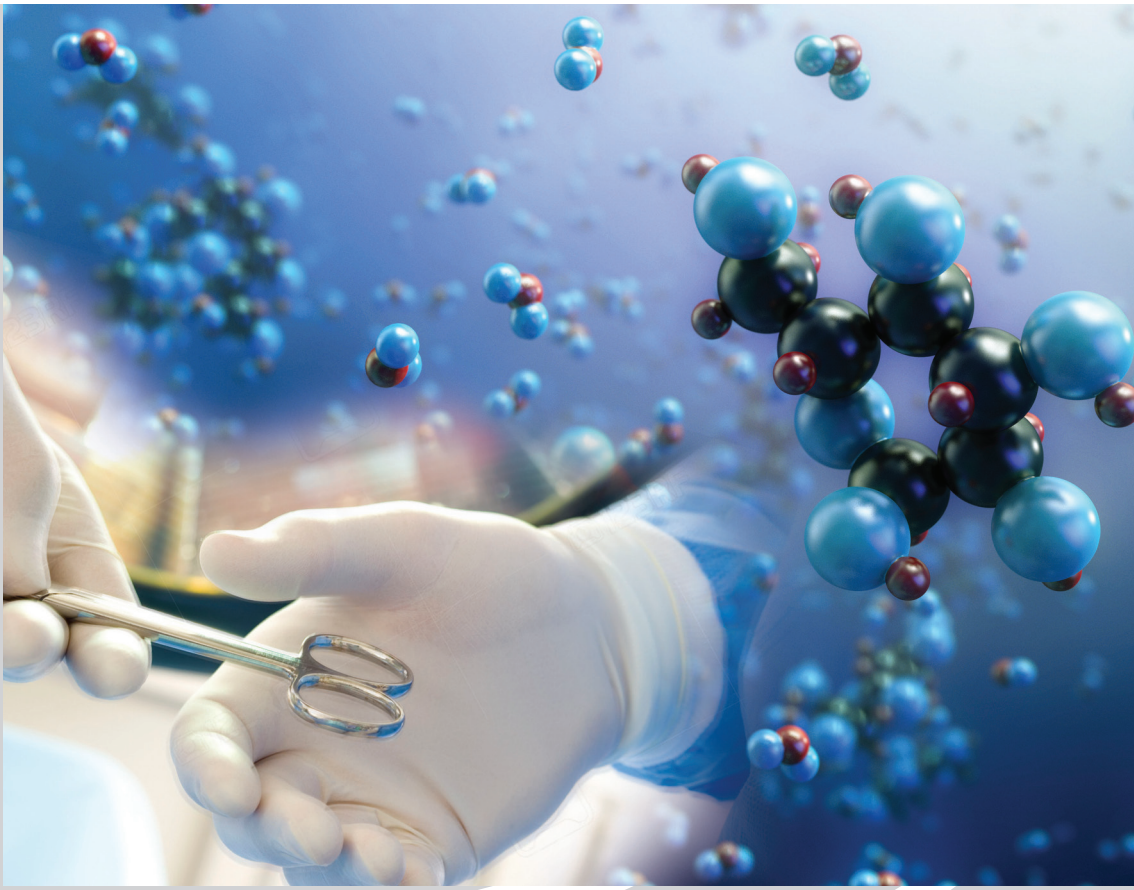
Highs and Lows

A review of the quality of care provided to patients over the age of 16 who had diabetes and underwent a surgical procedure



NCEPOD

Improving the quality of healthcare

Highs and Lows

A review of the quality of care provided to patients over the age of 16 who had diabetes and underwent a surgical procedure

A report published by the National Confidential Enquiry into Patient Outcome and Death (2018)

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Foreword

This is the first occasion on which I have had the privilege as the new Chair of NCEPOD to write the foreword to a report. It is a departure for me, having hitherto, been on the other side of the fence as a Clinical Co-ordinator, involved in compiling reports. I am humbled as Chair to follow in the footsteps of so many eminent predecessors, and looking back the style of forewords has varied enormously depending upon the personality of the chairperson of the day. As a Clinical Co-ordinator, I was always anxious that the foreword should not spoil the plot, but give the reader sufficient information to entice them to read on until the end. I will do my best to strike that difficult balance.

The management of patients with diabetes undergoing surgery has long been recognised as challenging, as this extract from the 1990 NCEPOD report demonstrates:

"The management of diabetes in patients for surgery still causes problems: when simple tests are used before the operation the results should not be ignored. One example of this was noted.

> *A locum Senior House Officer anaesthetised a 69-year-old dehydrated woman, ASA 4, for a defunctioning colostomy, in a District General Hospital. The presence of a triple-plus glucose in the urine before operation was apparently ignored (no measurement o blood glucose) despite the attendance of a consultant anaesthetists to help with the anaesthetic. Renal failure supervened and she died eight days later."*

Much has undoubtedly improved in the 30 years since that report, but the rising prevalence of diabetes, the increasingly elderly population, the complexity of surgical treatments available, and rising public expectations of healthcare, leave no room for complacency. As this report identifies, there is much still to be done to improve the perioperative care of patients with diabetes.

One of the main problems with the management of diabetes in the context of surgery is the wide spectrum of conditions which is encompassed within the term diabetes mellitus, from the very brittle and poorly controlled type 1, to the well-controlled type 2 patients, managed by careful diet alone. Furthermore the management of diabetes mellitus has becomes so much more sophisticated. It is vital that the surgical and anaesthetic teams recognise which patients can be managed by very simple protocols and which require expert multidisciplinary personalised input. Gone are the days of putting up a standard bag of glucose with some potassium and insulin in it and hoping for the best!

Diabetes is relatively common, and even more so in the inpatient population undergoing surgery, so it is important that all members of the surgical and anaesthetic teams are familiar with contemporary management of diabetes, and know how and when to involve multidisciplinary team members at the appropriate waypoints on the patient pathway.

Potential problems can start with poor communication at the referral stage from primary care, and failure to follow basic common sense when scheduling operations for patients with diabetes. In 9% (18/198) of hospitals, day surgery protocols placed a blanket prohibition on such patients; despite the fact that it is often these very patients who would be best served by minimising the disruption to their diabetic regimens in a day surgery environment.

The study identifies substantial unwarranted variation in the pre-operative assessment, perioperative and intra-operative management, recovery and discharge of patients with diabetes; this despite the fact that there is a plethora of guidelines available. However, that is, in part, the problem. Many specialty specific guidelines exist but none promoting joint ownership of the diabetes care.

If diabetes is not properly and carefully managed, the consequences can be potentially harmful to the patient. A patient under general anaesthesia or heavy sedation, may slip unnoticed into hypoglycaemia or hyperglycaemia. Whilst frequent intra-operative blood glucose monitoring for short procedures of less than an hour, in patients with good and stable glycaemic control, may not be necessary, in 15.2% (34/224) of patients in this study, the case reviewers were of the opinion that patients ought to have had more frequent monitoring.

In this study 4.7% (19/407) of patients had an intra-operative complication of hypoglycaemia, so we are not just talking about a theoretical risk; it is a very real risk for the patient with diabetes undergoing anaesthesia or sedation. Furthermore, 13.8% (59/426) of patients did not have adequate blood glucose monitoring in recovery, another period in the surgical journey when the drowsy patient is vulnerable because of the difficulty is recognising hypo, or hyper glycaemic complications.

In addition to monitoring glucose, the most basic of nutritional assessments (MUST) which should be done on every inpatient was only documented as having been done in 55.4% (221/399) of patients with diabetes admitted for surgery. It is perhaps a reflection on catering services that a suitable diet for patients with diabetes is more likely to be found in a high street fast food outlet, than in half of our hospitals.

So I hope that having read this report, that every one of you will reflect upon how the service you provide needs to be improved and how you will work with your colleagues in other specialties to ensure effective management of diabetes care across the patient pathway. I also hope you will use the tools accompanying this report, provided by NCEPOD, to identify where your service has gaps, and openly discuss this at multidisciplinary governance meetings, and come up with a clear plan to address the improvements that could be made to your service. This is very much a report for all involved in managing the care of surgical patients. It is not just for the expert diabetologists.

As ever I and my fellow Trustees are immensely grateful to all of those who make NCEPOD work: our Local Reporters and Ambassadors on the shop floor, all those clinicians who have diligently completed questionnaires, the steering group who scrutinise the report before publication, the reviewers, clinical coordinators and small band of permanent NCEPOD staff who have run the study and managed the compilation of this important report.

Mr Ian C Martin
NCEPOD Chair

Introduction

Diabetes is a serious, lifelong condition where blood glucose levels are too high. There are two main types; type 1 caused by the body not being able to produce any insulin, and therefore not able break down the glucose and type 2 where the body does not make enough insulin, or it is not good enough.[1]

The care of patients with diabetes is complex and this is particularly true of those undergoing surgery. The care can cross numerous specialties which can compound the issue of diabetes not being managed consistently. The recent National Diabetes Inpatient Audit (NaDIA) showed that 18% of inpatients have diabetes,[2] and previous work has shown that more than 15% of patients undergoing surgical procedures are known to have diabetes,[3] therefore it is essential that all staff are familiar with diabetes management to ensure care of the patient's glycaemic control, along with the clinical reason for their admission and surgery is coordinated and appropriate.

There are many national guidelines to aid clinicians in managing perioperative diabetes, published by the Association of Surgeons of Great Britain and Ireland (ASGBI),[4] Association of Anaesthetists of Great Britain and Ireland (AAGBI),[5] Joint British Diabetes Society (JBDS)[6] and the British Association of Day Surgery (BADS).[7] Despite their availability, this study was proposed as clinicians involved with this vulnerable patient group were aware that the guidelines were not always followed and that they do not encourage joint specialty working.

Good control of diabetes in surgical patients can improve outcomes. One study found that perioperative mortality in patients with diabetes undergoing coronary artery bypass grafting decreased by 50% when continuous insulin protocols were instituted (4.5% v 1.9% mortality).[8] In another study, perioperative hyperglycaemia was associated with increased length of stay, hospital complications, and mortality after non-cardiac general surgery.[9]

This NCEPOD study was developed with wide, multidisciplinary input and a number of areas for review were identified relating to the interactions that occur with and around the patient, and the quality of care provided to them. Particular areas included insulin administration errors and the monitoring of blood glucose to detect hyperglycaemia and hypoglycaemia - all of which can be serious and life-threatening complications. Another key area was the assessment of the patient prior to surgery. This process starts long before the patient reaches the operating theatre. The patient's own control of their diabetes is important and this involves their GP and local diabetes team. Equitable access to and the appropriateness of day surgery in patients with diabetes was also raised as an area for review to assess whether any hospitals are inappropriately excluding patients with diabetes from day surgery treatment.

This review includes an assessment of service structure at an organisational level and patient care at a clinical level. Recommendations are formed from data provided by clinicians at the hospital caring for patients and from external peer review of a sample of cases.

The areas for improvements in care raised by this report, and the recommendations made, have the potential to impact a large portion of surgical patients, providing quality improvement goals for hospitals to measure their practice against.

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Executive summary

Aim
The aim of this study was to highlight where care could be improved in patients with diabetes undergoing surgery.

Method
A retrospective case note and questionnaire review was undertaken in 509 patients aged 16 and over who had diabetes (type 1 or type 2) and who underwent a surgical procedure.

Key findings
The overarching theme of the findings was that that was a lack of clinical continuity of diabetes management across the different specialties in the perioperative pathway. Absence of joint ownership of the diabetes management and multiple guidelines targeted at specific specialties, rather than a joint multidisciplinary approach, meant that the diabetes management of the patient was falling between gaps in the surgical pathway.

Diabetologists, anaesthetists and surgeons were commonly involved in the patient's care, however there was under involvement of key diabetes team members such as diabetes specialist nurses, dietitians and pharmacists. Nutritional assessments and medicine reconciliations were frequently not undertaken, only 55.4% (221/399) of patients, had a MUST score calculated on admission to hospital and adequate medicines reconciliation by medical staff occurred in 84.4% (320/379) of patients but only by a pharmacist in 75.3% (192/255). This was particularly noticeable for elective surgery where pre-operative assessment clinics should have provided opportunity for such reviews to be undertaken and a management plan developed and explained to the patient.

The management plan for a patient with diabetes undergoing surgery should include their prioritisation on the operating list. This study found that 19.4% (42/439) of patients were not prioritised appropriately, which subjected them to prolonged fasting, putting them at increased risk of complications.

Regular monitoring of blood glucose was under-utilised pre- intra- and post-operatively. It was the opinion of the reviewers that better monitoring would have helped facilitate the assessment of patient status.

Overall the report highlighted that there was room for improvement in the clinical care of 35.8% (182/509) of patients in the study. This percentage was similar to that of good practice which was found in 34.8% (177/509) of patients. Organisational systems of care were deemed to require improvement in 9.2% (47/509) of cases reviewed and a further 14.1% (72/509) of cases indicated improvements both in clinical and organisational systems of care.

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Recommendations

These recommendations have been formed by a consensus exercise including all those listed in the acknowledgements

Recommendations 1, 2, 3, 9 and 12 have been highlighted as being the primary focus for action.

	Principal recommendations 1 to 5	**Study key findings**
1	Write and implement a national joint standard and policy for the multidisciplinary management of patients with diabetes who require surgery. Information should include responsibilities for diabetes management across all specialties during routine care and in high-risk patients. ***(AoMRC to lead at an organisational level, and the Clinical Lead for Perioperative Diabetes Management to lead at a local level)***	Numerous diabetes guidelines are in existence, but are specialty specific: • Association of Surgeons of Great Britain and Ireland (ASGBI) • Association of Anaesthetists of Great Britain and Ireland (AAGBI) • Joint British Diabetes Society (JBDS) British Association of Day Surgery (BADS).
2	Appoint a clinical lead for perioperative diabetes care in hospitals where surgical services are provided. This person will be responsible for developing policies and processes to: a. Ensure diabetes management is optimised for surgery b. Ensure patients with diabetes are prioritised on the operating list, including the co-ordination of emergency surgery* c. Identify when involvement of the diabetes multidisciplinary team, including diabetes specialist nurse, is required d. Ensure high-risk patients are identified, such as those with type 1 diabetes e. Identify patients with poor diabetes control who may need pre-operative optimisation or VRIII f. Audit cases of prolonged starvation g. Ensure high quality discharge planning. ***(Medical Directors, Directors of Nursing)*** * *This supports the recommendation from the National Emergency Laparotomy Audit*	• 28.0% (87/311) of hospitals had a named clinical lead for perioperative diabetes • 83.8% (160/191) of hospitals where emergency surgery was performed, had a co-ordinator for emergency theatre bookings • 21.8% (41/188) of hospitals where emergency surgery was performed had no system for confirming that relevant investigations and resuscitation had been completed and that the patient was fit for surgery • 20.6% (40/194) of hospitals where emergency surgery was performed had no system for determining the clinical priority of emergency cases • 90.9% (288/317) of hospitals had a hospital policy or guideline on managing operating lists of which 258/282 (91.5%) stated patients with diabetes should be prioritised early on the morning or afternoon theatre list.

3	Use a standardised referral process for elective surgery to ensure appropriate assessment and optimisation of diabetes. This should include: a. Satisfactory HbA1c levels within 3 months of referral b. Control of co-morbidities c. A list of all current medications d. The patient's body mass index (BMI) e. Estimated glomerular filtration rate (eGFR) f. Perioperative risk rating. ***(Primary Care Providers, Commissioners, Clinical Lead for Perioperative Diabetes Management, Lead anaesthetist for pre-operative assessment)***	• The majority (144/253; 57%) of elective referrals in this study were made from general practitioners • In 41% (83/202) of referrals there was no information provided on the management of the patient's diabetes in the community • HbA1c within last 3 months was provided in only 50/118 (42%) • The recording of co-morbidities (90/118; 76%) and current medication (98/118; 84%) were frequently provided but not fully and evidence of regular blood glucose was only available in 22.0% (26/118) blood pressure measurement n 35.6% (42/118), urgency of referral in 21.2% (25/118), eGFR in 19.5% (23/118) and body mass index (BMI) in 37.3% (44/118).
4	Ensure that patients with diabetes undergoing surgery are closely monitored and their glucose levels managed accordingly. Glucose monitoring should be included: a. at sign-in and sign-out stages of the surgical safety checklist (e.g. WHO safety checklist) b. in anaesthetic charts c. in theatre recovery d. in early warning scoring systems System markers and alerts should be used to raise awareness of glucose levels, e.g. tagging of electronic medical records, use of a patient passport or unique stickers in paper based case notes. ***(Clinical Lead for Perioperative Diabetes Management, Lead Anaesthetist for Pre-Operative Assessment, Clinical Directors, Medical Directors, Directors of Nursing)***	• 46.9% (212/452) of patients did not have capillary blood glucose recorded intra-operatively • 13.8% (59/426) patients did not have their capillary blood glucose levels measured in the theatre recovery area • 21.2% (86/406) of patients did not have their blood glucose managed appropriately in the post-operative period, in the opinion of the case reviewers • A surgical safety checklist was used for 97.1% (432/444) of patients but diabetes management was not included in 30.2% (114/378) • If diabetes was mentioned on the surgical safety checklist then capillary blood glucose measurements were more likely to be undertaken (141/240; 58.8% vs 54/109; 49.5%) during the operation • Including diabetes in the surgical safety checklist was associated with more appropriate management of diabetes in the theatre recovery area 182/216 (84.3%) vs 65/102 (63.7%) in the view of the case reviewers.

5	Ensure a safe handover of patients with diabetes from theatre recovery to ward, this should be documented in the case notes and include: a. Medications given in theatre b. Glucose level on leaving the recovery area c. Glucose level on arriving into the ward d. Ongoing management of diabetes, especially VRIII e. Criteria for contacting the diabetes team. ***(Clinical Lead for Perioperative Diabetes Management, Clinical Directors, Medical Directors, Directors of Nursing)***	• 59.8% (274/458) of patients did not have a clear plan for the management of the patient's diabetes on the day of surgery recorded • 12.4% (55/445) of patients did not have diabetes medications documented on the day of surgery • 46.9% (212/452) of patients did not have capillary blood glucose recorded intra-operatively • 13.8% (59/426) patients did not have their capillary blood glucose levels measured in the theatre recovery area • 21.2% (86/406) of patients did not have their blood glucose managed appropriately in the post-operative period, in the opinion of the case reviewers • The post-operative clinical area was inappropriate in 19/503 (3.8%) of cases in the opinion of the case reviewers • Diabetes was not managed by all the appropriate staff in 77/464 (16.6%) patients, in the opinion of the case reviewers. Early involvement of a diabetes specialist nurse would have been beneficial in a majority of these patients (44) in the opinion of the case reviewers • Adequate discharge arrangements were not made for the patient's diabetes care in 78/390 (20.0%) patients, in the opinion of the case reviewers.
	Additional recommendations	**Study key findings**
6	Develop a pre-operative assessment clinic policy and standards for the management of patients with diabetes. These should be developed by the lead anaesthetist* and the clinical lead for perioperative diabetes management, and include: a. Identification of high-risk patients, such as those with poorly controlled or type 1 diabetes b. Optimisation for surgery c. Criteria for involvement of the diabetes multidisciplinary team These policies should be audited locally and the results acted upon. ***(Lead Anaesthetist for Pre-operative Assessment, Clinical Lead for Perioperative Diabetes Management, Clinical Directors)*** * *This supports the recommendation by the AAGBI guidelines in recommending that all hospitals should have a lead anaesthetist for pre-operative assessment.*	• 43.4% (132/304) of pre-operative assessment clinics did not have a specific policy for management of diabetes patients undergoing surgery. Those that did, varied with regards to the involvement of wider multidisciplinary team members.

7	Ensure that patients with diabetes attending a pre-operative assessment clinic prior to elective surgery have: a. Access to the diabetes multidisciplinary team, including diabetes specialist nurse input b. Written instructions regarding their diabetes management plan prior to surgery. ***(Lead Anaesthetist for Pre-operative Assessment, Clinical Lead for Perioperative Diabetes Management)***	• 86.7% (228/263) of elective patients attended a pre-operative assessment clinic • 9.9% (20/203) of patients were not seen by all appropriate staff at the pre-operative assessment clinic. Most commonly this was diabetes specialist nurses • 47.1% (88/187) of patients had no documented specific instructions on management of their diabetes prior to surgery • 70.2% (120/171) of cases had no documented evidence that the patient was included in their diabetes plan.
8	A clinical lead for day surgery* should be in place in all hospitals providing day surgery services. This lead, along with the clinical lead for perioperative diabetes management should be responsible for ensuring that patients with diabetes are considered for day surgery, where appropriate. Policies should be developed to ensure patients with diabetes have equity of access to day surgery. ***(Clinical Lead for Day Surgery, Clinical Lead for Perioperative Diabetes Management, Clinical Directors)*** * *This supports guidelines from the British Association of Day Surgery, the AAGBI and the RCoA*	• 60.2% (142/236) of hospitals with a day surgery unit had a clinical lead or director of the day surgery unit • Only 28.0% (87/311) of hospitals had a named clinical lead for perioperative diabetes.
9	Cancellation of elective surgery in patients with diabetes should be avoided, particularly for known clinical reasons. Cancellation rates should be audited locally and the results acted upon. ***(Clinical Lead for Perioperative Diabetes Management, Lead Anaesthetist for Pre-operative Assessment, Clinical Directors)***	• 12.9% (34/229) of elective patients had their surgery cancelled on a previous occasion • 5/20 patients had their operation cancelled due to poor glycaemic control and a further 5 due to avoidable co-morbidity • There were more type 1 than type 2 patients (9/113; 8% vs 9/359; 2.5%) admitted non-electively who were already on the elective waiting list.
10	Develop and implement referral criteria for surgical inpatients with diabetes to: a. Diabetes specialist nurses b. Dietitians c. Pharmacists d. Other diabetes multidisciplinary team members as required. ***(Clinical Lead for Perioperative Diabetes Management, Clinical Directors)***	• Reviewers felt 75 patients should have been seen by a diabetes specialist nurse and 23 by a consultant diabetologist but were not • 18.1% (66/364) of patients had an inadequate nutritional assessment • Case reviewers felt that inadequate medicines reconciliation by medical staff occurred in 59/379 (15.6%) patients and by a pharmacist in 163/255 (24.7%).

