National Pregnancy in Diabetes Audit Report, 2014

England, Wales and the Isle of Man

Prepared in collaboration with:

The Healthcare Quality Improvement Partnership (HQIP). The National Pregnancy in Diabetes Audit is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit Programme (NCA). HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement, and in particular to increase the impact that clinical audit has on healthcare quality in England and Wales. HQIP holds the contract to manage and develop the NCA Programme, comprising more than 30 clinical audits that cover care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual audits, also funded by the Health Department of the Scottish Government, DHSSPS Northern Ireland and the Channel Islands.

The Health and Social Care Information Centre (HSCIC) is the trusted source of authoritative data and information relating to health and care. The HSCIC managed the publication of the 2014 annual report.

Diabetes UK is the largest organisation in the UK working for people with diabetes, funding research, campaigning and helping people live with the condition.

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The national cardiovascular intelligence network (NCVIN) is a partnership of leading national cardiovascular organisations which analyses information and data and turns it into meaningful timely health intelligence for commissioners, policy makers, clinicians and health professionals to improve services and outcomes.

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Foreword

The risks associated with pregnancy in women with diabetes have long been recognised. The reductions in these risks, achievable through pregnancy preparation and multidisciplinary antenatal and obstetric care, are embedded in national guidance (National Service Framework for Diabetes[1], National Service Framework for Diabetes in Wales[2], National Institute for Health and Clinical Excellence (NICE) Clinical Guidelines[3,4] and NICE Quality Standards for Diabetes[5]). We welcome this second report of the National Pregnancy in Diabetes (NPID) audit which provides measurements of how successfully national guidance is being implemented. It reports on both pre-pregnancy and pregnancy management in women with diabetes and on adverse outcomes.

It is encouraging that the vast majority of services (150) now participate in the NPID audit and the large number of pregnancies now included, more than 4000 over two years, reinforces the strength of the conclusions. It is of concern that the outcomes data confirm the continuing adverse impact of pre-existing diabetes on pregnancy with high levels of congenital anomalies, stillbirths, neonatal deaths and babies that are large for gestational age, high rates of severe hypoglycaemia in the mothers and high rates of assisted delivery. Yet the data also show that there are substantial opportunities for improvement through, for example, helping more women to achieve lower glucose levels before conception and throughout pregnancy and ensuring that all women with diabetes contemplating pregnancy are taking folic acid supplements. This likely requires better multidisciplinary cross-organisational effort.

We are grateful to the National Diabetes Audit team for establishing this important national audit, and of course are extremely grateful to the local teams that have worked hard to provide the data for analysis. We look forward to witnessing the improvement programmes that should now be planned and implemented so that future results can document improvement in the pregnancy outcomes for women with diabetes.

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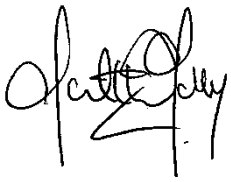

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Executive summary

Background

The National Pregnancy in Diabetes (NPID) Audit is part of the National Diabetes Audit programme (NDA), and is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit programme (NCA). The NDA is managed by the Health and Social Care Information Centre (HSCIC) in partnership with Diabetes UK and is supported by Public Health England (PHE).

This report is the second annual report from a continuous audit of the care and outcomes for women with diabetes who become pregnant. All maternity units with a joint diabetes and maternity service are eligible to submit data to the audit. The number of participating diabetes and maternity services in England and Wales has increased from 128 in 2013 to 150 in 2014.

The audit is a measurement system to support quality improvement in the care of women with diabetes who are pregnant or planning pregnancy, and seeks to address three key questions:

- Were women adequately prepared for pregnancy?
- Were adverse maternal outcomes minimised?
- Were adverse fetal/infant outcomes minimised?

The NPID audit measures the quality of care received by women with diabetes who become pregnant using national standards set out in a National Institute for Health and Clinical Excellence (NICE) guideline (Clinical Guideline 63[3], superseded by NICE Guideline 3 in February 2015[4]).

The report will matter to the public, especially to women with diabetes, to health planners and policy makers, as well as Acute Trusts, Clinical Commissioning Groups, strategic clinical networks, primary care teams, and specialist diabetes and maternity services.

Local information is published in regional reports available to download from http://www.hscic.gov.uk/pubs/npdaudit15

The majority of analysis in this report relates to pregnancies ending in 2014. Some tables report on pregnancies ending in 2013, or combined 2013 and 2014 data.

This report does not compare the audit results from 2013 and 2014. The 2013 report was published in October 2014 and the data collection period for this report finished in December 2014 so there is no possibility that services could have responded to the 2013 recommendations. Please note that differences between the 2013 and 2014 audit results at national/regional level may be due to an increase in participation by eligible units, and more complete data submission by participating units.

This report includes data on the method of onset of labour, mode of delivery and hypoglycaemia episodes during pregnancy.

At relevant points, data from the NPID audit is compared to the findings of the CEMACH survey of pregnancies in women with diabetes in 2002-03, published in 2005[6].

A glossary of terms used in this summary and the full report is included at the end of the report.

Data collection

The majority of the data for the NPID audit is collected and submitted by hospitals' diabetes and maternity teams. Each participating hospital team obtains explicit consent from each woman prior to data being collected. Where the woman does not consent, their information is not collected.

The deadline for submissions for inclusion in this report was 12 February 2015.

Some data items are obtained by linking the NPID audit data to the National Diabetes Audit (NDA), Hospital Episode Statistics (HES) and the Patient Episode Database for Wales (PEDW).

Participation

The audit collected data submitted by 150 units on 2,553 pregnancies ending in 2014.

Although a definitive list of eligible units is not available, 83 per cent of consultant led maternity units in England and 69 per cent of such units in Wales that were listed in a 2013 Royal College of Obstetricians and Gynaecologists (RCOG) census[7] participated in the 2014 NPID audit.

Key messages

The second cycle of the NPID audit has built strongly on the foundations laid in 2013. The majority of units are now taking part and over its first two years a sound baseline has been established from well over 4,000 women with diabetes in 150 units across England, Wales and the Isle of Man. This has given us a clearer picture than ever of the preparation that women with diabetes make for pregnancy, what happens during pregnancy, and the outcomes.

The results show that women generally enter pregnancy poorly prepared and that outcomes have changed little since the CEMACH report from 2002-03. Renewed commitments are needed from all diabetes and maternity services to:

- participate in the NPID audit
- review results with women of reproductive age who have diabetes
- review results within teams and networks of collaborating units
- innovate and implement local improvement initiatives to reduce pregnancy risk.

Primary care diabetes networks also have an essential role to play in:

- helping to ensure information about pregnancy risks and preparation for safe pregnancies forms part of routine diabetes care at GP practices for women in the relevant age group
- working with diabetes and maternity services on local quality improvement initiatives.

Key findings

- A high proportion of pregnancies are in women with Type 2 diabetes (46.7 per cent). In seven out of ten regions (the nine government office regions and Wales), over 40 per cent of births were to women with Type 2 diabetes. One region (London) reported 60.6 per cent of births were to women with Type 2 diabetes. Women in the audit with Type 2 diabetes were more likely to be older, overweight, of Asian or Black origin and to live in an area with a higher index of deprivation.

Preparation for pregnancy

The NICE guideline includes the following recommendations for advice to women with diabetes who are planning to become pregnant:

- to take folic acid (5mg/day) prior to becoming pregnant and until 12 weeks of gestation to reduce the risk of having a baby with a neural tube defect
- where it is safely achievable, to aim to maintain HbA_{1c} below 43 mmol/mol (6.1%)
- aim to maintain HbA_{1c} below 48 mmol/mol (6.5%) [updated guideline from February 2015]
- to be reassured that any reduction in HbA_{1c} level towards this target is likely to reduce the risk of congenital malformations
- not to get pregnant if the HbA_{1c} level is above 86 mmol/mol (10%) because of the associated risks.

The guideline includes the following recommendations for clinicians caring for women with diabetes:

- ACE inhibitors/Angiotensin Receptor Blockers (ARBs) and statins should be discontinued before pregnancy or as soon as pregnancy is confirmed
- although metformin may be used where the likely benefits outweigh the potential for harm, all other oral blood glucose-lowering agents should be discontinued before pregnancy and insulin substituted.

The audit found that women were generally poorly prepared for pregnancy, whether this is assessed based on folic acid use prior to pregnancy, HbA_{1c} levels in the first trimester, or avoidance of potentially harmful treatments such as statins, ACE inhibitors and ARBs.

- Less than half of women were known to be taking folic acid in any dose prior to pregnancy (41.9 per cent). Women with Type 1 diabetes were more likely to be taking folic acid (50.5 per cent) than women with Type 2 diabetes (33.3 per cent) and were more likely to be taking the recommended higher dose of 5mg (44.9 per cent and 23.7 per cent respectively).
- A first HbA_{1c} measurement in pregnancy was recorded in the first trimester in only 75.1 per cent of pregnancies.
- Just 7.9 per cent of women with Type 1 diabetes and 21.7 per cent of women with Type 2 diabetes had a first trimester HbA_{1c} measurement below 43 mmol/mol (the target for women planning pregnancy in the NICE guideline in place in 2014).
- Only 15.4 per cent of women with Type 1 diabetes and 35.8 per cent of women with Type 2 diabetes had a first trimester HbA_{1c} measurement below the new (February 2015) NICE target of 48 mmol/mol.
- Asian and Black women, and women living in areas with the highest deprivation scores were less likely to achieve a first trimester HbA_{1c} measurement below 48 mmol/mol.
- In almost one in ten women (9.7 per cent), HbA_{1c} was at or above 86 mmol/mol.
- Among women for whom both folic acid use and HbA_{1c} measurement data was available, 11.8 per cent of those with Type 1 diabetes and 13.1 per cent of those with Type 2 diabetes were both taking the recommended 5mg dose of folic acid and had a first trimester HbA_{1c} measurement below the 48 mmol/mol target.

- Potentially harmful medications (statins, ACE inhibitors and ARBs) were being taken by 6.2 per cent of women at the time of conception (3.0 per cent of those with Type 1 diabetes; 10.5 per cent of those with Type 2 diabetes).
- 9.2 per cent of women with Type 2 diabetes became pregnant while taking a potentially hazardous glucose lowering recommendation.

Care in pregnancy and maternal outcomes

- The NICE guideline recommends that women with diabetes who become pregnant should be offered immediate contact with a joint diabetes and antenatal clinic.

  The audit found that 52.0 per cent of women with Type 1 diabetes had their first contact with the specialist antenatal diabetes team prior to 8 weeks gestation, but only 36.7 per cent of women with Type 2 diabetes had their first contact with the team within this time.
- 6.3 per cent of women in the audit in 2013 had one or more hospital stays involving hypoglycaemia during pregnancy (9.3 per cent of women with Type 1 diabetes; 2.7 per cent of women with Type 2 diabetes). This is significantly higher than the annual rates of hospital stays involving hypoglycaemia for women aged 20 to 39 recorded in the National Diabetes Audit (2.1 per cent of women in this age group with Type 1 diabetes and 0.4 per cent of those with Type 2 diabetes).
- For pregnancies recorded in the audit in 2013, just 13.6 per cent of women went into spontaneous labour. This is lower than the 18.0 per cent in the CEMACH[6] report in 2002-03. The introduction of the NICE guideline in 2008 recommending elective birth through induction of labour or by elective caesarean section after 38 completed weeks may have contributed to this reduction.
- Caesarean section rates (60.1 per cent) were higher than in the general population (26.2 per cent[8]). However, emergency caesarean section rates have fallen since 2002-03 (30.0 per cent in 2013 compared with 37.6 per cent in the CEMACH survey).

Fetal/infant outcomes

The NICE guideline recommends explaining to women with diabetes who are planning to become pregnant that establishing good blood glucose control before conception and continuing this throughout pregnancy will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death.

The audit analysis of pregnancy outcomes and HbA_{1c} values during pregnancy found that:

- combined 2013 and 2014 audit data confirm high rates of adverse outcomes - 12.8 stillbirths per 1000 live and stillbirths, 7.6 neonatal deaths per 1000 live births and 44.2 anomalies per 1000 live and stillbirths
- combined 2013 and 2014 data show that among pregnancies where the outcome was a congenital anomaly, first trimester HbA_{1c} values were higher for both women with Type 1 and Type 2 diabetes.

The NICE guideline recommends that women with diabetes who are planning to become pregnant are given information on the increased risk of having a baby who is large for gestational age, which increases the likelihood of induction of labour, caesarean section and birth trauma such as shoulder injuries and risk of brain damage.

The audit found that:

- more than one third of women (34.3 per cent) had babies that were large for gestational age. 46.3 per cent of women with Type 1 diabetes and 23.1 per cent of women with Type 2 diabetes had babies at or above the 90th birthweight centile, and 21.2 per cent of babies were at or above the 97.7th birthweight centile
- a baby was more likely to be large for gestational age if the mother had an HbA_{1c} measurement above 48 mmol/mol after 24 weeks gestation.

The NICE guideline recommends that babies of women with diabetes should stay with their mothers unless there is a clinical complication or there are abnormal clinical signs that warrant admission for intensive or special care, such as management of hypoglycaemia, or respiratory problems (particularly for preterm deliveries). Keeping babies with their mothers where possible maximises opportunities for early skin-to-skin contact and breastfeeding.

The audit found that:

- two-thirds (66.6 per cent) of babies were able to remain with their mothers and did not need intensive or special neonatal care.

(The audit does not analyse whether admissions to intensive or special care were avoidable.)

Recommendations

The first priority remains to find ways to proactively engage with all women with diabetes who may become pregnant, provide education and support for both women and professionals, and work in partnership with women to prepare for safe pregnancies.

Recommendations can be made for actions specific to diabetes and maternity services, strategic networks, primary care, and women with diabetes, but to be successful in reducing pregnancy risk in women with diabetes collaboration across current healthcare boundaries will be needed.

Barriers to accessing good health care may play an important role, so new ways of designing service delivery that successfully engage women in partnership across community, primary care and specialist settings are urgently required. Particular focus is needed on engagement with women with Type 2 diabetes, who are likely to receive their diabetes care wholly in a primary care setting and may have less contact with specialist teams, and women from ethnic minority groups or living in areas of high deprivation, fewer of whom have HbA_{1c} measurements within the recommended level.

An integrated approach involving strategic networks, policy makers, commissioners, acute trusts/LHBs, clinical teams, local general practices and professional bodies is necessary to develop a clear plan for change.

Recommendations for diabetes and maternity services and networks

Many women with diabetes have their first contact with specialist diabetes and pregnancy services when they are already pregnant. Because women need to be aware of pregnancy risks and have access to information about how to minimise these risks in advance of pregnancy, diabetes and maternity services (and networks of collaborating units) need to develop a focus on pregnancy preparation. Services and networks will be a key element of an integrated approach to engaging with and informing women, and specifically should:

- work with primary care teams to identify and inform all women with diabetes who might become pregnant about the importance of, and options for, safe effective contraception and pregnancy planning
- ensure that structured education programmes for all women with diabetes in the relevant age groups include information about the risks of pregnancy, and how to prepare for pregnancy
- support women to achieve optimal glucose control prior to pregnancy in pre-pregnancy counselling services
- continue to seek optimal glucose control throughout pregnancy, reducing HbA_{1c} as far as possible to reduce the risk of adverse fetal outcomes, while also controlling the risk of significant hypoglycaemia.

Recommendations for primary care

Most women with Type 2 diabetes and many women with Type 1 diabetes receive most or all of their diabetes care in a primary care setting. General practices should:

- identify and inform all women with diabetes who might become pregnant about the importance of, and options for, safe effective contraception and pregnancy planning
- encourage women with diabetes to engage with healthcare professionals when they are considering pregnancy, or as soon as they think they may be pregnant, so that they can be put in contact with specialist diabetes and maternity services
- advise women with diabetes to take 5mg folic acid daily when they are considering pregnancy, or as soon as they think they may be pregnant
- support women to achieve optimal glucose control prior to pregnancy, balancing the aim of achieving the recommended HbA_{1c} level with the risk of hypoglycaemia
- review glucose lowering medications and medications for diabetes related complications for women considering pregnancy
- engage with quality improvement initiatives set up by diabetes and maternity services or networks.

Recommendations for specialist diabetes services

Specialist diabetes services should:

- identify and inform all women attending the service who might become pregnant about the importance of, and options for, safe effective contraception and pregnancy planning
- encourage women to engage with their care team when they are considering pregnancy, or as soon as they think they may be pregnant, so that they can be put in contact with the diabetes and maternity service
- advise women with diabetes to take 5mg folic acid daily when they are considering pregnancy, or as soon as they think they may be pregnant
- support women to achieve optimal glucose control prior to pregnancy, balancing the aim of keeping below the recommended HbA_{1c} level with the risk of hypoglycaemia
- review glucose lowering medications and medications for diabetes related complications for women considering pregnancy.

Recommendations for women with diabetes

Women with diabetes are the main agents of their care. The report emphasises that preparation for pregnancy and good glucose control in pregnancy are critical to outcomes. Women with diabetes should therefore:

- seek and expect to be routinely involved in discussions with healthcare professionals about safe effective contraception and preparing for pregnancy from puberty to menopause as part of a care planning process in primary or specialist care settings
- when considering pregnancy:
    - access advice from health professionals
    - ask for 5mg folic acid supplement on prescription
    - ask to have their HbA_{1c} measured monthly
    - aim for the best possible glucose control
    - know what treatments for diabetes and related complications to avoid
- access specialist services as soon as pregnancy is suspected
- maintain the best possible glucose control throughout pregnancy, balancing HbA_{1c} control with avoiding hypoglycaemia
- feel able, should they wish to, to link with lay organisations such as Diabetes UK to advocate for the provision of high standard support and services locally
- request that their data be submitted to the NPID audit to help inform future pregnancy care for women with diabetes locally and nationally.

