.80**	**0.81**	**0.79**	**0.78**	**0.82**

(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

(b) Sourced from the NPDC, calculated as the average of total number of mothers for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown).

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Indications

Literature suggests that the primary risk factor for peripartum hysterectomy is haemorrhage, most commonly associated with uterine rupture, retained placenta, morbidly adherent placenta or uterine atony (Bodelon et al. 2009; Howell et al. 2012). Other risk factors include placenta praevia, placental abruption, uterine infection, repeat caesarean section, increasing parity, increasing maternal age and obesity (Bodelon et al. 2009; Haynes et al. 2004; Howell et al. 2012; Umezurike & Adisa 2012).

The analysis in this section has informed the development of the data element *Female – related condition contributing to pregnancy-associated hysterectomy, code N[N]*, proposed for the National Health Data Dictionary (implementation date to be determined), which replaced the original proposed 'indications for peripartum hysterectomy' data element. All cases of pregnancy-associated hysterectomy were analysed, rather than just cases of peripartum hysterectomy. As with the rate of peripartum hysterectomy, the rate of pregnancy-associated hysterectomy has remained stable over time, at around 0.88 per 1,000 mothers.

The following principal and additional diagnoses (and their ICD-10-AM codes) were selected for analysis, for their relevance to pregnancy-associated hysterectomy, and because a relevant ICD-10-AM code exists:

- placenta accreta/percreta/increta (ICD-10-AM code O43.2)
- placenta praevia (ICD-10-AM codes O44.0 and O44.1)
- placental abruption (ICD-10-AM codes O45.0; O45.8 and O45.9)
- uterine rupture (ICD-10-AM codes O71.00; O71.01; O71.02; O71.10; O71.11 and O71.12)
- early pregnancy haemorrhage (ICD-10-AM codes O03.1; O03.6; O04.1; O04.6; O05.1; O05.6; O06.1; O06.6; O07.1; O07.6; O08.1; O20.0; O20.8 and O20.9)
- antepartum or intrapartum haemorrhage (ICD-10-AM codes O46.0; O46.8; O46.9; O67.0; O67.8 and O67.9)
- postpartum haemorrhage (ICD-10-AM codes N83.7; O71.7; O72.0; O72.1; O72.2; O72.3 and O90.2)
- cancer (ICD-10-AM codes C53.-; C54.-; C55; C58; D39.0 and D39.2)
- leiomyoma (ICD-10-AM codes D25.-)
- uterine atony (ICD-10-AM code O62.2)
- infection (ICD-10-AM codes O85 and O86.-)
- sterilisation (ICD-10-AM code Z30.2).

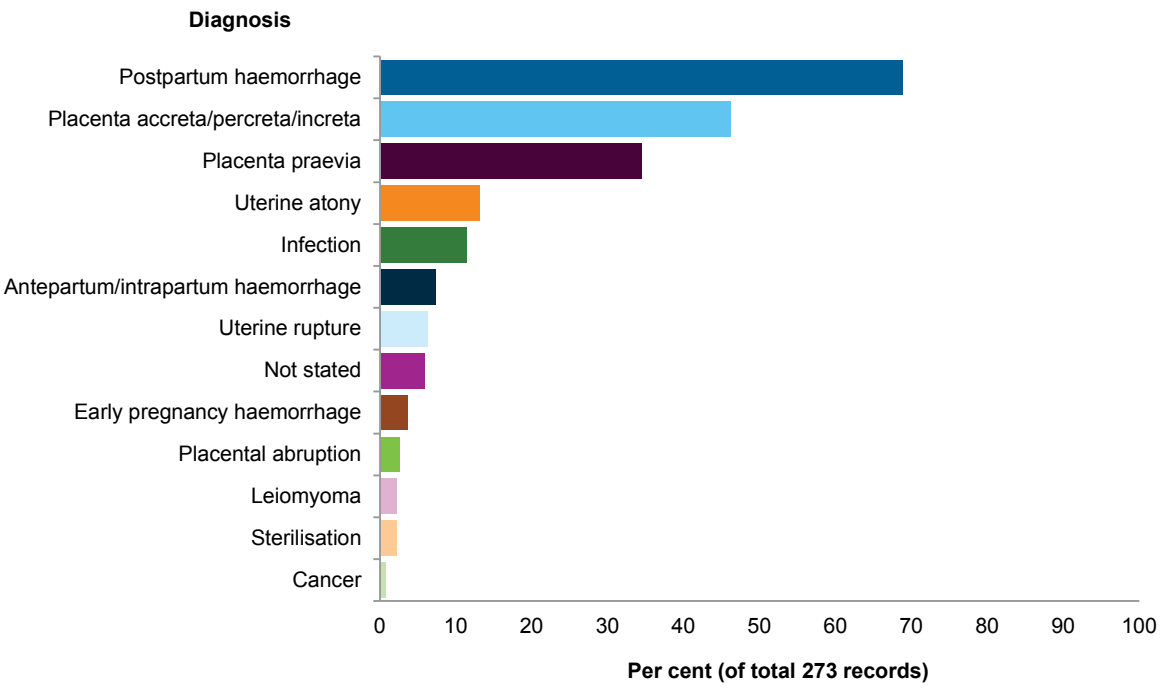
See Appendix, Table A2, for a detailed list of the above ICD-10-AM codes.

Each pregnancy-associated hysterectomy separation record could include more than one of the selected diagnoses. Records without one or more of the above diagnosis codes are classified as 'Not stated', as listed codes do not identify a relevant reason (as defined in the proposed data element) for this major intervention.

Overview of indications

Postpartum haemorrhage, placenta accreta/percreta/increta and placenta praevia (with or without haemorrhage) are consistently the most common related diagnoses reported for

separations with pregnancy-associated hysterectomy. In 2012–13, more than two-thirds of women had a diagnosis of postpartum haemorrhage (188 records; 69%), just under half had placenta accreta/percreta/increta (126 records; 46%) and a third of women had placenta praevia (94 records; 34%) (see Figure 4.4).



(a) Includes all separation records of pregnancy-associated hysterectomy (see Table 4.1).

Note: See Table A2 for associated ICD-10-AM codes.

Source: AIHW National Hospital Morbidity Database.

Figure 4.4: Selected diagnoses related to pregnancy-associated hysterectomy(a), 2012-13

Each related condition was also separately analysed, using 2012–13 data, to examine the other conditions listed in the separation record. This showed that:

- about half of separations (53%) with a diagnosis of placenta accreta also have a diagnosis of placenta praevia and 75% of records with a diagnosis of placenta accreta also have a diagnosis of postpartum haemorrhage
- over 70% of separations with a diagnosis of placenta praevia also have a diagnosis of placenta accreta, while about two-thirds (68%) also have a diagnosis of postpartum haemorrhage
- 1 in 4 separation records (25%) of pregnancy-associated hysterectomy have diagnoses for both placenta praevia and placenta accreta.

The varied ICD-10-AM codes found in the 'Not stated' category (separation records not immediately identified with reasons for the hysterectomy) are mostly associated with early pregnancy.

Some conditions (for example placenta praevia or placenta accreta) may only be found on subsequent histological examination, and if the results are not timely, the condition may not necessarily be noted in the patient's separation record. This analysis can only provide insight

into the likely coexistence of particular conditions and events occurring with cases of pregnancy-associated hysterectomy.

Rate of indications

The frequency and rate of the conditions related to pregnancy-associated hysterectomy over the 11-year period are outlined in Table 4.10.

Overall, there appear to be minimal changes to the rates of the related conditions over time.

Caution should be exercised when interpreting any rate changes due to the small numbers and likely variability. It is also not known to what extent any changes observed reflect real change or simply changes in coding practice.

Table 4.10: Selected principal and additional diagnoses related to pregnancy-associated hysterectomy[a] (frequency and rate per 1,000 mothers[b]), 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Frequency														
Placenta accreta/percreta/increta (ICD-10-AM code O43.2)	68	71	100	92	125	97	111	124	123	126	129	1,166	414	484
Placenta praevia (without haemorrhage) (O44.0)	16	11	23	14	19	13	11	13	10	7	16	153	69	41
Placenta praevia (with haemorrhage) (O44.1)	47	64	68	72	72	76	81	111	78	87	81	837	288	357
Placenta praevia (with or without haemorrhage) (O44.0; O44.1)[c]	62	75	91	86	91	89	92	124	88	94	96	988	357	398
Placental abruption (O45.0; O45.8; O45.9)	n.p.	6	5	8	5	7	16	8	n.p.	n.p.	6	75	25	35
Uterine rupture (O71.00; O71.01; O71.02; O71.10; O71.11; O71.12)[d]	12	15	19	19	15	9	11	14	10	17	20	161	62	52
Early pregnancy haemorrhage (O03.1; O03.6; O04.1; O04.6; O05.1; O05.6; O06.1; O06.6; O07.1; O07.6; O08.1; O20.0; O20.8; O20.9)	7	6	n.p.	14	8	6	n.p.	n.p.	11	10	10	90	36	31
Antepartum or intrapartum haemorrhage (O46.0; O46.8; O46.9; O67.0; O67.8; O67.9)	18	5	15	12	17	18	18	17	15	20	22	177	62	70
Postpartum haemorrhage (N83.7; O71.7; O72.0; O72.1; O72.2; O72.3; O90.2)	149	149	184	169	188	174	170	182	198	188	192	1,943	715	738
Cancer (C53.-; C54.-; C55; C58; D39.0; D39.2)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	17	n.p.	8
Leiomyoma (D25.-)	9	8	n.p.	16	n.p.	12	5	8	7	6	n.p.	87	40	26
Uterine atony (O62.2)	13	13	15	13	13	19	25	28	49	36	34	258	60	138
Infection (O85; O86.-)	19	20	27	24	22	14	14	18	22	31	28	239	87	85
Sterilisation (Z30.2)	6	n.p.	n.p.	n.p.	5	n.p.	n.p.	n.p.	8	n.p.	8	56	n.p.	18
Not stated[e]	21	21	22	16	18	22	13	13	24	16	19	205	78	66