11	Record and monitor the time at which a patient begins fasting (for surgery or clinical reasons). If a patient misses more than one meal, their care should be escalated to the responsible medical team as this indicates prolonged starvation. ***(Clinical Lead for Perioperative Diabetes Management, Directors of Nursing)***	• Prolonged starvation resulted in a change in diabetes management in 9.6% (42/439) of patients, including the use of a VRIII in 35 patients of which reviewers felt 23 were avoidable.
12	Prioritise patients with diabetes on the operating list to avoid prolonged starvation.* Prioritisation of patients with diabetes on operating lists should be subject to local clinical audit and the results acted upon. ***(Lead Anaesthetist for Pre-operative Assessment, Clinical Lead for Perioperative Diabetes Management, Clinical Directors)*** ** This supports the Joint British Diabetes Society Guidelines*	• 19.4% (90/465) of patients were not scheduled appropriately for their surgery in the opinion of the case reviewers.
13	Provide patients with diabetes with education and information about their diabetes management at discharge from hospital as part of the discharge planning process. ***(Diabetes Specialist Nurses, Clinical Lead for Perioperative Diabetes Management)***	• Adequate discharge arrangements were not made for the patient's diabetes care in 78/390 (20.0%) patients, in the opinion of the case reviewers.

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Method and Data Returns

Study advisory group

A multidisciplinary group of clinicians comprising consultants from surgery, anaesthesia, diabetology, critical care, medicine for the elderly, diabetes specialist nursing, operating department practitioner, medicine, dietetics, pharmacy and lay representatives.

Aim

The aim of this study was to look at the process of care in the perioperative management of surgical patients with diabetes across the patient pathway from referral for surgery to discharge.

Objectives

Based on the issues raised by the Study Advisory Group, the objectives of the study were to collect information on the following aspects of care:

- Primary care for patients admitted electively, including timing, assessment, and referral procedures
- The pre-operative, intra-operative and post-operative management of diabetes including the assessment of blood glucose and HbA1c, medication and nutrition management, multidisciplinary review, risk assessment, delays in the process, recovery and discharge planning
- Organisational services

Study population and case ascertainment

Patients aged 16 and over were included who were admitted to hospital either as an emergency or for an elective procedure with an ICD10 code for diabetes mellitus (E10.0-E11.9) and who had a major surgical procedure with a minimum one night stay post-surgery between 1st February 2017 and 31st March 2017.

Exclusions

Patients undergoing day surgery without an overnight stay and patients who had a minor procedure were excluded.

Hospital participation

Hospitals within Acute Trusts/Health Boards including Independent Hospitals and Day Surgery Units in England, Wales, Northern Ireland and Scotland that provided surgical services to patients with diabetes, were expected to participate, as well as public hospitals in the Isle of Man, Guernsey and Jersey. Within each hospital, a named contact, referred to as the NCEPOD Local Reporter, acted as a link between NCEPOD and the hospital staff, facilitating case identification, dissemination of questionnaires and data collation.

Case identification

Using a pre-defined spreadsheet, NCEPOD Local Reporters were asked to retrospectively identify all patients meeting the study inclusion criteria. A list of OPCS codes for minor procedures was provided so that these patients could be removed from the data collection spreadsheet.

The spreadsheet was then imported into a database and up to 8 cases per hospital were selected using a ratio of 4 emergency to 4 elective cases with each of the 4 comprising of 2 patients with type 1 diabetes and 2 patients with type 2 diabetes. This bias was to ensure that type 1 diabetes patients were not under-represented in the sample, as national datasets indicate that approximately 90% of patients with diabetes have type 2 diabetes, and only 10% have type 1 diabetes.[10]

Questionnaires

Three questionnaires were disseminated to collect clinical and organisational data.

Surgical questionnaire
This questionnaire was sent to the consultant surgeon who was responsible for the patient's care at the time of their procedure. Information was collected relating to the care of the patient from referral (if an elective patient), the perioperative pathway through to discharge.

Anaesthetic questionnaire
This questionnaire was sent to the anaesthetist who was responsible for the patient at the time of their surgery to collect data on the pre-assessment, anaesthetic care and post-operative diabetes management.

Organisational questionnaire
An organisational questionnaire was sent to hospitals in which surgical services were provided to patients with diabetes. This included acute district general hospitals, independent hospitals, tertiary specialist hospitals and university teaching hospitals. Community hospitals and mental health hospitals were not required to take part in this study. The data requested in the organisational questionnaire included information on the services, facilities and staff training available, as well as policies and procedures in place for the management of patients with diabetes. For the purposes of this study, 'organisation' was defined as a hospital rather than a Trust/Health Board/ Healthcare service as a whole.

Case notes

Photocopied case note extracts for each case for peer review were requested covering the whole admission. The following documents were requested:

- GP related notes and referral letters
- Outpatient clinic notes
- Medical notes from admission to discharge/30 days post-surgery if discharge was more than 30 days after surgery
- Notes from multidisciplinary team meetings
- Imaging reports
- Consent forms
- Pre-anaesthetic assessment records including any previous assessments relating to this procedure
- Pre-assessment clinic notes/proforma
- Operation notes
- Anaesthetic charts
- Drug charts
- Fluid balance charts
- Bloods, HbA1c for the entire index admission
- Haematology and biochemistry including data on the perioperative blood glucose
- Critical care charts and notes and blood gas charts
- Insulin/glucose charts
- Recovery room records
- Integrated care pathways
- Nursing notes
- Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) documentation (if applicable)
- Autopsy report (if applicable)
- End of life care pathway (if applicable)
- Discharge summaries

Peer review of the case notes and data

A multidisciplinary group of case reviewers was recruited for the peer review process. This group comprised clinicians from the following specialties: surgeons, anaesthetists, intensivists, diabetologists, acute physicians, diabetes specialist nurses, pre-operative assessment nurses, dietitians, pharmacists and perioperative physicians. All questionnaires and case notes were anonymised by the non-clinical staff at NCEPOD. All patient identifiers were removed so neither Clinical Co-ordinators at NCEPOD, nor the reviewers, had access to patient identifiable information.

Once each case was anonymised it was reviewed by one reviewer as part of a multidisciplinary group. At regular intervals throughout the meeting, the Clinical Co-ordinator chairing the meeting allowed a period of discussion for each reviewer to summarise their case and ask for opinion from other specialties or raise aspects of the case for discussion. Using a semi-structured assessment form, case reviewers provided both quantitative and qualitative responses on the case that had been provided.

Throughout the reviewer assessment form, where the reviewers felt that there was insufficient information available in the case note extracts present to make a judgment decision, there was the option to select 'insufficient data'.

The grading system below was used by the reviewers to evaluate the overall care that each patient received:

Good practice – a standard that you would accept for yourself, your trainees and your institution
Room for improvement – aspects of **clinical** care that could have been better
Room for improvement – aspects of **organisational** care that could have been better
Room for improvement – aspects of both **clinical and organisational** care that could have been better
Less than satisfactory – several aspects of clinical and/or organisational care that were well below satisfactory
Insufficient information – too few case notes submitted to assess the quality of care

Information governance

All data received and handled by NCEPOD complies with all relevant national requirements, including the Data Protection Act (DPA) 1998 at the time of collection, and now the General Data Protection Regulation 2016 (Z5442652), the NHS Act 2006 (PIAG 4-08(b)/2003, App No 077) and the NHS Code of Practice.

Quality and confidentiality

Each case reviewed was given a unique NCEPOD number so that cases could not easily be linked to a hospital.

Prior to any analysis, the data were cleaned to ensure that there were no duplicate records and that erroneous data had not been entered during scanning.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries were produced. The qualitative data collected from the Reviewers' opinions and free text answers in the clinician questionnaires were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD Clinical Co-ordinators, a Clinical Researcher and a Researcher to identify the nature and frequency of recurring themes.

Case studies have been used to illustrate particular themes and are developed from multiple similar cases.

All data were analysed using Microsoft Access and Excel by the research staff at NCEPOD.

The findings of the report were reviewed by the Study Advisory Group, Reviewers, NCEPOD Steering Group including Clinical Co-ordinators, Trustees and Lay Representatives prior to publication.

Where guidelines were in place, that care could be assessed against, these have been highlighted in boxes throughout the report.

Data returns

In total 12,104 patients were identified as meeting the study inclusion criteria (Figure 1.1). When the sampling criteria of up to 8 cases per hospital and the ratio of 4 emergency and 4 elective cases, comprising 2 type 1 diabetes, and 2 type 2 diabetes cases was applied, 1,724 cases were identified randomly from each subgroup for inclusion in the main data collection. A large number of cases (466) were subsequently excluded for not meeting the inclusion criteria. A total of 821/1,278 (64.2%) of surgical questionnaires, 860/1,278 (67.3%) of anaesthetic questionnaires and 509 sets of case notes were returned to NCEPOD.

Within this study the denominator will change for each chapter and occasionally within each chapter. This is because data have been taken from different sources depending on the analysis required. For example, in some cases the data presented will be a total from a question taken from a clinician questionnaire only, whereas some analysis may have required a clinician questionnaire and the case reviewer's view taken from the case notes. The term 'clinician' is used to refer to data obtained from the clinicians responsible for that patient's care and the term 'reviewer' used to refer to data obtained from the multidisciplinary group who undertook the peer review of case notes.

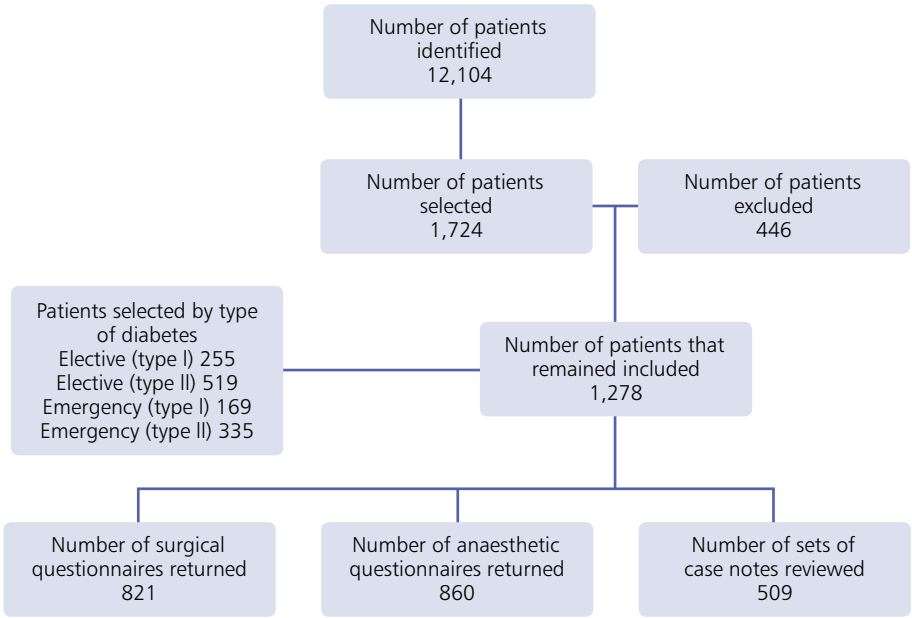

Figure 1.1 Data returns

2

Organisational data

This section of the report covers the staffing, facilities, policies and procedures in place for hospitals providing care to diabetes patients undergoing surgery including day surgery.

Type of hospital

Table 2.1 shows the types of hospital from which an organisational questionnaire was returned.

Table 2.1 Type of hospital

	Number of hospitals	%
District General Hospital ≤ 500 beds	102	31.0
District General Hospital > 500 beds	49	14.9
University Teaching Hospital	56	17.0
Independent	90	27.4
Tertiary Specialist Centre	17	5.2
Other	15	4.6
Total	**329**	

Type of surgical facility

Guidelines from the BADS and AAGBI 2011 'Day case and short stay surgery' state:
"Pre-operative preparation is best performed within a self-contained day surgery facility, where available. This allows patients and their relatives the opportunity to familiarise themselves with the environment and to meet staff who will provide their perioperative care. One-stop clinics, where pre-operative preparation is performed on the same day as decision for surgery, offer significant advantages."[11]

The types of surgical facilities provided by hospitals are shown in Figure 2.1. Most hospitals (309/329; 94%) had facilities for inpatient elective surgery, however, 21% (69/324) did not have a day surgery unit or standalone day surgery unit. It is possible that some patients suitable for day surgery were treated in inpatient elective surgery units rather than dedicated day surgery units, or were referred elsewhere for day surgery.

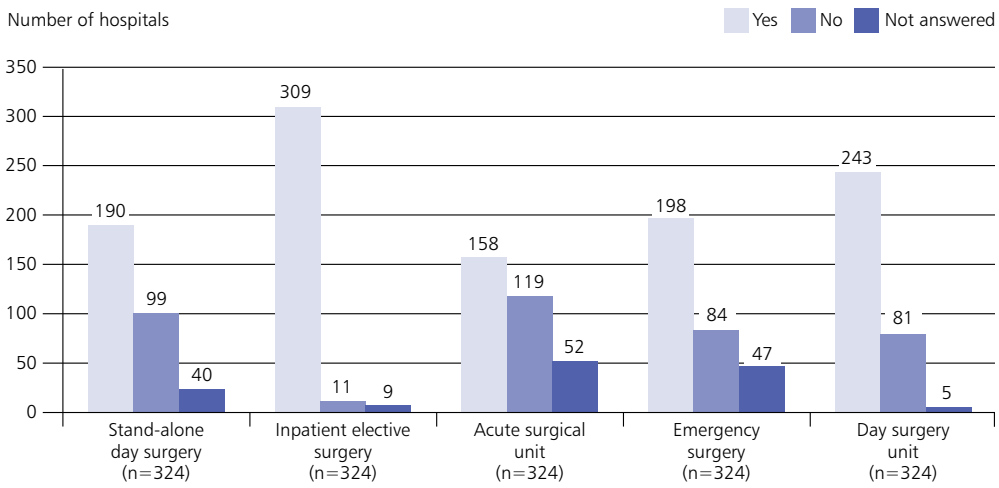

Figure 2.1 Types of surgical facilities available

Day surgery

Table 2.2 shows that independent hospitals were least likely to have a day surgery unit or standalone day surgery unit. Large district general hospitals were most likely to have this facility.

Table 2.2 Types of hospitals without a day surgery unit or standalone day surgery

	Number of hospitals
Independent Hospital	36
District General Hospital ≤ 500 beds	10
Tertiary Specialist Centre	9
University Teaching Hospital	8
District General Hospital > 500 beds	3
Other	3
Total	**69**

Guidelines from the BADS & AAGBI 2011 'Day case and short stay surgery' state:
"Every day surgery unit must have a Clinical Lead with specific interest in day surgery and whose remit includes the development of local policies, guidelines and clinical governance."[11]

Guidelines from the Royal College of Anaesthetists 2018 'Provision of anaesthesia services for day surgery' state:
"Day surgery should be a consultant-led service (surgical and anaesthetic) with a dedicated clinical lead or clinical director who has programmed activities allocated to the role within their job plan."[12]

In this study there was a clinical lead or director of the day surgery unit in only 60% (142/236) of hospitals from which it was reported that there was a day surgery unit (Table 2.3).

Table 2.3 Clinical lead or director

	Number of hospitals	%
Yes	142	60.2
No	94	39.8
Subtotal	**236**	
Not answered	7	
Total	**243**	

Table 2.4 shows the types of hospital and whether they had a clinical lead for day surgery. Independent hospitals (50%), large district general hospitals (43.6%) and tertiary specialist hospitals (50%) were least likely to have a clinical lead.

Table 2.4 Clinical lead for day surgery by type of hospital

	Clinical lead for day surgery			
	Yes		No	
Type of hospital	**Number of hospitals**	**%**	**Number of hospitals**	**%**
District General Hospital ≤ 500 beds	44	51.8	41	48.2
District General Hospital > 500 beds	30	73.2	11	26.8
University Teaching Hospital	31	67.4	15	32.6
Independent Hospital	27	61.4	17	38.6
Tertiary Specialist Centre	4	50.0	4	50.0
Other	6	50.0	6	50.0
Total	**142**		**94**	

When there was a lead or director they had allocated programmed activities for the role in 81% (107/132) of hospitals (Table 2.5).

Table 2.5 Clinical lead for day surgery had allocated programmed activities for the role

	Number of hospitals	%
Yes	107	81.1
No	25	18.9
Subtotal	**132**	
Not answered	10	
Total	**142**	

Guidelines from the BADS & AAGBI 2011 'Day case and short stay surgery' state:
"Patients with stable chronic disease such as diabetes, asthma or epilepsy are often better managed as day cases because of minimal disruption to their daily routine."[11]

Guidelines from the JBDS 2015 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:

1. *"Patients with diet-controlled diabetes are all suitable for day case surgery if the procedure itself is suitable for day surgery and all other criteria are fulfilled.*
2. *Patients with diabetes controlled by oral or injected medication are suitable for day case surgery if:*

a. *they fulfil all day case criteria*
b. *they can be early on a morning or afternoon list (ensures adequate recovery time.)"*

In the foreword, the National Clinical Director for Obesity and Diabetes stated "New data has shown that having diabetes remains a reason why many patients are inappropriately denied day case surgery."[13]

This study found that in 84% (198/236) of hospitals there was a policy for selecting patients for day surgery (Table 2.6).

Table 2.6 Policy for selecting patients for day surgery (data for hospitals with a day surgery unit)

	Number of hospitals	%
Yes	198	83.9
No	38	16.1
Subtotal	**236**	
Not answered	7	
Total	**243**	

In 9% (18/198) of hospitals this policy included the exclusion of patients with diabetes, confirming that patients were being inappropriately denied day case surgery if they have diabetes (Table 2.7).

Table 2.7 Policy specifies the exclusion of patients with diabetes

	Number of hospitals	%
Yes	18	9.1
No	180	90.9
Total	**198**	

Pre-operative assessment

Guidelines from the AAGBI 2010 'Pre-operative Assessment and Patient Preparation' state:
"Clinical Directors for anaesthesia and theatres should work with appropriate managers to establish comprehensive and integrated pre-operative assessment facilities and ensure that there is a lead anaesthetist for pre-operative assessment."[14]

Guidelines from the BADS & AAGBI 2011 'Day case and short stay surgery' state:

1. *"Pre-operative preparation is best performed within a self-contained day surgery facility, where available.*
2. *It is recommended that a multidisciplinary approach, with agreed protocols for patient assessment including inclusion and exclusion criteria for day surgery, should be agreed locally with the anaesthetic department.*
3. *Fitness for a procedure should relate to the patient's health as determined at pre-operative assessment and not limited by arbitrary limits such as ASA status, age or BMI* [13–15].
4. *Patients with stable chronic disease such as diabetes, asthma or epilepsy are often better managed as day cases because of minimal disruption to their daily routine."*[11]

It was reported that general pre-operative assessment clinics were available in 97.2% (314/323) of hospitals (Table 2.8) and 57.5% (134/233) of hospitals with a day surgery unit had a pre-operative assessment clinic dedicated to the day surgery unit (Table 2.9).

Table 2.8 General pre-operative assessment clinics

	Number of hospitals	%
Yes	314	97.2
No	9	2.8
Subtotal	**323**	
Not answered	6	
Total	**329**	

Table 2.9 Pre-operative assessment clinic dedicated to the day surgery unit

	Number of hospitals	%
Yes	134	57.5
No	99	42.5
Subtotal	**233**	
Not answered	10	
Total	**243**	

One-stop pre-operative assessment clinics

Guidelines from the BADS & AAGBI 2011 'Day case and short stay surgery' state:
"One-stop clinics, where pre-operative preparation is performed on the same day as decision for surgery, offer significant advantages."[11]

Only 54.6% (166/304) of hospitals had a policy stating that all investigations should be performed during a single visit (Table 2.10).

Table 2.10 Hospital policy stating that all investigations should be performed during a single visit

	Number of hospitals	%
Yes	166	54.6
No	138	45.4
Subtotal	**304**	
Not answered	10	
Total	**314**	

Furthermore only 56.6% (172/304) of hospitals had a policy for the pre-operative assessment of diabetes patients (Table 2.11).

Table 2.11 Policy specifically for the pre-operative assessment of diabetes patients

	Number of hospitals	%
Yes	172	56.6
No	132	43.4
Subtotal	**304**	
Not answered	10	
Total	**314**	

However, 43.4% (132/304) of pre-operative assessment clinics did not have a specific policy for the management of diabetes patients undergoing surgery.

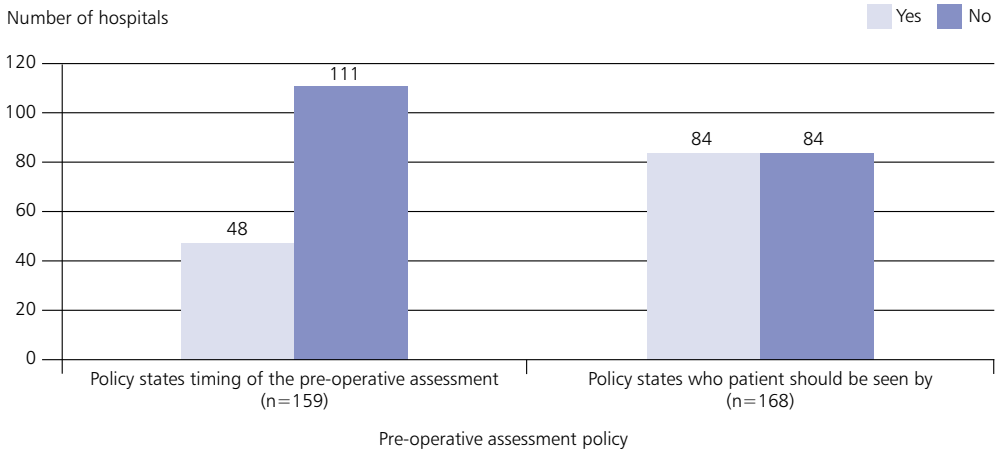

Figure 2.2 Policy for the pre-operative assessment of patients with diabetes

Figure 2.2 shows whether hospitals had a policy on timing of pre-operative assessment and who should see patients with diabetes. 70% (111/159) of hospitals had no policy on the timing of pre-operative assessment and 50% (84/168) stated who should see patients.

Guidelines from the AAGBI 2010 'Pre-operative Assessment and Patient Preparation' state:
"Patients often have co-morbidities that require careful assessment and co-ordination. Preparation for surgery may take weeks to achieve, and could therefore potentially cause delay and cancellation of surgery if not done adequately."[14]

These issues are particularly pertinent to patients with diabetes who need blood glucose or co-morbidity control.

