JBDS-IP

Joint British Diabetes Societies

for inpatient care

A good inpatient diabetes service

July 2019

ABCD

Association of British Clinical Diabetologists

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Foreword

This guideline is a summary of best practice in adult inpatient diabetes care, based on the suite of Joint British Diabetes Societies (JBDS) for Inpatient Care guidelines which have been published since 2011. The full guidelines are available on the ABCD and Diabetes UK websites[1] and have been widely adopted into UK practice. Nearly all UK Trusts now use most of the JBDS guidance.[2]

We felt it would be valuable for clinical teams (whether diabetes teams or generalists), policy makers, and commissioners to have all of the key elements of these guidelines condensed, and summarised in one place for easy reference. Implementation of these guidelines will lead to better patient care for people with diabetes who currently suffer too much unnecessary harm in hospital.

We have tried in these guidelines to link each area to key policy documents and publications for further reference and reading, and linked the clinical guidance with current national improvement strategies in the area of inpatient diabetes care. In particular, the pivotal Diabetes UK report on 'Making hospitals safe for people with diabetes'[3] and the 2018/19 GIRFT process.[4]

If you would like to comment on these guidelines, make suggestions or corrections, please let us know (christine.jones@nnuh.nhs.uk or mike.sampson@nnuh.nhs.uk).

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[1] ABCD website: abcd.care/joint-british-diabetes-societies-jbds-inpatient-care-group
Diabetes UK website:www.diabetes.org.uk/joint-british-diabetes-society

[2] Sampson M, Jones C; Joint British Diabetes Societies (JBDS) for Inpatient Care. Joint British Diabetes Societies for Inpatient Care: clinical guidelines and improving inpatient diabetes care. Diabet Med. 2018 Aug;35(8):988-991.

[3] https://www.diabetes.org.uk/professionals/resources/improving-inpatient-care-programme

[4] http://gettingitrightfirsttime.co.uk/medical-specialties/diabetes/

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Contents

1. The experience of people with diabetes during an inpatient stay

David Jones, Emily Watts, Diabetes UK

- All clinicians who talk to people with diabetes are aware that many are deeply unhappy about the quality of diabetes care they receive during a hospital admission. Much of this unhappiness relates to loss of personal control over insulin management and self-monitoring, to the quality of inpatient meals and meal choices, and to an objectively correct view that many hospital staff lack training and confidence in diabetes management.[5] This unhappiness has been a recurrent theme in patient surveys over several decades, and a common source of complaints to Diabetes UK about the quality of inpatient care

- In the 2017 National Diabetes Inpatient Audit (NaDIA)[6], 8,696 people with diabetes gave their views on their experiences of the diabetes care they had received while in hospital. Most people (84%) completing the survey said that they were 'very satisfied' or 'satisfied' with their diabetes care while in hospital. However, there is a wide variation in inpatient satisfaction across hospital sites, with some hospitals having consistently low levels of satisfaction across the measures

- Despite this high level of satisfaction with overall inpatient care, the percentage of people satisfied with staff knowledge has remained stagnant. In 2011, 66.8% said they were satisfied with staff knowledge of diabetes, in 2017 the figure was lower at 65%. Patient satisfaction with the level of staff awareness and knowledge of diabetes varies by over 75 percentage points across hospital sites

- When asked about food during their hospital stay, only 54% of patients were satisfied with their meal choice and 62% with meal timing. Patient satisfaction with hospital meals varies by over 60 percentage points across hospital sites. In the lowest performing hospital site, less than 1 in 10 inpatients were satisfied with their meal choice and less than 1 in 20 were satisfied with the meal timing[7]

- Finally, the NaDIA shows that people with diabetes experience unnecessary harm in hospital regularly. One in 25 people with Type 1 diabetes will experience diabetic ketoacidosis (DKA) in hospital. That means you are more likely to experience DKA in hospital than out. One in 5 people will experience an episode of hypoglycaemia and 1 in 3 a medication error. All hospitals should be as safe as possible for people with diabetes. At the moment they are not.

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[5] T George JT, Warriner D, McGrane DJ et al TOPDOC Diabetes Study Team. Lack of confidence among trainee doctors in the management of diabetes: the Trainees Own Perception of Delivery of Care (TOPDOC) Diabetes Study. QJM. 2011 Sep;104(9):761-6.

