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National Diabetes Inpatient Audit 2015

National Report

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The Healthcare Quality Improvement Partnership (HQIP) promotes quality in healthcare. HQIP holds commissioning and funding responsibility for the National Diabetes Inpatient Audit and other national clinical audits as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP).

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

Supported by:

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

We are delighted to present the National Diabetes Inpatient Audit (NaDIA) 2015 results for England and Wales and would again like to thank all the teams who have worked hard to contribute to this unique and valuable insight into the care of inpatients with diabetes. Including the pilot, this is the sixth year of NaDIA data collection and it is impressive that despite the enormous amount of work involved, the participation rate remains high demonstrating the value diabetes teams place in the data and their determination to improve inpatient diabetes care.

This report presents the 2015 results and analyses the changes in activity and outcomes over the last four contributory years (2010 to 2013). This year the number of patients in the audit exceeds 15,000; accounting for a record 16.8 per cent of occupied beds. In some sites this is nearing 40 per cent. This increase reflects the aging population and the increasing prevalence of diabetes in the community. Given the year upon year increase since the first audit and extrapolating forwards, the proportion of hospital inpatients with diabetes will almost certainly rise in coming years. As such, the data from these audits are important in planning services for the future.

Patient participation is also at an all-time high reaching just over 8,500; representing a record 56.0 per cent of all inpatients with diabetes. This is an impressive response rate given that up to 30 per cent of patients are estimated to be cognitively impaired and a significant number will have been too unwell to complete the questionnaire[1]. Sadly, patient experience has not improved and for meals has significantly worsened. The reason for the latter is unclear but should prompt investigation in individual Trusts where it has worsened.

Since the audit began there have been important improvements in medication errors and particularly insulin prescription errors. There has also been a very significant and appropriate reduction in the use of insulin infusions. This is welcome; however blood glucose control whilst on infusions remains unsatisfactory. There has also been a significant reduction in hypoglycaemic rates. However the improvements are small and hypoglycaemia remains far too frequent. Disappointingly, over the whole audit period there has been no change in rates of severe hypoglycaemia requiring injectable rescue treatment or in rates of diabetic ketoacidosis (DKA) occurring in hospital. These are serious, preventable and potentially life threatening conditions, most often related to insulin mismanagement. Further efforts must be made to prevent these severe harms including learning from those sites where rates are low.

Having seen a continuous increase in the number of hospitals with multi-disciplinary foot teams, it is disappointing to find that this year there has been a slight reversal in the trend, although it remains better than in the first NaDIA. On a positive note there has been an impressive fall in hospital acquired foot lesions to half of those seen in earlier audits. This is very good news as foot lesions are associated with great patient distress, risk of amputation, increased mortality and high cost.

Since the first NaDIA there has been a year on year increase in the number of patients appropriately referred to and visited by the inpatient diabetes teams. This year is no exception. Unfortunately, the increased workload is not matched by an increase in staffing levels. The percentage of sites without a dedicated diabetes inpatient specialist nurse remains at around 30 per cent and there are even more sites without a specialist dietitian than the first NaDIA.

[1] The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2013. p. 21 http://www.hscic.gov.uk/catalogue/PUB13662. Accessed 30 March 2016.

We would again like to thank diabetes teams for their hard work not only in undertaking these yearly audits but also in their dedication to improve inpatient diabetes care. They should feel pleased to know that their efforts have resulted in improvements in all areas of care since the first NaDIA but will be disappointed to know that this still does not extend to staffing levels. Greater investment into inpatient diabetes teams is needed to accelerate these improvements; this would be rewarded by better patient experience, reduced harm, reduced length of stay and reduced costs to the NHS. A worthwhile investment!

Gerry Rayman

National Clinical Lead for Inpatient Diabetes

Executive Summary

Background

The National Diabetes Inpatient Audit (NaDIA) is part of the National Diabetes Audit (NDA) programme and is commissioned by The Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP). 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).

The 2015 NaDIA report is the fifth annual snapshot audit of diabetes inpatient care in England and Wales. The audit is open to participation from hospitals with medical, surgical, gynaecology wards or intensive care units.

The audit sets out to measure the quality of diabetes care provided to people with diabetes while they are admitted to hospital, by answering the following questions:

- Did diabetes management minimise the risk of avoidable complications?
- Did harm result from the inpatient stay?
- Was patient experience of the inpatient stay favourable?
- Has the quality of care and patient feedback changed since NaDIA 2010, 2011, 2012 and 2013?

The report will be of interest to the public, especially to people with diabetes. Health planners and policy makers, as well as acute trusts, Clinical Commissioning Groups (CCGs), Local Health Boards (LHBs), Clinical Networks (CNs; formerly Strategic Clinical Networks or SCNs) and other providers and commissioners of specialist diabetes services will also make use of the information in this report.

The report presents findings from the 2015 audit – carried out on a day between 21 and 25 September 2015 – on patients admitted for at least 24 hours to specified types of inpatient ward. The audit collected data on characteristics of the hospital, patient clinical data and patient experience information using paper-based questionnaires.

Additional hospital episode outputs were acquired from the Hospital Episode Statistics (HES) database within the HSCIC, alongside data from the Patient Episode Database for Wales (PEDW).

Data collection

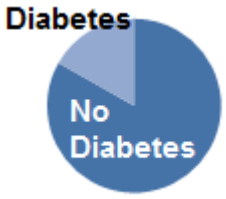
Each participating hospital identified all inpatients with diabetes and distributed questionnaires accordingly. Where the patient was able and willing a patient experience form was completed, as well as a bedside audit form which provided information on the patient's medical treatment taken from the patient's notes. The hospital team also completed a hospital characteristics questionnaire providing information on the hospital's resources and staffing structure.

Participation

Where at least one type of questionnaire (either patient experience, bedside audit or hospital characteristics) was returned, the hospital has been counted in the overall participation rate. 218 submitting organisations participated in the 2015 audit, assessing the clinical care of 15,229 inpatients with diabetes, and providing feedback on patient experience from 8,521 inpatients.135 Trusts in England and 6 Local Health Boards in Wales were represented.

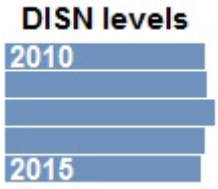
Key messages

Prevalence



1. People with diabetes occupied 17 per cent of acute hospital beds, an increase since the previous audit in 2013.

Diabetes teams and staffing

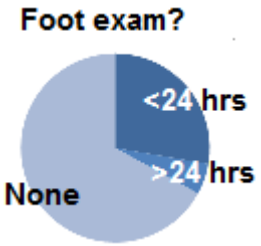


2. Inpatient referrals requiring the inpatient diabetes team have increased, although only two thirds of inpatients requiring referrals were seen.
3. Levels of referrals and patient contacts have increased amongst diabetes teams with no corresponding significant increase in staffing levels.
4. Almost one-third of sites in the audit have no diabetes inpatient specialist nurse (DISN) available, with no increase since audit inception.

Medication errors and patient harm

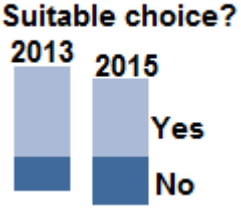
5. The proportion of inpatients experiencing medication errors has increased since the previous audit, reversing the earlier decreasing trend. This increase has largely been in medication management errors.
6. The rate of reportedly inappropriate insulin infusions amongst inpatients has not significantly decreased since the previous audit.
7. The incidence of both hypoglycaemic episodes requiring injectable treatment and diabetic ketoacidosis has not significantly reduced since the previous audit.

Foot care



8. 31 per cent of hospital sites do <u>not</u> have a multi-disciplinary diabetic foot care team, a significant improvement since audit inception (39 per cent in 2010).
9. Two thirds of inpatients did not have a specific diabetic foot risk examination.
10. Two fifths of inpatients admitted with active foot disease were not seen by a member of the multi-disciplinary diabetic foot care team within the first 24 hours of their hospital stay.

Patient experience



11. Inpatient satisfaction has reduced since the previous audit, with 34 per cent of patients reporting the hospital sometimes, rarely or never provided the right choice of food to manage their diabetes.

Recommendations

The following recommendations are made as a result of the findings of the audit.

Recommendations for health providers

Diabetes teams and staffing

- Hospitals should have a diabetes inpatient specialist team to respond to referrals and provide support and training to generalist staff. Weekend staffing levels should be reviewed by providers.

Medication errors and patient harm

- Hospitals should include severe hypoglycaemia and inpatient diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state (HHS) on their corporate risk register, record and review all events and share evidence of any novel systems that have successfully reduced the incidence of these severe harms.
- Clinicians should work with pharmacists to create safer prescribing systems, especially for insulin. Clinical pharmacist input for diabetic inpatients should be increased in order to reduce medication errors.

Foot care

- Hospitals should have a specialist multi-disciplinary foot care team led by podiatrists and supported by diabetes specialists, vascular surgeons, orthotists, microbiologists and orthopaedic surgeons.

Patient experience

- Hospitals should ensure that their nutrition policies are consistent with the needs of the one in six of their patients who have diabetes.

Recommendations for healthcare commissioners

- Commissioners should include, in their contracts with hospitals, requirements for the provision of the recommended standards of diabetes care[2].

[2] National Institute for Health and Care Excellence. Diabetes in adults quality standards http://guidance.nice.org.uk/QS6. Accessed 31 March 2016.

Key findings

Participation

NaDIA 2015 was carried out by diabetes teams in acute hospitals in England and Wales on a nominated day between 21 and 25 September 2015. A total of 206 sites took part, representing 135 Trusts in England and 6 Local Health Boards in Wales. These sites submitted bedside data from 15,229 inpatients with diabetes and feedback on patient experience from 8,521 inpatients that were capable and willing to complete questionnaires, representing a patient experience return rate of 56.0 per cent.

Prevalence

Characteristics of inpatients with diabetes

- 7.0 per cent had Type 1 diabetes and 28.6 per cent had insulin treated Type 2 diabetes.

Reason for admission

- In England 86.2 per cent of inpatients with diabetes had been admitted as an emergency, compared to 80.7 per cent of all patients in hospital, while in Wales 82.8 per cent of inpatients with diabetes had been admitted as an emergency, compared to 77.1 per cent of all patients in hospital.
- For 9.1 per cent of inpatients with diabetes, uncontrolled diabetes or a diabetic complication was the main reason for their admission to hospital, whereas 72.5 per cent of inpatients with diabetes were admitted for other medical reasons and 18.4 per cent were admitted for non-medical (i.e. surgical) reasons.
- Of inpatients admitted specifically for the management of their diabetes or a diabetic complication, 49.5 per cent were admitted for active diabetic foot disease.

Diabetes teams and staffing

Patient contact

- 35.5 per cent of inpatients with diabetes were seen by a member of the diabetes team.
- 83.7 per cent of sites reported an increase in referrals/patient contacts since the 2013 NaDIA.

Staffing

- 56.9 per cent of diabetes consultants' time was spent on the care of people with diabetes; but only 11.9 per cent of diabetes consultants' time was spent on inpatient care.
- 31.1 per cent of sites had no diabetes inpatient specialist nurses (DISNs) and 9.2 per cent of sites did not have any consultant time for diabetes inpatient care.
- 71.4 per cent of sites had no specialist inpatient dietetic staff time for people with diabetes.
- 31.0 per cent of sites did not have a multi-disciplinary foot care team.

Medication errors and patient harm

Medication errors

- 38.3 per cent of inpatient drug charts reviewed in the 2015 audit had at least one diabetes medication error in the previous 7 days; this is a significant increase from 37.0 per cent in 2013. The main increase is in medication management errors (insulin or oral hypoglycaemic agents).
- 22.2 per cent of inpatient drug charts had at least one prescription error in the previous 7 days, similar to the 21.9 per cent reported in 2013.
- 23.9 per cent of inpatient drug charts had at least one medication management error in the previous 7 days, a significant increase from 22.3 per cent in 2013.

Insulin infusions

- At the time of the audit, 9.0 per cent of inpatients with diabetes had been on an insulin infusion in the last 7 days, of which 8.3 per cent had been on an infusion for 7 days or longer.
- 6.2 per cent of insulin infusions were deemed inappropriately long.
- 1.8 per cent of inpatients on an infusion for longer than 24 hours had only between one and three glucose measurements during the last 24 hours on infusion (equivalent to less than one reading every eight hours), and 0.6 per cent of inpatients on an infusion did not have any glucose monitoring in that 24 hour period.

Hypoglycaemic episodes

- 21.8 per cent of inpatients had one or more hypoglycaemic episodes over the previous 7 days of their stay (blood glucose measurement of 3.9 mmol/L or less).
- 20.0 per cent of inpatients had one or more mild hypoglycaemic episodes (blood glucose measurement of 3.0 – 3.9 mmol/L).
- 9.8 per cent of inpatients had one or more severe hypoglycaemic episodes (blood glucose measurement of less than 3.0 mmol/L).
- Inpatients whose drug chart had at least one medication error were more than twice as likely to have one or more severe hypoglycaemic episodes (15.5 per cent) compared to inpatients whose drug chart had no medication errors (7.5 per cent).
- Inpatients with Type 1 diabetes were most likely to experience one or more mild hypoglycaemic episodes (42.5 per cent) or severe hypoglycaemic episodes (31.3 per cent).
- 2.1 per cent of inpatients had at least one hypoglycaemic episode that required injectable treatment.

DKA after admission

- 66 patients (0.4 per cent) were reported to have developed diabetic ketoacidosis (DKA) after their admission to hospital.

Foot care

Foot disease and foot risk assessment

- 12.8 per cent of inpatients with diabetes had a history of previous diabetic foot disease.
- Although 5.0 per cent of all inpatients with diabetes had been admitted because of their foot disease, 8.9 per cent of inpatients included in the audit had active diabetic foot disease on admission.
- 33.0 per cent of inpatients included in the 2015 audit had a specific diabetic foot risk examination during their hospital stay.
- Of the inpatients that were admitted with active diabetic foot disease, 59.5 per cent were seen by a member of the multi-disciplinary foot care team within 24 hours of admission.
- Of the inpatients that were admitted for active diabetic foot disease[3], 76.1 per cent were seen by a member of the multi-disciplinary foot care team within 24 hours of admission.
- 1.1 per cent of inpatients with diabetes developed a new foot lesion during their admission to hospital, a significant decrease from 2.2 per cent in 2010.

Patient experience

Patient satisfaction

- 23.4 per cent of inpatients who responded to the patient experience questionnaire in the 2015 audit said that they would have liked more involvement in the planning of their diabetes treatment; however, 12.5 per cent of inpatients stated that they would prefer to have been less involved in planning their treatment.
- 14.2 per cent of inpatients stated that they were not able to test their own blood glucose levels but would have liked to.
- 9.3 per cent of inpatients taking insulin for their diabetes reported that they were not permitted to self-administer insulin while in hospital but would have liked to do so.
- 34.1 per cent of patients reported that the hospital did not always provide the right choice of food to manage their diabetes.
- 84.1 per cent of inpatients were satisfied or very satisfied with the overall care of their diabetes while in hospital.

[3] Around half (50.6 per cent) of those admitted with active diabetic foot disease were admitted for active diabetic foot disease.

Introduction

The National Diabetes Inpatient Audit (NaDIA) is commissioned by the Healthcare Quality Improvement Partnership (HQIP) and delivered through the Health and Social Care Information Centre (HSCIC) working in collaboration with Diabetes UK.

The 2015 NaDIA was a snapshot audit of diabetes inpatient care in England and Wales. The audit set out to answer the following questions:

- Did diabetes management minimise the risk of avoidable complications?
- Did harm result from the inpatient stay?
- Was patient experience of the inpatient stay favourable?
- Has the quality of care and patient feedback changed since NaDIA 2010[4], 2011[5], 2012[6] and 2013[7]?

The NaDIA has been developed to support organisations implementing the National Service Framework (NSF) for Diabetes[8], National Service Framework (NSF) for Diabetes in Wales[9] and the National Institute for Health and Care Excellence (NICE) Quality Standards for Diabetes[10].

Participation in the NaDIA enables organisations to measure progress towards implementing national standards established in the NICE published Quality Standards for diabetes care for adults and measures for inpatient care[11] which states:

“People with diabetes admitted to hospital are cared for by appropriately trained staff, provided with access to a specialist diabetes team, and given the choice of self-monitoring and managing their own insulin.”

This report provides the 2015 audit national findings for England and Wales, and where possible compares to the 2010, 2011, 2012 and 2013 audit findings. There was no audit collection or report in 2014, so 2014 data is not available. It is supported by the hospital level analysis, which provides results at individual site level and can be downloaded from the audit website at:

http://www.hscic.gov.uk/catalogue/PUB20206

Please note that the 2010 data in this report represents England only, as sites from Wales did not participate in the 2010 NaDIA.

[4] NHS Diabetes. National Diabetes Inpatient Audit 2010. www.yhpho.org.uk/resource/view.aspx?RID=106455. Accessed 30 March 2016.
[5] The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2011. http://www.hscic.gov.uk/catalogue/PUB06279. Accessed 30 March 2016.
[6] The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2012. http://www.hscic.gov.uk/catalogue/PUB10506. Accessed 30 March 2016.
[7] The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2013. http://www.hscic.gov.uk/catalogue/PUB13662. Accessed 30 March 2016.
[8] Department of Health. National Service Framework for diabetes standardshttps://www.gov.uk/government/publications/national-service-framework-diabetes. Accessed 31 March 2016.
[9] NHS Wales. National Service Framework for Diabetes in Waleshttp://www.wales.nhs.uk/documents/DiabetesNSF_eng.pdf. Accessed 31 March 2016.
[10] National Institute for Health and Care Excellence. Diabetes in adults quality standards http://guidance.nice.org.uk/QS6. Accessed 31 March 2016.
[11] Ibid.

Methodology

The National Diabetes Inpatient Audit 2015 was carried out by hospital teams in England and Wales on a nominated day between 21 and 25 September 2015. The audit collected data on characteristics of the hospital including staffing structures, patient clinical data and patient experience information, using paper-based questionnaires.

Each participating hospital identified all inpatients with diabetes and distributed questionnaires accordingly. Where the patient was able and willing a patient experience form was completed, as well as a bedside audit form which provided information on the patient's medical treatment taken from the patient's notes. The hospital team also completed a hospital characteristics questionnaire providing information on the hospital's resources and staffing structure. Sample copies of the 2015 questionnaires can be found on the HSCIC website:

www.hscic.gov.uk/diabetesinpatientaudit

A patient was included in the inpatient audit if they had been admitted to a bed for 24 hours or more. Patients on an Obstetric or Paediatric ward were excluded from this audit. Mental Health wards were also excluded due to the high prevalence of long stay patients. Other exclusions included:

- Patients who were hyperglycaemic but not yet formally diagnosed with diabetes
- Accident and Emergency
- Day case ward
- Day surgery unit patients
- Observation ward (if patients had been admitted for less than 24 hours)
- Surgical short stay unit (if patients had been admitted for less than 24 hours)
- Palliative care centres
- Community Hospitals.

Once all questionnaires were returned the data was collated and cleaned to provide the analysis for this report.

Where at least one type of questionnaire (either patient experience, bedside audit or hospital characteristics) was returned, the hospital has been counted in the overall participation rate. Hospital characteristics questionnaires were completed either at hospital level or at site level (i.e. where a number of hospitals were aggregated together); therefore, prevalence rates are based on the number of participating sites rather than individual hospitals.

Hospital episode outputs were acquired from the Hospital Episode Statistics (HES) database within the HSCIC, alongside data from the Patient Episode Database for Wales (PEDW). Where possible, comparisons have been made between inpatients with diabetes and all inpatients within English and Welsh hospitals. At the time of preparing this analysis, HES data for September 2015 was not available, so a comparison with HES data from September 2014 was made. PEDW data for September 2015 was available, so a 2015 comparison was possible.

All percentages, charts and tables in this report relate to all inpatients in England and Wales, unless otherwise stated. Where the data for inpatients has been compared to hospital episode data that was collected separately for England (HES) and Wales (PEDW), the inpatient data has been analysed at country level to allow these comparisons to be made.

This differs from previous NaDIA annual reports that presented separate analysis for England and for Wales. The comparatives for 2011 and 2012 in this report will therefore differ from the figures published previously for those periods. Hospitals from Wales did not participate in the 2010 NaDIA.

Summary data by country for England and Wales is included in the 2015 Hospital Level Analysis available from:

http://www.hscic.gov.uk/pubs/nadia2015

Appendix 1 explains the testing mechanism used within this report.

Appendix 2 explains the ‘all recorded data’ method used within this report.

Audit Findings

Participation

The 2015 audit had participation from 218 submitting organisations assessing the clinical care of 15,229 inpatients with diabetes, representing 135 Trusts in England and 6 Local Health Boards in Wales.

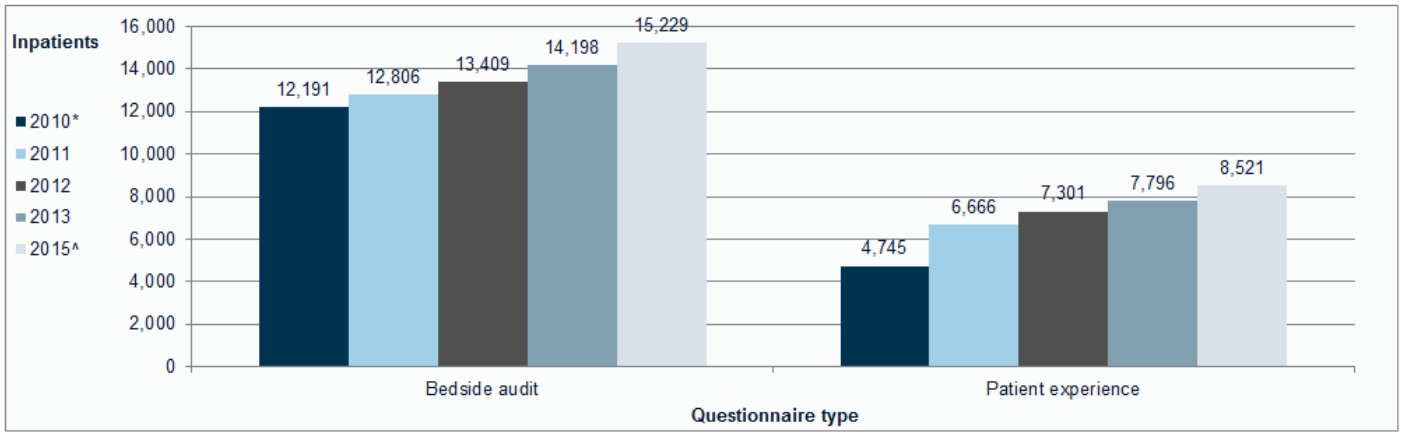
Table 1: NaDIA organisational participation, England and Wales, 2010 – 2013, 2015^

	Number of submitting organisations	Trusts (LHBs in Wales)
2015 England†	200	135
2015 Wales	18	6
2015 Grand Total†	218	141
2013	233	
2012	235	
2011	230	
2010*	169	

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
†Revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016 from 141 to 135 (England) and from 147 to 141 (Grand total).

In England and Wales, 206 sites[12] (representing 135 Trusts in England and 6 Local Health Boards in Wales) took part in the 2015 audit, which resulted in bedside data from 15,229 inpatients with diabetes (compared to 14,198 inpatients in 2013).

Chart 1: Number of NaDIA questionnaires returned, England and Wales, 2010 – 2013, 2015



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.

Audit findings: NaDIA participation

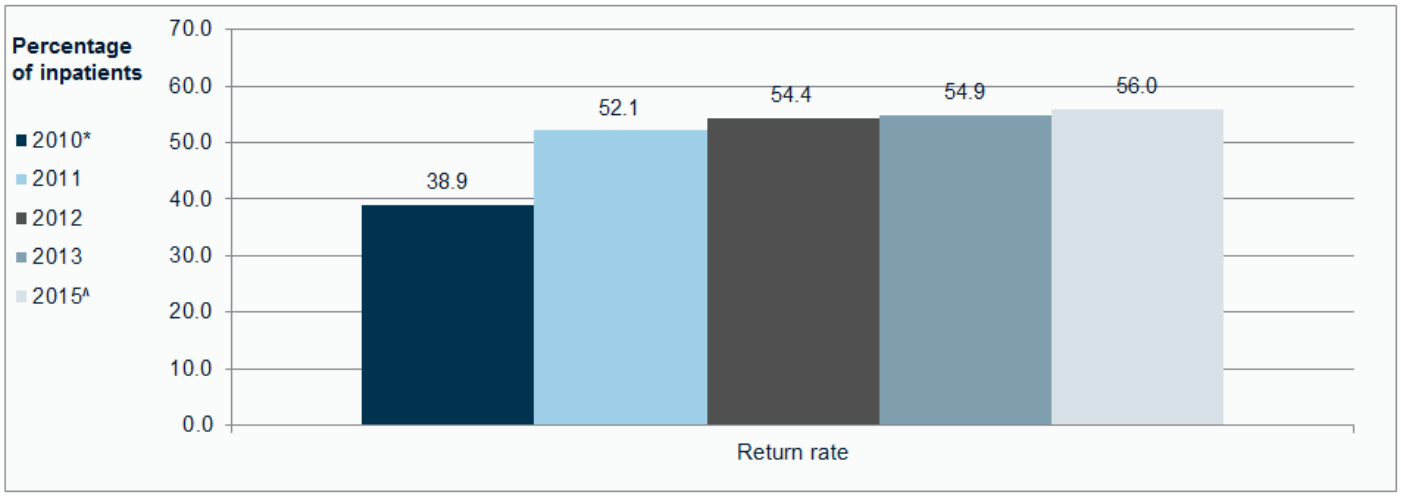
TRENDS SINCE 2013

- The number of bedside audit returns has **increased** by 7 per cent.
- The number of patient experience returns has **increased** by 9 per cent.

[12] The number of sites is less than the number of submitting organisations as some hospitals chose to have their data aggregated up to site/Trust level.

Of those capable and willing, 8,521 inpatients with diabetes (compared to 7,796 in 2013) each completed a patient experience questionnaire, which represented a patient experience return rate of 56.0 per cent (compared to 54.9 per cent in 2013). The increase in response rate between 2013 and 2015 was not statistically significant, though there has been a significant increase of 17 percentage points since 2010.

Chart 2: Patient experience return rate, England and Wales, 2010 – 2013, 2015†

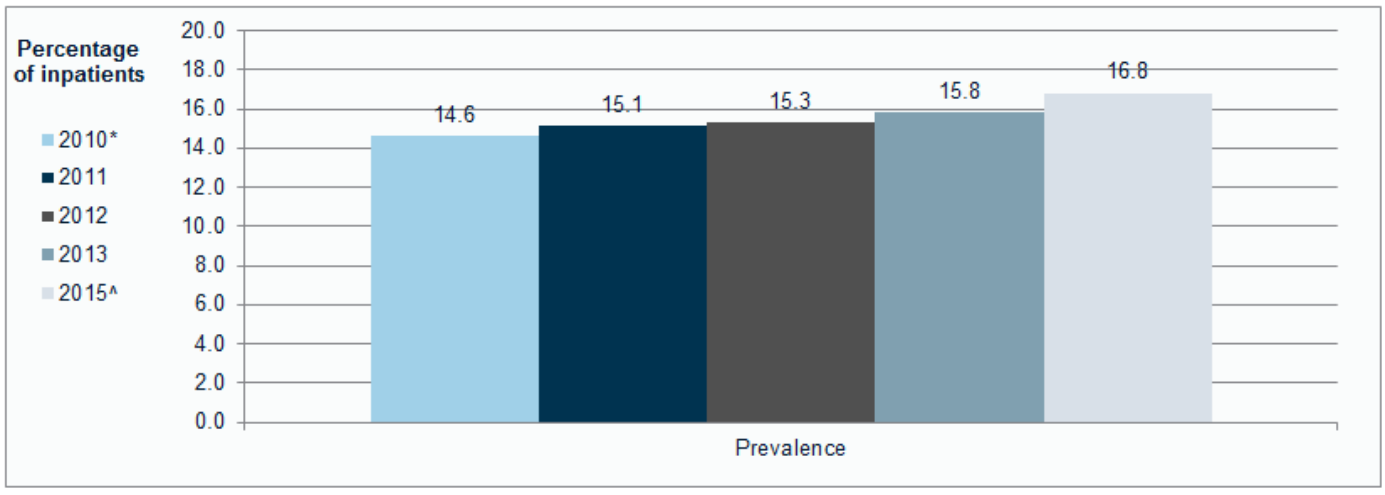


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values (p <0.05).

Of the 8,521 patient experience forms in 2015, 8,456 were matched to a corresponding bedside audit form. These were used in the patient experience analysis and the remaining 65 non-matching patient experience forms were excluded from the analysis.

In 2015, inpatients with diabetes represented 16.8 per cent of occupied beds at the time of the audit (compared to 15.8 per cent in 2013, a statistically significant increase).

Chart 3: National prevalence of diabetes in inpatients, England and Wales, 2010 – 2013, 2015†



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is a statistically significant difference between the 2013 and 2015 values: 15.8% vs 16.8% (p <0.05).

Prevalence at site level ranged from 4.0 per cent to 37.5 per cent, with a median of 16.8 per cent. The interquartile range is from 14.5 to 19.6 per cent.

Chart 4: Prevalence of diabetes at site level, bar chart, England and Wales, 2015

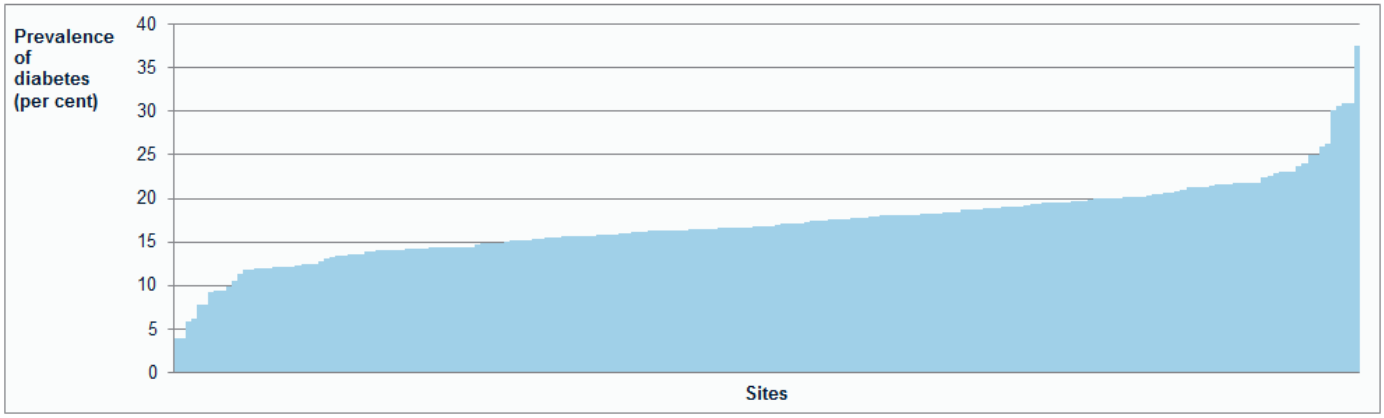
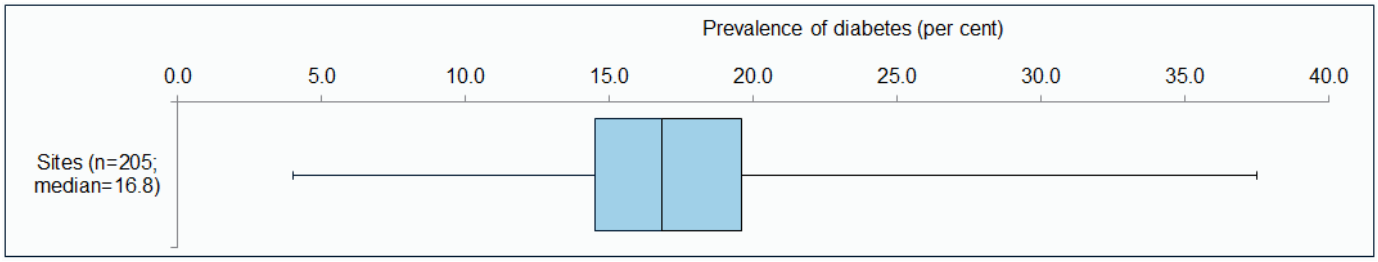
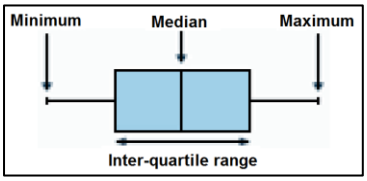


Chart 5: Prevalence of diabetes at site level, box and whisker plot, England and Wales, 2015





Audit finding: Diabetes prevalence

TRENDS SINCE 2013

- The prevalence of diabetes amongst hospital inpatients has **increased** from 16 per cent to 17 per cent.

TRENDS SINCE 2010

- The prevalence of diabetes amongst hospital inpatients has **increased** every year since audit inception, from 14.6 per cent to 16.8 per cent.

Characteristics of inpatients with diabetes

Since inception, NaDIA has looked at the characteristics of inpatients with diabetes and compared them to the characteristics of hospital inpatients as a whole. This year there is less focus on this aspect of the audit, although all inpatient characteristics breakdowns are included in the Supporting Data.

Type of diabetes

Of the inpatients with diabetes included in the audit, 91.2 per cent had Type 2 diabetes. Table 2 shows that the majority of inpatients had Type 2 diabetes not treated[13] with insulin. There was a statistically significant increase in the proportion of inpatients with Type 2 non-insulin treated diabetes, with a corresponding decrease in Type 2 insulin treated diabetes.

Table 2: Percentage of inpatients by diabetes type, England and Wales, 2010 – 2013, 2015‡

Diabetes type	Percentage of inpatients									
	2010*		2011		2012		2013		2015^	
	Number	%	Number	%	Number	%	Number	%	Number	%
Type 1	832	7.0	842	6.7	862	6.6	925	6.6	1,026	7.0
Type 2 (insulin treated)‡	3,673	30.9	4,284	34.1	4,559	34.8	4,806	**34.4**	4,187	**28.6**
Type 2 (non-insulin treated)‡	5,414	45.5	4,957	39.4	5,174	39.5	5,453	39.1	6,362	43.4
Type 2 (diet only)	1,982	16.7	2,334	18.6	2,317	17.7	2,575	**18.4**	2,816	**19.2**
Other†	N/A	N/A	153	1.2	191	1.5	204	**1.5**	258	**1.8**

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† 'Other' diabetes type group was added for the 2011 audit. Differences in percentages between 2010 and later audit years may be a result of the addition of the "Other" group.
‡ Statistically significant difference between the two **bolded** values ($p < 0.05$).

Table 3 below shows that the prevalence of Type 1 diabetes is lower amongst hospital inpatients with diabetes than in the population of people with diabetes as a whole.

Table 3: Percentage of inpatients by diabetes type in NaDIA* and NDA^, England and Wales, 2015 and 2014-15†

Diabetes type	Percentage of people with diabetes	
	NaDIA*	NDA^
Type 1†	**7.0**	**8.6**
Type 2 and Other†	**93.0**	**91.4**

* Inpatients with diabetes (the NaDIA 2015 cohort).
^ All people with diabetes (source: National Diabetes Audit (NDA) 2014-15 report: http://www.hscic.gov.uk/catalogue/PUB19900)
† Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant ($p < 0.05$).

Audit findings: Diabetes type

TRENDS SINCE 2013

- The proportion of NaDIA inpatients with Type 2 non-insulin treated diabetes has **increased** from 39 per cent to 43 per cent.
- The proportion of NaDIA inpatients with Type 2 insulin treated diabetes has **decreased** from 34 per cent to 29 per cent.

[13] Type 2 diabetes not requiring insulin for day to day management i.e. Type 2 (non-insulin treated) or Type 2 (diet only).

Reason for and type of admission

Table 4 shows that 86.2 per cent of inpatients with diabetes in England were admitted to hospital as an emergency compared to 81.1 per cent of all patients in hospital[14]. In Wales, 82.8 per cent of inpatients with diabetes were admitted to hospital as an emergency compared to 77.1 per cent of all patients in hospital[15]. This suggests that people with diabetes are more likely to be admitted as an emergency compared to all inpatients in hospital.

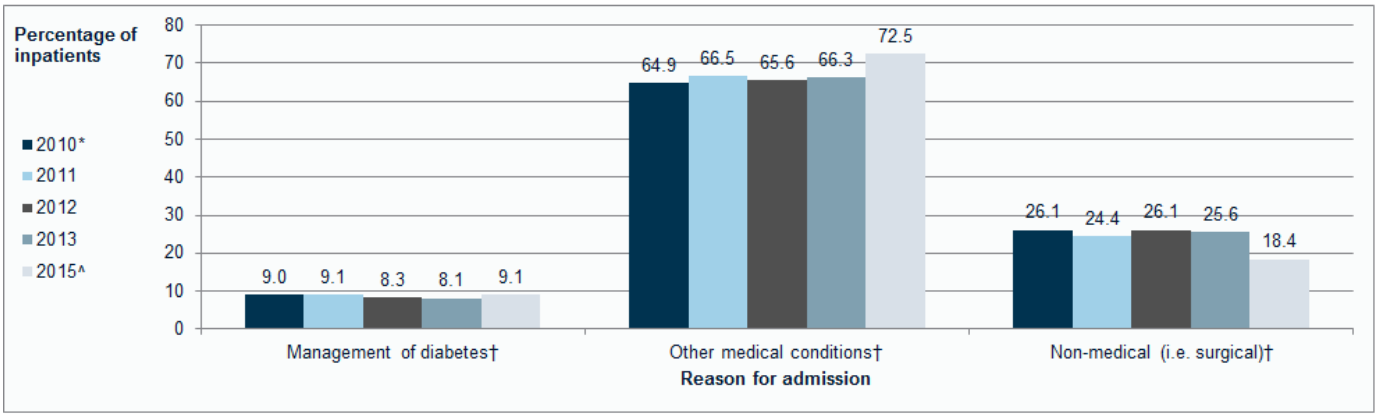
Table 4: Percentage of inpatients by admission type and main reason for admission, England and Wales, 2015

Admission	England		Wales	
	Inpatients with diabetes	All inpatients†	Inpatients with diabetes	All inpatients‡
Emergency*	86.2	81.1	82.8	77.1
Elective*	8.8	18.9	9.8	22.9
Medical	81.9	63.1	78.0	62.5
Surgical	18.1	36.9	22.0	37.5

* For inpatients with diabetes, percentages for Emergency and Elective do not add up to 100 per cent because the audit question includes a "transfer from another hospital" response, which is not included in this table.
† Source: Hospital Episode Statistics (HES) 22-26 September 2014, Health and Social Care Information Centre, figures exclude day cases.
‡ Source: Patient Episode Database for Wales (PEDW) 21-26 September 2015, NHS Wales Informatics Service.

Chart 6 shows a time series comparison of the main reason for admission to hospital. 9.1 per cent of inpatients were admitted to hospital specifically for the management of diabetes or a diabetes complication. A further 72.5 per cent were admitted for other medical reasons (e.g. respiratory, care of the elderly, gastroenterology) and 18.4 per cent were admitted for non-medical (i.e. surgical) reasons. Since 2013, admissions for both management of diabetes (8.1 per cent to 9.1 per cent) and other medical conditions (66.3 per cent to 72.5 per cent) have risen significantly, with a corresponding decrease in surgical admissions (25.6 per cent to 18.4 per cent).

Chart 6: Percentage of inpatients by main reason for admission, England and Wales, 2010 – 2013, 2015†

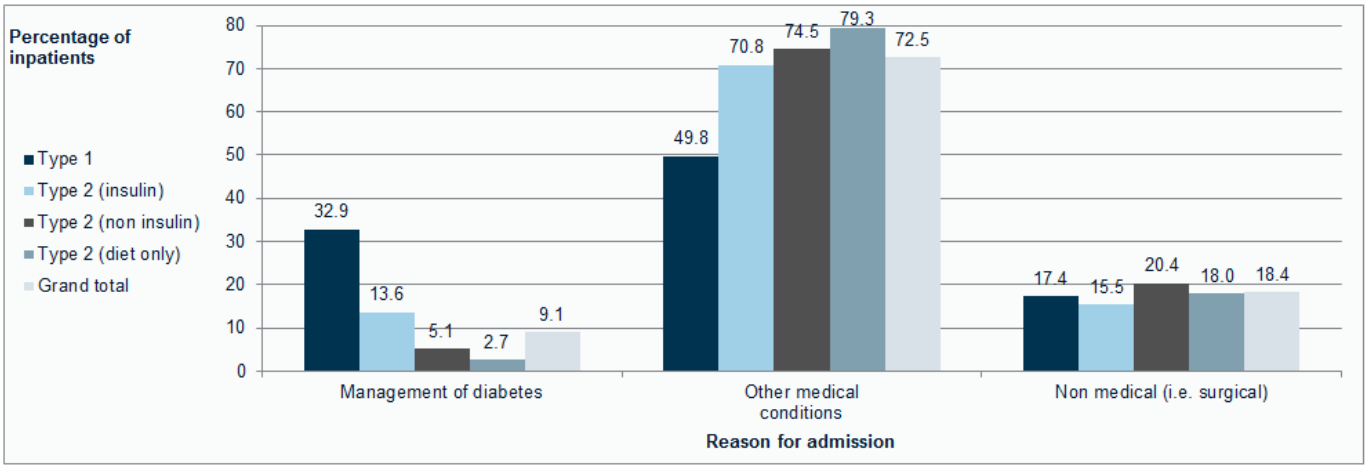


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

[14] Source: Hospital Episode Statistics (HES) 22-26 September 2014, Health and Social Care Information Centre, figures exclude day cases.
[15] Source: Patient Episode Database for Wales (PEDW) 21-26 September 2015, NHS Wales Informatics Service.

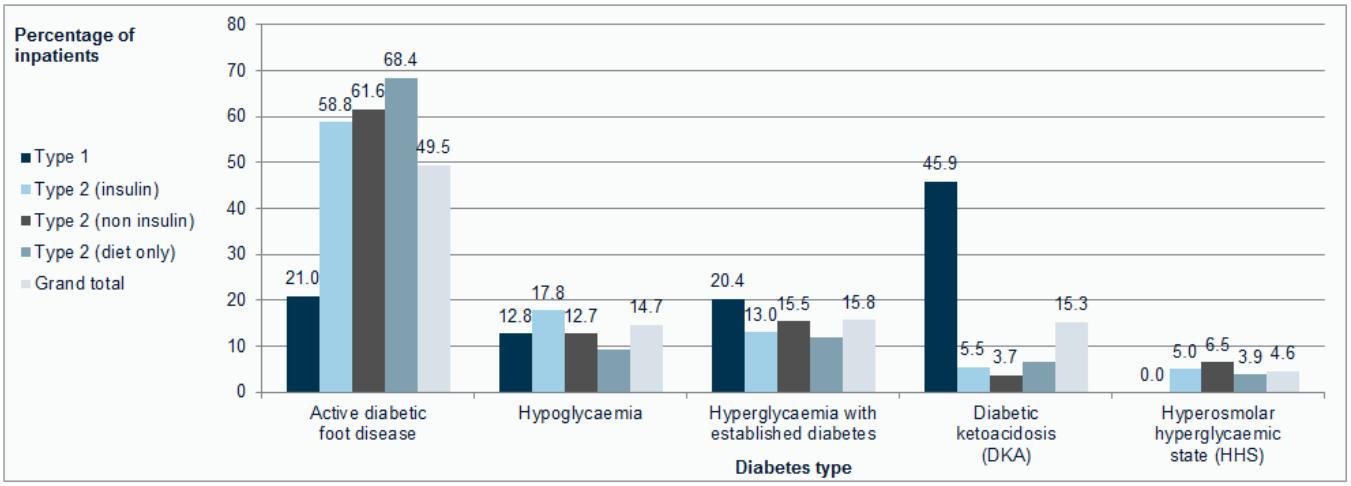
Chart 7 shows that inpatients with Type 1 diabetes (32.9 per cent) were significantly more likely to be admitted for the management of their diabetes or diabetes complications than inpatients with Type 2 diabetes treated with insulin (13.6 per cent) or any other diabetes type.

Chart 7: Percentage of inpatients by main reason for admission and diabetes type, England and Wales, 2015



Of the inpatients that were admitted specifically for the management of diabetes or a diabetes complication, the highest proportion (49.5 per cent) were admitted for active foot disease; this equates to 4.5 per cent of all inpatients included in the audit. A breakdown by diabetes type is shown in Chart 8. It is important to note that, although active diabetic foot disease was the most common reason for admission overall, diabetic ketoacidosis (DKA) predominated for patients with Type 1 diabetes (45.9 per cent).