(continued)

Table 4.10 (continued): Selected principal and additional diagnoses related to pregnancy-associated hysterectomy[a] (frequency and rate per 1,000 mothers[b]), 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Frequency (continued)														
Total no. of separation records[f]	**210**	**214**	**256**	**245**	**254**	**248**	**243**	**270**	**288**	**273**	**280**	**2,781**	**1,003**	**1,074**
Rate (per 1,000)[b]														
Placenta accreta/percreta/increta (ICD-10-AM code O43.2)	0.27	0.27	0.37	0.32	0.43	0.33	0.38	0.42	0.42	0.41	0.42	0.37	0.36	0.40
Placenta praevia (without haemorrhage) (O44.0)	0.06	0.04	0.08	0.05	0.07	0.04	0.04	0.04	0.03	0.02	0.05	0.05	0.06	0.03
Placenta praevia (with haemorrhage) (O44.1)	0.19	0.25	0.25	0.25	0.25	0.26	0.27	0.37	0.26	0.28	0.27	0.27	0.25	0.30
Placenta praevia (with or without haemorrhage) (O44.0; O44.1)[c]	0.25	0.29	0.33	0.30	0.31	0.30	0.31	0.42	0.29	0.31	0.31	0.31	0.31	0.33
Placental abruption (O45.0; O45.8; O45.9)	n.p.	0.02	0.02	0.03	0.02	0.02	0.05	0.03	n.p.	n.p.	0.02	0.02	0.02	0.03
Uterine rupture (O71.00; O71.01; O71.02; O71.10; O71.11; O71.12)[d]	0.05	0.06	0.07	0.07	0.05	0.03	0.04	0.05	0.03	0.06	0.07	0.05	0.05	0.04
Early pregnancy haemorrhage (O03.1; O03.6; O04.1; O04.6; O05.1; O05.6; O06.1; O06.6; O07.1; O07.6; O08.1; O20.0; O20.8; O20.9)	0.03	0.02	n.p.	0.05	0.03	0.02	n.p.	n.p.	0.04	0.03	0.03	0.03	0.03	0.03
Antepartum or intrapartum haemorrhage (O46.0; O46.8; O46.9; O67.0; O67.8; O67.9)	0.07	0.02	0.06	0.04	0.06	0.06	0.06	0.06	0.05	0.07	0.07	0.06	0.05	0.06
Postpartum haemorrhage (N83.7; O71.7; O72.0; O72.1; O72.2; O72.3; O90.2)	0.59	0.57	0.67	0.60	0.65	0.59	0.58	0.61	0.65	0.61	0.63	0.62	0.63	0.62
Cancer (C53.-; C54.-; C55; C58; D39.0; D39.2)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	0.01	n.p.	0.01
Leiomyoma (D25.-)	0.04	0.03	n.p.	0.06	n.p.	0.04	0.02	0.03	0.02	0.02	n.p.	0.03	0.04	0.02
Uterine atony (O62.2)	0.05	0.05	0.06	0.05	0.04	0.06	0.08	0.09	0.16	0.12	0.11	0.08	0.05	0.12
Infection (O85, O86.-)	0.08	0.08	0.10	0.08	0.08	0.05	0.05	0.06	0.07	0.10	0.09	0.08	0.08	0.07

(continued)

Table 4.10 (continued): Selected principal and additional diagnoses related to pregnancy-associated hysterectomy[(a)] (frequency and rate per 1,000 mothers[(b)]), 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Rate (per 1,000) (continued)														
Sterilisation (Z30.2)	0.02	n.p.	n.p.	n.p.	0.02	n.p.	n.p.	n.p.	0.03	n.p.	0.03	0.02	n.p.	0.02
Not stated[(e)]	0.08	0.08	0.08	0.06	0.06	0.07	0.04	0.04	0.08	0.05	0.06	0.06	0.07	0.06
Total pregnancy-associated hysterectomy rate (per 1,000)	**0.83**	**0.82**	**0.94**	**0.86**	**0.87**	**0.85**	**0.82**	**0.91**	**0.95**	**0.89**	**0.92**	**0.88**	**0.88**	**0.90**

(a) Includes all separation records of pregnancy-associated hysterectomy (see Table 4.1).

(b) Denominator from the NPDC, calculated as the average of total number of mothers for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown).

(c) One separation record from 2003–04 and one from 2013–14 had both placenta praevia without haemorrhage (O44.0) and placenta praevia with haemorrhage (O44.1). This has been taken into account when calculating total placenta praevia cases.

(d) The ICD-10-AM codes for uterine rupture changed from 4 characters (O71.1) to 5 characters (O71.1-) in ICD-10-AM sixth edition. Codes were mapped during the analysis to enable identification of uterine rupture across all reference years.

(e) 'Not stated' refers to separation records that did not have an identifiable reason for hysterectomy, and therefore were not classified into the any of the other above categories.

(f) Frequencies for individual conditions do not add to column total as each separation record may include more than one relevant diagnosis code.

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Caesarean section

The majority of women who gave birth within the same hospital episode as their peripartum hysterectomy event gave birth by caesarean section (84.0%). (Note that caesarean section status is unknown where the delivery did not occur in the same episode of care as the hysterectomy). Over the 11-year period, 0.6 per 1,000 women giving birth (1.9 per 1,000 women giving birth by caesarean section) had a caesarean section and a peripartum hysterectomy in the same hospital admission (Table 4.11).

Nearly 87% (1,937) of peripartum hysterectomies (2,238; excludes transfers and readmission records) were coded with *either* a current or previous caesarean section delivery over the 11-year period. (Previous caesarean section was identified through ICD-10-AM codes O34.2 *Maternal care for uterine scar* and O75.7 *Vaginal delivery following previous caesarean section*.) The rate of peripartum hysterectomy with *either* a current or previous caesarean section was 0.61 per 1,000 total women who gave birth (Table 4.11 and Figure 4.5).

Some 41% of records for peripartum hysterectomy (921 of 2,238) were coded with *both* a current and a previous caesarean section delivery over the 11-year period. This means that about 1 in 2 women (49%; 921 of1,879) undergoing a peripartum hysterectomy with a caesarean section in the current delivery also had a previous caesarean section. The rate of peripartum hysterectomy with *both* a current and a previous caesarean section was 0.29 per 1,000 total women who gave birth (Table 4.11).

All of these rates were relatively stable over the 11 years.

Table 4.11: Peripartum hysterectomy[a] with previous and/or current caesarean section[b], 2003–04 to 2013–14

Type of caesarean section	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Current caesarean section														
Caesarean section delivery (block 1340) (no.)	125	130	182	157	176	165	167	196	197	189	195	1,879	680	749
Peripartum hysterectomy events occurring with a caesarean section delivery (block 1340) (%)[c]	81.7	80.7	87.9	81.3	85.0	83.3	81.1	84.8	84.5	84.8	86.3	84.0	84.5	83.9
Rate (per 1,000) of peripartum hysterectomy with current caesarean section (block 1340) **in total caesarean section births**[d]	1.71	1.67	2.19	1.80	1.95	1.80	1.80	2.07	2.02	1.90	1.95	1.90	1.93	1.95
Rate (per 1,000) of peripartum hysterectomy with current caesarean section (block 1340) **in total births**[d]	0.49	0.50	0.67	0.55	0.61	0.56	0.57	0.66	0.65	0.62	0.64	0.60	0.60	0.62
Current OR previous caesarean section[e][f]														
Total peripartum hysterectomy events with current or previous caesarean section) (no.)	129	131	183	167	178	170	172	205	203	198	201	1,937	698	778
Total peripartum hysterectomy events with current or previous caesarean section (%)[c]	84.3	81.4	88.4	86.5	86.0	85.9	83.5	88.7	87.1	88.8	88.9	86.6	86.7	87.1
Rate (per 1,000) of peripartum hysterectomy with current or previous caesarean section **in total caesarean section births**[d]	1.76	1.69	2.20	1.91	1.98	1.85	1.85	2.17	2.08	1.99	2.01	1.96	1.98	2.02
Rate (per 1,000) of peripartum hysterectomy with current or previous caesarean section **in total births**[d]	0.51	0.50	0.67	0.59	0.61	0.58	0.58	0.69	0.67	0.65	0.66	0.61	0.61	0.65

(continued)

Table 4.11 (continued): Peripartum hysterectomy[a] with previous and/or current caesarean section[b], 2003–04 to 2013–14

Type of caesarean section	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Current AND previous caesarean section[e][g]														
Peripartum hysterectomy events with current and previous caesarean section (no.)	60	52	83	84	84	73	84	94	99	103	105	921	324	380
Peripartum hysterectomy events with current and previous caesarean section (%)[c]	39.2	32.3	40.1	43.5	40.6	36.9	40.8	40.7	42.5	46.2	46.5	41.2	40.2	42.6
Rate (per 1,000) of peripartum hysterectomy with current and previous caesarean section **in total caesarean section births**[d]	0.82	0.67	1.00	0.96	0.93	0.80	0.90	0.99	1.01	1.03	1.05	0.93	0.92	0.99
Rate (per 1,000) of peripartum hysterectomy with current and previous caesarean section **in total births**[d]	0.24	0.20	0.30	0.30	0.29	0.25	0.28	0.32	0.33	0.34	0.34	0.29	0.28	0.32

(a) Excludes separation records with non-obstetric principal diagnosis codes. Includes records with a principal diagnosis in the 'O' chapter of ICD-10-AM codes, or a principal diagnosis between Z30.- and Z39.-.