Guidelines from the AAGBI 2010 'Pre-operative Assessment and Patient Preparation' state:

1. *"It is important that pre-operative assessment nurses have readily available communication channels with pre-operative assessment anaesthetists; they should be able to discuss specific cases and receive feedback from the anaesthetist.*
2. *Liaison with secondary care diabetes teams and medical outreach teams can be particularly helpful and may prevent unnecessarily long stays in hospitals, both pre- and post- operatively."*[14]

Figure 2.3 shows whether hospitals had specific arrangements for patients with diabetes in the pre-operative assessment clinic. There was under-availability in a number of specialties including surgeons, diabetes specialist nurses, diabetologists, physiotherapists and perioperative physicians.

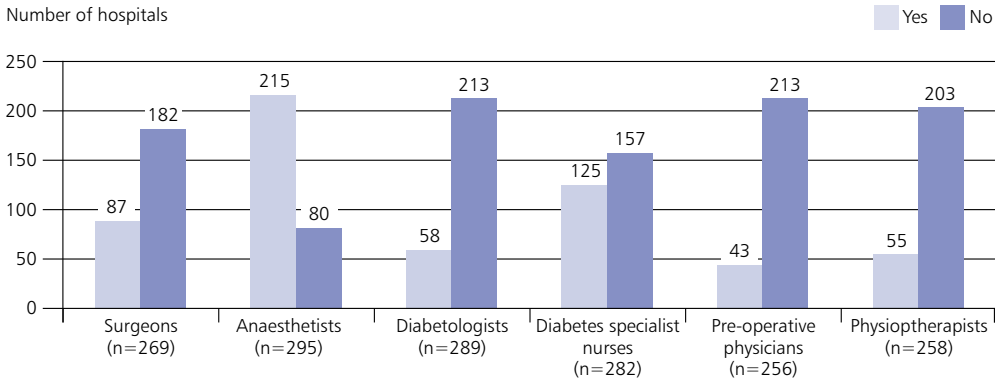

Figure 2.3 Specific arrangement for patients with diabetes within a pre-operative assessment clinic

Risk assessment

Patients with diabetes are at increased risk of significant co-morbidities and adverse outcomes following surgery. There is evidence that teams often fail to identify high-risk patients pre-operatively resulting in poor arrangements for perioperative interventions.[15]

Guidelines from the JBDS 2015 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:

1. *"Particular care should be paid to assessment of patients with diabetes to identify those at high risk of perioperative complications.*
2. *Identify high-risk patients (poor glycaemic control/ complications of diabetes) and make arrangements for post-operative admission to critical care if indicated."*[13]

NCEPOD has previously recommended the use of risk assessment of patients prior to surgery, and that an assessment of mortality risk is made explicit to patients and recorded clearly on consent forms and the medical record.[16]

There are numerous risk scoring systems available including ACS Risk Calculator,[17] ASA,[18] P-POSSUM[19] and SORT.[20] Patients undergoing emergency surgery are at further increased risk and the 2011 RCS guideline "*Emergency Surgery - Standards for unscheduled surgical care*"[21] made a number of recommendations that have become nationally assessed standards though the National Emergency Laparotomy Audit.[22]

Despite these recommendations, scoring systems were used routinely in only 84% of hospitals carrying out emergency surgery and 67% carrying out elective surgery (Figure 2.4).

In over 30% (102/307) of hospitals in which elective surgery was reported to be performed and 16% (31/193) in which emergency surgery was reported to be performed, there was no routine use of risk scoring systems prior to surgery. It can be seen from chapter 4 that the vast majority of patients in this study had a simple risk assessment performed using the ASA score but very few underwent more complex risk assessments.

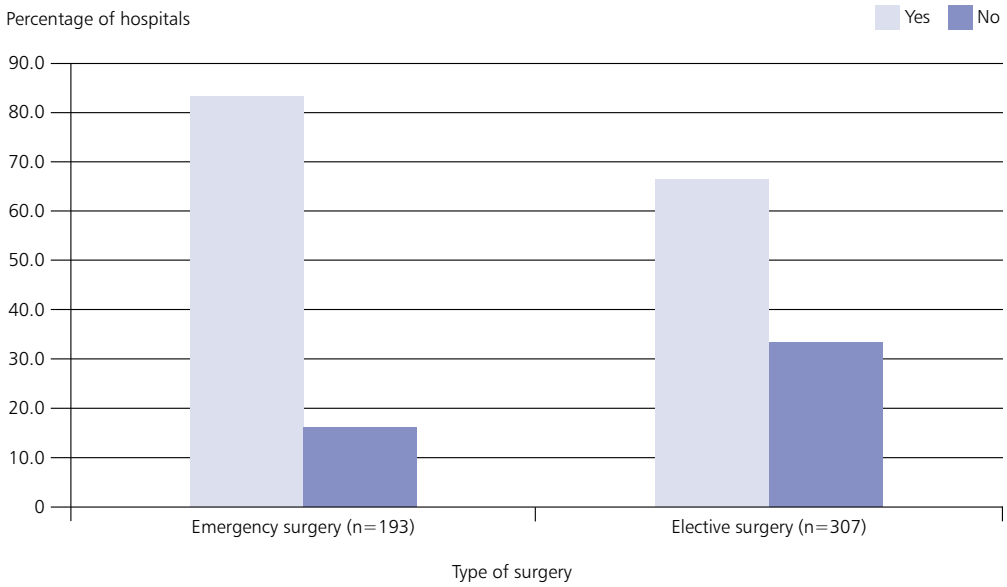

Figure 2.4 Routine use of risk scoring systems

Emergency surgery co-ordination

Recommendations from NCEPOD 2010 'An Age Old Problem' state:
"Delays in surgery for the elderly are associated with poor outcome. They should be subject to regular and rigorous audit in all surgical specialities, and this should take place alongside identifiable agreed standards."[23]

Recommendations from the National Emergency Laparotomy Audit 2016 state:

1. *"Provision of emergency theatre capacity needs to be sufficient to enable patients to receive emergency surgical treatment without undue delay, and may require capacity to allow emergency and elective care to continue in parallel. Where capacity is limited, prioritisation of time-sensitive emergency surgery can be facilitated by policies to defer elective activity*
2. *Trusts should ensure emergency theatre access matches need and ensure prioritisation of access is given to emergency surgical patients ahead of elective patients whenever necessary as significant delays are common and affect outcomes."* [24]

It was reported from 83.8% (160/191) of hospitals that there was a co-ordinator in place for emergency theatre bookings (Table 2.12).

Table 2.12 Coordinator for the emergency theatre

	Number of hospitals	%
Yes	160	83.8
No	31	16.2
Subtotal	**191**	
Not answered	7	
Total	**198**	

There were 78.2% (147/188) of hospitals from which it was reported that there was a system for confirming that relevant investigations and resuscitation had been completed and the patient was fit for surgery (Table 2.13).

Table 2.13 System for confirming that relevant investigations and resuscitation had been completed and the patient was fit for surgery

	Number of hospitals	%
Yes	147	78.2
No	41	21.8
Subtotal	**188**	
Not answered	10	
Total	**198**	

In 79.4% (154/194) of hospitals a grading system was used for determining clinical priority in emergency surgery (Table 2.14). It is of note that 20.6% (40/194) of hospitals neither had a system for determining clinical priority of patients nor confirmation of fitness for surgery.

Table 2.14 Grading system for determining clinical priority in emergency surgery

	Number of hospitals	%
Yes	154	79.4
No	40	20.6
Subtotal	**194**	
Not answered	4	
Total	**198**	

Pre-operative fasting and theatre list co-ordination

One of the most important goals in the management of the surgical patient with diabetes is to minimise the starvation time to promote early resumption of normal diet and normal medication at the normal time.

Guidelines from the JBDS 2015 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:

1. *"All patients with diabetes scheduled to undergo an elective procedure necessitating a period of starvation should attend a pre-operative assessment clinic as soon as possible*
2. *Many considerations determine the order of the operating lists. One of the most important goals in the management of surgical patient with diabetes is to minimise the starvation time to promote early resumption of normal diet and normal medication at the normal time. Thus, it is recommended that the elective surgical patient with diabetes is prioritised on the theatre list, so that they may have lunch at the correct time after a morning procedure, or evening meal at the correct time after an afternoon procedure. For this reason, elective evening operating is not recommended for patients taking blood glucose lowering medications."*[13]

The vast majority of hospitals reported that there was a hospital policy or guidance on how to manage operating lists (90.9%; 288/317) (Table 2.15).

Table 2.15 Hospital policy/guidance on managing operating lists

	Number of hospitals	%
Yes	288	90.9
No	29	9.1
Subtotal	**317**	
Not answered	12	
Total	**329**	

Most reported that this included prioritisation of diabetes patients first on morning or afternoon list (91.5%, 258/282) (Table 2.16). There was therefore some room for improvement in some hospitals for both operating list management and prioritisation of patients. This links to chapter 5, where it can be seen that in 19.4% (90/465) of patients reviewers stated that the patient not been scheduled appropriately for surgery.

Table 2.16 Hospital policy/guidance on managing operating lists stated that patients with diabetes should be prioritised to be first on the morning or afternoon list

	Number of hospitals	%
Yes	258	91.5
No	24	8.5
Subtotal	**282**	
Not answered	6	
Total	**288**	

Guidelines for the perioperative management of diabetes

Most of the guidelines regarding perioperative diabetes management as well as pre-operative assessment recommend protocols for the perioperative management of patients.

In this study it was reported that 90.7% (291/321) of hospitals had a protocol for the perioperative management of diabetes patients (Table 2.17). Furthermore, 93.7% (295/315) of hospitals had protocols for the recognition and management of hypo and hyperglycaemia (Table 2.18). These data are very similar to those reported by diabetes teams who said that their hospital had adopted the JBDS perioperative, diabetic ketoacidosis (DKA), and hypoglycaemia guidelines.[25]

Table 2.19 Protocols for the recognition and management of hypo and hyperglycaemia by protocols for the perioperative management of patients with diabetes

Protocols for the perioperative management of diabetes patients	Protocols for the recognition and management of hypo and hyperglycaemia				
	Yes	No	Subtotal	Unknown	Total
Yes	273	12	**285**	6	**291**
No	19	8	**27**	3	**30**
Subtotal	**292**	**20**	**312**	**9**	**321**
Unknown	3	0	**3**	5	**8**
Total	**295**	**20**	**315**	**14**	**329**

Hospitals in which there were protocols for the perioperative management of diabetes were also more likely to have protocols for the recognition of hypoglycaemia and hyperglycaemia (Table 2.19).

Independent hospitals made up the majority of hospitals (14/20) that did not have a protocol for the recognition and management of hypo and hyperglycaemia (Table 2.10).

Table 2.20 No protocols for the recognition and management of hypoglycaemia and hyperglycaemia

	Number of hospitals
Independent	14
District General Hospital ≤ 500 beds	3
Tertiary Specialist Centre	2
District General Hospital > 500 beds	1
Total	**20**

In the National Diabetes Inpatient Audit (NaDIA) 98% of NHS hospitals reported using the 2013 JBDS guidelines (or local guidelines based on the JBDS guidelines) for DKA and hypoglycaemia management.[2,26] Fewer (85%) were using the 2016 JBDS surgical guideline.[13]

Co-ordination of diabetes care

Guidelines from the JBDS 2016 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:
"All institutions should have a clinical lead for the perioperative management of patients with diabetes whose responsibility it is to ensure that the institution has up to date guidelines that are implemented. The clinical lead should also ensure that all patients with diabetes are optimally managed during their surgical admission." [13]

Despite this recommendation only 28% (87/311) of hospitals had a named clinical lead for perioperative diabetes (Table 2.21).

Table 2.21 Named lead for perioperative diabetes

	Number of hospitals	%
Yes	87	28.0
No	224	72.0
Subtotal	**311**	
Not answered	18	
Total	**329**	

Proformas have been used in a variety of settings to reduce variation and ensure errors of omission do not occur. They are a good way of establishing protocols or guidelines and many pre-assessment clinics use these. In 63.3% (200/316) of hospitals a proforma was used for the management of patients with diabetes undergoing surgery (Table 2.22).

Table 2.22 Proforma(s) for the management of patients with diabetes undergoing surgery

	Number of hospitals	%
Yes	200	63.3
No	116	36.7
Subtotal	**316**	
Not answered	13	
Total	**329**	

Figure 2.5 shows the factors which were often included as part of a proforma. Glucose monitoring, and escalation of care were commonly included. However, specialist nurse/team review at least 24 hours before surgery, pre-assessment timing and medicines optimisation in the months prior to surgery were often not included. There was under use of HbA1c and optimisation of diabetes medication on the day prior to and day of surgery.

Medication

It was reported that 70% (224/322) of hospitals in this study used paper-based systems to prescribe insulin; 14% (45/322) used paper and electronic system, and only 14% (46/322) used electronic prescribing alone (Figure 2.6). The NaDIA has shown that almost one-third of inpatients with diabetes have a medication error during their hospital stay and that errors were more common on surgical wards.[2] The most recent audit showed that medication errors had decreased from 38% to 31%.

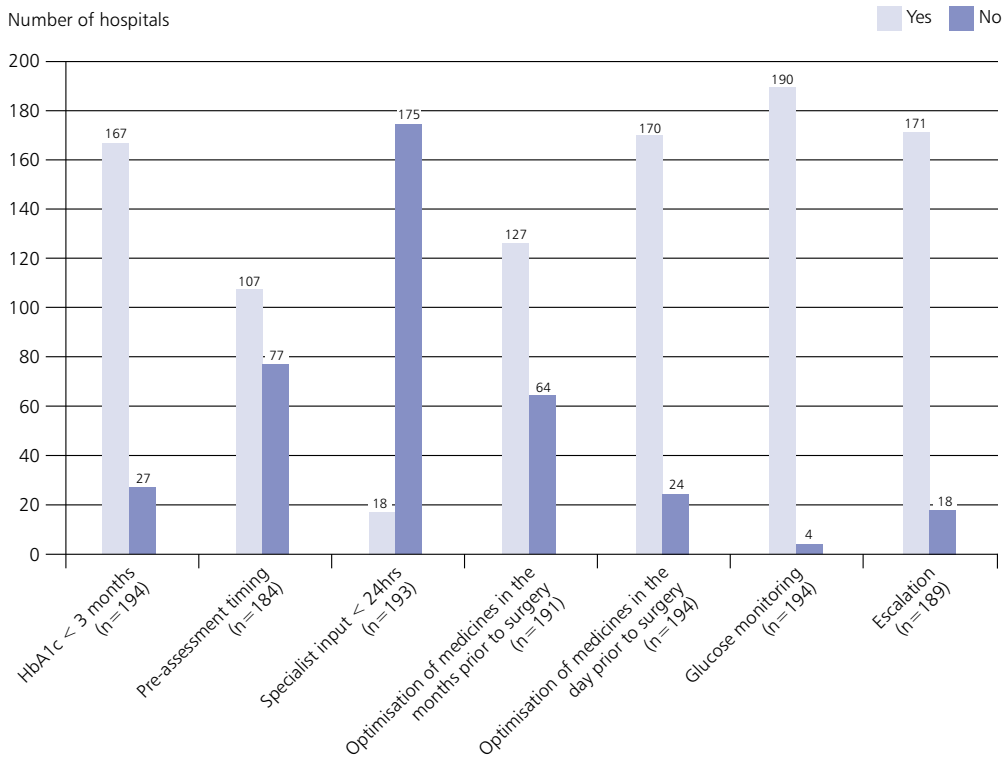

Figure 2.5 Factors included in a proforma

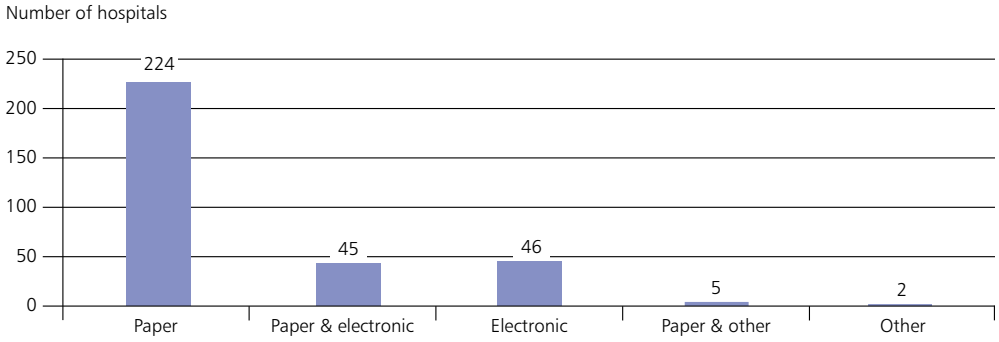

Figure 2.6 Insulin prescription format (n=322)

The NaDIA also showed that an increasing proportion of hospital sites are utilising an electronic patient record and electronic prescribing (17%) and 12% also use remote blood glucose monitoring. The report showed that inpatients with diabetes were less likely to have medication errors if an electronic patient record and electronic prescribing were used.[2]

Blood glucose monitoring

Capillary blood glucose (CBG) levels should be as near to 'normal' as possible with JBDS recommending 6-12 mmol/L as acceptable range in patients undergoing surgery.[13]

Regular CBG monitoring is particularly important in the unconscious surgical patient who can develop complications silently if monitoring is inadequate.

Guidelines from the NaDIA 2017 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:

1. *"Regular monitoring of a patient's blood glucose whilst in hospital is essential to avoid the onset of hypoglycaemic episodes, hyperglycaemia and other potential harms to the patient.*
2. *Monitoring is particularly important in hospital because a patient's blood glucose level may vary more than usual due to illness, treatment or changes to diet and diabetes care routines. It may also be more difficult for the person with diabetes to recognise changes to their blood glucose level."*[2]

Blood and urinary ketone measurement can be used to detect ketones in the blood when blood sugar is high. This allows recognition and treatment of diabetic ketoacidosis, which is an increased risk in unwell patients with diabetes.

Guidelines from NICE 2015 'Type 1 Diabetes in Adults: Diagnosis and Management' state:

1. *Consider ketone monitoring (blood or urine) as part of 'sick-day rules' for adults with type 1 diabetes, to facilitate self-management of an episode of hyperglycaemia.*
2. *In adults with type 1 diabetes presenting to emergency services, consider capillary blood ketone testing if:*

a. *DKA is suspected or*
b. *the person has uncontrolled diabetes with a period of illness, and urine ketone testing is positive.*

3. *Consider capillary blood ketone testing for inpatient management of DKA in adults that is incorporated into a formal protocol."*[27]

Point-of-care (bedside) testing systems

Figure 2.7 shows the availability of various point-of-care (bedside) testing systems used in different departments within the hospitals from which a response was received. Nearly all areas had access to blood glucose monitoring although this was not 100%. Most areas had access to bedside urinary ketone testing however 10% of theatres did not have access to this modality.

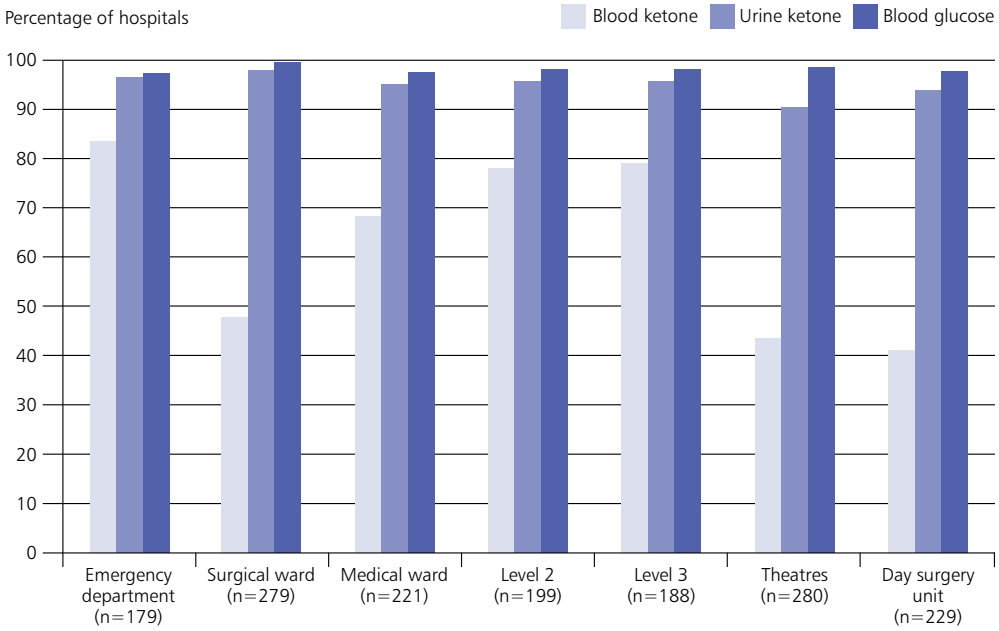

Figure 2.7 Point of care (bedside) testing

The access to bedside blood ketone measurement was not as good with only 48% of surgical wards, 44% of theatres and 41% of day surgery units having this available. This is important as type 1 patients with persistently high blood glucose require blood ketone measurement. Despite the 2015 NICE guideline bedside blood ketone measurement was not available in some emergency departments (16%).[27]

Variable rate intravenous insulin infusion (VRIII)

A VRIII (previously known as a sliding scale) is given to patients to control their blood glucose by intravenous insulin infusion when they cannot control their own blood glucose, either because of prolonged fasting (as in many surgical patients) or because it is too high.

Guidelines from the JBDS 2014 'The use of variable rate intravenous insulin infusion (VRIII) in medical inpatients' state:

1. *The use of a variable rate intravenous insulin infusion (VRIII) is a tool commonly used to achieve normoglycaemia in hospital inpatients.*
2. *Most acute trusts have guidelines for its use, but there is a wide variation across the country in, for example, the indications for its use, in rates of infusion, or duration of use. This heterogeneity increases the risk of errors which can potentially lead to significant morbidity and mortality.*
3. *Despite guidelines, both local and national audits have shown that VRIII is often used when not indicated, its duration is unnecessarily prolonged and the step down to other glucose lowering medication is often not practiced safely.*
4. *Errors in insulin prescribing are very common and insulin is one of the five highest-risk medications in the inpatient environment.*
5. *Dose errors can occur, such as where insulin is incorrectly prescribed, and management errors can cause harm through over - or under-dosing with insulin causing abnormal blood sugars.*
6. *It is important that health care professionals follow JBDS guidance and refer to local protocols to ensure safe prescribing is maintained."*[28]

There is evidence that variation in the use of VRIII exists and this can lead to errors with consequent morbidity and mortality.[29]

It would be expected that all hospitals treating patients with diabetes to have guidelines or a local protocol for the use of VRIII. However, 9% (28/321) of hospitals in this study did not have a hospital protocol or guideline in place (Table 2.23). In the 2017 NaDIA 100% of participating hospitals reported they use of some form of VRIII guideline and 85% of hospitals taking part reported that they used JBDS VRIII guidelines.[2] The remaining hospitals used guidelines based on JBDS guidelines.