Chart 8: Percentage of inpatients admitted for management of diabetes or a diabetes complication by diabetes type, England and Wales, 2015



Audit findings: Admissions

2015 FINDINGS

- Inpatients with diabetes are **more likely** to have been admitted as an emergency compared to all inpatients in hospital.
- Inpatients with Type 1 diabetes are **more likely** to be admitted for the management of their diabetes or diabetes complication than inpatients with other diabetes types (33 per cent compared to between 3 and 14 per cent).
- Where the inpatient was admitted for the management of diabetes or a diabetes complication, **almost half** (49 per cent) were admitted for active foot disease, although diabetic ketoacidosis (DKA) predominated for inpatients with Type 1 diabetes (46 per cent).

TRENDS SINCE 2013

- Admissions for the management of diabetes have **increased** (from 8 per cent to 9 per cent)
- Admissions for other medical conditions have **increased** (from 66 per cent to 73 per cent)
- Surgical admissions have **decreased** (from 26 per cent to 18 per cent).

Further information about characteristics of inpatients with diabetes can be found in the Supporting Data. The following charts and tables are included:

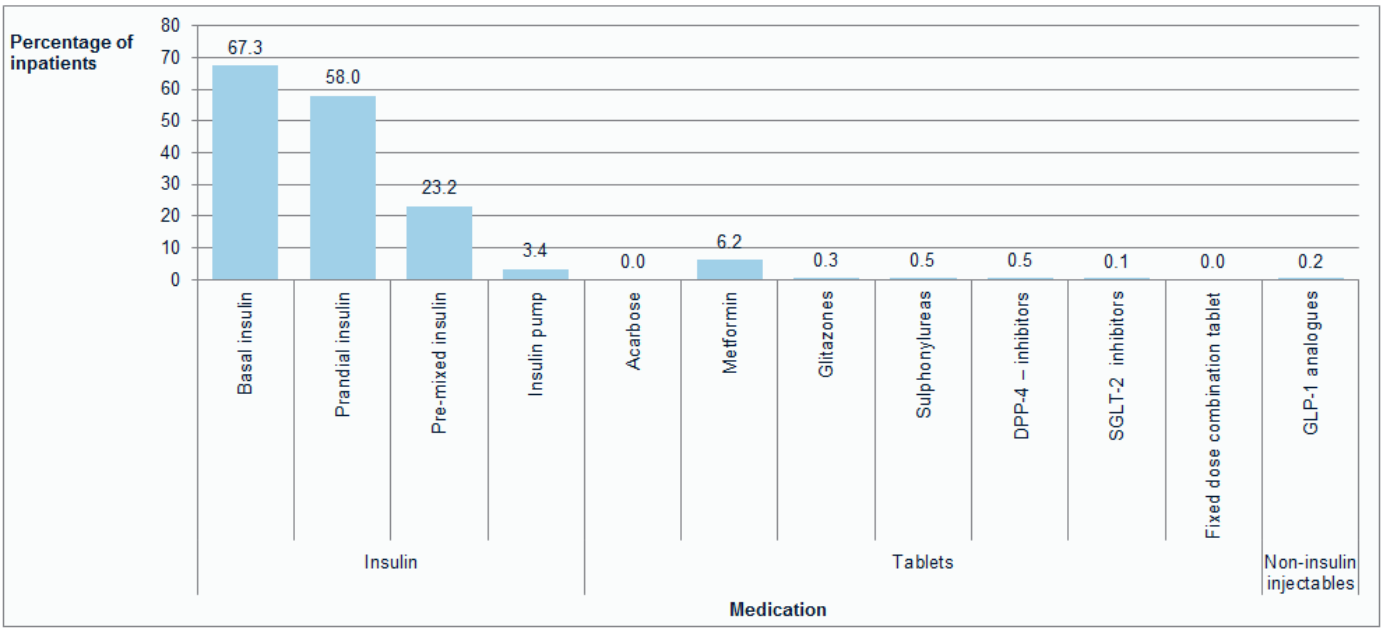
- Table 5: Percentage of inpatients diagnosed with diabetes for 15 years or longer by diabetes type, England and Wales, 2013, 2015
- Table 6: Ages of diabetes inpatients and all inpatients, England and Wales, 2015
- Chart 9: Age and sex distribution of inpatients with diabetes, England and Wales, 2015
- Table 7: Ethnic group of inpatients with diabetes, England and Wales, 2015
- Chart 10: Ethnic group of inpatients with diabetes, by diabetes type, England and Wales, 2015
- Chart 11: Diabetes type of inpatients with diabetes, by ethnic group, England and Wales, 2015
- Table 8: Percentage of inpatients by specialty of consultant, England and Wales, 2015 (with Chart)
- Chart 12: Prevalence of renal replacement therapy, England and Wales, 2010 – 2013, 2015
- Chart 13: Percentage of inpatients that had a history of foot disease, England and Wales, 2010 – 2013, 2015
- Chart 14: Percentage of inpatients having enteral feeding, England and Wales, 2015
- Chart 15: Percentage of inpatients where main reason for admission is 'Management of diabetes' by diabetes type, England and Wales, 2010 – 2013, 2015
- Chart 16: Percentage of inpatients admitted for management of diabetes or a diabetes complication by audit year, England and Wales, 2010 - 2013, 2015

Diabetes treatment regimen on admission

For the first time, data has been collected on the medication that formed part of the patient's diabetes treatment regimen on admission. Results have been reported separately for inpatients with Type 1 diabetes, Type 2 insulin treated diabetes and Type 2 non-insulin treated diabetes.

Insulin treatments predominate for Type 1 inpatients, with basal insulin (67.3 per cent) and prandial insulin (58.0 per cent) having the highest proportions, followed by pre-mixed insulin (23.2 per cent). Usage of insulin pumps is relatively rare at 3.4 per cent. Metformin (6.2 per cent) is the only non-insulin treatment with an incidence greater than 1 per cent. Of the three largest types of medication, the most popular combinations were basal insulin and prandial insulin (56.4 per cent), pre-mixed insulin only (21.7 per cent) and basal insulin only (9.7 per cent) (see Table 9 in the Supporting Data).

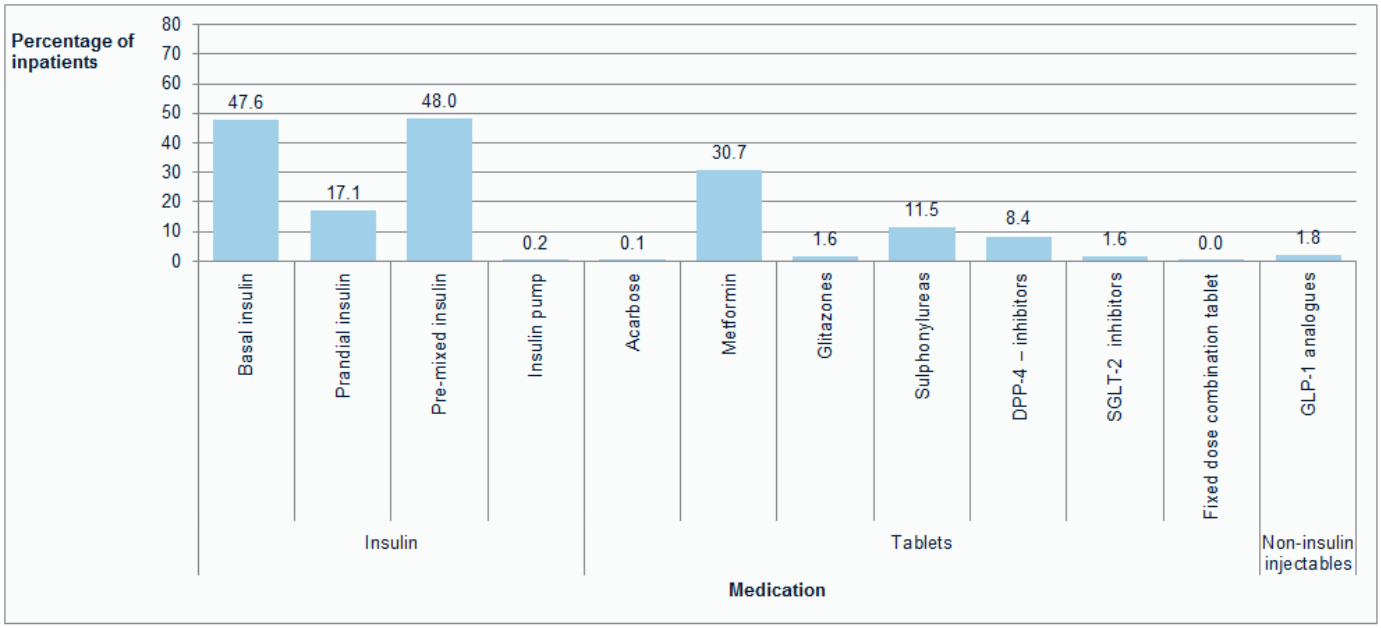
Chart 17: Medication that formed part of Type 1 inpatients' diabetes treatment regimen on admission, England and Wales, 2015[†]



[†] Inpatients may be using more than one type of medication on admission (e.g. basal insulin and prandial insulin).

For inpatients with Type 2 insulin treated diabetes, pre-mixed insulin (48.0 per cent) and basal insulin (47.6 per cent) are the most common insulin types, followed by prandial insulin (17.1 per cent). Only 0.2 per cent used an insulin pump. Metformin (30.7 per cent) has the highest prevalence amongst the tablet treatments, followed by Sulphonylureas (11.5 per cent) and DPP-4 inhibitors (8.4 per cent). Of the three largest types of insulin medication, the most popular combinations were pre-mixed insulin only (47.1 per cent), basal insulin only (31.7 per cent) and basal insulin and prandial insulin (15.3 per cent) (see Table 10 in the Supporting Data).

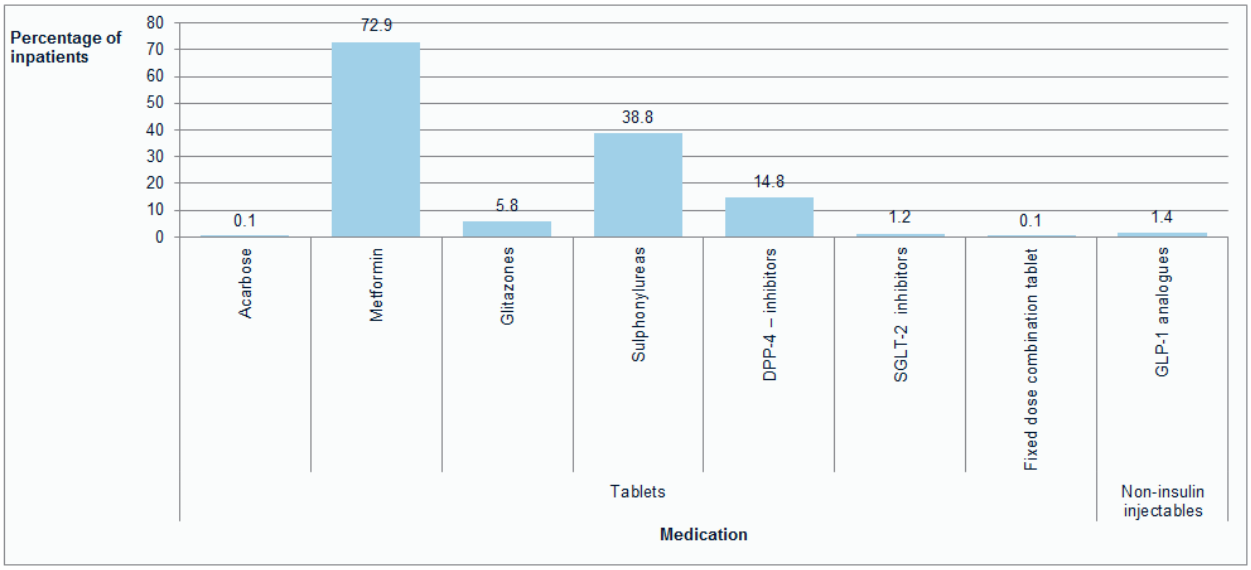
Chart 18: Medication that formed part of Type 2 insulin treated inpatients' diabetes treatment regimen on admission, England and Wales, 2015†



† Inpatients may be using more than one type of medication on admission (e.g. basal insulin and prandial insulin).

For inpatients with Type 2 non-insulin treated diabetes, Metformin (72.9 per cent) is by far the most prevalent treatment, followed by Sulphonylureas (38.8 per cent) and DPP-4 inhibitors (14.8 per cent). Of the three largest medication types, the most popular combinations are Metformin only (47.1 per cent), Metformin and Sulphonylureas (17.6 per cent) and Sulphonylureas only (15.2 per cent) (see Table 11 in the Supporting Data).

Chart 19: Medication that formed part of Type 2 non-insulin treated inpatients' diabetes treatment regimen on admission, England and Wales, 2015†



† Inpatients may be using more than one type of medication on admission (e.g. Metformin and Sulphonylureas).

Meeting the audit standards

This section of the report provides evidence against the National Service Framework (NSF) for Diabetes Standard 8, and the National Service Framework (NSF) for Diabetes (Wales) Standard 8, which outline the requirement for all patients with diabetes admitted to hospital to receive effective care for their diabetes and be involved in decisions on the management of their diabetes. It also provides information for NSF Standards 10, 11 and 12 which aim to "minimise the impact of long term complications of diabetes by early detection and effective treatment"[16] [17].

The NICE Quality Standards for diabetes[18] are also supported by the audit, in particular Quality Statement 12 which states:

"People with diabetes admitted to hospital are cared for by appropriately trained staff, provided with access to a specialist diabetes team, and given the choice of self-monitoring and managing their own insulin."

Initiatives introduced with the aim of improving quality of care

Hospital staff were asked to provide information on whether particular initiatives in diabetes care had been introduced in their hospital since the NaDIA began. Chart 20 in the Supporting Data shows the percentage of sites that had introduced each initiative listed.

Hospital staff were asked whether their hospital had electronic patient records, electronic prescribing and remote glucose monitoring. Table 12 shows the proportion of hospitals that responded to these new questions that had introduced each of these technologies. The 2015 data shows that there has been as increase in the proportion of sites using these technologies since 2013, with a rise of 5 to 6 percentage points for each technology where sites have returned 'yes'.

Table 12: Percentage of sites with electronic records and monitoring, England and Wales, 2013, 2015†

Percentage of sites with:	Yes		No		Partial	
	2013	2015^	2013	2015^	2013	2015^
Electronic patient record	25.1	30.4	44.8	42.2	30.0	27.5
Electronic prescribing	16.1	22.4	71.7	64.4	12.2	13.2
Remote blood glucose monitoring	33.0	39.6	56.2	50.0	10.8	10.4

^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values (p <0.05).

Audit findings: Initiatives introduced to improve quality of care

TRENDS SINCE 2013

- For each of the three initiatives assessed (electronic patient record, electronic prescribing and remote blood glucose monitoring), usage has **increased** by 5 to 6 per percentage points across hospital sites (not statistically significant).

[16] Department of Health. National Service Framework for diabetes standards https://www.gov.uk/government/publications/national-service-framework-diabetes. Accessed 31 March 2016.
[17] NHS Wales. National Service Framework for Diabetes in Wales www.wales.nhs.uk/documents/DiabetesNSF_eng.pdf. Accessed 31 March 2016.
[18] National Institute for Health and Care Excellence. Diabetes in adults quality standards http://guidance.nice.org.uk/QS6. Accessed 31 March 2016.

Did diabetes management minimise the risk of avoidable complications?

'Did diabetes management minimise the risk of avoidable complications?' is the first of four key questions posed by the audit (see Introduction on page 14). To help answer this question, the audit collected information on the structure of staff available to provide care for people with diabetes while in hospital, alongside information on care initiatives, processes and outcomes. This section will also address part of the fourth audit question: Has the quality of care changed since NaDIA 2010, 2011, 2012 and 2013?

Diabetes specialist team

The audit shows that 56.9 per cent of diabetes consultants' working time was spent on the care of people with diabetes, with 11.9 per cent of the consultants' total working time being spent on inpatient care. Due to changes to the guidance in the Hospital Characteristics questionnaire[19], results from previous audits have not been included because direct comparisons may be misleading.

Table 13: Percentage of total diabetes consultants' working time spent on diabetes care, England and Wales, 2015

Type of care	Percentage of total diabetes consultants' working time
Inpatient	11.9
Outpatient	31.6
General admin/ Meetings	10.0
Strategic innovation/management*	3.3
Grand total	56.9

* Strategic innovation/management related to inpatient care only.

For the first time, information on the amount of administration and management time has been captured separately. Table 14 provides the average amount of time per week that staff teams worked in the inpatient and outpatient settings providing care for people with diabetes. As above, changes to the guidance in the Hospital Characteristics questionnaire mean that historic comparisons cannot be made.

Table 15 shows that 31.1 per cent of sites did not have any diabetes inpatient specialist nurses (DISNs) and 9.2 per cent did not have any consultant time for diabetes inpatient care.

The majority of sites (71.4 per cent) stated that they did not have any specialist dietitian time for inpatient care for people with diabetes.

[19] Changes include the addition of two new categories ('General admin/ Meetings' and 'Strategic innovation/ management re inpatient care') which previously may have been split between the inpatient and outpatient categories.

Table 14: Average staffing for care of people with diabetes, England and Wales, 2015

Profession	Type of care	Hours per week per 100 beds	Time per week per inpatient with diabetes	
			Minutes	Hours†
Diabetes inpatient specialist nurse (DISN)	Inpatient	8.3	29.7	0.50
	Outpatient	1.1	3.8	0.06
	General admin/ Meetings	1.1	3.8	0.06
	Strategic innovation/management*	0.6	2.1	0.03
Diabetes specialist nurse (DSN)	Inpatient	2.9	10.4	0.17
	Outpatient	14.1	50.3	0.84
	General admin/ Meetings	2.5	9.0	0.15
	Strategic innovation/management*	0.6	2.2	0.04
Any diabetes specialist nurse (DISN and DSN)	Inpatient	11.2	40.1	0.67
	Outpatient	15.1	54.1	0.90
	General admin/ Meetings	3.6	12.7	0.21
	Strategic innovation/management*	1.2	4.3	0.07
Consultant	Inpatient	3.2	11.4	0.19
	Outpatient	8.4	30.1	0.50
	General admin/ Meetings	2.7	9.5	0.16
	Strategic innovation/management*	0.9	3.2	0.05
Podiatrist	Inpatient	1.8	6.4	0.11
	Outpatient	6.6	23.8	0.40
	General admin/ Meetings	0.6	2.1	0.03
	Strategic innovation/management*	0.2	0.7	0.01
Specialist dietitian	Inpatient	0.5	1.7	0.03
	Outpatient	5.5	19.9	0.33
	General admin/ Meetings	0.9	3.1	0.05
	Strategic innovation/management*	0.2	0.7	0.01
Non-specialist dietitian	Inpatient	1.3	4.5	0.08
	Outpatient	0.4	1.6	0.03
	General admin/ Meetings	0.1	0.4	0.01
	Strategic innovation/management*	0.0	0.1	0.00
Any dietitian	Inpatient	1.7	6.3	0.10
	Outpatient	6.0	21.5	0.36
	General admin/ Meetings	1.0	3.4	0.06
	Strategic innovation/management*	0.2	0.8	0.01
Specialist pharmacist	Inpatient	0.6	2.0	0.03
	Outpatient	0.1	0.3	0.01
	General admin/ Meetings	0.0	0.2	0.00
	Strategic innovation/management*	0.3	0.9	0.02

* Strategic innovation/management related to inpatient care only.
† The number of hours per week per inpatient with diabetes has been provided to enable comparability with the NaDIA Hospital Level Analysis (http://www.hscic.gov.uk/catalogue/PUB20206), which uses this definition for inpatient/outpatient staffing levels.

Table 15: Percentage of sites with no staff time available specifically for the care of people with diabetes, England and Wales, 2010-2013, 2015†

Profession	Type of care	Percentage of total sites participating where no staff time available specifically for the care of people with diabetes				
		2010*	2011	2012	2013	2015^
Diabetes inpatient specialist nurse (DISN)	Inpatient	31.5	31.9	33.3	31.7	31.1
	Outpatient	51.8	46.9	68.1	64.4	66.0
	General admin/ Meetings					40.3
	Strategic innovation/management‡					44.7
Diabetes specialist nurse (DSN)	Inpatient	45.2	52.2	50.0	48.6	48.5
	Outpatient	22.6	24.8	13.9	14.9	11.7
	General admin/ Meetings					20.9
	Strategic innovation/management‡					51.5
Any diabetes specialist nurse (DISN and DSN)	Inpatient	2.4	4.4	3.2	2.4	2.4
	Outpatient	5.4	7.5	6.9	4.3	4.9
	General admin/ Meetings					8.3
	Strategic innovation/management‡					23.3
Consultant	Inpatient	3.0	12.4	6.9	5.3	9.2
	Outpatient	1.2	7.5	3.7	2.9	6.8
	General admin/ Meetings					14.1
	Strategic innovation/management‡					24.8
Podiatrist	Inpatient	26.8	33.6	32.4	34.1	26.2
	Outpatient	7.7	17.3	17.1	16.3	14.1
	General admin/ Meetings					53.9
	Strategic innovation/management‡					69.9
Specialist dietitian	Inpatient	67.3	70.8	77.3	71.2	71.4
	Outpatient	25.6	20.4	20.4	12.5	15.5
	General admin/ Meetings					44.2
	Strategic innovation/management‡					71.8
Non-specialist dietitian	Inpatient†	58.9	55.8	50.9	**53.8**	**62.1**
	Outpatient	65.5	67.3	67.6	66.8	77.7
	General admin/ Meetings					90.3
	Strategic innovation/management‡					96.1
Any dietitian	Inpatient	38.1	39.8	42.1	39.4	46.6
	Outpatient	10.7	13.7	13.4	8.7	12.6
	General admin/ Meetings					43.2
	Strategic innovation/management‡					70.9
Specialist pharmacist	Inpatient				87.0	82.5
	Outpatient				96.2	95.1
	General admin/ Meetings					89.3
	Strategic innovation/management‡					87.4

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Where the 2013 and 2015 values are **bolded**, the difference between the two percentages is statistically significant (p <0.05).
‡ Strategic innovation/management related to inpatient care only

There was a significant increase in the proportion of sites where no non-specialist dietitian time was available specifically for the care of inpatients with diabetes, as shown in Table 15.

6.4 per cent of hospital sites provided diabetes inpatient specialist nurse (DISN) care 7 days a week, with the remaining 93.6 per cent unable to provide 7 day coverage.

Audit findings: Staffing

2015 FINDINGS

- 31 per cent of hospital sites did not have any diabetes inpatient specialist nurses (DISNs).
- 9 per cent of hospital sites did not have any consultant time for diabetes inpatient care.
- 71 per cent of hospital sites did not have any specialist dietitian time for inpatient care for people with diabetes.
- Only 6 per cent of hospital sites provided diabetes inpatient specialist nurse (DISN) care 7 days a week.

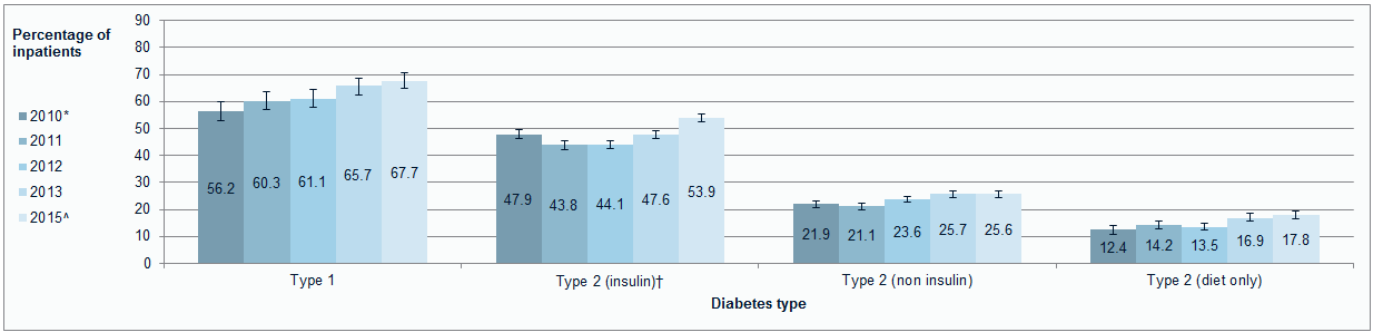
TRENDS SINCE 2013

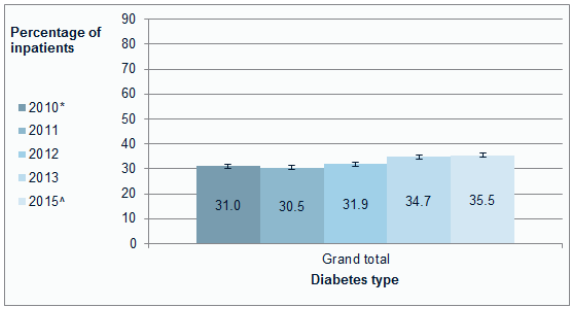
- There was an **increase** in the proportion of sites where no non-specialist dietitian time was available specifically for the care of inpatients with diabetes (from 54 per cent to 62 per cent).

Visits by Diabetes specialist teams

The audit shows that 35.5 per cent of inpatients were seen by a member of the diabetes team, compared to 34.7 per cent in 2013. There has been a statistically significant increase in the proportion being seen for inpatients with Type 2 insulin treated diabetes, though not for other diabetes types or amongst diabetic inpatients as a whole (see Chart 21).

Chart 21: Percentage of inpatients seen by the diabetes team, England and Wales, 2010 - 2013, 2015†





* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values ($p < 0.05$).

The 2015 audit included a question asking whether there had been an increase in referrals/patient contacts with the diabetes team. Of the 202 sites that responded to this question, 83.7 per cent of sites reported that there had been an increase (see Chart 22).

Based on the 'Think Glucose Criteria'[20] (see page 32 below), 43.7 per cent of inpatients should have been referred to the diabetes team[21], of which 67.6 per cent were actually seen by a member of the diabetes team (Chart 23). The proportion of inpatients seen by the diabetes team where it was deemed appropriate has increased significantly since 2013, from 62.5 per cent to 67.6 per cent. All diabetes types except Type 1 have shown a significant increase during this period.

Chart 22: Has there had been an increase in referrals/patient contacts with the diabetes team? England and Wales, 2015

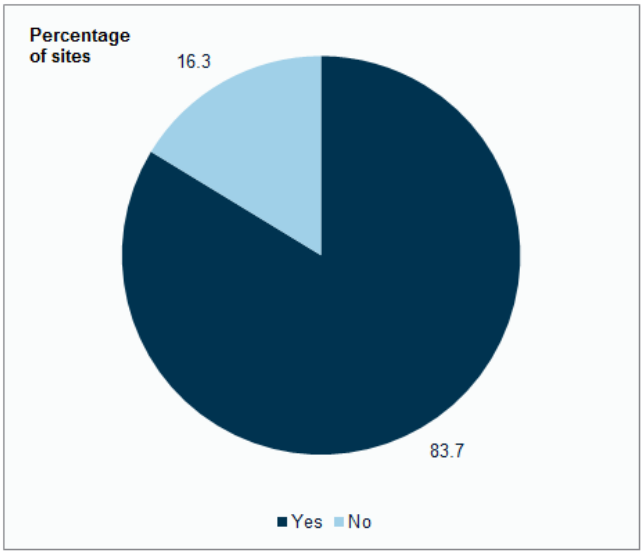
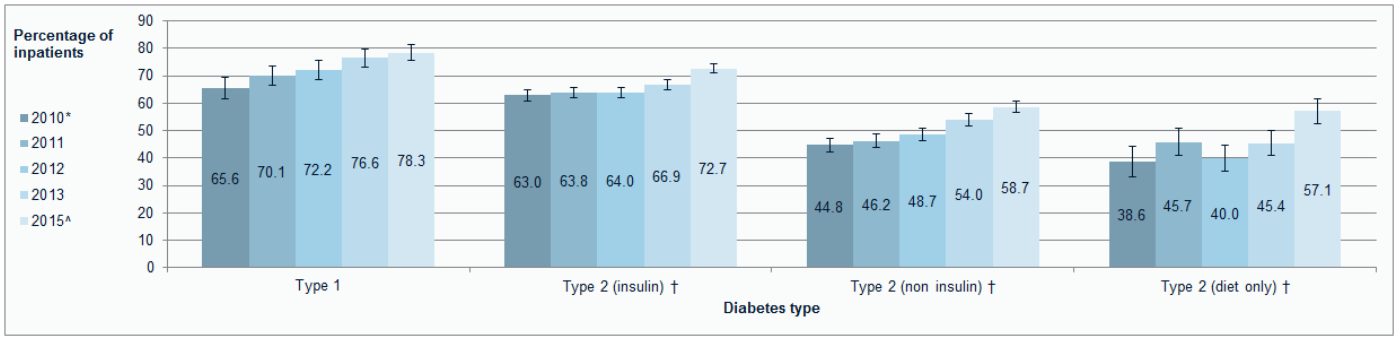
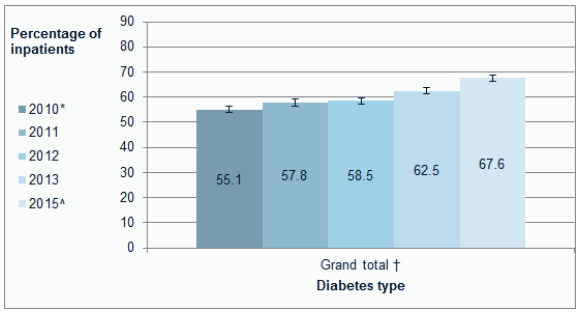


Chart 23: Percentage of inpatients seen by the diabetes team where it was deemed appropriate‡ by the healthcare professional, by diabetes type, England and Wales, 2010 – 2013, 2015†





* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values ($p < 0.05$).
‡ 'Deemed appropriate' is based on the 'Think Glucose' referral criteria or similar (see 'Think Glucose' referral criteria on page 32 below).

[20] NHS Institute for Innovation and Improvement. THINKGLUCOSE inpatient care for people with diabetes www.institute.nhs.uk/quality_and_value/think_glucose/welcome_to_the_website_for_thinkglucose.html. Accessed 31 March 2016.
[21] Revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016 from 43.6 per cent to 43.7 per cent.

'Think Glucose' referral criteria	
Patient status	Blood glucose testing frequency
Patient request	Sepsis
Severe hypoglycaemia	Vomiting
Acute coronary syndrome	Foot ulceration
Previous problems with diabetes as inpatient	Unable to self-manage
Intravenous insulin infusion for over 48 hours	Impaired consciousness
Intravenous insulin infusion with glucose outside limits	Newly diagnosed type 1 diabetes
Diabetic ketoacidosis/hyperosmolar hyperglycaemic state	Newly diagnosed type 2 diabetes

Table 16 below shows that inpatients treated in hospitals that provide diabetes inpatient specialist nursing (DISN) care 7 days a week[22] are more likely to have been seen by a member of the diabetes team than those treated elsewhere.

Table 16: Comparison of the proportion of inpatients seen by the diabetes team at sites with and without 7 day DISN provision, England and Wales, 2015*

Percentage of inpatients that:	Sites with 7 day DSN service	Sites without 7 day DSN service
Seen by the diabetes team	**40.0**	**35.1**
Seen by the diabetes team where it was deemed appropriate† by the healthcare professional	**73.9**	**66.8**

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05).
† 'Deemed appropriate' is based on the 'Think Glucose' referral criteria or similar (see 'Think Glucose' referral criteria above).

Audit findings: Diabetes specialist team

2015 FINDINGS

- 36 per cent of inpatients with diabetes were seen by the diabetes team.
- 68 per cent of inpatients with diabetes were seen by the diabetes team where it was deemed appropriate, based on the 'Think Glucose Criteria'.
- Inpatients treated in hospitals that provide DISN care 7 days a week are **more likely** to have a been seen by the diabetes team overall (40 per cent compared to 35 per cent) and where deemed appropriate (74 per cent compared to 67 per cent).

TRENDS SINCE 2013

- 84 per cent of hospital sites reported that there had been an **increase** in referrals/patient contacts.
- There has been an **increase** in the proportion of inpatients with diabetes seen by the diabetes team where it was deemed appropriate, based on the 'Think Glucose Criteria' (from 63 per cent to 68 per cent).

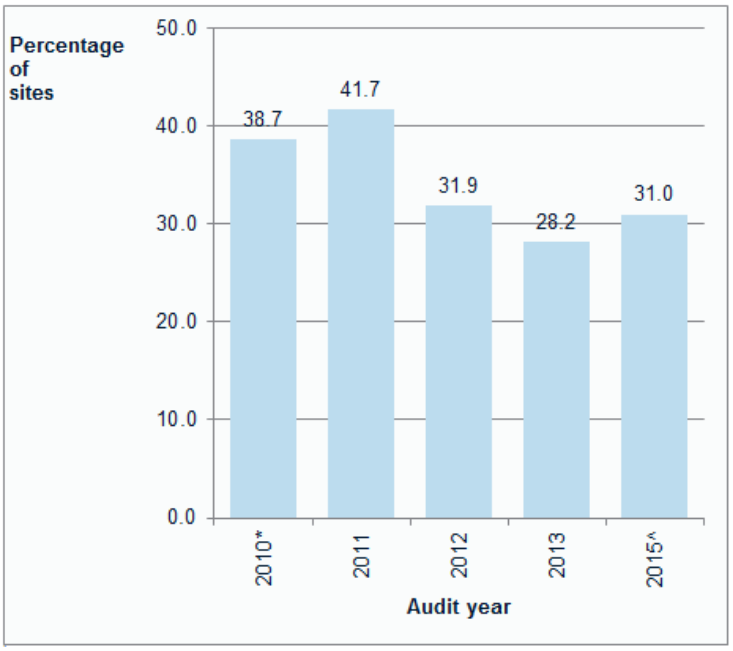
[22] This could include partial cover at the weekends.

Multi-disciplinary foot care teams

NICE[10] recommends that a multi-disciplinary foot care team should manage the care pathway of patients with diabetic foot problems who require inpatient care. The multi-disciplinary foot care team should normally include a diabetologist, a surgeon with the relevant expertise in managing diabetic foot problems, a diabetes nurse specialist, a podiatrist and a tissue viability nurse.

Chart 24 shows that, of the 203 sites that provided hospital characteristics information regarding the multi-disciplinary team as defined above, 63 sites (31.0 per cent) did not have a multi-disciplinary team, compared to 28.2 per cent of sites in 2013.

Chart 24: Percentage of sites <u>not</u> having a multi-disciplinary foot care team, England and Wales, 2010 – 2013, 2015†



Audit findings: Multi-disciplinary foot care teams

<u>2015 FINDINGS</u>

- Almost **one third** of hospital sites do <u>not</u> have a multi-disciplinary foot care team (31 per cent).

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values ($p < 0.05$).

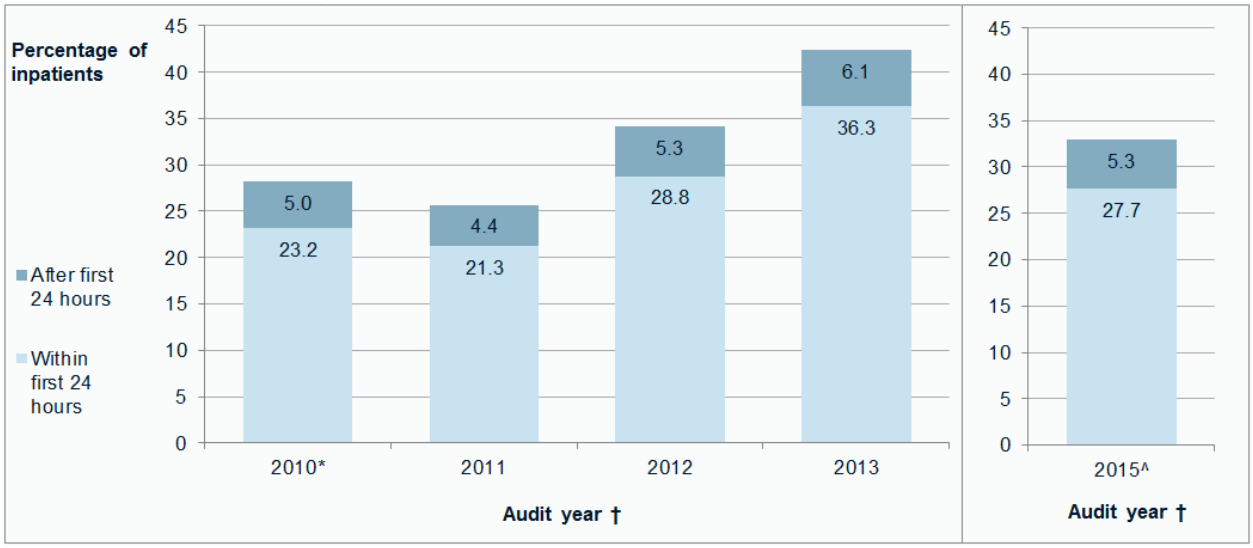
A breakdown of the composition of multi-disciplinary foot care teams, England and Wales, 2010 – 2013, 2015 is provided in Chart 25 in the Supporting Data.

Foot risk assessment and management

Appendix 4 shows that 98.0 per cent of sites utilise a general pressure ulcer risk scoring system for hospital admissions, with 2.0 per cent confirmed as having no system in place. Waterlow was the most prevalent system, used by 76.8 per cent of sites with an ulcer risk scoring. It should be noted that these scoring systems are not specific diabetic foot ulcer examinations.

It was confirmed that 33.0 per cent of inpatients had a specific diabetic foot risk examination for ulceration during their hospital stay, a definition which excludes the Waterlow score, Norton score and similar general pressure sore checks. 27.7 per cent of inpatients had a foot risk examination within 24 hours, with a further 5.3 per cent having an examination after 24 hours (see Chart 26). The 2015 figures are not directly comparable with the results from earlier audits, which did not explicitly exclude general pressure sore checks[23].

Chart 26: Percentage of inpatients having a specific diabetic foot risk examination for ulceration during their hospital stay within or after 24 hours, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Note that there were definitional changes for the 2015 NaDIA. The 2013 bedside audit form asked whether the inpatient had undergone a "foot risk assessment" only. The 2015 version adds more detail, specifying that a "specific diabetic foot risk (for ulceration) examination" took place, with an additional caveat excluding "Waterlow score, Norton score and similar general pressure sore checks".
‡ There is a statistically significant difference between the 2013 and 2015 values: 36.3% vs 27.7% and 6.1% vs 5.3% ($p < 0.05$).

Audit findings: Having foot risk assessment

2015 FINDINGS

- One third of inpatients (33 per cent) had a specific diabetic foot risk examination for ulceration during their hospital stay (28 per cent within 24 hours and a further 5 per cent after 24 hours).

TRENDS 2010 to 2013

- There was an **increase** in the proportion of inpatients having a documented foot risk examination during their hospital stay (from 28 per cent to 42 per cent).

[23] The 2013 bedside audit form asked whether the inpatient had undergone a "foot risk assessment" only. The 2015 version adds more detail, specifying that a "specific diabetic foot risk (for ulceration) examination" took place, with an additional caveat excluding "Waterlow score, Norton score and similar general pressure sore checks".

8.9 per cent of inpatients were admitted with active diabetic foot disease. Over 4 out of 5 (82.3 per cent) received a specific diabetic foot risk examination for ulceration within 24 hours, far higher than the proportion of total inpatients (27.7 per cent – see Table 17). 59.5 per cent were seen by a member of the multi-disciplinary foot care team within 24 hours of admission to hospital and 63.5 per cent had received input from the multi-disciplinary foot care team in the previous 7 days. Around 1 in 20 (5.2 per cent) developed a foot lesion during admission, compared to 1.1 per cent across the whole NaDIA cohort.

Around half (50.6 per cent) of those admitted with active diabetic foot disease were admitted for active diabetic foot disease, representing 4.5 per cent of total inpatients. As would be expected, this subgroup had higher proportions of specific diabetic foot risk examinations and more engagement with the multi-disciplinary foot care team than the wider cohort of inpatients admitted with active diabetic foot disease, though a similar figure (5.0 per cent) developed a foot lesion during admission.

Table 17: Comparison of foot care outcomes for inpatients admitted with/for active foot disease, England and Wales, 2015

Percentage of inpatients that:	Admitted with active diabetic foot disease	Admitted for active diabetic foot disease	All inpatients
Received specific diabetic foot risk examination for ulceration within 24 hours after admission*	82.3	92.2	27.7
Received specific diabetic foot risk examination for ulceration after 24 hours of admission*	76.7	85.5	21.9
Were seen by a member of the MDFT^ within 24 hours†	59.5	76.1	
Received input from the MDFT^ in the last 7 days†	63.5	79.6	
Had a foot lesion arise during admission	5.2	5.1	1.1

^ Multi-disciplinary diabetic foot care team.
* A single inpatient may have foot risk assessments both before and after 24 hours. In this scenario the inpatient would be counted in both measures.
† A single inpatient may have been seen by the MDFT within 24 hours and received input from the MDFT in the last 7 days. In this scenario the inpatient would be counted in both measures.

The following table is included in the Supporting Data:

- Table 18: Percentage of inpatients receiving foot risk examination where admitted with/for active foot disease, by admission type, England and Wales, 2010 – 2013, 2015 (with Chart)

Audit findings: Admission with and for active diabetic foot disease

2015 FINDINGS

- 9 per cent of inpatients with diabetes were admitted with active diabetic foot disease.
- Around half of this group (51 per cent) were admitted for active diabetic foot disease.
- Inpatients admitted with/for diabetic foot disease were **more likely** to have a specific diabetic foot risk examination for ulceration within 24 hours (82/92 per cent) than the total NaDIA cohort (28 per cent).
- The sub-group of inpatients admitted for diabetic foot disease had **higher** proportions of specific diabetic foot risk examinations and more engagement with the multi-disciplinary foot care team than the wider cohort of inpatients admitted with active diabetic foot disease.
- Around 1 in 20 inpatients admitted with/for diabetic foot disease had a foot lesion arise during admission (5 per cent), compared to 1 in 100 across the total NaDIA cohort (1 per cent).

Initiatives to improve foot examination take up

For the first time the 2015 audit included a question on whether the hospital has any tools or systems to increase the number of inpatients with diabetes that have a foot examination. 52.5 per cent of sites reported that a tool or system was used, with 46.0 per cent reporting that nothing was in place. In the remaining 1.5 per cent of sites a response of 'not known' was returned.

Inpatients with diabetes at hospitals with a tool or system in place were more than twice as likely to have had a specific diabetic foot risk examination for ulceration than those in other hospitals (a statistically significant difference of 43.0 per cent compared to 20.4 per cent). However, there was no corresponding reduction in the proportion of inpatients that developed a foot lesion in hospitals (see Table 19 below).

Table 19: Comparison of foot care input for inpatients where foot care examination initiatives have been introduced, England and Wales, 2015*

Percentage of inpatients that:	Sites with tools or systems to increase foot examinations	Sites without tools or systems to increase foot examinations
Received specific diabetic foot risk examination for ulceration after admission*†	**43.0**	**20.4**
Had a foot lesion arise during admission	1.0	1.2

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05).
† The foot risk assessment after admission may have occurred at any point after admission.

Audit finding: Initiatives to improve foot examination take up

2015 FINDINGS

- Inpatients with diabetes treated at hospital sites with tools or systems to increase foot examinations were more than **twice as likely** to receive a specific diabetic foot risk examination for ulceration after admission (43 per cent compared to 20 per cent).

Foot care programmes

The hospital characteristics data collected in the audit included information on whether each site had introduced 'Putting Feet First' or NICE inpatient foot guidance since the audit began in 2009.

Table 20 compares the percentage of inpatients receiving specific diabetic foot risk examinations and input from the multi-disciplinary foot care team between sites that had introduced these initiatives and sites that had not.

Table 20: Comparison of foot care outcomes for inpatients where foot care initiatives have been introduced, England and Wales, 2015*

Percentage of inpatients that:	Sites using 'Putting Feet First' or NICE inpatient foot guidance	Sites not using 'Putting Feet First' or NICE inpatient foot guidance
Received specific diabetic foot risk examination for ulceration within 24 hours after admission*^	**32.1**	**21.3**
Received specific diabetic foot risk examination for ulceration after 24 hours of admission*†	**25.8**	**17.4**
Were seen by a member of the MDFT‡ within 24 hours*	**63.2**	**51.1**
Received input from the MDFT‡ in the last 7 days*	**66.2**	**55.1**
Had a foot lesion arise during admission	1.1	1.0

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05).
‡ Multi-disciplinary diabetic foot care team.
^ Revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016 from 31.4 per cent to 32.1 per cent (Sites using 'Putting Feet First' or NICE inpatient foot guidance) and from 21.1 per cent to 21.3 per cent (Sites not using 'Putting Feet First' or NICE inpatient foot guidance).
† Revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016 from 25.5 per cent to 25.8 per cent (Sites using 'Putting Feet First' or NICE inpatient foot guidance).

Inpatients were significantly more likely to receive a specific diabetic foot risk examination for ulceration at sites where the initiatives had been introduced, both within the first 24 hours of admission, and after 24 hours of admission.