[6] NaDIA data https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017

[7] Rutter CL, Jones C, Dhatariya KK et al Determining in-patient diabetes treatment satisfaction in the UK--the DIPSat study. Diabet Med. 2013 30:731-8

Diabetes UK survey (2016)

- In 2016 Diabetes UK surveyed members with diabetes to understand the emotional impact of problems they had experienced in hospital. We contacted 875 members randomly selected from a population who had agreed to permission for further contact about diabetes service experiences. 96 people responded: mostly (61 percent) with type 1 diabetes. We also ran a small focus group (4 people – all insulin treated) to go more deeply into the issues with a group of people who had reported lasting effects, to better understand the impact and what they would like to see in future

- The responses describe feelings of a lack of control, poor trust and lasting anxiety. 56% of respondents said they did not feel in control of their diabetes while in hospital. Over half (53%) responding said they did not trust the healthcare professionals who cared for them in hospital. 60% of those responding to a question about issues in hospital had experienced some complication, ranging from a mild hypo to DKA

- Nearly half of respondents also reported lasting impact from the experience. These include concern about daily management of diabetes and worry about having to go back in to hospital in future

- The story they told was one of 'terror' of hospital and the impact of a hospital stay on the everyday management of diabetes. They described anxiety and pressure to maintain control, driven by fear of ending up in hospital rather than a desire to live well. They also described the frustration and stress of needing to advocate for themselves at a time of huge vulnerability

- Two strong themes emerged, a lack of care from non-specialist staff, particularly at night and weekends and a lack of respect for their knowledge. They also had issues with the food available (timing, choice and nutritional information).

What would people with diabetes like to see?

We asked the focus group to identify the things they would like to see in place based on their experience of hospital care. The group listed the area they thought would make a difference:

- *"Specialists should see you as you come into the hospital, however you come in"*

- *"Everyone should have a proper plan for managing their diabetes (and any other conditions) worked out with someone who understands. It would be adapted as needed and not stuck to rigidly."*

- *"People should be able to feel trust in staff's skills and knowledge. They should feel that there are enough staff available and that the staff have the necessary skills and knowledge to care for them."*

- *"Medication management should be competent and personalised. The staff involved will have the skills to be flexible"*

- *"Staff understand the boundaries of their knowledge and skills and will refer to someone more appropriate when needed."*

- *"Information needs to travel with the patient to avoid repetition and missing of vital information (or be readily accessible through electronic systems)."*

- *"Doctors need to change their attitude and behaviours – listen and don't be offended when someone asks questions or knows more"*

- *"Please make sure the menu is appropriate for people with diabetes (including the individual needs of people with additional challenges)"*

- *"Improve the timing of food"*

- *"Give people information about carbs and other nutritional elements of the meals provided"*

- *"People with diabetes can help by training staff across the hospital – to bring their knowledge and to use their experiences as learning points"*

These observations from people with diabetes highlight the issues they face during an inpatient stay, the risk of harm, and the safety issues all clinicians are aware of.
The following summaries of key JBDS guidance we hope will help clinicians improve inpatient care and safety.

2. NaDIA data: what has changed, what hasn't changed, and what should we do about it?

Gerry Rayman

Background

The National Diabetes Inpatient Audit (NaDIA) in England and Wales[8] is the world's first national audit of bedside inpatient diabetes care. It began as a pilot in 2009, and has occurred annually since.
Unlike hospital activity data which provides important data on length of stay, readmissions and mortality, NaDIA provides information on the actual care in patients with diabetes receive.

The audit is conducted on a single day in a week in September or October in over 98% of all acute hospitals in England and Wales. It surveys every inpatient to find those with diabetes, then evaluates the care received, and documents any complications arising during the admission, as well as treatment and management errors, and structures of care such as inpatient diabetes specialist staffing levels.
It also obtains direct feedback from patients on their inpatient experience.

Uniquely, NaDIA allows hospitals to benchmark against other hospitals and as well as against themselves as a means of improving care. The key findings of the NaDIA 2017 report, the 7th iteration provided data on 16,010 inpatients with diabetes admitted to 208 hospital sites in England and Wales are summarised in Tables 1 and 2 with comparisons made with the 2011 NaDIA, the first year in which Wales was included. NaDIA data on foot disease is presented in the section on 'Diabetic foot disease in hospital'.

Change in Prevalence The first NaDIA (2011) found that 14.9% of inpatient beds were occupied by people with diabetes; higher that the 10% often quoted from Hospital Episode Statistics data and three times the prevalence of the condition in the general population.[9,10] Since then there has been a yearly increase, and in 2017, diabetes accounted for more than one in six inpatient beds in England and Wales (17.9%). Assuming the current trajectory remains unchanged by 2030 this will exceed one in four inpatients and indeed in some UK hospitals the prevalence is already as high as 30%.