Where there was a protocol or guideline reported in this study there was variation in the content (Figure 2.8). For example 52% (152/293) did not have separate scales for insulin resistant patients, 12% (35/293) did not specify which fluid to use, 9% (27/293) did not indicate a target glucose range and 18% (54/293) did not include hourly monitoring of testing for glucose and ketones.

Table 2.23 Hospital protocol for VRIII

	Number of hospitals	%
Yes	293	91.3
No	28	8.7
Subtotal	**321**	
Not answered	8	
Total	**329**	

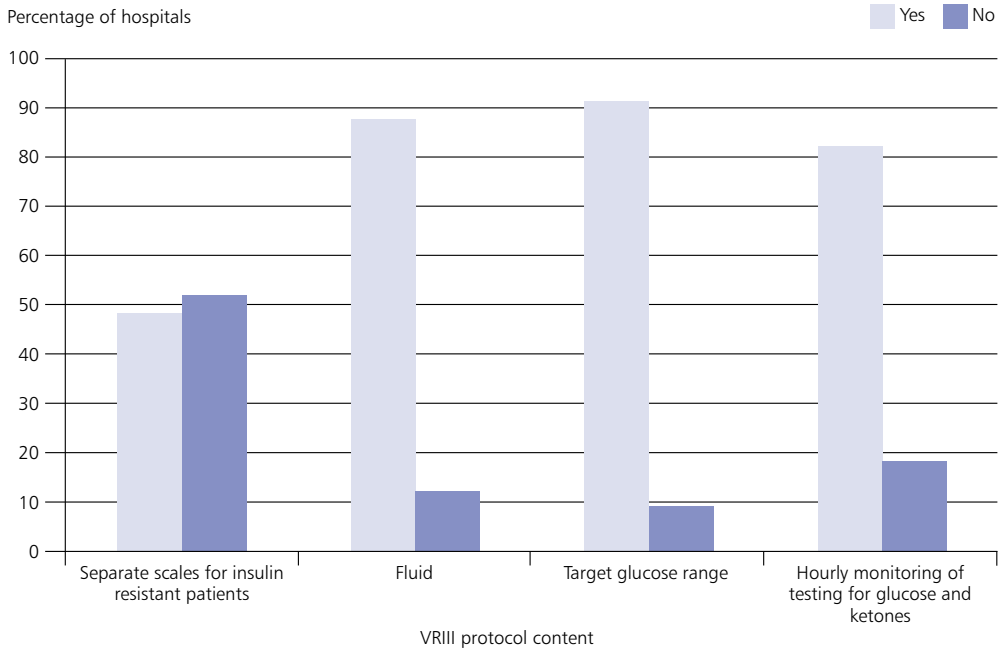

Figure 2.8 VRIII protocol/guideline (n=250)

Follow-up

Guidelines from the JBDS 2016 'Management of adults with diabetes undergoing surgery and elective procedures: Improving standard' state:

1. *"Individual Trusts need to formulate guidelines for the management of patients who are not under secondary care follow up for their diabetes but are found to have sub-optimally controlled diabetes. Some Trusts may require these patients to be referred back to their primary care team with subsequent re-referral to secondary care. Others may allow the pre-operative assessment team ready access to the secondary care team as part of the pre-assessment process.*
2. *Local discussions will need to take place about the risks and benefits of delaying elective surgery to allow for glycaemic optimisation ("stopping the clock") and the risks of post-operative complications in those with poor perioperative diabetes control."*[13]

In 66% (117/178) of hospitals it was reported that a diabetes team follow-up would be arranged after discharge for patients newly started on insulin (Figure 2.9), although most would refer patients with a high HbA1c, high blood glucose or new dose of diabetes medication back to their GP.

Clinical audit and morbidity and mortality (M&M) meetings

Surgical and anaesthetic departments are expected to conduct regular M&M meetings for both elective and emergency surgery. The 2011 RCS guidelines on emergency surgery recommend regular departmental clinical audit and morbidity and mortality meetings that report to the clinical governance committee.[21]

Only 25% (76/30) of hospitals in this study reported that an audit of perioperative diabetes management was conducted (Table 2.24).

Table 2.24 Local audit of perioperative diabetes management

	Number of hospitals	%
Yes	76	24.8
No	230	75.2
Subtotal	**306**	
Not answered	23	
Total	**329**	

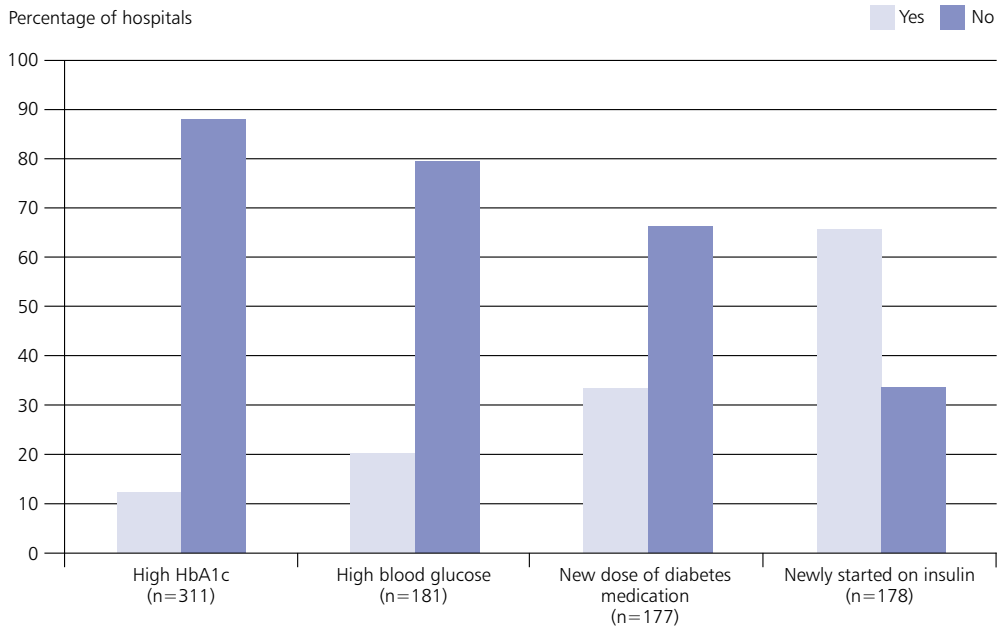

Figure 2.9 Routine follow-up from diabetes team

There was 58.2% (181/311) of all hospitals from which it was reported that data were submitted to the NaDIA (Table 2.25).

Table 2.25 Submits data to the National Diabetes Inpatient Audit (all hospitals)

	Number of hospitals	%
Yes	181	58.2
No	130	41.8
Subtotal	**311**	
Not answered	18	
Total	**329**	

This figure increased to 88.1% (171/194) of hospitals that were eligible to take part in NaDIA (Table 2.26). Of the 23 hospitals from which it was reported that data were not submitted, 10 were specialist tertiary centres.

Table 2.26 Submits data to the National Diabetes Inpatient Audit (eligible hospitals)

	Number of hospitals	%
Yes	171	88.1
No	23	11.9
Subtotal	**194**	
Not answered	14	
Total	**208**	

In 64% (191/299) of hospitals perioperative deaths in patients with diabetes were specifically discussed at M&M meetings (Table 2.27). The 2017 NaDIA reported 50% of sites held diabetes M&M meetings and 13% of sites had no M&M meeting at which diabetes was discussed.[2]

Table 2.27 Deaths in perioperative patients with diabetes specifically discussed at morbidity and mortality meetings

	Number of hospitals	%
Yes	191	63.9
No	108	36.1
Subtotal	**299**	
Not answered	30	
Total	**329**	

Enhanced recovery programmes

Enhanced recovery programmes are aimed at improving outcome and rapidity of recovery after surgery. Patients are encouraged to be active participants in their own recovery. The elements involved include pre-operative assessment, planning and preparation before admission, reducing physical stress of the operation, a structured approach to management and early mobilisation. Many of these elements would expect to benefit patients with diabetes but there is controversy regarding the carbohydrate loading used pre-operatively as part of the preparation.[30]

Enhanced recovery programmes usually recommend that patients take complex carbohydrate drinks before surgery to reduce post-operative insulin resistance and help recovery. It has no role in the patient with type 1 diabetes as they are insulin deficient rather than insulin resistant. In patients with diabetes, carbohydrate loading may affect glucose control. To date, the effects of enhanced recovery programmes on patients with diabetes have not been rigorously evaluated.[31] However, currently carbohydrate loading is not recommended.[30,13]

In this study 76.4% (239/313) of hospitals took part in an enhanced recovery programme (Table 2.28). In hospitals that did take part, half (113/225) did not have any guidance for patients with diabetes (data not shown). A lack of guidance regarding patients with diabetes and carbohydrate loading is a significant risk for patients who may end up with incorrect management as a result.

Table 2.28 Enhanced recovery programmes

	Number of hospitals	%
Yes	239	76.4
No	74	23.6
Subtotal	**313**	
Not answered/Not applicable	16	
Total	**329**	

Key Findings

1. 21.3% (69/324) of hospitals did not have a day surgery unit or standalone day surgery unit
2. 60.2% (142/236) of hospitals with a day surgery unit had a clinical lead or director of the day surgery unit
3. 57.5% (134/233) of hospitals with a day surgery unit had a dedicated pre-operative assessment clinic
4. 54.6% (166/304) of hospitals had a policy stating that all investigations should be performed during a single pre-operative assessment clinic visit
5. 43.4% (132/304) of pre-operative assessment clinics did not have a specific policy for management of diabetes patients undergoing surgery. Those that did varied with regards to the involvement of wider multidisciplinary team members
6. 83.8% (160/191) of hospitals where emergency surgery was performed, had a co-ordinator for emergency theatre bookings
7. 21.8% (41/188) of hospitals where emergency surgery was performed had no system for confirming that relevant investigations and resuscitation had been completed and that the patient was fit for surgery
8. 20.6% (40/194) of hospitals where emergency surgery was performed had no system for determining the clinical priority of emergency patients
9. 90.9% (288/317) of hospitals had a hospital policy or guideline on managing operating lists of which 258/282 (91.5%) stated patients with diabetes should be prioritised early on the morning or afternoon theatre list
10. 16.1% (38/236) of hospitals had no policy for selecting patients for day surgery
11. 9.1% (18/198) of hospitals with a selection policy for day surgery excluded patients with diabetes from day surgery treatment
12. 93.6% (295/315) of hospitals had protocols for recognition and management of hypoglycaemia and hyperglycaemia
13. 9.3% (30/321) of hospitals did not have a protocol for the perioperative management of diabetes patients
14. 33.2% (102/307) of hospitals where elective surgery was performed and 16.1% (31/193) of hospitals where emergency surgery was performed had no routine use of risk scoring systems prior to surgery
15. 28.0% (87/311) of hospitals had a named clinical lead for perioperative diabetes
16. 63.3% (200/316) of hospitals used a proforma for the management of patients with diabetes undergoing surgery
17. 69.6% (224/322) of hospitals used paper-based systems to prescribe insulin
18. 8.7% (28/321) of hospitals did not have a protocol or guideline for the use of VRIII and there was variability in protocols in those who did
19. Follow-up arrangements following changes to medication for patients with diabetes undergoing surgery were extremely variable
20. 24.8% (76/306) of hospitals reported conducting an audit of perioperative diabetes management
21. 76% (239/313) of hospitals took part in enhanced recovery programmes, 50% (113/225) of these had no guidance for patients with diabetes.

SEE RECOMMENDATIONS 2•3•4•5•6•7•8 10•11

3

Study population and demographics

Figure 3.1 shows that the patients in this study had a median age of 69. Half (255/509) of the sample were female although national figures report diabetes mellitus to be more common in men.[32] This difference was caused by case selection.

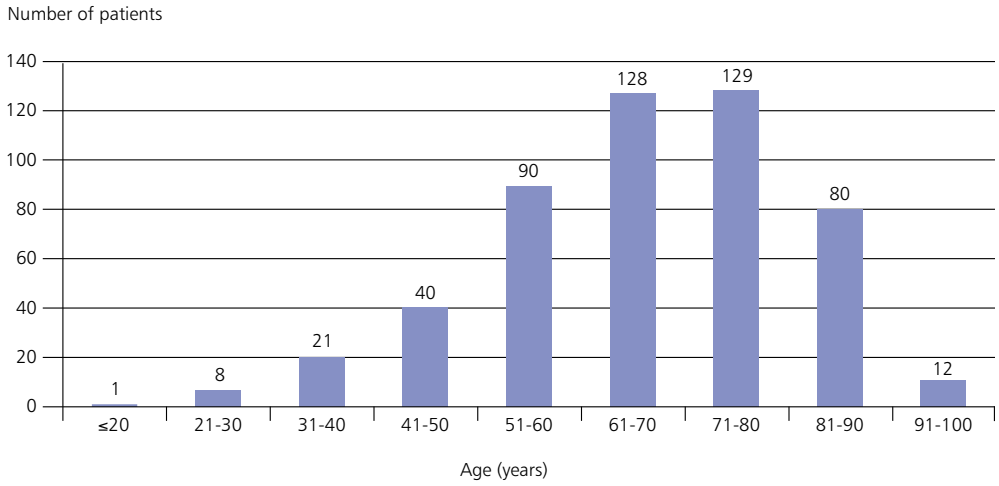

Figure 3.1 Age range of the study population

Table 3.1 shows that 23.2% (114/491) of patients selected for the study had been diagnosed with type 1 diabetes.

Table 3.1 Type of diabetes

	Number of patients	%
Type 1	114	23.2
Type 2	370	75.4
Other	7	1.4
Subtotal	**491**	
Not answered	18	
Total	**509**	

Whilst the method adopted in this study attempted to select 50% of patients from each group of type 1 and type 2 diabetes, not all hospitals could provide the required number of elective and non-elective patients with type 1 diabetes. In a multicentre study the background incidence of diabetes in surgical referrals was 8.8% with 69.2% type 2 and 14.2% type 1 diabetes. The remainder had no documentation of which diabetes type they had.[33]

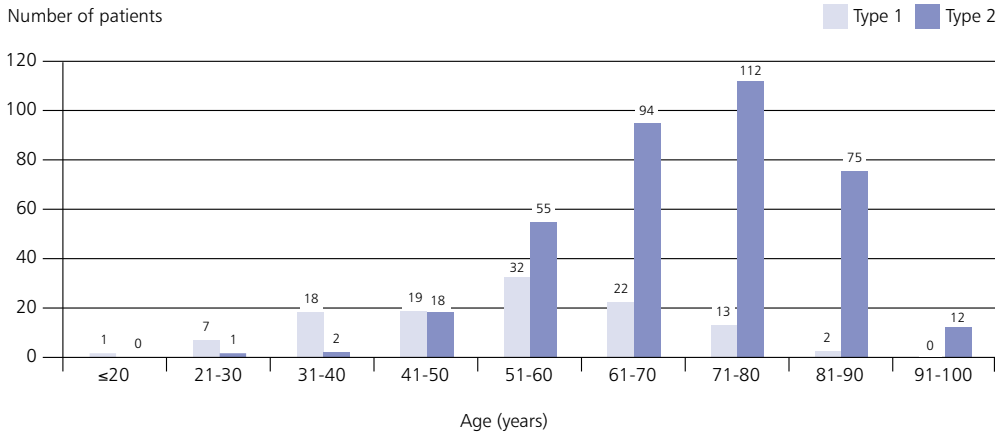

Figure 3.2 Age by type of diabetes

Figure 3.2 shows patients with type 1 diabetes (median age 54 years) were younger than those with type 2 (median age 72 years). In England, Public Health England diabetes prevalence data has shown that type 2 diabetes increases in the older age group (24% age over 75 years, 9% age 45-54).[32]

Overall 41% (199/483) of patients in this study were taking insulin including all type 1 patients and 24% (85/354) of type 2 patients (Table 3.2).

The majority of type 2 patients were taking some form of oral diabetes medication (249/354; 70%) but 18% (64/354) were treated with diet alone (Table 3.3).

Table 3.2 Type of medication

	Number of patients	%
Insulin	199	41.2
Oral hypoglycaemic agents	261	54.0
Diet	74	15.3
Non-insulin injectable therapy	5	1.0
Other	5	1.0
Total	**509**	

Answers may be multiple; n=483 patients, 26 not answered

Table 3.3 Type of medication by type of diabetes

	Type 1 (n=107)		Type 2 (n=354)	
Type of medication	**Number of patients**	**%**	**Number of patients**	**%**
Insulin	107	100.0	85	24.0
Oral hypoglycaemic agents	5	4.7	249	70.3
Diet	1	<1	66	18.6
Non-insulin injectable therapy	1	<1	4	1.1
Other	0	0.0	2	<1
Not answered	7		16	

Table 3.4 shows that 56% (280/498) of patients in this study were admitted electively. The remaining 44% (218/498) of patients were non-elective admissions, 3.6% (18/498) of which were patients who were already on a waiting list for surgery.

Table 3.4 Type of admission

	Number of patients	%
Elective	280	56.2
Non-elective (patient on a waiting list)	18	3.6
Non-elective (patient not on a waiting list)	200	40.2
Subtotal	**498**	
Not answered	11	
Total	**509**	

Table 3.5 shows that a larger proportion of type 1 patients were admitted non-electively (57/113; 50%) compared to type 2 patients (148/359; 41%). In addition there were more type 1 than type 2 patients (9/113; 8% vs 9/359; 2.5%) admitted non-electively who were already on the elective waiting list.

CASE STUDY 1

A middle-aged patient with type 1 diabetes was referred to the surgical outpatient clinic with symptomatic gallstones. Their diabetes control was satisfactory and the patient saw a surgical specialty doctor before being put on the waiting list for a laparoscopic cholecystectomy. The patient waited 4 months for surgery but was admitted as an emergency with cholecystitis before it could be performed. This resulted in an episode of severe sepsis necessitating an admission to critical care for intravenous antibiotics, variable rate intravenous insulin infusion (VRIII) and inotropic support. The patient developed an empyema of the gallbladder which was drained percutaneously. The patient was then discharged home. However, the patient was readmitted for laparoscopic cholecystectomy 6 weeks later and made an uneventful recovery.

Reviewers felt that this patient was at high risk of septic complications from their gallstones and treatment should have been prioritised to avoid this emergency admission.

Table 3.5 Type of admission by type of diabetes

	Type 1		Type 2	
Type of admission	**Number of patients**	**%**	**Number of patients**	**%**
Elective	56	49.6	211	58.8
Non-elective (patient on a waiting list)	9	8.0	9	2.5
Non-elective (patient not on a waiting list)	48	42.5	139	38.7
Subtotal	**113**		**359**	
Not answered	1		10	
Total	**114**		**369**	

Figures 3.3 shows the Rockwood Frailty Score for patients in the study. Overall 61% (308/502) of patients were managing well, well or very fit at admission whilst the remainder were vulnerable or more frail according to reviewers. Patients admitted non-electively were reported by case note reviewers to be more frail than those admitted electively.

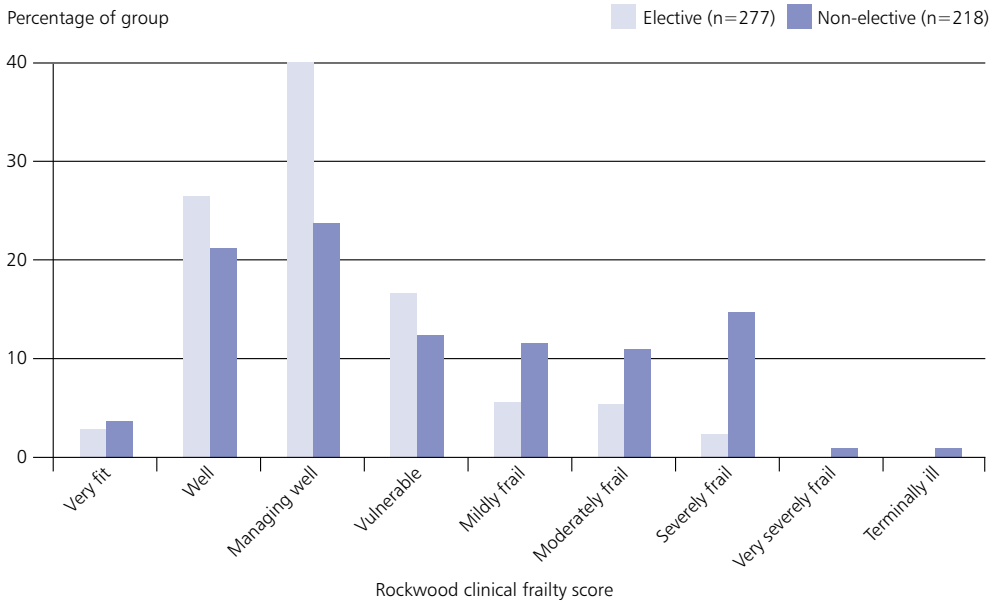

Figure 3.3 Rockwood clinical frailty score by type of admission

Key Findings

22. Patients in the study had mean age of 69 with equal ratio of male and female patients
23. 23% (114/491) of patients in this study had type 1 diabetes and 75% (370/491) had type 2 diabetes
24. The median age of patients in the study with type 1 diabetes was 54 years and type 2 was 72 years
25. 41% (199/483) of all patient in the study were taking insulin of which 24% (85/354) were patients with type 2 diabetes
26. 70% (249/354) of type 2 patients were taking a form of oral diabetes medication
27. 38.6% (194/502) patients in the study were vulnerable or frail at admission
28. 56% (280/498) of admissions were elective while 44% (218/498) were non-elective
29. There were more type 1 than type 2 patients (9/113; 8% vs 9/359; 2.5%) admitted non-electively who were already on the elective waiting list.

4

Pre-operative referral and assessment

Elective admissions

The majority (144/253; 57%) of elective referrals in this study were made from general practice (Figure 4.1).