Inpatients at these sites were also significantly more likely to be seen by a member of the multi-disciplinary foot care team within 24 hours, and to have received input from this team in the last 7 days.

At sites that had introduced these initiatives, inpatients were no more or less likely to be reported as having a foot lesion arise during their admission to hospital.

Audit findings: Foot care programmes

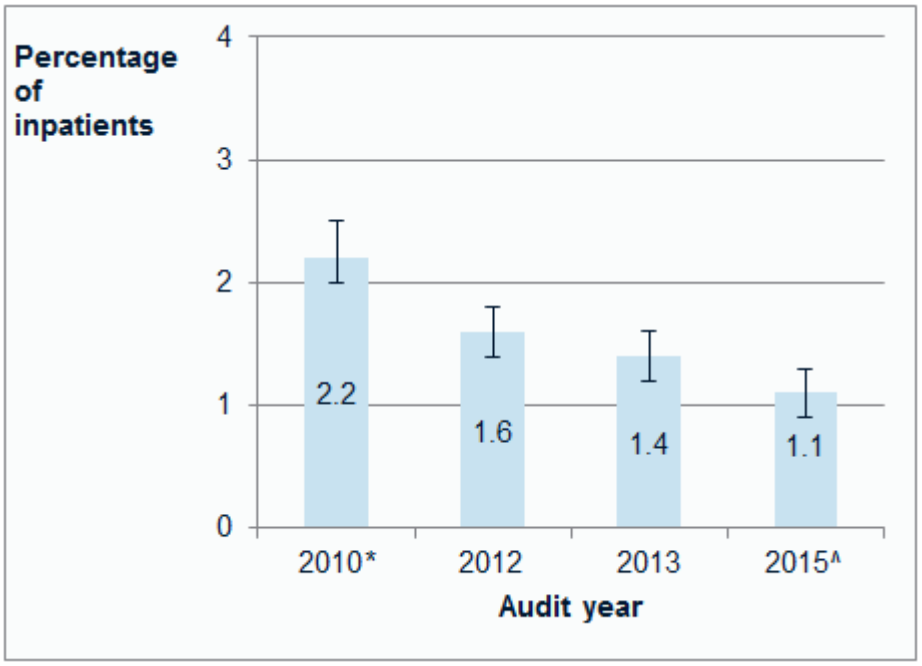
2015 FINDINGS

- Inpatients with diabetes treated at hospital sites using 'Putting Feet First' or NICE inpatient foot guidance were:
  - **more likely** to receive a specific diabetic foot risk examination for ulceration within 24 hours after admission (32 per cent compared to 21 per cent);
  - **more likely** to be seen by a member of the MDFT within 24 hours (63 per cent compared to 51 per cent);
  - **more likely** to have received input from the MDFT in the last 7 days (66 per cent compared to 55 per cent);
  - **no more or less likely** to have a foot lesion develop after admission (1.1 per cent compared to 1.0 per cent).

Development of foot lesions during admission

Chart 27 shows that the overall percentage of inpatients that developed a foot lesion during admission to hospital fell significantly from 2.2 per cent in 2010 to 1.1 per cent in 2015. This reduction is present both when comparing 2010, England only, to either 2015, England only or 2015, England and Wales. There has also been a significant fall between 2013 (1.4 per cent) and 2015 (1.1 per cent).

Chart 27: Percentage of inpatients who developed a foot lesion during their admission, England and Wales, 2010, 2012, 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
† The question concerning whether inpatients developed a foot lesion during their admission was omitted from the 2011 audit; therefore data is only available for 2010, 2012, 2013 and 2015.
^ There was no audit collection or report in 2014, so 2014 data is not available.
‡ There is a statistically significant difference between the 2010 and 2015 values: 2.2% vs 1.1% ($p < 0.05$).
There is a statistically significant difference between the 2013 and 2015 values: 1.4% vs 1.1% ($p < 0.05$).

Audit findings: Development of foot lesions during admission

2015 FINDINGS

- Around 1 in 100 (1.1 per cent) of inpatients with diabetes developed a foot lesion during their admission.

TRENDS SINCE 2013

- The proportion of inpatients with diabetes who developed a foot lesion during their admission has **decreased** (1.4 per cent to 1.1 per cent).

TRENDS SINCE 2010

- The proportion of inpatients with diabetes who developed a foot lesion during their admission has **halved** (2.2 per cent to 1.1 per cent).

Blood glucose control

Information was collected on inpatients' blood glucose control, looking at the previous 7 days of their hospital stay, excluding inpatients in diabetic ketoacidosis (DKA) or hyperglycaemic hyperosmolar state (HHS) at the time of the audit. The following guidelines were used to establish the appropriateness of blood glucose testing:

Patient status	Blood glucose testing frequency
Metformin or diet alone	1 or more/day
Long stay patient on diet and metformin with stable control	Once weekly or more
Insulin, Exenatide, SU or >1 oral agent including DPP-4 inhibitors and glitazones	2 or more/day
Unwell, unstable diabetes or basal bolus	4 or more/day

A 'good diabetes day' was defined as a day on which the frequency of blood glucose monitoring was appropriate, using the guidelines above, and there was no more than one blood glucose measurement greater than 11 mmol/L and no blood glucose measurements less than 4 mmol/L.

Appropriate blood glucose testing and good diabetes days

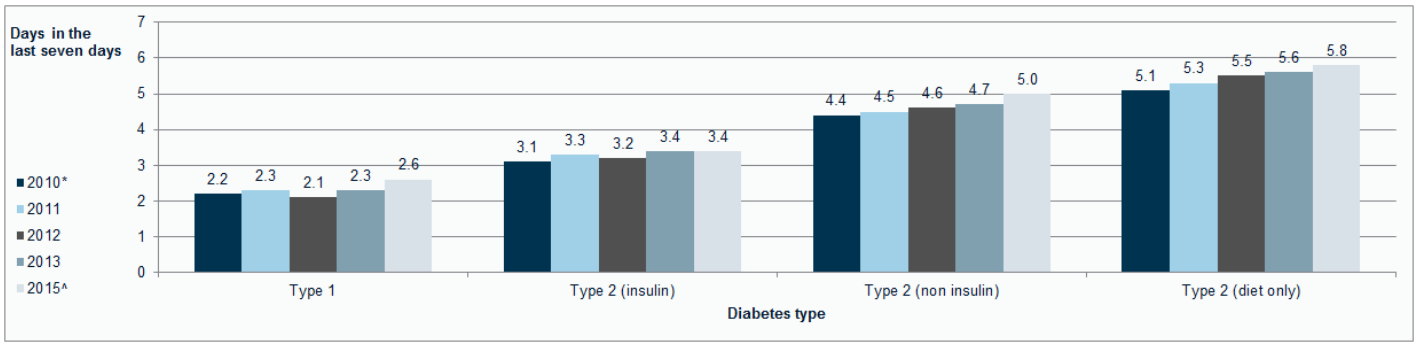
When adjusted for length of stay, glucose monitoring was undertaken on an average of 6.8 days out of the previous 7 days, equating to 96.5 per cent of the time. This monitoring was appropriate (see guidelines table above) on an average of 6.5 days or 92.2 per cent of the time (see Chart 28 in the Supporting Data).

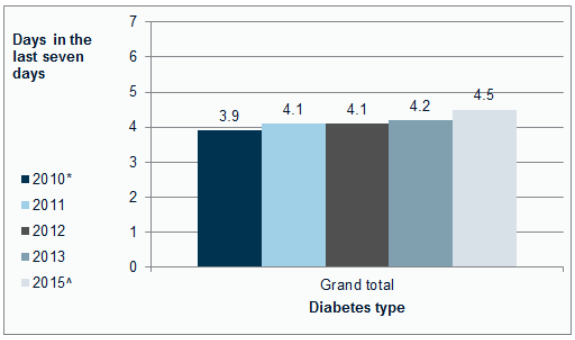
The average number of 'good diabetes days' in the previous 7 days was 4.5 days, or 63.9 per cent of the time, after adjusting for length of stay. Since audit inception there has been an improvement in the average number of 'good diabetes days' for all diabetes types.

Chart 29 indicates that the adjusted number of 'good diabetes days' was lower for inpatients with Type 1 diabetes (2.6 days) and Type 2 insulin treated diabetes (3.4 days) than for inpatients with Type 2 non-insulin treated diabetes (5.0 days) and Type 2 diet only diabetes (5.8 days)[24].

[24] The difference between 3.4 days for inpatients with Type 2 insulin treated diabetes and 5.0 days for inpatients with Type 2 non-insulin treated diabetes is statistically significant (p <0.05).

Chart 29: 'Good diabetes days' by diabetes type, England and Wales, 2010 – 2013, 2015





* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.

Audit findings: Appropriate blood glucose testing and good diabetes days

2015 FINDINGS

- Glucose monitoring was undertaken on an average of 6.8 days out of the previous 7 days.
- The average number of 'good diabetes days' in the previous 7 days was 4.5 days.

TRENDS SINCE 2010

- There has been an **improvement** in the average number of 'good diabetes days' for all diabetes types.

Blood glucose self-management

Table 21 shows the percentage of inpatients self-managing their diabetes medication, split by diabetes type. 27.4 per cent of inpatients with Type 1 diabetes self manage their glucose, significantly higher than inpatients with other diabetes types, which range from 1.6 (Type 2 diet only) to 11.7 per cent (Type 2 insulin treated). Inpatients with Type 1 diabetes are also more likely to self-administer and self-adjust their insulin than Type 2 insulin treated inpatients.

Table 21: Inpatient blood glucose self-management activity in the last 7 days by diabetes type, England and Wales, 2015

Diabetes type	Percentage of inpatients		
	Self-testing glucose	Self-administering insulin†	Self-adjusting insulin dosage†
Type 1	27.4	50.3	30.7
Type 2 (insulin)	11.7	31.8	9.7
Type 2 (non-insulin)	4.5		
Type 2 (diet only)	1.6		
Grand total†	8.1	35.8	14.3

† Results (including the grand total) are for insulin treated inpatients only. Insulin treated inpatients include those with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes.

Audit findings: Blood glucose self-management

2015 FINDINGS

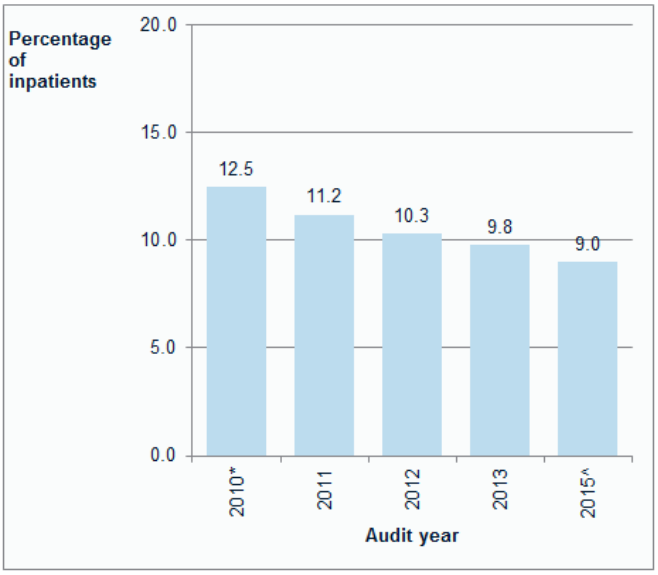
- Inpatients with Type 1 diabetes are:
  - **more likely** to self-test their glucose than inpatients with other diabetes types (27 per cent compared to between 2 and 12 per cent);
  - **more likely** to self-administer insulin than inpatients with Type 2 insulin treated diabetes (50 per cent compared to 32 per cent);
  - **more likely** to self-adjust their insulin dosage than inpatients with Type 2 insulin treated diabetes (31 per cent compared to 10 per cent).

Use of insulin infusions

Insulin infusions are used over a short period of time, generally seven days or less, as an alternative or supplement to subcutaneous injections of insulin or tablets with the aim of achieving safe insulin management during fasting/nil by mouth or to maintain glucose control during severe illness. The NHS Diabetes commissioned report written by the Joint British Diabetes Societies Inpatient Care Group "Management of adults with diabetes undergoing surgery and elective procedures: Improving Standards" states that "insulin must be infused at a variable rate to keep the blood glucose 6-10 mmol/L (acceptable range 4 – 12 mmol/L)"[10].

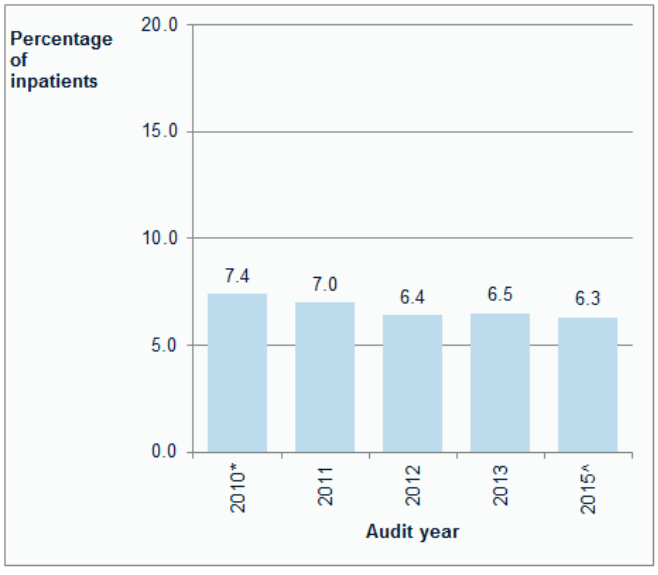
At the time of the audit, 9.0 per cent of inpatients with diabetes had been on an insulin infusion in the last 7 days, representing a statistically significant decrease compared to 9.8 per cent in 2013. The healthcare professionals collecting the data suggested that the use of insulin infusions was not appropriate for 6.3 per cent of these inpatients, similar to the proportion recorded in 2013 (6.5 per cent).

Chart 30: Percentage of inpatients that had been on an insulin infusion in the last 7 days, England and Wales, 2010 - 2013, 2015†



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is a statistically significant difference between the 2013 and 2015 values: 9.8% vs 9.0% (p <0.05).
There is a statistically significant difference between the 2010 and 2015 values: 12.5% vs 9.0% (p <0.05).

Chart 31: Percentage of inpatients using insulin infusions where healthcare professionals suggested insulin infusion was not appropriate, England and Wales, 2010 - 2013, 2015†



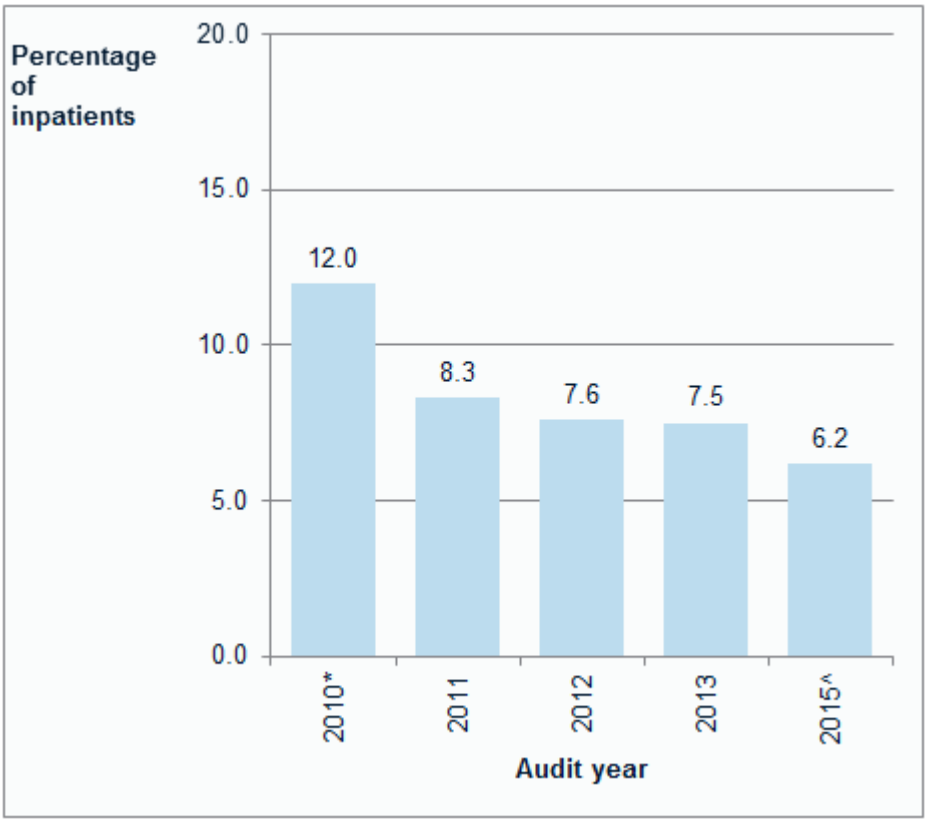
* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values: 6.5% vs 6.3% (p <0.05).
There is a statistically significant difference between the 2010 and 2015 values: 7.4% vs 6.3% (p <0.05).

Of inpatients with diabetes that were on an insulin infusion during the last 7 days, 31.2 per cent were on an insulin infusion for less than 1 day, while 8.3 per cent of inpatients were on an insulin infusion for 7 days or longer.

A breakdown of the duration (days) of insulin infusion use by the main reason for admission to hospital is supplied in Chart 32 in the Supporting Data.

The duration of insulin infusions was deemed inappropriate by the healthcare professionals collecting the data for 6.2 per cent of inpatients who received an infusion. This is lower than the proportion in 2013 (7.5 per cent), though the decrease is not statistically significant.

Chart 33: Percentage of inpatients using insulin infusions where healthcare professionals suggested the duration of insulin infusion was not appropriate, England and Wales, 2010 - 2013, 2015†

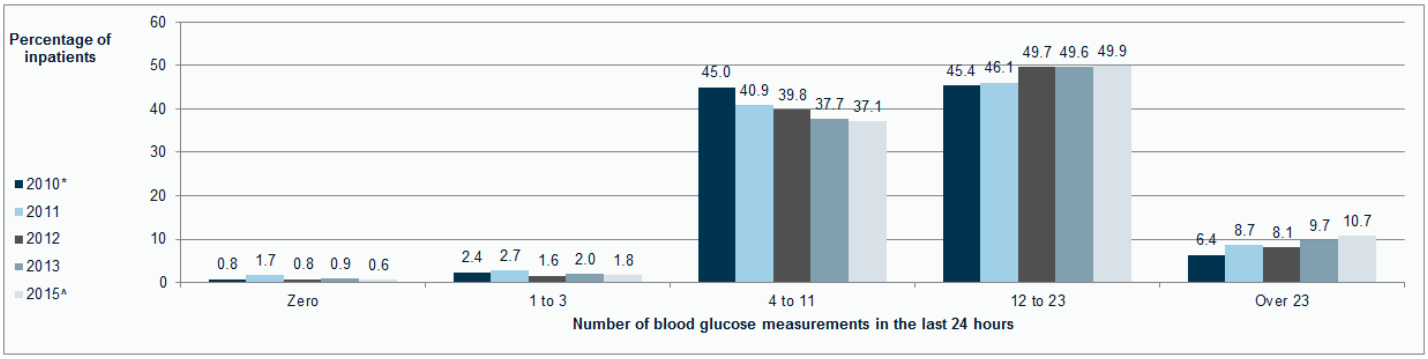


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values: 7.5% vs 6.2% (p <0.05).
There is a statistically significant difference between the 2010 and 2015 values: 12.0% vs 6.2% (p <0.05).

Of the inpatients that had received an insulin infusion that lasted longer than 24 hours in the last 7 days (Chart 34):

- 0.6 per cent did not have any glucose monitoring in the last 24 hours on infusion.
- 1.8 per cent had between one and three blood glucose measurements in the last 24 hours on infusion (equivalent to less than one reading every eight hours).
- 37.1 per cent had between four and eleven measurements in the last 24 hours on infusion (equivalent to less than one reading every two hours).
- 49.9 per cent had between 12 and 23 measurements in the last 24 hours on infusion.
- 10.7 per cent had over 23 measurements in the last 24 hours on infusion.

Chart 34: Number of blood glucose measurements in the last 24 hours on infusion for insulin infusions that lasted longer than 24 hours, England and Wales, 2010 – 2013, 2015



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.

Audit findings: Use of insulin infusions

2015 FINDINGS

- 9 per cent of inpatients with diabetes had been on an insulin infusion in the last 7 days.
- Use of an insulin infusion was not appropriate in 6 per cent of cases.
- The duration of the insulin infusion was deemed inappropriate for 6 per cent of inpatients who received an infusion.

TRENDS SINCE 2013

- The proportion of inpatients with diabetes that had been on an insulin infusion in the last 7 days **decreased** (from 10 per cent to 9 per cent).

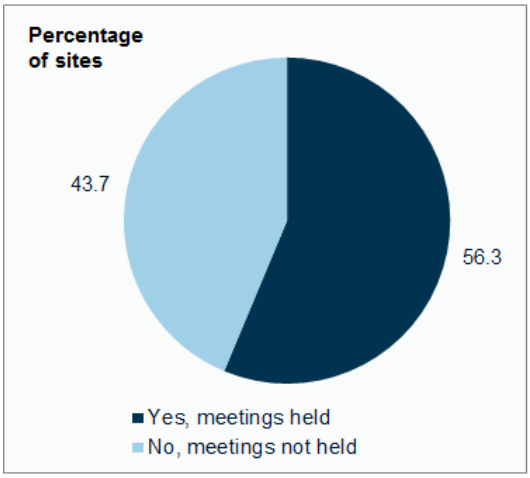
TRENDS SINCE 2010

- The proportion of inpatients with diabetes that had been on an insulin infusion in the last 7 days **decreased** (from 10 per cent to 9 per cent).
- The proportion of inpatients using insulin infusions where healthcare professionals suggested insulin infusion was not appropriate **decreased** (from 7 per cent to 6 per cent).
- The proportion of inpatients with diabetes using insulin infusions where healthcare professionals suggested the duration of insulin infusion was not appropriate **almost halved** (from 12 per cent to 6 per cent).

Diabetes Mortality and Morbidity meetings

For the first time in 2015, hospital staff were asked to provide information on whether their hospital holds Diabetes Mortality and Morbidity meetings. The aim of these meetings is to identify the root causes of inpatient diabetes management issues such as severe inpatient hypoglycaemia, new DKA/HSS during the inpatient stay, new foot ulceration during the inpatient stay or unexpected inpatient death. 56.3 per cent of sites confirmed that they held Diabetes Mortality and Morbidity meetings, with the remaining 43.7 per cent confirming that these meetings were not held.

Chart 35: Are Diabetes Mortality and Morbidity meetings held? England and Wales, 2015



Audit finding: Diabetes Mortality and Morbidity meetings

2015 FINDINGS

- 56 per cent of hospital sites confirmed that they held Diabetes Mortality and Morbidity meetings.

Pre-operative care planning

The 2015 audit included 4 new questions about pre-operative care planning. 2,848 inpatients were reported to have had surgery during the admission, 18.7 per cent of total inpatients. 39.5 per cent had elective surgery and 54.9 per cent had emergency surgery, with the remainder recorded as unknown (5.6 per cent). Table 22 shows the proportion of surgery inpatients that had a pre-operative assessment record available for review, split by the nature of surgery (elective or emergency).

Table 22: Percentage of surgical inpatients with a pre-operative assessment record available for review, by nature of surgery, England and Wales, 2015†

Nature of surgery	Percentage of surgical inpatients with a pre-operative assessment record available for review
Elective†	**76.0**
Emergency†	**58.3**
Grand total	63.2

† Statistically significant difference between the two **bolded** values (p <0.05).

Overall, 63.2 per cent of inpatients having surgery had a pre-operative assessment record available for review. This figure was significantly higher for elective surgery (76.0 per cent), where there would be more opportunity for pre-operative care planning, than for emergency surgery (58.3 per cent).

Of inpatients having a pre-operative assessment, Table 23 shows the proportion that had diabetes noted in their pre-operative assessment. Diabetes was noted in over 90 per cent of cases, with no significant difference between emergency and elective inpatients.

Table 23: Percentage of surgical inpatients that had diabetes noted in the their pre-operative assessment, by nature of surgery, England and Wales, 2015†

Nature of surgery	Percentage of surgical inpatients that had diabetes noted in the their pre-operative assessment
Elective	92.9
Emergency	90.3
Grand total	91.6

†Statistically significant difference between the two **bolded** values (p <0.05) – none found.

For inpatients having a pre-operative assessment that mentioned diabetes, Table 24 shows the proportion that had evidence of a plan for the management of their diabetes in the perioperative period. Results are split by the nature of surgery. A plan was in place in 59.0 per cent of total cases, again with no significant difference between emergency and elective inpatients.

Table 24: Percentage of surgical inpatients that had evidence of a plan for the management of their diabetes in the perioperative period, by nature of surgery, England and Wales, 2015†

Nature of surgery	Percentage of surgical inpatients that had evidence of a plan for the management of their diabetes in the perioperative period
Elective	57.8
Emergency	60.5
Grand total	59.0

†Statistically significant difference between the two **bolded** values (p <0.05) – none found.

Audit findings: Pre-operative care planning

2015 FINDINGS

- 19 per cent of inpatients with diabetes had surgery during their admission.
- The pre-operative assessment record was available for review in 63 per cent of cases.
- The pre-operative assessment record was **more likely** to be available for elective admissions than emergency admissions (76 per cent compared to 58 per cent).
- Over 9 out of 10 surgical inpatients with diabetes had diabetes noted in their pre-operative assessment (92 per cent).
- 41 per cent of surgical inpatients with diabetes **did not have** evidence of a plan for the management of their diabetes in the perioperative period.

Did harm result from the inpatient stay?

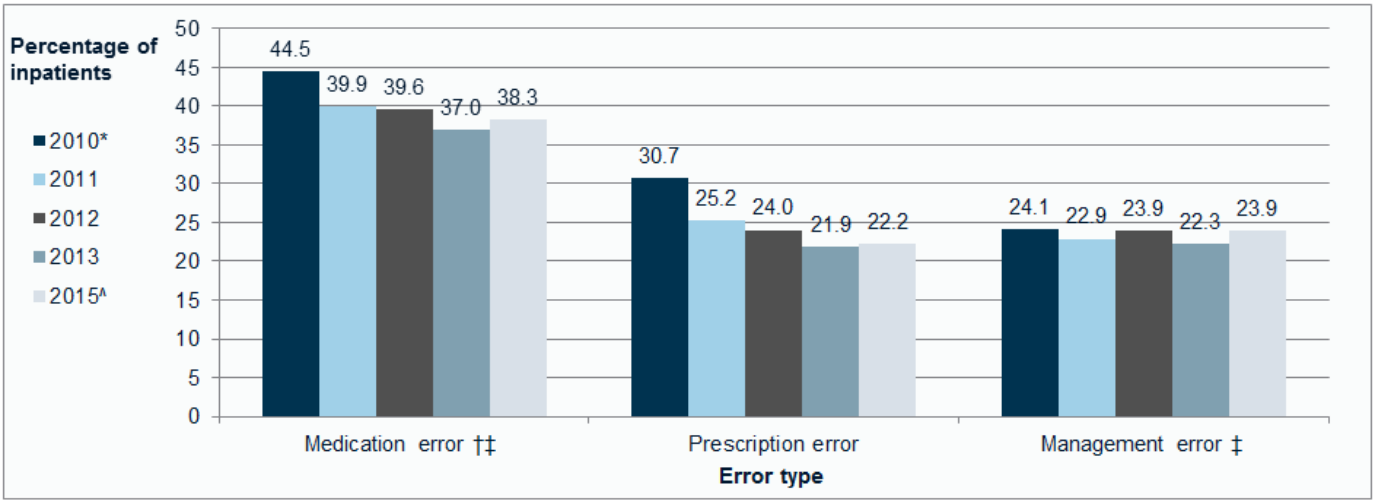
'Did harm result from the inpatient stay?' is the second of four key questions posed by the audit (see Introduction on page 14). In an attempt to answer this question, the following section looks at trends in the proportion of medication errors, hypoglycaemic episodes and other harms (e.g. DKA and HSS) that may have developed during the hospital stay. This section will also address part of the fourth audit question: Has the quality of care changed since NaDIA 2010, 2011, 2012 and 2013?

Medication errors: overview

The healthcare professionals collecting the information for the audit reviewed each inpatient's drug chart and recorded whether specified medication errors (prescription errors and/or management errors, see the list in Table 25 below) had occurred in the previous 7 days.

In 2015, over one third (38.3 per cent) of inpatient drug charts that were available and reviewed by the healthcare professionals collecting the data had at least one medication error (i.e. prescription error and/or management error) in the previous 7 days. This represents a statistically significant increase since 2013, when medication errors were reported in 37.0 per cent of eligible cases. 22.2 per cent of inpatient drug charts reviewed by the healthcare professionals had at least one prescription error in the previous 7 days, similar to the 21.9 per cent reported in 2013. 23.9 per cent of inpatient drug charts had at least one medication management error, a statistically significant increase since 2013 (22.3 per cent).

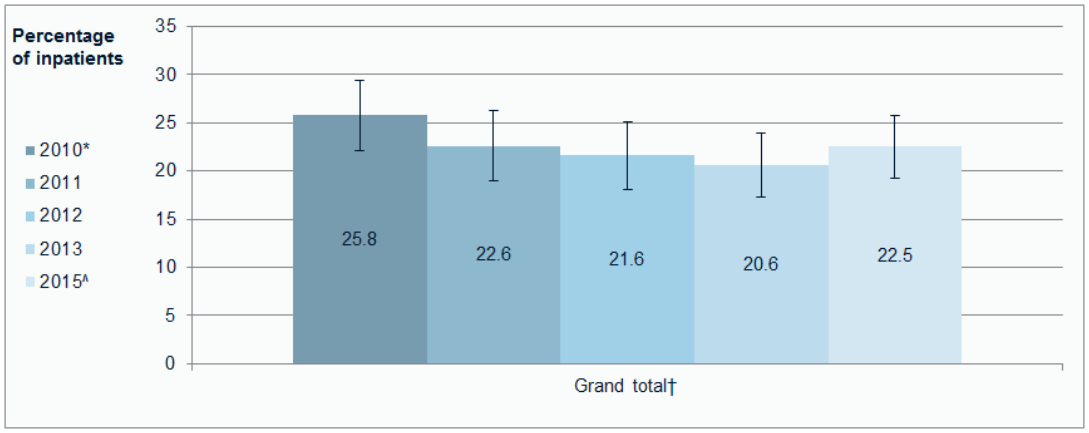
Chart 36: Frequency of medication errors, England and Wales, 2010 – 2013, 2015‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Prescription errors and/or management errors.
‡ Statistically significant difference between 2013 and 2015 values (p <0.05).

Over one in five inpatients (22.5 per cent) of all inpatients with diabetes had an insulin error (i.e. insulin prescription error and/or management error) in 2015, a significant increase since 2013 (20.6 per cent).

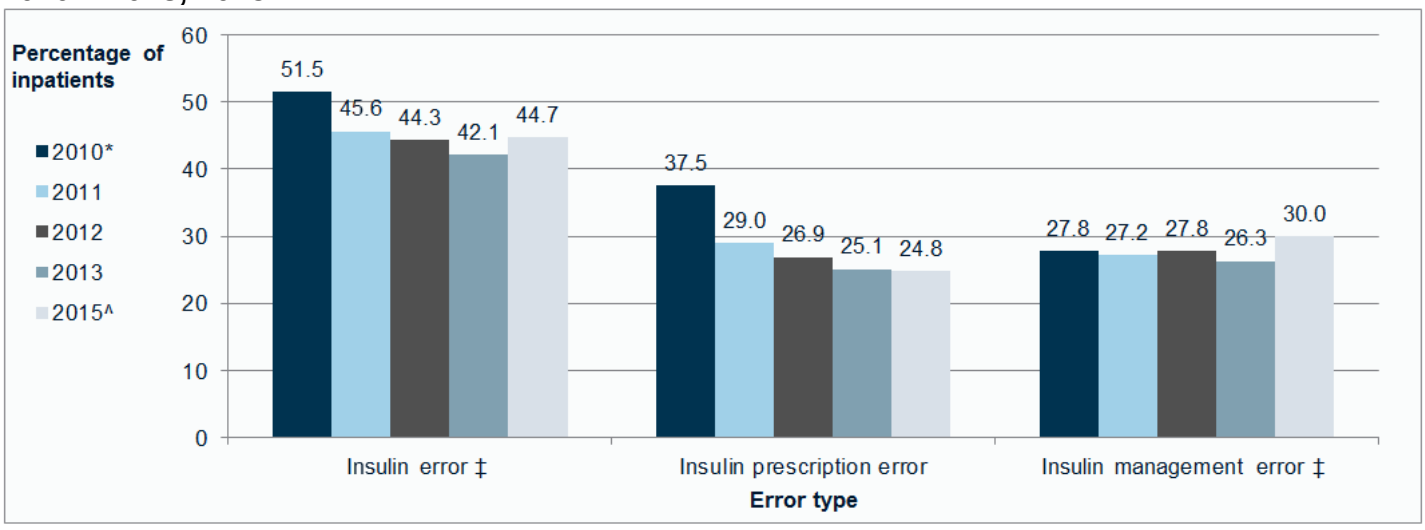
Chart 37: Percentage of inpatient drug charts with insulin errors in last 7 days, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).
‡ Denominator includes all inpatients, not just those that were insulin treated.

When looking at insulin treated inpatients only, the audit data showed that over four out of ten (44.7 per cent) insulin treated inpatients had at least one insulin error in the previous 7 days (see Chart 38 below). This compares to 42.1 per cent in 2013, a statistically significant increase of 2.6 per cent. 24.8 per cent of insulin treated inpatient drug charts had at least one insulin prescription error, similar to the proportion recorded in 2013 (25.1 per cent) and significantly lower than the figure recorded in 2010 (37.5 per cent). 30.0 per cent of insulin treated inpatient drug charts had at least one insulin management error, significantly higher than both the 2013 (26.3 per cent) and 2010 (27.8 per cent) figures.

Chart 38: Frequency of insulin errors for insulin treated inpatients†, England and Wales, 2010 – 2013, 2015‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Defined as where the inpatient's drug chart is available for review and the inpatient has received insulin in the previous 7 days.
‡ Statistically significant difference between 2013 and 2015 values (p <0.05).

Audit findings: Medication errors: overview

2015 FINDINGS

- Over one third of the inpatients reviewed had at least one medication error in the previous 7 days (38 per cent).
- Over one fifth of inpatients reviewed had at least one prescription error in the previous 7 days (22 per cent).
- Almost one quarter of inpatients reviewed had at least one management error in the previous 7 days quarter (24 per cent).
- Over one fifth of the inpatients reviewed had at least one insulin error in the previous 7 days (23 per cent).
- Over four out of ten of the insulin treated inpatients reviewed had at least one insulin error in the previous 7 days (45 per cent).

TRENDS SINCE 2013

- The proportion of inpatients having medication errors **increased** from 37 per cent to 38 per cent.
- The proportion of inpatients having prescription errors is **unchanged** at 22 per cent.
- The proportion of inpatients having management errors **increased** from 22 per cent to 24 per cent.
- The proportion of inpatients having insulin errors **increased** from 21 per cent to 23 per cent.
- The proportion of insulin treated inpatients having insulin errors **increased** from 42 per cent to 45 per cent.

Medication errors: breakdown

A breakdown of the proportions of individual medication errors is shown in Table 25 below, with results for 2013 and 2010 also provided. The full breakdowns of medication errors by audit year (2010 – 2013, 2015) are available in Appendices 5 and 6.

Table 25: Frequency of medication errors, broken down into prescription and medication errors, England and Wales, 2010, 2013, 2015*

Medication error		Current audit	Comparison with previous audit			Comparison with first audit		
		2015	2013	Difference: 2013 to 2015		2010	Difference: 2010 to 2015	
		%	%	% points	Change†	%	% points	Change†
Insulin prescription errors	Insulin not written up	2.2	**1.7**	0.5	Up	**2.7**	-0.6	Down
	Name of insulin incorrect	1.8	2.1	-0.3	No change	**5.0**	-3.3	Down
	Number (dose) unclear	1.7	1.9	-0.2	No change	**3.5**	-1.8	Down
	Unit abbreviated to 'u' or written unclearly	1.5	**1.9**	-0.4	Down	**6.3**	-4.8	Down
	Insulin or prescription chart not signed	2.1	1.9	0.1	No change	**2.8**	-0.7	Down
	Insulin not signed as given	4.9	4.8	0.0	No change	**6.0**	-1.1	Down
	Insulin given/ prescribed at wrong time	3.7	**3.1**	0.6	Up	3.9	-0.1	No change
Oral hypoglycaemic agent (OHA) prescription errors	OHA not signed as given	5.2	**4.6**	0.6	Up	5.6	-0.3	No change
	OHA given/ prescribed at wrong time	4.6	4.8	-0.3	No change	**6.0**	-1.4	Down
	Wrong dose	1.0	1.0	-0.1	No change	**1.5**	-0.5	Down
	OHA not written up	1.8	2.0	-0.2	No change	**2.6**	-0.8	Down
Insulin management errors	Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate	11.5	**9.8**	1.7	Up	**10.0**	1.5	Up
	Insulin not reduced if unexplained blood glucose less than 4 mmol/L	4.0	**3.3**	0.7	Up	3.8	0.2	No change
	Inappropriate omission of insulin after episode of hypoglycaemia	1.8	1.8	0.0	No change	**2.4**	-0.7	Down
OHA management errors	No action taken when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate	8.8	9.5	-0.7	No change	9.2	-0.3	No change
	OHA not reduced if unexplained blood glucose less than 4mmol/L	2.3	2.6	-0.3	No change	**3.2**	-0.8	Down
	Inappropriate omission of OHA after episode of hypoglycaemia	0.6	0.8	-0.2	No change	**1.1**	-0.5	Down

* Where the value is **bolded**, the difference between the bolded percentage and the equivalent 2015 percentage is statistically significant (p <0.05).
† p <0.05

The medication errors with the highest prevalence in 2015 are summarised in the Audit Findings box below.

Audit findings: Medication errors: breakdown

2015 FINDINGS

- 'Insulin not signed as given' was the most common insulin prescription error, affecting around 1 in 20 of inpatients reviewed (5 per cent).
- 'OHA not signed as given' was the most common OHA prescription error, affecting around 1 in 20 of inpatients reviewed (5 per cent).
- 'Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate' was the most common insulin management error, affecting around 1 in 10 of inpatients reviewed (11 per cent).
- 'No action taken when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate' was the most common OHA management error (9 per cent), affecting almost 1 in 10 of inpatients reviewed (9 per cent).

A full breakdown of insulin errors for insulin treated inpatients by audit year (2010 – 2013, 2015) is provided in Appendix 6. The main findings are included in the text box below.

Audit findings: Insulin errors: breakdown (insulin treated inpatients only)

2015 FINDINGS

- 'Insulin not signed as given' was the most common insulin prescription error, affecting around 1 in 10 of insulin treated inpatients reviewed (10 per cent).
- 'Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate' was the most common insulin management error, affecting around one fifth of insulin treated inpatients reviewed (23 per cent).

How has the frequency of medication errors changed over time?

Since the first audit in 2010, 12 of the 17 comparable medication errors have shown statistically significant decreases in prevalence (see Table 25). Of particular note, there has been a marked improvements in the 'Unit abbreviated to 'u' or written unclearly' (down from 6.3 per cent of drug charts in 2010 to 1.5 per cent in 2015), 'Name of insulin incorrect' (down from 5.0 per cent in 2010 to 1.8 per cent in 2015) and 'Number (dose) unclear' (down from 3.5 per cent to 1.7 per cent).

A single medication error has shown an increase during this period: 'Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate', which rose from 10.0 per cent in 2010 to 11.5 per cent in 2015.

Audit findings: Medication errors: trends over time

TRENDS SINCE 2010

- The majority of medication errors **decreased** in prevalence (12 of 17)
- Only one of the medication errors **increased** in prevalence (1 of 17).

TRENDS SINCE 2013

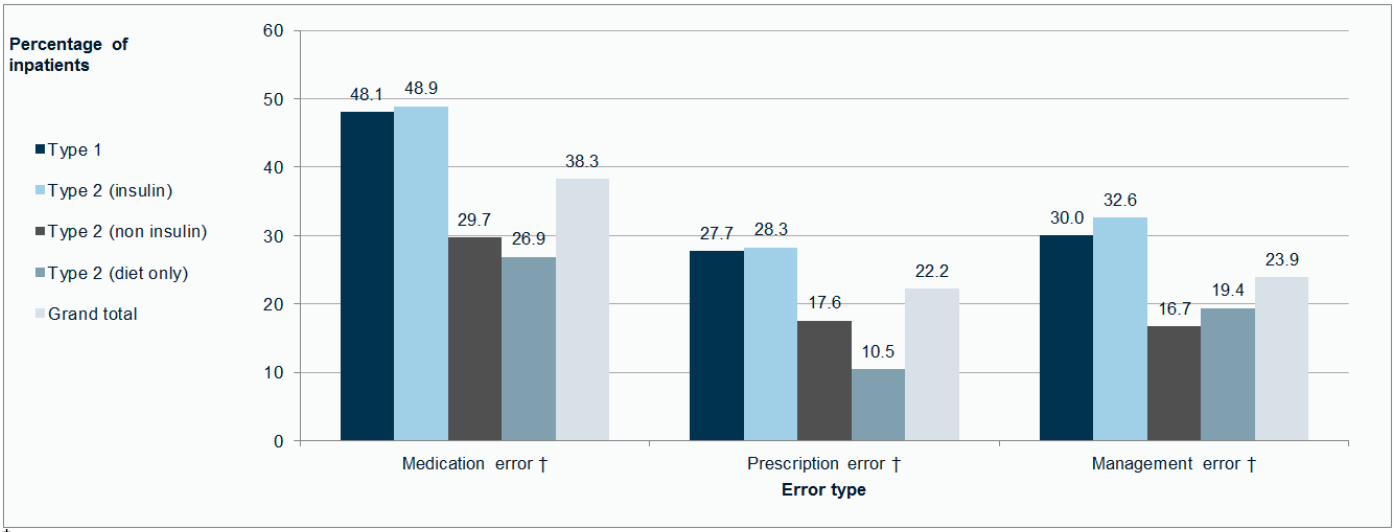
- 5 of the 17 medication errors **increased** in prevalence.
- Only 1 of the 17 medication errors **decreased** in prevalence.

Despite the improvements evident since 2010, 5 of the 17 comparable medication errors have shown statistically significant increases in prevalence between 2013 and 2015. Only one measure has exhibited a decrease in prevalence during this period ('Unit abbreviated to 'u' or written unclearly', decreasing from 1.9 per cent in 2013 to 1.5 per cent in 2015), while the other 11 medication errors remains unchanged.

Medication errors by diabetes type

Chart 39 below shows that, in 2015, medication errors were significantly more frequent for inpatients with Type 1 and Type 2 insulin treated diabetes compared to those with Type 2 non-insulin treated and Type 2 diet only diabetes. There was no difference in the frequency of medication errors between inpatients with Type 1 and Type 2 insulin treated diabetes. The same pattern is found when divided into prescription and management errors.

Chart 39: Frequency of medication errors by diabetes type, England and Wales, 2015†



† Statistically significant difference between Type 1 and both Type 2 non-insulin treated and Type 2 diet only values ($p < 0.05$).
Statistically significant difference between Type 2 insulin treated and both Type 2 non-insulin treated and Type 2 diet only values ($p < 0.05$).
No statistically significant difference between Type 1 and Type 2 insulin treated values ($p > 0.05$).

A more detailed review of the prevalence of medication errors by diabetes type is provided in Appendix 7.

Audit findings: Medication errors: by diabetes type

2015 FINDINGS

- Medication errors were **more frequent** for inpatients with Type 1 diabetes (48 per cent) and Type 2 insulin treated diabetes (49 per cent) than for inpatients with Type 2 non-insulin treated diabetes (30 per cent) and Type 2 diet only diabetes (27 per cent).
- Prescription errors were **more frequent** for inpatients with Type 1 diabetes (28 per cent) and Type 2 insulin treated diabetes (28 per cent) than for inpatients with Type 2 non-insulin treated diabetes (18 per cent) and Type 2 diet only diabetes (6 per cent).
- Medication management errors were **more frequent** for inpatients with Type 1 diabetes (30 per cent) and Type 2 insulin treated diabetes (33 per cent) than for inpatients with Type 2 non-insulin treated diabetes (17 per cent) and Type 2 diet only diabetes (19 per cent).
- There was **no difference** in the prevalence of medication errors between inpatients with Type 1 diabetes and Type 2 insulin treated diabetes.

How has the frequency of medication errors by diabetes type changed over time?