(b) ICD-10-AM was updated a number of times in the analysis period. Procedure block 1340 is used to ascertain the number of caesarean sections. There was a minor change made to both codes O34.2 and O75.7 in ICD-10-AM seventh edition (implemented 1 July 2010), which may have led to an increase in ascertainment over time. The term 'any' was added to the inclusion term to clarify that 'previous caesarean section' was not limited to the immediately preceding delivery episode of care.

(c) The denominator for this calculation excludes peripartum hysterectomy records for readmissions and transfers as the type of delivery is unknown for these records (total for 11-year period: 2,238).

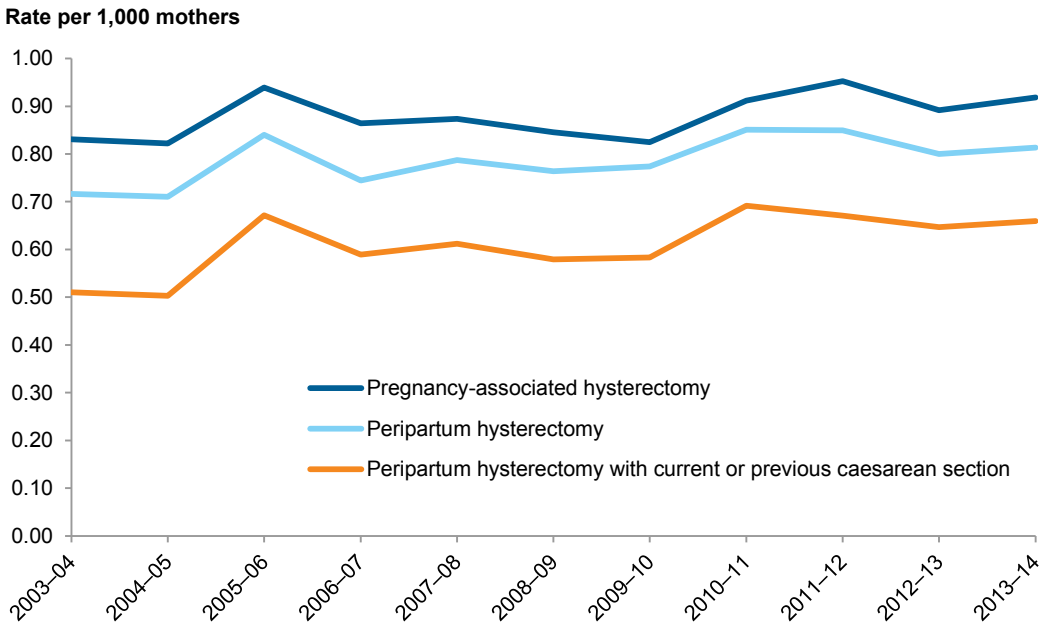
(d) Denominator from the NPDC, calculated as the average of total number of births or caesarean deliveries for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown).

(e) Previous caesarean section is identified through the diagnosis codes for *Maternal care for uterine scar* (O34.2) or *Vaginal delivery following previous caesarean section* (O75.7). See also note (b) above.

(f) Represents women who had a caesarean section delivery in the current birth but not necessarily in the previous birth, plus women who had a previous caesarean section birth but delivered vaginally in the current birth.

(g) Represents women who had caesarean section deliveries in the current and a previous birth; that is, repeat caesarean sections. Most (921; 94%) of the women who had a diagnosis code for a previous caesarean section (979 in total) also had a code (block 1340) indicating a caesarean section in the current delivery.

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.



Note: Sourced from the NPDC, calculated as the average of total number of mothers for the two years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown).

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Figure 4.5: Rate of peripartum hysterectomy, pregnancy-associated hysterectomy, and pregnancy-associated hysterectomy with current or previous caesarean section, 2003–04 to 2013–14

Similar to Figure 4.2, Figure 4.5 shows that there were fluctuations over time in the rate of pregnancy-associated hysterectomy, peripartum hysterectomy, and peripartum hysterectomy with current or previous caesarean section, with apparent increases particularly in 2005–06 and 2010–11. It is unclear if these increases could be attributed to changes to ICD-10-AM coding. New editions of ICD-10-AM were implemented on 1 July in the following years: 2004, 2006, 2008, 2010 and 2013, but it is possible that full introduction of the new editions in private hospitals may have been delayed. Rates for uncommon procedures can also be expected to fluctuate from year to year, so it is possible the pattern observed simply reflects volatility associated with small numbers.

Caesarean section delivery is highly associated with peripartum hysterectomy with postpartum haemorrhage, placenta accreta and placenta praevia (Table 4.12). Caesarean section delivery ends with peripartum hysterectomy in combination with a diagnosis of postpartum haemorrhage in 1.41 per 1,000 caesarean section deliveries, with a diagnosis of placenta accreta in 0.99 per 1,000 caesarean section deliveries, and with a diagnosis of placenta praevia in 0.97 per 1,000 caesarean section deliveries. Monk and others (2014) found an incidence of peripartum hysterectomy following postpartum haemorrhage of 1.64 per 1,000 women giving birth by caesarean section (6 cases) in a study of 3,651 women with low risk, singleton pregnancies.

The rate of peripartum hysterectomy occurring with the following conditions is higher in hysterectomies occurring with caesarean section delivery than for those occurring in total deliveries (see also Table 4.10):

- postpartum haemorrhage—1.41 per 1,000 women giving birth by caesarean section compared with 0.62 per 1,000 mothers giving birth
- placenta accreta—0.99 per 1,000 women giving birth by caesarean section compared with 0.37 per 1,000 mothers giving birth
- placenta praevia—0.97 per 1,000 women giving birth by caesarean section compared with 0.31 per 1,000 mothers giving birth.

More analysis of these differences would be necessary to understand their relative contribution to the risk of peripartum hysterectomy in different groups of women giving birth.

The overall rate of these conditions occurring with peripartum hysterectomy in caesarean section deliveries has changed slightly over time from 2005–06 to 2013–14. Changes should be interpreted with caution, as the numerators are low and are subject to variation. Coding practices of the ICD-10-AM may also vary over time. Please see the section on 'Limitations' in Chapter 5 for further discussion.

Table 4.12: Rate of selected principal and additional diagnoses related to peripartum hysterectomy separations, with current caesarean section delivery[a], 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block 2009–10 to 2012–13)
Frequency														
Placenta accreta/percreta/increta (ICD-10-AM code O43.2)	53	55	87	76	103	81	94	109	105	106	110	979	347	414
Placenta praevia (without haemorrhage) (O44.0)	15	10	23	14	19	13	11	13	10	7	16	151	69	41
Placenta praevia (with haemorrhage) (O44.1)	44	61	67	69	69	76	78	105	78	84	80	811	281	345
Placenta praevia (with or without haemorrhage) (O44.0; O44.1)[b]	58	71	90	83	88	89	89	118	88	91	95	960	350	386
Placental abruption (O45.0; O45.8; O45.9)	n.p.	6	n.p.	6	5	n.p.	14	n.p.	n.p.	7	6	62	19	28
Uterine rupture (O71.00; O71.01, O71.02; O71.10; O71.11; O71.12)[c]	6	8	9	9	n.p.	n.p.	n.p.	5	6	9	13	81	30	24
Antepartum or intrapartum haemorrhage (O46.0; O46.8; O46.9; O67.0; O67.8; O67.9)	16	n.p.	12	n.p.	15	16	17	14	13	20	18	152	n.p.	64
Postpartum haemorrhage (N83.7; O71.7; O72.0; O72.1; O72.2; O72.3; O90.2)	96	101	144	120	138	119	115	129	144	139	144	1,389	521	527
Cancer (C53.-; C54.-; C55; C58; D39.0; D39.2)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	15	n.p.	7
Leiomyoma (D25.-)	n.p.	n.p.	n.p.	10	n.p.	8	5	n.p.	n.p.	n.p.	n.p.	46	26	13
Uterine atony (O62.2)	7	9	8	9	10	14	18	19	32	22	24	172	41	91

(continued)

Table 4.12 (continued): Rate of selected principal and additional diagnoses related to peripartum hysterectomy separations, with current caesarean section delivery[a], 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Frequency (continued)														
Infection (O85; O86.-)	10	13	15	17	16	7	7	13	12	22	17	149	55	54
Sterilisation (Z30.2)	6	n.p.	9	n.p.	5	n.p.	n.p.	n.p.	8	6	8	55	21	18
Not stated[d]	n.p.	n.p.	8	n.p.	n.p.	7	n.p.	5	5	n.p.	n.p.	48	23	15
Total no. of separation records[e]	**125**	**130**	**182**	**157**	**176**	**165**	**167**	**196**	**197**	**189**	**195**	**1,879**	**680**	**749**
Rate (per 1,000)[f]														
Placenta accreta/percreta/increta (ICD-10-AM code O43.2)	0.72	0.71	1.05	0.87	1.14	0.88	1.01	1.15	1.07	1.06	1.10	0.99	0.98	1.08
Placenta praevia (without haemorrhage) (O44.0)	0.21	0.13	0.28	0.16	0.21	0.14	0.12	0.14	0.10	0.07	0.16	0.15	0.20	0.11
Placenta praevia (with haemorrhage) (O44.1)	0.60	0.79	0.80	0.79	0.77	0.83	0.84	1.11	0.80	0.84	0.80	0.82	0.80	0.90
Placenta praevia (with or without haemorrhage) (O44.0; O44.1)[b]	0.79	0.91	1.08	0.95	0.98	0.97	0.96	1.25	0.90	0.91	0.95	0.97	0.99	1.00
Placental abruption (O45.0; O45.8; O45.9)	n.p.	0.08	n.p.	0.07	0.06	n.p.	0.15	n.p.	n.p.	0.07	0.06	0.06	0.05	0.07
Uterine rupture (O71.00; O71.01, O71.02; O71.10; O71.11; O71.12)[c]	0.08	0.10	0.11	0.10	n.p.	n.p.	n.p.	0.05	0.06	0.09	0.13	0.08	0.09	0.06
Antepartum or intrapartum haemorrhage (O46.0; O46.8; O46.9; O67.0; O67.8; O67.9)	0.22	n.p.	0.14	n.p.	0.17	0.17	0.18	0.15	0.13	0.20	0.18	0.15	n.p.	0.17

