Diabetes mellitus during pregnancy

Diabetes mellitus refers to a group of diseases that affect how the body uses blood glucose. People with diabetes have too much glucose in their blood, which is referred to as hyperglycaemia. Hyperglycaemia in pregnancy can include pre-existing impaired fasting glucose and impaired glucose tolerance (pre-diabetes), pre-existing type 1 diabetes, pre-existing type 2 diabetes (either previously diagnosed or diagnosed during the first trimester of pregnancy) and gestational diabetes mellitus (GDM) (developed during pregnancy) (AHMAC 2014).

While type 1 and type 2 diabetes are chronic conditions, GDM is potentially reversible and may resolve after the baby is delivered (AHMAC 2014). However, GDM can recur in later pregnancies and women who develop gestational diabetes are at high risk of developing type 2 diabetes in later life (AHMAC 2014). GDM and pre-existing diabetes complicating a pregnancy can be grouped together as ‘diabetes in pregnancy’, and any woman with diabetes in pregnancy requires careful management.

Significance to maternal and perinatal morbidity and mortality

Diabetes in pregnancy can have short and long term implications for the health of a mother and her baby. Diabetes is known to adversely affect women and their babies during pregnancy, labour and delivery—however these adverse effects can differ by type of diabetes and between population groups.

An AIHW report (2010) provides some baseline data for Australian women affected by diabetes in pregnancy, and their babies. For example:

- mothers with pre-existing type 1 or type 2 diabetes, and their babies, are at highest risk of adverse effects
- mothers with gestational diabetes mellitus, and their babies, are at increased risk
- Aboriginal and Torres Strait Islander mothers and their babies are more likely to experience adverse effects than non-Indigenous mothers and their babies (AIHW 2010).

Adverse pregnancy outcomes for mothers can include miscarriage, pre-term birth, induced labour, pre-eclampsia, caesarean section, and a postnatal length of stay in hospital of 7 or more days (AIHW 2010). Adverse outcomes for babies can include congenital anomalies, high birthweight, birth injuries, neonatal jaundice, a low Apgar score, high-level resuscitation, admission to a Special Care Nursery or Neonatal Intensive Care Unit, and a hospital length of stay of 7–13 days (AIHW 2010).

Mothers with type 1 diabetes can experience higher rates of caesarean section, hypertension and pre-term birth than mothers with type 2 diabetes (AIHW 2010). Babies of mothers with type 2 diabetes are more likely to be stillborn than babies of mothers with type 1 diabetes (AIHW 2010).

Examples of short – and long-term risks and impacts for mothers and babies of pre-existing diabetes and GDM are given in Table 1.
<table>
<thead>
<tr>
<th>Short-term risks and effects for mothers</th>
<th>Pre-existing diabetes</th>
<th>Gestational diabetes mellitus (GDM)</th>
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<tbody>
<tr>
<td>Associated with a higher risk of miscarriage, pre-eclampsia, pre-term delivery, induced labour, caesarean section (de Valk et al. 2006).</td>
<td>Associated with a higher risk of gestational hypertension and pre-eclampsia, induced labour, and operative delivery (Anderberg et al. 2010; Stone et al. 2002).</td>
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| Short-term risks and effects for babies | Adverse effects include increased risk of miscarriage, congenital anomalies of the spine, heart and kidneys, stillbirth, macrosomia, birth injuries including shoulder dystocia, respiratory distress, jaundice and hypoglycaemia (de Valk et al. 2006; National Collaborating Centre for Women’s and Children’s Health 2008; Yang et al. 2006). | Adverse effects include: increased risk of stillbirth, caesarean section, macrosomia, shoulder dystocia, respiratory distress syndrome and jaundice (Gonzalez-Quintero et al. 2007; Hartling et al. 2012; Stewart & Malhotra 2015). |

| Long-term risks and effects for mothers | Progression of diabetes complications such as eye disease, kidney disease and cardiovascular disease (AIHW 2010). Serious complications associated with type 1 and type 2 diabetes can contribute significantly to poor quality of life, hospitalisation and premature death (AIHW 2010). | Higher risk of recurrent GDM in subsequent pregnancies and of progression to type 2 diabetes (Metzger 2007). About 17% of Australian women who have had GDM develop type 2 diabetes within 10 years, and up to 50% within 30 years (Lee et al. 2007). Increased risk of developing cardiovascular disease (Retnakaran & Shah 2009). |

| Long-term risks and effects for babies | Living with congenital anomalies arising from exposure to maternal diabetes, and being at increased risk of obesity, impaired glucose tolerance and type 2 diabetes in early adulthood (Fetita et al. 2007). | |

There is high-level evidence (randomised control trial) that treatment of gestational diabetes, including dietary advice, blood glucose monitoring and insulin therapy, reduces the risk of adverse pregnancy outcomes (Crowther et al. 2005; Landon et al. 2009).
Risk factors and causes

There are various risk factors for diabetes, some of which are specific to gestational diabetes. These are outlined in this section.