Table 26 below summarises the changes in the prevalence of medication errors between 2010 and 2015, split by diabetes type. We can see that medication errors have reduced for all diabetes types. However, management errors have not reduced to the same extent as other error types: improvement is evident for inpatients with Type 2 non-insulin treated diabetes, while errors have increased for those with Type 2 insulin treated diabetes.

Table 26: Changes in the prevalence of medication errors by diabetes type, 2010 to 2015

	Difference 2010 to 2015 (p <0.05)			
Diabetes type	Medication error*	Prescription error	Management error	Insulin error†
Type 1	**Down**	**Down**	No change	**Down**
Type 2 (insulin)	**Down**	**Down**	**Up**	**Down**
Type 2 (non-insulin)	**Down**	**Down**	**Down**	
Type 2 (diet only)	**Down**	No change	No change	
Grand total	**Down**	**Down**	No change	**Down**

* Prescription errors and/or management errors.
† Insulin prescription errors and/or insulin management errors.

Despite the general improvement since 2010, Table 27 appears to show an increase in the prevalence of medication errors for some diabetes types between 2013 and 2015, with no decreases evident during this period. This is suggestive of a more general trend of increasing medication errors since 2013, particularly affecting medication management errors.

Table 27: Changes in the prevalence of medication errors by diabetes type, 2013 to 2015

	Difference 2013 to 2015 (p <0.05)			
Diabetes type	Medication error*	Prescription error	Management error	Insulin error†
Type 1	No change	No change	**Up**	No change
Type 2 (insulin)	**Up**	No change	**Up**	**Up**
Type 2 (non-insulin)	No change	No change	No change	
Type 2 (diet only)	**Up**	No change	No change	
Grand total	**Up**	No change	**Up**	**Up**

* Prescription errors and/or management errors.
† Insulin prescription errors and/or insulin management errors.

Audit findings: Medication errors and diabetes type: general trends

TRENDS SINCE 2010

- Medication errors have **decreased** for all diabetes types.
- Prescription and insulin errors have **decreased** for most diabetes types.
- There is **no consistent trend** for medication management errors.

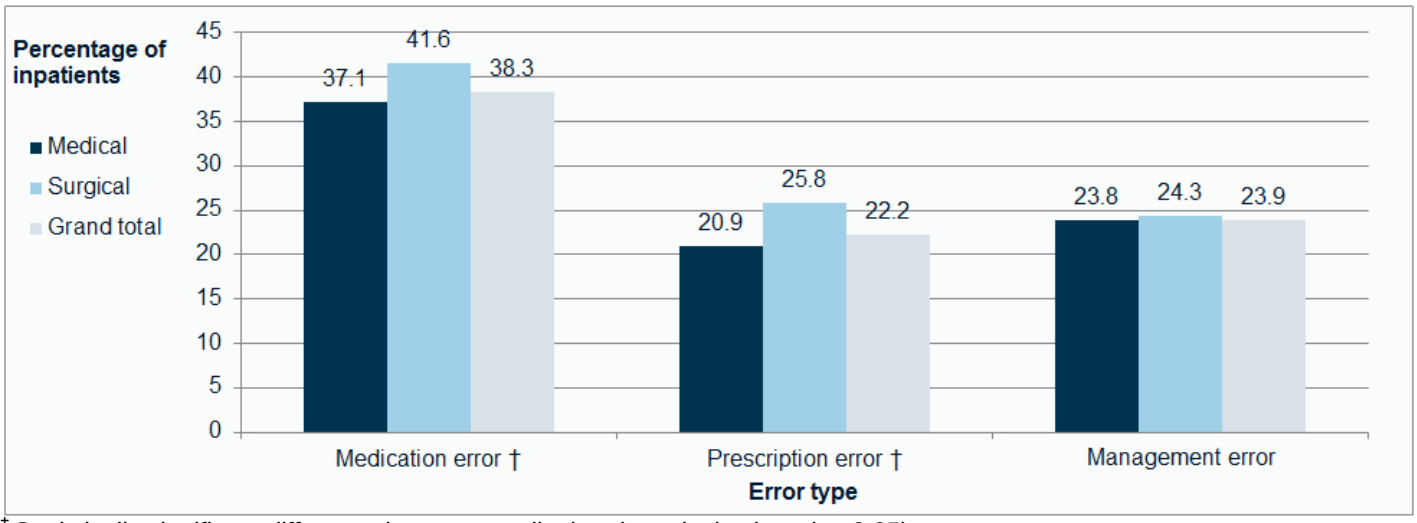
TRENDS SINCE 2013

- Medication errors have **increased** for some diabetes types, with no decreases evident.
- Medication management and insulin errors have **increased** for some diabetes types, with no decreases evident.
- Prescription errors are **unchanged** for all diabetes types.

Medication errors and ward type

Chart 40 below shows that, in 2015, medication errors occurred significantly more frequently for inpatients on surgical wards compared to those on medical wards. The same pattern is found for prescription errors, though there is no significant difference in the prevalence of management errors between ward types. In each case, the 2015 finding follows historic trends.

Chart 40: Frequency of medication errors by ward type, England and Wales, 2015†



† Statistically significant difference between medical and surgical values ($p < 0.05$).

A more detailed review of the prevalence of medication errors on medical and surgical wards is provided in Appendix 8.

Audit findings: Medication errors and ward type

TRENDS SINCE 2010

- Medication errors are **more prevalent** on surgical wards.
- Prescriptions errors are **more prevalent** on surgical wards.
- There is **no difference** in the prevalence of medication management errors on medical and surgical wards.
- There is **no difference** in the prevalence of insulin errors on medical and surgical wards.

Medication errors and the electronic patient record

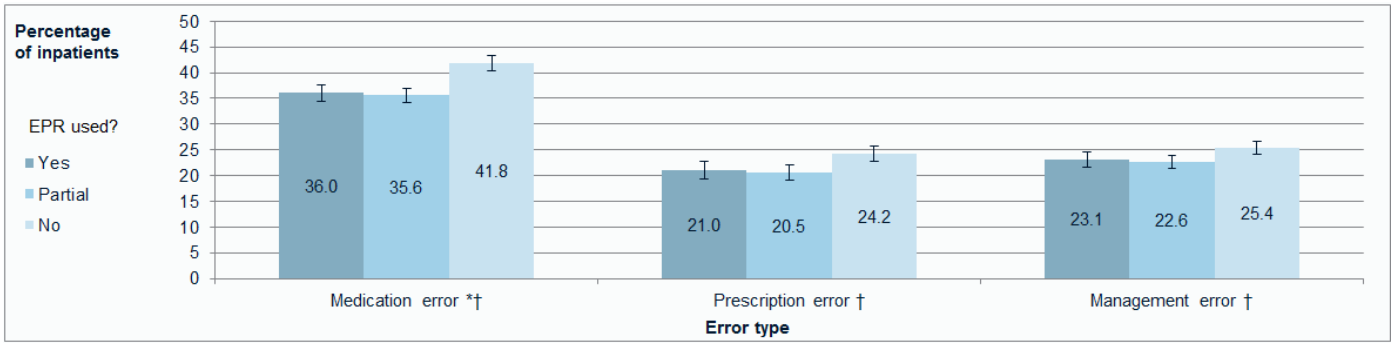
Chart 41 shows that medication errors on drug charts occurred significantly more frequently for inpatients at hospitals not using the electronic patient record (41.8 per cent) than for inpatients at hospitals that do use an electronic patient record (36.0 per cent). A significant difference is also observable for both prescription errors (24.2 per cent where no electronic patient record is used compared to 21.0 per cent where an electronic patient record is used) and medication management errors (25.4 per cent compared to 23.1 per cent).

Audit findings: Medication errors and the electronic patient record

2015 FINDINGS

- Medication errors are **less prevalent** in hospital sites that use the electronic patient record (36 per cent compared to 42 per cent).

Chart 41: Percentage of inpatient drug charts with errors in last 7 days by electronic patient record usage, England and Wales, 2015†



* Prescription errors and/or management errors. † Statistically significant difference between 'No' and 'Yes' values (p <0.05).

Medication errors and electronic prescribing

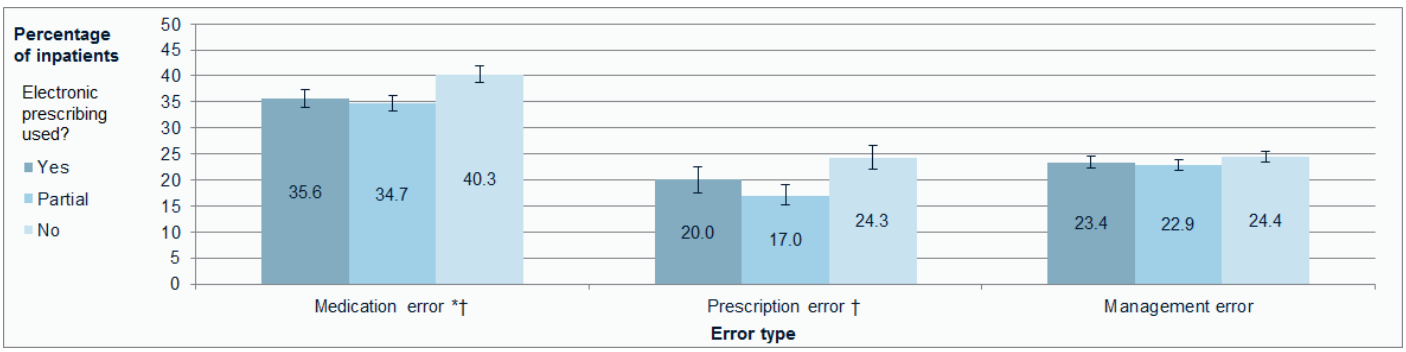
Chart 42 shows that medication errors on drug charts occurred significantly more frequently for inpatients at hospitals not using electronic prescribing (40.3 per cent) than for inpatients at hospitals that do use electronic prescribing (35.6 per cent). A significant difference is also observable for prescription errors (24.3 per cent where no electronic prescribing is used compared to 20.0 per cent where electronic prescribing is used), though there is no observable effect for medication management errors (24.4 per cent where no electronic prescribing is used compared to 23.4 per cent where electronic prescribing is used).

Audit findings: Medication errors and electronic prescribing

2015 FINDINGS

- Prescription errors are **less prevalent** in hospital sites that use the electronic prescribing (20 per cent compared to 24 per cent).

Chart 42: Percentage of inpatient drug charts with errors in last 7 days by electronic prescribing usage, England and Wales, 2015†



* Prescription errors and/or management errors. † Statistically significant difference between 'No' and 'Yes' values (p <0.05).

Hypoglycaemic episodes

For this audit, mild hypoglycaemia was defined as a capillary blood glucose of 3.0 – 3.9 mmol/L and severe hypoglycaemia was defined as a capillary blood glucose of less than 3.0 mmol/L, whether or not the patient was symptomatic. Information was collected on hypoglycaemic episodes over the previous 7 days of the inpatient's stay in hospital. Hypoglycaemic episodes are avoidable and they should be a rare occurrence in a hospital setting.

The 2015 audit found that over one fifth (21.8 per cent) of inpatients with diabetes had at least one or more hypoglycaemic episode, compared to 22.0 per cent in 2013.

In 2015, inpatients with Type 1 diabetes were significantly more likely to experience one or more hypoglycaemic episode (48.5 per cent) than inpatients with Type 2 insulin treated diabetes (34.5 per cent), Type 2 non-insulin treated diabetes (14.7 per cent) and Type 2 diet only diabetes (8.3 per cent). Chart 43 shows that there was a significant increase in Type 2 insulin treated inpatients having one or more hypoglycaemic episode between 2013 (31.2 per cent) and 2015 (34.5 per cent).

Audit findings: Hypoglycaemic episodes (mild and/or severe)

2015 FINDINGS

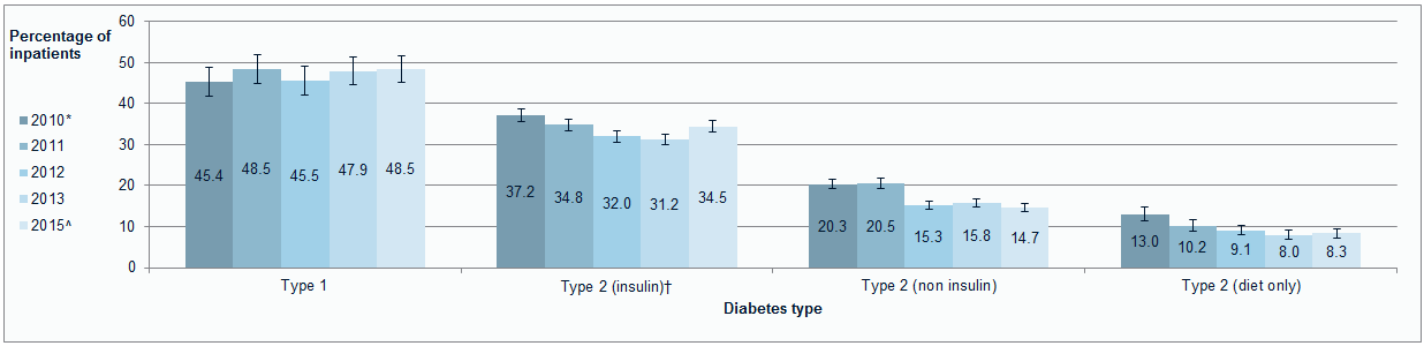
- Over one fifth of inpatients with diabetes had one or more hypoglycaemic episode (22 per cent).
- Inpatients with Type 1 diabetes were **more likely** to experience one or more hypoglycaemic episode than inpatients with other diabetes types (48 per cent compared to between 8 and 34 per cent).

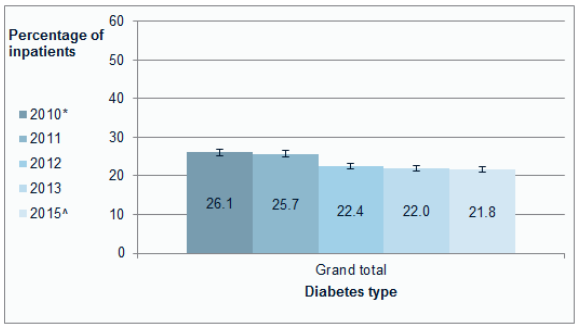
TRENDS SINCE 2013

- There has been an **increase** in Type 2 insulin treated inpatients having one or more hypoglycaemic episode (from 31 per cent to 34 per cent).

Since 2010, the proportion of inpatients having one or more hypoglycaemic episode has decreased overall and for all diabetes types except for Type 1.

Chart 43: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†





Audit findings: Hypoglycaemic episodes

TRENDS SINCE 2010

- There has been a **decrease** in the proportion of inpatients having one or more hypoglycaemic episode (from 26 per cent to 22 per cent).
- There has been a **decrease** in the proportion of inpatients having one or more hypoglycaemic episode for all diabetes types except Type 1 (Type 2 insulin treated: 37 per cent to 34 per cent; Type 2 non-insulin treated: 20 per cent to 15 per cent; Type 2 diet only: 13 per cent to 8 per cent).

* Sites from Wales did not participate in the 2010 NaDIA. Any hypoglycaemic episode (≤3.9mmol/L).
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

Mild hypoglycaemic episodes

One fifth (20.0 per cent) of inpatients with diabetes had at least one mild hypoglycaemic episode (3.0-3.9mmol/L), compared to 20.0 per cent in 2013.

In 2015, inpatients with Type 1 diabetes were significantly more likely to experience one or more mild hypoglycaemic episode (42.5 per cent) than inpatients with Type 2 insulin treated diabetes (31.1 per cent), Type 2 non-insulin treated diabetes (13.9 per cent) and Type 2 diet only diabetes (8.0 per cent). Chart 44 shows that there was a significant increase in Type 2 insulin treated inpatients having one or more hypoglycaemic episode between 2013 (28.2 per cent) and 2015 (31.1 per cent).

Since 2010, the proportion of inpatients having one or more mild hypoglycaemic episode has decreased overall and amongst those with Type 2 non-insulin treated and Type 2 diet only diabetes.

Audit findings: Mild hypoglycaemic episodes

2015 FINDINGS

- One fifth of inpatients with diabetes had one or more mild hypoglycaemic episode (20 per cent).
- Inpatients with Type 1 diabetes were **more likely** to experience one or more mild hypoglycaemic episode than inpatients with other diabetes types (43 per cent compared to between 8 per cent and 31 per cent).

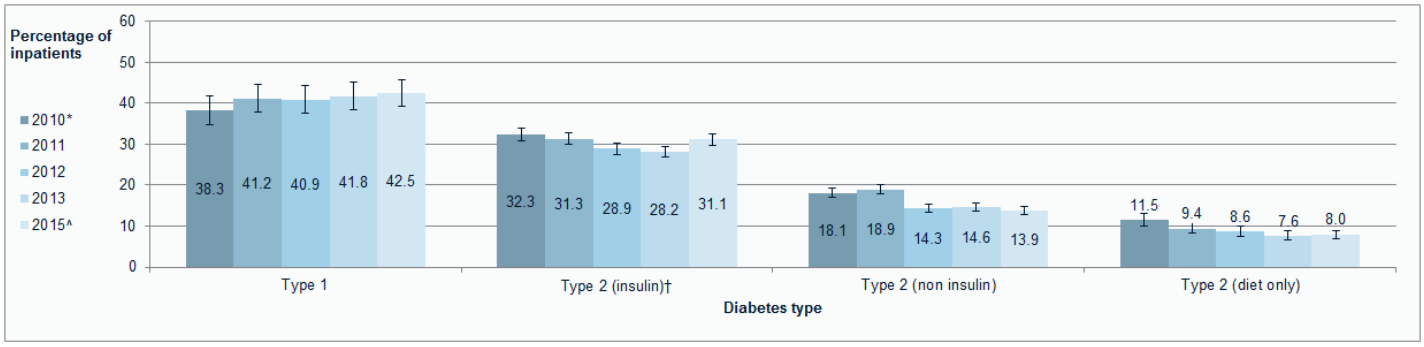
TRENDS SINCE 2013

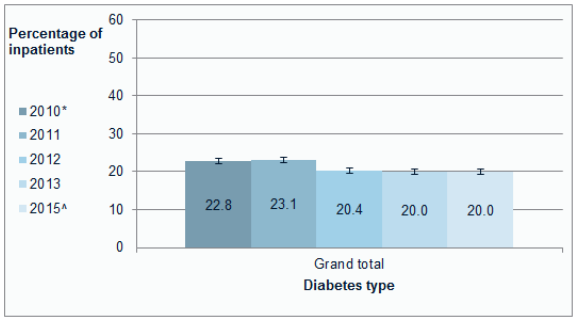
- There has been an **increase** in Type 2 insulin treated inpatients having one or more mild hypoglycaemic episode (from 28 per cent to 31 per cent).

TRENDS SINCE 2010

- There has been a **decrease** in the proportion of inpatients having one or more mild hypoglycaemic episode (from 23 per cent to 20 per cent).
- There has been a **decrease** in the proportion of inpatients with Type 2 non-insulin treated and Type 2 diet only diabetes having one or more hypoglycaemic episode (Type 2 non-insulin treated: 18 per cent to 14 per cent; Type 2 diet only: 12 per cent to 8 per cent).

Chart 44: Percentage of inpatients that experienced one or more mild hypoglycaemic episode (3.0-3.9mmol/L) in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†





* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values ($p < 0.05$). Mild hypoglycaemic episode (3.0-3.9mmol/L).

Severe hypoglycaemic episodes

Just under 1 in 10 inpatients with diabetes (9.8 per cent) had at least one severe hypoglycaemic episode (<3.0mmol/L), compared to 9.3 per cent in 2013.

In 2015, inpatients with Type 1 diabetes were significantly more likely to experience one or more severe hypoglycaemic episode (31.3 per cent) than inpatients with Type 2 insulin treated diabetes (17.2 per cent), Type 2 non-insulin treated diabetes (4.2 per cent) and Type 2 diet only diabetes (2.0 per cent). Chart 45 shows that there was a significant increase in Type 2 insulin treated inpatients having one or more hypoglycaemic episode between 2013 (14.4 per cent) and 2015 (17.2 per cent).

Since 2010, the proportion of inpatients having one or more severe hypoglycaemic episode has decreased overall and amongst those with Type 2 non-insulin treated and Type 2 diet only diabetes.

Audit findings: Severe Hypoglycaemic episodes

2015 FINDINGS

- Around 1 in 10 inpatients with diabetes had at least one severe hypoglycaemic episode (10 per cent).
- Inpatients with Type 1 diabetes were **more likely** to experience one or more severe hypoglycaemic episode than inpatients with other diabetes types (31 per cent compared to between 2 per cent and 17 per cent).

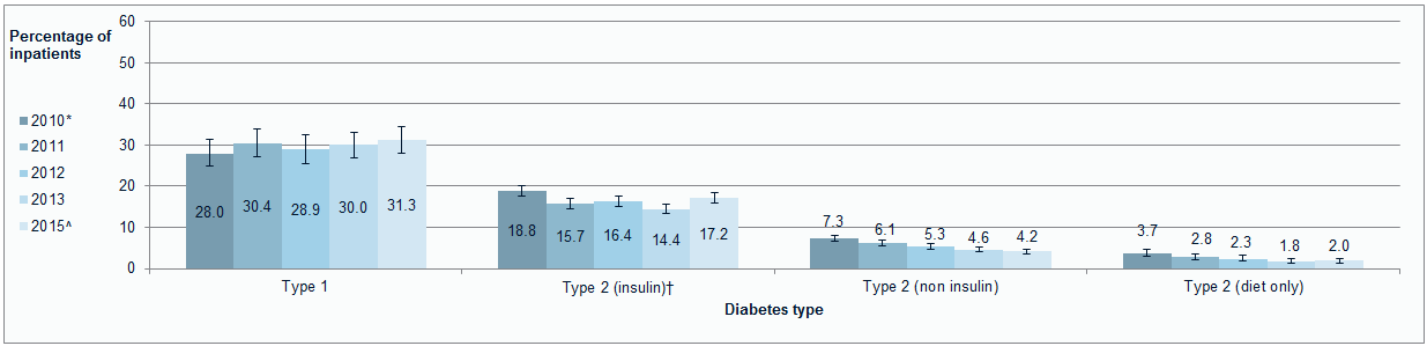
TRENDS SINCE 2013

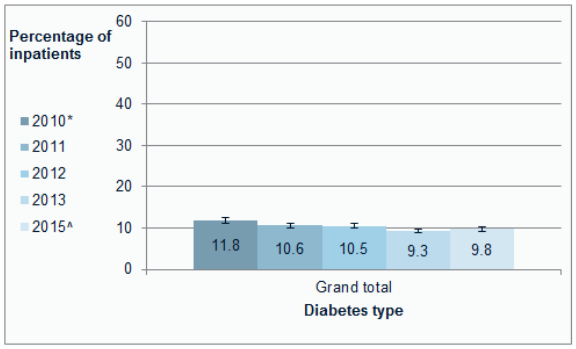
- There has been an **increase** in Type 2 insulin treated inpatients having one or more severe hypoglycaemic episode (from 14 per cent to 17 per cent).

TRENDS SINCE 2010

- There has been a **decrease** in the proportion of inpatients having one or more severe hypoglycaemic episode (from 12 per cent to 10 per cent).
- There has been a **decrease** in the proportion of inpatients with Type 2 non-insulin treated and Type 2 diet only diabetes having one or more mild hypoglycaemic episode (Type 2 non-insulin treated: 7 per cent to 4 per cent; Type 2 diet only: 4 per cent to 2

Chart 45: Percentage of inpatients that experienced one or more severe hypoglycaemic episode (<3.0mmol/L) in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†





* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values ($p < 0.05$).

Hypoglycaemic episodes by diabetes type

Table 28 below summarises the changes in the prevalence of hypoglycaemic episodes between 2010 and 2015. We can see that the proportion of hypoglycaemic episodes (mild, severe and any) has decreased significantly over this period, though there has been no change in the proportion of hypoglycaemic episodes in inpatients with Type 1 diabetes. Inpatients with Type 2 insulin treated diabetes are also unchanged when split into the mild and severe categories.

Table 28: Changes in the prevalence of hypoglycaemic episodes by diabetes type, 2010 to 2015

	Difference 2010 to 2015 (p <0.05)		
Diabetes type	Mild*	Severe*	Any*
Type 1	No change	No change	No change
Type 2 (insulin)	No change	No change	**Down**
Type 2 (non-insulin)	**Down**	**Down**	**Down**
Type 2 (diet only)	**Down**	**Down**	**Down**
Grand total	**Down**	**Down**	**Down**

* Mild hypoglycaemic episode (3.0-3.9mmol/L).
Severe hypoglycaemic episode (<3.0mmol/L).
Any hypoglycaemic episode (≤3.9mmol/L).

Table 29 shows that trends in the prevalence of hypoglycaemic episodes have been fairly static since 2013, with the exception of an apparent increase in hypoglycaemic episodes (mild, severe and any) for inpatients with Type 2 insulin treated diabetes.

Table 29: Changes in the prevalence of hypoglycaemic episodes by diabetes type, 2013 to 2015

	Difference 2013 to 2015 (p <0.05)		
Diabetes type	Mild*	Severe*	Any*
Type 1	No change	No change	No change
Type 2 (insulin)	**Up**	**Up**	**Up**
Type 2 (non-insulin)	No change	No change	No change
Type 2 (diet only)	No change	No change	No change
Grand total	No change	No change	No change

* Mild hypoglycaemic episode (3.0-3.9mmol/L).
Severe hypoglycaemic episode (<3.0mmol/L).
Any hypoglycaemic episode (≤3.9mmol/L).

Audit findings: Hypoglycaemic episodes by diabetes type - summary: general trends

TRENDS SINCE 2010

- Overall the prevalence of hypoglycaemic episodes has **decreased**.
- The prevalence of hypoglycaemic episodes in inpatients with Type 1 diabetes is **unchanged**.
- The prevalence of hypoglycaemic episodes in inpatients with Type 2 insulin treated diabetes is **unchanged** when mild and severe episodes are considered separately.

TRENDS SINCE 2013

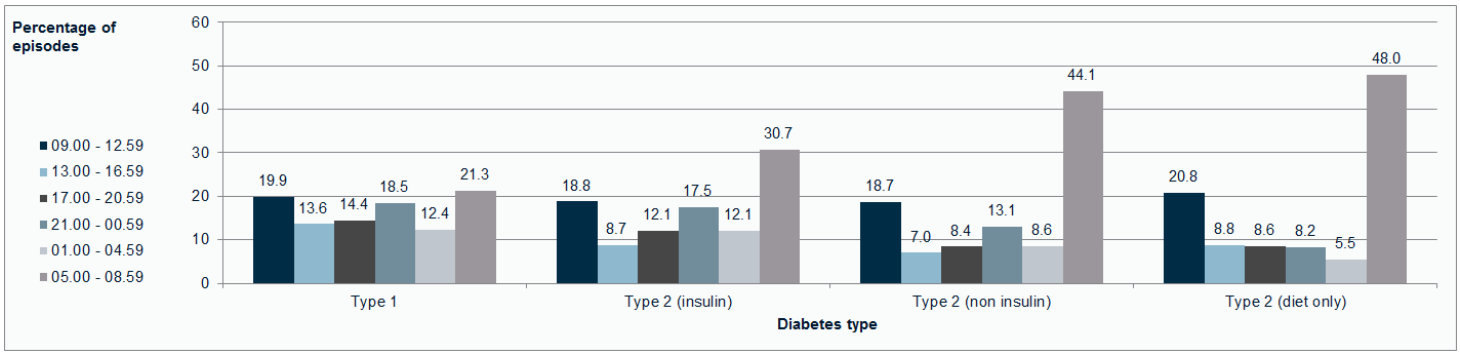
- Overall the prevalence of hypoglycaemic episodes is **unchanged**.
- The prevalence of hypoglycaemic episodes in inpatients with Type 2 insulin treated diabetes has **increased**.

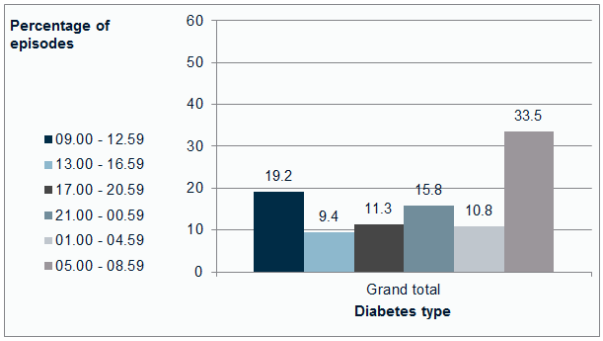
When do hypoglycaemic episodes occur?[25]

The audit collects details of the number of hypoglycaemic episodes (blood glucose measurement of ≤3.9mmol/L) that inpatients experienced in various time intervals within the last 7 days. The highest proportion of hypoglycaemic episodes (≤3.9mmol/L) for each diabetes type took place in the early morning, between 05:00 and 08:59. Overall there has been a significant increase in the proportion of hypoglycaemic episodes between 05:00 and 08:59 since 2013 (from 30.3 per cent to 33.5 per cent), although there was no observed increase for inpatients with Type 1 diabetes (from 23.1 per cent to 21.3 per cent).

The concentration of hypoglycaemic episodes between 05:00 and 08:59 is most pronounced for inpatients with Type 2 diabetes, particularly those with Type 2 non-insulin treated diabetes (44.1 per cent) and Type 2 diet only diabetes (48.0 per cent).

Chart 46: Percentage of hypoglycaemic episodes (≤3.9mmol/L) during time intervals in the last 7 days, by diabetes type, England and Wales, 2015*



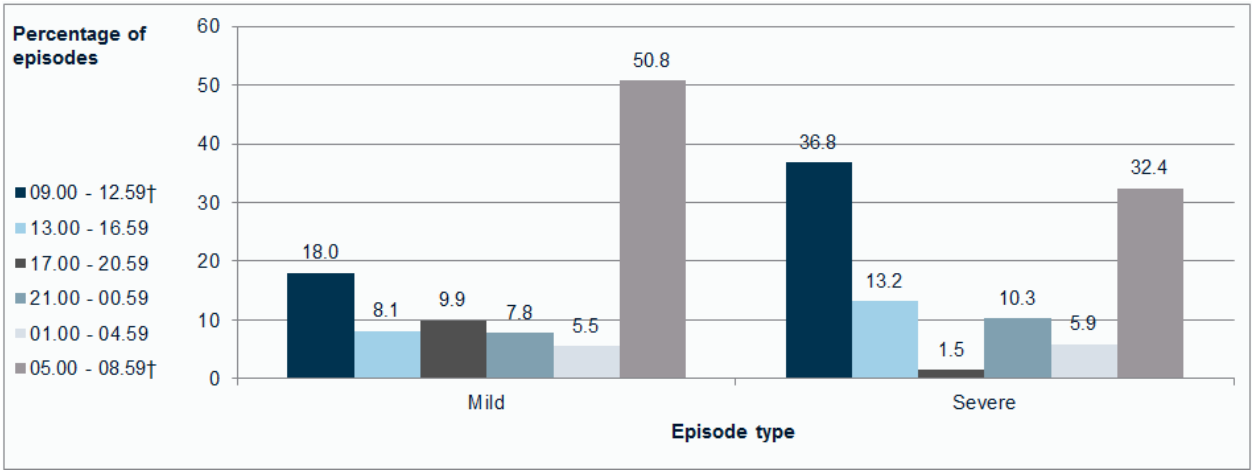


* Figures relating to the prevalence of hypoglycaemic episodes during time intervals have been extensively revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016.

There is little difference in the distribution of mild (3.0-3.9mmol/L) and severe (<3.0mmol/L) episodes across time intervals for all diabetes types except Type 2 diet only diabetes[26] (see Chart 47 below and Chart 49 and 50 in the Supporting Data). In this group a lower proportion of severe episodes occurred between 05:00 and 08:59 (32.4 per cent) compared to mild episodes (50.8 per cent), with a correspondingly higher proportion of severe episodes occurring between 09:00 and 12:59 (36.8 per cent compared to 18.0 per cent).

[25] Figures relating to the prevalence of hypoglycaemic episodes during time intervals have been extensively revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016.
[26] Excluding Type 2 diet only diabetes, the only significant difference in the proportions of mild and severe hypoglycaemic episodes by time interval was for inpatients with Type 2 non-insulin diabetes between 21:00 and 00:59 (12.2 per cent compared to 16.7 per cent).

Chart 47: Percentage of mild and severe hypoglycaemic episodes during time intervals in the last 7 days for inpatients with Type 2 diet only diabetes, England and Wales, 2015*†‡



* Mild hypoglycaemic episode (3.0-3.9mmol/L).
Severe hypoglycaemic episode (<3.0mmol/L).
† Statistically significant difference between mild and severe values (p <0.05).
‡ Figures relating to the prevalence of hypoglycaemic episodes during time intervals have been extensively revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016.

Further information about hypoglycaemic episodes can be found in the Supporting Data. The following charts are included:

- Chart 48: Percentage of mild and severe hypoglycaemic episodes during time intervals in the last 7 days, England and Wales, 2015
- Chart 49: Percentage of mild hypoglycaemic episodes during time intervals in the last 7 days, by diabetes type, England and Wales, 2015
- Chart 50: Percentage of severe hypoglycaemic episodes during time intervals in the last 7 days, by diabetes type, England and Wales, 2015

Audit findings: When do hypoglycaemic episodes occur?

2015 FINDINGS

- Over **one third** of hypoglycaemic episodes occurred between 05:00 and 08:59 (34 per cent).
- The concentration of hypoglycaemic episodes between 05:00 and 08:59 varied from around **one fifth** for inpatients with Type 1 diabetes (21 per cent) to almost **one half** for inpatients with Type 2 diet only diabetes (48 per cent).
- For inpatients with Type 1, Type 2 insulin treated and Type 2 non-insulin treated diabetes there is **little difference** in the distribution of mild and severe hypoglycaemic episodes across time intervals
- For inpatients with Type 2 diet only diabetes there is lower proportion of severe hypoglycaemic episodes between 05:00 and 08:59 (32.4 per cent compared to 50.8 per cent of mild episodes).

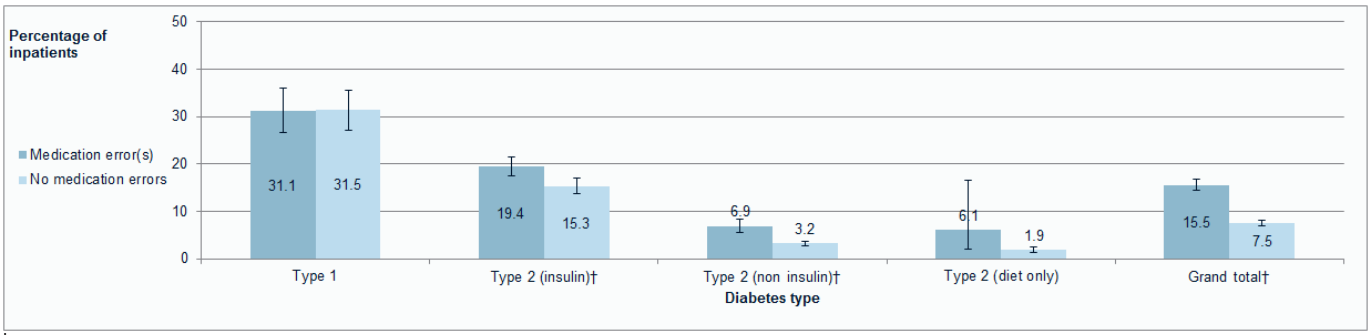
TRENDS SINCE 2013

- The proportion of hypoglycaemic episodes between 05:00 and 08:59 has **increased** (from 30 per cent to 34 per cent).
- The proportion of hypoglycaemic episodes between 05:00 and 08:59 has **increased** for inpatient diabetes types except for those with Type 1 diabetes (from 23 per cent to 21 per cent).

Hypoglycaemic episodes and medication errors

Inpatients whose drug charts had one or more medication error were more than twice as likely to experience a severe (blood glucose measurement of <3.0mmol/L) hypoglycaemic episode (15.5 per cent) compared to inpatients whose drug charts had no medication errors (7.5 per cent). The effect appears to be most pronounced for Type 2 non-insulin treated inpatients, where inpatients having medication errors were more than twice as likely to have a severe hypoglycaemic episode (6.9 per cent) compared to other inpatients in the cohort (3.2 per cent). Type 1 inpatients do not show any significant difference.

Chart 51: Percentage of inpatients that experienced one or more severe hypoglycaemic episode (<3.0mmol/L) in last 7 days, by whether inpatient had one or more drug chart medication error in the same period, England and Wales, 2015†



† Statistically significant difference between 'Medication error(s)' and 'No medication errors' values (p <0.05).

Audit findings: Hypoglycaemic episodes and medication errors

2015 FINDINGS

- Inpatients with diabetes that had a medication error were more than **twice as likely** to experience a severe hypoglycaemic episode than those with no medication errors (16 per cent compared to 7 per cent).
- The observed effect is greater for non-insulin treated inpatients, where the proportion experiencing a severe hypoglycaemic episode doubles when a medication has occurred.

Hypoglycaemic episodes and blood glucose self-management

Table 30 shows that inpatients that self-test their blood sugar levels are more likely to have one or more hypoglycaemic episode than those that do not: 30.6 per cent compared to 22.0 per cent for any hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L). Insulin treated inpatients that self-adjust their insulin dosage are also more likely to have a hypoglycaemic episode (42.4 per cent compared to 36.7 per cent), although this pattern does not apply to insulin treated inpatients that self-administer their insulin.

Table 30 uses data from the Bedside Audit return, which confirms whether the patient had self-tested glucose and/or self-administered insulin during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes. Similar findings in Tables 43 and 44 use the data reported on the Patient Experience form, which confirms whether the patient indicated that they were able to self-test their glucose levels and/or self-administer insulin during their hospital stay.

Table 30: Percentage of inpatients that experienced one or more hypoglycaemic episode in last 7 days, by type of blood glucose management, England and Wales, 2015*

Percentage of inpatients that had one or more*:	Self-testing glucose?‡		Self-administering insulin?†‡		Self-adjusting insulin dosage?†	
	Yes	No	Yes	No	Yes	No
Mild hypoglycaemic episode (3.0-3.9mmol/L)	**26.9**	**20.2**	33.4	33.8	**37.7**	**32.8**
Severe hypoglycaemic episode (<3.0mmol/L)	**16.1**	**10.0**	19.7	21.5	21.2	20.6
Any hypoglycaemic episode (≤3.9mmol/L)	**30.6**	**22.0**	37.4	37.8	**42.4**	**36.7**

* Where values in the table are **bolded**, the difference between the 'Yes' and 'No' percentages is statistically significant (p <0.05).

† Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes.

‡ As reported on the Bedside Audit return, which confirmed whether the patient had self-tested glucose and/or self-administered insulin during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes. Similar findings in Tables 43 and 44 use the data reported on the Patient Experience form, which confirms whether the patient indicated that they were able to self-test their glucose levels and/or self-administer insulin during their hospital stay.

Audit findings: Hypoglycaemic episodes and blood glucose self-management

2015 FINDINGS

- Inpatients that self-test their blood sugar levels are **more likely** to have one or more hypoglycaemic episode than those that do not (31 per cent compared to 22 per cent).
- Insulin treated inpatients that self-adjust their insulin dosage are **more likely** to have a hypoglycaemic episode (42 per cent compared to 37 per cent).

Hypoglycaemic episodes and remote glucose monitoring

Table 31 shows that inpatients treated in hospitals that used remote glucose monitoring technology were no more or less likely to have a hypoglycaemic episode (mild and/or severe) than those treated elsewhere.

Table 31: Percentage of inpatients that experienced one or more hypoglycaemic episode in last 7 days, by whether hospital uses remote glucose monitoring, England and Wales, 2015*

Percentage of inpatients that had one or more:	Remote blood glucose monitoring?	
	Yes	No
Mild hypoglycaemic episode (3.0-3.9mmol/L)	20.5	20.1
Severe hypoglycaemic episode (<3.0mmol/L)	9.8	10.2
Any hypoglycaemic episode (≤3.9mmol/L)	22.6	21.8

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05) – none found.

Audit findings: Hypoglycaemic episodes and remote glucose monitoring

2015 FINDINGS

- Inpatients treated in hospitals that used remote glucose monitoring technology are **no more likely** to have a hypoglycaemic episode (23 per cent compared to 22 per cent).

Hypoglycaemic episodes and Sulphonylurea

Sulphonylureas are a family of tablets that work by stimulating the cells in the pancreas to make more insulin[27]. On admission to hospital, Sulphonylureas were taken by 11.5 per cent of inpatients with Type 2 insulin treated diabetes and 38.8 per cent of inpatients with Type 2 non-insulin treated diabetes (see Chart 18 and Chart 19). Sulphonylureas are not usually taken by inpatients with Type 1 diabetes.

Table 32 shows that the percentage of inpatients receiving sulphonylurea with non-insulin treated diabetes that had one or more hypoglycaemic episode (24.7 per cent) was significantly lower than the percentage of inpatients with insulin treated diabetes not receiving sulfonylurea that had such an episode (37.9 per cent). The differences in incidence of both mild and severe hypoglycaemic episodes were similarly significant.

Table 32: Percentage of inpatients that experienced one or more hypoglycaemic episode in the last 7 days by diabetes treatment type, England and Wales, 2015*

Percentage of inpatients that had one or more:	Treated with Sulphonylurea only†	Treated with insulin only†
Mild hypoglycaemic episode (3.0-3.9mmol/L)*	**23.3**	**34.0**
Severe hypoglycaemic episode (<3.0mmol/L)*	**8.0**	**20.7**
Any hypoglycaemic episode (≤3.9mmol/L)*	**24.7**	**37.9**

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05).

† Patients treated with Sulphonylurea only comprised Type 2 (non-insulin treated), Type 2 (diet only) and Other (non-insulin treated) patients treated with Sulphonylurea. Patients treated with insulin only comprised Type 1, Type 2 (insulin treated) and Other (insulin treated) patients not treated with Sulphonylurea.

[27] https://www.diabetes.org.uk/Guide-to-diabetes/What-is-diabetes/Diabetes-treatments/Sulphonylureas/. Accessed 27 April 2016.

Hypoglycaemic episodes requiring injectable treatment

A total of 213 inpatients (2.1 per cent) had at least one hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L) that required injectable treatment, which was similar to the number of patients that had an episode requiring injectable treatment in 2013 (218 patients or 2.2 per cent, not significantly different). Of the 213 inpatients who had at least one hypoglycaemic episode that required injectable treatment, 28.2 per cent had Type 1 diabetes and 34.7 per cent had Type 2 (insulin treated) diabetes. 8.6 per cent of Type 1 inpatients had at least one hypoglycaemic episode that required injectable treatment, more than three times higher than any other diabetes type (see Table 33).

Inpatients admitted specifically for the management of diabetes and diabetes complications were significantly more likely to have had a hypoglycaemic episode requiring injectable treatment (5.9 per cent) than inpatients admitted for other medical reasons (1.8 per cent) and non-medical (i.e. surgical) reasons (1.4 per cent).

A significantly higher percentage of inpatients on a medical ward (2.3 per cent) than on a surgical ward (1.5 per cent) had one or more hypoglycaemic episode requiring injectable treatment.

Table 33: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment in the last 7 days by diabetes type, England and Wales, 2015*

Diabetes type	Inpatients having any hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment	
	Number	Percentage
Type 1	60	8.6
Type 2 (insulin)	74	2.6
Type 2 (non-insulin)	46	1.1
Type 2 (diet only)	13	0.7
Grand total	213	2.1

* The difference between the Type 1 percentage and the percentage for all over diabetes types is statistically significant (p <0.05).

Table 34: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment in the last 7 days by audit year, England and Wales, 2010 - 2013, 2015†

Audit year	Inpatients having any hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment	
	Number	Percentage
2010*	257	2.4
2011	250	2.2
2012	232	2.3
2013	218	2.2
2015^	213	2.1

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The decrease from 2.2 per cent in 2013 to 2.1 per cent in 2015 is not statistically significant (p <0.05).

Table 35: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment in the last 7 days by main reason of admission, England and Wales, 2015*

Main reason for admission	Any hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment
	Percentage
Management of diabetes and diabetes complications	**5.9**
Other medical reasons	**1.8**
Non-medical reasons	1.4
Grand total	2.1

* The difference between the percentage for 'management of diabetes and diabetes complications' and the percentage for 'other medical reasons' is statistically significant (p <0.05) – associated values are **bolded**.

Table 36: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment in the last 7 days by ward type, England and Wales, 2015*

Ward type	Any hypoglycaemic episode (≤3.9mmol/L) that required injectable treatment
	Percentage
Medical	**2.3**
Surgical	**1.5**
Grand total	2.1

* The difference between the percentages for medical and surgical wards is statistically significant (p <0.05) – associated values are **bolded**.