(continued)

Table 4.12 (continued): Rate of selected principal and additional diagnoses related to peripartum hysterectomy separations, with current caesarean section delivery[(a)], 2003–04 to 2013–14

Type of related condition (selected principal and additional diagnoses)	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Rate (per 1,000) (continued)														
Postpartum haemorrhage (N83.7; O71.7; O72.0; O72.1; O72.2; O72.3; O90.2)	1.31	1.30	1.73	1.37	1.53	1.30	1.24	1.36	1.47	1.39	1.44	1.41	1.48	1.37
Cancer (C53.-; C54.-; C55; C58; D39.0; D39.2)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.	0.02	n.p.	0.02
Leiomyoma (D25.-)	n.p.	n.p.	n.p.	0.11	n.p.	0.09	0.05	0.04	n.p.	n.p.	n.p.	n.p.	0.07	0.03
Uterine atony (O62.2)	n.p.	n.p.	n.p.	0.10	0.11	0.15	0.19	0.20	0.33	0.22	0.24	0.17	0.12	0.24
Infection (O85, O86.-)	0.14	0.17	0.18	0.19	0.18	0.08	0.08	0.14	0.12	0.22	0.17	0.15	0.16	0.14
Sterilisation (Z30.2)	0.08	n.p.	0.11	n.p.	0.06	n.p.	n.p.	n.p.	0.08	0.06	0.08	0.06	0.06	0.05
Not stated[(d)]	n.p.	n.p.	0.10	n.p.	n.p.	0.08	n.p.	0.05	0.05	n.p.	n.p.	0.05	0.07	0.04
Rate (per 1,000) of peripartum hysterectomy with current caesarean section (block 1340) in total caesarean section births	**1.71**	**1.67**	**2.19**	**1.80**	**1.95**	**1.80**	**1.80**	**2.07**	**2.02**	**1.90**	**1.96**	**1.90**	**1.93**	**1.95**

(a) Caesarean section ascertained from block 1340.

(b) One separation record from 2003–04 and one from 2013–14 had both placenta praevia without haemorrhage (O44.0) and placenta praevia with haemorrhage (O44.1). This has been taken into account when calculating total placenta praevia cases.

(c) The ICD-10-AM codes for uterine rupture changed from 4 characters (O71.1) to 5 characters (O71.1-) in ICD-10-AM sixth edition. Codes were mapped during the analysis to enable identification of uterine rupture across all reference years.

(d) 'Not stated' refers to separation records that did not have an identifiable reason for hysterectomy and therefore were not classified into the any of the other above categories.

(e) Frequencies for individual conditions do not add to column total as each separation record may include more than one relevant diagnosis code.

(f) Denominator from the NPDC, calculated as the average of total number of caesarean deliveries for the 2 years (except for 2013–14, where the total for 2013 is used, because the total number of mothers in 2014 is unknown).

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Peripartum hysterectomy and placenta accreta

Over the 11-year period, there were 592 separation records of peripartum hysterectomy with a previous caesarean section with a diagnosis of placenta accreta reported (Table 4.13). Around 3 in 5 (60.5%) of all peripartum hysterectomy cases with a previous caesarean section had a diagnosis of placenta accreta.

As noted in Chapter 2, abnormal placentation, such as placenta accreta, may occur more readily in the presence of a uterine scar, such as that from a previous caesarean section delivery (Awan et al. 2011; Sholapurkar 2013; Yang et al. 2007).

Table 4.13: Placenta accreta[(a)] and previous caesarean section[(b)] in peripartum hysterectomy separations, 2003–04 to 2013–14

Condition	All years	4-year block (2005–06 to 2008–09)	4-year block (2009–10 to 2012–13)
Peripartum hysterectomy with placenta accreta and previous caesarean section (no.)	592	207	257
Peripartum hysterectomy cases with placenta accreta and previous caesarean section in total placenta accreta cases (%)	52.8	52.0	54.9
Peripartum hysterectomy cases with placenta accreta and previous caesarean section in total previous caesarean section cases (%)	60.5	60.5	62.8

(a) Placenta accreta identified by ICD-10-AM code O43.2.

(b) Previous caesarean section identified by ICD-10-AM code/s O75.7 *Vaginal birth after caesarean section* and O43.2 *Maternal care for uterine scar*. There was a minor change made to both codes O34.2 and O75.7 in ICD-10-AM seventh edition (implemented 1 July 2010), which may have led to an increase in ascertainment over time. The term 'any' was added to the inclusion term to clarify that 'previous caesarean section' was not limited to the immediately preceding delivery episode of care.

Source: AIHW National Hospital Morbidity Database.

Deaths

Maternal deaths in hospital for in peripartum hysterectomy cases

Between 2003–04 and 2013–14, there were 16 hospitalisations that ended with death (identified by 'separation mode'), or 0.6% of all peripartum hysterectomies. All 16 deaths were associated with the peripartum period (rather than early pregnancy).

These deaths do not include women who may have been discharged from hospital and later died.

Fetal deaths in peripartum hysterectomy cases

Between 2003–04 and 2013–14, fetal death (or stillbirth) was recorded in 93 separations or 3.7% of all peripartum hysterectomies. These separation records were identified by ICD-10-AM codes Z37.1; Z37.3; Z37.4 and O36.4.

Fetal death is recorded as the outcome of delivery code (Z37.-) on the mother's record but neonatal death, where death occurs in a live born infant up to 28 completed days after birth, is not. (Neonatal death is recorded on the infant's record, via the separation mode.) As it is not possible to identify the neonatal deaths in the mother's records, or to know how many died after discharge from hospital, only fetal deaths have been considered here.

Fetal death occurred in 0.7% of all births in 2013 (AIHW 2015b). The rate of fetal death occurring with peripartum hysterectomy is higher than would be expected, compared with the total maternal population.

5 Discussion

Implications of findings

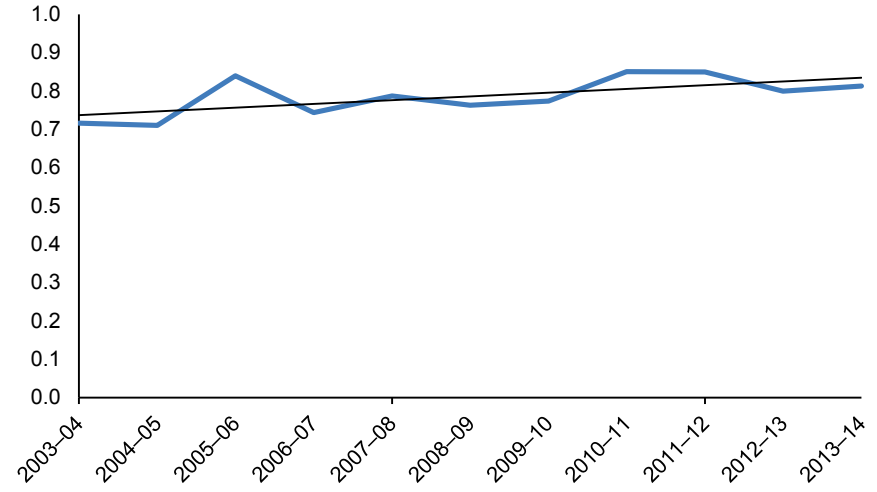
Evidence from around the world suggests that the incidence of peripartum hysterectomy is increasing, and is possibly linked to the increasing rate of caesarean section. Peripartum hysterectomy is associated with severe maternal morbidity, and monitoring its incidence and characteristics may help inform quality of care during pregnancy and in the postpartum period.

To date, incidence of peripartum hysterectomy in Australia has not been consistently monitored. This working paper aims to present the latest available information on national rates of peripartum hysterectomy using national hospital morbidity data.

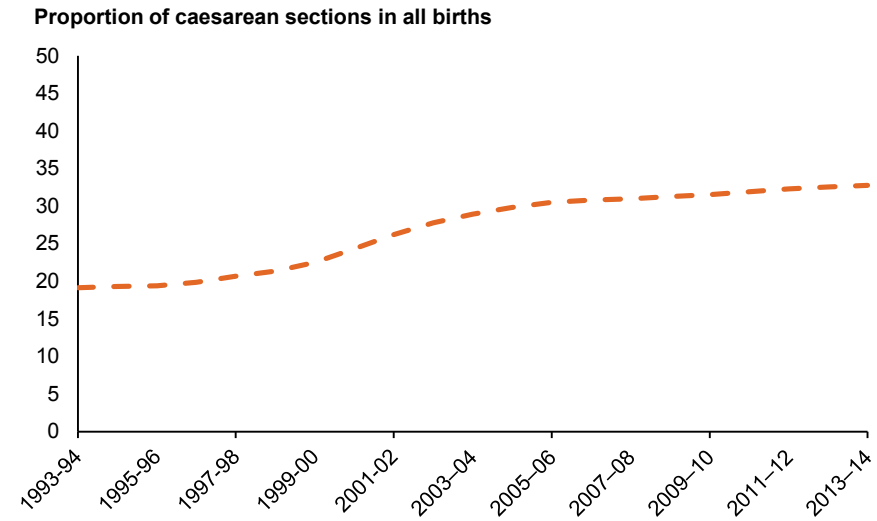
The rate of peripartum hysterectomy in Australia appears relatively unchanged over the 9-year period from 2005–06 to 2013–14, with a rate of around 0.80 per 1,000 mothers. This is consistent with previously reported incidence rates for Australia (AIHW: Johnson et al. 2014; Haynes et al. 2004; Wills 2012), and internationally (Machado 2011).