Introduction

The CEMACH survey[6] of diabetes and pregnancy in 2002-03 identified severe deficiencies in the provision of care before and during pregnancy for women with diabetes in England and Wales, and poor outcomes by international standards.

To address the concerns raised by the CEMACH survey, a national guideline was developed by the National Institute for Health and Clinical Excellence (NICE) in 2008 (Clinical Guideline (CG) 63[3]).

The NPID audit was commissioned by the Healthcare Quality Improvement Partnership (HQIP) to monitor the quality of care provided for women with diabetes who become pregnant against national standards (NICE CG 63[3], NICE Quality Standard (QS) for Diabetes 6[5]) as part of the National Diabetes Audit programme (NDA). The NDA programme is part of the National Clinical Audit programme (NCA) and is managed by the Health and Social Care Information Centre (HSCIC) in partnership with Diabetes UK and is supported by Public Health England (PHE).

The NPID audit began collecting data in 2013, and the first annual report was published in October 2014.

The NICE guideline was reviewed during 2013-14, and CG 63 was superseded by NICE guideline (NG) 3 in February 2015[4]. CG63 was in place throughout the 2014 audit period, but we note where recommendations have been updated in NG3.

The audit aims to support quality improvement in the care of women with diabetes who are pregnant or planning pregnancy, and seeks to address three key questions:

- Were women adequately prepared for pregnancy?
- Were adverse maternal outcomes minimised?
- Were adverse fetal/infant outcomes minimised?

The audit addresses these questions by collecting information about women with diabetes who are pregnant and give their consent for their data to be submitted, and measuring how many women took the preparatory steps recommended in the NICE guideline, and the frequency of adverse outcomes.

Methodology

The National Pregnancy in Diabetes (NPID) Audit is an ongoing data collection with data submitted by hospital teams in England, Wales and the Isle of Man. The audit collects demographic and clinical information on women with diabetes who become pregnant.

Participating organisations (outside the North East of England) were asked to collect a list of data items for all eligible women. A copy of the data collection form for this audit period is included in Appendix 4 of this report.

Each participating organisation provided their patients with an information leaflet outlining the audit and the process for collecting information, and obtained explicit patient consent prior to data being collected. Where the patient did not provide consent their information was not collected.

Participating organisations added the data they collected to the audit database using the web based NPID submission tool. The deadline for submissions for inclusion in this report was 12 February 2015.

This data was cleaned to remove inconsistent entries prior to analysis.

For women attending maternity and diabetes units in the North East of England, much of the information collected in the NPID audit is already recorded in the Northern Diabetes in Pregnancy (NorDIP) Survey[9] managed by the Regional Maternity Service Office on behalf of Public Health England. To reduce the burden of data submission, this report uses data collected in the NorDIP survey. For pregnancies that ended in 2013, aggregate data has been provided from the NorDIP survey. The NorDIP survey adopted new consent arrangements part way through 2014 to permit sharing of individual level data with the NPID audit. As the new consent model was adopted part way through the audit year, 45 per cent of 2014 pregnancies recorded in the NorDIP survey were submitted.

The burden of data submission was minimised by obtaining data from the National Diabetes Audit (NDA), Hospital Episode Statistics (HES) and the Patient Episode Database for Wales (PEDW).

When the NPID audit was launched, it was intended that maternal diabetes type would be obtained from the NDA. However, maternal diabetes type could not be obtained for all pregnancies in the NPID data via this method, as some GP practices did not participate in the NDA. In order to improve the quality of the NPID data and analysis, maternal diabetes type has been added to the NPID audit data collection form from 1 January 2015, and has been populated retrospectively for 2013 and 2014 pregnancies by some, but not all, maternity units. Where maternal diabetes type was not recorded for records entered using the online submission tool, this has been obtained where possible from the NDA.

The following data was obtained from the NDA for pregnancies submitted via the NPID online submission tool, and for the 2014 pregnancies submitted by the NorDIP survey:

- year of diabetes diagnosis
- ethnicity
- Indices of Multiple Deprivation[10] score for their area of residence.

The timing of the NDA data collection for 2013-14 means that the most recent NDA data available to obtain these items is from the 2012-13 NDA collection. For this report we have obtained data from the 2012-13 and 2011-12 collections for the NDA. Where these items from the NDA are missing, this is because either the woman's GP practice did not participate in the NDA, or the woman has been diagnosed with diabetes since 31 March 2013. This 'recently diagnosed' group may include a higher proportion of women with Type 2 diabetes.

The majority of tables in this report present data for all pregnancies (including those where the mother's diabetes type is unknown) and data for women with Type 1 and Type 2 diabetes. The data for women whose diabetes type is unknown is not shown separately.

Due to the time lag in availability of linked HES data, the sections of this report relating to the following data relate to pregnancies ending in 2013:

- parity (number of previous pregnancies resulting in a registrable birth)
- whether the mother had any hospital episodes including a diagnosis of hypoglycaemia during pregnancy
- labour/delivery onset method
- delivery method.

For records entered via the NPID online submission tool by units in England, data on these characteristics of pregnancy were obtained by linking to HES data.

For records entered via the NPID online submission tool by units in Wales, it was only possible to obtain data on hypoglycaemia episodes from PEDW, as maternity data is not currently available.

For pregnancies that ended in 2013 recorded in the NorDIP survey, aggregate data tables were provided for inclusion in the relevant sections of this report.

Due to the relative infrequency of the serious adverse fetal outcomes of stillbirth, neonatal death and congenital anomalies, the section on these outcomes reports on the 2013 and 2014 audit years together. This section therefore includes all 2013 and 2014 data submitted via the online submission tool, 2013 NorDIP data in the form of aggregate tables, and 2014 NorDIP data where consent was obtained to submit individual level data to the NPID audit.

Participation

The 2014 audit received completed pregnancy data from 150 submitting units in England, Wales and the Isle of Man, an increase from 128 submitting units in 2013. The 150 submitting units in 2014 represent 124 Trusts in England, 4 Local Health Boards in Wales and the Isle of Man.

The 2014 audit recorded data on 2,537 women – the increase from 1,697 women in 2013 is likely to be due to additional units participating in the audit, and more complete annual data submitted by units that began participating part way through 2013, rather than an increase in pregnancies among women with diabetes.

Figure 1 shows the geographical distribution of units that submitted audit data for 2014, including units that submitted records using the online submission tool, and units that provided data via the Northern Diabetes in Pregnancy Survey (NorDIP)[9].

Figure 1: Map of organisations that participated in the audit, 2014

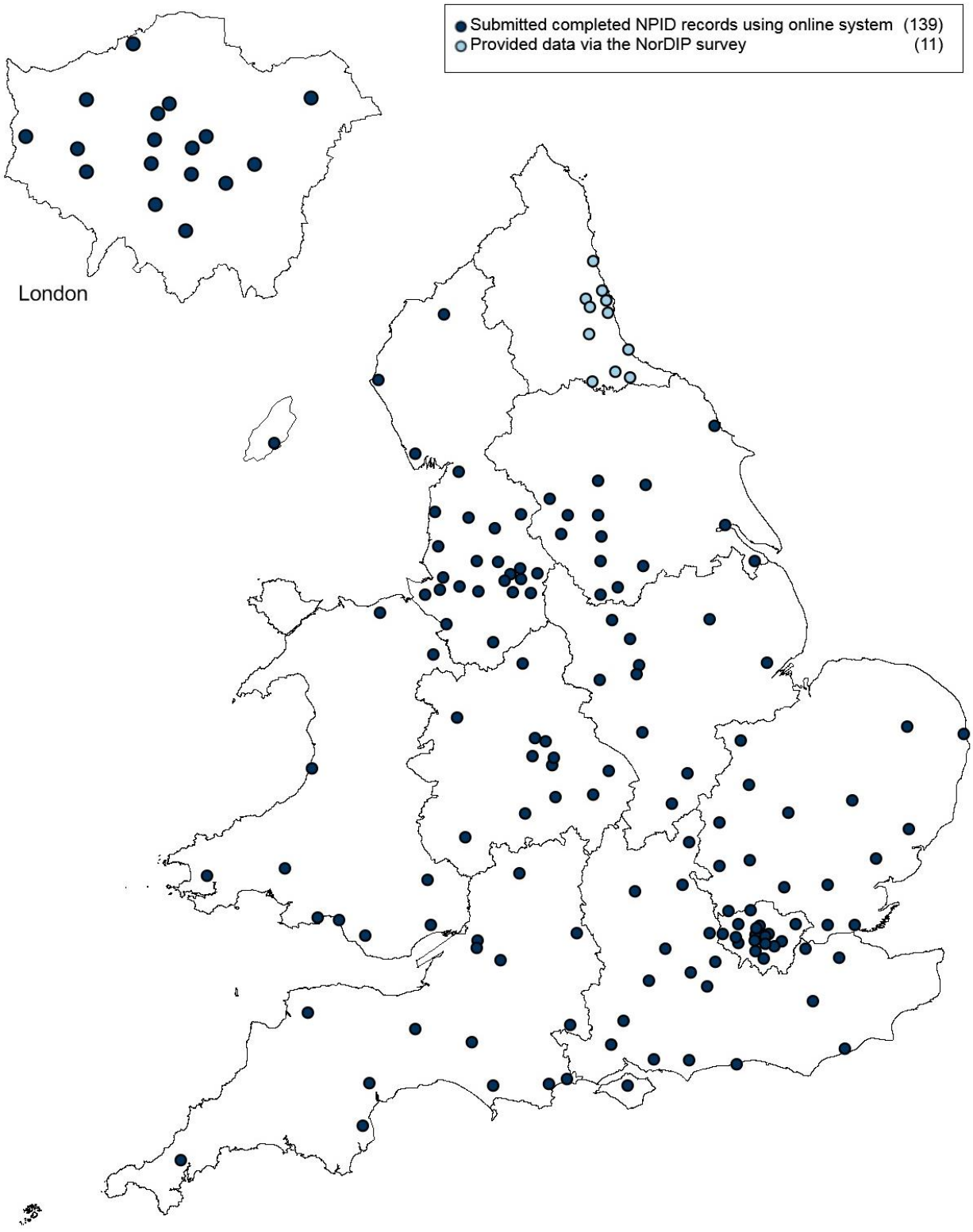

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Table 1: Organisations submitting data to the audit, 2014

	Number of organisations submitting completed pregnancy records
England (including the Isle of Man)	140
Wales	10
England and Wales	150

There is no comprehensive list of units eligible to take part in the audit, so it is not possible to calculate the percentage of eligible units that participated in 2014.

The Royal College of Obstetricians and Gynaecologists (RCOG) publishes a workforce census that identifies consultant led maternity units, although the census does not record whether units have a joint antenatal diabetes team. In the census, some units are defined as covering several hospitals, which may have registered separately for the NPID audit. Of the 144 consultant units and consultant units with co-located midwife-led units in England and 13 units in Wales identified in the 2013 RCOG census[7], 128 units in England (83 per cent) and 9 units in Wales (69 per cent) submitted data to the NPID audit. The NPID audit also received 2014 data from six of the eight units that did not respond to the RCOG census, and from five other units not listed in the census.

Five more units that did not submit data in 2014 have begun submitting data during 2015, and further units have registered to begin collecting and submitting data in the near future.

The type of diabetes was identified for 89.7 per cent of pregnancies ending in 2014 recorded in the audit. Where the diabetes type is not known, this is because the woman's diabetes type was not recorded in the NPID audit and her details were not included in the NDA for 2011-12 or 2012-13, or her diabetes type was recorded as 'Not specified'. As the most recent diagnosis date available in the NDA is March 2013, diabetes type is more likely to be unrecorded in the NPID audit for recently diagnosed women.

Among the women for whom their diabetes type was recorded, 52.0 per cent had Type 1 diabetes, and 46.7 per cent had Type 2 diabetes. 14 women (0.6 per cent) had MODY (maturity onset diabetes of the young), and the same number had 'Other diabetes'.

Table 2: Women, pregnancies and babies included in the audit, 2014

	All women	Women with Type 1 diabetes	Women with Type 2 diabetes	Other women with diabetes[a]
Women	2,537	1,184	1,064	289
Pregnancies	2,553[b]	1,193	1,069	291
Total pregnancy outcomes[c]	2,584[d]	1,211	1,077	296
Pregnancies ongoing after 24 completed weeks of gestation	2,387	1,117	1,000	270
Live births after 24 completed weeks of gestation	2,390	1,120	1,000	270
Stillbirths	26	14	8	4
Total infants born after 24 completed weeks of gestation	2,416	1,134	1,008	274
Live births with gestation unknown	17	5	9	3
Total registered births	2,433	1,139	1,017	277

[a] Women whose diabetes type was not recorded (261 women), or who were recorded as having maturity onset diabetes of the young (MODY) (14 women) or 'Other' diabetes types (14 women).

[b] 16 women had two pregnancies recorded within the audit period.

[c] Total pregnancy outcomes include live births, stillbirths, terminations of pregnancy and miscarriages. Each fetus/baby is counted, so a twin pregnancy is counted as two outcomes.

[d] There were 31 twin pregnancies recorded in the audit.

Table 3 shows the regional distribution of the pregnancies ending in 2014 recorded in the audit.

Table 3: Regional distribution[a] of pregnancies in the audit, 2014

	Number of submitting units	All pregnancies	Pregnancies in women with Type 1 diabetes		Pregnancies in women with Type 2 diabetes		Pregnancies in other women[b] with diabetes	
		Number	Number	Percentage	Number	Percentage	Number	Percentage
England	**140**	**2,473**	**1,144**	**46.3**	**1,044**	**42.2**	**285**	**11.5**
East Midlands	10	151	86	57.0	59	39.1	6	4.0
East of England	16	302	164	54.3	110	36.4	28	9.3
London	17	470	154	32.8	255	54.3	61	13.0
North East[c]	11	67	36	53.7	29	43.3	2	3.0
North West[d]	26	507	233	46.0	230	45.4	44	8.7
South East	19	276	134	48.6	92	33.3	50	18.1
South West	15	252	142	56.3	82	32.5	28	11.1
West Midlands	12	238	83	34.9	109	45.8	46	19.3
Yorkshire and the Humber	14	210	112	53.3	78	37.1	20	9.5
Wales	**10**	**80**	**49**	**61.3**	**25**	**31.3**	**6**	**7.5**

[a] Based on the location of the organisation recording the pregnancy care data (which may differ from the delivery location and from the woman's residence).

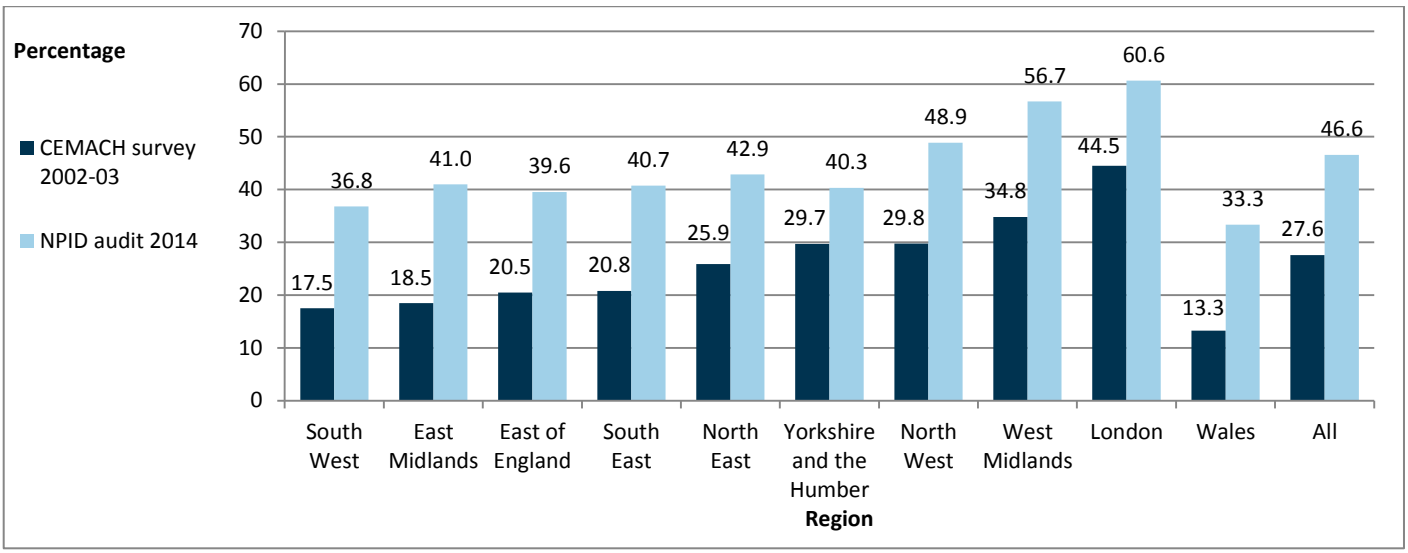
[b] Women whose diabetes type was not recorded (263 pregnancies), or who were recorded as having maturity onset diabetes of the young (MODY) (14 pregnancies) or 'Other' diabetes types (14 pregnancies).