Audit findings: Hypoglycaemic episodes requiring injectable treatment

2015 FINDINGS

- 2 per cent of inpatients with diabetes had at least one hypoglycaemic episode that required injectable treatment.
- 9 per cent of inpatients with Type 1 diabetes had at least one hypoglycaemic episode that required injectable treatment.
- Inpatients admitted for the management of diabetes were **more likely** to have had a hypoglycaemic episode requiring injectable treatment than inpatients with diabetes admitted for other medical reasons (6 per cent compared to between 1 per cent and 2 per cent).
- Inpatients with diabetes on medical wards were **more likely** to have at least one hypoglycaemic episode that required injectable treatment than those treated on surgical wards (2.3 per cent compared to1.5 per cent).

Diabetic ketoacidosis (DKA)

66 patients (0.4 per cent) were reported to have developed diabetic ketoacidosis (DKA) after their admission to hospital, which was similar to the number of patients that developed DKA in 2013 (63 patients or 0.4 per cent, not significantly different). Type 1 inpatients were over 10 times more likely to develop DKA after admission than inpatients with other diabetes types, with 4.2 per cent of inpatients with Type 1 diabetes (see Table 38). The development of DKA after admission suggests that the inpatient's insulin treatment was omitted for an appreciable time.

Table 37: Percentage of inpatients that developed diabetic ketoacidosis (DKA) after their admission to hospital by audit year, England and Wales, 2010 - 2013, 2015†

Audit year	Developed diabetic ketoacidosis (DKA) after their admission to hospital	
	Number	Percentage
2010*	44	0.4
2011	68	0.5
2012	61	0.5
2013	63	0.4
2015^	66	0.4

† The difference between the percentages for 2013 and 2015 is not statistically significant (p <0.05).
* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.

Table 38: Percentage of inpatients that developed diabetic ketoacidosis (DKA) after their admission to hospital by diabetes type, England and Wales, 2015

Diabetes type	Developed diabetic ketoacidosis (DKA) after their admission to hospital	
	Number	Percentage
Type 1	42	4.2
Type 2 (insulin)*	12	0.3
Type 2 (non-insulin)	8	0.1
Type 2 (diet only)	1	0.0
Grand total	66	0.4

Audit findings: Diabetic ketoacidosis (DKA)

2015 FINDINGS

- 0.4 per cent of inpatients with diabetes developed diabetic ketoacidosis (DKA) after their admission to hospital.
- Type 1 inpatients are 10 times **more likely** to develop DKA after admission than inpatients with other diabetes types (4.2 per cent compared to between 0.0 per cent and 0.3 per cent).

TRENDS SINCE 2013

- **No change**.

Hyperosmolar hyperglycaemic state (HHS)

For the first time, NaDIA collected information on whether the patient developed HHS at any time after their admission. Hyperosmolar Hyperglycaemic State (HHS) typically occurs in people with Type 2 diabetes who experience very high blood glucose levels (often over 40mmol/l). It can develop over a course of weeks through a combination of illness (e.g. infection) and dehydration.[28]

29 patients (0.2 per cent) were reported to have developed HHS after their admission to hospital. Type 2 insulin treated inpatients has more instances of HHS after admission than inpatients with other diabetes types (see Table 39), though numbers and proportions are very low for all groups.

Table 39: Percentage of inpatients that developed Hyperosmolar Hyperglycaemic State (HHS) at any time after their admission by diabetes type, England and Wales, 2015*

Diabetes type	Developed hyperosmolar hyperglycaemic state (HHS) after their admission to hospital	
	Number	Percentage
Type 1	1	0.1
Type 2 (insulin)*	14	0.3
Type 2 (non-insulin)	6	0.1
Type 2 (diet only)	3	0.1
Grand total	29	0.2

* The incidence of HSS after admission is statistically higher amongst inpatients with Type 2 insulin treated diabetes compared to inpatients with other diabetes types (combined) (p <0.05). The small number of cases prevents statistical comparison between individual diabetes types.

Audit findings: Hyperosmolar hyperglycaemic state (HHS)

2015 FINDINGS

- 0.2 per cent of inpatients with diabetes developed hyperosmolar hyperglycaemic state (HHS) after their admission to hospital.

[28] Diabetes UK. Hypersmolar Hyperglycaemic State (HHS): https://www.diabetes.org.uk/Guide-to-diabetes/Complications/Hyperosmolar_Hyperglycaemic_State_HHS/. Accessed 07 April 2016.

Was patient experience of the inpatient stay favourable?

'Was patient experience of the inpatient stay favourable?' is the third of four key questions posed by the audit (see Introduction on page 14). This section will also address the fourth audit question: Has patient feedback changed since NaDIA 2010, 2011, 2012 and 2013?

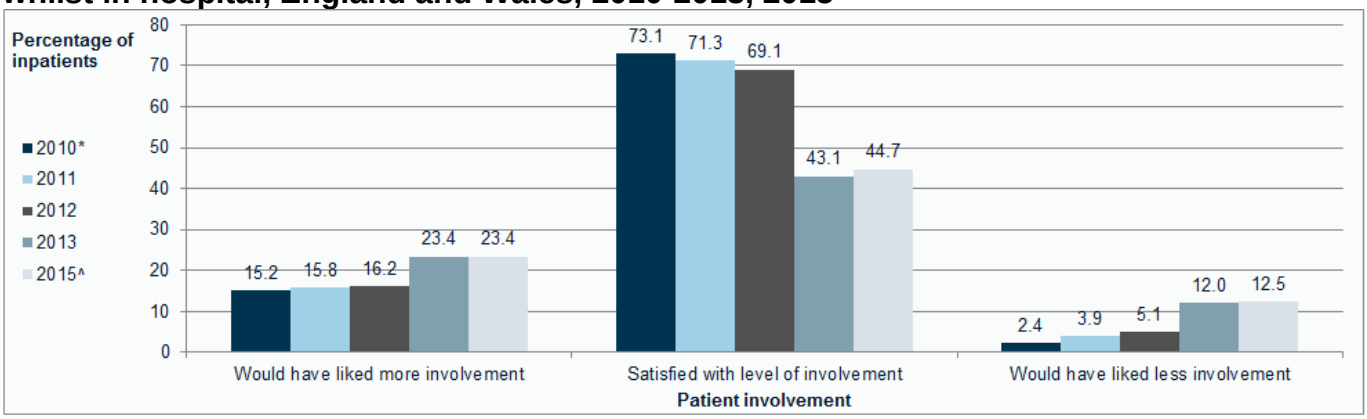
Inpatients that were able and willing were asked to provide information on their experience of diabetes management while in hospital. 8,521 inpatients responded to questionnaires on their inpatient experience, of which 8,456 were matched to a corresponding bedside audit form. These responses have been weighted in the following analysis to reflect differing response rates by age, ethnic group, type of admission, type and duration of diabetes, ward specialty and length of hospital stay at the time of the audit.

Patient involvement in the care planning

Of the inpatients who responded to the patient experience questionnaire, 23.4 per cent said that they would have liked more involvement in the planning of their diabetes treatment, equal to the proportion recorded in 2013 (see Chart 52). 12.5 per cent of inpatients stated that they would prefer to have been less involved in planning their treatment, compared to 12.0 per cent in 2013.

Since 2010 there has been a significant decrease of 28.5 percentage points in the proportion of inpatients satisfied with their level of involvement. This drop was first noticeable in 2013 NaDIA and the trend has continued in 2015.

Chart 52: Inpatients' views on their involvement in the planning of their diabetes treatment whilst in hospital, England and Wales, 2010-2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Can't remember / not sure" responses have not been included in this chart.
‡ Statistically significant difference between 2013 and 2015 values ($p < 0.05$) – none found.

Audit findings: Patient involvement in the care planning

2015 FINDINGS

- **Less than half** of inpatients are satisfied with their level of involvement in the planning of their diabetes treatment (45 per cent).

TRENDS SINCE 2013

- **No change**.

TRENDS SINCE 2010

- The proportion of inpatients that are satisfied with their level of involvement in the planning of their diabetes treatment has **decreased** (from 73 per cent to 45 per cent).

Further information about care planning can be found in the Supporting Data:

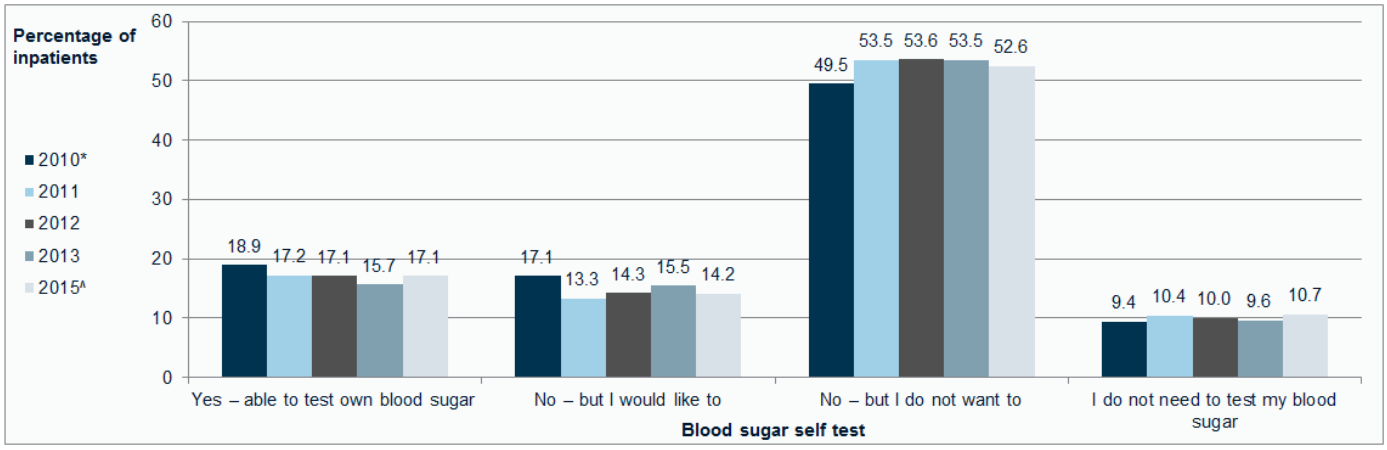
- Table 40: Inpatients' views on their involvement in the planning of their diabetes treatment whilst in hospital by ward type, England and Wales, 2015
- Chart 53: Inpatients' views on whether hospital staff have taken their preferences for diabetes treatment into account, England and Wales, 2010-2013, 2015
- Table 41: Inpatients' views on whether hospital staff have taken their preferences for diabetes treatment into account by ward type, England and Wales, 2015

Patient involvement in the management of diabetes

Of the inpatients who responded to the patient experience questionnaire, 17.1 per cent of inpatients reported they were able to test their own blood glucose levels while in hospital, compared to 15.7 per cent in 2013. 14.2 per cent of inpatients stated that they were not able to test their own blood glucose levels but would have liked to, compared to 15.5 per cent in 2013. Neither of these changes was statistically significant.

The proportions in each category have fluctuated since 2010 and no strong trends are evident.

Chart 54: Inpatients' views on their ability to test their own blood sugar level while in hospital, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Not sure" responses have not been included in this chart.
‡ Statistically significant difference between 2013 and 2015 values ($p < 0.05$) – none found.

Further information about care planning can be found in the Supporting Data:

- Table 42: Inpatients' views on their ability to test their own blood sugar level while in hospital by ward type, England and Wales, 2015

Audit findings: Patient ability to self-test blood sugar level while in hospital

2015 FINDINGS

- 14 per cent of inpatients were unable to self-test their glucose levels while hospital, but would like to.

TRENDS SINCE 2013

- **No change**.

TRENDS SINCE 2010

- **No change**.

Of those inpatients who were able to test their own glucose, 27.6 per cent had one or more hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L) in the previous seven days. This was significantly higher than the 21.1 per cent of inpatients who were not able to test their own glucose that had one or more hypoglycaemic episode. For inpatients on medical wards, the same pattern is evident, with a statistically significant difference between those that could self-test (29.0 per cent) and those that could not (21.4 per cent). There was no significant difference for inpatients on surgical wards.

Table 43 uses data reported on the Patient Experience return, which confirms whether the patient indicated that they were able to test their own glucose during their hospital stay. Similar findings in Table 30 use the data reported on the Bedside Audit form, which confirmed whether the patient had self-tested their own glucose during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes.

Table 43: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) in the last 7 days, by inpatient ability to test their own blood sugar level and by ward type, England and Wales, 2015*

	Percentage of inpatients having any hypoglycaemic episode (≤3.9mmol/L)		
Inpatient able to test their own glucose?†	Medical ward*	Surgical ward	Grand total*
Yes	**29.0**	22.9	**27.6**
No	**21.4**	19.8	**21.1**

* Where the values in a column in the table are **bolded**, the difference between the two percentages is statistically significant ($p < 0.05$).

† As reported on the Patient Experience return, which confirms whether the patient indicated that they were able to test their own glucose during their hospital stay. Similar findings in Table 30 use the data reported on the Bedside Audit form, which confirmed whether the patient had self-tested their own glucose during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes.

Audit findings: Hypoglycaemic episodes by patient ability to self-test glucose levels

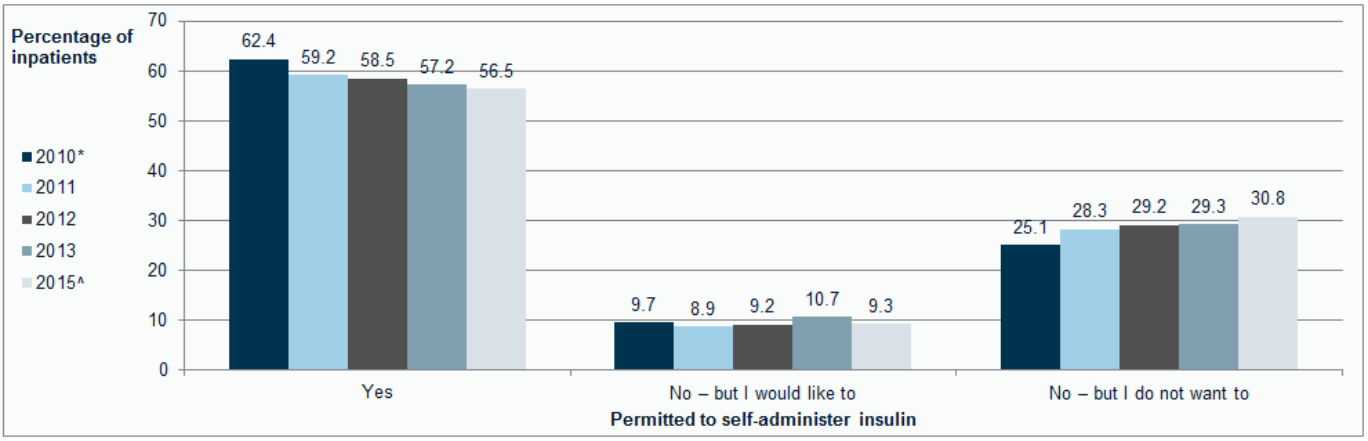
2015 FINDINGS

- Inpatients that stated that they were able to test their own blood sugar are **more likely** to have a hypoglycaemic episode (28 per cent compared to 21 per cent).

Over half of inpatients (56.5 per cent) taking insulin for their diabetes had been permitted to self-administer insulin while in hospital (compared to 57.2 per cent in 2013). 9.3 per cent of inpatients taking insulin for their diabetes reported that they were not permitted to self-administer insulin while in hospital but would have liked to do so (compared to 10.7 per cent in 2013). 30.8 per cent of inpatients taking insulin stated that they did not want to self-administer while in hospital (similar to 29.3 per cent in 2013). None of these changes was statistically significant.

Since 2010 there has been a significant drop in the proportion of insulin treated inpatients that had been permitted to self-administer insulin while in hospital (62.4 per cent compared to 56.5 per cent).

Chart 55: Inpatients' views on whether they were permitted to self-administer insulin while in hospital, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Not sure" responses have not been included in this chart.
‡ Statistically significant difference between 2013 and 2015 values (p <0.05) – none found.

Audit findings: Patient ability to self-administer insulin while in hospital

2015 FINDINGS

- **More than half** of inpatients taking insulin for their diabetes had been permitted to self-administer insulin while in hospital (57 per cent).

TRENDS SINCE 2013

- **No change**.

TRENDS SINCE 2010

- The proportion of insulin treated inpatients that had been permitted to self-administer insulin while in hospital has **decreased** (from 62 per cent to 57 per cent).

The percentage of inpatients that were able to self-administer insulin who had one or more hypoglycaemic episode (35.1 per cent), was the same as among inpatients that were not able to self-administer insulin. Similarly there was no difference between medical or surgical wards.

Table 44: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) in the last 7 days, by inpatient ability to self-administer insulin and by ward type, England and Wales, 2015*

	Percentage of inpatients having any hypoglycaemic episode (≤3.9mmol/L)		
Inpatient able to self-administer insulin?†	Medical ward	Surgical ward	Grand total
Yes	34.9	35.6	35.1
No	36.4	36.4	36.7

* Where the values in a column in the table are **bolded**, the difference between the two percentages is statistically significant (p <0.05) – none found.
† As reported on the Patient Experience return, which confirms whether the patient indicated that they were allowed to administer their own insulin during their hospital stay. Similar findings in Table 30 use the data reported on the Bedside Audit form, which confirmed whether the patient had self-administered their own insulin during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes.

Table 44 uses data reported on the Patient Experience return, which confirms whether the patient indicated that they were allowed to administer their own insulin during their hospital stay. Similar findings in Table 30 use the data reported on the Bedside Audit form, which confirmed whether the patient had self-administered their own insulin during the last 7 days according to the Bedside Audit questionnaire completed by a medical professional using information from the patient's notes.

Audit findings: Hypoglycaemic episodes by ability to self-administer insulin while in hospital

2015 FINDINGS

- Inpatients that stated that they were able to self-administer insulin are **no more likely** to have a hypoglycaemic episode (35 per cent compared to 37 per cent).

Further information about patient views of their involvement in the management of diabetes can be found in the Supporting Data:

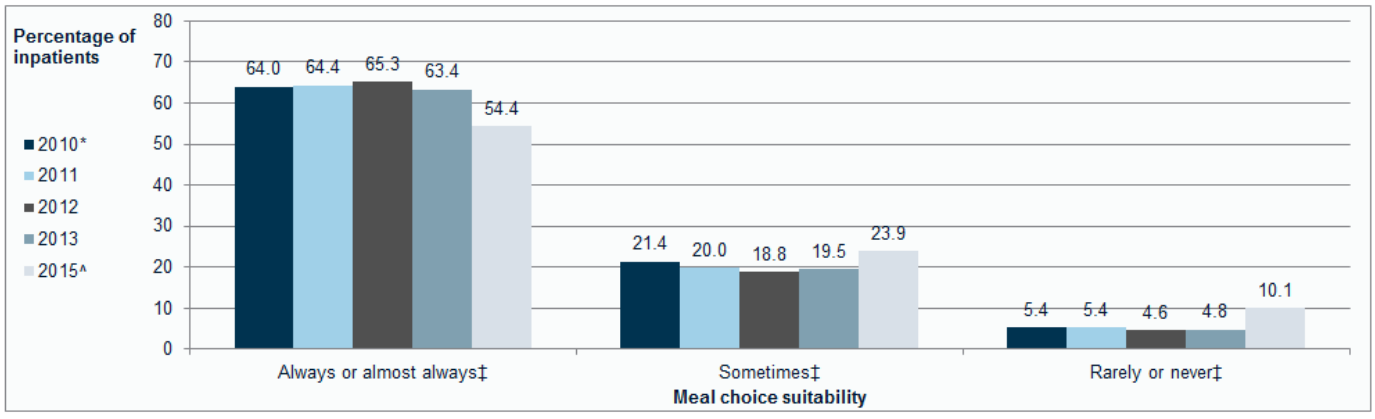
- Table 45: Inpatients' views on whether they were permitted to self-administer insulin while in hospital by ward type, England and Wales, 2015
- Chart 56: Inpatients' views on their ability to take control of their diabetes whilst in hospital, England and Wales, 2010 – 2013, 2015
- Table 46: Inpatients' views on their ability to take control of their diabetes whilst in hospital by ward type, England and Wales, 2015

Appropriate content and timing of meals

An essential aspect of the management of diabetes is the timely provision of suitable food.

Around half of inpatients with diabetes reported that the choice of meals was always or almost always appropriate (54.4 per cent). Patient responses to the question on the suitability of the choice of meal remained fairly static between 2010 and 2013. However, there has been a statistically significant drop of 9.1 percentage points since 2013, from 63.4 per cent to 54.4 per cent. 10.1 per cent stated that the choice of meal was rarely or never suitable for their diabetes. The latter figure is more than double the proportion reported in 2013 (4.8 per cent). A time series comparison for meal choice suitability is shown in Chart 57.

Chart 57: Inpatients' views on how often the meal choice was suitable for their diabetes, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Don't know/Can't remember" responses have not been included in this chart. ‡ Statistically significant difference between 2013 and 2015 values (p <0.05).

Audit findings: Patient views on appropriate content of meals

2015 FINDINGS

- Around **half** of inpatients with diabetes reported that the choice of meals was always or almost always appropriate (54 per cent).

TRENDS SINCE 2013

- There has been a **drop** of 9 percentage points in the proportion of inpatients with diabetes reporting that the choice of meals was always or almost always appropriate (from 63 per cent to 54 per cent).

TRENDS SINCE 2010

- Inpatient views on the suitability of their meals were similar between 2010 and 2013, but have **worsened** in 2015.

Of the inpatients that reported that the choice of meals was rarely or never suitable for the management of their diabetes, 24.3 per cent had one or more hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L), compared to 21.0 per cent where the choice of meals was always or almost always suitable (not statistically significant). Results over time can be seen in Table 47 below. Although the proportions having a hypoglycaemic episode were typically higher in inpatients with a poor view of their choice of meal, there was no significant difference between the cohorts.

Table 47: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) in the last 7 days, by inpatient view on meal suitability and by audit year, England and Wales, 2015†‡

	Percentage of inpatients having any hypoglycaemic episode (≤3.9mmol/L)				
Inpatients' view	2010*	2011	2012	2013	2015^
Always or almost always	24.4	23.2	22.5	21.6	21.0
Sometimes	29.2	29.2	23.4	23.4	24.0
Rarely or never	26.5	29.1	24.7	23.3	24.3

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Where the values in a column in the table are **bolded**, the difference between the 'Always or almost always' and 'Rarely or never' percentages is statistically significant (p <0.05) – none found.
‡ The values for each year do not add up to 100 per cent as "Don't know/Can't remember" responses have not been included in this chart.

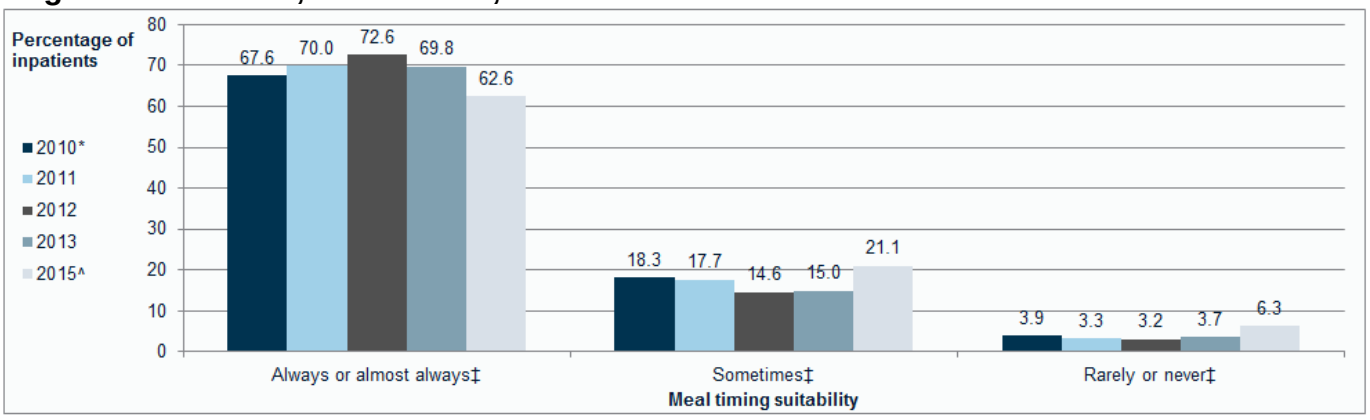
Audit findings: Hypoglycaemic episodes by patient views on appropriate content of meals

2015 FINDINGS

- Inpatients that reported that their choice of meal was rarely or never suitable for their diabetes are **no more likely** to have a hypoglycaemic episode.

The majority of inpatients (62.6 per cent) stated that the timing of meals was always or almost always suitable for their diabetes, although there has been a statistically significant drop since 2013 when the figure was 69.8 per cent. The proportion of inpatients stating that the timing of their meals was always or almost always suitable is now significantly lower than at audit inception in 2010 (63 per cent compared to 68 per cent in 2010). A time series comparison of inpatients' views on meal timing suitability is shown in Chart 58.

Chart 58: Inpatients' views on how often the meal timing was suitable for their diabetes, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Don't know/Can't remember" responses have not been included in this chart.
‡ Statistically significant difference between 2013 and 2015 values (p <0.05).

Audit findings: Patient views on appropriate timing of meals

2015 FINDINGS

- Over 60 per cent of inpatients with diabetes reported that the timing of meals was always or almost always appropriate (63 per cent).

TRENDS SINCE 2013

- There has been a **drop** of 7 percentage points in the proportion of inpatients with diabetes reporting that the timing of meals was always or almost always appropriate (from 70 per cent to 63 per cent).

TRENDS SINCE 2010

- The proportion of inpatients with diabetes that consider the timing of meals to be always or almost always appropriate has **decreased** from 68 per cent to 63 per cent.

Of the inpatients that reported that the timing of meals was rarely or never suitable for the management of their diabetes, 25.3 per cent (compared to 29.4 per cent in 2013) had one or more hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L). Although the proportions having a hypoglycaemic episode were typically higher in inpatients with a poor view of the timing of their meals, there was no significant difference between the cohorts.

Table 48: Percentage of inpatients that experienced one or more hypoglycaemic episode (≤3.9mmol/L) in the last 7 days, by inpatient view on meal timing suitability and by audit year, England and Wales, 2015†

	Percentage of inpatients having any hypoglycaemic episode (≤3.9mmol/L)				
Inpatients' view	2010*	2011	2012	2013	2015^
Always or almost always	24.3	24.2	21.8	21.4	20.9
Sometimes	29.0	27.6	25.8	26.2	24.7
Rarely or never	31.9	30.3	26.8	29.4	25.3

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.

† Where the values in a column in the table are **bolded**, the difference between the 'Always or almost always' and 'Rarely or never' percentages is statistically significant (p <0.05) – none found.

Audit findings: Hypoglycaemic episodes by patient views on appropriate timing of meals

2015 FINDINGS

- Inpatients that reported that the timing of their meals was rarely or never suitable for their diabetes are **no more likely** to have a hypoglycaemic episode (25 per cent compared to 21 per cent in 2015).

Table 49 contrasts the views regarding the food provided in hospital of inpatients treated with insulin and inpatients not treated with insulin. Inpatients who had insulin treated diabetes were significantly more likely to report that the meal choice was sometimes, rarely or never suitable (39.1 per cent) than those with non-insulin treated types of diabetes (31.2 per cent).

Table 49: Inpatients' views on food in hospital, by diabetes treatment type, England and Wales, 2015*

Percentage of inpatients that reported that:	Insulin treated†	Non-insulin treated†
The choice of meals was sometimes, rarely or never suitable*	**39.1**	**31.2**
The timing of meals was sometimes, rarely or never suitable*	**32.2**	**24.6**

* Where the values in a line in the table are **bolded**, the difference between the two percentages is statistically significant (*p* <0.05).
† Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.

Audit findings: Insulin treated inpatients views on appropriate content and timing of meals

2015 FINDINGS

- Inpatients with insulin treated diabetes were **more likely** to report that the meal choice was sometimes, rarely or never suitable (39 per cent compared to 31 per cent).
- Inpatients with insulin treated diabetes were **more likely** to report that the meal timing was sometimes, rarely or never suitable (32 per cent compared to 25 per cent).

Inpatients who had insulin treated diabetes were also significantly more likely to report that the timing of meals was sometimes, rarely or never suitable (32.2 per cent) than inpatients who had non-insulin treated types of diabetes (24.6 per cent).

Staff knowledge and communications

Detailed information about patient views of their involvement in the management of diabetes can be found in the Supporting Data:

- Chart 59: Inpatients' views on whether hospital staff knew enough about diabetes to meet their needs, England and Wales, 2010 - 2013, 2015
- Table 50: Inpatients' views on whether hospital staff knew enough about diabetes to meet their needs by ward type, England and Wales, 2015
- Chart 60: Inpatients' views on the ability of hospital staff to answer their questions, England and Wales, 2010 – 2013, 2015

- Table 51: Inpatients' views on the ability of hospital staff to answer their questions by ward type, England and Wales, 2015

Staff awareness of inpatient diabetes

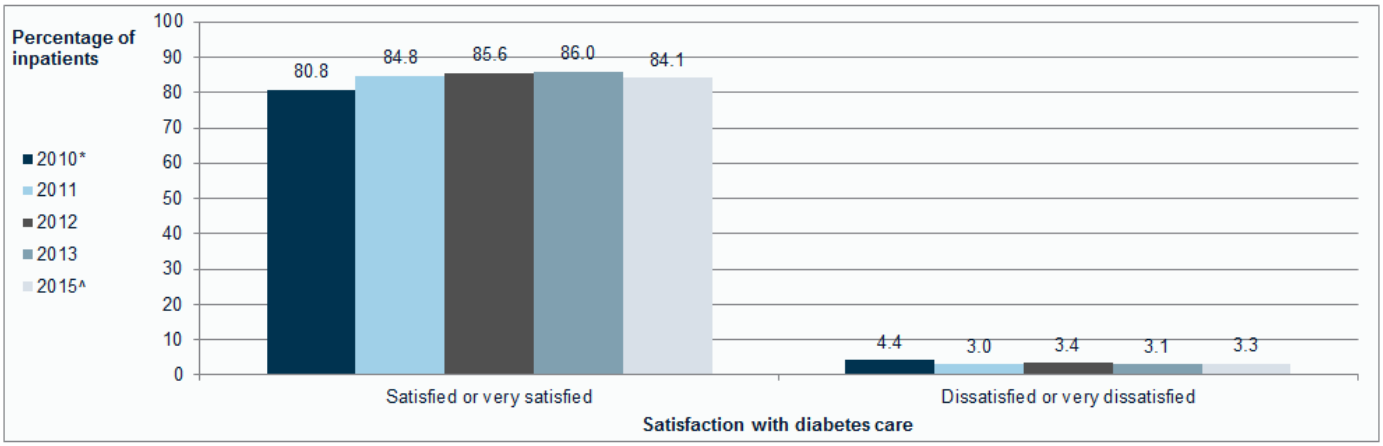
Detailed information about inpatient views of hospital staff awareness of their diabetes can be found in the Supporting Data:

- Chart 61: Inpatients' views on whether they thought that the hospital staff caring for them were aware that they had diabetes, England and Wales, 2010 – 2013, 2015
- Table 52: Inpatients' views on whether they thought that the hospital staff caring for them were aware that they had diabetes by ward type, England and Wales, 2015

Overall inpatient satisfaction with diabetes care

Results for overall inpatient satisfaction remain stable. The majority of inpatients (84.1 per cent) stated that they were satisfied or very satisfied with the overall care of their diabetes while in hospital (compared to 86.0 per cent in 2013, not significantly different). 3.3 per cent of inpatients were dissatisfied or very dissatisfied with their overall care (compared to 3.1 per cent in 2013, again not significantly different) (see Chart 62 below). However, the proportion of inpatients that were satisfied or very satisfied with their diabetes care has significantly increased since 2010, from 80.8 per cent to 84.1 per cent.

Chart 62: Inpatients' views of their overall satisfaction with their diabetes care while in hospital, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† The values for each year do not add up to 100 per cent as "Neither satisfied nor dissatisfied" responses have not been included in this chart.
‡ Statistically significant difference between 2013 and 2015 values ($p < 0.05$) – none found.

Table 53 breaks down the overall inpatient satisfaction with diabetes care by diabetes type. Inpatients with Type 1 diabetes are proportionally twice as likely to be dissatisfied or very dissatisfied with their diabetes care while in hospital than inpatients with Type 2 non-insulin treated diabetes.

Table 53: Inpatients' views of their overall satisfaction with their diabetes care while in hospital by diabetes type, England and Wales, 2015*†

	Percentage of inpatients				
Inpatients' view	Type 1	Type 2 (insulin)	Type 2 (non-insulin)	Type 2 (diet only)	Grand total
Satisfied or very satisfied	82.0	85.2	85.6	80.5	84.1
Dissatisfied or very dissatisfied*	7.1	4.3	**2.3**	2.5	3.3

* Where the value in the table is **bolded**, the difference between the **bolded** percentage and the equivalent Type 1 percentage is statistically significant (p <0.05).
† The values for each diabetes type do not add up to 100 per cent as "Neither satisfied or dissatisfied" responses have not been included in this table.

Audit findings: Overall inpatient satisfaction with diabetes care

2015 FINDINGS

- The **large majority** of inpatients with diabetes said that they were satisfied or very satisfied with their diabetes care.

TRENDS SINCE 2013

- **No change**.

TRENDS SINCE 2010

- The proportion of inpatients with diabetes that said that they were satisfied or very satisfied with their diabetes care has **increased** (from 81 per cent to 84 per cent).

Has inpatient satisfaction with their diabetes care changed over time?

Table 54 below looks at trends in inpatient satisfaction since the previous audit (2013) and since audit inception (2010). Since the first audit in 2010, inpatient satisfaction has decreased in over half of comparable measures (6 of the 11). The most marked reduction relates to satisfaction with the level of involvement in care planning (from 73.1 per cent to 44.7 per cent), with satisfaction levels for meal choice and timing also showing large drops (down by 9.6 and 5.0 percentage points respectively). Contrary to this trend, satisfaction with the overall care for diabetes while in hospital has increased by 3.3 per cent during this period.

Since 2013 some increases in satisfaction levels are evident, accounting for 3 of the 11 comparable measures. However, satisfaction with meal choice and timing dropped significantly between 2013 and 2015 (by 9.1 and 7.3 percentage points respectively), accounting for most of the decrease in meal satisfaction since 2010.

Table 54: Trends in inpatients' views on their hospital stay, England and Wales, 2010, 2013, 2015*

	Current audit	Comparison with previous audit			Comparison with first audit		
Inpatients' view	2015	2013	Difference: 2013 to 2015		2010	Difference: 2010 to 2015	
	%	%	% points	Change†	%	% points	Change†
Satisfied with the level of involvement in care planning	44.7	43.1	1.6	No change	**73.1**	-28.5	**Down**
Able to take control of their diabetes whilst in hospital as much as possible	59.2	**54.7**	4.5	**Up**	56.2	2.9	No change
Preferences for diabetes treatment were taken into account (definitely or to some degree)	85.9	**81.5**	4.4	**Up**	**95.0**	-9.2	**Down**
Permitted to self-administer insulin while in hospital	56.5	57.2	-0.6	No change	**62.4**	-5.9	**Down**
Able to test their own blood sugar level while in hospital	17.1	15.7	1.4	No change	18.9	-1.8	No change
Meal choice always or almost always suitable	54.4	**63.4**	-9.1	**Down**	**64.0**	-9.6	**Down**
Meal timing always or almost always suitable	62.6	**69.8**	-7.3	**Down**	**67.6**	-5.0	**Down**
All or most hospital staff are aware that they have diabetes	84.4	**81.7**	2.7	**Up**	**87.7**	-3.3	**Down**
All or most hospital staff know enough about diabetes to meet needs while in hospital	65.7	67.5	-1.8	No change	64.7	0.9	No change
Hospital staff were able to answer questions on diabetes in a way that could be understood (definitely or to some extent)	81.6	78.8	2.8	No change	82.6	-1.0	No change
Satisfied or very satisfied with the overall care for diabetes while in hospital	84.1	86.0	-1.9	No change	**80.8**	3.3	**Up**

* Where the value is **bolded**, the difference between the bolded percentage and the equivalent 2015 percentage is statistically significant (p <0.05).
† p <0.05

Audit findings: Inpatient satisfaction: 2010 to 2015 and 2013 to 2015

TRENDS SINCE 2010

- Inpatient satisfaction has **decreased** for the majority of patient experience measures (6 of 11).
- Inpatient satisfaction with the level of involvement in care planning has **decreased** by 28 percentage points (from 73 per cent to 45 per cent).

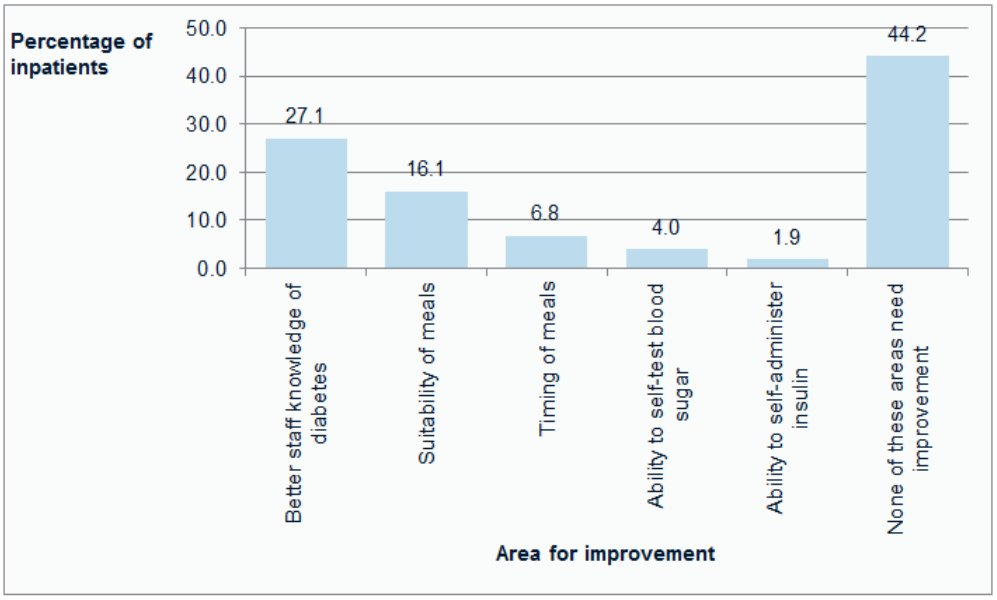
TRENDS SINCE 2013

- Inpatient satisfaction has **increased** for some patient experience measures (3 of 11).
- Inpatient satisfaction with the choice and timing of meals has **decreased** by 9 and 7 percentage points respectively.

Areas for improvement

For the first time in 2015, inpatients were asked to select one area of their diabetes care that they felt was most important for the hospital to improve. Six options were provided[29]. The results are shown in Chart 63 below.

Chart 63: Inpatients' views of the areas of diabetes care they feel is most important for the hospital to improve, England and Wales, 2015



Better staff knowledge of diabetes was the most popular area for improvement identified (27.1 per cent), followed by the suitability of meals with 16.1 per cent. The timing of meals (6.8 per cent) and the ability to either self-test blood sugar (4.0 per cent) or self-administer insulin (1.9 per cent) were each selected by less than ten per cent of respondents. Table 55 breaks down the overall inpatient satisfaction with diabetes care by diabetes type.

Table 55: Inpatients' views of the areas of diabetes care they feel is most important for the hospital to improve by diabetes type, England and Wales, 2015

	Percentage of inpatients				
Area for improvement	Type 1	Type 2 (insulin)	Type 2 (non-insulin)	Type 2 (diet only)	Grand total
Better staff knowledge of diabetes	32.9	31.2	25.8	23.0	27.1
Suitability of meals	14.2	16.5	17.2	13.8	16.1
Timing of meals	10.3	7.8	6.4	5.3	6.8
Ability to self-test blood sugar	4.5	4.2	3.7	4.3	4.0
Ability to self-administer insulin	5.2	4.2	0.7	0.2	1.9
None of these areas need improvement	33.0	36.2	46.3	53.5	44.2

[29] The full text for each option is as follows:

1. Having staff who know enough about diabetes to meet your needs
2. Offering a choice of meal suitable for your diabetes
3. Serving meals at times suitable for your diabetes
4. Allowing you to administer insulin yourself while in hospital
5. Offering the ability to test your own blood sugar level while in hospital
6. None of these areas need improvement

Where an area for improvement was identified, the order of the top three choices was the same for each diabetes type, although other differences are discernible. There was a general split in prioritisation between insulin treated and non-insulin treated inpatients[30]. Inpatients treated with insulin were more likely to identify better staff knowledge of diabetes (31.5 per cent compared to 24.7 per cent) and the ability to self-administer insulin (4.4 per cent compared to 0.5 per cent) as areas for improvement, whereas inpatients not treated with insulin were more likely to identify no areas for improvement (48.6 per cent compared to 35.6 per cent)[31].

Audit findings: Areas for improvement

2015 FINDINGS

- Better staff knowledge of diabetes was the most popular area for improvement identified (27 per cent).
- Inpatients treated with insulin were more likely to identify better staff knowledge of diabetes (32 per cent compared to 25 per cent of non-insulin treated inpatients).
- Inpatients not treated with insulin were more likely to identify no areas for improvement (49 per cent compared to 36 per cent of insulin treated inpatients).

[30] Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.
[31] Differences between the insulin treated and non-insulin treated inpatient groups are statistically significant (p <0.05).

Patient harms and regression modelling

For the first time in 2015, logistic regression has been used to examine the relationship between patient harms and NaDIA variables, with the aim of identifying factors that predict the likelihood of the harms occurring. Four patient harms were chosen for modelling:

- Development of a foot lesion after admission
- Development of DKA after admission
- Hypoglycaemic episodes in hospital
- Medication errors in hospital

For each of the patient harms, the NaDIA Advisory Group identified variables from the audit which might impact on the chance of each harm occurring. Only variables relating to either patient characteristics on admission or hospital characteristics were included. Events that occurred in hospital which may have happened after the harm occurred[32] have been excluded from the models.

When the logistic regression model was run, backwards elimination was used to remove variables that were found not to be significant, producing a final model that included variables with significant associations only. Multi-level logistic regression was also used to improve the models (see Appendix 9).

Interpreting outputs from the models

The quality of the models will be improved in subsequent years as the methodology is refined and the number of patients increases.

Two outputs are particularly useful when interpreting the results of a logistic regression model:

The **c-statistic** can be used to assess the goodness of fit, with values ranging from 0.5 to 1.0. A value of 0.5 indicates that the model is no better than chance at making a prediction of membership in a group and a value of 1.0 indicates that the model perfectly identifies those within a group and those not. Models are typically considered reasonable when the c-statistic is higher than 0.7 and strong when the c-statistic exceeds 0.8 (Hosmer and Lemeshow, 2000)[33].

Odds ratios (OR) illustrate how strongly a particular value of a variable is associated with the outcome. The further from one the ratio is (either above or below), the stronger the association between it and the outcome. For example, an odds ratio of 0.764 would suggest a stronger association than an odds ratio of 0.830. An odds ratio of one would show that the variable value has no bearing on how likely the outcome is.

There is always a degree of uncertainty in the calculated odds ratio. This is described by the **confidence interval**. The wider the confidence interval, the less certainty there is in the odds ratio. If the confidence intervals are either side of 1 this indicates that the value taken by the variable has no bearing on how likely the outcome is. Where the confidence interval approaches 1 this indicates that the association with the outcome may be weak.

When interpreting the models, it is important to note that a causal link between variables and patient harms cannot be assumed. For example, the existence of a particular hospital policy may be indicative of the effectiveness of diabetic care across the organisation, rather than having a direct causal or preventative relationship to the occurrence of the harm.

[32] Such as being seen by a member of the diabetes team, which may have occurred after the harm occurred.
[33] Hosmer DW, Lemeshow S. Applied Logistic Regression (2nd Edition). New York, NY: John Wiley & Sons; 2000

Model to explain the risk of developing a foot lesion in hospital

In 2015, 1.1 per cent of inpatients in the audit developed a foot lesion after admission to hospital. Logistic regression has been used to examine the relationship between the development of foot lesions and the NaDIA variables suggested by the NaDIA Advisory Group.

The multi-level models were both better than the initial regression model at predicting the development of foot lesions in hospital, reaching above the 'strong' 0.8 level where hospital variation was blocked. The c-statistic with patient variation blocked was just below 0.7, suggesting a borderline reasonable goodness of fit. Full details are provided in Appendix 10.

Results from the logistic regression models

Using the multi-level models, a small number of variables were found to be associated with the development of foot lesions in hospital. As may be expected, a strong association with admission for foot disease was found (OR=4.47), suggesting that patients admitted for foot disease are more likely to develop foot lesions in hospital than those admitted for other reasons. Caution is advised when interpreting this finding: it is possible that the audit question[34] has sometimes been misinterpreted to include patients who were admitted with foot lesions, regardless of whether a further lesion developed in hospital.