Staffing levels The pilot NaDIA found worrying deficiencies in staffing at all levels but particularly of Diabetes Inpatient Specialist Nurses (DISNs), Dieticians, Podiatrists and Diabetes Multidisciplinary Foot Teams/Services (MDFS). There has been some improvement in the provision of MDFS, partly driven by Diabetes UK's 'Putting Feet First' campaign and NICE guidance[11,12] However, there has been little or no change in other staffing levels (Table 2). Disappointingly, nearly 30% of Trusts still do not have a dedicated DISN, which may explain why 30% of patients who require support from a DISN are not seen.

Medication Errors Medication and insulin errors, though significantly reduced, remain at unacceptable levels (Table 2). That there is an insulin error in four of ten type 1 diabetes charts is particularly concerning. Inpatients with diabetes were more likely to have

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[8] National Diabetes Inpatient Audit 2017; https://files.digital.nhs.uk/pdf/s/7/nadia-17-rep.pdf

[9] Whitston M, Chung S, Henderson J, Young B. What can be learned about the impact of diabetes on hospital admissions from routinely recorded data? Diabet Med. 2012 Sep;29(9):1199-205

[10] IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Ogurtsova K, da Rocha Fernandes J, et al Diabetes Research and Clinical Practice 2017: 128; 40-50

[11] Diabetes UK. Putting Feet First. Commissioning specialist services for the management and prevention of diabetic foot disease in hospital. http://www.footindiabetes.org/media/FDUK/PuttingfeetfirstJun09FINAL.pdf

[12] NICE ng19. Diabetic Foot Problems: prevention and management https://www.nice.org.uk/guidance/ng19

medication errors if treated on a surgical ward than on a medical ward and this remained the case throughout the NaDIA years.

Glucose control - Good Glucose Days, Hypoglycaemia, Diabetic Ketoacidosis and Hyperglycaemic Hyperosmolar Syndrome
Good glucose days, defined as no day with a blood glucose below 4.0mmol/L and/or 2 values above 11.1mmol/L adjusted for length of stay expressed per 7 days, have significantly improved since 2011 from 4.1 to 4.6 days in 2017. However, in people with type 1 diabetes only 2.6 days of 7 were good glucose days. NaDIA revealed concerning levels of hypoglycaemia. In 2011, 25.7% of people with diabetes experienced a hypoglycaemic episode during their admission; 10.6% were severe. Since, there have been year on year improvements; in 2017, the respective figures were 18.4% and 7.0%, reductions of 28% and 34% respectively. Importantly, hypoglycaemic episodes requiring injectable rescue treatment (IV glucose or IV/IM glucagon) have fallen from 2.1% to 1.3%. Although these are welcome and significant improvements, there are still in the region of 10,000 of the latter life threatening hypoglycaemic events a year. Unfortunately, there has been no reduction in cases of Diabetic Ketoacidosis (DKA) or Hyperosmolar Hyperglycaemic State (HHS) occurring in hospital. Shockingly, one in twenty-five patients with type 1 diabetes experiences DKA during their hospital stay due to inadequate care. Extrapolating from the number of cases in the audit week it is estimated that there were approximately 2,200 episodes of DKA and 900 episodes of HHS occurring in hospital in 2017.

Intravenous Insulin Infusions In critically ill patients and those unable to eat or drink, continuous intravenous insulin infusion is the choice method for achieving and maintaining glucose control. However, DKA, hypoglycaemia, fluid overload, hypokalaemia and/or hyponatraemia and cannula site infection are potential risks of intravenous insulin infusion. Given these risks, and the discomfort and intrusion of frequent monitoring especially overnight for the patient, intravenous insulin infusions should only be used where absolutely necessary. In the NaDIA 2011,

11.2 % of patients had received an intravenous insulin infusion in the audit week, 7.0% of infusions were considered unnecessary, 8.0% continued too long and in 18.9% of patients, the transfer back to subcutaneous insulin not well managed. Fortunately, the situation has improved and in 2017, the respective figures were 8.2%, 6.1%, 7.1, and 16.4%.

Use of new technologies Glycaemic control in hospitalised patients with diabetes requires accurate near-patient glucose monitoring systems. Currently, fourth-generation point-of-care blood glucose data management systems are available that connect seamless and bi-directionally with wireless enabled point-of-care BG meters to provide remote monitoring.[13] These can be configured to provide alerts of out of range glucose results to enable early review of medication to prevent recurrent hypoglycaemia. These have been effectively utilised in some trusts to improve glycaemic control, but in 2013 only 33% of hospital sites utilised such meters; by 2017 this had increased to 55.1%. Electronic patient records (EPR) and electronic prescribing (EP) were uncommon in 2011. The 2017 survey found that EPR and EP were available in 39% and 29.3% of trusts. The NaDIA found marginal improvements in medication errors in trusts that had introduced EPRs and EP. Although there has been progress in introducing these new technologies, in 2017 only 12% of trusts have access to all three technologies.