[c] The coverage of pregnancies in the North East region in this report is less complete than for other regions as 45 per cent of pregnancies recorded by the NorDIP survey for 2014 were submitted to the NPID audit (see methodology for further details).

[d] Data for the participating hospital in the Isle of Man have been included in the North West Region and the England total.

Figure 2 shows the regional distribution of births to women with Type 2 diabetes (as a proportion of births to women whose diabetes type was known) compared with the CEMACH[6] survey from 2002-03. The percentage of births to women with Type 2 diabetes has increased from that reported in CEMACH for every region, and for 2014 varies from 33.3 per cent for Wales to 60.9 per cent for London. As noted in the CEMACH report, this variation can be partly explained by demographic factors, with the regions having the highest proportion of births to women with Type 2 diabetes tending to have greater ethnic diversity and/or social deprivation. There are also likely to be differences in ascertainment between regions due to differences in unit participation and also potentially due to local variations in the proportion of women consenting for their data to be submitted to the audit.

Figure 2: Proportion of births to women with Type 2 diabetes by region, 2014 compared with proportion of births to women with Type 2 diabetes in the CEMACH survey, 2002-03



Characteristics of women included in the audit

This section of the report describes 2,537 women with diabetes who had 2,553 pregnancies ending between 1 January 2014 and 31 December 2014 recorded in the audit. (There were a small number of women (16) with more than one completed pregnancy in 2014; for consistency the count of pregnancies includes both pregnancies for each of these women separately.)

Type of diabetes

The woman's type of diabetes was recorded for 2,290 of the 2,553 pregnancies included in the audit[1]. 1,193 pregnancies were in women with Type 1 diabetes and 1,069 were in women with Type 2 diabetes. Of the pregnancies in women with Type 2 diabetes where their diabetes treatment regimen at the first day of their last menstrual period was known, 24.1 per cent had been on insulin[2], and 60.5 per cent were not on insulin but were taking an oral hypoglycaemic agent[3].

Age and body mass index (BMI) of women

Women with Type 2 diabetes were older at the end of their pregnancy, and had a higher BMI compared with those with Type 1 diabetes.

Table 4: Characteristics of pregnancies in the audit, 2014

	All pregnancies	Pregnancies in women with Type 1 diabetes	Pregnancies in women with Type 2 diabetes
Average (mean) maternal age in years at completion of pregnancy	31.7	29.5	34.0
n	2,553	1,193	1,069
Average (mean) age in years at diagnosis	21.0	14.9	28.8
n	1,976	1,081	833
Average (mean) Body Mass Index (BMI), kg/m^2	29.8	26.8	33.0
n	2,546	1,189	1,066

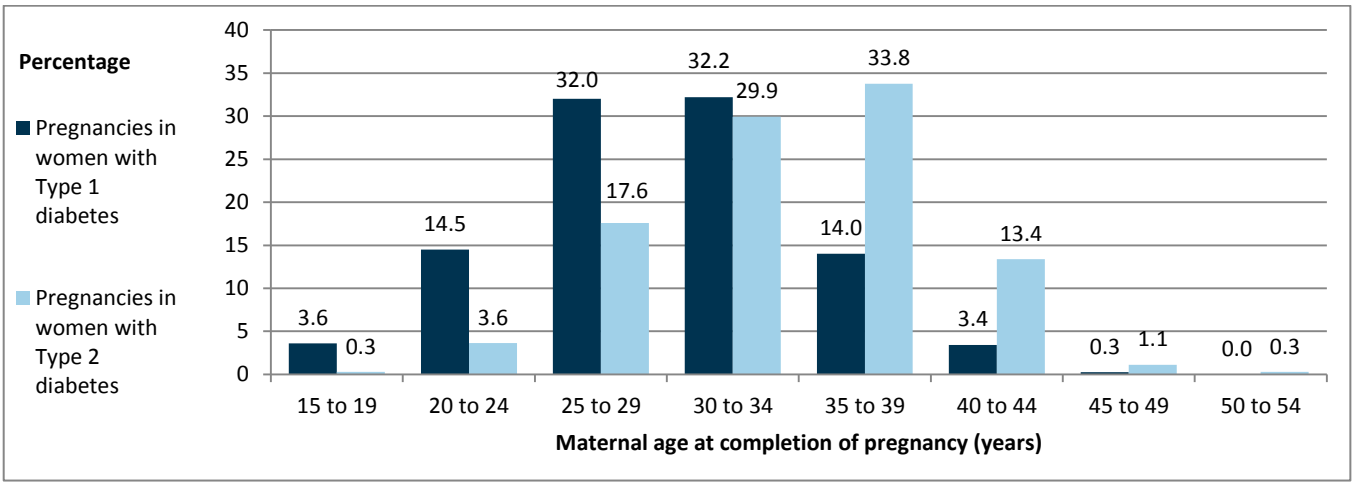
[1] Where the diabetes type is not known, this is because either the woman's details were not recorded in the NPID audit or in the NDA for 2011-12 or 2012-13, or her diabetes type was recorded as 'Not specified'. As the most recent diagnosis date available in the NDA is March 2013, diabetes type may be more likely to be unrecorded for recently diagnosed women.

[2] On insulin includes basal bolus insulin regimen, mixed insulin or basal insulin only, and insulin pump therapy. For data collected in the NorDIP survey, includes Glargine, Detemir, any other insulin and insulin pump therapy.

[3] Oral hypoglycaemic medication includes metformin, sulphonylurea or glitinide, gliptin, GLP-1 analogue or pioglitazone.

Figure 3 shows the age distribution of the women included in the audit by diabetes type. 78.5 per cent of women with Type 2 diabetes were aged 30 years and over, compared with 49.9 per cent of women with Type 1 diabetes.

Figure 3: Age group distribution of women in the audit, 2014



Ethnicity and deprivation

Table 5 shows the ethnicity of the women recorded in the audit. Among women of Asian or Black ethnic origin, over 80 per cent of women whose diabetes type was recorded had Type 2 diabetes.

Table 5: Ethnicity of women in the audit, 2014

Ethnicity	All pregnancies (n=2,086)[a]	Pregnancies where diabetes type recorded (n=2,027)[b]	Pregnancies in women with Type 1 diabetes (n=1,129)		Pregnancies in women with Type 2 diabetes (n=876)	
	Number	Number	Number	Percentage	Number	Percentage
White	1,214	1,176	805	68.5	357	30.4
Mixed	42	42	15	35.7	27	64.3
Asian	321	311	41	13.2	269	86.5
Black	99	98	17	17.3	80	81.6
Other	38	38	18	47.4	20	52.6
Not stated/not known	372	362	233	64.4	123	34.0

[a] Ethnicity is only available where the woman's details are included in the 2011-12 or 2012-13 NDA.

[b] Pregnancies where ethnicity was recorded in the 2011-12 or 2012-13 NDA, and the woman's diabetes type was Type 1, Type 2, MODY or 'Other specified'.

Index of Multiple Deprivation (IMD)[10] scores mapped from England and Wales postcodes are ranked and split into five equal groups to give quintiles of deprivation. The distribution of the IMD scores for the postcodes of women included in the audit within these quintiles is shown in Table 6. More women with Type 2 diabetes were resident in the most deprived areas (38.3 per cent) than women with Type 1 diabetes (24.2 per cent).

Table 6: Deprivation score of area of residence of women in the audit, 2014

Deprivation[b]	All pregnancies (n=2,074)[a]		Pregnancies in women with Type 1 diabetes (n=1,121)		Pregnancies in women with Type 2 diabetes (n=872)	
	Number	Percentage	Number	Percentage	Number	Percentage
1st quintile (least deprived)	249	12.0	182	16.2	54	6.2
2nd quintile	317	15.3	217	19.4	84	9.6
3rd quintile	388	18.7	217	19.4	154	17.7
4th quintile	497	24.0	234	20.9	246	28.2
5th quintile (most deprived)	623	30.0	271	24.2	334	38.3

[a] Deprivation quintile is only available where the woman's details are included in the 2011-12 or 2012-13 NDA.

[b] The index of multiple deprivation (IMD) quintiles are based on the postcode of the woman's place of residence. This table includes women resident in England and Wales, but not women resident in the Isle of Man.

Parity

For each woman, parity is the count of previous pregnancies where the outcome was one or more live births or stillbirths. For pregnancy records submitted via the NPID online tool, parity is obtained by linking to Hospital Episode Statistics (HES) data (this data item is not currently available from the Patient Episode Database for Wales (PEDW)). The timing of availability of HES data means that these data are not yet available for pregnancies ending in 2014. Table 7 therefore shows parity data for pregnancies that ended in calendar year 2013 (the first year of the audit). For pregnancies that ended in 2013 submitted via the NorDIP survey, parity is obtained from the NorDIP data collection form.

Table 7: Parity (number of previous pregnancies resulting in registrable birth) for women in the audit, 2013

	All pregnancies (n=1,193)		Pregnancies in women with Type 1 diabetes (n=580)		Pregnancies in women with Type 2 diabetes (n=490)	
	Number	Percentage	Number	Percentage	Number	Percentage
Zero	372	31.2	220	37.9	116	23.7
1	376	31.5	199	34.3	142	29.0
2 or more	445	37.3	161	27.8	232	47.3

Women with Type 2 diabetes were significantly more likely to have had two or more previous pregnancies resulting in a live birth or stillbirth (47.3 per cent) than women with Type 1 diabetes (27.8 per cent). This is likely to be linked to the higher average age at delivery for women with Type 2 diabetes.

Data on whether these previous pregnancies were before or after the onset of diabetes are not available.

These figures are not comparable to the CEMACH[6] survey, which reported on gravidity (the number of previous pregnancies regardless of outcome, which may be greater than the parity count for each woman).

Were women adequately prepared for pregnancy?

The NICE guideline for diabetes in pregnancy (CG63) in place during 2014 stated that women with diabetes should be informed of the importance of good glycaemic control to reduce the risk of miscarriage, congenital abnormality, stillbirth and neonatal death, as well as a recommendation to take high dose folic acid. These recommendations remain in the updated NICE guideline NG3 published in 2015.

This section of the report provides evidence of achievement against the NICE guideline looking in particular at folic acid supplement and HbA_{1c} level.

Folic acid supplement

Women with diabetes have an increased risk of having a pregnancy affected by a neural tube defect. NICE guidance recommends that they should take 5 milligrams (5mg) of folic acid while planning pregnancy and then up to 12 weeks gestation to reduce this risk. This dose is available on prescription.

Half (50.5 per cent) of women with Type 1 diabetes had been taking folic acid prior to their last menstrual period (Table 8), compared with only one-third (33.3 per cent) of women with Type 2 diabetes. Less than a quarter (23.7 per cent) of women with Type 2 diabetes were taking the recommended 5mg dose.

Table 8: Use of folic acid supplement prior to pregnancy in the audit, 2014

	All pregnancies (n=2,547)		Pregnancies in women with Type 1 diabetes (n=1,190)		Pregnancies in women with Type 2 diabetes (n=1,066)	
	Number	Percentage	Number	Percentage	Number	Percentage
Dose 400mcg	202	7.9	67	5.6	102	9.6
Dose 5mg	865	34.0	534	44.9	253	23.7
All doses	**1,067**	**41.9**	**601**	**50.5**	**355**	**33.3**
Not taken	1,210	47.5	478	40.2	590	55.3
Not known[a]	270	10.6	111	9.3	121	11.4

[a] 'Not known' in this table includes women who were recorded to be taking folic acid but with an unknown dose

HbA_{1c} control

NICE CG63 and the updated guideline NG3 recommend that as part of preconception planning and care, women with diabetes who are planning to become pregnant should receive an explanation that establishing good glucose control before conception and continuing this throughout pregnancy will reduce the risk of miscarriage, congenital malformation, stillbirth and neonatal death.

1,918 of 2,553 pregnancies (75.1 per cent) included in the audit had an HbA_{1c} measurement recorded in the first trimester (the first 13 weeks of pregnancy). Table 9 shows the average measurements and the proportion of pregnancies for which HbA_{1c} measurements below certain thresholds were recorded.

During this audit period, the NICE recommended HbA_{1c} level for women with diabetes planning to become pregnant was 43 mmol/mol (6.1%). A first trimester HbA_{1c} measurement below 43 mmol/mol was recorded for only 7.9 per cent of pregnancies in women with Type 1 diabetes, and 21.7 per cent of pregnancies in women with Type 2 diabetes.

The updated NICE guideline NG3 recommends that women with diabetes planning to become pregnant aim to keep their HbA_{1c} level below 48 mmol/mol (6.5%). A first trimester HbA_{1c} measurement below 48 mmol/mol was recorded for 15.4 per cent of pregnancies in women with Type 1 diabetes and 35.8 per cent of pregnancies in women with Type 2 diabetes.

Both the previous and current NICE guidelines note that women should be reassured that any reduction in HbA_{1c} towards the target is likely to reduce the risk of congenital malformations. For over half of all pregnancies (51.6 per cent), a first trimester HbA_{1c} measurement below 58 mmol/mol (7.5%) was recorded.

A first trimester HbA_{1c} measurement of 86 mmol/mol (10.0%) or more was recorded for 11.6 per cent of pregnancies in women with Type 1 diabetes and 8.1 per cent of pregnancies in women with Type 2 diabetes. The NICE guidelines recommend that women with diabetes whose HbA_{1c} is above this level should be strongly advised to avoid pregnancy.

Table 9: First trimester HbA_{1c} measurement in the audit, 2014

	All pregnancies (n=1,918)		Pregnancies in women with Type 1 diabetes (n=963)		Pregnancies in women with Type 2 diabetes (n=765)	
	Number	Percentage	Number	Percentage	Number	Percentage
Mean HbA_{1c} value (mmol/mol)	60.4		64.4		56.5	
Standard deviation	18.2		17.8		17.6	
Result <43 mmol/mol (6.1%)	280	14.6	76	7.9	166	21.7
Result <48 mmol/mol (6.5%)	496	25.9	148	15.4	274	35.8
Result <58 mmol/mol (7.5%)	990	51.6	386	40.1	481	62.9
Result ≥86 mmol/mol (10%)	187	9.7	112	11.6	62	8.1

Table 10 compares the demographic characteristics for pregnancies where a first trimester HbA_{1c} below 48 mmol/mol was recorded with those where the first trimester HbA_{1c} was 48 mmol/mol or more.

Women with Type 1 diabetes who had a first trimester HbA_{1c} below 48 mmol/mol were on average older, had been diagnosed with diabetes at a later age and had a lower BMI than women with Type 1 diabetes who had first trimester HbA_{1c} measurements of 48 mmol/mol or more. There was no difference between women with Type 2 diabetes who had first trimester HbA_{1c} below 48 mmol/mol, and women with Type 2 diabetes who had first trimester HbA_{1c} of 48 mmol/mol or more.

Table 10: Characteristics of women by first trimester HbA_{1c} measurement, 2014

	All pregnancies		Pregnancies in women with Type 1 diabetes		Pregnancies in women with Type 2 diabetes	
	First trimester HbA_{1c}<48 mmol/mol	First trimester HbA_{1c} >=48 mmol/mol	First trimester HbA_{1c}<48 mmol/mol	First trimester HbA_{1c} >=48 mmol/mol	First trimester HbA_{1c}<48 mmol/mol	First trimester HbA_{1c} >=48 mmol/mol
Average (mean) maternal age in years at completion of pregnancy	33.0	31.1	31.8	29.1	34.0	34.2
n	496	1,422	148	815	274	491
Average (mean) age in years at diagnosis	24.9	19.4	17.7	14.5	29.4	28.9
n	361	1,163	125	755	216	387
Average (mean) Body Mass Index (BMI), kg/m^2	30.0	29.4	26.0	27.0	32.5	33.5
n	496	1,420	148	814	274	490

Figure 4 shows that for both women with Type 1 and Type 2 diabetes, the percentage that had a first trimester HbA_{1c} below 48 mmol/mol was lowest for women of Asian and Black ethnic origins.