Inpatients with Type 1 diabetes (OR=2.76) and Type 2 insulin treated diabetes (OR=2.56) were also found to have a higher risk of developing a foot lesion during their inpatient stay.

No associations with known hospital characteristics were found, although there was one significant association with an unknown category[35]. This result has been excluded from the summary tables because the category relates to NaDIA data quality (completed or not completed) rather than the actual characteristics of the hospital[36].

Results from the models are summarised on the following page. The full outputs are shown in Appendix 10, Tables 57 to 59.

Audit findings: Model to predict the risk of developing a foot lesion in hospital

2015 FINDINGS

- The quality of the derived models was **strong** (hospital characteristics blocked) and borderline **reasonable** (patient characteristics blocked).
- The following patient characteristics were associated with an **increased** risk of developing a foot lesion in hospital:
  - admission for **foot disease**
  - having **Type 1** or **Type 2 insulin treated** diabetes
- No strong associations with hospital characteristics were found.

[34] Did a foot lesion (e.g. heel ulcer) arise during this admission?
[35] Where the Hospital Characteristics form did not record whether the hospital had a multi-disciplinary foot team.
[36] The unknown category also covered a small number of inpatients (less than 200) in a small number of hospitals (3) only, which would skew the results if one or more of the hospitals had higher or lower incidences of foot lesion development than expected

Factors associated with developing foot lesions in hospital: summary sheet

Caution should be applied to the results below, particularly because associated variables (e.g. foot disease on admission) have caveats attached. Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.

Patient characteristics associated with developing a foot lesion in hospital

The multi-level logistic regression model (hospital variation blocked) predicted with a **strong** level of certainty whether an individual would develop a foot lesion in hospital (c-statistic of 0.8439‡, n=13,952).

Characteristic(s) that were associated with an increased likelihood of developing a foot lesion in hospital^ were:

- Where the inpatient's main admission reason was **foot disease**†
  (OR: 4.47 [2.81-7.11] vs. Non-diabetes medical)*
- Where the inpatient had **Type 1** diabetes *(OR*: 2.76 [1.48-5.14] vs. Type 2 non-insulin treated)*
- Where the inpatient had **Type 2 (insulin treated)** diabetes *(OR*: 2.56 [1.69-3.875] vs. Type 2 non-insulin treated)*

Hospital characteristics associated with developing a foot lesion in hospital

The multi-level logistic regression model (patient variation blocked) predicted with a poor-to-**reasonable** level of certainty whether an individual would develop a foot lesion in hospital (c-statistic of 0.6912‡, n=13,952).

No known characteristics were associated with an increased likelihood of developing a foot lesion in hospital^.

^ $\rho<0.05$.
* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios. A significant result for the category 'not known whether the hospital has a multi-disciplinary foot team" has been excluded as the category relates to NaDIA data quality (completed or not completed) rather than the actual characteristics of the hospital.
‡ See page 81 for an explanation of how to interpret the c-statistic.

Model to explain the risk of developing diabetic ketoacidosis (DKA) in hospital

In 2015, 4.2 per cent of inpatients with Type 1 diabetes developed diabetic ketoacidosis (DKA) during their hospital admission, representing 42 inpatients. Logistic regression was used to examine the relationship between hospital developed DKA and the NaDIA variables suggested by the NaDIA Advisory Group.

The small size of the Type 1 cohort (1,003 patients) meant it was not possible to account for variation between hospital sites using multi-level modelling. Where patient variation was blocked, the goodness of fit was considerably better than in the initial logistic regression, approaching the 0.8 level indicating a strong model. Full details are provided in Appendix 11.

Results from the logistic regression models

Using the multi-level models, only two variables were found to be associated with the development of DKA in hospital. As may be expected, a strong association with admission for DKA was found (OR=6.22), suggesting that patients admitted for DKA are more likely to develop DKA in hospital than those admitted for other reasons. However, it is also possible that the audit question[37] has sometimes been misinterpreted to include patients who were admitted for DKA, regardless of whether a further episode of DKA developed in hospital. Caution is therefore advised when interpreting this finding.

The strong association between the 10-14 hour DISN/DSN[38] staffing level and the development of DKA in hospital (OR=0.24) is unusual because no significant association was found for bandings with a greater number of hours. As there is no particular reason why 10-14 hours of nursing care is the optimal amount, this finding should be treated with caution and will be reviewed in future analysis.

Results from the models are summarised on the following page. The full outputs are shown in Appendix 11, Tables 61 and 62.

Audit findings: Model to predict the risk of developing DKA in hospital

2015 FINDINGS

- The quality of the derived models was **reasonable**.
- Acknowledging the **reasonable** quality of the associated model, the following patient characteristic were associated with an **increased** risk of developing DKA in hospital:
  - admission for **DKA** (caveat: possible data quality issue)
- Acknowledging the **reasonable** quality of the associated model, the following patient characteristic were associated with a **reduced** risk of developing DKA in hospital:
  - DISN / DSN staffing level at 10-14 hrs / week / 100 beds (caveat: unknown reason for association)

[37] Did the patient develop DKA at any time after their admission?
[38] Diabetes inpatient specialist nurses (DISN)/diabetes specialist nurse (DSN).

Factors associated with developing DKA in hospital: summary sheet

Caution should be applied to the results below, particularly because the cohort is small, the c-statistics are only reasonable (less than 0.8) and associated variables (DKA on admission and DISN/DSN staffing levels[39]) have caveats attached. Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.

Patient characteristics associated with developing DKA in hospital

The logistic regression model predicted with a **reasonable** level of certainty whether an individual would develop DKA in hospital (c-statistic of 0.7108‡, n=1,003).

Characteristic(s) that were associated with an increased likelihood of developing DKA in hospital^ were:

- Where the inpatient's main admission reason was **DKA**
  (OR: 6.22 [2.96-13.07] vs. Non-diabetes medical)*

Hospital characteristics associated with developing DKA in hospital

The multi-level logistic regression model (patient variation blocked) predicted with a **reasonable** level of certainty whether an individual would develop DKA in hospital (c-statistic of 0.7722‡, n=1,003).

Characteristic(s) that were associated with a reduced likelihood of developing DKA in hospital^ were:

- Where the hours of **DISN or DSN time** per week per 100 beds was 10-14 hours
  (OR: 0.24 [0.09-0.66] vs. 0-4 hours)*

† Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in grey italics.
^ ρ<0.05.
* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios.
‡ See page 81 for an explanation of how to interpret the c-statistic.

[39] Diabetes inpatient specialist nurses (DISN)/diabetes specialist nurse (DSN).

Model to explain the risk of having a hypoglycaemic episode in hospital

In 2015, 21.8 per cent of inpatients in the audit experienced one or more hypoglycaemic episode (blood glucose measurement of ≤3.9mmol/L) during the course of the last 7 days of their admission. One fifth (20.0 per cent) of inpatients with diabetes had at least one mild hypoglycaemic episode (3.0-3.9mmol/L) and just under 1 in 10 inpatients with diabetes (9.8 per cent) had at least one severe hypoglycaemic episode (<3.0mmol/L). Logistic regression was used to examine the relationship between the occurrence of hypoglycaemic episodes and the NaDIA variables suggested by the NaDIA Advisory Group. Separate models were created for severe and mild hypoglycaemic episodes.

The multi-level models were slightly better at predicting hypoglycaemic episodes than the initial regression models, with the model for hypoglycaemic episodes almost reaching the 0.8 level indicating a strong goodness of fit. The c-statistic for all models was reasonable (in the 0.7 to 0.79 range) – see Appendix 12 for more details.

Results from the logistic regression models

The mild and severe multi-level models produced a similar list of associated patient characteristics, with the c-statistic and odds ratios indicating stronger associations in the severe model than in the mild model. In both models, use of insulin as part of the inpatient's treatment regimen on admission was the strongest predictor of hypoglycaemic episodes (OR=13.51 [severe] and 6.87 [mild]), with the use of sulphonylureas on admission also significant (OR=1.86 and 2.12). Of reasons for admission, hypoglycaemia (OR= OR=3.655 and 2.425), DKA (OR=1.83 and 1.545) and foot disease (OR=1.53 and 1.41) were each associated with increased risk in both models. Inpatients in the Black ethnic group were found to have an increased risk of a mild hypoglycaemic episode only (OR=1.38), though caution is advised because the lower confidence interval is close to 1 (1.09) and no association was found in the severe model.

Having Type 2 diet only diabetes (OR=0.62 and 0.74), being aged between 45 and 54 (OR=0.63 and 0.685) and being admitted electively (OR=0.69 and 0.75) were all associated with a reduced risk of having a hypoglycaemic episode, with the under 45 category identified in the severe model only (0.67).

Although significant hospital characteristic associations were found, the upper or lower confidence intervals were always close to 1 (highlighted in *grey italics* in the summary sheet below), suggesting that firm conclusions should not be drawn from these initial findings. The quality of the model and the strength of associations may improve as more data is added in future years.

Audit findings: Model to predict the risk of having a hypoglycaemic episode in hospital

2015 FINDINGS

- The quality of the derived models was **reasonable**.
- Acknowledging the **reasonable** quality of the associated models, the following patient characteristics were consistently associated with an **increased** risk of having a hypoglycaemic episode in hospital:
  - use of **insulin** or **sulphonylureas** as part of the inpatient's treatment regimen on admission
  - admission for **hypoglycaemia**, **DKA** or **foot disease**
  - being from a **Black** ethnic group (mild episodes only)
- Acknowledging the **reasonable** quality of the associated models, the following patient characteristics were consistently associated with a **reduced** risk of having a hypoglycaemic episode in hospital:
  - having **Type 2 diet only** diabetes
  - being **aged 45 to 54**
  - being admitted **electively**
- No strong associations with hospital characteristics were found.

Results from the models are summarised on the following pages. The full outputs are found in Appendix 12, Tables 64 to 66. Although not discussed above, relationships where a confidence interval is close to 1 are included in the summary boxes below.

Factors associated with having a severe hypoglycaemic episode (<3.0mmol/L) in hospital: summary sheet

Caution should be applied to the results below, particularly where the 95% confidence intervals for the odds ratio (OR) are close to 1 (highlighted in grey italics in the summary boxes below). Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.

Patient characteristics associated with having a severe hypoglycaemic episode in hospital

The multi-level logistic regression model (hospital variation blocked) predicted with a **reasonable** level of certainty whether an individual would have a severe hypoglycaemic episode (blood glucose measurement of <3.0mmol/L) in hospital (c-statistic of 0.7942‡, n=11,369).

Characteristic(s) that were associated with an increased likelihood of having a severe hypoglycaemic episode in hospital^ were:

- Where **insulin** was part of the inpatient's treatment regimen on admission
  (OR: 13.51 [4.12-44.33] vs. not treated with insulin on admission)*
- Where the patient's main admission reason was for **hypoglycaemia**
  (OR: 3.655 [2.59-5.16] vs. main admission reason was non-diabetes medical)*
- Where **sulphonylureas** were part of the inpatient's treatment regimen on admission
  (OR: 1.86 [1.55-2.24] vs. not treated with sulphonylureas on admission)*
- Where the patient's main admission reason was for **DKA**
  (OR: 1.83 [1.26-2.65] vs. main admission reason was non-diabetes medical)*
- Where the patient's main admission reason was for **foot disease**
  (OR: 1.53 [1.18-1.97] vs. main admission reason was non-diabetes medical)*

Characteristic(s) that were associated with a reduced likelihood of having a severe hypoglycaemic episode in hospital^ were:

- Where the patient had **Type 2 diet only** diabetes
  (OR: 0.62 [0.435-0.885] vs. Type 2 non-insulin treated)*
- Where the patient was **aged 45-54** *(OR*: 0.63 [0.47-0.84] vs. 75-84 years)*
- Where the patient was **aged under 45** *(OR*: 0.67 [0.49-0.91] vs. 75-84 years)*
- Where the patient was admitted **electively** *(OR*: 0.69 [0.515-0.92] vs.* Emergency*)*
- Where the patient was *aged 65-74*† *(OR*: 0.82 [0.68-0.98] vs. 75-84 years)*

Hospital characteristics associated with having a severe hypoglycaemic episode in hospital

The multi-level logistic regression model (patient variation blocked) predicted with a **reasonable** level of certainty whether an individual would have a severe hypoglycaemic episode (blood glucose measurement of <3.0mmol/L) in hospital (c-statistic of 0.7831‡, n=11,369).

Characteristic(s) that were associated with an increased likelihood of having a severe hypoglycaemic episode in hospital ^ were:

- Where the hours of *diabetes consultant time*† per week per 100 beds was 3-5 hours
  (OR: 1.24 [1.04-1.48] vs. 1-2 hours)*
- Where the hours of *diabetes consultant time*† per week per 100 beds was under 1 hour
  (OR: 1.23 [1.03-1.46] vs. 1-2 hours)*

Characteristic(s) that were associated with a reduced likelihood of having a severe hypoglycaemic episode in hospital ^ were:

- Where the hospital did not have an *upper glucose target*† for action
  (OR: 0.85 [0.73-1.00] vs. did have an upper glucose target for action)*

† Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in *grey italics*.
^ ρ<0.05. Results have been ordered by OR (descending) to highlight the variables with the strongest association.
* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios. ‡ See page 81 for an explanation of how to interpret the c-statistic.

Factors associated with having a mild hypoglycaemic episode (3.0-3.9mmol/L) in hospital: summary sheet

Caution should be applied to the results below, particularly because the c-statistics are only reasonable (around 0.7) and the 95% confidence intervals for the odds ratio (OR) are close to 1 in some instances (highlighted in grey italics in the summary boxes below). Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.

Patient characteristics associated with having a mild hypoglycaemic episode in hospital

The multi-level logistic regression model (hospital variation blocked) predicted with a **reasonable** level of certainty whether an individual would have a mild hypoglycaemic episode (blood glucose measurement of 3.0-3.9mmol/L) in hospital (c-statistic of 0.7310‡), n=13,135.

Characteristic(s) that were associated with an increased likelihood of having a mild hypoglycaemic episode in hospital ^ were:

- Where **insulin** was part of the inpatient's treatment regimen on admission
  (OR: 6.87 [3.59-13.155] vs. not treated with insulin on admission)*
- Where the inpatient's main admission reason was for **hypoglycaemia**
  (OR: 2.425 [1.78-3.31] vs. main admission reason was non-diabetes medical)*
- Where **sulphonylureas** was part of the inpatient's treatment regimen on admission
  (OR: 2.12 [1.88-2.40] vs. not treated with sulphonylureas on admission)*
- Where the inpatient's main admission reason was for **DKA**
  (OR: 1.545 [1.11-2.16] vs. main admission reason was non-diabetes medical)*
- Where the inpatient's main admission reason was for **foot disease**
  (OR: 1.41 [1.16-1.72] vs. main admission reason was non-diabetes medical)*
- Where the inpatient was from the **Black** ethnic group *(OR*: 1.38 [1.09-1.745] vs. White)*
- Where the inpatient was from the ***Asian***† ethnic group *(OR*: 1.23 [1.03-1.47] vs. White)*
- Where the inpatient was ***female***† *(OR*: 1.12 [1.02-1.23] vs. male)*

Characteristic(s) that were associated with a reduced likelihood of having a mild hypoglycaemic episode in hospital were:

- Where the inpatient was **aged 45-54** *(OR*: 0.685 [0.56-0.84] vs. 75-84 years)*
- Where the inpatient had **Type 2 diet only** diabetes *(OR*: 0.74 [0.62-0.89] vs. Type 2 non-insulin treated)*
- Where the inpatient was admitted **electively** *(OR*: 0.75 [0.62-0.91] vs.* Emergency*)*
- Where the inpatient had ***Type 2 insulin treated***† diabetes
  (OR: 0.51 [0.26-0.98] vs. Type 2 non-insulin treated)*

Hospital characteristics associated with having a mild hypoglycaemic episode in hospital

The multi-level logistic regression model (patient variation blocked) predicted with a **reasonable** level of certainty whether an individual would have a mild hypoglycaemic episode (blood glucose measurement of 3.0-3.9mmol/L) in hospital (c-statistic of 0.7156‡), n=13,135.

Characteristic(s) that were associated with an increased likelihood of having a mild hypoglycaemic episode in hospital^ were:

- Where the hospital does use ***electronic prescribing***†
  (OR: 1.52 [1.03-1.40] vs. partial use of electronic prescribing)*
- Where the hospital does not use ***electronic prescribing***†
  (OR: 1.18 [1.01-1.37] vs. partial use of electronic prescribing)*

† Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in ***grey italics***.

^ ρ<0.05. Results have been ordered by OR (descending) to highlight the variables with the strongest association. Significant results from the ethnic group and main reason for admission 'Unknown' categories have not been included in the summary.

* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios. ‡ See page 81 for an explanation of how to interpret the c-statistic.

Model to explain the risk of having a medication error in hospital

In 2015, over one third (38.3 per cent) of inpatient drug charts had at least one medication error in the previous 7 days[40]. Logistic regression was used to examine the relationship between medication errors and the NaDIA variables suggested by the NaDIA Advisory Group. Separate models were created for insulin treated and non-insulin treated inpatients.

Although the multi-level models were better at predicting the occurrence of a medication error in hospital than the initial regression models, the multi-level models remained poor. Where hospital variation was blocked, the c-statistic was just below the 0.7 level that suggests a reasonable model. Where patient variation was blocked the models were worse at around 0.6, suggesting that they were only slightly better than chance at predicting medication errors. Full details are provided in Appendix 13.

Results from the logistic regression models

Despite the models being unable to sufficiently predict the likelihood of a medication error, some variables were found to have a significant association. Non-insulin treated inpatients admitted for a non-diabetes medical reason were associated with a reduced risk of having a medication error (OR=0.77), as were insulin treated inpatients admitted for DKA (OR=0.64). Non-insulin treated inpatients from a Black ethnic group were found to be associated with a higher risk of having a medication error (OR=1.61).

Results at hospital level should be treated with caution due to the poor quality of the models (c-statistics around 0.6 with patient variation blocked). With this in mind, not using the Electronic Patient Record was associated with increased risk for both inpatient groups (OR=1.52 and 1.24), as was not using an upper glucose target for non-insulin treated inpatients only (OR=1.26). Unusually, higher levels of nursing care were associated with an increased risk of non-insulin treated inpatients having a medication error. This association will be revisited in future analysis, but the model's poor goodness of fit should be considered when interpreting this finding (c-statistic of 0.6017). Having a partial electronic prescribing system in place was associated with a reduced risk of having a medication error (OR=0.73).

Results from the models are summarised on the following pages. The full outputs are shown in Appendix 13, Tables 68 and 71. Although not discussed above, relationships where a confidence interval is close to 1 are included in the summary boxes, highlighted in ***grey italics***.

Audit findings: Model to predict the risk having a medication error in hospital

2015 FINDINGS

- The quality of the derived models was borderline **reasonable** (hospital characteristics blocked) and **poor** (patient characteristics blocked).
- Acknowledging the **reasonable** quality of the associated model, the following patient characteristics were associated with an **increased** risk of having a medication error in hospital:
  - being from a **Black** ethnic group (non-insulin treated inpatients only)
- Acknowledging the **reasonable** quality of the associated model, the following patient characteristics were consistently associated with a **reduced** risk of having a medication error in hospital:
  - being admitted for **non-diabetes medical** reasons (non-insulin treated inpatients only) or for **DKA** (insulin treated inpatients only)
- The **poor** quality of the associated models means that associations between hospital characteristics and medication errors cannot be confidently drawn.

[40] Medication errors for diabetes inpatients include prescription errors and medication management errors relating to insulin and oral hypoglycaemic agents (OHA).

Factors associated with non-insulin treated inpatients[$] having a medication error: summary sheet

*Caution should be applied to the results below, particularly because the c-statistics for the models are low and the 95% confidence intervals for the odds ratio (OR) are close to 1 in some instances (coloured **grey** in the summary boxes below). Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.*

Patient characteristics associated with medication errors: non-insulin treated inpatients[$]

The multi-level logistic regression model (hospital variation blocked) predicted with a **low** level of certainty whether an individual would have a medication error in hospital (c-statistic of 0.6678[‡], n=5,763).

Characteristic(s) that were associated with an increased likelihood of medication errors occurring^ were:

- Where the inpatient was from the **Black** ethnic group *(OR[*]: 1.61 [1.15-2.24] vs. White)*
- Where the inpatient was from the ***Asian***[†] ethnic group *(OR*: 1.29 [1.03-1.62] vs. White)*
- Where the inpatient was admitted as an ***emergency***[†] *(OR*: 1.27 [1.025-1.57] vs. Elective)*
- Where the inpatient was ***aged 65-74***[†] *(OR*: 1.19 [1.02-1.39] vs. 75-84 years)*

Characteristics that were associated with a reduced likelihood of medication errors occurring were:

- Where the inpatient's main admission reason was **non-diabetes medical**
  (OR: 0.77 [0.66-0.89] vs. Surgical)*

Hospital characteristics associated with medication errors: non-insulin treated inpatients[$]

The multi-level logistic regression model (patient variation blocked) predicted with a **low** level of certainty whether an individual would have a medication error in hospital (c-statistic of 0.6017[‡], n=5,763).

Characteristic(s) that were associated with an increased likelihood of medication errors occurring^ were:

- Where the hospital does not use the **electronic patient record**
  (OR[*]: 1.52 [1.32-1.76] vs. does use the electronic patient record)
- Where the hours of **DISN or DSN time[‡]** per week per 100 beds was 5 or greater
  (OR[*]: various – see Appendix 13, Table 71 vs. 0-4 hours)
- Where the hospital did not have an **upper glucose target** for action
  (OR[*]: 1.26 [1.11-1.43] vs. did have an upper glucose target for action)

Characteristic(s) that were associated with a reduced likelihood of medication errors occurring^ were:

- Where the hours of **diabetes consultant time** per week per 100 beds was 3-9 hours
  (OR[*]: various – see Appendix 13, Table 71 vs. <1 hour)

[†] Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in ***grey italics***.
^ ρ<0.05. Results have been ordered by OR (descending) to highlight the variables with the strongest association.
* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios. [‡] See page 81 for an explanation of how to interpret the c-statistic.
[$] Non-insulin treated inpatients comprised inpatients with the relevant variables recorded that had Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes or Other (non-insulin treated) diabetes.
‡ Diabetes inpatient specialist nurses (DISN)/diabetes specialist nurse (DSN).

Factors associated with insulin treated inpatients[$] having a medication error: summary sheet

*Caution should be applied to the results below, particularly because the c-statistics for the models are low and the 95% confidence intervals for the odds ratio (OR) are close to 1 in some instances (coloured **grey** in the summary boxes below). Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.*

Patient characteristics associated with medication errors: insulin treated inpatients[$]

The multi-level logistic regression model (hospital variation blocked) predicted with a low-to-**reasonable** level of certainty whether an individual would have a medication error in hospital (c-statistic of 0.6843[‡], n=4,796).

Characteristic(s) that were associated with a reduced likelihood of medication errors occurring were:

- Where the inpatient's main admission reason was for **DKA**
  (OR: 0.64 [0.45-0.91] vs. Surgical)*

Hospital characteristics associated with medication errors: insulin treated inpatients[$]

The multi-level logistic regression model (patient variation blocked) predicted with a **very low** level of certainty whether an individual would have a medication error in hospital (c-statistic of 0.5691[‡], n=4,796).

Characteristic(s) that were associated with an increased likelihood of medication errors occurring^ were:

- Where the hospital does not use the **electronic patient record**
  (OR[*]: 1.24 [1.06-1.44] vs. does use the electronic patient record)
- Where the hospital did not have an ***upper glucose target***[†] for action
  (OR[*]: 1.16 [1.01-1.33] vs. did have an upper glucose target for action)

Characteristic(s) that were associated with a reduced likelihood of medication errors occurring were:

- Where the hospital has **partial electronic prescribing** in place
  (OR: 0.73 [0.60-0.88] vs. does not have electronic prescribing)*
- Where the hours of ***diabetes consultant time***[†] per week per 100 beds was 1-5 hours
  (OR[*]: various – see Appendix 13, Table 71 vs. <1 hour)
- Where the hospital has ***more than 800 adult inpatient beds***[†] available
  (OR[*]: 0.83 [0.69-0.99] vs. has fewer than 400)

[†] Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in ***grey italics***.
^ ρ<0.05. Results have been ordered by OR (descending) to highlight the variables with the strongest association.
* OR = odds ratio. The 95% confidence intervals and reference category have been included. See page 81 for an explanation of how to interpret odds ratios.
[‡] See page 81 for an explanation of how to interpret the c-statistic.
[$] Insulin treated inpatients comprised inpatients with the relevant variables recorded that had Type 1 diabetes, Type 2 (insulin treated) diabetes or Other (insulin treated) diabetes.

Summary of results from the logistic regression models

Table 72: Summary of results from the logistic regression models^

*Caution should be applied to the results below, particularly because the c-statistics for the models are often low and the 95% confidence intervals for the odds ratio (OR) are close to 1 in some instances (coloured **grey** in the summary boxes below). Results from the models do not establish direct or indirect causation between the variables and the patient harm. The choice of reference category will influence which variable values are found to have significant differences.*

	Foot lesion	DKA	Hypoglycaemic episodes		Medication errors	
	All (n=13,952)	Type 1 (n=1,003)	Mild (n=13,135)	Severe (n=11,369)	Non-insulin (n=5,763)	Insulin (n=4,796)
Patient characteristics	c statistic*=0.8439	c statistic*=0.7108	c statistic*=0.7310	c statistic*=0.7942	c statistic*=0.6678	c statistic*=0.6843
Sex *[vs. male]*			*Female*† ▲[1.02-1.23]			
Age *[vs. 75-84]*			**45-54** ▼[0.56-0.84]	**<45** ▼[0.49-0.91] **45-54** ▼[0.47-0.84] *65-74*† ▼[0.68-0.98]	*65-74*† ▲[1.02-1.39]	
Ethnic group *[vs. White]*			**Black** ▲[1.09-1.745] *Asian*† ▲[1.03-1.47]		**Black** ▲[1.15-2.24] *Asian* ▲[1.03-1.62]	
Diabetes type *[vs. Type 2 non-insulin]*	**T1** ▲[1.48-5.14] **T2 insulin** ▲[1.69-3.875]		*T2 insulin*† ▼[0.26-0.98] **T2 diet only** ▼[0.62-0.89]	**T2 diet only** ▼ [0.435-0.885]		
Type of admission *[vs. emergency for hypos]* *[vs. elective for med errors]*			**Elective** ▼[0.62-0.91]	**Elective** ▼[0.515-0.92]	*Emergency*† ▲ [1.025-1.57]	
Main reason for admission‡ *[vs. non-diabetes medical for all except med errors]* *[vs. non-medical for med errors only]*	**Foot disease** ▲ [1.18-1.97]	**DKA** ▲[2.96-13.07]	**DKA** ▲[1.11-2.16] **Hypo** ▲[1.78-3.31] **Foot disease** ▲[1.16-1.72]	**DKA** ▲[1.26-2.65] **Hypo** ▲[2.59-5.16] **Foot disease** ▲[1.18-1.97]	**Non-diabetes med** ▼[0.66-0.89]	**DKA** ▼[0.45-0.91]
Treated with insulin on admission *[vs. No]*			**Yes** ▲[3.59-13.155]	**Yes** ▲[4.12-44.33]		
Treated with sulphonylureas on admission *[vs. No]*			**Yes** ▲[1.88-2.40]	**Yes** ▲[2.59-5.16]		
Hospital characteristics	c statistic*=0.6912	c statistic*=0.7722	c statistic*=0.7156	c statistic*=0.7831	c statistic*=0.6017	c statistic*=0.5691
Upper glucose limit used *[vs. Yes]*				*No*† ▼[0.73-1.00]	**No** ▲[1.11-1.43]	*No*† ▲[1.01-1.33]
Electronic patient record used *[vs. Yes]*					**No** ▲[1.32-1.76]	**No** ▲[1.06-1.44]
Electronic prescribing used *[vs. Partial for hypos]* *[vs. No for med errors]*			*Yes*† ▲[1.03-1.40] *No*† ▲[1.01-1.37]			**Partial** ▼[0.60-0.88]
DISN or DSN time per week per 100 beds‡ *[vs. 0-4 hours]*		**10-14 hours** ▼ [0.09-0.66]			***>4 hours*** ▲[Various$]	
Diabetes consultant time per week per 100 beds *[vs. 1-2 hours for hypos]* *[vs. <1 hour for med errors]*				*<1 hour*† ▲[1.03-1.46] *3-5 hours*† ▲[1.04-1.48]	*>1 hour*† ▼[Various$]	*>1 hour*† ▼[Various$]
Hospital size *[vs. Small (under 400 beds)]*						*Large (over 800)*† ▼ [0.69-0.99]

^ 95% confidence intervals for odds ratios (OR) are provided in square brackets e.g. [1.48-5.14].
See page 81 for an explanation of how to interpret odds ratios. See key (right) for explanation of symbols.
* See page 81 for an explanation of how to interpret the c-statistic.
† Confidence interval for OR close to 1 (between 0.95 and 1.05). Associated variable highlighted in ***grey italics***.
$ For results for each category, see Appendices 12 and 13. ‡ Diabetes inpatient specialist nurses (DISN) / diabetes specialist nurses (DSN).

Key

▲	Associated with increased harm
▼	Associated with reduced harm

Discussion

NaDIA was developed as a measurement tool to support improvement in the care of people with diabetes in hospital. Its purpose is to identify areas of concern both locally and nationally, allowing teams to prioritise areas for change and to measure their effect; the goal is comprehensive implementation of the National Service Framework (NSF) for Diabetes[41], National Service Framework (NSF) for Diabetes in Wales[42] and the National Institute for Health and Care Excellence (NICE) Quality Standards for Diabetes[43].

Despite the considerable organisation and time commitment involved, the impressive number of Trusts who participate in successive audits shows that diabetes teams continue to place great value in the information provided. The usage of the measurements is demonstrated by the numerous service improvements reported by these teams and their widespread adoption of up-to-date national guidelines. Importantly NaDIA has demonstrated consistent improvements in diabetes inpatient care over successive years resulting in significantly reduced harm to patients.

The majority of the questions included in the 2015 audit were the same as those in the previous audits, making it possible to examine for changes over the six years including those in patient demographics, bed occupancy, staffing levels, activity of diabetes teams, patient outcomes and patients' satisfaction with the care received in hospital. On this occasion, questions on perioperative care were also included. The wording of questions related to working hours was also changed to try to better assess time devoted to inpatient care of the various health care professionals; as a result no comparisons were made with previous years.

In England the first official audit occurred in 2010, after an extensive pilot in 2009. Wales joined in 2011. No audit took place in 2014. The statistical analysis in this report looks at changes since the previous audit in 2013 and since audit inception, though it should be noted that Wales did not submit to the 2010 collection.

The median age of inpatients with diabetes, the percentage of inpatients with Type 1 diabetes and the percentage admitted for a specific diabetes complication have not substantially changed since the audit began, and would have not been expected to, confirming the robustness of NaDIA. An exception this year has been a fall in the number of people with Type 2 diabetes treated with insulin. This is in line with what might be expected, as many patients who would have been started on insulin in the past are now being treated with newer agents rather than insulin. Compared with previous years there has been a decrease in the proportions of people with diabetes admitted for surgical reasons. This may reflect increasing use of day care surgery the numbers of which are not captured in this audit.

An important statistic is the percentage of all acute beds occupied by patients with diabetes. This continues to increase year upon year reflecting the increasing prevalence of diabetes in the general population as well as the increasing life expectancy of people with diabetes. Based on the increase seen over the period of NaDIA and the predicted increase in the prevalence of diabetes in the community, the proportion of hospital inpatients with diabetes will almost certainly rise in coming years. For this reason, the NaDIA data is crucial not only for improving care today but for planning future care.

[41] Department of Health. National Service Framework for diabetes standards https://www.gov.uk/government/publications/national-service-framework-diabetes. Accessed 31 March 2016.
[42] NHS Wales. National Service Framework for Diabetes in Wales http://www.wales.nhs.uk/documents/DiabetesNSF_eng.pdf. Accessed 31 March 2016.
[43] National Institute for Health and Care Excellence. Diabetes in adults quality standards http://guidance.nice.org.uk/QS6. Accessed 31 March 2016.

As in the previous years of NaDIA, the most important and interlinking issues relate to:

- staffing and who is looking after the person with diabetes in hospital;
- the impact of medication errors, in particular hypoglycaemia; patient harms, including diabetic ketoacidosis (DKA) following admission to hospital;
- deficiencies in foot care.

Staffing levels

The vast majority of inpatients with diabetes are admitted for conditions other than diabetes but also happen to have diabetes. As such the majority are not cared for under a diabetes consultant. However, they may need the support of the diabetes specialist team at some time during their admission. For newly diagnosed patients, those with unstable glucose control and those with coexisting or newly developing foot lesions, ready access to the diabetes team is particularly important.

In 2015, 84 per cent of sites reported an increase in diabetes referrals and, since the first NaDIA, there has been a steady increase in the percentage of patients who should be referred to the diabetes team that are actually seen. Though a very positive outcome this increased burden is being borne without a significant change in inpatient staffing levels. In 2015, just over 30 per cent of sites had no diabetes inpatient specialist nurse, a proportion unchanged since the audit began. Only 6 per cent of Trusts were providing a weekend diabetes inpatient specialist nurse service. Over 70 per cent of sites have no specialist dietitian; worse than at the start of the audit.

Given these staffing levels, the relative lack of weekend services and the increasing referrals it is not surprising that only 68 per cent per cent of the 44 per cent of patients who should have been referred to the inpatient diabetes team according to the 'Think Glucose Criteria'[44] were seen by the team. Nevertheless, this is an improvement from 2011 when only 58 per cent of such patients were seen. With no increase in staffing levels, this implies that these teams are working harder and/or are more organised. It is disappointing that despite the high profile that NaDIA has received, staffing levels remain inadequate.

In the patient survey the stand out priority for improvement is staff knowledge of diabetes. This is especially so for those patients who are on insulin. Education of general ward nurses and doctors is an important role of diabetes specialist staff and is likely to be less good in sites where there are insufficient diabetes specialists.

[44] NHS Institute for Innovation and Improvement. THINKGLUCOSE inpatient care for people with diabetes www.institute.nhs.uk/quality_and_value/think_glucose/welcome_to_the_website_for_thinkglucose.html. Accessed 31 March 2016.

Medication errors and their consequences

Medication errors comprise both prescription and management errors for insulin and oral hypoglycaemic agents. Since the first audit there has been a year upon year improvement in medication errors from 45 per cent of drug charts having an error in 2010 to 37 per cent in 2013. However there has been a reversal in 2015 with 38 per cent of drug charts having an error and five of the seventeen errors increasing in prevalence, with only one decreasing.

Prescription errors have reduced from 31 per cent in the original England audit in 2010 and 25 per cent for England and Wales in 2011 to 22 per cent in 2015, similar to the 2013 audit.

Over the years there have been impressive year upon year reductions in insulin prescribing errors. However, it is disappointing that between 2013 and 2015 there has been either no further improvement or a small reversal; the only error to have improved is the error of writing ‘u’ for units which if misread as ‘0’ can be fatal.

In contrast to prescription errors, management errors for both insulin and oral hypoglycaemia agents have showed little change since the first audit and have actually increased between 2013 and 2015 with 24 per cent of charts now having an error. This suggests that clinical teams are still not proactive enough in addressing poor glycaemic control and in reducing insulin or oral hypoglycaemic drug doses to prevent recurrence of hypoglycaemia. Improved training in blood glucose management is required to help non-specialists caring for patients with diabetes to manage the glycaemic instability that is common during illness in the absence of specialist advice.

The 2015 NaDIA again demonstrates that medication errors are associated with an increased risk of hypoglycaemia. In the last audit we speculated that electronic prescribing may help reduce the frequency of errors and thus hypoglycaemia. Although electronic prescribing was associated with a significant reduction in errors, hypoglycaemic rates were no different[45].

Intravenous insulin infusions (IVII) are key components to managing the glycaemic control of many inpatients with diabetes in whom subcutaneous insulin therapy presents difficulties. However, in many situations their use is unwarranted and indeed potentially dangerous. These infusions should only be used in clearly defined circumstances and their duration should be limited. It is pleasing to see that the trend for more appropriate use of the infusions has been maintained and that transfer back to subcutaneous insulin is being more appropriately managed.

[45] There is no statistically significant difference between the proportion of inpatients having hypoglycaemic episodes at sites that did or did not use electronic prescribing ($p < 0.05$). For mild episodes: 20.9% [did] vs. 19.7% [did not]; severe episodes: 9.7% vs. 10.1%; mild and/or severe episodes: 22.4% vs. 21.7%.

Patient harms

The purpose of NaDIA is to improve the care of people with diabetes in hospital and so prevent harm. Although there has been a trend of reducing hypoglycaemic rates since the introduction of NaDIA, the downward trend has not been sustained in 2015 with an increase in both mild and severe hypoglycaemic rates in Type 1 and Type 2 insulin treated inpatients between 2013 and 2015. It is also disappointing that in the week of the audit there were 213 episodes of severe hypoglycaemia requiring injectable treatment and 66 cases of diabetic ketoacidosis (DKA) developing during hospital admission, almost identical to previous years. This year for the first time the audit collected data on cases developing hyperosmolar hyperglycaemic state (HHS) after hospital admission. This data had not previously been included, as it was believed it to be a very rare event. We were surprised to find that there were 29 cases in the week of the audit. Assuming that these rates are repeated each week over a year this equates to approximately 11,000 cases of hypoglycaemia requiring rescue treatment, 3,400 cases of DKA and 1,500 cases of HHS. This is disturbing as these life-threating events are entirely preventable. That there has been no improvement is even more shocking given the increased level of awareness following previous NaDIA reports and particularly with the increasing media attention that both complications have attracted following a number of deaths.

Increased attention to glucose monitoring, particularly in those on insulin infusions, safe use of insulin and other hypoglycaemic agents and identifying and addressing deteriorating glucose control at an early stage should be priorities within the harm reduction strategies of all hospitals. Remote glucose monitoring (RGM) has been reported to be helpful in reducing hypoglycaemic rates in some trusts but the audit was unable to find a relationship between the use of RGM and hypoglycaemic rates.

The NaDIA data again highlights some important relationships which should help direct efforts to reduce harm. Although differences are not statistically significant, a relationship between patient's dissatisfaction with the timing and choice of hospital meals and severe hypoglycaemic episodes is again suggested. Once more hypoglycaemia was found to more frequent in the early morning (05:00 to 08:59), possibly related to the more prolonged fast between these meals than is usual at home. Improving the choice, content and timings of meals has been highlighted in previous audits. It is therefore disappointing to see that in 2015 there has been more dissatisfaction with choice and timing of meals than at any other time.

Foot care

As mentioned earlier, the positive trend of more hospitals being served by multi-disciplinary foot teams has disappointingly shown a reversal although both remain significantly better than at the start of the audit. It is of note that sites which have put in place measures to increase foot examinations have seen a significant benefit with almost twice as many specific diabetic foot risk examinations being undertaken than at sites that have not done so. Additionally, patients at sites which have adopted NICE or 'Putting Feet First' guidance are more likely to receive a specific diabetic foot risk examination and to have been seen by the multi-disciplinary foot team.

The most impressive change has been in the number of patients developing foot and heel lesions whilst in hospital. These have fallen significantly from 257 (2.2 per cent) in 2010 to 153 (1.1 per cent) in 2015. Preventing over one hundred patients each week suffering this catastrophic and potentially life changing event is a major outcome and results in many thousands of prevented lesions per year. The prevention of lesions is of great benefit to the patients, but also translates as a saving of tens of millions of pounds for the NHS. Contrary to expectations, in NaDIA 2013 sites that had put in place measures to improve foot examinations had more hospital acquired foot ulcers (1.6 per cent) compared with those that did not (1.1 per cent). We speculated that sites being more proactive may detect more foot lesions which others may have missed before discharge to the community. It is of interest that the statistically significant reduction in foot lesions in 2015 was confined to these

proactive sites where the rates fell from 1.6 per cent to 1.1 per cent. This suggests that if others adopt these preventative strategies even more foot lesions could be prevented.

Conclusion

NaDIA is an invaluable tool for diabetes teams to reflect on the care they provide, to address areas of weakness and to take pride in areas in which they excel. From its introduction, the audit has driven small but important improvements in inpatient care year upon year. Due to funding issues there was a break between 2013 and 2015. Over this time improvements have halted, and in several areas, including medication errors and the activities of the multi-disciplinary foot team, the gains made have slightly reversed, although results remain significantly better than in the first audit. Whether this is the result of diabetes teams 'taking their eye off the ball' during the break is speculative but quite possible. The data from NaDIA 2015 should help teams refocus their efforts. What is clear is the lack of investment and indeed in some areas disinvestment in diabetes inpatient services. This is short sighted as the prevalence of diabetes in hospital is relentlessly increasing such that it may account for one in four occupied hospital beds in 2025. Investing in diabetes inpatient teams would reap rewards in reduced bed days and reduced harms to patients. The 50 per cent reduction in hospital acquired foot ulcers seen since the introduction of NaDIA on its own would provide sufficient savings to fund the inpatient diabetes specialist team.

Gerry Rayman

National Clinical Lead for Inpatient Diabetes

Further information

This National Report presents the key findings from the National Diabetes Inpatient Audit (NaDIA) 2015. This summary is supported by the NaDIA Hospital Level Analysis containing national and local results for the 2015 audit for both England and Wales.

Local health economies and care providers can learn more about the details of their own services and how they compare with other services by consulting the NaDIA Hospital Level Analysis.

For more information on the NaDIA or access to the Hospital Level Analysis please visit the NaDIA webpage at:

http://www.hscic.gov.uk/diabetesinpatientaudit

For further information about this report, please contact The Health and Social Care Information Centre's Contact Centre on 0845 300 6016 or email enquiries@hscic.gov.uk.

References

NHS Diabetes. National Diabetes Inpatient Audit 2010

http://www.yhpho.org.uk/resource/view.aspx?RID=106455

The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2011

http://www.hscic.gov.uk/catalogue/PUB06279

The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2012

http://www.hscic.gov.uk/catalogue/PUB10506

The Health and Social Care Information Centre. National Diabetes Inpatient Audit 2013

http://www.hscic.gov.uk/catalogue/PUB13662

Department of Health. National Service Framework for diabetes standards
https://www.gov.uk/government/publications/national-service-framework-diabetes

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

National Institute for Health and Care Excellence. Diabetes in adults quality standards
http://guidance.nice.org.uk/QS6

Diabetes UK. Putting feet first
www.diabetes.org.uk/Documents/Reports/Putting_Feet_First_010709.pdf

NHS Institute for Innovation and Improvement. THINKGLUCOSE inpatient care for people with diabetes
www.institute.nhs.uk/quality_and_value/think_glucose/welcome_to_the_website_for_thinkglucose.html

National Institute for Health and Care Excellence (NICE): CG119 Diabetic foot problems - inpatient management: full guideline

http://publications.nice.org.uk/diabetic-foot-problems-cg119

NHS Diabetes. Management of adults with diabetes undergoing surgery and elective procedures: Improving Standards

www.diabetes.org.uk/About_us/What-we-say/Improving-diabetes-healthcare/Management-of-adults-with-diabetes-undergoing-surgery-and-elective-procedures-improving-standards

Appendices

Appendix 1: Glossary

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 of service users. 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

$$P_{lower} = \frac{(2O + z^2 - z\sqrt{z^2 + 4Oq})}{2(n + z^2)}$$

$$\boldsymbol{P_{upper} = \frac{(2O + z^2 + z\sqrt{z^2 + 4Oq})}{2(n + z^2)}}$$

We have used the following calculation of a 95 per cent confidence interval (CI) for the estimate of a proportion **p** from a sample survey:

Where:

O is the observed number of individuals in the sample having the specified characteristic

n is the sample size achieved (number of useable responses);

q = (1-p) is the proportion without the specified characteristic;

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

Significance testing

Most significance testing of differences over time in this report compares NaDIA values from the 2013 and 2015 audits, as 2013 was the previous audit year for which inpatient data was collected. Some significance testing is done on NaDIA values from the 2010 and 2015 audits, though it should be noted that Wales did not submit data for this collection.

Response rates

A patient is classed as a respondent if they responded to one or more question, allowing them to express their views on areas they feel strongly about without having to complete the entire questionnaire.

8,521 inpatients responded to the Patient Experience element of the audit out of the total responses to the audit (15,229 patients), a response rate of 56.0 per cent.

Weighting

When conducting sample surveys it is important to consider weighting the data to allow for any survey design effects as well as potential bias caused by non-response.

The patient experience survey results have been weighted to reflect the differing response rates by age, ethnic group, type of admission, type and duration of diabetes, ward speciality and length of hospital stay at the time of the audit. The weights are calculated using the relative proportions of the eligible population, the Bedside Audit respondents.

Appendix 2: How did we calculate the values in the 2015 audit?

The information in the National Diabetes Inpatient Audit is collected by medical and audit professionals across England and Wales using three questionnaires. We appreciate all their hard work.