Generally, overweight, and in particular obesity, are key risk factors for the development of diabetes. Increased body weight can lead to increased insulin resistance and defects in insulin secretion (AIHW 2008). Excessive weight gain in pregnancy similarly contributes to the risk of developing diabetes (Gibson et al. 2012). Age is also a risk factor for diabetes (Teh et al. 2011). Both risk factors (overweight and age) are especially noteworthy considering that both weight in, and age of, first pregnancy have increased over the last few decades (ABS 2012; Ramachenderan et al. 2008).

Other evidence suggests that increased risk of gestational diabetes is associated with physical inactivity before and during early pregnancy (Cuilin et al. 2014), increased parity (for example a third or subsequent pregnancy) (Schneider et al. 2011), and metabolic syndrome (Hartling et al. 2012).

The risk of gestational diabetes is higher with a previous obstetric history of gestational diabetes, and a previous high birthweight baby (Nanda et al. 2011). Family history can increase the risk of developing diabetes, and this is particularly the case for gestational diabetes when family history is on the maternal side (McLean et al. 2006).

Further, insulin resistance associated with polycystic ovary syndrome can lead to an increased risk of gestational diabetes (Hartling et al. 2012).

The risk of gestational diabetes is higher in women from ethnic backgrounds known to have a high prevalence of type 2 diabetes, including Aboriginal and Torres Strait Islander people (Chamberlain et al. 2015) and people of Hispanic, African, Native American, South Asian, East Asian, or Pacific Island origin (Makgoba et al. 2012; Nanda et al. 2011; Teh et al. 2011). Increased risk is also associated with being a migrant, including those who have entered the country as a refugee (Schneider et al. 2011).

Prevalence, mortality and trends

The overall prevalence of diabetes in the Australian population appears to be increasing over time. In 2011–12, around 4.6% of the Australian population had diagnosed diabetes (excluding gestational diabetes) (ABS 2013a) compared to 2.4% in 1995 (ABS 1997).

Diabetes was said to have affected about 1 in 20 pregnancies in Australia between 2005 and 2007 (AIHW 2010). Less than 1% of pregnancies were affected by pre-existing diabetes in 2005–2007, while 5% of pregnancies were affected by GDM (AIHW 2010). The diagnostic criteria have since been revised, and current estimates suggest that 1 in 10 pregnancies are now affected by either pre-existing diabetes or GDM (WHO 2013). As indicated earlier, 17% of Australian women who have had GDM develop type 2 diabetes within 10 years (Lee et al. 2007). More than one-third of diagnoses of diabetes in pregnancy occurred in women aged 35 years and over (AIHW 2010).
Pre-existing diabetes rates during pregnancy among Aboriginal and Torres Strait Islander mothers were 3 to 4 times those of non-Indigenous mothers, with GDM rates being twice as high (AIHW 2010). Type 2 diabetes in particular is 10 times more common in Indigenous mothers (AIHW 2010). These figures are a reflection of higher rates of diabetes overall in the Australian Aboriginal and Torres Strait Islander population (ABS 2014).

Similarly, the prevalence of diabetes is higher in mothers who are born in high-diabetes-risk regions such as Polynesia, Asia and the Middle East. Mothers born in these areas were 3 times as likely to have GDM as mothers from other regions, and slightly more likely to have type 2 diabetes (AIHW 2010).

The Australian National antenatal care guidelines (Module 2) (AHMAC 2014) indicate that the prevalence of diabetes in pregnancy has increased over the past decades in parallel with increases in obesity rates and type 2 diabetes. This trend is expected to continue (Hartling et al. 2012). The Australian Health Survey 2011–2012 showed rates of overweight and obesity rose from 56.3% in 1995 to 62.8% in 2011–12 for adults 18 years and over (ABS 2013b). In 2011–12, 27.5% of Australians were obese, an increase from 18.7% in 1995 (ABS 2013b).