Figure 4: Percentage of pregnancies with first trimester HbA_{1c} <48 mmol/mol by ethnicity, 2014

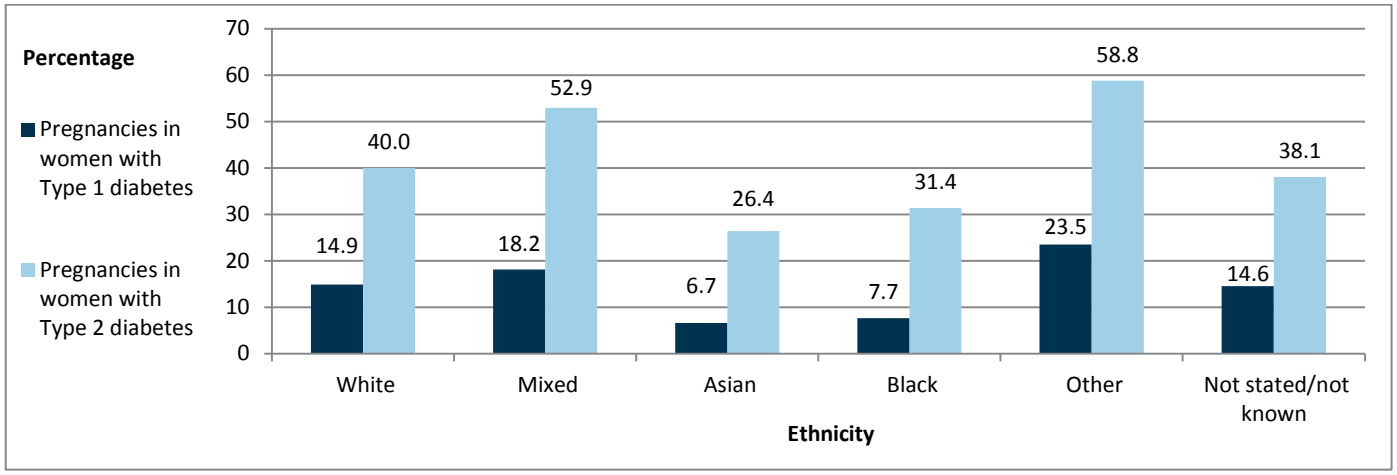
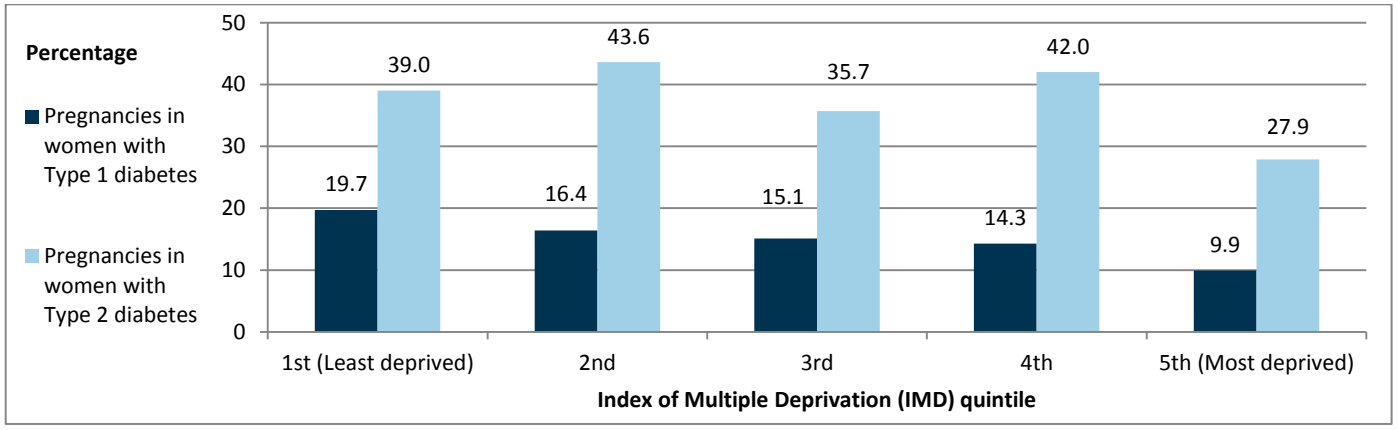


Figure 5 shows that among women with Type 1 diabetes, twice as many women resident in the least deprived 20 per cent of areas had a first trimester HbA_{1c} below 48 mmol/mol (19.7 per cent) compared with women resident in the most deprived 20 per cent of areas (9.9 per cent). Among women with Type 2 diabetes, the women resident in the most deprived 20 per cent of areas were also least likely to have a first trimester HbA_{1c} below 48 mmol/mol (27.9 per cent).

Figure 5: Percentage of pregnancies with first trimester HbA_{1c} <48 mmol/mol by deprivation score of area of residence, 2014



Of the 1,729 women who had a first trimester HbA_{1c} value and details of whether they were taking folic acid prior to pregnancy recorded in the audit (Table 11), 125 (7.2 per cent) were taking the recommended 5mg folic acid dose and had a first trimester HbA_{1c} measurement below 43 mmol/mol.

Measuring against the new NICE guideline in effect from February 2015, 221 women (12.8 per cent) were taking the recommended 5mg folic acid dose and had a first trimester HbA_{1c} measurement below 48 mmol/mol. Although women with Type 1 diabetes were more likely to be taking folic acid (Table 8) and women with Type 2 diabetes were more likely to have a first trimester HbA_{1c} measurement below 48 mmol/mol (Table 9), similar proportions of women with Type 1 diabetes (11.8 per cent) and Type 2 diabetes (13.1 per cent) met both recommendations.

Table 11: Folic acid use and first trimester HbA_{1c} measurement, 2014

	All pregnancies (n=1,729)		Pregnancies in women with Type 1 diabetes (n=876)		Pregnancies in women with Type 2 diabetes (n=688)	
	Number	Percentage	Number	Percentage	Number	Percentage
Taking 5mg folic acid and HbA_{1c} <43 mmol/mol	125	7.2	56	6.4	53	7.7
Taking 5mg folic acid and HbA_{1c} <48 mmol/mol	221	12.8	103	11.8	90	13.1

Diabetes treatment regimen prior to pregnancy

Table 12 shows the number of women on selected diabetes treatment regimens at their last menstrual period.

Table 12: Diabetes treatment regimen at last menstrual period in the audit, 2014[a]

	All pregnancies (n=2,549)		Pregnancies in women with Type 1 diabetes (n=1,192)		Pregnancies in women with Type 2 diabetes (n=1,066)	
	Number	Percentage	Number	Percentage	Number	Percentage
On insulin[b] only	1,273	49.9	1,082	90.8	102	9.6
On insulin and metformin only	222	8.7	52	4.4	146	13.7
On metformin only	647	25.4	12	1.0	539	50.6
On other diabetes medications[c]	114	4.5	6	0.5	98	9.2

[a] There are other diabetes treatment combinations not shown in this table.

[b] 'On insulin' includes basal bolus insulin regimen, mixed insulin or basal insulin only, and insulin pump therapy. For data collected in the NorDIP survey this includes Glargine, Detemir, Any other insulin and insulin pump therapy.

[c] 'Other diabetes medications' in this table are sulphonylurea or glitinide, gliptin, GLP-1 analogue and pioglitazone, irrespective of whether the woman was also taking metformin and/or insulin.

The NICE guideline recommends that all oral hypoglycaemic agents other than metformin should be discontinued before pregnancy. 9.2 per cent of women with Type 2 diabetes became pregnant while taking a potentially hazardous glucose lowering medication.

There were 1,273 women on insulin alone as their diabetes treatment regimen at the start of their pregnancy. Table 13 shows the number of women on each insulin treatment.

Table 13: Type of insulin treatment of women on insulin[a] only in the audit, 2014[b]

	All pregnancies (n=1,273)		Pregnancies in women with Type 1 diabetes (n=1,082)		Pregnancies in women with Type 2 diabetes (n=102)	
	Number	Percentage	Number	Percentage	Number	Percentage
Basal bolus insulin regimen	895	70.3	760	70.2	70	68.6
Mixed insulin or basal insulin only	146	11.5	104	9.6	30	29.4
Insulin pump therapy	230	18.1	217	20.1	2	2.0
Multiple insulin treatments	2	0.2	1	0.1	0	0.0

[a] 'On insulin' includes basal bolus insulin regimen, mixed insulin or basal insulin only, and insulin pump therapy.

[b] Data on the type of insulin treatment are collected differently in the NPID online submission tool and the NorDIP survey. Insulin pump therapy is collected by both. The other NorDIP categories have been mapped as follows for this table – Glargine and Detemir included in basal bolus insulin regimen, any other insulin included in mixed insulin or basal insulin only.

Women with diabetes have increased risks of kidney and cardiovascular disease so may be prescribed statins, angiotension-converting enzyme inhibitors (ACE inhibitors) or angiotensin receptor blockers (ARBs), drugs that have potential to cause fetal harm. NICE recommends that these drugs should be discontinued before pregnancy or as soon as pregnancy is confirmed.

Table 14: Use of statins at last menstrual period in the audit, 2014

	All pregnancies (n=2,548)		Pregnancies in women with Type 1 diabetes (n=1,191)		Pregnancies in women with Type 2 diabetes (n=1,066)	
	Number	Percentage	Number	Percentage	Number	Percentage
On statins	105	4.1	25	2.1	76	7.1
Not on statins	2,386	93.6	1,151	96.6	959	90.0
Not known	57	2.2	15	1.3	31	2.9

Table 15: Use of ACE inhibitor/ARB at last menstrual period, 2014

	All pregnancies (n=2,548)		Pregnancies in women with Type 1 diabetes (n=1,191)		Pregnancies in women with Type 2 diabetes (n=1,066)	
	Number	Percentage	Number	Percentage	Number	Percentage
On ACE inhibitor/ARB	82	3.2	15	1.3	61	5.7
Not on ACE inhibitor/ARB	2,409	94.5	1,155	97.0	977	91.7
Not known	57	2.2	21	1.8	28	2.6

6.2 per cent of women were taking either statins or an ACE inhibitor/ARB or both medications when they became pregnant (3.0 per cent of women with Type 1 diabetes and 10.5 per cent of women with Type 2 diabetes).

Care in pregnancy and HbA_{1c} values

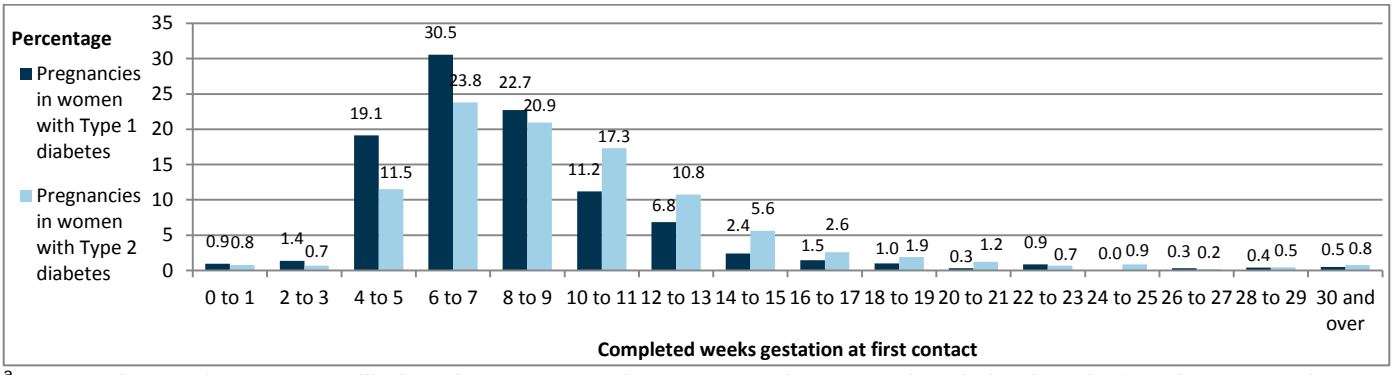
Women with diabetes who become pregnant are at higher risk of having an adverse outcome including miscarriage, congenital abnormality, stillbirth and neonatal death. It is therefore important that antenatal appointments include care specifically for women with diabetes in addition to routine antenatal care, and that glycaemic control is assessed regularly.

Gestation at first contact with specialist antenatal diabetes team

Women with diabetes who become pregnant should have their first appointment with the joint diabetes and antenatal team as early as possible in pregnancy to ensure that any pregnancy risks not reviewed prior to pregnancy are addressed promptly.

Figure 6 shows that 52.0 per cent of women with Type 1 diabetes had their first contact with the specialist team prior to 8 weeks gestation, but only 36.7 per cent of women with Type 2 diabetes had their first contact with the team within this time.

Figure 6: Gestation (completed weeks) at first contact[a] with specialist antenatal diabetes team, 2014



[a] Very early appointments are likely to be preconception care appointments already in place before the woman knew she was pregnant.

HbA_{1c} control

NICE guideline CG63 recommends that HbA_{1c} should not be used routinely for assessing glycaemic control in the second and third trimesters of pregnancy. However, the new NICE guideline NG3 recommends that HbA_{1c} levels are measured at the booking appointment, and that measuring HbA_{1c} levels in the second and third trimesters should be considered, to assess the level of risk for the pregnancy. It is therefore likely that in future more HbA_{1c} measurements during pregnancy will be recorded in the audit.

The first and last HbA_{1c} measurements in pregnancy were recorded as part of the audit. These have been grouped by gestation and where the two measurements were in the same gestation period, the last measurement has been used. Table 16 shows HbA_{1c} control during pregnancy by completed weeks of gestation.

Table 16: HbA_{1c} values during pregnancy by completed weeks of gestation, 2014

	Pregnancies in women with Type 1 diabetes				Pregnancies in women with Type 2 diabetes			
	Completed weeks of gestation							
	<13		24 and over		<13		24 and over	
Mean HbA_{1c} (mmol/mol)	64.4		51.3		56.5		44.5	
Standard deviation	17.8		12.0		17.7		10.8	
Number of pregnancies where HbA_{1c} recorded	963		867		765		728	
HbA_{1c} measurement	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
<48 mmol/mol (6.5%)	148	15.4	352	40.6	274	35.8	507	69.6
48-57 mmol/mol (6.5% - 7.4%)	238	24.7	300	34.6	207	27.1	141	19.4
58-71 mmol/mol (7.5% - 8.6%)	290	30.1	176	20.3	138	18.0	59	8.1
72-85 mmol/mol (8.7% - 9.9%)	175	18.2	29	3.3	84	11.0	16	2.2
≥86 mmol/mol (10.0%)	112	11.6	10	1.2	62	8.1	5	0.7

HbA_{1c} levels fall as the pregnancy progresses for both women with Type 1 and Type 2 diabetes: 40.6 per cent of women with Type 1 diabetes had an HbA_{1c} value below 48 mmol/mol at or after 24 weeks gestation, compared with 15.4 per cent in the first trimester, and 69.6 per cent of women with Type 2 diabetes had an HbA_{1c} value below 48 mmol/mol at or after 24 weeks gestation, compared with 35.8 per cent in the first trimester. HbA_{1c} falls physiologically in pregnancy because of changes in iron transport and red cell turnover[11], so it is uncertain whether this fall represents an improvement in glycaemic control.

Were adverse maternal outcomes minimised?

The NICE guideline recommends that targets for blood glucose for women with diabetes who are planning to become pregnant should take into account the risk of hypoglycaemia, and women should aim to maintain their HbA_{1c} level below the specified target if it is safely achievable. During pregnancy, the risk of hypoglycaemia may increase due to efforts to maintain strict glycaemic control, changes in diabetes treatment, and due to nausea and vomiting. There is also an increased risk of lack of awareness of hypoglycaemia symptoms during pregnancy due to physiological changes.

By linking NPID audit data to Hospital Episode Statistics (HES) data for England, and the Patient Episode Database for Wales (PEDW), we can report on women with diabetes who had inpatient hospital episodes during their pregnancy where hypoglycaemia was recorded. The timing of availability of HES data means that these data are not yet available for pregnancies ending in 2014. This section therefore reports on pregnancies that ended in calendar year 2013 (the first year of the audit).

It is not possible to identify from the hospital episode data whether the episode was an admission for hypoglycaemia, or the admission was for another reason with hypoglycaemia noted as an additional diagnosis for the episode. Please also note that this analysis includes only hospital inpatient episodes – it does not include episodes of hypoglycaemia where treatment was provided by medical professionals without admission to hospital, or where it was self-managed. For 2013 pregnancy records collected by the NorDIP survey, data was collected on whether the woman had any hospital admissions for hypoglycaemia. This NorDIP data has been included in Table 17.

Table 17: Hospital episodes with diagnosed hypoglycaemia during pregnancy, 2013

	All (n=1,812)		Pregnancies in women with Type 1 diabetes (n=872)		Pregnancies in women with Type 2 diabetes (n=731)	
	Number	Percentage	Number	Percentage	Number	Percentage
At least one admission	115	6.3	81	9.3	20	2.7
No admissions recorded	1,697	93.7	791	90.7	711	97.3

Almost one in ten (9.3 per cent) of women with Type 1 diabetes had at least one hospital episode with hypoglycaemia recorded as a diagnosis during their pregnancy. Women with Type 2 diabetes were less likely (2.7 per cent) than women with Type 1 diabetes to have a hospital episode with hypoglycaemia recorded as a diagnosis during their pregnancy.

For each type of diabetes, the women in the NPID audit were significantly more likely to have such an episode compared with all women aged 20 to 39 in the National Diabetes Audit for 2012-13. (2.1 per cent of all women with Type 1 diabetes, and 0.4 per cent of all women with Type 2 diabetes in the National Diabetes Audit 2012-13 in the comparison age group had at least one such episode during the 12 month period April 2012 to March 2013.)

Access to retinopathy screening data continues to be difficult for many centres; this is being addressed by the NHS Diabetic Eye Screening Programme but it will take time for systems to improve so that this data can be included in NPID audit data submissions. It has therefore not been possible to report on retinopathy deterioration during pregnancy.

Were adverse fetal/infant outcomes minimised?

Onset of labour and method of delivery

Data on the onset of labour and method of delivery are obtained by linking to Hospital Episode Statistics (HES) data (these data items are not currently available from the Patient Episode Database for Wales (PEDW)). The timing of availability of HES data means that data are not yet available for pregnancies ending in 2014. This section therefore reports on pregnancies that ended in calendar year 2013 (the first year of the audit) submitted by hospitals in England. For pregnancies that ended in 2013 submitted via the NorDIP survey, these data are obtained from the NorDIP data collection form.

The section of the CEMACH[6] survey report on characteristics of labour and delivery did not publish data by mother's diabetes type, so comparisons between the NPID audit data and the CEMACH data in this section can only be made for 'All pregnancies'. Differences between the figures from the NPID audit data and the results from the CEMACH survey should be interpreted with caution, as they may be at least partly due to the increase in the proportion of pregnancies in women with Type 2 diabetes between 2002-03 and 2013.