The audit forms are divided into sections. When we receive audit forms most are filled in completely but some have gaps. Some sections will have an answer in some boxes but other boxes will be blank.

When we analyse the data we have to make a decision. Do we only include results for patients where every box in a section has been completed (i.e. only include complete records)? Or do we include results from all boxes that have been completed, even if there is missing information elsewhere in that section (i.e. use all the recorded data)? Both methods of analysis are valid (see the examples below).

It has been decided that the audit should be using as much of the data as possible (all recorded data). The audit report was prepared using the 'all recorded data' method for the first time in 2012.

For more detail or any questions please contact NaDIA@hscic.gov.uk.

Example - Insulin prescription errors:

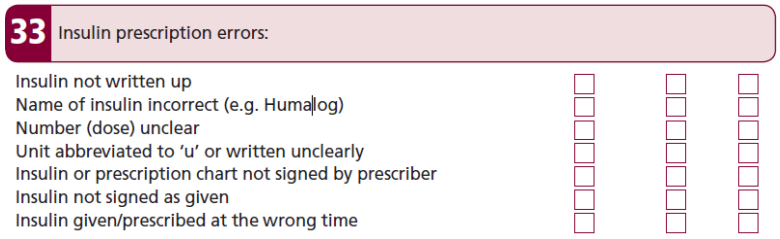


Table # Bedside Audit Questionnaire, Question 33, Insulin prescription errors

Insulin	Form 1	Form 2	Form 3	Form 4	Form 5	Form 6	Form 7	Form 8	Form 9	Form 10
Insulin not written up	Y	N	N	N	N		N	N	N	
Name of insulin incorrect (e.g. Humalog)	N	N	N	N	N	Y	N	N	N	
Number (dose) unclear	N	N	N	N	N		N	N	N	
Unit abbreviated to 'u' or written unclearly	N	N	N	N	N		N	N	N	
Insulin or prescription chart not signed by prescriber	N	N	N	Y	N		N	N	N	
Insulin not signed as given	N	N	N	N	N		N	N	N	Y
Insulin given/prescribed at wrong time	N	N	N	N	N		N	N	N	

Y = did occur, N = did not occur

'Completed records method' using only forms in which every box was completed (grey columns): 2 Y in 8 forms = 25% had a prescription error.

'All recorded data method' using all completed boxes: 4 Y in 10 forms = 40% had a prescription error.

Appendix 3: 2015 Participation

England

Trust		Site	
Code	Name	Code	Name
REM	Aintree University Hospital NHS Foundation Trust	REM21	University Hospital Aintree
RCF	Airedale NHS Foundation Trust	RCF22	Airedale General Hospital
RTK	Ashford and St Peter's Hospitals NHS Foundation Trust	RTK	Trust level participant
RF4	Barking, Havering and Redbridge University Hospitals NHS Trust	RF4DG	King George Hospital
		RF4QH	Queen's Hospital
RFF	Barnsley Hospital NHS Foundation Trust	RFFAA	Barnsley Hospital
R1H	Barts Health NHS Trust	R1HNH	Newham General Hospital
		R1H12	Royal London Hospital
		R1HKH	Whipps Cross University Hospital
RDD	Basildon and Thurrock University Hospitals NHS Foundation Trust	RDDH0	Basildon University Hospital
RC1	Bedford Hospital NHS Trust	RC110	Bedford Hospital
RXL	Blackpool Teaching Hospitals NHS Foundation Trust	RXL01	Blackpool Victoria Hospital
RMC	Bolton NHS Foundation Trust	RMC01	Royal Bolton Hospital
RAE	Bradford Teaching Hospitals NHS Foundation Trust	RAE	Trust level participant
RXH	Brighton and Sussex University Hospitals NHS Trust	RXH09	Princess Royal Hospital (Brighton and Sussex)
		RXH01	Royal Sussex County Hospital
RXQ	Buckinghamshire Healthcare NHS Trust	RXQ	Trust level participant
RJF	Burton Hospitals NHS Foundation Trust	RJF02	Queen's Hospital, Burton Upon Trent
RWY	Calderdale and Huddersfield NHS Foundation Trust	RWY02	Calderdale Royal Hospital
		RWY01	Huddersfield Royal Infirmary
RGT	Cambridge University Hospitals NHS Foundation Trust	RGT01	Addenbrooke's Hospital
RW3	Central Manchester University Hospitals NHS Foundation Trust	RW3	Manchester Site - Including Manchester Royal Eye Hospital, Manchester Royal Infirmary and St Mary's Hospital
		RW3TR	Trafford General Hospital
RQM	Chelsea and Westminster Hospital NHS Foundation Trust	RQM01	Chelsea and Westminster Hospital
RFS	Chesterfield Royal Hospital NHS Foundation Trust	RFSDA	Chesterfield Royal Hospital
RLN	City Hospitals Sunderland NHS Foundation Trust	RLNGL	Sunderland Royal Hospital
RDE	Colchester Hospital University NHS Foundation Trust	RDE	Trust level participant
RJR	Countess of Chester Hospital NHS Foundation Trust	RJR05	Countess of Chester Hospital
RXP	County Durham and Darlington NHS Foundation Trust	RXPBA	Bishop Auckland Hospital
		RXPDA	Darlington Memorial Hospital
		RXPCP	University Hospital Of North Durham
RJ6	Croydon Health Services NHS Trust	RJ611	Croydon University Hospital
RN7	Dartford and Gravesham NHS Trust	RN707	Darent Valley Hospital

Trust		Site	
Code	Name	Code	Name
RTG	Derby Teaching Hospitals NHS Foundation Trust	RTGFG	Royal Derby Hospital
RP5	Doncaster and Bassetlaw Hospitals NHS Foundation Trust	RP5BA	Bassetlaw Hospital
		RP5DR	Doncaster Royal Infirmary
RBD	Dorset County Hospital NHS Foundation Trust	RBD01	Dorset County Hospital
RNA	Dudley Group NHS Foundation Trust	RNA01	Russells Hall Hospital
RWH	East and North Hertfordshire NHS Trust	RWH01	Lister Hospital
RJN	East Cheshire NHS Trust	RJN71	Macclesfield District General Hospital
RVV	East Kent Hospitals University NHS Foundation Trust	RVVKC	Kent and Canterbury Hospital
		RVV09	Queen Elizabeth the Queen Mother Hospital
		RVV01	William Harvey Hospital
RXR	East Lancashire Hospitals NHS Trust	RXR20	Royal Blackburn Hospital
RXC	East Sussex Healthcare NHS Trust	RXC01	Conquest Hospital
		RXC02	Eastbourne District General Hospital
RVR	Epsom and St Helier University Hospitals NHS Trust	RVR50	Epsom Hospital
		RVR05	St Helier Hospital
RDU	Frimley Health NHS Foundation Trust	RDU01	Frimley Park Hospital
		RDU1	Frimley Sites - Including Wexham Park Hospital and Heatherwood Hospital
RR7	Gateshead Health NHS Foundation Trust	RR7EN	Queen Elizabeth Hospital (Gateshead)
RLT	George Eliot Hospital NHS Trust	RLT01	George Eliot Hospital
RTE	Gloucestershire Hospitals NHS Foundation Trust	RTE01	Cheltenham General Hospital
		RTE03	Gloucestershire Royal Hospital
RN3	Great Western Hospitals NHS Foundation Trust	RN325	Great Western Hospital
RJ1	Guy's and St Thomas' NHS Foundation Trust	RJ1	Trust level participant
RN5	Hampshire Hospitals NHS Foundation Trust	RN506	Basingstoke and North Hampshire Hospital
		RN541	Royal Hampshire County Hospital
RCD	Harrogate and District NHS Foundation Trust	RCD01	Harrogate District Hospital
RR1	Heart of England NHS Foundation Trust	RR10	Birmingham Site - Including Heartlands Hospital and Solihull Hospital[46]
		RR105	Good Hope Hospital
RAS	Hillingdon Hospitals NHS Foundation Trust	RAS	Trust level participant
RQQ	Hinchingbrooke Health Care NHS Trust	RQQ31	Hinchingbrooke Hospital
RQX	Homerton University Hospital NHS Foundation Trust	RQXM1	Homerton University Hospital
RWA	Hull and East Yorkshire Hospitals NHS Trust	RWA	Trust level participant
RYJ	Imperial College Healthcare NHS Trust	RYJ02	Charing Cross Hospital
		RYJ03	Hammersmith Hospital
		RYJ01	St Mary's Hospital (London)
RGQ	Ipswich Hospital NHS Trust	RGQ02	Ipswich Hospital
R1F	Isle of Wight NHS Trust	R1F01	St Mary's Hospital (Isle of Wight)

[46] RR10 is also available split by hospital site: Heartlands Hospital (RR101) and Solihull Hospital (RR109).

Trust		Site	
Code	Name	Code	Name
RGP	James Paget University Hospitals NHS Foundation Trust	RGP75	James Paget University Hospital
RNQ	Kettering General Hospital NHS Foundation Trust	RNQ51	Kettering General Hospital
RJZ	King's College Hospital NHS Foundation Trust	RJZ01	King's College Hospital (Denmark Hill)
		RJZ30	Princess Royal University Hospital
RAX	Kingston Hospital NHS Foundation Trust	RAX01	Kingston Hospital
RXN	Lancashire Teaching Hospitals NHS Foundation Trust	RXN01	Chorley and South Ribble Hospital
		RXN02	Royal Preston Hospital
RR8	Leeds Teaching Hospitals NHS Trust	RR8	Trust level participant
RJ2	Lewisham and Greenwich NHS Trust	RJ231	Queen Elizabeth Hospital (South London)
		RJ224	University Hospital Lewisham
R1K	London North West Healthcare NHS Trust	R1K02	Central Middlesex Hospital
		R1K04	Ealing Hospital
		R1K01	Northwick Park Hospital
RC9	Luton and Dunstable University Hospital NHS Foundation Trust	RC971	Luton and Dunstable Hospital
RWF	Maidstone and Tunbridge Wells NHS Trust	RWF03	Maidstone Hospital
		RWFTW	Tunbridge Wells Hospital
RPA	Medway NHS Foundation Trust	RPA02	Medway Maritime Hospital
RBT	Mid Cheshire Hospitals NHS Foundation Trust	RBT20	Leighton Hospital
RQ8	Mid Essex Hospital Services NHS Trust	RQ8L0	Broomfield Hospital
RXF	Mid Yorkshire Hospitals NHS Trust	RXF10	Dewsbury and District Hospital
		RXF05	Pinderfields General Hospital
RD8	Milton Keynes University Hospital NHS Foundation Trust	RD816	Milton Keynes Hospital
RTD	Newcastle Upon Tyne Hospitals NHS Foundation Trust	RTD	Trust level participant
RM1	Norfolk and Norwich University Hospitals NHS Foundation Trust	RM102	Norfolk and Norwich University Hospital
RVJ	North Bristol NHS Trust	RVJ	Trust level participant
RNL	North Cumbria University Hospitals NHS Trust	RNLAY	Cumberland Infirmary
		RNLBX	West Cumberland Hospital
RVW	North Tees and Hartlepool NHS Foundation Trust	RVWAE	University Hospital of North Tees
RNS	Northampton General Hospital NHS Trust	RNS01	Northampton General Hospital
RBZ	Northern Devon Healthcare NHS Trust	RBZ12	North Devon District Hospital
RJL	Northern Lincolnshire and Goole NHS Foundation Trust	RJL30	Diana, Princess of Wales Hospital
		RJL32	Scunthorpe General Hospital
RTF	Northumbria Healthcare NHS Foundation Trust	RTF	Trust level participant
RX1	Nottingham University Hospitals NHS Trust	RX1CC	Nottingham City Hospital
		RX1RA	Queen's Medical Centre
RTH	Oxford University Hospitals NHS Foundation Trust	RTH02	Churchill Hospital
		RTH05	Horton General Hospital
		RTH08	John Radcliffe Hospital
		RTH03	Nuffield Orthopaedic Centre

Trust		Site	
Code	Name	Code	Name
RW6	Pennine Acute Hospitals NHS Trust	RW601	Fairfield General Hospital
		RW602	North Manchester General Hospital
		RW603	Royal Oldham Hospital
RGN	Peterborough and Stamford Hospitals NHS Foundation Trust	RGN80	Peterborough City Hospital
RK9	Plymouth Hospitals NHS Trust	RK950	Derriford Hospital
RD3	Poole Hospital NHS Foundation Trust	RD304	Poole Hospital
RHU	Portsmouth Hospitals NHS Trust	RHU03	Queen Alexandra Hospital
RQW	Princess Alexandra Hospital NHS Trust	RQWG0	Princess Alexandra Hospital
RCX	Queen Elizabeth Hospital, King's Lynn, NHS Foundation Trust	RCX70	Queen Elizabeth Hospital (King's Lynn)
RFR	Rotherham NHS Foundation Trust	RFRPA	Rotherham District General Hospital
RHW	Royal Berkshire NHS Foundation Trust	RHW01	Royal Berkshire Hospital
RDZ	Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	RDZ20	Royal Bournemouth General Hospital
REF	Royal Cornwall Hospitals NHS Trust	REF12	Royal Cornwall Hospital
RH8	Royal Devon and Exeter NHS Foundation Trust	RH801	Royal Devon and Exeter Hospital
RAL	Royal Free London NHS Foundation Trust	RAL26	Barnet Hospital
		RAL27	North Middlesex Hospital
		RAL01	Royal Free Hospital
RQ6	Royal Liverpool and Broadgreen University Hospitals NHS Trust	RQ6	Trust level participant
RA2	Royal Surrey County Hospital NHS Foundation Trust	RA201	Royal Surrey County Hospital
RD1	Royal United Hospitals Bath NHS Foundation Trust	RD130	Royal United Hospital Bath
RL4	Royal Wolverhampton NHS Trust	RL403	New Cross Hospital (Wolverhampton)
RM3	Salford Royal NHS Foundation Trust	RM301	Salford Royal
RNZ	Salisbury NHS Foundation Trust	RNZ00	Salisbury District Hospital
RXK	Sandwell and West Birmingham Hospitals NHS Trust	RXK02	City Hospital
		RXK01	Sandwell General Hospital
RHQ	Sheffield Teaching Hospitals NHS Foundation Trust	RHQNG	Northern General Hospital
		RHQ1	Sheffield Site - Including Royal Hallamshire Hospital and Western Park Hospital
RK5	Sherwood Forest Hospitals NHS Foundation Trust	RK5BC	King's Mill Hospital
RXW	Shrewsbury and Telford Hospital NHS Trust	RXWAT	Princess Royal Hospital (Shrewsbury and Telford)
		RXWAS	Royal Shrewsbury Hospital
RTR	South Tees Hospitals NHS Foundation Trust	RTR45	Friarage Hospital Site
		RTRAT	James Cook University Hospital
RE9	South Tyneside NHS Foundation Trust	RE9GA	South Tyneside District Hospital
RJC	South Warwickshire NHS Foundation Trust	RJC02	Warwick Hospital
RAJ	Southend University Hospital NHS Foundation Trust	RAJ01	Southend Hospital
RVY	Southport and Ormskirk Hospital NHS Trust	RVY	Trust level participant
RJ7	St George's University Hospitals NHS Foundation Trust	RJ701	St George's Hospital (Tooting)

Trust		Site	
Code	Name	Code	Name
RBN	St Helens and Knowsley Hospitals NHS Trust	RBN	Trust level participant
RWJ	Stockport NHS Foundation Trust	RWJ09	Stepping Hill Hospital
RTP	Surrey and Sussex Healthcare NHS Trust	RTP04	East Surrey Hospital
RMP	Tameside Hospital NHS Foundation Trust	RMP01	Tameside General Hospital
RBA	Taunton and Somerset NHS Foundation Trust	RBA11	Musgrove Park Hospital
RA9	Torbay and South Devon NHS Foundation Trust	RA901	Torbay Hospital
RWD	United Lincolnshire Hospitals NHS Trust	RWDLP	Grantham and District Hospital
		RWDDA	Lincoln County Hospital
		RWDLA	Pilgrim Hospital
RRV	University College London Hospitals NHS Foundation Trust	RRV03	University College Hospital
RM2	University Hospital of South Manchester NHS Foundation Trust	RM202	Wythenshawe Hospital
RHM	University Hospital Southampton NHS Foundation Trust	RHM01	Southampton General Hospital
RRK	University Hospitals Birmingham NHS Foundation Trust	RRK02	Queen Elizabeth Hospital (Birmingham)
RA7	University Hospitals Bristol NHS Foundation Trust	RA7	Trust level participant
RKB	University Hospitals Coventry and Warwickshire NHS Trust	RKB03	Hospital of St Cross
		RKB01	University Hospital (Coventry)
RWE	University Hospitals of Leicester NHS Trust	RWEAE	Glenfield Hospital
		RWEAK	Leicester General Hospital
		RWEAA	Leicester Royal Infirmary
RTX	University Hospitals of Morecambe Bay NHS Foundation Trust	RTXBU	Furness General Hospital
		RTX02	Royal Lancaster Infirmary
RJE	University Hospitals of North Midlands NHS Trust	RJE	Trust level participant
RBK	Walsall Healthcare NHS Trust	RBK02	Walsall Manor Hospital
RWW	Warrington and Halton Hospitals NHS Foundation Trust	RWWHG	Halton Hospital
		RWWWH	Warrington Hospital
RWG	West Hertfordshire Hospitals NHS Trust	RWG08	Hemel Hempstead Hospital
		RWG03	St Albans City Hospital
		RWG02	Watford General Hospital
RFW	West Middlesex University Hospital NHS Trust	RFW01	West Middlesex University Hospital
RGR	West Suffolk NHS Foundation Trust	RGR50	West Suffolk Hospital
RYR	Western Sussex Hospitals NHS Foundation Trust	RYR16	St Richard's Hospital
		RYR18	Worthing Hospital
RA3	Weston Area Health NHS Trust	RA301	Weston General Hospital
RKE	Whittington Hospital NHS Trust	RKEQ4	Whittington Hospital
RWP	Worcestershire Acute Hospitals NHS Trust	RWP01	Alexandra Hospital
		RWP31	Kidderminster Hospital
		RWP50	Worcestershire Royal Hospital
RRF	Wrightington, Wigan and Leigh NHS Foundation Trust	RRF	Trust level participant

Trust		Site	
Code	Name	Code	Name
RLQ	Wye Valley NHS Trust	RLQ01	Hereford County Hospital
RA4	Yeovil District Hospital NHS Foundation Trust	RA430	Yeovil District Hospital
RCB	York Teaching Hospital NHS Foundation Trust	RCBCA	Scarborough General Hospital
		RCB55	York Hospital

Wales

Trust		Site	
Code	Name	Code	Name
7A3	Abertawe Bro Morgannwg University Local Health Board	7A3C7	Morriston Hospital
		7A3CJ	Neath Port Talbot Hospital
		7A3B7	Princess of Wales Hospital
		7A3C4	Singleton Hospital
7A6	Aneurin Bevan University Local Health Board	7A6AM	Nevill Hall Hospital
		7A6AR	Royal Gwent Hospital
		7A6AV	Ysbyty Ysrad Fawr Hospital
7A1	Betsi Cadwaladr University Local Health Board	7A1A4	Wrexham Maelor Hospital
		7A1A1	Ysbyty Glan Clwyd
		7A1AU	Ysbyty Gwynedd
7A4	Cardiff & Vale University Local Health Board	7A4C1	University Hospital Llandough
		7A4BV	University Hospital of Wales
7A5	Cwm Taf University Local Health Board	7A5B3	Prince Charles Hospital
		7A5B1	Royal Glamorgan Hospital
7A2	Hywel Dda University Local Health Board	7A2AJ	Bronglais General Hospital
		7A2AL	Prince Philip Hospital
		7A2AG	West Wales General Hospital
		7A2BL	Withybush General Hospital

Appendix 4: Pressure ulcer risk scoring systems

Information on local pressure ulcer risk scoring system policy has been collected for the first time for the 2015 NaDIA. Chart 64 shows that 98.0 per cent of sites utilise a pressure ulcer risk scoring system for hospital admissions, with 2.0 per cent confirmed as having no system in place. Waterlow was the most prevalent system, used by 76.8 per cent of sites with an ulcer risk scoring system (see Chart 65).

Chart 64: Pressure ulcer risk scoring system usage, England and Wales, 2015

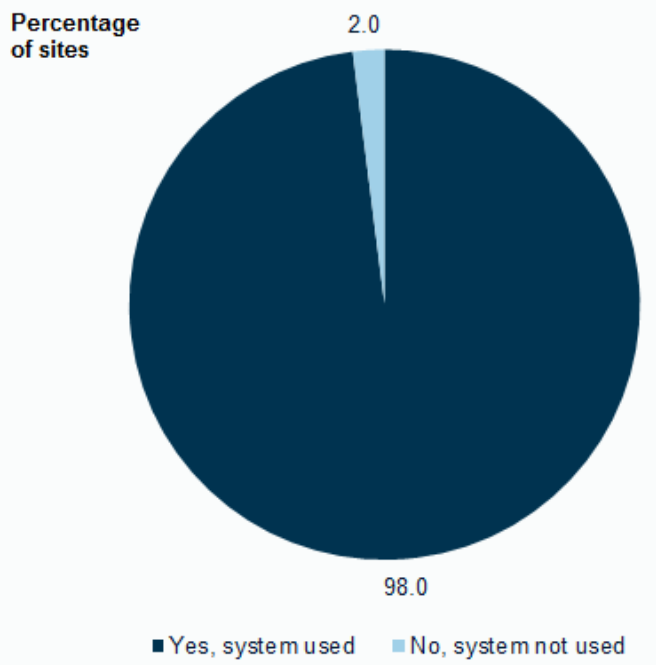
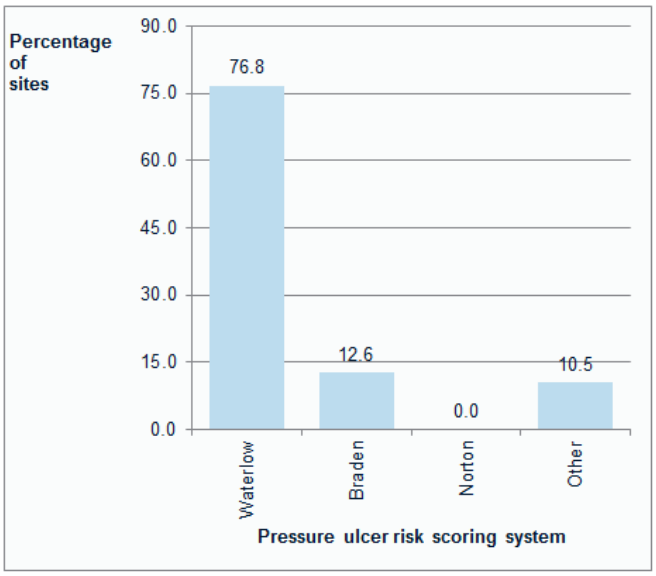


Chart 65: Pressure ulcer risk scoring systems used by hospital sites, England and Wales, 2015†



†Excluding sites that did not use a pressure ulcer scoring system.

Appendix 5: Frequency of medication errors

The full table of medication errors (2010 – 2013, 2015) is produced on the following page.

Table 73: Frequency of medication errors, broken down into prescription and medication errors, in last 7 days, England and Wales, 2010 – 2013, 2015†

Medication error		2010*		2011		2012		2013		2015^	
		Number	%	Number	%	Number	%	Number	%	Number	%
Insulin prescription errors	Insulin not written up†	243	2.7	186	2.1	174	1.7	174	**1.7**	237	**2.2**
	Name of insulin incorrect	444	5.0	266	2.9	248	2.5	219	2.1	192	1.8
	Number (dose) unclear	307	3.5	209	2.3	206	2.1	201	1.9	186	1.7
	Unit abbreviated to 'u' or written unclearly†	557	6.3	311	3.4	252	2.5	199	**1.9**	166	**1.5**
	Insulin or prescription chart not signed	244	2.8	218	2.4	206	2.1	204	1.9	225	2.1
	Insulin not signed as given	528	6.0	462	5.1	502	5.0	508	4.8	531	4.9
	Insulin given/ prescribed at wrong time†	345	3.9	280	3.1	304	3.0	328	**3.1**	410	**3.7**
Oral hypoglycaemic agent (OHA) prescription errors	OHA not signed as given†	493	5.6	459	5.1	525	5.2	483	**4.6**	571	**5.2**
	OHA given/ prescribed at wrong time	529	6.0	479	5.3	548	5.5	509	4.8	498	4.6
	Wrong dose	133	1.5	101	1.1	124	1.2	109	1.0	105	1.0
	OHA not written up	227	2.6	206	2.3	239	2.4	208	2.0	197	1.8
Insulin management errors	Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate†	884	10.0	858	9.5	1,030	10.3	1,032	**9.8**	1,254	**11.5**
	Insulin not increased when persistent blood glucose greater than 11 mmol/L and less than or equal to15 mmol/L and better glycaemic control appropriate									1,002	9.2
	Insulin not increased when persistent blood glucose greater than 15 mmol/L and better glycaemic control appropriate									936	8.6
	Insulin not reduced if unexplained blood glucose less than 4 mmol/L†	338	3.8	357	4.0	353	3.5	345	**3.3**	436	**4.0**
	Inappropriate omission of insulin after episode of hypoglycaemia	214	2.4	189	2.1	191	1.9	188	1.8	192	1.8
OHA management errors	No action taken when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate	814	9.2	811	9.0	1,053	10.5	1,004	9.5	967	8.8
	No action taken when persistent blood glucose greater than11 mmol/L and less than or equal to15 15 mmol/L and better glycaemic control appropriate									818	7.5
	No action taken when persistent blood glucose >15 mmol/L and better glycaemic control appropriate									612	5.6
	OHA not reduced if unexplained blood glucose less than 4mmol/L	280	3.2	259	2.9	281	2.8	273	2.6	253	2.3
	Inappropriate omission of OHA after episode of hypoglycaemia	94	1.1	89	1.0	90	0.9	80	0.8	62	0.6

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Where the 2013 and 2015 values are **bolded**, the difference between the two percentages is statistically significant (p <0.05). The denominator includes inpatients with drug charts only.

Appendix 6: Frequency of insulin errors for insulin treated inpatients

Table 74: Frequency of insulin errors for insulin treated diabetes inpatients, broken down into insulin prescription and medication errors, in last 7 days, England and Wales, 2010 – 2013, 2015†

Insulin error		2010*		2011		2012		2013		2015^	
		Number	% of inpatient drug charts	Number	% of inpatient drug charts	Number	% of inpatient drug charts	Number	% of inpatient drug charts	Number	% of inpatient drug charts
Insulin prescription errors *[Insulin treated patients only]*	Insulin not written up†	243	5.5	186	4.2	174	3.6	174	**3.4**	237	**4.3**
	Name of insulin incorrect†	444	10.0	266	5.9	248	5.1	219	**4.3**	192	**3.5**
	Number (dose) unclear	307	6.9	209	4.7	206	4.2	201	3.9	186	3.4
	Unit abbreviated to 'u' or written unclearly†	557	12.5	311	6.9	252	5.2	199	**3.9**	166	**3.0**
	Insulin or prescription chart not signed	244	5.5	218	4.9	206	4.2	204	4.0	225	4.1
	Insulin not signed as given	528	11.9	462	10.3	502	10.3	508	9.9	531	9.6
	Insulin given/prescribed at wrong time†	345	7.8	280	6.2	304	6.2	328	**6.4**	410	**7.4**
Insulin management errors *[Insulin treated patients only]*	Insulin not increased when persistent blood glucose greater than 11 mmol/L and better glycaemic control appropriate†	884	19.9	858	19.1	1,030	21.1	1032	**20.0**	1,254	**22.8**
	Insulin not increased when persistent blood glucose greater than 11 mmol/L and less than or equal to15 mmol/L and better glycaemic control appropriate									1,002	18.2
	Insulin not increased when persistent blood glucose greater than 15 mmol/L and better glycaemic control appropriate									936	17.0
	Insulin not reduced if unexplained blood glucose less than 4 mmol/L†	338	7.6	357	8.0	353	7.2	345	**6.7**	436	**7.9**
	Inappropriate omission of insulin after episode of hypoglycaemia‡	214	4.8	189	4.2	191	3.9	188	3.6	192	3.5

* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Where the 2013 and 2015 values are **bolded**, the difference between the two percentages is statistically significant (p <0.05).
‡ Revised since presentation at the 2016 Diabetes UK Conference on 2 March 2016 from 3.5 per cent to 1.8 per cent (2015).

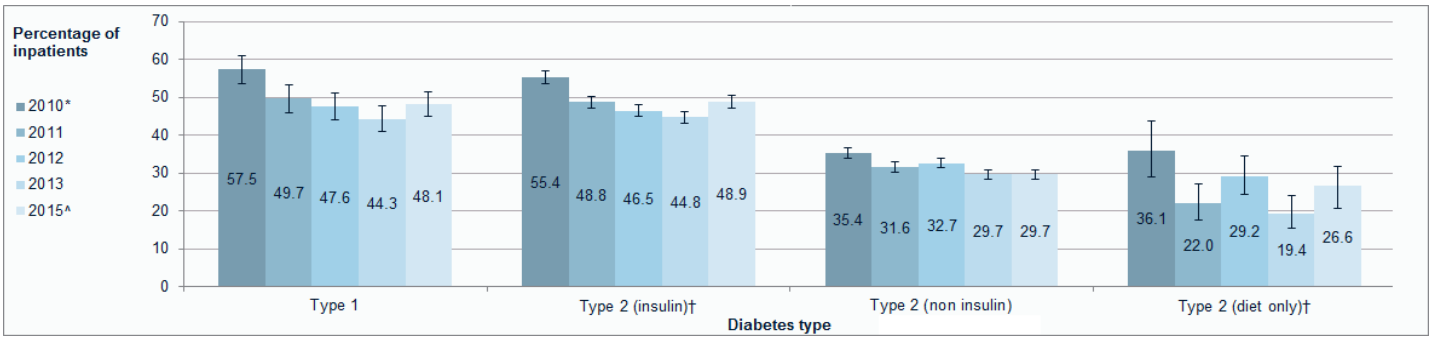
Appendix 7: Medication errors by diabetes type

Medication errors

In 2015, medication errors (including all prescription and management errors) were significantly more frequent for inpatients with Type 1 diabetes (48.1 per cent) and Type 2 insulin treated diabetes (48.9 per cent) than for inpatients with Type 2 non-insulin treated diabetes (29.7 per cent) and Type 2 diet only diabetes (26.6 per cent). The data also shows that there was a significant decrease in medication errors from 2010 to 2015 for all diabetes types.

However, between 2013 and 2015 there was a significant increase in medication errors for inpatients with both Type 2 insulin treated diabetes and Type 2 diet only diabetes, as well for inpatients with diabetes as a whole (see Chart 66 below).

Chart 66: Percentage of inpatient drug charts with medication errors in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†

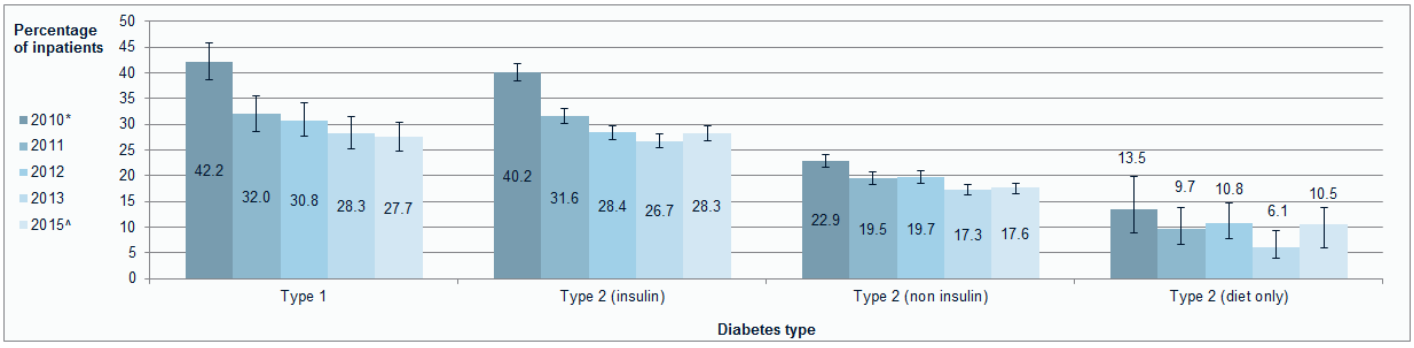


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

Prescription errors by diabetes type

In 2015 prescription errors on drug charts were significantly more frequent for inpatients with Type 1 diabetes (27.7 per cent) and Type 2 insulin treated diabetes (28.3 per cent) than for inpatients with Type 2 non-insulin treated diabetes (17.6 per cent) and Type 2 diet only diabetes (10.5 per cent). The data also shows that there was a significant decrease in prescription errors on drug charts from 2010 to 2015 for all diabetes types except for Type 2 (diet only). There was no significant change between 2013 and 2015 for any diabetes type (see Chart 67).

Chart 67: Percentage of inpatient drug charts with prescription errors in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†



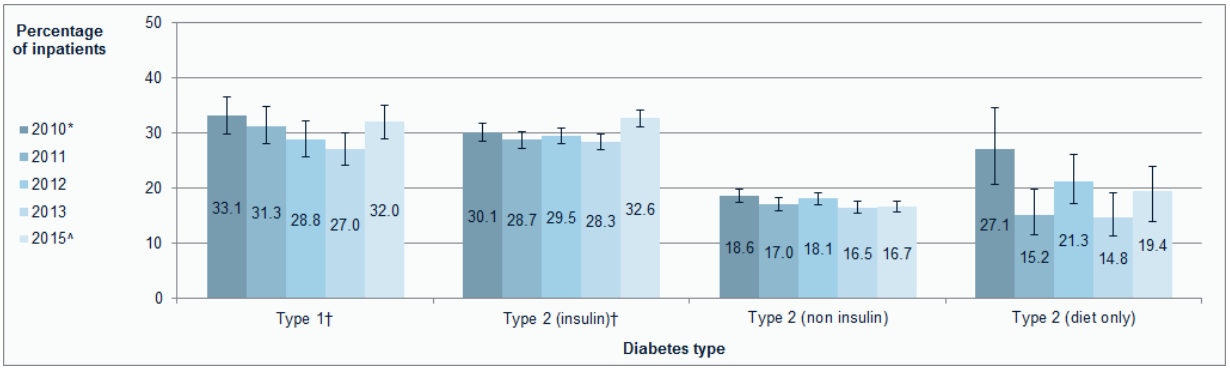
* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values (p <0.05).

Medication management errors by diabetes type

In 2015 medication management errors on drug charts were significantly more frequent for inpatients with Type 1 diabetes (32.0 per cent) and Type 2 insulin treated diabetes (32.6 per cent) than for inpatients with Type 2 non-insulin treated diabetes (16.7 per cent) and Type 2 diet only diabetes (19.4 per cent).

Between 2013 and 2015 there were significant increases in the prevalence of medication management errors on drug charts for inpatients with Type 1 diabetes and Type 2 insulin treated diabetes, as well as for inpatients with diabetes as a whole (see Chart 68). Since 2010, inpatients with Type 2 non-insulin treated have had significantly fewer medication management errors, although the proportion of inpatients with Type 2 insulin treated diabetes having these errors has increased.

Chart 68: Percentage of inpatient drug charts with medication management errors in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†



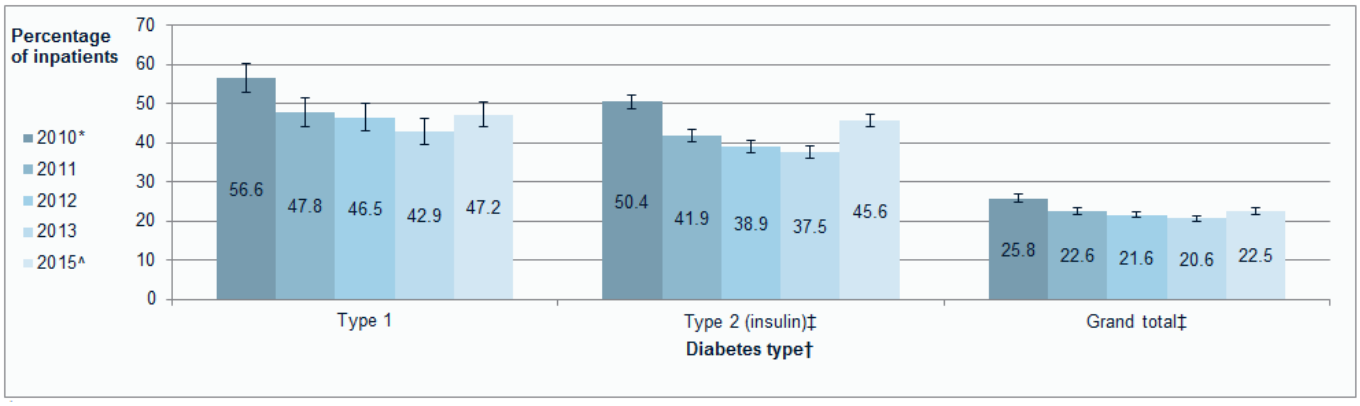
* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

Insulin errors by diabetes type

In previous NaDIA collections (2010 to 2013), inpatients with Type 1 diabetes have shown a statistically higher prevalence of insulin errors compared to inpatients with Type 2 insulin treated diabetes. However, in 2015 rates of insulin errors (including insulin prescription and insulin management errors) on drug charts were similar between inpatients the groups with Type 1 diabetes (47.2 per cent for inpatients with Type 1 diabetes and 45.6 per cent for inpatients with Type 2 insulin treated diabetes).

Whilst the proportion of insulin errors has fallen significantly for each group since 2010, the prevalence amongst those with Type 2 insulin treated diabetes has risen significantly between 2013 and 2015 (see Chart 69).

Chart 69: Percentage of inpatient drug charts with insulin errors in last 7 days by diabetes type, England and Wales, 2010 – 2013, 2015†‡



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Only values for inpatients with Type 1 and Type 2 (insulin treated) diabetes and the grand total are reported, as inpatients with Type 2 (non-insulin treated) and Type 2 (diet only) diabetes would not usually receive insulin as part of their care.
‡ Statistically significant difference between 2013 and 2015 values ($p < 0.05$).

Medication error trends and diabetes type: summary

Table 75 below summarises the changes in the prevalence of medication errors between 2010 and 2015. We can see that medication errors, prescription errors and insulin errors have reduced for almost all diabetes types. Management errors have not reduced to the same extent, though improvement is evident for inpatients with Type 2 non-insulin treated diabetes, while errors have increased for those with Type 2 insulin treated diabetes. No medication error for any diabetes type has increased over this period.

Table 75: Changes in the prevalence of medication errors by diabetes type, 2010 to 2015

	Difference 2010 to 2015 (p <0.05)			
Diabetes type	Medication error*	Prescription error	Management error	Insulin error†
Type 1	**Down**	**Down**	No change	**Down**
Type 2 (insulin)	**Down**	**Down**	**Up**	**Down**
Type 2 (non-insulin)	**Down**	**Down**	**Down**	
Type 2 (diet only)	**Down**	No change	No change	
Grand total	**Down**	**Down**	No change	**Down**

* Prescription errors and/or management errors.
† Insulin prescription errors and/or insulin management errors.

However, Table 76 appears to show an increase in the prevalence of medication errors for many diabetes types between 2013 and 2015, with no decreases evident during this period. This is suggestive of a more general trend of increasing medication errors since 2013.

Table 76: Changes in the prevalence of medication errors by diabetes type, 2013 to 2015

	Difference 2013 to 2015 (p <0.05)			
Diabetes type	Medication error*	Prescription error	Management error	Insulin error†
Type 1	No change	No change	**Up**	No change
Type 2 (insulin)	**Up**	No change	**Up**	**Up**
Type 2 (non-insulin)	No change	No change	No change	
Type 2 (diet only)	**Up**	No change	No change	
Grand total	**Up**	No change	**Up**	**Up**

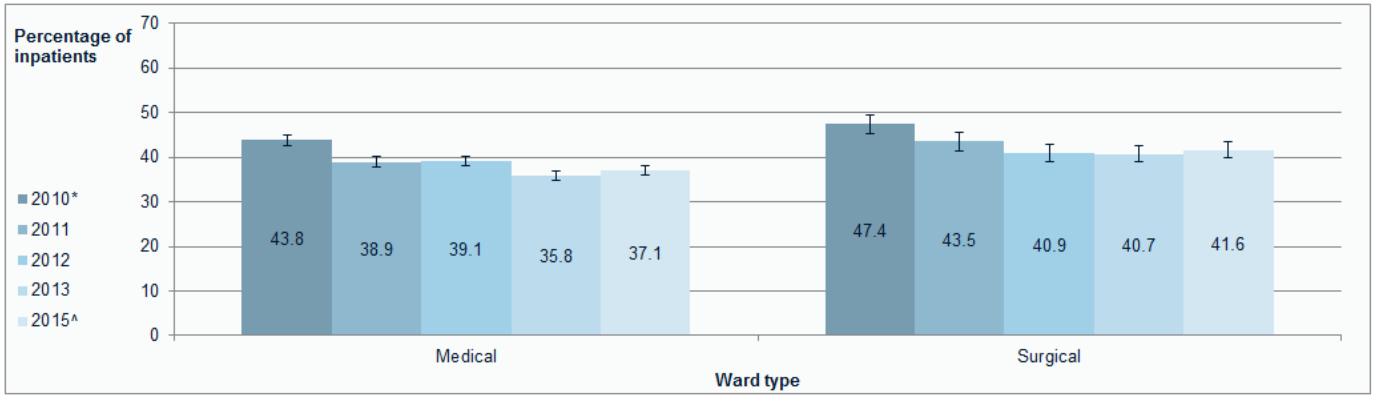
* Prescription errors and/or management errors.
† Insulin prescription errors and/or insulin management errors.

Appendix 8: Medication errors by ward type

Medication errors

In 2015 medication errors on drug charts were significantly more frequent for inpatients on surgical wards (41.6 per cent) than for inpatients on medical wards (37.1 per cent). This pattern has been consistent since audit inception in 2010, with the exception of 2012 when the proportions were similar (40.9 per cent compared to 39.1 per cent).

Chart 70: Percentage of inpatient drug charts with medication errors in last 7 days by ward type, England and Wales, 2010 – 2013, 2015†

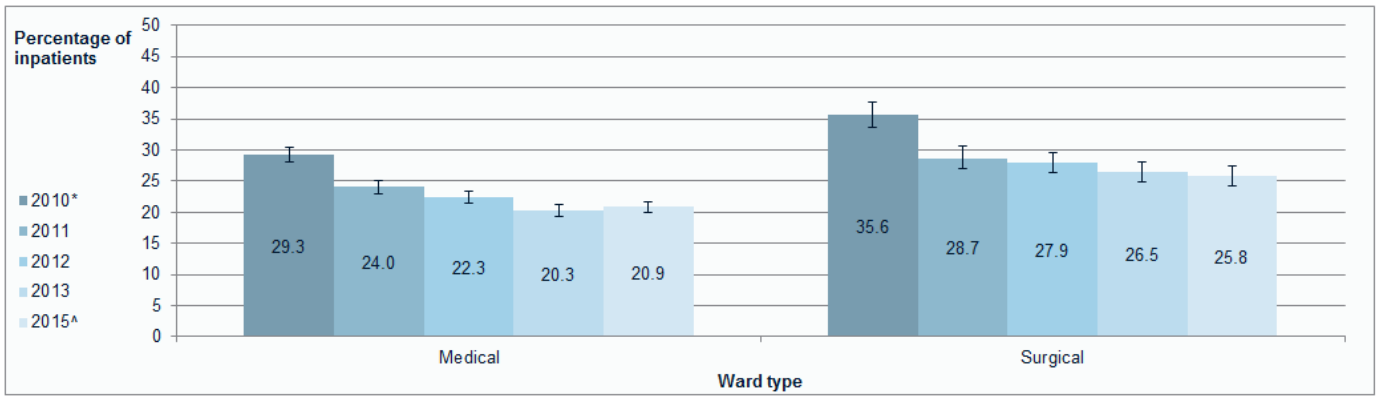


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values (p <0.05).

Prescription errors

In 2015 prescription errors on drug charts were significantly more frequent for inpatients on surgical wards (25.8 per cent) than for inpatients on medical wards (20.9 per cent). This pattern has been consistent since audit inception in 2010.