The rates in 2003–04 and 2004–05 were slightly lower, at around 0.72 per 1,000 mothers. Study of years before 2003–04 was outside the scope of this paper and, without analysis of this earlier period, it is unclear whether the increase in rates since 2003–04 is due to random variation or whether it is a real change. Existing evidence indicates that increases in peripartum hysterectomy rates occurred from the mid-to-late-1990s to the early 2000s. Haynes and others (2004) described an increase that occurred from 1999 to 2002, Bateman and others (2012) compared rates from 1994–1995 to 2006–2007 and Muench and others (2008) compared rates from 1991 to 2001. It may be that rates of peripartum hysterectomy increased before our study years and have remained steady since. Howell and others (2012) state that the incidence of peripartum hysterectomy in Queensland generally remained stable between 2000–01 and 2010–11.

The findings from this analysis of the NHMD are consistent with studies showing that peripartum hysterectomy is strongly associated with caesarean section deliveries (either in a previous or the current pregnancy). The proportion of deliveries that are caesarean sections in Australia has increased since 1996 (19.5% in 1996 to 32.8% in 2013); however, the largest increase occurred between 1996 and 2005 (from 19.5% to 30.3%) (AIHW: Laws & Sullivan 2004; AIHW: Laws et al. 2007). Since 2005, the proportion of caesarean section deliveries has increased at a slower rate to 32.8% in 2013. Despite the strong association between peripartum hysterectomy and caesarean section, it is not possible to determine with certainty, based on the current NHMD data, whether the relatively stable rate of peripartum hysterectomy is linked to the slower increase in caesarean section deliveries (see Figure 5.1).



Source: AIHW National Hospital Morbidity Database.



(a) Sourced from the NPDC.

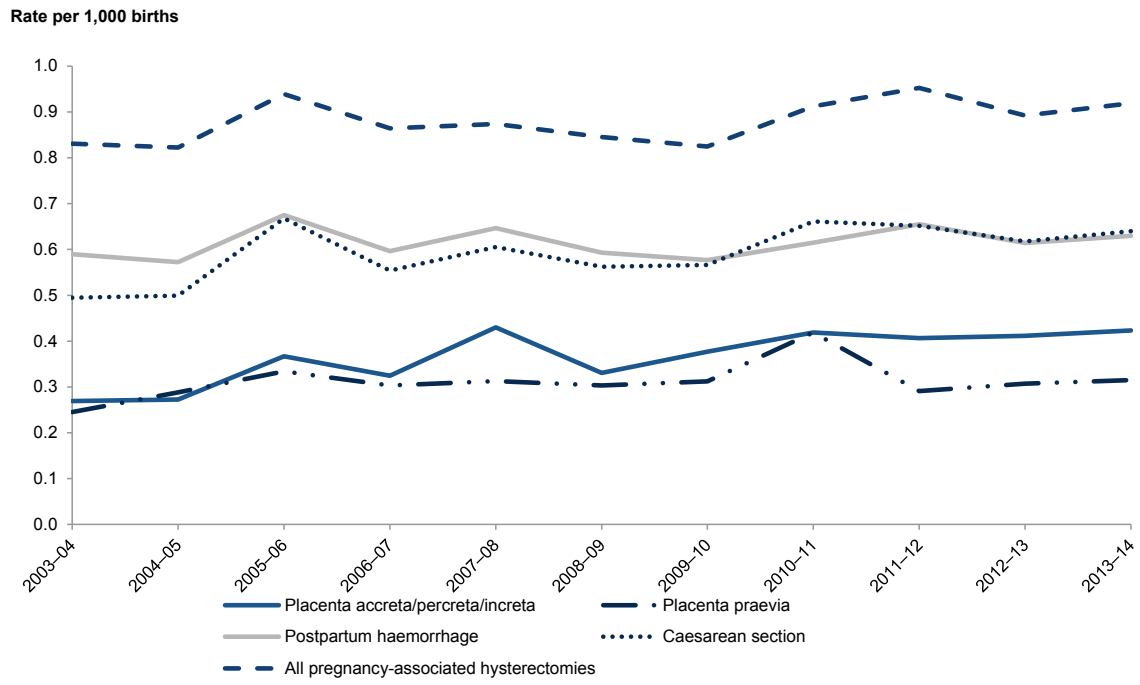
Source: AIHW National Perinatal Data Collection.

Figure 5.1: Rate and linear trend of peripartum hysterectomy cases per 1,000 births, 2003–04 to 2013–14 (top chart) and proportion of births[(a)] that are caesarean sections, 1993–04 to 2013–14 (bottom chart)

It must be noted that while there is good evidence to suggest caesarean sections are associated with peripartum hysterectomy, the relationship cannot be validated from NHMD data alone, as we cannot analyse why a caesarean section was performed. A caesarean section may be more likely to result in severe postpartum haemorrhage than other forms of delivery, resulting in a hysterectomy, or, equally plausible, a caesarean section may be performed due to high risk complications, such as placenta accreta, a condition that can deteriorate and necessitate a peripartum hysterectomy (Howell et al. 2012). Such cause and effect relationships are not discernible in NHMD data. Howell and others (2012) found that

the primary reasons for caesarean section among women who had the caesarean section before labour and subsequently a hysterectomy, were placenta praevia, previous uterine scar and morbidly adherent placenta.

The findings from the NHMD are also consistent with studies showing that peripartum hysterectomy is associated with increasing maternal age and multiple birth (such as twins), and is strongly associated with postpartum haemorrhage, placenta accreta and placenta praevia (Bodelon et al. 2009; Howell et al. 2012; Jakobsson et al. 2015). Similarly, the conditions associated with 'abnormal placentation' (placenta praevia, abruptio placentae and placenta accreta) were all found to be associated with peripartum hysterectomy (Figure 5.2). These associations do not appear to have changed over time, in our study period. The numbers of women who were reported in the NHMD as having had a peripartum hysterectomy with placental abruption, uterine rupture, cancer or leiomyoma were quite low.



Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Figure 5.2: Rates of pregnancy-associated hysterectomy per 1,000 births occurring with placenta accreta, with postpartum haemorrhage, with caesarean section (current delivery), and total rate

The rate of women who had a peripartum hysterectomy with placenta accreta was found to be 0.37 per 1,000 maternities for the 11-year period. The preliminary result from AMOSS of an incidence of 0.42 per 1,000 is comparable (AIHW: Johnson et al. 2014), however, includes all women with placenta accreta, and not just those who had a peripartum hysterectomy. Full results from AMOSS, with information on exclusion and inclusion criteria, will be of interest, for further comparisons.

Nationally consistent and regularly collected information on peripartum hysterectomy and its risk factors will allow further investigation and monitoring of its patterns and trends, and its association with caesarean section.

Limitations

The analyses in this paper used the NHMD data set. This is considered to be the best available source for regular monitoring of rates of peripartum hysterectomy in Australia. The strengths of the data set include that it has national coverage of all hospital admissions, of which hysterectomy procedures are expected to be generally well coded. In addition, it is ongoing, allowing for monitoring of trends over time.

However, several important limitations of the data source should be noted.

Firstly, there is limited information available in the NHMD on maternal characteristics, such as body mass, parity and neonatal outcomes. These details may provide further information on potential confounders. Further, some variables in the NHMD that may provide additional information may not be recorded consistently across years. It is also important to note that this paper was limited to cases of peripartum hysterectomy only, and does not provide information on women with severe haemorrhage who were successfully treated with other therapies (Knight 2007).

Secondly, principal and additional diagnoses are coded using ICD-10-AM codes. The classification system is subject to modifications over time which can affect comparability between years. In some instances, a change to ICD-10-AM coding may be minor, and have little to no effect on analysis. In other situations, the changes may be able to be accounted for. Other changes, such as that involving delivery codes O80–O84, may have a greater effect. Where possible, these coding changes have been clearly noted in this paper. It is possible that some coding changes may still be unaccounted for in this analysis, though it is expected that the effect of these will be minor. Other coding changes would need to be taken into account if years before 2003–04 are studied.

Further, there is no definitive method for identifying, in the NHMD, the total number of the pregnancy-associated hysterectomies associated with the peripartum period, defined as after 20 weeks' gestation and within 6 weeks postpartum. The majority of episodes will have a diagnosis code for delivery; that is, an O80–O84 code and/or a Z37 code. However, it is more difficult to identify the time frame associated with cases where the hysterectomy and birth did not occur in the same episode. These hysterectomies are important to identify, particularly because of the link between conservative management of placenta accreta and subsequent hysterectomy. Data linkage techniques could potentially be used to link the birth and hysterectomy separation records.

In addition, the use of averaged data from the NPDC as a denominator is not entirely comparable to the NHMD. The NPDC and NHMD are separate data collections, and have different data collection methods. However, the use of one denominator series over another has been found to have a negligible effect on rates of peripartum hysterectomy. Hence, future analyses could use total births as reported in the NHMD.

The analysis presented in this working paper does not adjust for potential confounding factors, such as maternal age, Indigenous status or hospital sector.

Finally, these data have not been validated against any other data source.

Future research

As stated above, the NHMD provides a good data source for monitoring population-level rates of peripartum hysterectomy in Australia; however, the limitations outlined should be

considered carefully. It would be useful to validate the data against a source such as AMOSS which collected data on all cases of peripartum hysterectomy occurring in hospitals in 2010 and 2011.

Further work to confirm readmission rates for peripartum hysterectomy would be useful. This would involve linkage across episodes of hospitalisation and across reference years in some cases. A small study at the jurisdictional level could prove helpful.