The NICE guideline in place in 2013 recommended that pregnant women with diabetes who have a normally grown fetus should be offered elective birth through induction of labour, or by elective caesarean section if indicated, after 38 completed weeks.

Table 18 shows that only a minority of women with diabetes (13.6 per cent) went into spontaneous labour. This is a significant reduction from 18.0 per cent of women that went into spontaneous labour in the CEMACH survey. The NICE guideline recommending offering induction or elective caesarean after 38 completed weeks was introduced after the CEMACH survey, and this may have contributed to the reduction in the proportion of women having spontaneous labour. This decrease may also be related to a similar decrease in the percentage of women in England having spontaneous labour, from 69.0 per cent in 2002-03 to 61.8 per cent in 2013-14[8].

The percentage of women having a caesarean before the onset of labour has not changed from the CEMACH survey (41.5 per cent in 2013 compared with 42.7 per cent in 2002-03). Women with Type 1 diabetes were more likely to have a caesarean before labour (45.0 per cent) than women with Type 2 diabetes (36.9 per cent).

Table 18: Onset of labour for pregnancies in the audit continuing at 24 weeks gestation, 2013

	All (n=1,370)		Pregnancies in women with Type 1 diabetes (n=662)		Pregnancies in women with Type 2 diabetes (n=550)	
	Number	Percentage	Number	Percentage	Number	Percentage
Spontaneous	187	13.6	90	13.6	74	13.5
Induced[a]	614	44.8	274	41.4	273	49.6
Caesarean	569	41.5	298	45.0	203	36.9

[a] Includes surgical induction, medical induction and combined surgical and medical induction.

Deliveries before 37 completed weeks of gestation are classed as preterm. 27.2 per cent of the 1,370 pregnancies ongoing at 24 weeks where onset of labour is known resulted in a preterm delivery (34.9 per cent of pregnancies in women with Type 1 diabetes and 17.8 per cent of pregnancies in women with Type 2 diabetes).

Over half (55.6 per cent) of all women that had a preterm delivery had a caesarean before labour, and women with Type 1 diabetes that had a preterm delivery were more likely (61.5 per cent) to have had a caesarean before labour than women with Type 2 diabetes (41.8 per cent).

Induction (surgical, medical or combined) was the most common onset of labour for women with diabetes that delivered at or after 37 completed weeks (52.7 per cent).

Table 19 shows the mode of delivery for pregnancies ending in 2013. The (emergency and elective) caesarean section rate (60.1 per cent) was between two and three times the rate for mothers in England (26.2 per cent)[12]. Women with Type 1 diabetes were more likely to have a caesarean section (66.9 per cent) than women with Type 2 diabetes (52.0 per cent).

The rate of caesarean sections was lower than the 67.4 per cent of deliveries in the CEMACH survey in 2002-03 – in particular, the percentage of deliveries that were emergency caesareans reduced from 37.6 per cent in 2002-03 to 30.0 per cent in 2013. This reduction may be at least partially due to the increase in the proportion of births to women with Type 2 diabetes, compared with the CEMACH survey.

Table 19: Mode of delivery for births in the audit from pregnancies continuing at 24 weeks gestation, 2013

	All births (n=1,418)		Births to women with Type 1 diabetes (n=689)		Births to women with Type 2 diabetes (n=569)	
	Number	Percentage	Number	Percentage	Number	Percentage
Spontaneous	412	29.1	156	22.6	207	36.4
Instrumental	131	9.2	67	9.7	54	9.5
Elective caesarean	427	30.1	227	32.9	155	27.2
Emergency caesarean	426	30.0	234	34.0	141	24.8
Other	22	1.6	5	0.7	12	2.1

For women with Type 2 diabetes that delivered preterm, 38.3 per cent had a spontaneous vaginal delivery compared with only 13.1 per cent of women with Type 1 diabetes that had a preterm delivery. Almost four out of five preterm deliveries for women with Type 1 diabetes were caesarean sections (78.4 per cent), compared with 57.0 per cent of preterm deliveries for women with Type 2 diabetes.

Where labour was induced (surgical, medical or combined), 31.0 per cent of women went on to have an emergency caesarean section. This is a significant reduction from the CEMACH survey in 2002-03, where 43.0 per cent of inductions resulted in an emergency caesarean section.

Pregnancy outcomes

Table 20 shows that there were 2,407 live births from 2,433 registered births for women with diabetes (98.9 per cent).

In England and Wales 99.5 per cent of all registered births in 2014 were live births.

Table 20: Pregnancy outcomes in the audit, 2014

	Outcome				
	Total	Live birth	Stillbirth	Miscarriage[b]	Termination of pregnancy
All pregnancies					
All pregnancies	2,584	2,407	26	135	16
Pregnancies in women with Type 1 diabetes	1,211	1,125	14	63	9
Pregnancies in women with Type 2 diabetes	1,077	1,009	8	57	3
Pregnancies continuing at 24 weeks gestation[a]					
All pregnancies	2,416	2,390	26		
Pregnancies in women with Type 1 diabetes	1,134	1,120	14		
Pregnancies in women with Type 2 diabetes	1,008	1,000	8		

[a] Excludes pregnancies with unknown gestation length at delivery.

[b] Early miscarriages (prior to the booking appointment) are likely to be under-reported in the audit.

Adverse outcomes

Tables 21 and 22 use data for pregnancies ending between 1 Jan 2013 and 31 December 2014 (for data submitted to the NorDIP survey, this includes all pregnancies ending in 2013, and pregnancies ending in 2014 where consent was obtained to share individual data with the NPID audit). As these adverse pregnancy outcomes are rare, using two years of audit data helps to form more accurate estimates of the rates of each adverse outcome.

Table 21: Stillbirth and neonatal mortality in the audit, 2013 and 2014 combined

	Births to all women with diabetes			Births to women with Type 1 diabetes			Births to women with Type 2 diabetes		
	Number	Rate	95 per cent CI	Number	Rate	95 per cent CI	Number	Rate	95 per cent CI
Stillbirth (rate per 1,000 live and stillbirths)	53	12.8	(9.6,16.7)	25	12.7	(8.3,18.8)	19	11.1	(6.7,17.3)
Neonatal death (rate per 1,000 live births)	31	7.6	(5.1, 10.8)	12	6.2	(3.2,10.8)	16	9.4	(5.4,15.3)

The width of the confidence intervals for the rates due to the rarity of the outcomes, and also the number of births for which the mother's diabetes type is not known mean it can be difficult to detect reductions in the rates of these adverse outcomes. The data in Table 21 suggest that the stillbirth rates for women with Type 1 and Type 2 diabetes have fallen from the rates reported in the CEMACH[6] survey in 2002-03, but this cannot be confirmed statistically without more complete diabetes type information. As maternal diabetes type is collected directly by the NPID audit from 1

January 2015 onwards, the impact of this uncertainty on estimates should reduce in future audit periods.

In 2013 in England and Wales, the Office for National Statistics reported a stillbirth rate for all births of 4.7 per 1,000 live and stillbirths, and a neonatal death rate of 2.6 per 1,000 live births[13]. Stillbirth and neonatal mortality rates for the UK population and by country calculated on a different basis to the ONS rates were also published by the MBRRACE-UK (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK) Perinatal Mortality Surveillance Report[14].

Caution is required when comparing the NPID rates in Table 21 and other rates – for example, a greater proportion of women in the NPID audit were aged 35 and over compared with the general maternity population, and stillbirth and neonatal death rates in the general maternity population are known to be higher for these age groups[13]. There may also be methodological differences in the rate calculations which mean that the rates are not directly comparable, such as the exclusion of births at less than 24 weeks gestational age from the MBRRACE-UK rates. Furthermore, the geographical coverage of the NPID audit remains incomplete.

Table 22: Congenital anomalies by diabetes type, 2013 and 2014 combined[a]

	All pregnancy outcomes (n=4,206)	Outcomes for women with Type 1 diabetes (n=1,990)	Outcomes for women with Type 2 diabetes (n=1,736)
Yes	183	87	72
No	3,840	1,819	1,589
Not known	183	84	75

[a] Includes live births and terminations at any stage of the pregnancy, stillbirths, and miscarriages after 20 completed weeks.

The rate of congenital anomalies in the pregnancies recorded in the audit across both years was 44.2 per 1,000 live and stillbirths (with a 95 per cent confidence interval of (38.0, 51.0)).

The British Isles Network of Congenital Anomaly Registers (BINOCAR) reported an anomaly rate of 22.7 per 1,000 live and stillbirths for 2012[15]. When comparing these rates, it should be noted that differences in the recording methods of the audit and the Registers might contribute to the difference in rates. For example, the counts for the NPID audit include all pregnancies where any congenital anomaly was reported, irrespective of type, whereas the BINOCAR rate specifically excludes certain anomalies (see Appendix B of the BINOCAR report). The NPID data are likely to include only anomalies identified by the delivery unit prior to discharge from hospital, while the BINOCAR registers accept notifications of anomalies from a range of sources that may be identified some time after birth.

The CEMACH 2002-03 survey reported a prevalence of confirmed major anomalies of 41.8 per 1,000 live and stillbirths. While this data was collected on the same basis as for the NPID audit (restricted to anomalies diagnosed in the first 28 days after birth), the count in the CEMACH survey included only major anomalies in contrast to the NPID audit data which includes all reported anomalies.

The NICE guideline in place from February 2015 recommends that measurement of HbA_{1c} levels in the second and third trimesters of pregnancy is considered to assess the level of risk for the pregnancy, noting that the level of risk for the pregnancy increases with an HbA_{1c} level above 48 mmol/mol (6.5%).

Table 23 shows the relationship between certain adverse pregnancy outcomes and HbA_{1c} measurements in early and late pregnancy. For women with Type 1 diabetes, HbA_{1c} values were higher in both the first trimester and in late pregnancy where there was an adverse outcome. For women with Type 2 diabetes, HbA_{1c} values were higher in the first trimester where the outcome was a miscarriage or a fetal congenital anomaly, and higher in the third trimester for pregnancies with normally formed stillbirth or neonatal death outcomes.

Table 23: HbA_{1c} control at various stages in pregnancy and pregnancy outcomes in the audit, 2013 and 2014[a]

	Outcomes for all women with diabetes				Outcomes for women with Type 1 diabetes				Outcomes for women with Type 2 diabetes			
	Completed weeks of gestation											
	<13		24 and over		<13		24 and over		<13		24 and over	
Congenital anomaly	**n =177**				**n = 88**				**n=65**			
Mean HbA_{1c} (mmol/mol)	67.8		51.3		70.0		56.7		65.3		46.6	
Number of outcomes with HbA_{1c} recorded	136		101		73		51		46		40	
Result <48 mmol/mol (6.5%) number (per cent[b])	23	16.9	44	43.6	5	6.8	12	23.5	14	30.4	25	62.5
Miscarriage	**n=211**				**n=98**				**n=85**			
Mean HbA_{1c} (mmol/mol)	67.0				73.2				63.0			
Number of outcomes with HbA_{1c} recorded	174				83				69			
Result <48 mmol/mol (6.5%) number (per cent)	36	20.7			5	6.0			22	31.9		
Normally formed stillbirth or neonatal death[c]	**n=72**				**n=31**				**n=31**			
Mean HbA_{1c} (mmol/mol)	68.2		58.6		73.1		60.4		63.7		54.9	
Number of outcomes with HbA_{1c} recorded	41		44		20		22		15		17	
Result <48 mmol/mol (6.5%) number (per cent)	5	12.2	9	20.5	0	0	3	13.6	3	20.0	5	29.4
Normally formed and alive at 28 days	**n=3,767**				**n=1,774**				**n=1,559**			
Mean HbA_{1c} (mmol/mol)	60.1		47.7		63.3		51.1		56.6		44.2	
Number of outcomes with HbA_{1c} recorded	2,765		2,790		1,402		1,368		1,095		1,119	
Result <48 mmol/mol (6.5%) number (per cent)	680	24.6	1,564	56.1	220	15.7	574	42.0	372	34.0	784	70.1

[a] This table does not include data from pregnancies recorded in the NorDIP survey for 2013.

[b] Number of HbA_{1c} tests with a result below 48 mmol/mol (6.5%) as a proportion of all HbA_{1c} tests recorded for that period.

[c] Neonatal death is defined as a live birth where the baby was no longer alive 28 days after birth.

Logistic regression is a statistical method for calculating the probability of an event happening based on a group of defined explanatory variables. Within healthcare it is commonly used to calculate the probability of an outcome for a patient based on their personal characteristics such as age and where they live, and health characteristics such as use of medications, time to receiving

treatment and test results. The model calculates how well these characteristics (the explanatory variables) predict the likelihood of the event, both individually and as a group. The outputs from the model can be used to assess the importance of the variables in predicting the outcome. Even if some variables are significant, the model as a whole may not adequately model the probability of the outcome and be considered unfit for use.

Using the NPID audit data a logistic regression model was derived using data for pregnancies ending in 2013 and 2014. The model looked for factors associated with the adverse outcomes of neonatal death, stillbirth, or congenital anomaly. (There is some overlap of the categories included in adverse outcome, as a baby could be both a stillbirth and have a congenital anomaly). Explanatory variables considered for the model were age of mother at delivery, deprivation quintile based on residence, BMI, duration of diabetes, ethnicity, diabetes type, gestation at first contact, folic acid use prior to last menstrual period and first trimester HbA_{1c} measurement.

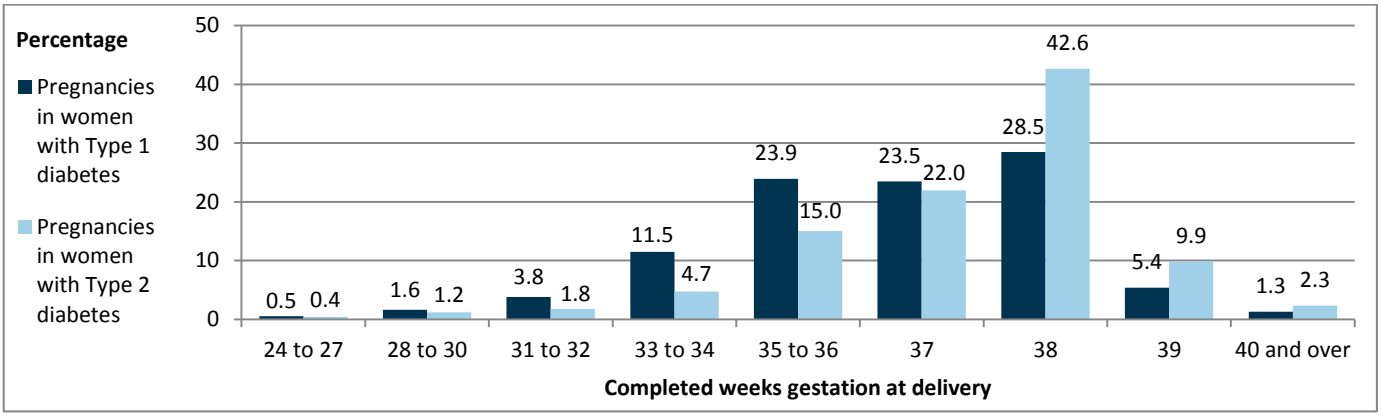
Approximately 3,500 records were used in the model, of which around 200 had an adverse outcome. Of all the variables only first trimester HbA_{1c} measurement and deprivation were significant, although the individual levels of deprivation (as split into five groups) were not. All of the other variables were found to not have a significant association with the adverse outcomes. With the two significant variables the model derived does not explain the variation in the outcome between women to a reasonable degree. Additional data may improve the quality of the model, both additional records and variables not currently available within the NPID audit data set, such as smoking status prior to pregnancy. As the NPID data set grows over time with additional years of data we will revisit the model.

Gestation length and preterm deliveries

The NICE guideline in place in 2014 recommended that pregnant women with diabetes who have a normally grown fetus should be offered elective birth through induction of labour, or by elective caesarean section if indicated, after 38 completed weeks. The updated NICE guideline (2015) recommends that pregnant women with diabetes and no other complications should be advised to have an elective birth by induction of labour or caesarean between 37^{+0} weeks and 38^{+6} weeks. In future audit periods the gestation at delivery is therefore likely to reduce slightly.

Figure 7 shows the distribution of gestation length for pregnancies ongoing at 24 completed weeks by the mother's diabetes type. The mean gestational age at delivery for singleton pregnancies ongoing at 24 weeks was 36.3 weeks for women with Type 1 diabetes and 37.1 weeks for women with Type 2 diabetes. Women with Type 2 diabetes were more likely to have pregnancies continuing at 38 weeks gestation (54.8 per cent) than women with Type 1 diabetes (35.1 per cent).

Figure 7: Gestation length of pregnancies by diabetes type for singleton live births and stillbirths in the audit, 2014



Babies delivered before 37 completed weeks (37^{+0}) are classed as preterm. The audit shows that a higher proportion (42.6 per cent) of babies born to women with Type 1 diabetes where the pregnancy was ongoing at 24 completed weeks were delivered preterm, compared with the proportion of preterm babies (23.6 per cent) born to women with Type 2 diabetes.

The NICE guideline in place from February 2015 recommends that measurement of HbA_{1c} levels in the second and third trimesters of pregnancy is considered to assess the level of risk for the pregnancy, noting that the level of risk for the pregnancy increases with an HbA_{1c} level above 48 mmol/mol (6.5%).