Chart 71: Percentage of inpatient drug charts with prescription errors in last 7 days by ward type, England and Wales, 2010 – 2013, 2015†

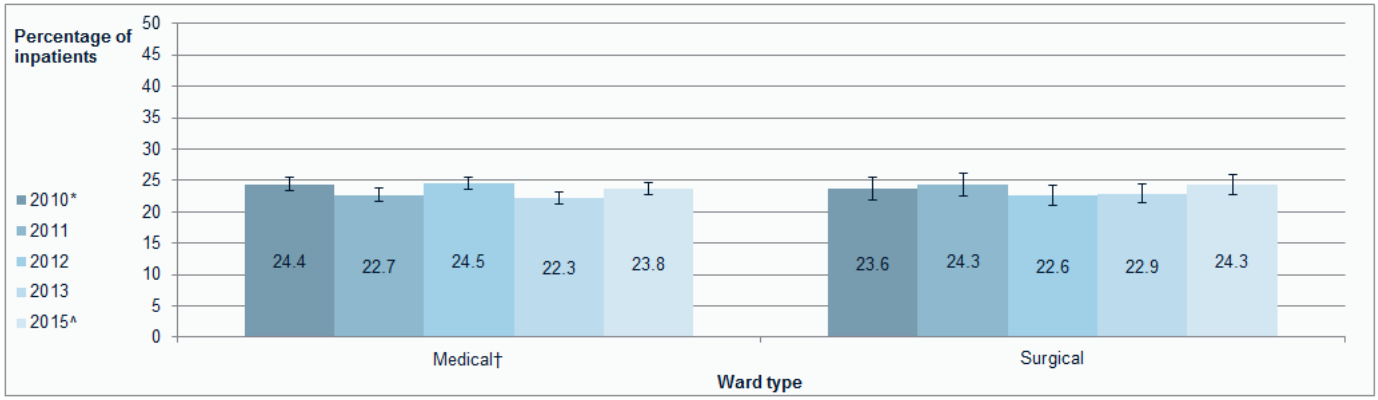


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† There is no statistically significant difference between the 2013 and 2015 values (p <0.05).

Medication management errors

In 2015 there was no significant different in the prevalence of medication management errors on drug charts between medical and surgical wards (23.8 per cent compared to 24.3 per cent). This pattern has been consistent since audit inception in 2010, with the exception of 2012 when a greater proportion of medication management errors occurred on medical wards (24.5 per cent compared to 22.6 per cent). Between 2013 and 2015 there has been a significant increase in medication management errors on medical wards, with no significant difference between the equivalent surgical figures (see Chart 72).

Chart 72: Percentage of inpatient drug charts with medication management errors in last 7 days by ward type, England and Wales, 2010 – 2013, 2015†

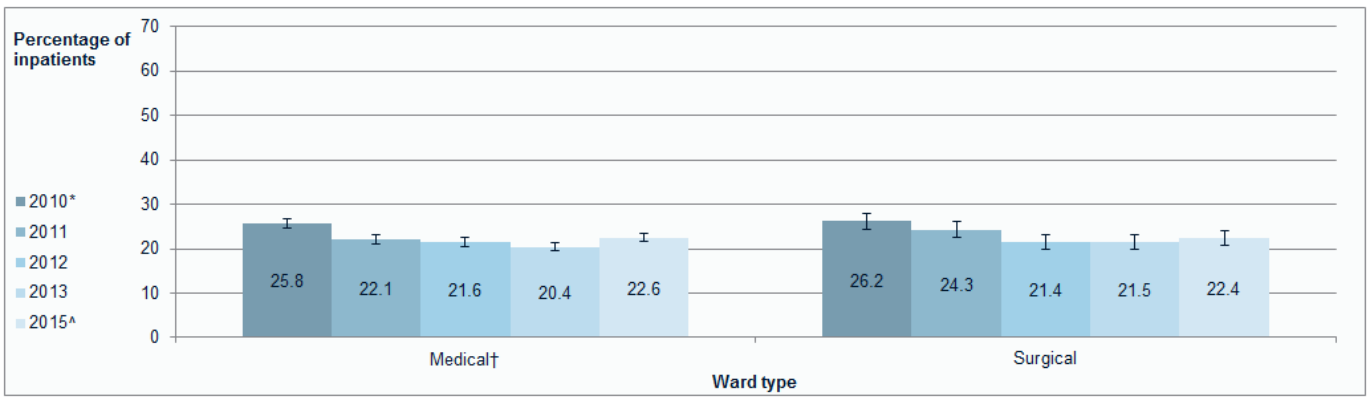


* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

Insulin errors

In 2015 there was no significant difference in the prevalence of insulin errors between medical and surgical wards (22.6 per cent compared to 22.4 per cent). This pattern has been consistent since audit inception in 2010, with the exception of 2011 when a greater proportion of medication management errors occurred on surgical wards (22.1 per cent compared to 24.3 per cent). Compared to 2013 there was a significant increase in medication management errors on medical wards in 2015, with no significant difference between the 2013 and 2015 surgical figures (see Chart 73).

Chart 73: Percentage of inpatient drug charts with insulin errors in last 7 days by ward type, England and Wales, 2010 – 2013, 2015†



* Sites from Wales did not participate in the 2010 NaDIA.
^ There was no audit collection or report in 2014, so 2014 data is not available.
† Statistically significant difference between 2013 and 2015 values (p <0.05).

Appendix 9: Multi-level logistic regression

As some hospital level variables have been included in the patient harm models, multi-level logistic regression has been used to separate out the effects of patient characteristics (different for patients admitted to the same site) from the effects of hospital characteristics (the same for patients admitted to the same site), by blocking the variation associated with particular variables as random noise. Used in this way, multi-level logistic regression modelling attempts to:

a) account for variations that were associated with the hospital so the effect of the patient associated characteristics could be better understood; and
b) smooth out the differences associated with patient demographics to see if there was any variation particularly associated with hospital level variables.

The effects of multi-level logistic regression on the quality of the models can be seen in Appendices 10 to 13 below.

Appendix 10: Building a model to explain the risk of developing a foot lesion in hospital

In 2015, 13,952 inpatients had a record of whether a foot lesion developed during their admission. From this group the initial logistic regression model was just below the 0.7 c-statistic level describing a model of reasonable accuracy. The results from this model are shown in Table 57.

By using multi-level logistic regression to account for variation between hospital sites, the multi-level model was better able to predict the outcomes from patient level variables than the initial model, with a c-statistic meeting the 0.8 c-statistic level for a good predictive model (see Table 56 below). There was little difference in the goodness of fit where patient variation was blocked. The full results from the multi-level regression models are detailed in Table 58 (hospital variation blocked) and Table 59 (patient variation blocked).

Table 56: Goodness of fit (c-statistic*) of logistic regression models to explain the risk of developing a foot lesion in hospital

Model type	2015 Cohort All ‡ (n=13,952)
Logistic regression	▲ 0.6896
Multi-level logistic regression (hospital variation blocked)	■ 0.8439
Multi-level logistic regression (patient variation blocked)	▲ 0.6912

Key:
● = very poor c-stat <0.6
▲ = poor c-stat ≥0.6 to <0.7
◆ = reasonable^ c-stat ≥0.7 to <0.8
■ = strong^ c-stat ≥0.8

* For an explanation of the c-statistic, see page 81.
^ Based on Hosmer DW, Lemeshow S. Applied Logistic Regression (2nd Edition). New York, NY: John Wiley & Sons; 2000.
† The small size of the cohort (1,003 patients) meant it was not possible to account for variation between hospital sites using multi-level modelling.
‡ Inpatients with Type 1 diabetes and the relevant variables recorded.

Table 57: Results from multivariate analysis of data for development of foot lesions, England and Wales, 2015^

Number of observations used in model	13,952	
Filters: Audit year: 2015, Diabetes type known	Foot lesion status recorded	
c-statistic*	0.6896	
	Odds Ratio*	95% CI Limits*
Type of diabetes – reference category = Type 2 non-insulin		
Type 1 vs. Type 2 non-insulin	2.707 (1.467, 4.993)	
Type 2 insulin vs. Type 2 non-insulin	2.494 (1.656, 3.756)	
Type 2 diet vs. Type 2 non-insulin	1.471 (0.872, 2.484)	
Type other vs. Type 2 non-insulin	1.463 (0.350, 6.117)	
Main reason for admission – reference category = Non-diabetes medical		
DKA vs. Non-diabetes medical	1.170 (0.344, 3.984)	
HHS vs. Non-diabetes medical	2.016 (0.273, 14.896)	
Hypo vs. Non-diabetes medical	0.957 (0.232, 3.950)	
Hyper vs. Non-diabetes medical	-	
Foot disease vs. Non-diabetes medical	4.731 (3.040, 7.361)	
Non-medical vs. Non-diabetes medical	1.064 (0.670, 1.692)	
Unknown vs. Non-diabetes medical	2.163 (0.671, 6.970)	
Does the hospital have an established multi-disciplinary diabetic foot team? – reference category = Yes		
No vs. Yes	1.106 (0.757, 1.615)	
Unknown vs. Yes	3.124 (1.251, 7.802)	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a foot lesion during admission, and green highlighting an association with decreased odds of a foot lesion during admission. Results are presented as odds ratios with 95% confidence intervals in brackets.

* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Table 58: Variable effects in multi-level regression modelling for development of foot lesions (Hospital variation blocked), England and Wales, 2015^

Number of observations used in model	13,952	
Filters: Audit year: 2015, Diabetes type known	Foot lesion status recorded	
c-statistic*	0.8439	
	Odds Ratio*	95% CI Limits*
Type of diabetes – reference category = Type 2 non-insulin		
Type 1 vs. Type 2 non-insulin	2.758 (1.481, 5.138)	
Type 2 insulin vs. Type 2 non-insulin	2.561 (1.693, 3.875)	
Type 2 diet vs. Type 2 non-insulin	1.483 (0.875, 2.514)	
Type other vs. Type 2 non-insulin	1.424 (0.334, 6.061)	
Main reason for admission – reference category = Non-diabetes medical		
DKA vs. Non-diabetes medical	1.185 (0.342, 4.099)	
HHS vs. Non-diabetes medical	2.161 (0.284, 16.442)	
Hypo vs. Non-diabetes medical	0.944 (0.226, 3.943)	
Hyper vs. Non-diabetes medical	-	
Foot disease vs. Non-diabetes medical	4.473 (2.813, 7.113)	
Non-medical vs. Non-diabetes medical	1.041 (0.651, 1.666)	
Unknown vs. Non-diabetes medical	2.054 (0.624, 6.764)	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a foot lesion during admission, and green highlighting an association with decreased odds of a foot lesion during admission. Results are presented as odds ratios with 95% confidence intervals in brackets.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Table 59: Variable effects in multi-level regression modelling for development of foot lesions (Patient variation blocked), England and Wales, 2015^

Number of observations used in model	13,952	
Filters: Audit year: 2015, Diabetes type known	Foot lesion status recorded	
c-statistic*	0.6912	
	Odds Ratio*	95% CI Limits*
Does the hospital have an established multi-disciplinary diabetic foot team? – reference category = Yes		
No vs. Yes	1.109 (0.760, 1.620)	
Unknown vs. Yes	3.048 (1.222, 7.605)	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a foot lesion during admission, and green highlighting an association with decreased odds of a foot lesion during admission. Results are presented as odds ratios with 95% confidence intervals in brackets.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Appendix 11: Building a model to explain the risk of developing DKA in hospital

Looking at the 2015 Type 1 cohort with the required variables recorded (1,003 inpatients), the logistic regression model predicted with a reasonable degree of certainty whether an individual would develop DKA during their admission (c-statistic of 0.7108). The results from this model are shown in Table 61.

The small size of the cohort (1,003 patients) meant it was not possible to account for variation between hospital sites using multi-level modelling. When accounting for variation between patient characteristics, the multi-level models were better able to predict the outcomes from hospital level variables than the initial models, with a c-statistic approaching the 0.8 level that is considered a strong model (0.7722). The results from the multi-level regression model (patient variation blocked) are shown in Table 62.

Table 60: Goodness of fit (c-statistic*) of logistic regression models to explain the risk of developing diabetic ketoacidosis (DKA) in hospital

Model type	2015 Cohort Type 1‡ (n=1,003)
Logistic regression	0.7108
Multi-level logistic regression (hospital variation blocked) †	-
Multi-level logistic regression (patient variation blocked)	0.7722

Key:
= very poor c-stat <0.6
= poor c-stat ≥0.6 to <0.7
= reasonable^ c-stat ≥0.7 to <0.8
= strong^ c-stat ≥0.8

* For an explanation of the c-statistic, see page 81.
^ Based on Hosmer DW, Lemeshow S. Applied Logistic Regression (2nd Edition). New York, NY: John Wiley & Sons; 2000.
† The small size of the cohort (1,003 patients) meant it was not possible to account for variation between hospital sites using multi-level modelling.
‡ Inpatients with Type 1 diabetes and the relevant variables recorded.

Table 61: Results from multivariate analysis of data for development of DKA in Type 1 diabetes inpatients, England and Wales, 2015^

Number of observations used in model	1,003	
Filters: Audit year: 2015	Diabetes type: Type 1, DKA/HHS status recorded	
c-statistic*	0.7108	
	Odds Ratio*	95% CI Limits*
Main reason for admission – reference category = Non-diabetes medical		
DKA vs. Non-diabetes medical	6.224 (2.964, 13.068)	
HHS vs. Non-diabetes medical	-	
Hypo vs. Non-diabetes medical	0.996 (0.126, 7.855)	
Hyper vs. Non-diabetes medical	1.927 (0.529, 7.020)	
Foot disease vs. Non-diabetes medical	1.838 (0.505, 6.688)	
Non-medical vs. Non-diabetes medical	0.720 (0.201, 2.582)	
Unknown vs. Non-diabetes medical	-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of DKA occurring during the admission, and green highlighting an association with decreased odds of DKA occurring during the admission. Results are presented as odds ratios with 95% confidence intervals in brackets.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Table 62: Results from multivariate analysis of data for development of DKA in Type 1 diabetes inpatients (Patient variation blocked), England and Wales, 2015^

Number of observations used in model	1,003	
Filters: Audit year: 2015	Diabetes type: Type 1, DKA/HHS status recorded	
c-statistic*	0.7722	
	Odds Ratio*	95% CI Limits*
Staffing levels: hours of DISN or DSN time per week per 100 beds† – reference category = 0-4 hours		
5-9 hours vs. 0-4 hours	0.548 (0.238, 1.266)	
10-14 hours vs. 0-4 hours	0.239 (0.087, 0.657)	
15-19 hours vs. 0-4 hours	0.635 (0.202, 1.993)	
20-24 hours vs. 0-4 hours	0.430 (0.050, 3.666)	
25+ hours vs. 0-4 hours	0.465 (0.094, 2.301)	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of DKA occurring during the admission, and green highlighting an association with decreased odds of DKA occurring during the admission. Results are presented as odds ratios with 95% confidence intervals in brackets.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.
† Diabetes inpatient specialist nurses (DISN) / diabetes specialist nurses (DSN).

Appendix 12: Building a model to explain the risk of having a hypoglycaemic episode in hospital

Using the 2015 patient cohort with the required variables recorded (13,194 inpatients), the initial regression model produced had a reasonable degree of accuracy when predicting the occurrence of hypoglycaemic episodes in inpatients (c-statistic of 0.7283).

The model was then adjusted to consider mild and severe hypoglycaemic episodes separately. The derived models were both reasonable, with a better goodness of fit in the severe model (0.7813 vs. 0.7142). The results from these models are shown in Table 64.

Accounting for variation between hospital sites, the multi-level models were better able to predict the outcomes from patient level variables than the initial models, although the differences in all of the three cases were not particularly marked (see Table 63) and made little difference to which characteristics were identified as being associated with hypoglycaemic episodes. The results from the multi-level regression models are detailed in Table 65 (hospital variation blocked) and Table 66 (patient variation blocked).

Table 63: Goodness of fit (c-statistic*) of logistic regression models to explain the risk of having a hypoglycaemic episode in hospital

	2015 cohort‡		
Model type	Any hypo† (n=13,194)	Severe hypo† (n=11,369)	Mild hypo† (n=13,135)
Logistic regression	0.7283	0.7813	0.7142
Multi-level logistic regression (hospital variation blocked)	0.7456	0.7942	0.7310
Multi-level logistic regression (patient variation blocked)	0.7303	0.7831	0.7156

Key:
= very poor c-stat <0.6
= poor c-stat ≥0.6 to <0.7
= reasonable^ c-stat ≥0.7 to <0.8
= strong^ c-stat ≥0.8

* For an explanation of the c-statistic, see page 81.
^ Based on Hosmer DW, Lemeshow S. Applied Logistic Regression (2nd Edition). New York, NY: John Wiley & Sons; 2000.
† Mild hypoglycaemic episode (3.0-3.9mmol/L). Severe hypoglycaemic episode (<3.0mmol/L).
Any hypoglycaemic episode (≤3.9mmol/L).
‡ Inpatients with the relevant variables recorded.

Table 64: Results from multivariate analysis of data for hypoglycaemic episodes, England and Wales, 2015^

Number of observations used in model	13,194		11,369		13,135	
Filters: Audit year: 2015, Chart available for review, Diabetes type known	Mild Hypo or Severe Hypo status recorded		Severe Hypo status recorded		Mild Hypo status recorded	
c-statistic*	0.7283		0.7813		0.7142	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Sex – reference category = Male						
Female vs. Male	-		-		1.123 (1.024, 1.231)	
Unknown vs. Male	-		-		0.862 (0.614, 1.210)	
Age group – reference category = 75-84 years						
Under 45 vs. 75-84 years	0.852 (0.677, 1.072)		0.678 (0.500, 0.920)		0.853 (0.675, 1.078)	
45-54 vs. 75-84 years	0.697 (0.571, 0.849)		0.635 (0.478, 0.845)		0.698 (0.570, 0.856)	
55-64 vs. 75-84 years	0.879 (0.759, 1.019)		0.817 (0.658, 1.014)		0.909 (0.783, 1.056)	
65-74 vs. 75-84 years	0.894 (0.793, 1.009)		0.821 (0.684, 0.984)		0.887 (0.784, 1.004)	
85+ vs. 75-84 years	1.090 (0.958, 1.241)		0.940 (0.768, 1.149)		1.064 (0.932, 1.215)	
Unknown vs. 75-84 years	0.896 (0.640, 1.252)		1.015 (0.635, 1.620)		1.037 (0.736, 1.463)	
Ethnic group – reference category = White						
Asian vs. White	1.352 (1.029, 1.456)		-		1.256 (1.056, 1.494)	
Black vs. White	1.476 (1.181, 1.846)		-		1.396 (1.111, 1.755)	
Mixed and Other vs. White	0.777 (0.475, 1.270)		-		0.787 (0.476, 1.302)	
Unknown vs. White	1.352 (1.029, 1.776)		-		1.412 (1.073, 1.857)	
Type of admission – reference category = Emergency						
Elective vs. Emergency	0.742 (0.620, 0.888)		0.690 (0.517, 0.919)		0.762 (0.634, 0.916)	
Transfer vs. Emergency	1.109 (0.911, 1.350)		0.909 (0.670, 1.233)		1.203 (0.988, 1.466)	
Unknown vs. Emergency	1.208 (0.778, 1.876)		1.649 (0.905, 3.005)		1.180 (0.753, 1.850)	
Type of diabetes – reference category = Type 2 non-insulin						
Type 1 vs. Type 2 non-insulin	1.282 (0.702, 2.340)		1.070 (0.323, 3.549)		0.984 (0.511, 1.896)	
Type 2 insulin vs. Type 2 non-insulin	0.604 (0.331, 1.101)		0.411 (0.124, 1.363)		0.505 (0.263, 0.973)	
Type 2 diet vs. Type 2 non-insulin	0.739 (0.620, 0.879)		0.614 (0.430, 0.875)		0.739 (0.619, 0.883)	
Type other vs. Type 2 non-insulin	1.030 (0.582, 1.823)		0.866 (0.267, 2.805)		0.864 (0.464, 1.610)	
Insulin part of the inpatient's treatment regimen on admission – reference category = No						
Yes vs. No	6.379 (3.526, 11.539)		13.508 (4.121, 44.281)		6.909 (3.617, 13.198)	
Sulphonylureas part of the inpatient's treatment regimen on admission – reference category = No						
Yes vs. No	2.174 (1.932, 2.447)		1.853 (1.543, 2.225)		2.135 (1.893, 2.408)	

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Table 64: Results from multivariate analysis of data for hypoglycaemic episodes, England and Wales, 2015^ (continued)

	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Main reason for admission – reference category = Non-diabetes medical						
DKA vs. Non-diabetes medical	1.629 (1.172, 2.264)		1.817 (1.258, 2.625)		1.533 (1.101, 2.134)	
HHS vs. Non-diabetes medical	1.343 (0.711, 2.538)		1.643 (0.661, 4.086)		1.371 (0.717, 2.620)	
Hypo vs. Non-diabetes medical	2.985 (2.184, 4.080)		3.625 (2.573, 5.108)		2.371 (1.740, 3.232)	
Hyper vs. Non-diabetes medical	0.973 (0.700, 1.352)		1.044 (0.679, 1.606)		0.961 (0.685, 1.347)	
Foot disease vs. Non-diabetes medical	1.430 (1.184, 1.727)		1.533 (1.191, 1.974)		1.411 (1.162, 1.713)	
Non-medical vs. Non-diabetes medical	0.983 (0.867, 1.115)		0.883 (0.724, 1.077)		0.997 (0.877, 1.134)	
Unknown vs. Non-diabetes medical	1.653 (1.104, 2.476)		1.296 (0.728, 2.306)		1.718 (1.141, 2.586)	
Does the hospital use remote blood glucose monitoring? – reference category = Partial						
No vs. Partial	1.179 (1.017, 1.367)		-		-	
Yes vs. Partial	1.240 (1.068, 1.440)		-		-	
Unknown vs. Partial	1.001 (0.671, 1.493)		-		-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a hypoglycaemic episode, and green highlighting an association with decreased odds of a hypoglycaemic episode. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Table 65: Variable effects in multi-level regression modelling of hypoglycaemic episodes (Hospital variation blocked), England and Wales, 2015^

Number of observations used in model	13,194		11,369		13,135	
Filters: Audit year: 2015, Chart available for review, Diabetes type known	Mild Hypo or Severe Hypo status recorded		Severe Hypo status recorded		Mild Hypo status recorded	
c-statistic*	0.7456		0.7942		0.7310	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Sex – reference category = Male						
Female vs. Male	1.103 (1.007, 1.207)		-		1.120 (1.021, 1.229)	
Unknown vs. Male	0.923 (0.662, 1.286)		-		0.881 (0.625, 1.240)	
Age group – reference category = 75-84 years						
Under 45 vs. 75-84 years	0.846 (0.671, 1.067)		0.669 (0.492, 0.909)		0.852 (0.673, 1.078)	
45-54 vs. 75-84 years	0.685 (0.561, 0.837)		0.630 (0.473, 0.840)		0.685 (0.558, 0.841)	
55-64 vs. 75-84 years	0.875 (0.755, 1.015)		0.813 (0.654, 1.009)		0.903 (0.777, 1.050)	
65-74 vs. 75-84 years	0.892 (0.790, 1.008)		0.820 (0.683, 0.984)		0.885 (0.781, 1.002)	
85+ vs. 75-84 years	1.078 (0.947, 1.229)		0.941 (0.768, 1.152)		1.064 (0.931, 1.216)	
Unknown vs. 75-84 years	0.922 (0.652, 1.305)		1.010 (0.631, 1.617)		1.039 (0.735, 1.469)	

Continued on following page.

Table 65: Variable effects in multi-level regression modelling of hypoglycaemic episodes (Hospital variation blocked), England and Wales, 2015^ (continued)

	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Ethnic group – reference category = White						
Asian vs. White	1.196 (1.001, 1.428)		-		1.229 (1.027, 1.470)	
Black vs. White	1.445 (1.147, 1.819)		-		1.380 (1.090, 1.745)	
Mixed and Other vs. White	0.783 (0.478, 1.282)		-		0.786 (0.474, 1.303)	
Unknown vs. White	1.333 (1.010, 1.758)		-		1.402 (1.062, 1.850)	
Type of admission – reference category = Emergency						
Elective vs. Emergency	0.735 (0.613, 0.882)		0.688 (0.515, 0.918)		0.752 (0.624, 0.906)	
Transfer vs. Emergency	1.132 (0.927, 1.382)		0.925 (0.680, 1.258)		1.214 (0.993, 1.483)	
Unknown vs. Emergency	1.189 (0.762, 1.853)		1.651 (0.906, 3.012)		1.161 (0.739, 1.825)	
Type of diabetes – reference category = Type 2 non-insulin						
Type 1 vs. Type 2 non-insulin	1.305 (0.713, 2.390)		1.090 (0.328, 3.619)		1.003 (0.519, 1.937)	
Type 2 insulin vs. Type 2 non-insulin	0.607 (0.332, 1.110)		0.414 (0.125, 1.373)		0.510 (0.264, 0.984)	
Type 2 diet vs. Type 2 non-insulin	0.741 (0.622, 0.883)		0.621 (0.435, 0.885)		0.742 (0.621, 0.887)	
Type other vs. Type 2 non-insulin	1.045 (0.589, 1.855)		0.879 (0.271, 2.852)		0.865 (0.463, 1.616)	
Insulin part of the inpatient's treatment regimen on admission – reference category = No						
Yes vs. No	6.389 (3.521, 11.593)		13.511 (4.118, 44.332)		6.872 (3.590, 13.155)	
Sulphonylureas part of the inpatient's treatment regimen on admission – reference category = No						
Yes vs. No	2.170 (1.926, 2.445)		1.861 (1.548, 2.238)		2.122 (1.880, 2.396)	
Main reason for admission – reference category = Non-diabetes medical						
DKA vs. Non-diabetes medical	1.627 (1.167, 2.269)		1.827 (1.261, 2.646)		1.545 (1.107, 2.157)	
HHS vs. Non-diabetes medical	1.327 (0.699, 2.519)		1.614 (0.646, 4.032)		1.352 (0.705, 2.592)	
Hypo vs. Non-diabetes medical	3.054 (2.230, 4.183)		3.655 (2.588, 5.160)		2.425 (1.776, 3.311)	
Hyper vs. Non-diabetes medical	0.983 (0.705, 1.369)		1.034 (0.671, 1.594)		0.965 (0.687, 1.357)	
Foot disease vs. Non-diabetes medical	1.463 (1.207, 1.773)		1.528 (1.184, 1.972)		1.414 (1.162, 1.722)	
Non-medical vs. Non-diabetes medical	0.982 (0.865, 1.116)		0.883 (0.723, 1.079)		1.000 (0.878, 1.138)	
Unknown vs. Non-diabetes medical	1.610 (1.070, 2.421)		1.272 (0.712, 2.272)		1.694 (1.122, 2.559)	
Does the hospital use remote blood glucose monitoring?[$] – reference category = Partial						
No vs. Partial	1.172 (0.964, 1.426)		-		-	
Yes vs. Partial	1.249 (1.023, 1.525)		-		-	
Unknown vs. Partial	0.984 (0.601, 1.609)		-		-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a hypoglycaemic episode, and green highlighting an association with decreased odds of a hypoglycaemic episode. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the parent variable was found not to be significant in that model and was removed.

* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

[$] Although the multi-level model accounted for some of the hospital level variation, the following hospital level variable was still returned as significant for the any hypo status cohort: 'Does the hospital use remote blood glucose monitoring?'

Table 66: Variable effects in multi-level regression modelling of hypoglycaemic episodes (Patient variation blocked), England and Wales, 2015^

Number of observations used in model	13,194		11,369		13,135	
Filters: Audit year: 2015, Chart available for review, Diabetes type known	Mild Hypo or Severe Hypo status recorded		Severe Hypo status recorded		Mild Hypo status recorded	
c-statistic*	0.7303		0.7831		0.7156	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Does the hospital use remote blood glucose monitoring? – reference category = Partial						
No vs. Partial	1.202 (1.033, 1.398)		-		1.068 (0.927, 1.231)	
Yes vs. Partial	1.258 (1.082, 1.463)		-		1.160 (0.990, 1.358)	
Unknown vs. Partial	0.897 (0.556, 1.448)		-		2.560 (1.116, 5.871)	
Does the hospital use electronic prescribing? – reference category = Partial						
No vs. Partial	1.086 (0.945, 1.250)		-		1.179 (1.011, 1.374)	
Yes vs. Partial	1.178 (1.005, 1.381)		-		1.199 (1.028, 1.397)	
Unknown vs. Partial	1.944 (0.846, 4.466)		-		0.782 (0.478, 1.282)	
Does the hospital have an agreed lower glucose target, below which action should be taken? – reference category = Yes						
No vs. Yes	-		1.124 (0.798, 1.584)		-	
Unknown vs. Yes	-		0.423 (0.217, 0.823)		-	
Does the hospital have an agreed upper glucose target, above which action should be taken? – reference category = Yes						
No vs. Yes	-		0.853 (0.730, 0.997)		-	
Unknown vs. Yes	-		0.916 (0.580, 1.449)		-	
Staffing levels: hours of diabetes consultant time per week per 100 beds – reference category = 1-2 hours						
Under 1 hour vs. 1-2 hours	1.131 (1.001, 1.381)		1.226 (1.026, 1.464)		-	
3-5 hours vs. 1-2 hours	1.138 (1.009, 1.282)		1.243 (1.043, 1.481)		-	
6-9 hours vs. 1-2 hours	0.980 (0.836, 1.148)		1.026 (0.813, 1.295)		-	
10+ hours vs. 1-2 hours	1.187 (0.950, 1.484)		1.158 (0.833, 1.611)		-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a hypoglycaemic episode, and green highlighting an association with decreased odds of a hypoglycaemic episode. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

Appendix 13: Building a model to explain the risk of having a medication error

Looking at the full 2015 cohort where medication errors were recorded[47] (10,559 inpatients), the derived model predicted with a low level of certainty whether an individual was expected to have a medication error (c-statistic[48] of 0.6317), far below the 0.7 value indicating a reasonable model. When split into insulin-treated and non-insulin-treated cohorts[49], results were similar for insulin treated inpatients (c-statistic of 0.6035) and substantially worse for the insulin treated group (c-statistic of 0.5449). Results from the logistic regression models are shown in Tables 68 and 69.

By accounting for variation between hospital sites, the multi-level models were better able to predict the outcomes from patient level variables than the initial models. The resulting models still returned c-statistics below 0.7, though all three patient groups had higher c-statistics than in the corresponding standard regression model. The improvement for insulin-treated patients was particularly marked (from 0.5449 to 0.6843).

Blocking patient variation only had a small impact on the quality of the models, with the resultant models either poor (0.6017 for non-insulin) or very poor (0.5691 for insulin).

The results from the multi-level regression models are detailed in Table 70 (hospital variation blocked) and Table 71 (patient variation blocked).

Table 67: Goodness of fit (c-statistic*) of logistic regression models to explain the risk of having a medication error in hospital

	2015 cohort†		
Model type	All (n=10,559)	Non-insulin treated‡ (n=5,763)	Insulin treated‡ (n=4,796)
Logistic regression	▲ 0.6317	▲ 0.6035	● 0.5449
Multi-level logistic regression (hospital variation blocked)	▲ 0.6835	▲ 0.6678	▲ 0.6843
Multi-level logistic regression (patient variation blocked)	▲ 0.6355	▲ 0.6017	● 0.5691

Key:
● = very poor c-stat <0.6
▲ = poor c-stat ≥0.6 to <0.7
◆ = reasonable^ c-stat ≥0.7 to <0.8
■ = strong^ c-stat ≥0.8

* For an explanation of the c-statistic, see page 81.
^ Based on Hosmer DW, Lemeshow S. Applied Logistic Regression (2nd Edition). New York, NY: John Wiley & Sons; 2000.
† Inpatients with the relevant variables recorded and drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.
‡ Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.

[47] Inpatients with the relevant variables recorded and drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.
[48] For an explanation of the c-statistic, see page 81.
[49] Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.

Table 68: Results from multivariate analysis of data for medication errors (patient level variables), England and Wales, 2015^

Number of observations used in model	10,559		5,763		4,796	
Filters: Audit year: 2015	Diabetes type: known†		Diabetes type: non-insulin treated‡		Diabetes type: insulin treated‡	
c-statistic*	0.6317		0.6035		0.5449	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Age group – reference category = 75-84 years						
Under 45 vs. 75-84 years	-		1.383 (0.907, 2.108)		-	
45-54 vs. 75-84 years	-		1.270 (0.975, 1.654)		-	
55-64 vs. 75-84 years	-		1.090 (0.900, 1.321)		-	
65-74 vs. 75-84 years	-		1.184 (1.015, 1.380)		-	
85+ vs. 75-84 years	-		0.914 (0.778, 1.075)		-	
Unknown vs. 75-84 years	-		1.164 (0.745, 1.820)		-	
Ethnic group – reference category = White						
Asian vs. White	-		1.361 (1.098, 1.687)		-	
Black vs. White	-		1.717 (1.246, 2.365)		-	
Mixed and Other vs. White	-		0.914 (0.274, 1.193)		-	
Unknown vs. White	-		1.442 (1.032, 2.014)		-	
Type of admission – reference category = Elective						
Emergency vs. Elective	-		1.297 (1.052, 1.599)		-	
Transfer vs. Elective	-		0.904 (0.641, 1.277)		-	
Unknown vs. Elective	-		0.955 (0.463, 1.969)		-	
Main reason for admission – reference category = Non-medical						
Diabetes complications vs. Non-medical	0.889 (0.762, 1.038)		1.088 (0.829, 1.428)		-	
Non-diabetes medical vs. Non-medical	0.818 (0.736, 0.908)		0.763 (0.657, 0.886)		-	
Unknown vs. Non-medical	0.810 (0.541, 1.212)		1.319 (0.664, 2.618)		-	
Insulin part of the inpatient's treatment regimen on admission – reference category = Yes						
No vs. Yes	0.430 (0.396, 0.467)		-		-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a medication error, and green highlighting an association with decreased odds of a medication error. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.
† Inpatients with drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.
‡ Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.

Table 69: Results from multivariate analysis of data for medication errors (hospital level variables), England and Wales, 2015^

Number of observations used in model	10,559		5,763		4,796	
Filters: Audit year: 2015	Diabetes type: known†		Diabetes type: non-insulin treated‡		Diabetes type: insulin treated‡	
c-statistic*	0.6317		0.6035		0.5449	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Does the hospital have an agreed upper glucose target, above which action should be taken? – reference category = Yes						
No vs. Yes	1.202 (1.095, 1.320)		1.264 (1.111, 1.439)		1.160 (1.021, 1.318)	
Unknown vs. Yes	0.758 (0.569, 1.009)		0.746 (0.497, 1.120)		0.778 (0.524, 1.154)	
Does the hospital use the electronic patient record? – reference category = No						
Partial vs. No	0.801 (0.722, 0.889)		0.699 (0.605, 0.808)		-	
Yes vs. No	0.741 (0.665, 0.825)		0.654 (0.566, 0.756)		-	
Unknown vs. No	0.931 (0.645, 1.345)		1.003 (0.594, 1.696)		-	
Does the hospital use electronic prescribing? – reference category = No						
Partial vs. No	0.793 (0.695, 0.905)		-		0.729 (0.611, 0.870)	
Yes vs. No	0.922 (0.830, 1.024)		-		0.799 (0.698, 0.914)	
Unknown vs. No	0.483 (0.232, 1.002)		-		0.327 (0.105, 1.017)	
Staffing levels: hours of diabetes consultant time per week per 100 beds – reference category = < 1 hour						
1-2 hours vs. < 1 hour	0.830 (0.742, 0.928)		0.875 (0.751, 1.019)		-	
3-5 hours vs. < 1 hour	0.793 (0.695, 0.906)		0.781 (0.649, 0.939)		-	
6-9 hours vs. < 1 hour	0.764 (0.646, 0.903)		0.585 (0.451, 0.759)		-	
10+ hours vs. < 1 hour	0.813 (0.649, 1.019)		0.827 (0.598, 1.143)		-	
Staffing levels: hours of DISN or DSN time per week per 100 beds$ – reference category = 0-4 hours						
5-9 hours vs. 0-4 hours	-		1.347 (1.109, 1.635)		-	
10-14 hours vs. 0-4 hours	-		1.400 (1.156, 1.697)		-	
15-19 hours vs. 0-4 hours	-		1.442 (1.144, 1.818)		-	
20-24 hours vs. 0-4 hours	-		1.657 (1.184, 2.318)		-	
25+ hours vs. 0-4 hours	-		1.479 (1.082, 2.023)		-	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a medication error, and green highlighting an association with decreased odds of a medication error. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.
† Inpatients with drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.
‡ Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.
$ Diabetes inpatient specialist nurses (DISN) / diabetes specialist nurses (DSN).

Table 70: Variable effects in multi-level regression modelling of medication errors (hospital variation blocked), England and Wales, 2015^

Number of observations used in model	10,559		5,763		4,796	
Filters: Audit year: 2015	Diabetes type: known[†]		Diabetes type: non-insulin treated[‡]		Diabetes type: insulin treated[‡]	
c-statistic*	0.6835		0.6678		0.6843	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Age group – reference category = 75-84 years						
Under 45 vs. 75-84 years	0.990 (0.806, 1.216)		1.329 (0.866, 2.039)		-	
45-54 vs. 75-84 years	1.132 (0.954, 1.345)		1.279 (0.980, 1.671)		-	
55-64 vs. 75-84 years	1.142 (1.000, 1.306)		1.094 (0.901, 1.329)		-	
65-74 vs. 75-84 years	1.139 (1.020, 1.273)		1.192 (1.020, 1.391)		-	
85+ vs. 75-84 years	0.948 (0.837, 1.075)		0.918 (0.779, 1.082)		-	
Unknown vs. 75-84 years	0.968 (0.707, 1.325)		1.138 (0.726, 1.786)		-	
Ethnic group – reference category = White						
Asian vs. White	-		1.288 (1.027, 1.616)		-	
Black vs. White	-		1.607 (1.154, 2.240)		-	
Mixed and Other vs. White	-		0.555 (0.264, 1.167)		-	
Unknown vs. White	-		1.335 (0.950, 1.876)		-	
Type of admission – reference category = Elective						
Emergency vs. Elective	-		1.268 (1.025, 1.569)		-	
Transfer vs. Elective	-		0.890 (0.627, 1.264)		-	
Unknown vs. Elective	-		0.864 (0.415, 1.801)		-	
Main reason for admission – reference category = Non-medical						
DKA vs. Non-medical	0.696 (0.500, 0.970)		0.769 (0.254, 2.328)		0.636 (0.446, 0.908)	
HHS vs. Non-medical	1.222 (0.680, 2.198)		1.081 (0.440, 2.655)		1.253 (0.568, 2.763)	
Hypo vs. Non-medical	0.886 (0.630, 1.247)		1.176 (0.560, 2.468)		0.823 (0.558, 1.215)	
Hyper vs. Non-medical	1.193 (0.866, 1.642)		1.786 (0.991, 3.217)		0.964 (0.657, 1.413)	
Foot disease vs. Non-medical	0.867 (0.707, 1.064)		0.943 (0.669, 1.330)		0.824 (0.635, 1.070)	
Non-diabetes medical vs. Non-medical	0.835 (0.749, 0.931)		0.766 (0.658, 0.892)		0.850 (0.721, 1.003)	
Unknown vs. Non-medical	0.810 (0.537, 1.220)		1.241 (0.618, 2.490)		0.643 (0.387, 1.067)	
Insulin part of the inpatient's treatment regimen on admission – reference category = Yes						
No vs. Yes	0.424 (0.389, 0.461)		-		-	
Does the hospital use electronic prescribing?[$] – reference category = No						
Partial vs. No	0.743 (0.587, 0.940)		-		-	
Yes vs. No	0.931 (0.772, 1.122)		-		-	
Unknown vs. No	0.471 (0.153, 1.449)		-		-	
Does the hospital use the electronic patient record? [$] – reference category = No						
Partial vs. No	0.816 (0.677, 0.983)		-		-	
Yes vs. No	0.743 (0.617, 0.894)		-		-	
Unknown vs. No	0.938 (0.459, 1.919)		-		-	

Continued on following page.

Table 70: Variable effects in multi-level regression modelling of medication errors (hospital variation blocked), England and Wales, 2015^ (continued)

Staffing levels: hours of diabetes consultant time per week per 100 beds[$] – reference category = < 1 hour			
1-2 hours vs. < 1 hour	0.795 (0.651, 0.971)	-	-
3-5 hours vs. < 1 hour	0.748 (0.595, 0.942)	-	-
6-9 hours vs. < 1 hour	0.724 (0.537, 0.975)	-	-
10+ hours vs. < 1 hour	0.821 (0.569, 1.187)	-	-

^ Text is highlighted where there is a significant difference compared to the reference group (ρ<0.05). Red highlighting indicates an association with increased odds of a medication error, and green highlighting an association with decreased odds of a medication error. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.
* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.
† Inpatients with drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.
‡ Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.
$ Although the multi-level model accounted for some of the hospital level variation, three hospital level variables were still returned as significant for the all patients cohort.

Table 71: Variable effects in multi-level regression modelling of medication errors (patient variation blocked), England and Wales, 2015

Number of observations used in model	10,559		5,763		4,796	
Filters: Audit year: 2015	Diabetes type: known†		Diabetes type: non-insulin treated‡		Diabetes type: insulin treated‡	
c-statistic*	0.6355		0.6017		0.5691	
	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*	Odds Ratio*	95% CI Limits*
Does the hospital have an agreed upper glucose target, above which action should be taken? – reference category = Yes						
No vs. Yes	1.206 (1.098, 1.326)		1.259 (1.107, 1.433)		1.159 (1.012, 1.327)	
Unknown vs. Yes	0.726 (0.543, 0.969)		0.752 (0.502, 1.128)		0.687 (0.455, 1.039)	
Does the hospital use the electronic patient record? – reference category = Yes						
Partial vs. Yes	1.060 (0.944, 1.192)		1.063 (0.902, 1.252)		1.086 (0.921, 1.281)	
No vs. Yes	1.355 (1.216, 1.509)		1.521 (1.316, 1.758)		1.236 (1.061, 1.440)	
Unknown vs. Yes	1.254 (0.862, 1.826)		1.534 (0.908, 2.592)		1.088 (0.637, 1.857)	
Does the hospital use electronic prescribing? – reference category = No						
Partial vs. No	0.802 (0.701, 0.918)		-		0.726 (0.601, 0.877)	
Yes vs. No	0.915 (0.822, 1.019)		-		0.904 (0.774, 1.055)	
Unknown vs. No	0.441 (0.212, 0.920)		-		0.281 (0.089, 0.888)	
What is the type of hospital? – reference category = Small (under 400 beds)						
Medium (400-799 beds) vs. Small	-		-		1.006 (0.876, 1.154)	
Large (over 800 beds) vs. Small	-		-		0.829 (0.692, 0.993)	
Staffing levels: hours of diabetes consultant time per week per 100 beds – reference category = < 1 hour						
1-2 hours vs. < 1 hour	0.834 (0.746, 0.934)		0.874 (0.751, 1.018)		0.820 (0.697, 0.965)	
3-5 hours vs. < 1 hour	0.791 (0.692, 0.903)		0.780 (0.649, 0.938)		0.783 (0.643, 0.954)	
6-9 hours vs. < 1 hour	0.753 (0.636, 0.892)		0.590 (0.455, 0.764)		0.882 (0.698, 1.113)	
10+ hours vs. < 1 hour	0.802 (0.638, 1.007)		0.824 (0.596, 1.138)		0.776 (0.559, 1.078)	
Staffing levels: hours of DISN or DSN time per week per 100 beds$ – reference category = 0-4 hours						
5-9 hours vs. 0-4 hours	1.211 (1.059, 1.383)		1.344 (1.108, 1.631)		1.091 (0.903, 1.319)	
10-14 hours vs. 0-4 hours	1.147 (1.004, 1.310)		1.398 (1.155, 1.693)		0.930 (0.769, 1.124)	
15-19 hours vs. 0-4 hours	1.148 (0.975, 1.351)		1.438 (1.142, 1.812)		0.875 (0.694, 1.105)	
20-24 hours vs. 0-4 hours	1.241 (0.974, 1.581)		1.654 (1.184, 2.312)		0.922 (0.648, 1.314)	
25+ hours vs. 0-4 hours	1.061 (0.799, 1.319)		1.473 (1.078, 2.013)		0.752 (0.557, 1.015)	

^ Text is highlighted where there is a significant difference compared to the reference group ($\rho<0.05$). Red highlighting indicates an association with increased odds of a medication error, and green highlighting an association with decreased odds of a medication error. Results are presented as odds ratios with 95% confidence intervals in brackets. Where dashes ('-') are returned, the variable was found not to be significant in that model and was removed.

* For an explanation of the c-statistic, odds ratios and confidence intervals, see page 81.

† Inpatients with drug charts that were available and reviewed by the healthcare professionals collecting the NaDIA data.

‡ Insulin treated inpatients comprised inpatients with Type 1 diabetes, Type 2 (insulin treated) diabetes and Other (insulin treated) diabetes. Non-insulin treated inpatients comprised inpatients with Type 2 (non-insulin treated) diabetes, Type 2 (diet only) diabetes and Other (non-insulin treated) diabetes.

$ Diabetes inpatient specialist nurses (DISN) / diabetes specialist nurses (DSN).

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