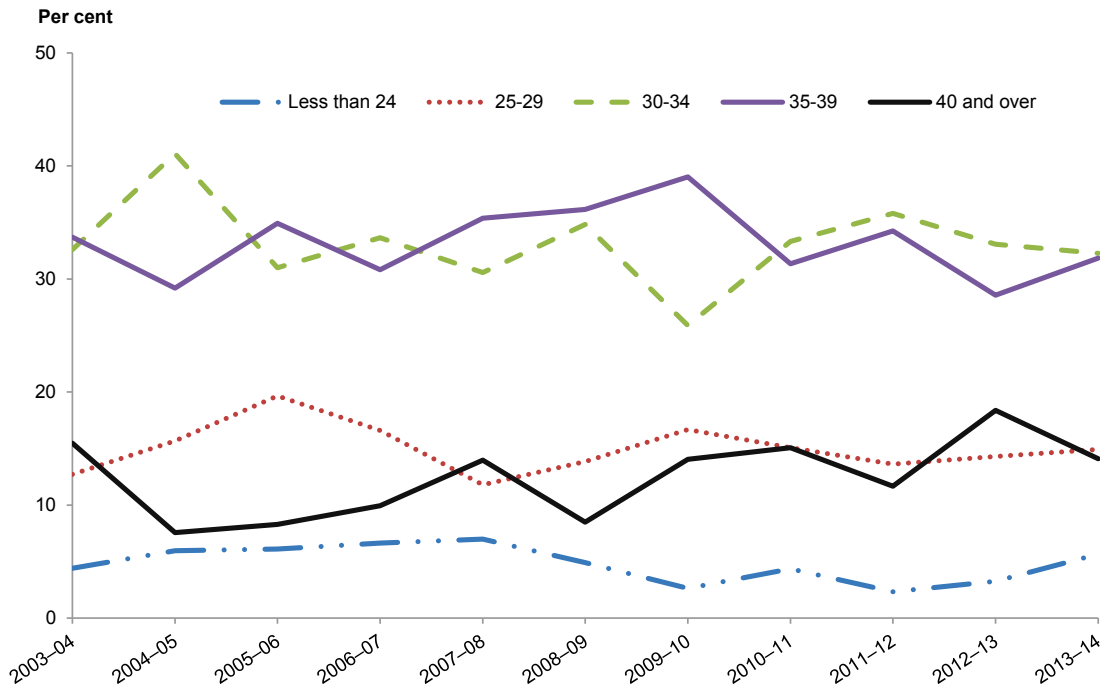
Future work could include linkage of the mother's hospital separation record for the birth episode with the birth event as recorded in the perinatal (midwives) data collection. Such linkage would enable information about the mother's demographics, risk factors, medical history, pregnancy and birth to be examined together with the hospital separation record for the birth and/or hysterectomy episodes.

Appendix

Table A1: ICD-10-AM eighth edition codes for identifying cases of early pregnancy and readmissions or transfers (if no delivery code present)

ICD-10-AM codes	Definition	Assumption
O00.-	Ectopic pregnancy	Early pregnancy
O01.-	Hydatidiform mole	Early pregnancy
O02.-	Other abnormal products of conception	Early pregnancy
O03.-	Spontaneous abortion	Early pregnancy
O04.-	Medical abortion	Early pregnancy
O05.-	Other abortion	Early pregnancy
O06.-	Unspecified abortion	Early pregnancy
O07.-	Failed attempted abortion	Early pregnancy
O08.-	Complications following abortion and ectopic and molar pregnancy	Early pregnancy
O09.0; O09.1; O09.2	Duration of pregnancy <20 weeks	Early pregnancy
O20.8	Other haemorrhage in early pregnancy	Early pregnancy
O72.-	Postpartum haemorrhage	Readmission/transfer
O73.-	Retained placenta and membranes, without haemorrhage	Readmission/transfer
O75.7	Vaginal delivery following previous caesarean section	Readmission/transfer
O85	Puerperal sepsis	Readmission/transfer
O86.-	Other puerperal infections	Readmission/transfer
O90.-	Complications of the puerperium, not elsewhere classified	Readmission/transfer
O99.03	Anaemia complicating childbirth and the puerperium	Readmission/transfer
Z39.-	Postpartum care and examination	Readmisson/transfer

Note: New ICD-10-AM editions were implemented in the analysis period, 2003–04 to 2013–14, with specific changes made to O03.-; O07.-; O08.-; O09.-; and O99.03. The impact of these changes (if any) is discussed in 'Chapter 4 Results' of this paper.



(a) Only includes separation records identified as occurring in the peripartum period (see Table 4.1).

Sources: AIHW National Hospital Morbidity Database; AIHW National Perinatal Data Collection.

Figure A1: Peripartum hysterectomy[(a)] by age group (years), 2003–04 to 2013–14

Table A2: Selected ICD-10-AM eighth edition codes for related conditions contributing to pregnancy-associated hysterectomy

ICD–10-AM codes	Definition
Placenta accreta/percreta/increta	
O43.2	Morbidly adherent placenta
Placenta praevia	
O44.0	Placenta praevia specified as without haemorrhage
O44.1	Placenta praevia with haemorrhage
Placental abruption	
O45.0	Premature separation of placenta with coagulation defects
O45.8	Other premature separation of placenta
O45.9	Premature separation of placenta, unspecified
Uterine rupture	
O71.00	Rupture of uterus before onset of labour, unspecified
O71.01	Spontaneous rupture of uterus before onset of labour
O71.02	Traumatic rupture of uterus before onset of labour
O71.10	Rupture of uterus during labour, unspecified
O71.11	Spontaneous rupture of uterus during labour
O71.12	Traumatic rupture of uterus during labour
Early pregnancy haemorrhage	
O03.1	Spontaneous abortion, incomplete, complicated by delayed or excessive haemorrhage
O03.6	Spontaneous abortion, complete or unspecified, complicated by delayed or excessive haemorrhage
O04.1	Medical abortion, incomplete, complicated by delayed or excessive haemorrhage
O04.6	Medical abortion, complete or unspecified, complicated by delayed or excessive haemorrhage
O05.1	Other abortion, incomplete, complicated by delayed or excessive haemorrhage
O05.6	Other abortion, complete or unspecified, complicated by delayed or excessive haemorrhage
O06.1	Unspecified abortion, incomplete, complicated by delayed or excessive haemorrhage
O06.6	Unspecified abortion, complete or unspecified, complicated by delayed or excessive haemorrhage
O07.1	Failed medical abortion, complicated by delayed or excessive haemorrhage
O07.6	Other and unspecified failed attempted abortion, complicated by delayed or excessive haemorrhage
O08.1	Delayed or excessive haemorrhage following abortion and ectopic and molar pregnancy
O20.0	Threatened abortion
O20.8	Other haemorrhage in early pregnancy
O20.9	Haemorrhage in early pregnancy, unspecified

(continued)

Table A2 (continued): Selected ICD-10-AM eighth edition codes for related conditions contributing to pregnancy-associated hysterectomy

ICD-10-AM codes	Definition
Antepartum or intrapartum haemorrhage	
O46.0	Antepartum haemorrhage with coagulation defect
O46.8	Other antepartum haemorrhage
O46.9	Antepartum haemorrhage, unspecified
O67.0	Intrapartum haemorrhage with coagulation defect
O67.8	Other intrapartum haemorrhage
O67.9	Intrapartum haemorrhage, unspecified
Postpartum haemorrhage	
N83.7	Haematoma of broad ligament
O71.7	Obstetric haematoma of pelvis
O72.0	Third stage haemorrhage
O72.1	Other immediate postpartum haemorrhage
O72.2	Delayed and secondary postpartum haemorrhage
O72.3	Postpartum coagulation defects
O90.2	Haematoma of obstetric wound
Cancer	
C53.-	Malignant neoplasm of cervix uteri
C54.-	Malignant neoplasm of corpus uteri
C55	Malignant neoplasm of uterus, part unspecified
C58	Malignant neoplasm of placenta
D39.0	Neoplasm of uncertain or known behaviour of uterus
D39.2	Neoplasm of uncertain or known behaviour of placenta
Leiomyoma of uterus	
D25.-	Leiomyoma of uterus
Uterine atony	
O62.2	Other uterine inertia
Infection	
O85	Puerperal sepsis
O86.-	Other puerperal infections
Sterilisation	
Z30.2	Sterilisation

Note: New ICD-10-AM editions were implemented in the analysis period, 2003–04 to 2013–14, with specific changes made to O03.–; O07.–; O08.–; O43.2; O71.–; and O85. The impact of these changes (if any) is discussed in 'Chapter 4Results' of this paper.

Glossary

caesarean section: A method of birth by which a surgical incision is made into the mother's uterus via the abdomen to directly remove the baby.

fetal death (stillbirth): Death before the complete expulsion or extraction from its mother of a product of conception of 20 or more completed weeks of gestation or of 400 grams or more birthweight. The death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

haemorrhage (bleeding): The escape of blood from a ruptured blood vessel, externally or internally.

hospital sector: Whether a hospital has been classified as public or private.

hospitalisation: Synonymous with admission and separation; that is, an episode of hospital care that starts with the formal admission process and ends with the formal separation process. An episode of care can be completed by the patient being discharged, transferred to another hospital or care facility, or dying, or by a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation).

ICD-10-AM: See **International Statistical Classification of Diseases and Related Health Problems**.

incidence: The number of new cases (of an illness, disease or event) occurring during a given period.

Indigenous: A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander.