Figure 8 compares the proportion of preterm deliveries for women with HbA_{1c} measurements at or after 24 weeks gestation that were below or in excess of 48 mmol/mol. For both women with Type 1 and Type 2 diabetes, those with higher HbA_{1c} measurements in late pregnancy were more likely to have a preterm delivery.

Figure 8: Percentage of singleton pregnancies ongoing at 24 weeks gestation that were delivered preterm and maternal HbA_{1c} measurement at 24 weeks or later gestation, 2014

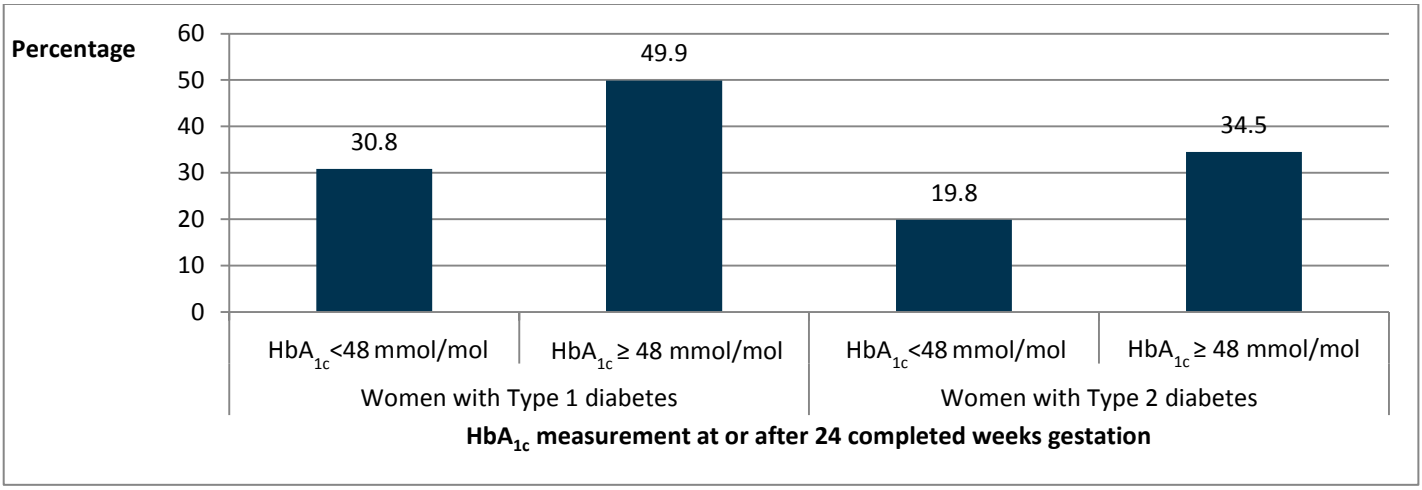


Table 24: Gestation at delivery by outcome, for singleton live and stillbirths after 24 completed weeks in the audit, 2014[a]

Completed weeks gestation	All births (n=2,364)			Births to women with Type 1 diabetes (n=1,101)			Births to women with Type 2 diabetes (n=996)		
	Alive at 28 days	Stillbirth	Neonatal death[b]	Alive at 28 days	Stillbirth	Neonatal death	Alive at 28 days	Stillbirth	Neonatal death
Less than 34	152	5	5	96	4	1	47	1	2
34 to 36	511	8	0	310	5	0	151	1	0
37	479	5	0	243	2	0	190	2	0
38	719	3	4	280	0	0	358	2	4
39 and over	222	1	2	67	0	1	115	1	0
Unknown	15	1	0	4	1	0	8	0	0
Total	2,098	23	11	1,000	12	2	869	7	6

[a] 232 Live births for which the 'Alive at 28 days' status was recorded as 'Not known' are excluded from this table.

[b] For data collected via the NPID online submission tool, 'neonatal death' is identified where the pregnancy outcome is a live birth and the response to 'Alive at 28 days' is 'No'. No tracing of baby NHS numbers to confirm neonatal deaths is carried out.

Babies

Table 25 shows the distribution of birthweights for singleton registrable births.

Table 25: Birthweight distribution for singleton babies by maternal diabetes type in the audit, 2014

	All babies (n=2,357)		Babies of mothers with Type 1 diabetes (n=1,093)		Babies of mothers with Type 2 diabetes (n=997)	
	Number	Percentage	Number	Percentage	Number	Percentage
Less than 2,500g	270	11.5	120	11.0	123	12.3
2,500g to 2,999g	423	17.9	152	13.9	212	21.3
3,000g to 3,499g	725	30.8	293	26.8	343	34.4
3,500g to 3,999g	603	25.6	329	30.1	207	20.8
4,000g to 4,499g	263	11.2	157	14.4	90	9.0
4,500g and over	73	3.1	42	3.8	22	2.2

Macrosomia (birthweight 4,000g and over) is a recognised complication for babies of women with diabetes. Of the 2,357 singleton babies where a birthweight was recorded, 336 (14.3 per cent) had a birthweight of 4,000g or over. For babies born to women with Type 1 diabetes, 18.2 per cent had a birthweight of 4,000g or over compared with 11.2 per cent of babies born to women with Type 2 diabetes.

The average (mean) birthweight for singleton babies born to women with Type 1 diabetes was 3,371g (standard deviation 730g) and 3,214g (standard deviation 660g) for babies born to women with Type 2 diabetes.

Birthweight centiles are used to adjust the babies' actual birthweight in line with maternal factors such as ethnicity, height and weight as well as gestational age at delivery. For example at 40 weeks, a 3,000g baby is small for a mother of average height and weight but may be normal for a shorter or lighter mother.

Birthweight centiles were calculated for all singleton babies where the gestation at delivery and birthweight was known, using the GROW centile tool[16].

Table 26: Birthweight centiles (adjusted for maternal characteristics and gestational length), 2014[a]

	All babies (n=2,340)		Babies of mothers with Type 1 diabetes (n=1,088)		Babies of mothers with Type 2 diabetes (n=988)	
	Number	Percentage	Number	Percentage	Number	Percentage
Birthweight ≥ 97.7th centile	495	21.2	326	30.0	130	13.2
Large for gestational age Birthweight ≥ 90th centile	802	34.3	504	46.3	228	23.1
Small for gestational age Birthweight < 10th centile	244	10.4	62	5.7	144	14.6

[a] Singleton live and stillbirths where the gestation length and the birthweight of the baby was recorded.

Just over one-third (34.3 per cent) of babies were at or above the 90th centile (Table 26) – for babies born to women with Type 1 diabetes, 46.3 per cent were at or above the 90th centile, while for babies born to women with Type 2 diabetes, 23.1 per cent were at or above the 90th centile.

The NICE guideline in place from February 2015 recommends that measurement of HbA1c levels in the second and third trimesters of pregnancy is considered to assess the level of risk for the pregnancy, noting that the level of risk for the pregnancy increases with an HbA1c level above 48 mmol/mol (6.5%).

Figure 9 shows the relationship between HbA_{1c} measurements in late pregnancy (at or after 24 completed weeks gestation) and the baby being large for gestational age. Both mothers with Type 1 and Type 2 diabetes that had an HbA_{1c} measurement in late pregnancy of 48 mmol/mol or more were more likely to have a baby that was large for gestational age.

Figure 9: Percentage of singleton babies that were large for gestational age at delivery and maternal HbA_{1c} measurement at 24 weeks or later gestation, 2014

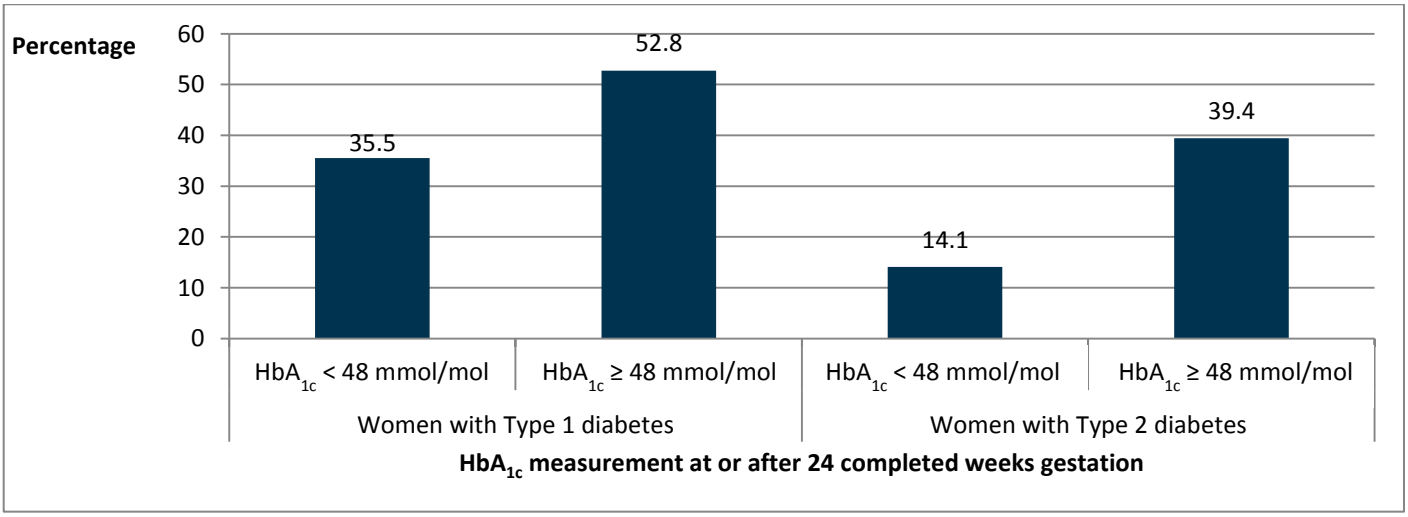
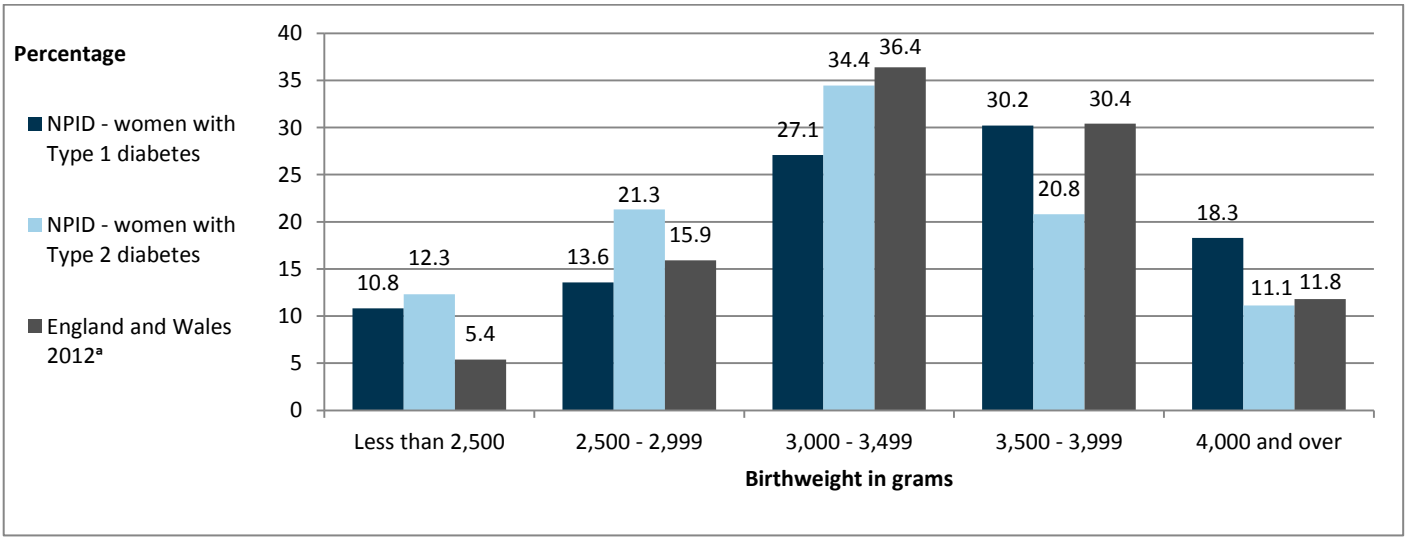


Figure 10: Comparison of birthweight (grams) for live births for singleton babies included in the audit in 2014 to birthweight of all live singleton births in England and Wales in 2012[a]



[a] Source: Office for National Statistics, Childhood, Infant and Perinatal Mortality in England and Wales, 2012[13]

Figure 10 compares the birthweights for singleton live births to women with diabetes in 2014 with birthweights for all singleton live births in England and Wales in 2012. When comparing the birthweights it may appear that babies born to women with diabetes (particularly those with Type 2 diabetes) do not tend to be larger. However it is important to bear in mind in this comparison that many babies born to women with diabetes will have been delivered at a lower gestational age – 41.4 per cent of singleton live births to women with Type 1 diabetes and 23.2 per cent of singleton

live births to women with Type 2 diabetes were preterm, compared with only 5.7 per cent of all singleton live births in England and Wales.

The NICE guideline recommends that 'Babies of women with diabetes should be kept with their mothers unless there is a clinical complication or there are abnormal clinical signs that warrant admission for intensive or special care.' Table 27 shows the type of neonatal care received by mother's diabetes type and by gestational age at delivery.

Table 27: Neonatal care by gestational age in the audit, 2014

	Gestational age in completed weeks								
	Less than 34 weeks		34-36 weeks		37 weeks and over		Total		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Mean gestational age
All babies									
Normal	24	12.6	271	45.5	1,297	80.9	1,592	66.6	37.4
Special care admission	76	39.8	251	42.2	250	15.6	577	24.1	35.8
Intensive care admission	91	47.6	73	12.3	57	3.6	221	9.2	33.6
Babies born to women with Type 1 diabetes									
Normal	10	8.8	156	43.6	488	75.3	654	58.4	37.2
Special care admission	45	39.5	155	43.3	137	21.1	337	30.1	35.7
Intensive care admission	59	51.8	47	13.1	23	3.5	129	11.5	33.2
Babies born to women with Type 2 diabetes									
Normal	13	22.4	89	50.0	645	84.4	747	74.7	37.5
Special care admission	18	31.0	67	37.6	88	11.5	173	17.3	36.2
Intensive care admission	27	46.6	22	12.4	31	4.1	80	8.0	34.3

Two-thirds (66.6 per cent) of babies received 'Normal' postnatal care. Babies born to women with Type 2 diabetes were more likely (74.7 per cent) to receive 'Normal' postnatal care than babies born to women with Type 1 diabetes (58.4 per cent). Four-fifths (80.9 percent) of babies born at 37 weeks or later received 'Normal' postnatal care. This is higher than the 54.9 per cent of babies in the CEMACH survey in 2002-03 that received 'Postnatal ward normal care with mother'. Only 15.6 per cent of babies delivered at 37 weeks or later were admitted to special care compared to 32.6 per cent in the CEMACH survey in 2002-03.

Discussion

Pregnancy in diabetes became a national priority in response to the deficiencies in care and outcomes identified in the CEMACH survey of diabetes and pregnancy in 2002-03[6], and has now been the subject of two cycles of NICE guidance (2008[3] and 2015[4]). The NPID audit measures pre-conception and pregnancy care for women with diabetes against the recommendations in the NICE guidelines. The audit is part of the National Diabetes Audit programme commissioned by HQIP and led by the HSCIC and a clinical advisory group, in collaboration with Diabetes UK and Public Health England.

The audit collected data on 2,553 pregnancies ending in 2014 submitted by 150 centres. These figures have increased significantly from those in the 2013 report, reflecting higher levels of participation by local teams. Of 167 consultant led maternity units identified in a 2013 Royal College of Obstetricians and Gynaecologists (RCOG) census[7], 82 per cent participated in the 2014 NPID audit (plus 6 units that did not take part in the RCOG survey).

Because of the longer reporting cycle for Hospital Episode Statistics (HES) data, analysis of HES data for pregnancies that ended in 2013 has been included in this report. Data on uncommon adverse outcomes in 2013 and 2014 have been combined for analysis in this report.

The 2013 NPID audit report is expected to have had limited direct impact on the outcomes for 2014, since it was published in October 2014, but taken together, the findings from 2013 and 2014 provide a strong baseline for future cycles.

The audit confirms the 2013 finding of a much higher proportion of pregnancies in women with Type 2 diabetes than in 2002-03, and demonstrates that this is the case across all regions. This appears to have strong demographic determinants with women with Type 2 diabetes being older, more likely to be overweight, live in an area with a higher deprivation score, and to be of Asian or Black origin.

The audit asks the questions:

- Were women adequately prepared for pregnancy?
- Were adverse maternal outcomes minimised?
- Were adverse fetal / infant outcomes minimised?

Were women adequately prepared for pregnancy?

Women were generally poorly prepared for pregnancy, whether this is measured based on folic acid use prior to pregnancy, HbA_{1c} levels in the first trimester, or avoidance of potentially harmful treatments such as statins, ACE inhibitors and Angiotensin Receptor Blockers.

Less than half of women were taking folic acid (41.9 per cent). Women with Type 1 diabetes were more likely to be taking folic acid (50.5 per cent, compared with 33.3 per cent of women with Type 2 diabetes) and to be taking the recommended higher dose of 5mg (44.9 per cent, compared with 23.7 per cent of women with Type 2 diabetes). This suggests that they were more likely to have had support for pregnancy preparation from someone with specific knowledge and training, or have been able to access this information better. By contrast, women with Type 2 diabetes may have accessed the specific advice needed to prepare for pregnancy less routinely. This may be related to the demographic differences for women with Type 2 diabetes described.