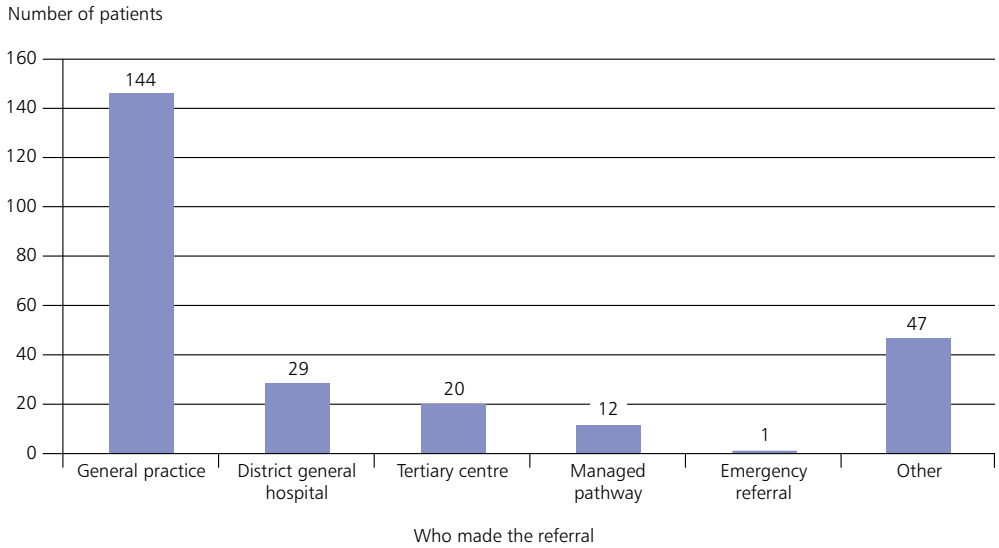

Figure 4.1 Referral process for patients admitted electively (n=253)

The content of GP referrals in patients with diabetes undergoing surgery should include recent HbA1c, blood pressure, weight and details of diabetes complications and medication.[13]

In 41% (83/202) of referrals there was no information provided on the management of the patient's diabetes in the community, according to case note reviewers. Similar findings were reported by the clinicians who returned a questionnaire on their own patients (Table 4.1).

Table 4.1 Information of the management of the patient's diabetes in the community was available at the referral

	Reviewers' opinion		Clinician's opinion	
	Number of patients	%	Number of patients	%
Yes	119	58.9	207	47.7
No	83	41.1	227	52.3
Subtotal	**202**		**434**	
Insufficient data	96		28	
Total	**298**		**462**	

Where information was provided in the referral letter, HbA1c within the previous three months was provided in only 50/118 (42%) letters despite national guidance recommending this in all patients (Table 4.2).[13]

Table 4.2 If information was available in the community, what did this include:

	Number of patients	%
List of current medications	98	83.1
Patient co-morbidities	90	76.3
HbA1c (within previous 3 months)	50	42.4
Body mass index	44	37.3
Blood pressure	42	35.6
Diabetes related complications	31	26.3
Evidence of regular blood sugar measurement	26	22.0
Urgency of referral	25	21.2
Estimated glomerular filtration rate (eGFR)	23	19.5
Evidence from primary care about the need to optimise the patient's diabetes prior to surgery	8	6.8
Community diabetes specialist nurse assessment or notes	6	5.1
Other	2	1.7

Answers may be multiple; n=118

The recording of co-morbidities (90/118; 76%) and current medication (98/118; 84%) were more frequently provided, although evidence of regular blood sugar was only available in 22.0% (26/118), blood pressure measurement in 35.6% (42/118), urgency of referral in 21.2% (25/118) and body mass index (BMI) in 37.3% (44/118).

Pre-operative assessment clinics

The 2015 AAGBI safety guideline for pre-operative assessment and patient preparation recommended standards for pre-operative assessment clinics and services.[34] These include risk assessment to ensure every patient understands their individual risk, identification of co-existing medical illness, optimal preparation for surgery, identification of patients at high risk of perioperative complications and discharge planning.

The 2016 JBDS guideline also recommended that all patients with diabetes undergoing surgery should be seen as early as possible in a pre-operative assessment clinic with specific recommendations for organisation of care.[13]

In this study 86.7% (228/263) of elective patients attended a pre-operative assessment clinic (Table 4.3).

Table 4.3 Pre-operative assessment clinic attendance

	Number of patients	%
Yes	228	86.7
No	35	13.3
Subtotal	**263**	
Not answered	35	
Total	**298**	

Of those who attended a pre-operative assessment clinic, reviewers felt that 90.1% (183/203) of patients were seen by all appropriate staff (Table 4.4). Lack of input from a diabetes specialist nurse was the most common reason for not being seen by all appropriate staff. Fifty-five patients were neither seen in a pre-operative assessment clinic nor did they see all appropriate staff to optimise their diabetes care for surgery.

Table 4.4 The patient was seen by all the appropriate staff

	Number of patients	%
Yes	183	90.1
No	20	9.9
Subtotal	**203**	
Insufficient data	36	
Total	**239**	

The 2016 JBDS guideline recommends that all patients are involved in their diabetes pathway plan before and after surgery.[13]

In this study, there was documented evidence of patients being given specific instructions on the management of their diabetes, prior to surgery, in only 53% (99/187) of cases reviewed (Table 4.5).

Table 4.5 Documented evidence that the patient was given specific instructions on the management of their diabetes prior to surgery

	Number of patients	%
Yes	99	52.9
No	88	47.1
Subtotal	**187**	
Insufficient data	52	
Total	**239**	

It was also found that there was no documented evidence of the patient being included in their diabetes plan in 70.2% of cases reviewed (120/171) (Table 4.6).

Table 4.6 Documented evidence that the patient was included in their diabetes management plan

	Number of patients	%
Yes	51	29.8
No	120	70.2
Subtotal	**171**	
Insufficient data	68	
Total	**239**	

The JBDS guidelines recommend that clinicians in the pre-operative assessment clinic ensure the adequacy of diabetes control, including a recent HbA1c.[13]

Reviewers found that only 64.6% (128/198) of patients had an HbA1c within 3 months of attending a pre-operative assessment clinic, and a similar figure was seen by anaesthetists who returned a clinical questionnaire (Table 4.7).

Table 4.7 A recent (3 months prior to surgery) HbA1c was available at the pre-operative assessment clinic

	Reviewers' opinion		Clinician's opinion	
	Number of patients	%	Number of patients	%
Yes	128	64.6	238	68.2
No	70	35.4	111	31.8
Subtotal	**198**		**349**	
Insufficient data	41		81	
Total	**239**		**430**	

Table 4.8 HbA1c was above the accepted range for surgery

	Number of patients	%
Yes	38	16.1
No	198	83.9
Subtotal	**236**	
Not answered	2	
Total	**238**	

It was also found that where patients had an HbA1c, 16.1% (38/236) were above the accepted range for surgery (>69mmol/mol or >8.5%) (Table 4.8).

Table 4.9 shows what was done to attempt to control diabetes prior to surgery. One-third of patients were referred to primary or secondary care for diabetes management whilst the remaining patients had no treatment or unknown intervention. Well documented plans for managing patients with poor diabetes control were not available in nearly two-thirds of patients. This would have implications for assessment of control and planning treatment of these patients and may increase the risk of high blood glucose associated with surgery.

Table 4.9 Specialty the patient was referred to in an attempt to improve diabetes control

	Number of patients
Primary care	6
Diabetes team	6
Diabetes team/primary care	2
Other	2
None	9
Subtotal	**25**
Unknown	13
Total	**38**

The 2016 JBDS guidelines suggest that every effort should be made to avoid cancellation of surgery in patients with diabetes in particular cancellation due to poor diabetes control.[13]

This study found that 35.4% (70/198) of patients did not have a recent HbA1c at pre-assessment clinic and 12.9% (34/263) of patients had surgery cancelled on a previous occasion (Table 4.10).

Table 4.10 The patient's admission had been cancelled on a previous occasion (elective)

	Number of patients	%
Yes	34	12.9
No	229	87.1
Subtotal	**263**	
Unknown	17	
Total	**280**	

The NHS non-clinical cancellation rates are 1.3%,[35] whilst in this study sample 1% (2/20) were cancelled for non-clinical reasons. Figure 4.2 shows that over half of the clinical cancellations were avoidable. Where a reason could be identified five patients had poor diabetes control identified as the reason for cancellation. A further five cancellations were due to avoidable poor control of other medical co-morbidities. This further supports the findings that pre-operative assessment processes are not identifying and optimising patients with diabetes prior to surgery.

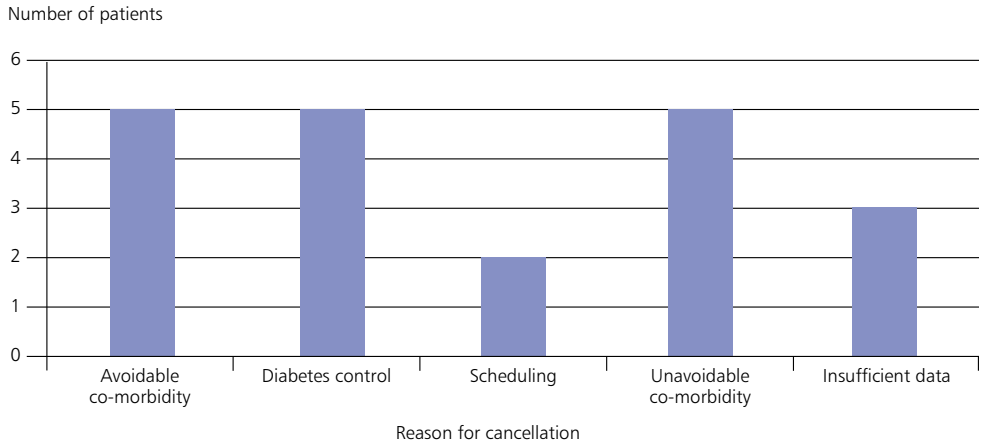

Figure 4.2 Clinical reasons for cancellations

CASE STUDY 2

An elderly patient with type 2 diabetes was referred to outpatients for a total hip replacement (THR) for arthritis. The GP letter did not mention that the patient had diabetes and omitted the medication which included metformin and insulin. There was no information regarding the diabetes control or co-morbidities and no recent HbA1c. The patient was seen by a consultant orthopaedic surgeon who put the patient on the waiting list for a THR. The patient waited 3 months for a date for surgery and was sent a pre-operative assessment date 2 weeks before the operation. At the pre-assessment clinic the patient was noted to have diabetes and all regular medication was recorded. The results of routine blood tests returned a few days later and showed that the patient's HbA1c was 85mmol/mol. The pre-operative assessment nurses waited 3 days for an anaesthetic opinion and it was decided to take the patient off the waiting list and refer them back to the GP for control of their diabetes. The consultant surgeon and GP were not informed, but the patient attended the GP as instructed. After 3 months and modification of their medication by the GP the patient's diabetes control had improved and their HbA1c was 59mmol/mol. The patient was re-referred by the GP and had to wait again to be seen in clinic and added back to the waiting list. The patient waited a total of 12 months for surgery.

The reviewers felt that the GP referral was inadequate and should have contained information regarding diabetes management and control including HbA1c within 3 months of referral. They also felt that the pre-operative assessment process had been used to remove the patient from the waiting list rather than facilitate surgery and obtain better diabetes control. Reviewers considered that communication was inadequate at various stages in the process.

Key Findings

30. 41% (83/202) of referral letters had no information provided on the management of the patient's diabetes in the community
31. 57% (144/253) of elective referrals in this study were made from general practitioners
32. The recording of co-morbidities (90/118; 76%) and current medication (98/118; 84%) were frequently provided, although evidence of regular blood sugar was only available in 22.0% (26/118) blood pressure measurement in 35.6% (42/118), urgency of referral in 21.2% (25/118) and body mass index (BMI) in 37.3% (44/118)
33. 8.3% (18/218) of patients admitted non-electively were on an elective list for surgery
34. 52.3% (227/434) of referral letters had no information on the management of the patient's diabetes in the community
35. Where information was provided in the referral letter, HbA1c within the previous three months was provided in only 50/118 (42%)
36. 86.7% (228/263) of elective patients attended a pre-operative assessment clinic
37. 9.9% (20/203) of patients were not seen by all appropriate staff, most commonly diabetes specialist nurse, in the opinion of the reviewers
38. 47.1% (88/187) of patients had no documented specific instructions on management of their diabetes prior to surgery
39. 70.2% (120/171) of case notes had no documented evidence that the patient was included in their diabetes plan
40. 65% (128/198) of patients had an HbA1c within 3 months prior to surgery
41. 16.1% (38/236) of patients whose HbA1c was checked were outside of the accepted range for elective surgery
42. 12.9% (34/229) of elective patients had their surgery cancelled on a previous occasion.

SEE RECOMMENDATIONS 3•4•6•9•10

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5

Inpatient care

Time to consultant review

Reviewers reported that most patients were seen by a consultant in a timely manner (Table 5.1). There was a delay in only 7.3% (30/411) of patients. There was no difference in delay to consultant review and whether the patient was elective or non-elective (data not shown). This suggested that there was good consultant input into surgical patients with diabetes.

Table 5.1 Delay in the patient being seen by a consultant

	Number of patients	%
Yes	30	7.3
No	381	92.7
Subtotal	**411**	
Unknown	98	
Total	**509**	

Medication

Reviewers reported that adequate medicines reconciliation by medical staff occurred in 84.4% (320/379) of patients and by a pharmacist in 75.3% (192/255). However, it was not possible to assess the adequacy of medicines reconciliation for a large number of patients (Figure 5.1).

In the 2017 NaDIA nearly one-third of inpatients with diabetes experienced a medication error.[2] They also found that inpatients on a surgical ward were more likely to experience an error. Conversely, patients were less likely to experience an error if electronic patient records or electronic prescribing was used. Medication errors occurred in 33% of surgical patients whilst prescription error happened in 21%. Both glucose management and insulin errors occurred in 19% of patients.[2]

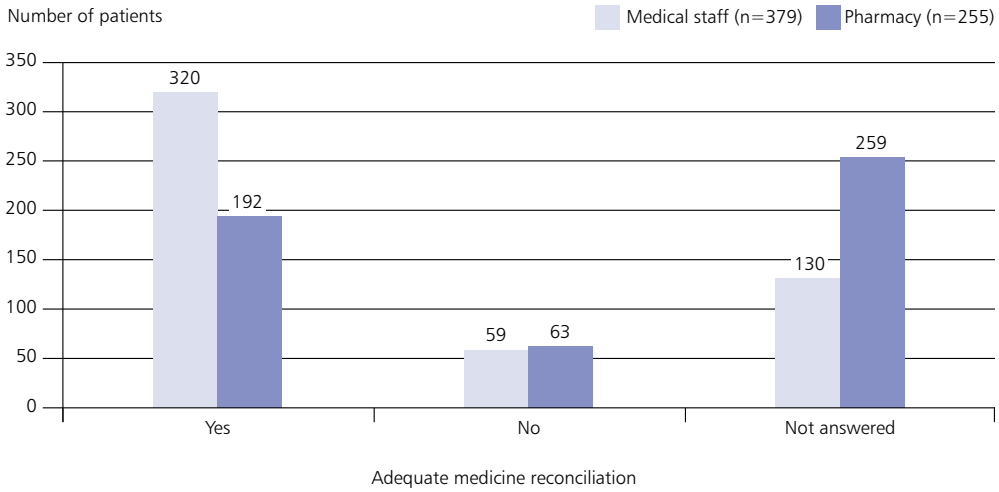

Figure 5.1 Adequacy of medicine reconciliation – reviewers' opinion

Table 5.2 VRIII commended on admission by admission type

	Elective		Non-elective	
VRIII commenced on admission	**Number of patients**	**%**	**Number of patients**	**%**
Yes	26	9.9	46	22.4
No	236	90.1	159	77.6
Subtotal	**262**		**205**	
Insufficient data	18		13	
Total	**280**		**218**	

Variable rate intravenous insulin infusion (VRIII)

This study found that 9.9% (26/262) of elective surgical patients were commenced on a VRIII on admission (Table 5.2). The NaDIA showed that 19% of elective and emergency inpatients had been on a VRIII within the last 7 days of admission and 40% of insulin-treated inpatients experienced an insulin error during their hospital stay.[36]

These data may reflect the large cohort of type 1 patients in this study and many of these VRIIIs may have been appropriate. However, the use of VRIII has been shown to increase the likelihood of insulin errors and should be avoided if possible.[29]

Prolonged starvation resulted in the use of a VRIII in 35 patients and the reviewers stated that this was avoidable in 23/35 patients, suggesting not all VRIIIs were indicated. Furthermore, reviewers felt that nearly 20% of VRIIIs started intra-operatively were inappropriately commenced. This was higher than in the NaDIA where 3.5% of inpatients who had undergone surgery had been commenced inappropriately on a VRIII.[36]

Nutrition

Nutritional assessment is an essential element of the preparation of patients with diabetes undergoing surgery because surgery may delay the reintroduction of nutrition and the disease process may also contribute to alterations in diet. Glucose control can be a challenge during this period. The ThinkGlucose campaign from the NHS Institute for Innovation and Improvement expects close liaison between staff and the diabetes team for all inpatients.[37]
Meal choices may be difficult in hospital as the 2017 NaDIA study showed that only 53.8% of patients felt that they had adequate choice of food.[2] It would be expected that an assessment of nutritional status on all patients admitted to hospital using a nutrition screening tool such as the malnutrition universal screening tool (MUST) score.[38,39]

Table 5.3 shows that only 55.4% (221/399) of patients had a MUST score calculated on admission to hospital.

Table 5.3 A MUST score was calculated on admission

	Number of patients	%
Yes	221	55.4
No	178	44.6
Subtotal	**399**	
Insufficient data	110	
Total	**509**	

Table 5.4 MUST score by type of admission

	Type of admission				
MUST score calculated on admission	**Elective**	**Non-elective**	**Subtotal**	**Not answered**	**Total**
Yes	130	86	**216**	5	**221**
No	93	81	**174**	4	**178**
Subtotal	**223**	**167**	**390**	**9**	**399**
Unknown	57	51	**108**	2	**110**
Total	**280**	**218**	**498**	**11**	**509**

Table 5.4 shows MUST scores by type of admission showing that a higher proportion of elective patients (130/223; 58%) compared to non-elective patients (86/167; 51%) had a MUST score calculated.

Reviewers stated that nutritional assessment was inadequate in 18.1% (66/364) of patients (Table 5.5).

Table 5.5 Adequate nutritional assessment – reviewers' opinion

	Number of patients	%
Yes	298	81.9
No	66	18.1
Subtotal	**364**	
Insufficient data	91	
Not answered	54	
Total	**509**	

Dietitians were consulted for only 5.1% (24/475) of patients prior to surgery (Table 5.6), whilst reviewers stated a further 8% (31/389) of patients should have been seen (Table 5.7).

Reviewers also reported that nutritional treatment was adequate in 90.9% (391/430) of patients (Table 5.8).

Table 5.6 A dietitian was consulted prior to surgery

	Number of patients	%
Yes	24	5.1
No	451	94.9
Subtotal	**475**	
Insufficient data	31	
Not answered	3	
Total	**509**	

Table 5.7 A dietitian was not consulted prior to surgery and should have been

	Number of patients	%
Yes	31	8.0
No	358	92.0
Subtotal	**389**	
Insufficient data	45	
Total	**434**	

Table 5.8 Adequate nutritional treatment given – reviewers' opinion

	Number of patients	%
Yes	391	90.9
No	39	9.1
Subtotal	**430**	
Not answered	79	
Total	**509**	

Prolonged starvation

The 2016 JBDS guidelines advise that prolonged starvation should be minimised and patients should be placed on operating lists as early as possible in the day.[13]

Prolonged starvation (more than one missed meal) places the patient at increased risk of catabolism and increases the chance of needing a VRIII. This places the patient at risk of serious complications relating to VRIII including hypoglycaemia, hyponatraemia, dual route administration, insulin dose miscalculation, wrong infusion protocol and incorrect administration.

Table 5.9 shows that reviewers reported that prolonged starvation led to a change in patient management in 9.6% (42/439) of patients. In 35 patients a VRIII was commenced and in 9 patients IV fluids were commenced. Reviewers felt that in 21/32 patients prolonged starvation was avoidable.

Table 5.9 Prolonged starvation result in a change in the management of the patient's diabetes

	Number of patients	%
Yes	42	9.6
No	397	90.4
Subtotal	**439**	
Not applicable	44	
Not answered	26	
Total	**509**	

Pre-operative inpatient specialist input

The 2016 JBDS guidelines advise that patients with poor control of their diabetes should be referred to the diabetes team for advice and guidance.[13]

A diabetes specialist team was consulted prior to surgery in 11.7% (53/476) of patients (Table 5.10).

Table 5.10 Diabetes specialist team was consulted prior to surgery

	Number of patients	%
Yes	57	11.7
No	430	88.3
Subtotal	**487**	
Insufficient data	17	
Not applicable	5	
Total	**509**	

The diabetes team was contacted for 5.7% (15/265) of elective and 18% (38/211) of non-elective patients (Table 5.11).

Table 5.11 Diabetes team consultation by type of admission

	Elective		Non-elective	
Diabetes specialist team consulted prior to surgery	**Number of patients**	**%**	**Number of patients**	**%**
Yes	15	5.7	38	18.0
No	250	94.3	173	82.0
Subtotal	**265**		**211**	
Unknown	15		7	
Total	**280**		**218**	

Reviewers felt that 13.6% (54/398) of patients who were not reviewed by a diabetes specialist team, should have been (Table 5.12). There was no difference in whether the patient was an elective or non-elective admission. In the NaDIA study 60.6% of elective and 68.9% of emergency patients who had undergone surgery and had been deemed appropriate to be seen by the diabetes team had been seen by the diabetes team.[36]

Table 5.12 The diabetes specialist team was not consulted prior to surgery but should have been

	Number of patients	%
Yes	54	13.6
No	344	86.4
Subtotal	**398**	
Insufficient data	32	
Total	**430**	

Figure 5.2 shows the staff members involved in the care of patients in the study. This shows that the specialist diabetes team input was limited to a relatively small number of patients (81/503, 16%) and when it was provided it tended to be a diabetes specialist nurse.

CASE STUDY 3

An elderly patient with type 2 diabetes was experiencing abdominal pain and worsening vomiting for a week. The patient was having difficulty eating and had omitted their oral Metformin. The patient was admitted via the surgical assessment unit with suspected diverticulitis. The team kept the patient 'nil by mouth', commenced IV fluids with dextrose/saline and started IV antibiotics but did not start a variable rate intravenous insulin infusion (VRIII). A CT was arranged 6 hours later and this showed a sigmoid perforation. At this stage the patient was booked for a laparotomy. When the anaesthetist came to review the patient it was noted that the capillary blood glucose was 22mmol/L and they commenced a VRIII. This delayed the operation for a further 2 hours.

Reviewers felt that as the patient had already experienced prolonged starvation, raised blood sugar and was at high risk of poor diabetes control and that the diabetes specialist nurse should have been contacted.