International Statistical Classification of Diseases and Related Health Problems: The World Health Organization's internationally accepted classification of death and disease. The Tenth Revision (ICD-10) is currently in use. The Tenth Revision, Australian Modification (ICD-10-AM) is currently in use in Australian hospitals for admitted patients.

maternal age: Mother's age in completed years at the birth of her baby.

neonatal death: Death of a live born baby within 28 days of birth.

other Australians: People who have declared they are not of Aboriginal or Torres Strait Islander descent, and those for whom their Indigenous status is unknown. Compare with **Indigenous**.

parity: Number of previous pregnancies resulting in live births or stillbirths, excluding the current pregnancy.

perinatal: Pertaining to, or occurring in, the period shortly before or after birth (usually up to 28 days after).

peripartum hysterectomy: A pregnancy-associated hysterectomy that occurs immediately after the birth of a baby (alive or stillborn) of at least 20 weeks' gestation or weighing at least 400 grams at birth, or in the postpartum period; that is, up to 6 weeks after birth. See also **pregnancy-associated hysterectomy**.

pregnancy-associated hysterectomy: The surgical removal of the uterus performed either:

- in pregnancy; for example, in association with an abortion or termination of pregnancy, including in early pregnancy
- immediately after a woman has given birth, or
- in the postpartum period, up to 6 weeks after birth.

It is usually an emergency life-saving procedure to arrest massive obstetric haemorrhage. Hysterectomy may include removal of the cervix and ovaries, fallopian tubes and lymph nodes and lymph channels. The uterus may be removed through the abdominal wall or through the vagina and, in some cases, the procedure may be performed laparoscopically. Menstruation ceases after hysterectomy.

principal diagnosis: The diagnosis listed in hospital records to describe the problem that was chiefly responsible for **hospitalisation**.

puerperium: The time after childbirth, lasting approximately 6 weeks, during which the anatomical and physiological changes brought about by pregnancy resolve and a woman adjusts to the new or expanded responsibilities of motherhood and non-pregnancy life.

rate: Is 1 number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers.

separation: The term used to refer to the episode of admitted patient which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation). In this paper, described by the term **hospitalisation**.

stillbirth: See **fetal death (stillbirth)**.

Definitions for medical conditions referred to in this report

The following definitions are from Harris and others (2011).

abnormal placentation: See **placenta praevia**, **placental abruption**, **placenta accreta**, **placenta percreta** and **placenta increta**.

antepartum haemorrhage: Bleeding from the uterus during a pregnancy in which the placenta appears to be normally situated, particularly after the 28th week and before the first stage of labour.

atony (as in 'uterine atony'): Decreased or absent muscle tone.

intrapartum haemorrhage: Copious bleeding during labour, usually caused by abruptio placentae or placenta praevia.

leoimyoma: A benign tumour of smooth muscle.

morbidly adherent placenta: See **placenta accreta**, **placenta increta** and **placenta percreta**.

placenta accreta: A placenta that invades the uterine muscle making separation from the muscle difficult. Note the term 'placenta accreta' is widely used to refer to all cases of placenta accreta/increta/percreta (unless specified), and is used this way in this paper.

placenta increta: A placenta that invades the uterine muscle and passes through the wall of the uterus into the abdominal cavity and adheres to adjacent abdominal organs, such as the bladder or bowel. See also **placenta accreta**.

placenta percreta: A placenta that invades the uterine muscle and passes through the wall of the uterus into the abdominal cavity. See also **placenta accreta**.

placenta praevia: A condition of pregnancy in which the placenta is implanted abnormally in the uterus so that it impinges on, or covers, the internal opening of the uterine cervix.

placental abruption (abruptio placentae): Separation of the placenta implanted in normal position in a pregnancy of 20 weeks or more or during labour before delivery of the fetus.

postpartum haemorrhage: Excessive bleeding (a loss of more than 500 mL of blood) usually from the genital tract after childbirth. May also occur during the course of performing a caesarean section.

preeclampsia: An abnormal condition of pregnancy characterised by the onset of acute hypertension in the second half of pregnancy.

thromboembolism: A condition in which a blood vessel is obstructed by a clot carried in the bloodstream from its site of formation.

uterine atony: See **atony**.

References

AIHW (Australian Institute of Health and Welfare) 2013. Indigenous identification in hospital separations data: quality report. Cat. no. IHW 90. Canberra: AIHW.

AIHW 2014. Australia's health 2014. Australia's health series no. 14. Cat. no. AUS 178. Canberra: AIHW.

AIHW 2015a. Admitted patient care 2013–14: Australian hospital statistics. Health services series no. 60. Cat. no. HSE 156. Canberra: AIHW.

AIHW 2015b. Australia's mothers and babies 2013—in brief. Perinatal statistics series no. 31. Cat. no. PER 72. Canberra: AIHW.

AIHW: Johnson S, Bonello MR, Li Z, Hilder L & Sullivan EA 2014. Maternal deaths in Australia 2006–2010. Maternal deaths series no. 4. Cat. no. PER 61. Canberra: AIHW.

AIHW: Laws PJ, Abeywardana S, Walker J & Sullivan EA 2007. Australia's mothers and babies 2005. Perinatal statistics series no. 20. Cat. no. PER 40. Canberra: AIHW.

AIHW: Laws PJ & Sullivan EA 2004. Australia's mothers and babies 2001. Perinatal statistics series no. 13. Cat. no. PER 25. Canberra: AIHW.

Al-Zirqi I, Stray-Pedersen B, Forsén L & Vangen S 2010. Uterine rupture after previous caesarean section. BJOG 117(7):809–20.

Armstrong AA, Harding S, Matthews T & Dickenson JE 2004. Is placenta accreta catching up with us? Australian and New Zealand Journal of Obstetrics and Gynaecology 44:210–3.

AMOSS (Australasian Maternity Outcomes Surveillance System) 2013. Current studies: peripartum hysterectomy. Sydney: AMOSS. Viewed 1 June 2016, <http://www.amoss.com.au/content/peripartum-hysterectomy>.

Awan N, Bennett MJ & Walters WAW 2011. Emergency peripartum hysterectomy: a 10-year review at the Royal Hospital for Women, Sydney. Australian and New Zealand Journal of Obstetrics and Gynaecology 51(3):210–5.

Banks CL, Paterson AM & Thomson AJ 2011. Cesarean hysterectomy. Global Library of Women's Medicine. Viewed 1 September 2015, <http://www.glowm.com/section_view/heading/Cesarean%20Hysterectomy/item/134>.

Bateman B, Mhyre J, Callaghan W & Kuklina E 2012. Peripartum hysterectomy in the United States: nationwide 14 year experience. American Journal of Obstetrics & Gynecology 206:63. doi:10.1016/j.ajog.2011.07.030.

Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P et al. 2007. Rates of caesarean section: analysis of global, regional and national estimates. Paediatric and Perinatal Epidemiology 21(2):98–113.

Bodelon C, Bernabe-Oritz A, Schiff MA & Reed SD 2009. Factors associated with peripartum hysterectomy. Obstetrics and Gynecology 114(1):115–23.

Charach R & Sheiner E 2013. Risk factors for peripartum hysterectomy following uterine rupture. Journal of Maternal-Fetal & Neonatal Medicine 26(12):1196–200.

Clausen C, Lönn L & Langhoff-Roos J 2014. Management of placenta percreta: a review of published cases. Acta Obstetricia et Gynecologica Scandinavica 93(2):138–43.

de la Cruz C, Coulter M, O'Rourke K, Amina Alio P, Daley E & Mahan C 2013. Women's experiences, emotional responses, and perceptions of care after emergency peripartum hysterectomy: a qualitative survey of women from 6 months to 3 years postpartum. Birth 40(4):256–63.

de la Cruz C, Thompson E, O'Rourke K & Nembhard W 2015. Cesarean section and the risk of emergency peripartum hysterectomy in high-income countries: a systematic review. Archives of Gynecology and Obstetrics 292(6):1201–15.

D'Souza R & Arulkumaran S 2013. To 'C' or not to 'C'? Caesarean delivery upon maternal request: a review of facts, figures and guidelines. Journal of Perinatal Medicine 41(1):5–15.

Ferreira Carvalho J, Cubal A, Torres S, Costa F & do Carmo O 2012. Emergency peripartum hysterectomy: a 10-year review. ISRN Emergency Medicine 2012.

Fitzpatrick K, Sellers S, Spark P, Kurinczuk JJ, Brocklehurst P & Knight M 2014. The management and outcomes of placenta accreta, increta, and percreta in the UK: a population-based descriptive study. BJOG 121(1):62–71.

Flood M, Said S, Geary M, Robson M, Fitzpatrick C & Malone F 2009. Changing trends in peripartum hysterectomy over the last 4 decades. American Journal of Obstetrics & Gynecology 200(6):632.e1–6.

Grace Tan SE, Jobling TW, Wallace EM, McNeilage LJ, Manolitsas T & Hodges RJ 2013. Surgical management of placenta accreta: a 10-year experience. Acta Obstetricia et Gynecologica Scandinavica 92(4):445–50.

Harris P, Nagy S & Vardaxis N (eds) 2011. Mosby's dictionary of medicine, nursing and health professions. 2nd Australian and New Zealand edition. Chatswood, NSW: Elsevier Australia.

Haynes K, Stone C & King J 2004. Major morbidities associated with childbirth in Victoria: obstetric haemorrhage and associated hysterectomy. Melbourne: Public Health Group, Department of Human Services.

Higgins M, Monteith C, Foley M & O'Herlihy C 2013. Real increasing incidence of hysterectomy for placenta accreta following previous caesarean section. European Journal of Obstetrics & Gynecology and Reproductive Biology 171(1):54–6.

Hill E, Graham M & Shelley J 2010. Hysterectomy trends in Australia—between 2000/01 and 2004/05. Australian and New Zealand Journal of Obstetrics and Gynaecology 50(2):153–8.

Hinton L, Locock L & Knight M 2015. Support for mothers and their families after life-threatening illness in pregnancy and childbirth: a qualitative study in primary care. British Journal of General Practice 65(638):e563–9.