The proportion of first-time mothers aged over 35 years in Australia is also increasing (AIHW 2015), which may increase the prevalence of gestational diabetes. In addition, a study of diabetes in pregnancy in Victoria for the years 1998–2008 found that rates of GDM had increased in all maternal age groups over the period, with the age-standardised prevalence of GDM in 2008 being 31% higher overall than in 1999 (Abouzeid et al. 2014).

Data collection and analysis issues

While the National Perinatal Data Collection (NPDC) contains some information on diabetes, the data have been collected in different ways in different jurisdictions, making comparisons across jurisdictions difficult.

All jurisdictions currently collect data on pre-existing diabetes in the NPDC—however the reported rates of the condition are very different among jurisdictions. It is believed that this is due to a lack of standardised collection practices rather than population differences (AIHW 2014). There are multiple coding issues, including differences in the information collected (some jurisdictions collect information about types of diabetes and therapies used, while others do not), and a range of terms is used to describe the same condition (AIHW 2014). This is a well-known issue nationally and internationally. Worldwide, it has been difficult to compare research findings and draw conclusions due to the variation in definitions used in different studies. Feig and others (2015) conducted a systematic review of literature on diabetes in pregnancy and created a repository of recommended standard definitions for use in future studies. Adopting these standard definitions, or similar classifications, would be a first step toward improving consistency of reporting and comparability of these data across jurisdictions.

Data on diabetes can also be extracted from the National Hospital Morbidity Database (NHMD), which may be more accurate than the perinatal data collection, although there is concern over possible under-reporting in the NHMD (AIHW 2014). Data from the NHMD have been used to supplement NPDC analyses in the past (AIHW 2010), most pertinently to highlight differences between mothers with type 1 and type 2 diabetes in pregnancy. However, this was not possible for all analyses, as the NHMD has limited information on diagnoses and maternal characteristics, and limited data on infants (AIHW 2010).
Data development undertaken through the National Maternity Data Development Project

Data development for diabetes during pregnancy began in 2013 after the item was included on the National Maternity Data Development Project (NMDDP) priority data item list. (See *Foundations for enhanced maternity data collection and reporting in Australia: National maternity data development project*—Stage 1 (AIHW 2014) for more information on the NMDDP priority data item list.) Data development incorporated consultation with a clinical and data reference group (CDRG), the NMDDP Advisory Group and jurisdictional stakeholders.

New data elements for diabetes during pregnancy were included in the Perinatal Data Set Specification (DSS) 2014–15, and where feasible, jurisdictions started collecting them from 1 July 2014. Collection of data elements in the Perinatal DSS is optional for jurisdictions. However it is expected that diabetes in pregnancy items will be included in a future Perinatal National Minimum Data Set (NMDS), making them mandatory for collection once all jurisdictions are able to implement the necessary processes.

The new national data elements for diabetes during pregnancy are:

*Female*—diabetes mellitus during pregnancy indicator, yes/no/not stated/inadequately described, code N (METeOR identifier 504291)

*Female*—type of diabetes mellitus during pregnancy, code N (METeOR identifier 516668)

*Female*—type of diabetes mellitus therapy during pregnancy, code N (METeOR identifier 516185).

(More information about METeOR, the AIHW's metadata registry, is available on the AIHW website at <http://meteor.aihw.gov.au/content/index.phtml/itemId/181162>.)

It is expected that for some women, these data items will be collected by midwives based on women's self-report. Self-report data are often criticised for lack of reliability—however Jackson and others (2014) found that self-report data for a condition such as diabetes are likely to be reliable.

Importance of national collection of these data items

The short – and long-term impacts of diabetes in pregnancy for mothers and their babies are significant. The increasing rates of diabetes and obesity in the Australian population are of concern, with suggestions that more mothers will have their pregnancies affected by diabetes.

The development of new national standards for reporting on diabetes during pregnancy may lead to a better understanding and monitoring of the risk factors for and outcomes of diabetes (including the different types of diabetes) during pregnancy. Data can inform population health change, the impact of interventions during pregnancy, and service delivery.

Further, national standards may allow for the impact of diabetes during pregnancy to be better understood in populations that experience diabetes at different rates to the norm.
References


AIHW 2014. Foundations for enhanced maternity data collection and reporting in Australia: National maternity data development project stage 1. Cat. no. PER 60. Canberra: AIHW.