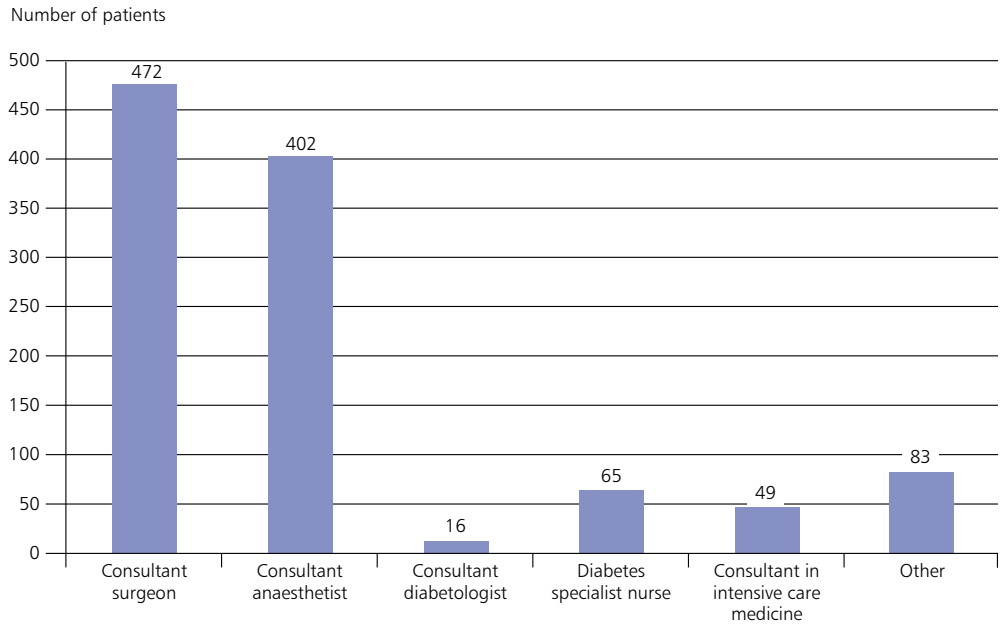

Figure 5.2 Specialist input (n=503, answers may be multiple)

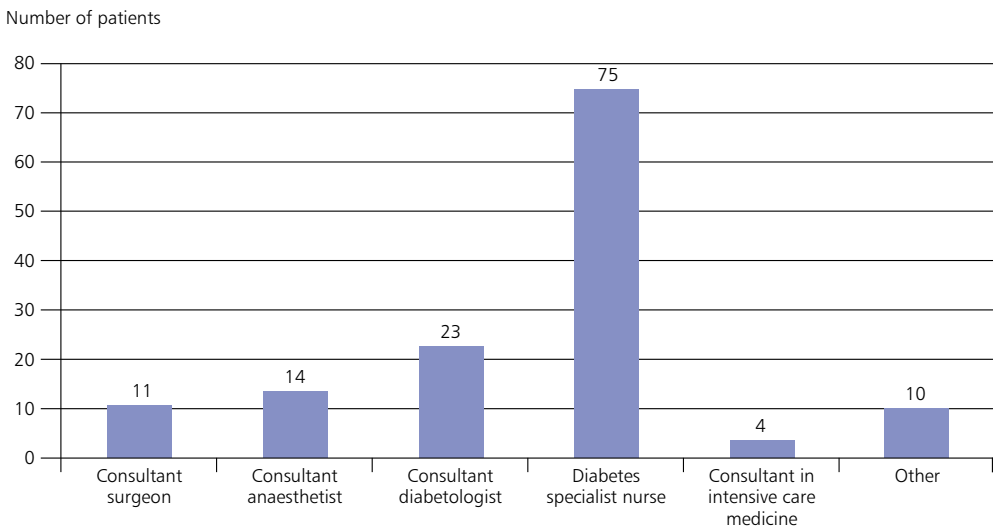

Figure 5.3 Specialist input patient should have received but did not

When reviewers were asked which specialist teams or staff should have been involved in patients' management the diabetes specialist nurse was the most frequent omission in 75 cases and consultant diabetologist in 23 cases (Figure 5.3).

Pre-operative risk assessment

The AAGBI safety guideline on the role of the anaesthetist in pre-operative assessment and patient preparation (2010) recommends that adequate time should be given to pre-operative assessment of a patient after admission to hospital and before arrival into the anaesthetic room. This includes providing sufficient information to patients after ensuring an adequate assessment.[10]

The AAGBI published further guidelines for perioperative management of surgical patients with diabetes in 2015[5] recommending that all patients with diabetes should be undergo pre-operative assessment for their surgical and anaesthetic risk as soon as possible.

The aim of pre-operative assessment is to optimise the patient's glycaemic control, by targeting HbA1c to below 69mmol/mol (8.5%), assuming it is safe to do so. Similar standards should be adhered to for unplanned admissions, especially because there is higher risk of error in an emergency. The experience and number of staff may be lower out of hours. There is also a risk of prolonged periods of starvation and fluid deprivation.

A pre-operative risk assessment was undertaken in 93.6% (442/472) of patients (Table 5.13).

Table 5.13 A pre-operative assessment of risk was made on admission

	Number of patients	%
Yes	442	93.6
No	30	6.4
Subtotal	**472**	
Insufficient data	37	
Total	**509**	

Most patients were assessed using the American Society of Anesthesiologists (ASA) grade system (96.6%; 420/435) (Table 5.14). However, case reviewers highlighted that ASA was too simple a tool to assess risk in a quarter of these patients.

Table 5.14 Pre-operative risk assessment tool used on admission

	Number of patients	%
ASA	420	96.6
P-POSSUM	13	3.0
Other	13	3.0
American College of Surgeons	8	1.8
SORT	4	0.9

Answers may be multiple; n= 435

Case reviewers were of the opinion that pre-operative risk assessment was inadequate in 24 cases (data not shown). The most common reasons for this decision were cited as inadequate assessment of diabetes, its pre-operative management and planning intra-operative and post-operative glycaemic control. They noted inadequate planning and documentation in multiple areas in more than half of these patients.

Scheduling of surgery

JBDS 2016 recommends that patients should be scheduled early on the procedure list.[13]

Pre-operative preparation usually involves fasting the patient prior to surgery. Long durations of fasting increase the risk of hypoglycaemia and fluid/electrolyte disturbances. In patients with type 1 diabetes this may mean long durations of VRIII and monitoring for acute complications of their diabetes.

Case reviewers were of the opinion that 19.4% (90/465) patients were not scheduled appropriately for their surgery, highlighting a major discrepancy between policy and practice (Table 5.15). There was also no documentation in clinical notes of the duration that a patient had been fasted, or the time from which they were started as "nil by mouth".

Table 5.15 Appropriate scheduling of the operation – reviewers' opinion

	Number of patients	%
Yes	375	80.6
No	90	19.4
Subtotal	**465**	
Not answered	44	
Total	**509**	

Delays to surgery

Delays to surgery after admission to hospital have a negative impact on patient experience. In addition to delaying the surgical intervention, delays also risk prolonging the period of fasting and fluid deprivation. This can adversely affect patients, especially the elderly and vulnerable. Extended periods of delay may result in a need for repeat pre-operative assessment, meaning duplication of work and further strain on clinical services. Moreover, an extended stay in hospital increases the risk of complications, such as hospital acquired infections and could deprive some patients benefiting from day surgery.

Surgery was delayed in 15.5% (76/491) of patients in this group (Table 5.16). The duration of delay varied widely, ranging from 1 hour to 16 days, with the mean duration of 62.5 hours. The most common duration of delay was 24 hours.

Table 5.16 Delays to surgery following admission – reviewers' opinion

	Number of patients	%
Yes	76	15.5
No	415	84.5
Subtotal	**491**	
Insufficient data	18	
Total	**509**	

Poor glycaemic control was the least common factor for surgical delays. Theatre availability and co-morbid conditions were more common (Table 5.17). Case reviewers were of the opinion that the delay was avoidable in 29 cases reviewed.

Table 5.17 Reasons for delays to surgery

	Number of patients
Co-morbidities	23
Theatre availability	35
Awaiting other procedures/interventions	9
Delayed decision making	8
Diabetes control	6
Other reasons	4

Answers may be multiple; n=73

Anaesthetic review on the day of surgery

The majority of the patients in this study were assessed by an anaesthetist on the day of surgery (466/475; 98.2%) (Table 5.18).

Table 5.18 Patient was assessed by an anaesthetist on the day of surgery

	Number of patients	%
Yes	466	98.1
No	9	1.9
Subtotal	**475**	
Unknown	34	
Total	**509**	

In the opinion of case reviewers 14.5% (64/440) of patients did not have an adequate anaesthetic assessment at this stage (Table 5.19). The most common reason that influenced this opinion was the lack of a documented diabetes management plan (51).

Table 5.19 Adequate anaesthetic assessment – reviewers' opinion

	Number of patients	%
Yes	376	85.5
No	64	14.5
Subtotal	**440**	
Unknown	26	
Total	**466**	

Key Findings

43. There was a delay to consultant review in only 30/411 (7.3%) of patients
44. Case reviewers felt that inadequate medicines reconciliation by medical staff occurred in 59/379 (15.6%) patients and by a pharmacist in 163/255 (24.7%)
45. 9.9% (26/262) of elective surgical patients were commenced on a VRIII on admission
46. Prolonged starvation resulted in a change in diabetes management in 9.6% (42/439) of patients, including the use of a VRIII in 35 patients of which reviewers felt 2/3 were avoidable
47. Diabetes team were consulted pre-operatively in 15/265 (5.7%) of elective and 38/211 (18.0%) of non-elective patients
48. 13.6% (54/398) of patients who were not reviewed by diabetes team should have been
49. 55.5% (221/399) of patients had a MUST score on hospital admission
50. 18.1% (66/364) of patients had an inadequate nutritional assessment
51. Reviewers felt 75 patients should have been seen by a diabetes specialist nurse and 23 by a consultant diabetologist but were not
52. 6.4% (30/472) patients did not have a pre-operative assessment of risk
53. 96.6% (420/435) of patients were assessed using an ASA score
54. 15.5% (76/491) of patients experiences a delay in their surgery. Theatre availability and co-morbid conditions were the most common cause whilst poor glycaemic control was the least common factor for delays
55. 98.2% (466/475) of patients were assessed by an anaesthetist on the day of surgery
56. 14.5% (64/440) of patients did not have an adequate anaesthetic assessment on the day of surgery in the opinion of case reviewers. The most common reason for this opinion was the lack of a documented diabetes management plan (51/64 patients).

SEE RECOMMENDATIONS 4•6•7•10•11•12

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6

Intra-operative care

The 2016 JBDS-Perioperative guidelines advise that the management plan on the day of surgery should have been agreed beforehand, ideally during the pre-operative assessment and on the day of admission. This should be clearly documented along with plans for unexpected emergency situations like hyperglycaemia or hypoglycaemia. It should also provide details of blood glucose monitoring and control if variable rate insulin infusion (VRIII) is planned.[40]

The guideline above does not specify which individual clinician is best placed to ensure this.

A majority of patients (59.8%; 274/458) did not have a clear plan for the management of their diabetes recorded on the day of surgery (Table 6.1).

Table 6.1 Documented diabetes management plan

	Number of patients	%
Yes	184	40.2
No	274	59.8
Subtotal	**458**	
Unknown	8	
Total	**466**	

Case reviewers also highlighted the fact that there was variation in monitoring and recording capillary blood glucose (CBG), increasing the risk that abnormal results are not acted upon.

Just over half (55/100; 55%) the patients in this study with type 1 diabetes had a documented management plan compared with just over a third of patients (121/335, 36%) with type 2 diabetes (Table 6.2).

Table 6.2 Documented diabetes management plan by type of diabetes

	Type 1		Type 2	
Management plan	**Number of patients**	**%**	**Number of patients**	**%**
Yes	55	55.0	121	36.1
No	45	45.0	214	63.9
Subtotal	**100**		**335**	
Unknown	1		7	
Total	**101**		**342**	

Based on documented medications on the day of surgery in Table 6.3 there were 52 patients on diet control only. It is possible that no specific notes were made about diabetes management in these patients.

CASE STUDY 4

A middle-aged patient was admitted for an elective orthopaedic procedure. Anaesthetic documents noted patient as 'IDDM' but did not list which medications (or insulin) the patient was on. The patient said that they had been advised to stop all oral intake after midnight. The patient was not prescribed their regular Metformin or Insulatard on the morning of surgery. The operation started at 4pm meaning that they missed two meals. Blood glucose was recorded as 10.4mmol/L on the morning of surgery. The patient appeared to be drowsy and confused in recovery so their blood glucose was checked and found to be 16mmol/L with no blood ketones. The patient was started on a variable rate intravenous insulin infusion and moved to high dependency care where they improved over the next 48 hours.

Reviewers were of the opinion that this patient should have been prioritised on the operation list so as not to miss more than one meal. The Metformin should have been prescribed and long acting insulin continued, albeit reduced by 20%, prior to surgery. The patient's blood glucose should have been monitored on an hourly basis whilst they were placed on VRIII.

Medication

The risk of drug errors can be catastrophic in patients on diabetes medications, many of which can cause severe hypoglycaemia. The recent report by NaDIA 2017 identifies medication errors in 30% cases despite steady improvements in this area over the years as a result of electronic prescribing and electronic medical records.[2]

Diabetes medications were not documented on the day of surgery in 12.4% (55/445) of cases (Table 6.3).

Table 6.3 Documented diabetes medications

	Number of patients	%
Yes	390	87.6
No	55	12.4
Subtotal	**445**	
Not answered	21	
Total	**466**	

Details of the diabetes medications that were documented are provided in Table 6.4.

Table 6.4 Diabetes medications documented on the day of surgery

	Number of patients	%
Oral hypoglycaemic agents	176	45.8
Insulin	108	28.1
None - diet controlled	52	13.5
Insulin & oral hypoglycaemic agents	48	12.5
Subtotal	**384**	
Not answered	6	
Total	**390**	

Case reviewers were of the opinion that diabetes medicines were not managed appropriately in 14.7% (51/348) patients (Table 6.5).

Table 6.5 Appropriate management of diabetes medicines

	Number of patients	%
Yes	297	85.3
No	51	14.7
Subtotal	**348**	
Not answered	118	
Total	**466**	

Insulin-related errors were the most common reason (33/51). Insulin was inappropriately omitted on the morning of surgery in 13 cases. VRIII was not started in another 10 patients when it was required. Conversely, VRIII was commenced in another 10 patients when it was not indicated. Inappropriate discontinuation of oral medications was recorded in 12 patients.

Reviewers found incomplete documentation of medications in 13 cases. In comparison, NaDIA (2017) found that 19.2% (468/2443) of patients with diabetes who underwent surgery received an insulin infusion in the previous 7 days and that in 3.5% (16/461) of cases the infusion was deemed inappropriate.

Enhanced recovery programmes

Enhanced recovery programmes in surgical patients help reduce hospital stay by promoting return to normal diet and mobility. Returning patients with diabetes to their regular diet ensures they can be weaned off variable rate insulin treatment and return to their usual diabetes medication.

JBDS-IP (2016) recommends that the principles of enhanced recovery programmes should be implemented in patients with diabetes undergoing surgery.[40] Furthermore, the AAGBI (2015) recommend avoiding carbohydrate loading in diabetes patients receiving insulin and are planned for a short period of fasting.[34]

Table 6.6 shows that there was 73.1% (182/249) of patients not on an enhanced recovery programme. Case notes provided evidence of pre-operative carbohydrate loading in only 9 patients.

Table 6.6 The patient was on an enhanced recovery programme

	Number of patients	%
Yes	67	26.9
No	182	73.1
Subtotal	**249**	
Unknown	31	
Total	**280**	

Surgical safety checklists

Surgical safety checklists are useful tools in improving patient safety and quality of care. The WHO surgical safety checklist is one of the most commonly used checklists in the NHS.[41]

JBDS 2016 recommends that this bundle should be used to maintain intra-operative blood glucose levels between 6-10mmol/L (up to 12mmol/L may be acceptable in the sedated/anaesthetised patient, although in patients who are awake a lower limit of 4mmol/L is safe).

Whilst 97.1% (432/445) of patients had evidence of the use of such a surgical safety checklist (Table 6.7) there was a large amount of variation in when diabetes was used. Diabetes management was not included in 30.2% (114/378) cases (Table 6.8). Some checklists had no mention of diabetes/ hyperglycaemia, some others just had a "tick-box" for considering diabetes and others were more specific about recording diabetes. No space was provided to record blood glucose levels, neither at sign-in nor at sign-out.

Table 6.7 Surgical safety checklist performed

	Number of patients	%
Yes	432	97.1
No	13	2.9
Subtotal	**445**	
Unknown	64	
Total	**509**	

Table 6.8 Diabetes management formed part of the surgical safety checklist (where performed)

	Number of patients	%
Yes	264	69.8
No	114	30.2
Subtotal	**378**	
Insufficient data	54	
Total	**432**	

Further analysis showed that if diabetes was mentioned on the surgical safety checklist, capillary blood glucose measurements were more likely during the operation than not (141/240; 58.8% vs 54/109; 49.5%). Including diabetes in surgical safety checklists was also associated with more appropriate management of diabetes in the theatre recovery area (182/216 (84.3%) vs 65/102 (63.7%).

CASE STUDY 5

A young patient was admitted as an emergency after a road traffic accident. The patient was known to have diabetes. There was no record of blood glucose levels being taken before or during surgery. The first blood glucose level recorded was 19mmol/L in post-operative recovery. The patient was started on a variable rate intravenous insulin infusion and transferred to critical care in view of the co-morbid conditions. Although a surgical safety checklist was used (WHO) it did not include diabetes or blood glucose levels.

Reviewers were of the opinion that a prompt for blood glucose in the checklist could have prevented such an adverse oversight.

Prevention of post-operative nausea and vomiting (PONV)

The AAGBI 2015 recognises the importance of preventing and treating post-operative nausea and vomiting (PONV).[5] In patients with diabetes this is especially important to because PONV would delay return to normal diet and therefore to the patient's usual insulin therapy and other diabetes medications. The role of corticosteroids in raising blood glucose levels is well established, therefore use of dexamethasone in patients with diabetes remains under discussion.

The JBDS 2016 recommends that the diabetes specialist team should be involved in steroid induced diabetes.[10]

Whilst most patients were given 5-HT3 antagonists for PONV (336/407; 82.6%), dexamethasone was administered, on its own or in combination with other medications, in 24.1% (98/407) of patients (Table 6.9).

Table 6.9 Methods to minimise post-operative nausea and vomiting

	Number of patients	%
5-HT3 antagonist	336	82.6
Dexamethasone	98	24.1
Other	40	9.8
Antihistamines	39	9.6
Total intravenous anaesthesia	37	9.1
Dopamine antagonists	9	2.2

Answers may be multiple; n=407

The case reviewers reported that methods to reduce PONV were not appropriate in 15.1% (66/438) of cases reviewed (Table 6.10).

Table 6.10 Appropriate methods used to minimise PONV – reviewers' opinion

	Number of patients	%
Yes	372	84.9
No	66	15.1
Subtotal	**438**	
Insufficient data	71	
Total	**509**	

Variable Rate Intravenous Insulin Infusion (VRIII)

Maintaining stable blood glucose levels throughout the perioperative period is important in all patients with diabetes to reduce the risk of perioperative morbidity and mortality. Stability can be achieved in many patients with diabetes by reducing the duration of fasting prior to surgery, although this can be challenging in patients requiring emergency surgery, having persistent hyperglycaemia (>12mmol/L), being subjected to prolonged starvation or being deprived of background insulin (especially in type 1 diabetes).

In patients who have prolonged starvation, VRIII may be used to maintain blood glucose levels within the target range (usually 6-10mmol/L). Regular and frequent (usually hourly) bedside capillary blood glucose monitoring is an important part of this treatment and all hospitals should have clearly written guidelines on VRIII.

VRIII was started intra-operatively in 24.1% (114/473) of patients (Table 6.11).

Table 6.11 VRIII was used intra-operatively

	Number of patients	%
Yes	114	24.1
No	359	75.9
Subtotal	**473**	
Insufficient data/unknown	36	
Total	**509**	

Case reviewers were of the opinion that it was used appropriately in just over 80% of patients (88/108) (Table 6.12).

Table 6.12 Where VRIII used intra-operatively, this was used appropriately

	Number of patients	%
Yes	88	81.5
No	20	18.5
Subtotal	**108**	
Not answered	6	
Total	**114**	

Capillary blood glucose measurement

JBDS 2016 recommends that it should be checked just prior to induction of anaesthesia and regularly thereafter.[40] The AAGBI recommends that CBG and any VRIII should be documented in anaesthetic notes along with any other medications given.[5]

Regular capillary blood glucose (CBG) measurement should be part of patient monitoring during surgery of all patients with diabetes. Hypoglycaemia can cause drowsiness, confusion, seizures and death. Almost all these features would not be recognised in a patient under general anaesthesia or sedation. If the patient is on VRIII, at least hourly readings of blood glucose should be made. CBG was not recorded in 46.9% (212/452) of patients during surgery (Table 6.13).

Table 6.13 Capillary blood glucose measurements were recorded at any time during surgery – reviewers' opinion

	Number of patients	%
Yes	240	53.1
No	212	46.9
Subtotal	**452**	
Insufficient data	57	
Total	**509**	

It is possible that some of these patients had good glycaemic control prior to surgery and did not need further monitoring, especially if the duration of surgery was less than an hour. Figure 6.1 overleaf provides the percentage of CBG measurements during surgery and the time they were done. It shows that in only 40% of cases where CBG was not tested did surgery last was up to an hour.