The audit findings reiterate the impact of pre-conception and first trimester glucose control on adverse outcomes – specifically where the outcome was a fetal congenital anomaly, first trimester

HbA_{1c} values were higher. During 2014, the NICE targets for pre-conception HbA_{1c} levels were reviewed, and the new guideline from February 2015 includes a less stringent target of 48 mmol/mol (previously 43 mmol/mol). This report presents 2014 data against the 43 mmol/mol target in place at the time, but also reviews the 2014 data against the new target. Despite reasonable success in having HbA_{1c} measured in the first trimester (75.1 per cent of pregnancies had a test recorded), the majority of women did not achieve good glucose control in early pregnancy. Even when compared against the new more generous NICE target, only 15.4 per cent of women with Type 1 diabetes and 35.8 per cent of women with Type 2 diabetes had a measurement below 48 mmol/mol. Ethnic minority groups and those living in areas with the highest deprivation scores were less likely to achieve good glucose control.

A significant proportion of women (10.5 per cent of women with Type 2 diabetes, 3.0 per cent of women with Type 1 diabetes) were taking potentially harmful treatments (statins, ACE inhibitors or Angiotensin Receptor Blockers) at the time of conception. The higher proportion of women with Type 2 diabetes taking these medications may reflect the older demographic of women with Type 2 diabetes in the audit.

These data suggest that, while women with Type 2 diabetes may have better glucose control in early pregnancy, they may not be accessing support for planning pregnancy and may have less awareness, engagement and accurate advice than women with Type 1 diabetes. In keeping with this, women with Type 2 diabetes tend to present to specialist diabetes antenatal clinics later than women with Type 1 diabetes (Figure 6) and this represents a missed opportunity to address pregnancy risks.

Better preparation for pregnancy requires the dual focus of better specialist support for women with Type 1 diabetes to achieve good glucose control, and better education and support for women with Type 2 diabetes about folic acid and potentially harmful treatments, as well as glucose control.

Were adverse maternal outcomes minimised?

New HES data in the 2014 report, relating to pregnancies in 2013, allow an estimate of the extent to which women experience hypoglycaemia in pregnancy. It is a concern that almost 1 in 10 women with Type 1 diabetes (9.3 per cent) experienced a hospital stay in which hypoglycaemia was recorded. The proportion of these stays in which hypoglycaemia was the main reason for admission is unclear, but in any case, this is likely to underestimate the extent of all significant hypoglycaemia and highlights the need to specifically address maternal hypoglycaemia risk.

Use of HES data has also allowed analysis of type of labour and delivery for women delivered in 2013. Some caution is required when comparing with 2002-03 data from the CEMACH report, as comparisons cannot be made separately for women with Type 1 and Type 2 diabetes, and differences in overall rates may be at least partly due to the increased proportion of women with Type 2 diabetes in the 2013 data. Bearing this in mind, comparing the NPID data with the CEMACH data shows a lower rate of spontaneous labour (13.6 per cent in 2013 compared with 18.0 per cent in 2002-03), and also a reduction in the emergency caesarean rate (30.0 per cent in 2013 compared with 37.6 per cent in 2002-03). While there is a downward trend in spontaneous labour in the general maternity population, we would also expect the spontaneous labour rate to be lower and the planned caesarean rate to be higher than in 2002-03, following the NICE recommendation in 2008 that women with diabetes with no other complications of pregnancy should be offered elective birth after 38 completed weeks.

Were adverse fetal / infant outcomes minimised?

Because of the small numbers of adverse outcomes (stillbirth, neonatal death and congenital anomaly) this report analyses data on adverse outcomes in 2013 and 2014. Rates of stillbirth (12.8 per 1000 live and stillbirths) neonatal death (7.6 per 1000 live births) and congenital anomaly (44.2 per 1000 live and stillbirths) remain high.

Women with diabetes are more at risk of macrosomia, and 14.3 per cent of singleton babies in the audit weighed over 4,000g at birth. More than one in three babies were large for gestational age (34.3 per cent) and this was more common in women with Type 1 diabetes (46.3 per cent compared with 23.1 per cent for women with Type 2 diabetes). High HbA_{1c} levels after 24 weeks gestation were associated with an increased risk of LGA babies (Figure 10) and also of preterm delivery (Figure 8). Once again, this highlights the risks associated with high HbA_{1c} in later pregnancy.

Conclusions

The second cycle of the NPID audit has built strongly on the foundations laid in 2013. The majority of units are now taking part and over its first two years a sound baseline has been established from well over 4,000 women with diabetes in 150 units distributed across England, Wales and the Isle of Man. This has given us a clearer picture than ever of the preparation that women with diabetes make for pregnancy, what happens during pregnancy and the outcomes. Huge credit must be given to local teams for the hard work and enthusiasm that has made this analysis possible.

The results however continue to show that women generally enter pregnancy poorly prepared and that outcomes have changed little since the CEMACH report from 2002-03. The 2013 and 2014 audits should act as a call to policy makers, commissioners, CCGs and LHBs, acute Trusts, and clinical teams to review the national and regional results. The results provide a starting place to identify what needs to change and work with women with diabetes to develop ways to make improvements, and then to test the success of these improvements in subsequent audit cycles.

Further information

This summary National Report is supported by the NPID Regional Analysis available from

www.hscic.gov.uk/pubs/npdaudit15

For more information on the NPID audit please visit the NPID webpage at

www.hscic.gov.uk/npid

For further information about this report, please contact The Health and Social Care Information Centre's Contact Centre on 0300 303 5678 or email enquiries@hscic.gov.uk

References

(All links last accessed 12 November 2015)

1. National Service Framework (NSF) for Diabetes
   https://www.gov.uk/government/publications/national-service-framework-diabetes

2. NHS Wales. National Service Framework for Diabetes in Wales
   http://www.wales.nhs.uk/documents/DiabetesNSF_eng.pdf

3. NICE Diabetes in Pregnancy: Management of diabetes and its complications from pre-conception to the post natal period
   https://www.nice.org.uk/guidance/cg63

4. NICE Diabetes in Pregnancy: Management of diabetes and its complications from pre-conception to the post natal period
   http://www.nice.org.uk/Guidance/NG3

5. NICE – Diabetes in Adults Quality Standard
   http://www.nice.org.uk/guidance/QS6

6. Confidential Enquiry into Maternal and Child Health: Pregnancy in Women with Type 1 and Type 2 diabetes in 2002-03, England Wales and Northern Ireland. London: CEMACH; 2005.
   http://www.hqip.org.uk/national-programmes/a-z-of-clinical-outcome-review-programmes/cmace-reports/

7. RCOG Census Report 2013
   https://www.rcog.org.uk/globalassets/documents/careers-and-training/census-workforce-planning/census-report-2013.pdf

8. NHS Maternity Statistics – England, 2013-14: NHS Maternity Statistics tables
   http://www.hscic.gov.uk/catalogue/PUB16725/nhs-mate-eng-2013-14-tab-v1.xlsx

9. NorDIP – Northern Diabetes in Pregnancy Survey
   http://www.nepho.org.uk/rmso/surveys/diabetes

10. Index of Multiple Deprivation
    https://data.gov.uk/dataset/index-of-multiple-deprivation

11. Worth R, Potter JM, Drury J, Fraser RB, Cullen DR. Glycosylated haemoglobin in normal pregnancy: a longitudinal study with two independent methods.
    Diabetologia 1985; 28:76-9

12. NHS Maternity Statistics – England, 2013-14 Summary Report
    http://www.hscic.gov.uk/catalogue/PUB16725/nhs-mate-eng-2013-14-summ-repo-rep.pdf

13. Office for National Statistics: Childhood, Infant and Perinatal Mortality in England and Wales, 2013
    http://www.ons.gov.uk/ons/rel/vsob1/child-mortality-statistics--childhood--infant-and-perinatal/2013/stb-child-mortality-stats-2013.html

14. Manktelow BM, Smith LK, Evans TA, Hyman_Taylor P, Kurinczuk JJ, Field DJ, Smith PW, Draper ES, on behalf of the MBRRACE-UK collaboration. Perinatal Mortality Surveillance Report UK Perinatal Deaths for births from January to December 2013. Leicester: The Infant Mortality and Morbidity Group, Department of Health Sciences, University of Leicester. 2015

https://www.npeu.ox.ac.uk/downloads/files/mbrrace-uk/reports/MBRRACE-UK%20Perinatal%20Surveillance%20Report%202013.pdf

15. British Isles Network of Congenital Anomaly Registers (BINOCAR), Congenital Anomaly Statistics, England and Wales
http://binocar.org/content/Annual%20report%202012_FINAL_nologo.pdf

16. GROW centile tool: Gardosi J, Francis A.
Customised Weight Centile Calculator. GROW v6.7.5.1 (UK), 2014. Gestation Network, www.gestation.net

17. Office for National Statistics: Gestation-specific Infant Mortality 2012

http://www.ons.gov.uk/ons/rel/child-health/gestation-specific-infant-mortality-in-england-and-wales/2012/stb-gestation-specific-infant-mortality--2012.html

Glossary

ACE inhibitor

Angiotensin-converting enzyme inhibitor; a class of drugs that reduce blood pressure by relaxing blood vessels

ARB

Angiotensin receptor blockers; a class of drugs that reduce blood pressure by widening blood vessels

Basal bolus insulin regimen

Any regimen involving a combination of background insulin either once or twice daily in combination with a short-acting insulin at meal times.

Birth weight centile

A measure of how a birth weight compares to the expected range of birth weights taking into account gestation, mother's height, weight and ethnicity, and the sex of the baby. For example, a birth weight at the 90th centile means that for every 100 babies born to a woman with similar characteristics at that gestation, 90 per cent would be expected to be lighter than this birth weight, and 10 per cent would be expected to be heavier.

Body Mass Index (BMI)

The body's weight in kilograms divided by the square of the height in metres, used in assessing whether a person is overweight or underweight

Booking appointment

Antenatal appointment usually at between 8 to 12 weeks gestation at which a number of medical tests are completed, and options for care during pregnancy and birth are discussed.

Caesarean section

Surgical abdominal delivery of a baby

CEMACH

Confidential Enquiry into Maternal and Child Health (2002-03, published 2005), a survey of pregnant women with diabetes in the UK.

Clinical audit

A way of measuring healthcare practice against national guidelines with the aim of improving the care provided by making recommendations for improvements.

Confidence interval

A range of values that assesses the level of uncertainty in an estimate that is caused by only obtaining values for a sample from the population. The 95 per cent confidence interval gives the range in which you would expect the true value to fall 95 times if 100 samples were selected.

Congenital anomaly/abnormality/malformation

A physical or biochemical malformation that develops during pregnancy and is present at birth

Congenital anomaly rate

Number of live births, stillbirths, miscarriages after 20 completed weeks and terminations with a congenital anomaly per 1,000 live and stillbirths.

Elective caesarean section

A planned caesarean section when a medical need for the operation becomes apparent during pregnancy or the mother requests the operation in advance

Emergency caesarean section

An unplanned caesarean when concerns for maternal and/or fetal wellbeing mean that the baby needs to be delivered as soon as possible

Folic acid

A water-soluble vitamin in the B-complex group that helps to prevent fetal neural tube defects when taken by the mother before becoming pregnant. A 5mg dose can be obtained on prescription, and a 400mcg dose can be obtained over the counter.

Gestation

The time from conception to birth, assessed by an ultrasound scan or measured from the first day of the last normal menstrual period if calculated prior to the earliest ultrasound scan

Glycaemic control

Control of blood glucose

HbA_{1c}

Glycosylated haemoglobin, measured in mmol/mol, reflects how well the blood glucose level has been controlled over the previous 2 – 3 months

Hypoglycaemia

An abnormally low level of blood glucose

Induction of labour

The process of attempting to start labour artificially. Methods of induction are using drugs that act like natural hormones to start labour, physical methods such as breaking waters or a combination of both drug and physical methods

Instrumental delivery

Assisted vaginal delivery of the baby using ventouse or forceps

Insulin pump therapy

A regime where short acting insulin is administered subcutaneously and continuously long term using an infusion device

Intensive care

Care provided for babies who are the most unwell or unstable and have the greatest needs in relation to staff skills and staff-to-patient ratios (Level 3) (British Association of Perinatal Medicine, 2011)

Logistic regression model

A statistical model used to estimate the probability of an outcome based on the values of one or more explanatory variables

Macrosomia

High birth weight (4,000g or more), a recognised complication for babies of women with diabetes.

Mean

The average value, sum of all values divided by the number of values

Metformin

An oral hypoglycaemic agent that decreases blood glucose levels

Miscarriage

Spontaneous ending of a pregnancy before 24 weeks of gestation

Mixed insulin or basal insulin only

Any regimen using biphasic insulins or background insulin exclusively (i.e. without additional meal time insulin)

MODY

Maturity onset diabetes of the young, caused by a single gene defect and associated with decreased insulin production and varying degrees of clinical severity.

National Diabetes Audit

A clinical audit of the effectiveness of diabetes healthcare against NICE Clinical Guidelines and NICE Quality Standards in England and Wales, that collects data from GP practices and specialist diabetes services.

Neonatal death

Death of a live born baby before 28 completed days after birth

Neonatal death rate

The number of neonatal deaths per 1000 live births

Neural tube defect

A major congenital anomaly caused by abnormal development of the neural tube, the structure present during early pregnancy which later gives rise to the central nervous system (brain and spinal cord)

NICE

The National Institute for Health and Clinical Excellence (NICE) is the independent regulatory body providing national guidance and advice to improve health and social care.

Normal care

Care provided for babies who themselves have no medical indication to be in an intensive care unit in hospital (None or Level 1) (British Association of Perinatal Medicine, 2001) and can therefore stay with their mother on the postnatal ward

Oral hypoglycaemic agents

Medicines taken by mouth that are used to help lower blood sugar levels in people with diabetes, which may be used alone or in combination with insulin.

Parity

The number of previous pregnancies where the woman has delivered one or more live or stillbirths

Preconception planning and care

Counselling and clinical management for women with diabetes, including ensuring near-normal glycaemic control before conception, commencing high dose folic acid, reviewing medication, screening for diabetes complications, and giving information about pregnancy risks, appropriate diet and lifestyle.

Preterm delivery

Delivery before 37 completed weeks' gestation (37^{+0} weeks)

Retinopathy

A condition related to diabetes where there is damage to small blood vessels that supply the eye, affecting sight.

Singleton pregnancy

A pregnancy with a single fetus/baby.

Special care

Care provided for babies who require additional care delivered by the neonatal service but do not require either intensive or high dependency care (Level 2) (British Association of Perinatal Medicine, 2011).

Spontaneous vaginal delivery

A baby delivered vaginally without instrumental assistance

Statins

A group of medicines that can help lower the level of cholesterol in the blood to help prevent heart disease.

Stillbirth

Legal definition from Section 41 of the Births and Deaths Registration Act 1953 as amended by the Stillbirth Definition Act 1992: a child that has issued forth from its mother after the 24th week of pregnancy and which did not at any time after being completely expelled from its mother breathe or show any other signs of life

Stillbirth rate

The number of stillbirths per 1000 total births (live births and stillbirths)

Trimester

One of the 3-month periods into which pregnancy is divided. The first trimester is 0-12 completed weeks of gestation. The second trimester is 13 – 28 completed weeks gestation, and the third trimester is 29 weeks of gestation until birth.

Type 1 diabetes

The person's insulin producing cells are permanently destroyed so no insulin is produced. The person needs regular insulin, given either by injection or an insulin pump.

Type 2 diabetes

The person's insulin producing cells produce too little, and/or the insulin produced is not effective (insulin resistance). The condition may be controlled by diet and exercise alone, or the person may also need diabetes medication or insulin.

Appendix 1: Characteristics of women included in the audit, 2014

		All pregnancies	Pregnancies in women with Type 1 diabetes	Pregnancies in women with Type 2 diabetes
All		2,553	1,193	1,069
Age (years)	15 to 19	47	43	3
	20 to 24	239	173	39
	25 to 29	619	382	188
	30 to 34	811	384	320
	35 to 39	598	167	361
	40 to 44	219	41	143
	45 to 49	17	3	12
	50 to 54	3	0	3
Type of diabetes	Type 1	1,193	1,193	
	Type 2	1,069		1,069
	MODY/Other	28		
	Not specified/not known[a]	263		
Body Mass index (kg/m^2)	<18.5	15	10	3
	18.5 - 24.9	695	487	126
	25 - 29.9	804	445	276
	30 - 34.9	511	165	287
	35 - 39.9	297	57	199
	40+	224	25	175
	Not known	7	4	3
Ethnic group	White	1,214	805	357
	Mixed	42	15	27
	Asian	321	41	269
	Black	99	17	80
	Other	38	18	20
	Not stated/Not known[a]	839	297	316
Index of multiple deprivation (IMD) quintile	5th quintile (most deprived)	623	271	334
	4th quintile	497	234	246
	3rd quintile	388	217	154
	2nd quintile	317	217	84
	1st quintile (least deprived)	249	182	54
	Not known[a]	479	72	197

[a] The 'Not known' categories in this table include those records where the diabetes type, ethnic group and IMD quintile are not available because the woman was not recorded in the NDA. This differs from the tables in the body of the report, in particular Table 5 where ethnicity 'Not stated/not known' includes only the records with ethnicity recorded as 'Not stated' or 'Not known' in the NDA.