Howell S, Johnston T, Cornes S & Wills R 2012. The incidence of peripartum hysterectomy in Queensland. StatBite #47, March 2012. Brisbane: Health Statistics Centre, Queensland Health.

Hutchinson M & Joyce A 2014. Western Australia's mothers and babies 2011: twenty-ninth annual report of the Western Australian Midwives' Notification System. Perth: Department of Health, Western Australia.

Jakobsson M, Tapper AM, Colmorn LB, Lindqvist PG, Klungsøyr K, Krebs L et al. 2015. Emergency peripartum hysterectomy: results from the prospective Nordic Obstetric Surveillance Study (NOSS). Acta Obstetricia et Gynecologica Scandinavica 94(7):745–54.

Jones B, Zhang E, Alzouebi A, Robbins T, Paterson-Brown S, Prior T et al. 2013. Maternal and perinatal outcomes following peripartum hysterectomy from a single tertiary centre. Australian and New Zealand Journal of Obstetrics and Gynaecology 53(6):561–5.

Joseph K, Rouleau J, Kramer M, Young D, Liston R & Baskett T 2007. Investigation of an increase in postpartum haemorrhage in Canada (for the Maternal Health Study Group of the Canadian Perinatal Surveillance System). BJOG 114(6):751–9.

Kaser D, Melamed A, Bormann C, Myers D, Missmer S, Walsh B et al. 2015. Cryopreserved embryo transfer is an independent risk factor for placenta accreta. Fertility and Sterility 103(5):1176–84.

Kastner ES, Figueroa R, Garry D & Maulik D 2002. Emergency peripartum hysterectomy: experience at a community teaching hospital. Obstetrics & Gynecology 99(6):971–75.

Kayem G, Davy C, Goffinet F, Thomas C, Clement D & Cabrol D 2004. Conservative versus extirpative management in cases of placenta accreta. Obstetrics & Gynecology 104(3):531–6.

Khong T 2008. The pathology of placenta accreta, a worldwide epidemic. Journal of Clinical Pathology 61:1243–6.

Knight M on behalf of UKOSS (United Kingdom Obstetric Surveillance System) 2007. Peripartum hysterectomy in the UK: management and outcomes of the associated haemorrhage. BJOG 114(11):1380–7.

Knight M, Callaghan WM, Berg C, Alexander S, Bouvier-Colle M, Ford JB et al. 2009. Trends in postpartum hemorrhage in high resource countries: a review and recommendations from the International Postpartum Hemorrhage Collaborative Group. BMC Pregnancy and Childbirth 9:55.

Knight M, Kurinczuk JJ, Spark P & Brocklehurst P 2008. Cesarean delivery and peripartum hysterectomy. Obstetrics & Gynecology 111(1):97–105. doi:10.1186/1471-2393-9-55.

Kramer M, Berg C, Abenhaim H, Dahhou M, Rouleau J, Mehrabadi A et al. 2013. Incidence, risk factors, and temporal trends in severe postpartum haemorrhage. American Journal of Obstetrics & Gynecology 209:449.e1–7.

Lee IH, Son JH, Shin YC, Byun JH, Yoon HJ & Jee YS 2012. Anesthetic review of emergency peripartum hysterectomy following vaginal and cesarean delivery: a retrospective study. Korean Journal of Anesthesiology 63(1):43–7.

Lim W, Pavlov T & Dennis A 2014. Analysis of emergency peripartum hysterectomy in Northern Tasmania. Australian Journal of Rural Health 22(5):235–40.

Lutomski JE, Murphy M, Devane D, Meaney S & Greene RA 2014. Private health care coverage and increased risk of obstetric intervention. BMC Pregnancy and Childbirth 14:13. doi:10.1186/1471-2393-14-13.

Machado L 2011. Emergency peripartum hysterectomy: incidence, indications, risk factors and outcome. North American Journal of Medical Sciences 3(8):358–61.

Monk A, Tracy M, Foureur M, Grigg C & Tracy S. 2014. Evaluating midwifery units: a prospective cohort study of freestanding midwifery units in New South Wales, Australia. BMJ Open 4:e006252.

Muench MV, Baschat AA, Oyelese Y, Kush ML, Mighty HE & Malinow AM 2008. Gravid hysterectomy: a decade of experience at an academic referral center. Journal of Reproductive Medicine 53(4):271–8.

NCCC (National Casemix and Classification Centre) 2012. The international statistical classification of diseases and related health problems, tenth revision, Australian modification (ICD-10-AM), Australian Classification of Health Interventions (ACHI) and Australian Coding Standards (ACS). 8th edn. Wollongong: University of Wollongong.

Orbach A, Levy A, Wiznitzer A, Mazor M, Holcberg G & Sheiner E 2011. Peripartum cesarean hysterectomy: critical analysis of risk factors and trends over the years. Journal of Maternal-Fetal & Neonatal Medicine 24(3):480–4.

Ossola W, Somiglian E, Mauro M, Acaia B, Benaglia L & Fedele L 2011. Risk factors for emergency postpartum hysterectomy: the neglected role of previous surgically induced abortions. Acta Obstetricia et Gynecologica Scandinavica 90:1450–3.

Queensland Health Statistics Centre 2009. E-Bulletin Issue No. 22. Viewed 27 August 2015, <https://www.health.qld.gov.au/hic/ebulletin/Ebulletin_22.pdf >.

RANZCOG (Royal Australian and New Zealand College of Obstetricians and Gynaecologists) 2014. Placenta accreta. Melbourne: RANZCOG. Viewed 14 August 2015, via <https://www.ranzcog.edu.au/college-statements-guidelines.html>.

Sahin S, Guzin K, Eroglu M, Kayabasoglu F & Yasartekin M 2014. Emergency peripartum hysterectomy: our 12-year experience. Archives of Gynecology and Obstetrics 289(5):953–8.

Selo-Ojeme D, Bhattacharjee P, Izuwa-Njoku N & Kadir R 2005. Emergency peripartum hysterectomy in a tertiary London hospital. Archives of Gynecology and Obstetrics 271(2):154–9.

Shamsa A, Harris A & Anpalagan A 2015. Peripartum hysterectomy in a tertiary hospital in Western Sydney. Journal of Obstetrics and Gynaecology 35(4):350–3.

Sholapurkar S 2013. Increased incidence of placenta praevia and accreta with previous caesareans—a hypothesis for causation. Journal of Obstetrics and Gynaecology 33(8):806–9.

Tahseen S & Griffiths M 2010. Vaginal birth after two caesarean sections (VBAC-2)—a systematic review with meta-analysis of success rate and adverse outcomes of VBAC-2 versus VBAC-1 and repeat (third) caesarean sections. BJOG 117(1):5–19.

Tikkanen M 2010. Placental abruption: epidemiology, risk factors and consequences. Acta Obstetricia et Gynecologica Scandinavica 90(2):140–9.

Turgut A, Sak M, Ozler A, Soydinc H, Goruk N, Karacot T et al. 2013. Emergency peripartum hysterectomy: our experiences with 189 cases. Perinatal Journal 21:113-8.

Umezurike C & Adisa C 2012. Peripartum hysterectomy. In: Al-Hendy A (ed). Hysterectomy. Rijeka, Croatia: InTech, 93–102. Viewed 31 May 2015, <http://cdn.intechopen.com/pdfs/35350/InTech-Peripartum_hysterectomy.pdf>.

Wills R 2012. Morbidity and mortality associated with peripartum hysterectomy in Queensland. StatBite #54, November 2012. Brisbane: Health Statistics Centre, Queensland Health.

Wright JD, Devine P, Shah M, Gaddipati S, Lewin SN, Simpson LL et al. 2010. Morbidity and mortality of peripartum hysterectomy. Obstetrics & Gynecology 115(6):1187–93.

Yang Q, Wen S, Oppenheimer L, Chen X, Black D, Gao J et al. 2007. Association of caesarean delivery for first birth with placenta praevia and placental abruption in second pregnancy. BJOG 114(5):609–13.

Yoong W, Massiah N & Oluwu A 2006. Obstetric hysterectomy: changing trends over 20 years in a multiethnic high risk population. Archives of Gynecology and Obstetrics 274(1):37–40.

List of tables

List of figures

List of boxes

Related publications

AIHW (Australian Institute of Health and Welfare) 2013. Foundations for enhanced maternity data collection and reporting in Australia: National Maternity Data Development Project Stage 1. Cat. no. PER 60. Canberra: AIHW.

AIHW 2015. Australia's mothers and babies 2013—in brief. Perinatal statistics series no. 31. Cat. no. PER 72. Canberra: AIHW.

AIHW 2016. Enhancing maternity data collection and reporting in Australia: National Maternity Data Development Project Stage 2. Cat. no. PER 73. Canberra: AIHW.

AIHW 2016. National Maternity Data Development Project: Peripartum hysterectomy and its indications. Research brief no. 7. Cat. no. PER 81. Canberra: AIHW. Viewed 1 June 2016, <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129554615>.

AIHW: Humphrey MD, Bonello MR, Chughtai A, Macaldowie A, Harris K & Chambers GM 2015. Maternal deaths in Australia 2008–2012. Maternal deaths series no. 5. Cat. no. PER 70. Canberra: AIHW.

AIHW: Johnson S, Bonello MR, Li Z, Hilder L & Sullivan EA 2014. Maternal deaths in Australia 2006–2010. Maternal deaths series no. 4. Cat. no. PER 61. Canberra: AIHW.

Peripartum hysterectomy, a life-saving procedure to stop haemorrhage after giving birth, can have considerable consequences for mothers and their babies. This working paper analyses 11 years of national hospitalisation data to derive the estimated rate of peripartum hysterectomy in Australia in recent years and examine the rates of diagnoses for particular conditions contributing to peripartum hysterectomy. This is part of the National Maternity Data Development Project's work to develop national data standards for maternal morbidity data items.