Further review of the cases where CBG was measured during surgery, case reviewers were of the opinion that the frequency of CBG monitoring was appropriate in 84.8% (190/224) cases (Table 6.14)

Table 6.14 Appropriate frequency of CBG measurements recorded during surgery – reviewers' opinion

	Number of patients	%
Yes	190	84.8
No	34	15.2
Subtotal	**224**	
Insufficient data	16	
Total	**240**	

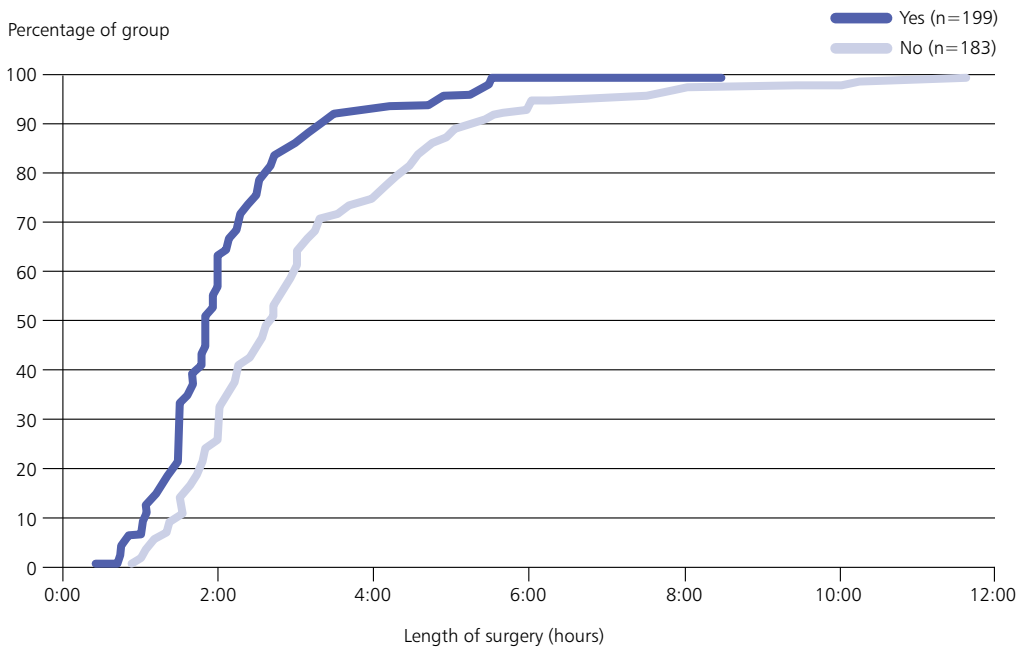

Figure 6.1 Capillary blood glucose measurement

Complications

A diabetes patient undergoing surgery is at risk of hyperglycaemia due to multiple factors. Hyperglycaemia raises the risk of infections (and therefore sepsis), and impaired wound healing. The stress of surgery can also lead to diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar syndrome (HHS), both of which carry serious risks of morbidity and mortality. At the other end of the glycaemic scale, untreated hypoglycaemia can cause serious neurological complications and death. It is also associated with prolonged hospital (and ICU) stay. All guidelines therefore highlight the importance of preventing these complications. Early detection of diabetic complications and their prompt management saves lives.

In the intra-operative period, hypoglycaemia occurred in 19 and hyperglycaemia in 6 patients (Table 6.15). Of the 19 patients who developed intra-operative hypoglycaemia 11 were on VRIII. Case reviewers were of the opinion that 18 of 24 complications were avoidable. Only half were managed appropriately. No cases of DKA or HHS were identified. These results are better than the NaDIA 2017, which found 4% of type 1 diabetes patients developed DKA and 0.12% of type 2 diabetes patients developed HHS, while in hospital. The report also noted that there had been no significant change in the incidence of these complications since NaDIA started collecting such data. Hypoglycaemic episodes in similar inpatients have reduced from 26% in 2011 to 18% in 2017.

Table 6.15 Diabetes-related complications developed intra-operatively

	Number of patients	%
Hypoglycaemia requiring treatment (<4mmol/L)	19	82.6
Hyperglycaemia (>12mmol/L)	6	24.1
Diabetic ketoacidosis	0	9.8
Hyperosmolar hyperglycaemic state	0	9.6
Total intravenous anaesthesia	37	9.1
Dopamine antagonists	9	2.2

Answers may be multiple; n=407

Once a patient is started on VRIII, it is important to monitor their capillary blood glucose (CBG) regularly and ensure they remain within the recommended safe limits.

Other complications, not directly related to diabetes, occurred in 47 patients (10.9%) (Table 6.16). The most common complication was hypotension (21/47), then bleeding (6/47) and cardiovascular complications (7/47). Two complications were deemed avoidable but were managed appropriately in the opinion of case reviewers.

Table 6.16 Additional complications developed intra-operatively

	Number of patients	%
Yes	47	10.9
No	386	89.1
Subtotal	**433**	
Insufficient data	76	
Total	**509**	

Key Findings

57. 59.8% (274/458) of patients did not have a clear plan for the management of the patient's diabetes on the day of surgery recorded
58. 12.4% (55/445) of patients did not have diabetes medications documented on the day of surgery
59. 14.7% (51/348) of case reviewers were of the opinion that diabetes medicines were not managed appropriately
60. A surgical safety checklist was used for 432/445 (97.1%) patients. Diabetes management was not included in 114/378 (30.2%) cases
61. If diabetes was mentioned on the surgical safety checklist then capillary blood glucose measurements were more likely to be undertaken (141/240; 58.8% vs 54/109; 49.5%) during the operation
62. Including diabetes in the surgical safety checklist was associated with more appropriate management of diabetes in the theatre recovery area 182/216 (84.3%) vs 65/102 (63.7%)
63. Case reviewers found that methods to reduce post-operative nausea and vomiting were not appropriate in 66/438 (15.1%) cases
64. 24.1% (114/473) patients had VRIII was started intra-operatively
65. Case reviewers were of the opinion that VRIII was used inappropriately in 18.5% (20/108) of patients
66. 46.9% (212/452) of patients did not have capillary blood glucose recorded intra-operatively
67. In the intra-operative period, hypoglycaemia occurred in 19 and hyperglycaemia in 6 patients. No cases of DKA or HHS were recorded
68. Of the 19 patients who developed intra-operative hypoglycaemia 11 were on a VRIII
69. 19.4% (90/465) of patients were not scheduled appropriately for their surgery in the opinion of the case reviewers.

SEE RECOMMENDATIONS 4•10•12

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7

Post-operative care

Theatre recovery

After surgery, patients are taken to the post-operative recovery area for further observation before transferring them to their base ward, or another appropriate area.

Case reviewers found that a 21.2% (86/406) of patients were not managed appropriately in theatre recovery (Table 7.1). In 58/86 patients, capillary blood glucose levels were either never checked (39) or not checked regularly (19). This is despite there being documented evidence of hyperglycaemia in a quarter of these patients (23/86). There were also instances of unnecessary use of VRIII or not starting insulin when it was required (11/86).

Table 7.1 Appropriate management of diabetes in the theatre recovery area

	Number of patients	%
Yes	320	78.8
No	86	21.2
Subtotal	**406**	
Not answered	103	
Total	**509**	

Capillary blood glucose (CBG) monitoring

Regular and timely CBG monitoring forms an essential part of perioperative care in a patient with diabetes. While many patients might still be drowsy post-operatively, they may also experience nausea and/or vomiting. Intravenous fluids (IV fluids) commenced during surgery also may need to be replenished depending on the duration of surgery and recovery. Patients who undergo unplanned (emergency) surgery are particularly vulnerable. This can be a dangerous time for patients and diabetes specialist staff should be involved early if CBG levels are outside the recommended range.[10] CBG levels were not measured in 13.8% (59/426) patients in the theatre recovery area (Table 7.2). Case reviewers were of the opinion that blood glucose was not managed appropriately in 21.2% (86/406) patients.

Table 7.2 Capillary blood glucose was measured in the theatre recovery area

	Number of patients	%
Yes	367	86.2
No	59	13.8
Subtotal	**426**	
Not answered	83	
Total	**509**	

Post-operative ward care

Following surgery patients either return to the ward they came from, are transferred to higher levels of care based on a pre-operative plan or may require intensive care due to unexpected complications.

In this study, the majority of patients (77.8%; 393/505) returned to surgical wards (Table 7.3). Seventy patients (13.4%) needed transfer to higher levels of care. Since the study inclusion criteria required a minimum one-night hospital stay, the number of patients located in the day surgery unit was low (1.2%).

Table 7.3 Patient location following theatre recovery

	Number of patients	%
Surgical ward	393	77.8
Critical care (level 2)	50	9.9
Critical care (level 3)	20	4.0
Medical ward	18	3.6
Other	18	3.6
Day surgery unit	6	1.2
Subtotal	**505**	
Not answered	4	
Total	**509**	

Case reviewers were of the opinion that the clinical area was inappropriate in 3.8% (19/503) cases (Table 7.4).

Table 7.4 Appropriate location following theatre recovery – reviewers' opinion

	Number of patients	%
Yes	484	96.2
No	19	3.8
Subtotal	**503**	
Not answered	6	
Total	**509**	

A transfer from theatre recovery area to ward carries a higher degree of clinical risk. The patient transitions from the continuity of care provided in the immediate pre-operative, operative and post-operative period in theatre, to the ward-based team. Patients transferred to ward on VRIII need particular attention to rates of fluid, electrolyte and insulin infusion to prevent wide fluctuations, especially in blood glucose levels. Good communication between medical and nursing staff from theatres to wards is vital in ensuring the prevention of diabetes related complications.

JBDS 2016 recommends that the diabetes team should be involved promptly if satisfactory glycaemic control cannot be maintained.[10] The recent NaDIA report recommends that diabetes inpatient teams should work with their surgical colleagues to improve patient safety.[2]

Case reviewers found that diabetes was not managed by the appropriate staff in 16.6% (77/464) of cases (Table 7.5). Analysis of their comments (data not shown) in these 77 cases highlighted issues of persistent or recurrent hyperglycaemia in over half the patients (40). In addition, 7 also developed hypoglycaemia. Issues with continuing VRIII inappropriately (7) or stopping insulin too early (8) along with other evidence of inadequate planning (16) were found. Case reviewers were of the opinion that early involvement of Diabetes Specialist Nurse would have been beneficial in a majority of these patients (44/77).

Table 7.5 Appropriate staff managing the diabetes care in the post-operative period – reviewers' opinion

	Number of patients	%
Yes	387	83.4
No	77	16.6
Subtotal	**464**	
Not answered	45	
Total	**509**	

Post-operative blood glucose measurement was considered satisfactory by case reviewers in 81.2% (346/426) cases (Table 7.6). It is also noteworthy that insufficient data in 83 case notes meant that it was not possible to judge whether satisfactory blood glucose monitoring was provided to them.

Table 7.6 Satisfactory post-operative blood glucose measurement – reviewers' opinion

	Number of patients	%
Yes	346	81.2
No	80	18.8
Subtotal	**426**	
Not answered	83	
Total	**509**	

CASE STUDY 6

A middle-aged patient was admitted for elective abdominal surgery. A post-operative stay on the ward was marked by blood glucose levels persistently raised above 10mmol/L due to a secondary infection. The patient received their regular medication, and intermittent doses of insulin, based on a review by the on-call medical team which was different each day. The patient was subsequently started on a variable rate intravenous insulin infusion (VRIII), after which the diabetes team was contacted to help achieve stable blood glucose levels.

Reviewers were of the opinion that the surgical team should have involved the diabetes specialist nurse at an early stage. This would have prevented hyperglycaemia lasting for days, helped with discontinuation of VRIII at the right time, educated the patient and helped with hospital discharge planning.

Discharge planning

Discharge planning forms an important part for the continuum of care of patients with diabetes. Following the stress of surgery and alteration of diet during the hospital stay, patients with diabetes need close monitoring to ensure that their blood glucose levels remain within the recommended range of 6-12 mmol/L. Poor discharge planning may result in readmission with complications of poor glycaemic control.

Ward teams should work closely with the diabetes specialist team to define criteria for discharge and manage the discharge process collaboratively. This is especially important if blood glucose levels were not well controlled in hospital. Patient education forms an important part of this collaborative working, as does the community diabetes team.

Majority of patients did receive adequate discharge planning (92.8%, 415/447) (Table 7.7).

Table 7.7 Adequate discharge planning – reviewer's opinion

	Number of patients	%
Yes	415	92.8
No	32	7.2
Subtotal	**447**	
Not answered	50	
Total	**497**	

The arrangements for diabetes care post-discharge were not thought to be arranged appropriately in 20% (78/390) of patients (Table 7.8). The results were similar for type 1 and type 2 diabetes patients.

Table 7.8 Adequate discharge arrangements made for the patient's diabetes care post-discharge

	Number of patients	%
Yes	312	80.0
No	78	20.0
Subtotal	**390**	
Insufficient data	107	
Total	**497**	

Key Findings

70. 13.8% (59/426) of patients did not have their capillary blood glucose levels measured in the theatre recovery area
71. 21.2% (86/406) of patients did not have their blood glucose managed appropriately in the post-operative period, in the opinion of the case reviewers
72. The post-operative clinical area was inappropriate in 19/503 (3.8%) of cases reviewed in the opinion of the case reviewers
73. Diabetes was not managed by all the appropriate staff in 77/464 (16.6%) patients, in the opinion of the case reviewers. Early involvement of a diabetes specialist nurse would have been beneficial in a majority of these patients (44) in the opinion of the case reviewers
74. Adequate discharge arrangements were not made for the patient's diabetes care in 78/390 (20.0%) patients, in the opinion of the case reviewers.

SEE RECOMMENDATIONS 4•5•11

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8

Overall quality of care

Case reviewers were asked to provide a global opinion on the quality of care provided to each patient after completing each case review.

The standard used is based on their opinion of whether the care provided would be considered good practice or had scope for improvement in clinical and/or organisational care. Figure 8.1 shows that good practice was found in the quality of care of 34.8% (177/509) patients. There was room for improvement in clinical care in 35.8% (182/509) of patient cases. In contrast, organisational systems of care were deemed to require improvement in 9.2% (47/509) cases reviewed. A further 14.1% (72/509) of cases indicated improvements both in clinical and organisational systems of care. Overall care was considered less than satisfactory in 3.1% (16/509) of patients.

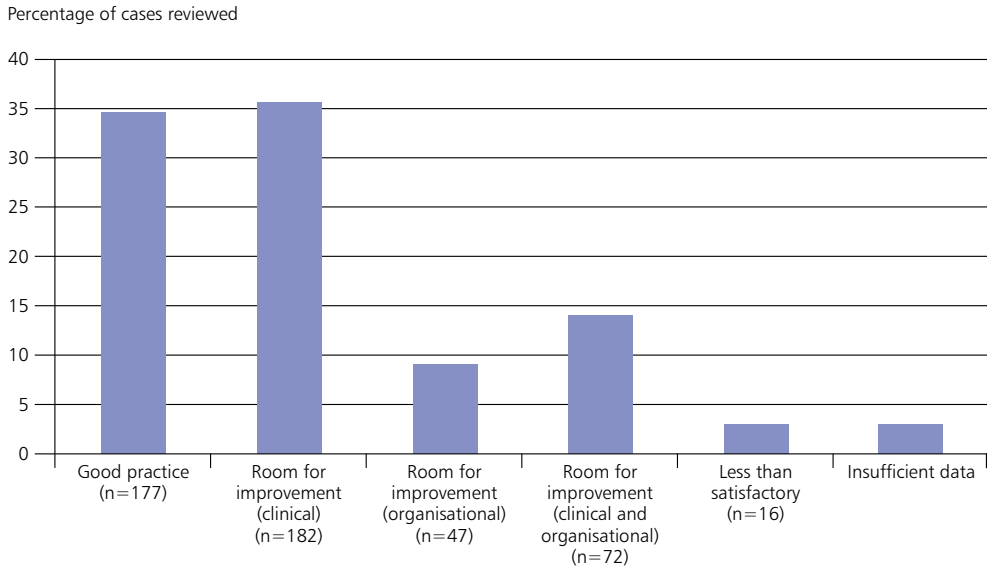

Figure 8.1 Overall quality of care (n=509)

The only area with comparatively better care was in the way organisational systems were set up for type 1 diabetes with only 5.3% needing improvement.

Reviewing the same data by type of diabetes it was found that fewer patients in this study with type 1 diabetes received good care, totalling 28.1% of all such patients compared to 35.5% of type 2 patients. The other main difference between groups was reflected in the less than satisfactory category where 7% of type 1 compared to 2.2% of type 2 cases were graded as less than satisfactory by the case reviewers.

Case reviewers were of the opinion that more needed to be done at organisational level for type 2 diabetes (10.8%) compared to type 1 diabetes (5.3%) (Figure 8.2).

Overall quality of care by type of diabetes

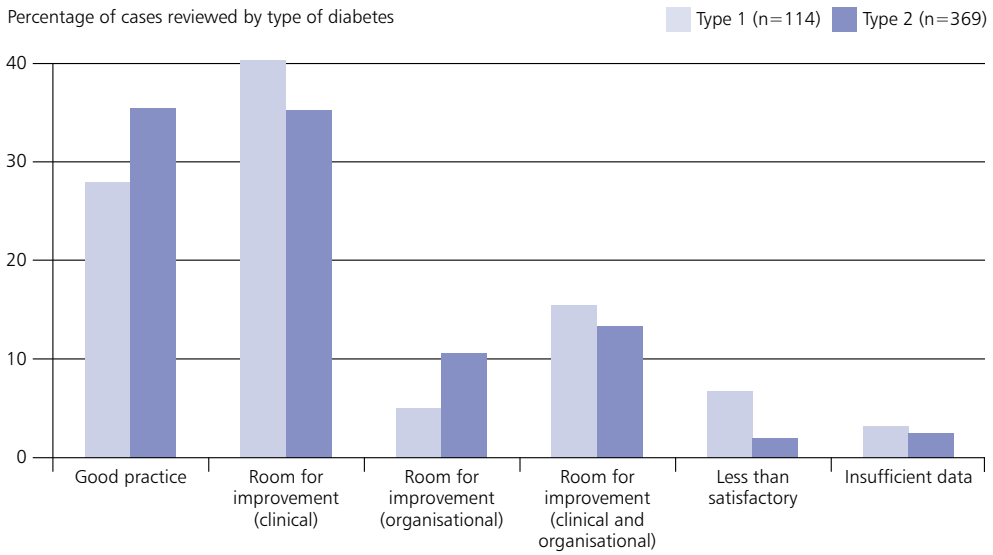

Figure 8.2 Overall quality of care by type of diabetes

References

1. Diabetes.org.uk. Diabetes: the basics. https://www.diabetes.org.uk/diabetes-the-basics
2. NHS Digital. National Diabetes Inpatient Audit England and Wales, 2017. Published 2018. https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017
3. Dhatariya, K, Levy, N, Kilvert et al. NHS Diabetes guideline for the perioperative management of the adult patient with diabetes. Diabetic Medicine 2012, 29(4), 420-433
4. Association of Surgeons of Great Britain and Ireland. Issues in professional practice: Guidelines for implementation of enhanced recovery protocols. 2009. http://asgbidocuments.surgicalmembershipportal.co.uk/issues%20in%20Professional%20Practice/issues_in_professional_practice_eras_guidelines_-_as_gone_to_press.pdf
5. Association of Anaesthetists of Great Britain and Ireland. Peri-operative management of the surgical patient with diabetes 2015. Anaesthesia 2015; 70: 1427-1440 https://www.aagbi.org/sites/default/files/Diabetes%20FINAL%20published%20in%20Anaesthesia%20Sept%2015%20with%20covers%20for%20online[1].pdf
6. Joint British Diabetes Society (JBDS) https://abcd.care/joint-british-diabetes-societies-jbds-inpatient-care-group
7. British Association of Day Surgery (BADS) https://daysurgeryuk.net/en/home/
8. Furnary AP, Gao G, Grunkemeier GL, et al. Continuous insulin infusion reduces mortality in patients with diabetes undergoing coronary artery bypass grafting. J Thorac Cardiovasc Surg, 2003; 125(5): 1007–1021
9. Nirantharakumar K, Marshall T, Kennedy A, et al. Hypoglycaemia is associated with increased length of stay and mortality in people with diabetes who are hospitalised. Diabet Med, 2012; 29(12): e445-448
10. Diabetes.org.uk. Facts and Figures. https://www.diabetes.org.uk/professionals/position-statements-reports/statistics
11. Verma R., Alladi, R., Jackson, I et al. Association of Anaesthetists of Great Britain and Ireland; British Association of Day Surgery. Day Case and Short Stay Surgery 2. Anaesthesia, 2011; 66 (417-434)
12. Stocker, M., Montgomery J., Russon, K et al. Royal College of Anaesthetists. Guidelines for the Provision of Anaesthesia Services: Chapter 6 Guidelines for the Provision of Anaesthesia Services for Day Surgery. 2018. https://www.rcoa.ac.uk/system/files/GPAS-2018-06-DAYSURGERY.pdf
13. Joint British Diabetes Societies for Inpatient Care. Management of adults with diabetes undergoing surgery and elective procedures: Improving standards. 2016. https://www.diabetes.org.uk/resources-s3/2017-09/Surgical%20guidelines%202015%20-%20full%20FINAL%20amended%20Mar%202016_0.pdf
14. Association of Surgeons of Great Britain and Ireland. Pre-operative Assessment and Patient Preparation: The Role of the Anaesthetist. 2010 https://www.aagbi.org/sites/default/files/preop2010.pdf
15. Who Operates When? National Confidential Enquiry into Patient Outcome and Death (1995/6) https://www.ncepod.org.uk/1995_6.html
16. Knowing the Risk. National Confidential Enquiry into Patient Outcome and Death (2011) https://www.ncepod.org.uk/2011poc.html
17. Surgical Risk Calculator. American College of Surgeons. https://riskcalculator.facs.org/RiskCalculator/index.jsp
18. ASA Physical Status Classification System. American Society of Anaesthesiologists. https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system
19. P-POSSUM. http://www.riskprediction.org.uk/index-pp.php
20. Surgical Outcome Risk Tool (SORT). NCEPOD and SOuRCe. https://www.ncepod.org.uk/sort.html