Appendix 2: Confidence intervals

Surveys produce statistics that are estimates of the real figure for the whole population which would only be known if the entire population was surveyed. Therefore, estimates from sample surveys are always surrounded by a confidence interval which assesses the level of uncertainty caused by only surveying a sample. The 95 per cent confidence interval gives the range in which you would expect the true value to fall 95 times if 100 samples were selected.

Calculating Confidence Intervals

We have used the following calculation of a 95 per cent confidence interval (CI) for the estimate of a rate of events r:

$$r_{lower} = \frac{O}{n} \times \left(1 - \frac{1}{90} - \frac{z}{3\sqrt{O}}\right)^3$$

$$\mathbf{r_{upper}} = \frac{\mathbf{(O+1)}}{\mathbf{n}} \times \left(\mathbf{1} - \frac{\mathbf{1}}{\mathbf{9(O+1)}} + \frac{\mathbf{z}}{\mathbf{3\sqrt{(O+1)}}}\right)^{\mathbf{3}}$$

Where:

O is the number of observed events

n is the rate denominator (for example, for the stillbirth rate this is the number of live and stillbirths).

z is the 100(1-α/2)th percentile value from the Standard Normal distribution. For example for a 95 per cent confidence interval α = 0.05 and z = 1.96

The rate r and confidence interval (r_{lower}, r_{upper}) are then multiplied by 1,000 to give a rate per 1,000.

Appendix 3: Organisations submitting data to the audit

Organisations that submitted completed records to the audit for 2014 using the online submission tool – England

East Midlands	
Trust	**Submitting unit**
Chesterfield Royal Hospital NHS Foundation Trust	Chesterfield Royal Hospital
Derby Teaching Hospitals NHS Foundation Trust	Royal Derby Hospital
Kettering General Hospital NHS Foundation Trust	Kettering General Hospital
Northampton General Hospital NHS Trust	Northampton General Hospital
Nottingham University Hospitals NHS Trust	Nottingham University NHS Trust - City Campus
	Nottingham University NHS Trust - Queen's Medical Centre Campus
Sherwood Forest Hospitals NHS Foundation Trust	King's Mill Hospital
United Lincolnshire Hospitals NHS Trust	Lincoln County Hospital
	Pilgrim Hospital
University Hospitals Of Leicester NHS Trust	University Hospitals Of Leicester NHS Trust

East of England	
Trust	**Submitting unit**
Basildon and Thurrock University Hospitals NHS Foundation Trust	Basildon University Hospital
Bedford Hospital NHS Trust	Bedford Hospital
Cambridge University Hospitals NHS Foundation Trust	Rosie Hospital
Colchester Hospital University NHS Foundation Trust	Colchester General Hospital
East and North Hertfordshire NHS Trust	Lister Hospital
Hinchingbrooke Health Care NHS Trust	Hinchingbrooke Hospital
Ipswich Hospital NHS Trust	Ipswich Hospital NHS Trust
James Paget University Hospitals NHS Foundation Trust	James Paget University Hospital
Luton and Dunstable Hospital NHS Foundation Trust	Luton and Dunstable Hospital
Mid Essex Hospital Services NHS Trust	Broomfield Hospital
Norfolk and Norwich University Hospitals NHS Foundation Trust	Norfolk and Norwich University Hospital
Peterborough and Stamford Hospitals NHS Foundation Trust	Peterborough Maternity Unit
Southend University Hospital NHS Foundation Trust	Southend Hospital
Princess Alexandra Hospital NHS Trust	Princess Alexandra Hospital
West Hertfordshire Hospitals NHS Trust	Watford General Hospital
West Suffolk NHS Foundation Trust	West Suffolk Hospital

London	
Trust	**Submitting unit**
Barking, Havering and Redbridge University Hospitals NHS Trust	Queen's Hospital
Barts Health NHS Trust	Royal London Hospital
Chelsea and Westminster Hospital NHS Foundation Trust	Chelsea and Westminster Hospital
Croydon Health Services NHS Trust	Croydon University Hospital
Ealing Hospital NHS Trust	Ealing Hospital
Guy's and St Thomas' NHS Foundation Trust	Guy's And St Thomas' NHS Trust
Hillingdon Hospitals NHS Foundation Trust	Hillingdon Hospital
Imperial College Healthcare NHS Trust	St Mary's Hospital (HQ)
King's College Hospital NHS Foundation Trust	King's College Hospital (Denmark Hill)
Lewisham and Greenwich NHS Trust	Queen Elizabeth Hospital
	University Hospital Lewisham
North West London Hospitals NHS Trust	Northwick Park Hospital
Royal Free London NHS Foundation Trust	Barnet Hospital
	Royal Free Hospital
St George's University Hospitals NHS Foundation Trust	St George's Hospital (Tooting)
West Middlesex University Hospital NHS Trust	West Middlesex University Hospital
Whittington Hospital NHS Trust	Whittington Hospital

North West and the Isle of Man	
Trust	**Submitting unit**
Aintree University Hospital NHS Foundation Trust	University Hospital Aintree
Blackpool Teaching Hospitals NHS Foundation Trust	Blackpool Victoria Hospital
Bolton NHS Foundation Trust	Royal Bolton Hospital
Central Manchester University Hospitals NHS Foundation Trust	St Mary's Hospital
	Trafford General Hospital
Countess Of Chester Hospital NHS Foundation Trust	Countess of Chester Hospital (Maternity)
East Lancashire Hospitals NHS Trust	Blackburn Hospitals
	Burnley Hospitals
Lancashire Teaching Hospitals NHS Foundation Trust	Royal Preston Hospital
Liverpool Women's NHS Foundation Trust	Liverpool Women’s Hospital
Mid Cheshire Hospitals NHS Foundation Trust	Leighton Hospital
North Cumbria University Hospitals NHS Trust	Cumberland Infirmary
	West Cumberland Hospital
Pennine Acute Hospitals NHS Trust	Pennine Acute Hospitals NHS Trust
Salford Royal NHS Foundation Trust	Salford Royal
Southport and Ormskirk Hospital NHS Trust	Southport and Formby District General Hospital
St Helens and Knowsley Hospitals NHS Trust	Whiston Hospital
Stockport NHS Foundation Trust	Stockport NHS Foundation Trust
Tameside Hospital NHS Foundation Trust	Tameside General Hospital
University Hospital Of South Manchester NHS Foundation Trust	Wythenshawe Hospital
University Hospitals Of Morecambe Bay NHS Foundation Trust	Furness General Hospital
	Royal Lancaster Infirmary
Warrington and Halton Hospitals NHS Foundation Trust	Warrington Hospital
Wirral University Teaching Hospital NHS Foundation Trust	Arrowe Park Hospital
Wrightington, Wigan and Leigh NHS Foundation Trust	Royal Albert Edward Infirmary
Nobles (IOM) Hospital	Noble's Hospital

South East	
Trust	**Submitting unit**
Ashford and St Peter's Hospitals NHS Foundation Trust	St Peter's Hospital
Buckinghamshire Healthcare NHS Trust	Stoke Mandeville Hospital
Dartford and Gravesham NHS Trust	Darent Valley Hospital
East Sussex Healthcare NHS Trust	Conquest Hospital
Frimley Health NHS Foundation Trust	Frimley Park Hospital
Hampshire Hospitals NHS Foundation Trust	Basingstoke and North Hampshire Hospital
	Royal Hampshire County Hospital
Heatherwood and Wexham Park Hospitals NHS Foundation Trust	Wexham Park Hospital
Isle of Wight NHS Trust	Isle of Wight NHS - HQ
Maidstone and Tunbridge Wells NHS Trust	Tunbridge Wells Hospital
Medway NHS Foundation Trust	Medway Maritime Hospital
Milton Keynes Hospital NHS Foundation Trust	Milton Keynes Hospital
Oxford University Hospitals NHS Trust	John Radcliffe Hospital
Portsmouth Hospitals NHS Trust	Queen Alexandra Hospital
Royal Berkshire NHS Foundation Trust	Royal Berkshire Hospital
Royal Surrey County Hospital NHS Foundation Trust	Royal Surrey County Hospital
University Hospital Southampton NHS Foundation Trust	Princess Anne Hospital
Western Sussex Hospitals NHS Foundation Trust	St Richard's Hospital
	Worthing Hospital

South West	
Trust	**Submitting unit**
Dorset County Hospital NHS Foundation Trust	Dorset County Hospital
Gloucestershire Hospitals NHS Foundation Trust	Gloucestershire Royal Hospital
Great Western Hospitals NHS Foundation Trust	Great Western Hospital
North Bristol NHS Trust	Southmead Hospital
Northern Devon Healthcare NHS Trust	North Devon District Hospital
Poole Hospital NHS Foundation Trust	Poole General Hospital
Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	Royal Bournemouth General Hospital
Royal Cornwall Hospitals NHS Trust	Royal Cornwall Hospital (Treliske)
Royal Devon and Exeter NHS Foundation Trust	Royal Devon and Exeter Hospital (Wonford)
Royal United Hospitals Bath NHS Foundation Trust	Royal United Hospital
Salisbury NHS Foundation Trust	Salisbury District Hospital
South Devon Healthcare NHS Foundation Trust	Torbay Hospital
Taunton and Somerset NHS Foundation Trust	Musgrove Park Hospital
University Hospitals Bristol NHS Foundation Trust	St Michael's Hospital
Yeovil District Hospital NHS Foundation Trust	Yeovil District Hospital

West Midlands	
Trust	**Submitting unit**
Birmingham Women's NHS Foundation Trust	Birmingham Women's Hospital
Dudley Group NHS Foundation Trust	Russells Hall Hospital
Royal Wolverhampton Hospitals NHS Trust	New Cross Hospital
Sandwell and West Birmingham Hospitals NHS Trust	City Hospital
Shrewsbury and Telford Hospital NHS Trust	Royal Shrewsbury Hospital
South Warwickshire NHS Foundation Trust	Warwick Hospital
University Hospitals Coventry and Warwickshire NHS Trust	University Hospital (Coventry)
University Hospitals of North Midlands NHS Trust	North Staffs Maternity Hospital
Walsall Healthcare NHS Trust	Manor Hospital
Worcestershire Acute Hospitals NHS Trust	Alexandra Hospital
	Worcestershire Royal Hospital
Wye Valley NHS Trust	Hereford County Hospital

Yorkshire and the Humber	
Trust	**Submitting unit**
Airedale NHS Foundation Trust	Airedale General Hospital
Barnsley Hospital NHS Foundation Trust	Barnsley Hospital
Bradford Teaching Hospitals NHS Foundation Trust	Bradford Royal Infirmary
Calderdale and Huddersfield NHS Foundation Trust	Calderdale Royal Hospital
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	Doncaster Royal Infirmary
Harrogate and District NHS Foundation Trust	Harrogate and District NHS Foundation Trust
Hull and East Yorkshire Hospitals NHS Trust	Hull Royal Infirmary
Leeds Teaching Hospitals NHS Trust	St James's University Hospital
Mid Yorkshire Hospitals NHS Trust	Pinderfields General Hospital
Northern Lincolnshire and Goole Hospitals NHS Foundation Trust	Diana Princess of Wales Hospital
Rotherham NHS Foundation Trust	Rotherham District General Hospital
Sheffield Teaching Hospitals NHS Foundation Trust	Sheffield Teaching Hospitals
York Teaching Hospital NHS Foundation Trust	Scarborough General Hospital
	York Hospital

Organisations that submitted completed records to the audit for 2014 using the NPID online submission tool – Wales

Local Health Board	Submitting unit
Abertawe Bro Morgannwg University LHB	Neath Port Talbot Hospital
	Princess Of Wales Hospital
	Singleton Hospital
Aneurin Bevan University LHB	Nevill Hall Hospital
	Royal Gwent Hospital
Betsi Cadwaladr University LHB	Wrexham Maelor Hospital
	Ysbyty Glan Clwyd
Hywel Dda University LHB	Bronglais General Hospital
	West Wales General Hospital
	Withybush General Hospital

Organisations that provided data to the audit via the NorDIP survey

Trust	Submitting unit
City Hospitals Sunderland NHS Foundation Trust	Sunderland Royal Hospital
County Durham and Darlington NHS Foundation Trust	Darlington Memorial Hospital
	University Hospital of North Durham
Gateshead Health NHS Foundation Trust	Queen Elizabeth Hospital
North Tees and Hartlepool NHS Foundation Trust	University Hospital of Hartlepool
	University Hospital of North Tees
Northumbria Healthcare NHS Foundation Trust	Wansbeck General Hospital
	North Tyneside General Hospital
South Tees Hospitals NHS Foundation Trust	James Cook University Hospital
South Tyneside NHS Foundation Trust	South Tyneside District Hospital
Newcastle Upon Tyne Hospitals NHS Foundation Trust	Royal Victoria Infirmary

Appendix 4: NPID audit 2014 data collection form

National Pregnancy in Diabetes (NPID) Audit
Data Collection Form

For help completing this form, please refer to the guidance notes. If you have any questions, please contact the audit team at npid@hscic.gov.uk. Completed forms should be submitted via the HSCIC secure web portal at https://clinicalaudit.ic.nhs.uk/.

Please do not use this form for any purpose other than the NPID audit.

SECTION A: PARTICIPANT AND PRE-PREGNANCY DETAILS

NHS Number: ☐☐☐☐☐☐☐☐☐☐		Consent obtained: ☐
Height (cm): ☐☐☐	Weight (kg): ☐☐☐.☐	Date of birth: D D M M Y Y
First contact with specialist antenatal diabetes team after LMP: D D M M Y Y		
Estimated delivery date (earliest post 7-12/40 scan): D D M M Y Y		

Folic Acid, including dosage:
Please tick (✓) all that apply, including the relevant dose

Folic Acid prior to LMP:	☐	Dose:	400mcg ☐	5mg ☐
Folic Acid since LMP:	☐	Dose:	400mcg ☐	5mg ☐

Diabetes treatment regime at 1st day of LMP:
Please tick (✓) all that apply

Metformin	☐
Sulphonylurea or glitinide	☐
Gliptin	☐
GLP-1 analogue	☐
Basal Bolus Insulin Regimen	☐
Mixed Insulin or Basal insulin only	☐
Insulin pump therapy	☐
Pioglitazone	☐
Other	☐

ACE inhibitor/ARB at 1st day of LMP:
Please tick (✓) one box only

Not on ACE inhibitor/ARB	☐
On ACE inhibitor/ARB	☐
Not known	☐

Statins on 1st day of LMP:
Please tick (✓) one box only

Not on Statins	☐
On Statins	☐
Not known	☐

Treated hypertension prior to 1st day of LMP:
Please tick (✓) one box only

No known hypertension	☐
Treated hypertension	☐
Not known	☐

Ischaemic heart disease prior to 1st day of LMP:
Please tick (✓) one box only

No known IHD	☐
Known IHD	☐
Not known	☐

SECTION B: PREGNANCY DETAILS

First HbA1c in pregnancy (mmol/mol): ☐☐☐	Date of first HbA1c: D D M M Y Y
Last HbA1c in pregnancy (mmol/mol): ☐☐☐	Date of last HbA1c: D D M M Y Y

Retinal screening grade in first trimester:
Please tick (✓) all that apply. Both R and M code should be recorded.

R0	☐	R3A	☐
R1	☐	R3S	☐
R2	☐	M0	☐
R3	☐	M1	☐

Retinal screening grade in last trimester:
Please tick (✓) all that apply. Both R and M code should be recorded.

R0	☐	R3A	☐
R1	☐	R3S	☐
R2	☐	M0	☐
R3	☐	M1	☐

SECTION C: PREGNANCY OUTCOME

BABY 1

NHS Number: ☐☐☐☐☐☐☐☐☐☐ Date pregnancy ended: D D M M Y Y

Pregnancy outcome:
Please tick (✓) one box only

- Live birth ☐
- Stillbirth ☐
- Termination of Pregnancy ☐
- Miscarriage ☐

Congenital malformation (confirmed post-delivery, please refer to NPID guidance notes):
Please write below

Sex:
Please tick (✓) one box only

- Male ☐
- Female ☐
- Indeterminate ☐

Neonatal Care:
Please tick (✓) one box only

- Normal ☐
- Special Care Admission ☐
- Intensive Care Admission ☐

Weight (kg): ☐.☐☐☐

Baby alive at 28 days?
Yes ☐ No ☐ Not known ☐

BABY 2

NHS Number: ☐☐☐☐☐☐☐☐☐☐ Date pregnancy ended: D D M M Y Y

Pregnancy outcome:
Please tick (✓) one box only

- Live birth ☐
- Stillbirth ☐
- Termination of Pregnancy ☐
- Miscarriage ☐

Congenital malformation (confirmed post-delivery, please refer to NPID guidance notes):
Please write below

Sex:
Please tick (✓) one box only

- Male ☐
- Female ☐
- Indeterminate ☐

Neonatal Care:
Please tick (✓) one box only

- Normal ☐
- Special Care Admission ☐
- Intensive Care Admission ☐

Weight (kg): ☐.☐☐☐

Baby alive at 28 days?
Yes ☐ No ☐ Not known ☐

For further babies please use an additional form, remembering to include the mother's NHS number on each form.

FOR LOCAL USE ONLY

Form completed by: _____ Date: D D M M Y Y

Local Centre:

_____

Thank you for participating in the National Pregnancy in Diabetes (NPID) Audit.

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