21. Emergency Surgery: Standards for unscheduled surgical care. Royal College of Surgeons of England. 2011. https://www.rcseng.ac.uk/library-and-publications/rcs-publications/docs/emergency-surgery-standards-for-unscheduled-care/
22. NELA Project Team. Third Patient Report of the National Emergency Laparotomy Audit. RCoA London, 2017.
23. An Age Old Problem. A review of the care received by elderly patients undergoing surgery. National Confidential Enquiry into Patient Outcome and Death (2010)
24. NELA Project Team. Second Patient Report of the National Emergency Laparotomy Audit. RCoA London, 2016
25. Sampson M., Jones C., Joint British Diabetes Society for Inpatient Care. Joint British Societies for Inpatient Care: clinical guidelines and improving inpatient diabetes care. Diab Med 2018; 35(8): 988-991
26. Joint British Diabetes Societies Inpatient Care Group. The Management of Diabetic Ketoacidosis in Adults. 2nd edition, 2013. http://www.diabetologists-abcd.org.uk/JBDS/JBDS_IP_DKA_Adults_Revised.pdf
27. National Institute for Health and Care Excellence (NICE). NICE Guideline NG17. Type 1 diabetes in adults: diagnosis and management. 2016. https://www.nice.org.uk/guidance/ng17/resources
28. Joint British Diabetes Societies Inpatient Care Group. The use of variable rate intravenous insulin infusion (VRIII) in medical inpatients. 2014. https://abcd.care/sites/abcd.care/files/resources/JBDS_IP_VRIII.pdf
29. George S, Dale J, Stanisstreet D et al. A guideline for the use of variable rate intravenous insulin infusion in medical inpatients. Diab Med 2015; 32(6): 706-713
30. Rushakoff RJ, Wick EC, McDonnell ME. Enhanced Recovery in Patients with Diabetes: Is it Time for a Moratorium on Use of Pre-operative Carbohydrate Beverages? Ann Surg 2018.
31. Albalawi Z., Laffin M., Gramlich L et al. Enhanced Recovery after Surgery (ERAS®) in Individuals with Diabetes: A Systematic Review. World J Surg 2017; 41(8): 1927-1934
32. 3.8 million people in England now have diabetes. Public Health England & National Cardiovascular Intelligence Network. 2016. https://www.gov.uk/government/news/38-million-people-in-england-now-have-diabetes
33. Pournaras DJ, Photi ES, Barnett N et al. Assessing the quality of primary care referrals to surgery of patients with diabetes in the East of England: A multi-centre cross-sectional cohort study. Int J Clin Pract 2017; 71(7): e12971
34. Association of Anaesthetists of Great Britain and Ireland. Perioperative management of the surgical patient with diabetes 2015. Anaesthesia 2015; 70(12): 1427-1440
35. NHS England. Cancelled Elective Operations: Quarter Ending March 2018. https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2018/05/NHS-cancelled-elective-operations-commentary-Q4-2017-18-75099.pdf
36. National Diabetes Inpatient Audit. England and Wales, 2017. Surgical data. https://digital.nhs.uk/data-and-information/find-data-and-publications/supplementary-information/2018-supplementary-information-files/national-diabetes-inpatient-audit-nadia-2017-inpatients-that-had-undergone-surgery
37. Think Glucose. Inpatient care for people with diabetes 2010. http://webarchive.nationalarchives.gov.uk/20150401104927/http://www.institute.nhs.uk/quality_and_value/think_glucose/welcome_to_the_website_for_thinkglucose.html
38. The British Association for Parenteral and Enteral Nutrition. The 'MUST' Explanatory Booklet: A Guide to the 'Malnutrition Universal Screening Tool' ('MUST') for Adults. 2003. https://www.bapen.org.uk/pdfs/must/must_explan.pdf
39. National Institute for Health and Care Excellence (NICE). Quality Standard QS24. Nutrition Support in Adults. 2012. https://www.nice.org.uk/guidance/qs24
40. Joint British Diabetes Societies for Inpatient Care. Management of adults with diabetes undergoing surgery and elective procedures: Improving standards. 2016. http://www.diabetologists-abcd.org.uk/JBDS/Surgical_guideline_2015_summary_FINAL_amended_Mar_2016.pdf
41. NHS England. New recommendations to further improve surgical safety. 2014. https://www.england.nhs.uk/2014/02/surgical-safety/

Appendices

Glossary

Perioperative		The perioperative period (not to be confused with perioperative period - during the course of the operation) is the time period of a patient's surgical procedure. It commonly includes ward admission, anaesthesia, surgery, and recovery.
Diabetes mellitus		Diabetes mellitus (or diabetes) is a chronic, lifelong condition that affects the body's ability to use the energy found in food.
Type 1 diabetes		With this type of diabetes, a person's pancreas produces no insulin. It occurs when the body's own defence system (the immune system) attacks and destroys the insulin-producing cells in the pancreas.
Type 2 diabetes		People with type 2 diabetes either don't make enough insulin or don't make insulin that the body can use properly. The cells in the body become resistant to insulin, making a greater amount of insulin necessary to keep blood glucose levels within a normal range. Eventually, the pancreas can wear out from producing extra insulin, and it may start making less and less.
Glycaemic		The presence of glucose in the blood.
Variable rate intravenous insulin infusion	VRIII	This was formerly known as sliding scale insulin, and has been used for decades to achieve normal blood sugar for patient in hospital.
HbA1c		This is a test that is used to measure average three-month blood glucose concentration. The test is limited to a three-month average because the lifespan of a red blood cell is four months.
Hypoglycaemia		Low blood sugar.
Hyperglycaemia		High blood sugar.
Diabetic ketoacidosis	DKA	This is a potentially life-threatening complication of diabetes that results from a shortage of insulin. In response the body switches to burning fatty acids which produces acidic ketones which are dangerous in high quantities.
Rockwood clinical frailty score		A measure of fitness and frailty in older people.
Estimated Glomerular filtration rate	eGFR	This is a measure of the function of the kidneys. This test measures the level of creatinine in the blood and uses the result in a formula to calculate a number that reflects how well the kidneys are functioning, called the estimated GFR or eGFR.
Catabolic		This is a pathway that breaks down molecules into smaller units that are either used to release energy or used in other reactions.
Capillary blood glucose	CBG	Capillary blood tests measure whole blood glucose as opposed to venous samples which measure plasma glucose. It is used for the care of people with diabetes, as a monitoring tool, giving a guide to blood glucose levels, at a specific moment in time.

Appendix 1 - The role and structure of NCEPOD

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is an independent body to which a corporate commitment has been made by the Medical and Surgical Royal Colleges, Associations and Faculties related to its area of activity. Each of these bodies nominates members on to NCEPOD's Steering Group.

Steering Group 2018/2019

Dr M Nathanson	Association of Anaesthetists of Great Britain and Ireland
Vacancy	Association of Surgeons of Great Britain and Ireland
Mr K Altman	Faculty of Dental Surgery, Royal College of Surgeons of England
Vacancy	Faculty of Public Health Medicine
Mr S Barasi	Lay Representative
Ms S Payne	Lay Representative
Dr J C Carey	Royal College of Anaesthetists
Dr K Ramachandran	Royal College of Anaesthetists
Dr J Butler	Faculty of Intensive Care Medicine
Dr A Tavaré	Royal College of General Practitioners
Dr N Ashby	Royal College of Nursing
Mr T Hillard	Royal College of Obstetricians and Gynaecologists
Mr W Karwatowski	Royal College of Ophthalmologists
Dr I Doughty	Royal College of Paediatrics and Child Health
Dr L Igali	Royal College of Pathologists
Mr M McKirdy	Royal College of Physicians and Surgeons of Glasgow
Dr M Jones	Royal College of Physicians of Edinburgh
Dr H Skene	Royal College of Physicians of London
Dr M Kumwenda	Royal College of Physicians of London
Dr A Gibson	Royal College of Physicians of London
Dr J Carlile	Royal College of Psychiatrists
Prof R McWilliams	Royal College of Radiologists
Mr W Tennant	Royal College of Surgeons of Edinburgh
Mr J Abercrombie	Royal College of Surgeons of England
Miss S Vig	Royal College of Surgeons of England

Observers

Dr D Sharpstone	Coroners' Society of England and Wales

Trustees
Mr I C Martin – Chair | Dr D Mason – Honorary Treasurer
Ms J Barber | Professor T J Hendra

NCEPOD is a company, limited by guarantee
(Company number: 3019382) and a registered charity
(Charity number: 1075588)
Company Secretary Dr M Mason

Clinical Co-ordinators
The Steering Group appoint a Lead Clinical Co-ordinator for a defined tenure. In addition there are 8 Clinical Co-ordinators who work on each study. All Co-ordinators are engaged in active academic/clinical practice (in the NHS) during their term of office.

Lead Clinical Co-ordinator: Dr V Srivastava (Medicine)
Clinical Co-ordinators: Dr K Wilkinson (Anaesthesia)
Dr M Juniper (Medicine)
Dr A P L Goodwin (Anaesthesia)
Mr M Sinclair (Surgery)
Dr S McPherson (Interventional Radiology)
Dr A Michalski (Oncology)

Lay Representatives
NCEPOD has a number of lay representatives who assist in all aspects of NCEPOD's work.
Alice Joy | Ron Newall |Sharon North| Hayley Topping
Nigel Buck | Constantinos Regas

Commissioning and supporting organisations
The Clinical Outcome and Review Programme into Medical and Surgical Care is commissioned by the Healthcare Quality Improvement Partnership (HQIP) on behalf of NHS England, NHS Wales, the Health and Social care division of the Scottish Government, the Northern Ireland Department of Health, Social Services and Public Safety (DHSSPS), the States of Jersey, the Bailiwick of Guernsey, and the Isle of Man.

Members of the Clinical Outcome Review Programme into Medical and Surgical Care Independent Advisory Group:
Rachel Binks | Mike Dent | Mark Ferreira | Margaret Hughes
Donal O'Donoghue | Terence O'Kelly | Joan Russell
David Saunders | Roger Taylor | William Taylor | Phil Willan
Paddy Woods

Members of the HQIP commissioning team
Mirek Skrypak | Jill Stoddart | Vivien Seagrove
James Campbell

Appendix 2 - Participation

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
Abertawe Bro Morgannwg University Health Board	4	4	20	18	19	20
Aintree Hospitals NHS Foundation Trust	1	1	6	6	6	6
Airedale NHS Foundation Trust	1	1	5	5	5	5
Aneurin Bevan University Health Board	3	3	0	-	-	-
Ashford & St Peter's Hospitals NHS Trust	2	2	6	6	6	6
Aspen Healthcare	4	4	9	7	6	9
Barking, Havering & Redbridge University Hospitals NHS Trust	2	2	0	-	-	-
Barnsley Hospital NHS Foundation Trust	1	1	7	4	6	4
Barts Health NHS Trust	5	2	0	-	-	-
Basildon & Thurrock University Hospitals NHS FoundationTrust	2	0	8	8	8	8
Bedford Hospital NHS Trust	1	1	7	7	7	5
Belfast Health and Social Care Trust	4	0	15	8	3	0
Benenden Hospital	1	1	2	2	2	0
Betsi Cadwaladr University Local Health Board	4	4	16	6	9	1
Blackpool Teaching Hospitals NHS Foundation Trust	1	1	8	5	6	6
BMI Healthcare	24	24	28	13	10	6
Bolton Hospital NHS Foundation Trust	1	1	4	2	1	3
Bradford Teaching Hospitals NHS Foundation Trust	1	1	6	3	4	4
Brighton and Sussex University Hospitals NHS Trust	3	3	17	13	13	15
Buckinghamshire Healthcare NHS Trust	2	1	7	3	6	7
Calderdale & Huddersfield NHS Foundation Trust	2	2	2	2	1	2
Cambridge University Hospitals NHS Foundation Trust	1	1	7	7	7	7
Cardiff and Vale University Health Board	3	1	11	8	10	11
Chelsea & Westminster NHS Foundation Trust	2	2	4	2	3	3
Chesterfield Royal Hospital NHS Foundation Trust	1	1	3	3	3	3
City Hospitals Sunderland NHS Foundation Trust	1	1	5	5	5	5
Countess of Chester Hospital NHS Foundation Trust	1	1	0	-	-	-
County Durham and Darlington NHS Foundation Trust	3	3	13	8	10	11
Croydon Health Services NHS Trust	1	1	3	3	3	3
Cwm Taf University Health Board	2	2	9	5	7	7
Dartford & Gravesham NHS Trust	1	1	0	-	-	-
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	3	3	1	1	1	1
Dorset County Hospital NHS Foundation Trust	1	1	0	-	-	-
East & North Hertfordshire NHS Trust	1	1	4	4	4	4
East Cheshire NHS Trust	1	1	4	4	4	4

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
East Kent Hospitals University NHS Foundation Trust	3	2	17	12	5	14
East Kent Medical Services	1	1	2	0	0	0
East Lancashire Hospitals NHS Trust	2	1	11	7	7	10
East Suffolk and North Essex NHS Foundation Trust (ESNEFT)	3	2	13	8	11	8
East Sussex Healthcare NHS Trust	2	2	13	13	12	13
Epsom and St Helier University Hospitals NHS Trust	3	0	13	3	2	0
Fairfield Independent Hospital	1	1	0	-	-	-
Frimley Health NHS Foundation Trust	2	2	12	12	12	12
Gateshead Health NHS Foundation Trust	1	1	6	3	4	1
George Eliot Hospital NHS Trust	1	1	5	5	5	5
Gloucestershire Hospitals NHS Foundation Trust	2	0	16	10	8	5
Great Western Hospitals NHS Foundation Trust	1	1	6	6	6	6
Guy's & St Thomas' NHS Foundation Trust	2	2	16	16	15	15
Hampshire Hospitals NHS Foundation Trust	2	1	12	6	9	1
Harrogate and District NHS Foundation Trust	1	1	4	4	4	4
HCA International	1	1	0	-	-	-
Hillingdon Hospitals NHS Foundation Trust	1	1	5	5	5	5
Homerton University Hospital NHS Foundation Trust	1	0	4	1	2	1
Hospital of St John and St Elizabeth	1	1	2	2	0	1
Hull and East Yorkshire Hospitals NHS Trust	2	2	12	8	8	8
Hywel Dda University Health Board	4	4	9	6	8	6
Imperial College Healthcare NHS Trust	4	4	13	13	13	12
Isle of Man Department of Health & Social Security	1	1	0	-	-	-
Isle of Wight NHS Trust	1	1	2	2	1	0
James Paget University Hospitals NHS Foundation Trust	1	1	7	7	7	7
Kettering General Hospital NHS Foundation Trust	1	0	7	7	7	7
KIMS Hospital	1	1	0	-	-	-
King Edward VII's Hospital Sister Agnes	1	1	2	0	1	0
King's College Hospital NHS Foundation Trust	3	3	18	3	8	15
Kingston Hospital NHS Foundation Trust	1	1	4	3	4	4
Lancashire Teaching Hospitals NHS Foundation Trust	2	2	8	5	4	5
Lewisham and Greenwich NHS Trust	2	0	13	13	13	13
Liverpool Heart and Chest Hospital NHS Trust	1	1	4	4	4	4
Liverpool Women's NHS Foundation Trust	1	1	2	1	2	1
London North West University Healthcare NHS Trust	3	3	14	14	14	14
Luton and Dunstable Hospital NHS Foundation Trust	1	1	4	0	2	0

Appendix 2 - Participation (continued)

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
Maidstone and Tunbridge Wells NHS Trust	2	0	11	6	5	2
Manchester University NHS Foundation Trust	5	1	21	10	10	8
Medway NHS Foundation Trust	1	1	6	6	6	6
Mid Cheshire Hospitals NHS Foundation Trust	1	1	0	-	-	-
Mid Essex Hospitals NHS Trust	1	1	8	8	6	5
Mid Yorkshire Hospitals NHS Trust	3	3	8	3	3	8
Milton Keynes University Hospital NHS Foundation Trust	1	1	2	2	1	2
Moorfields Eye Hospital NHS Foundation Trust	1	1	0	-	-	-
New Victoria Hospital	1	1	3	1		0
Newcastle upon Tyne Hospitals NHS Foundation Trust	2	2	16	13	3	16
NHS Ayrshire & Arran	2	0	0	-	-	-
NHS Borders	1	1	0	-	-	-
NHS Dumfries & Galloway	2	0	0	-	-	-
NHS Fife	4	0	0	-	-	-
NHS Forth Valley	1	1	2	0	1	0
NHS Grampian	3	3	6	3	4	3
NHS Highland	5	2	7	2	0	2
NHS Lanarkshire	3	1	12	7	10	0
NHS Lothian	3	0	0	-	-	-
NHS Orkney	1	0	1	0	0	0
NHS Shetland	1	0	0	-	-	-
NHS Tayside	4	0	0	-	-	-
NHS Western Isles	1	0	3	1	0	0
Norfolk & Norwich University Hospital NHS Trust	1	1	6	5	6	6
North Bristol NHS Trust	2	1	7	7	7	7
North Cumbria University Hospitals NHS Trust	2	2	11	5	5	3
North Middlesex University Hospital NHS Trust	1	0	5	0	1	0
North Tees and Hartlepool NHS Foundation Trust	2	2	4	4	4	4
North West Anglia NHS Foundation Trust	3	2	16	15	14	16
Northampton General Hospital NHS Trust	1	1	7	7	7	7
Northern Devon Healthcare NHS Trust	1	1	2	2	2	2
Northern Health & Social Care Trust	6	0	0	-	-	-
Northern Lincolnshire & Goole NHS Foundation Trust	3	3	15	14	13	14
Northumbria Healthcare NHS Foundation Trust	5	5	11	5	9	1
Nottingham University Hospitals NHS Trust	2	1	9	0	8	0
Nuffield Health	19	19	38	18	14	10
Oxford University Hospitals NHS Foundation Trust	4	4	24	11	18	15

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
Papworth Hospital NHS Foundation Trust	1	0	6	5	5	5
Pennine Acute Hospitals NHS Trust	4	2	17	9	15	17
Phoenix Hospital Group	1	1	0	0	0	0
Poole Hospital NHS Foundation Trust	1	0	6	0	2	0
Portsmouth Hospitals NHS Trust	1	0	7	5	5	2
Queen Victoria Hospital NHS Foundation Trust	1	1	4	3	4	2
Ramsay Health Care UK	21	21	8	3	3	0
Robert Jones and Agnes Hunt Orthopaedic Hospital NHS Foundation Trust	1	1	4	1	2	0
Rotherham NHS Foundation Trust	1	1	6	6	3	6
Royal Berkshire NHS Foundation Trust	1	1	5	5	5	5
Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	1	1	7	7	7	7
Royal Brompton and Harefield NHS Foundation Trust	2	2	0	-	-	-
Royal Cornwall Hospitals NHS Trust	2	0	4	3	1	3
Royal Devon and Exeter NHS Foundation Trust	1	1	6	6	6	6
Royal Free London NHS Foundation Trust	3	2	13	3	5	0
Royal Liverpool & Broadgreen University Hospitals NHS Trust	1	1	8	8	5	8
Royal National Orthopaedic Hospital NHS Trust	1	1	5	5	5	5
Royal Orthopaedic Hospital NHS Foundation Trust	1	0	3	2	2	0
Royal Surrey County Hospital NHS Trust	1	1	3	3	3	3
Royal United Hospitals Bath NHS Foundation Trust	1	1	8	7	8	8
Salford Royal Hospitals NHS Foundation Trust	1	1	7	2	6	5
Salisbury NHS FoundationTrust	1	1	0	0	0	0
Sandwell and West Birmingham Hospitals NHS Trust	3	2	0	0	0	0
Sheffield Teaching Hospitals NHS Foundation Trust	2	2	14	9	11	14
Sherwood Forest Hospitals NHS Foundation Trust	2	2	2	2	2	2
Shrewsbury and Telford Hospitals NHS Trust	2	2	11	10	9	11
South Eastern Health & Social Care Trust	3	3	5	2	1	0
South Tees Hospitals NHS Foundation Trust	2	2	12	7	9	6
South Tyneside NHS Foundation Trust	1	1	6	5	3	2
South Warwickshire NHS Foundation Trust	1	1	5	2	3	0
South Western Ambulance Service NHS Foundation Trust	1	0	0	-	-	-
Southend University Hospital NHS Foundation Trust	1	1	8	3	8	4
Southern Health & Social Care Trust	2	2	5	4	5	4
Southport & Ormskirk Hospitals NHS Trust	2	0	1	1	1	1

Appendix 2 - Participation (continued)

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
Tameside and Glossop Integrated Care NHS Foundation Trust	1	1	6	6	6	6
Taunton & Somerset NHS Foundation Trust	1	1	8	5	6	5
The Christie NHS Foundation Trust	1	1	3	2	2	2
The Dudley Group NHS Foundation Trust	2	2	7	7	7	7
The Foscote Private Hospital	1	1	1	1	1	1
The Hospital Management Trust	2	1	0	-	-	-
The Leeds Teaching Hospitals NHS Trust	4	4	18	15	13	13
The London Clinic	1	1	4	4	4	4
The Princess Alexandra Hospital NHS Trust	1	1	0	-	-	-
The Queen Elizabeth Hospital King's Lynn NHS FoundationTrust	1	1	8	4	8	8
The Royal Marsden NHS Foundation Trust	2	1	3	1	3	3
The Royal Wolverhampton Hospitals NHS Trust	2	2	12	6	7	12
The University Hospitals of the North Midlands NHS Trust	2	0	11	9	10	11
The Walton Centre NHS Foundation Trust	1	1	6	6	6	6
Torbay and South Devon NHS Foundation Trust	1	1	7	7	4	6
Ulster Independent Clinic	1	0	0	-	-	-
United Lincolnshire Hospitals NHS Trust	4	4	8	8	8	8
University College London Hospitals NHS Foundation Trust	5	5	0	-	-	-
University Hospital Southampton NHS Foundation Trust	2	1	8	8	8	8
University Hospitals Birmingham NHS Foundation Trust	4	4	25	23	24	18
University Hospitals Coventry and Warwickshire NHS Trust	2	2	10	6	6	6
University Hospitals of Bristol NHS Foundation Trust	4	2	8	2	4	0
University Hospitals of Derby and Burton NHS Foundation Trust	2	2	8	7	8	8
University Hospitals of Leicester NHS Trust	3	3	19	19	18	18
University Hospitals of Morecambe Bay NHS Trust	3	2	7	7	5	7
University Hospitals Plymouth NHS Trust	1	1	5	5	5	5
Virgin Care Limited	1	0	0	-	-	-
Walsall Healthcare NHS Trust	1	1	6	5	5	6
Warrington & Halton Hospitals NHS Foundation Trust	2	0	10	7	5	4
West Hertfordshire Hospitals NHS Trust	2	2	1	1	1	0
West Suffolk NHS Foundation Trust	1	1	6	5	1	6
Western Health & Social Care Trust	2	2	9	4	1	0

Trust/Health Board	No. of hospitals participating	No. of OQs received	No. of cases included	No. of CQ- A received	No. of CQ-B received	No. of sets of case notes received
Western Health & Social Care Trust	2	2	9	4	1	0
Western Sussex Hospitals NHS Foundation Trust	3	3	12	10	12	12
Weston Area Health Trust	1	0	4	2	0	0
Whittington Health NHS Trust	1	1	4	4	4	4
Wirral University Teaching Hospital NHS Foundation Trust	2	0	0	-	-	-
Worcestershire Acute Hospitals NHS Trust	3	3	0	-	-	-
Wrightington, Wigan & Leigh NHS Foundation Trust	3	0	8	5	1	8
Wye Valley NHS Trust	1	0	4	2	2	1
Yeovil District Hospital NHS Foundation Trust	1	1	6	6	6	6
York Teaching Hospitals NHS Foundation Trust	3	3	7	7	7	7

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