Patient Feedback There has been little improvement in patient empowerment. A significant proportion of patients report that they are not sufficiently involved in their own diabetes care, including being allowed to self-monitor their blood glucose, self-administer insulin and contribute to decisions on insulin dose adjustment. It is notable that whereas there has been improvement or no change in all previously described NaDIA data, patients' satisfaction of hospital meals is the only metric that has worsened. In 2011 only 64.4% were satisfied with the meal choice and 70% with the timing of the meal in relation to insulin administration; in 2017 this has worsened to 53.8% and 62.4% in 2011, respectively.

[13] Rajendran R, Rayman G. Point-of-care blood glucose testing for diabetes care in hospitalized patients: an evidence-based review. J Diabetes Sci Technol. 2014 Nov;8(6):1081-90

Table 1

Staffing Provision

Percentage of sites with:	2011		2017
No inpatient DISNs	31.9%		27.9%
No inpatient podiatric service for people with diabetes	33.6%		31.7%
No specialist inpatient dietetic provision for people with diabetes	70.8%		73.2%
No Multidisciplinary Foot Service	41.7%		20%
7 day DISN provision	N/A		8.8%

Table 2

Care Delivery and Harms

Metric	2011		2017
Percentage of patients seen by diabetes team	57.8%		71.8%
Good glucose days (All patients)	4.1 of 7 days		4.6 of 7 days
Good glucose days (Type 1)	2.1 of 7 days		2.6 of 7 days
Patients on an intravenous insulin infusion (IVII) during the audit week	11.2%		8.2%
IVII considered inappropriate	7.0%		6.1%
Transfer from IVII to sc insulin not managed appropriately	18.9%		16.4%
1-2hrly BG monitoring on IVII	46.1%		57.8%
Medication errors	39.9%		31.2%
Type 1 insulin errors	47.8%		40.4%
Hypos all	25.7%		18.4%
Hypos severe	10.6%		7.9%
Hypos requiring IV/IM rescue treatment	2.2%		1.3%
Hospital acquired foot ulceration	1.60%*		0.97%

*2012 data as that for 2011 was omitted from the questionnaire.

3. The costs of in hospital diabetes care in the UK

Mike Sampson

- This brief summary outlines for commissioners and clinical teams the costs associated with inpatient diabetes care activity in the UK. It should be emphasised that the costs associated with inpatient diabetes care are:

  - attributable to hospital admissions and emergency attendance due to emergency specific diabetes determined complications (largely severe hypoglycaemia (SH), diabetic foot disease (DFD), or DKA

  - attributable to age adjusted excess length of inpatient stay in diabetes inpatients

  - associated with the elective and emergency inpatient population, admitted with other conditions, who have associated diabetes

  - associated with a bias towards admissions for people with diabetes at key points such as A/E attendance or elective day case surgery.

Costs attributable to non-elective diabetes determined complications

- These data are summarised (Table 1) for SH, DFD and DKA. There is a strong clinical evidence base for strategies that reduce admission rates and costs (see Chapter 4)

- Modelling based on ambulance call out rates in the UK and the prevalence of SH calls, suggests there are between 48,400 and 98,736 SH 999 Ambulance call outs per annum.[14][15] If we assume that one-third of these calls are from repeat callers,[16][17] then there are perhaps up to 33,000 Ambulance SH calls per annum generated by repeat callers

- The conveyance rate to hospital is commonly recorded as 21% - 35.3 %[18][19] which implies a maximum 32,500 A&E transports to Emergency Departments per annum in the UK, of which about one third are for people making repeat calls to emergency services. About 11,579 SH hospital admissions were recorded in 2012 in England based on HES data[20].

[14] JBDS admissions avoidance
https://abcd.care/sites/abcd.care/files/resources/JBDS_IP_Admissions_Avoidance_Diabetes.pdf

[15] Duncan EAS, Fitzpatrick D. Improving self - referral for diabetes care following hypoglycaemic emergencies: a feasibility study with linked patients data analysis. *BMC Emerg. Med* 2016; 16:13

[16] Sampson M, Bailey M, Clark J et al A new integrated care pathway for ambulance attended severe hypoglycaemia in the East of England: The Eastern Academic Health Science Network (EAHSN) model. Diabetes Res Clin Pract. 2017 133:50-59

[17] Barranco RJ, Gomez – Peralta F, Abreu C et al. Incidence and care related costs of severe hypoglycaemia requiring emergency treatment in Andalusia (Spain): the PAUEPAD project. *Diabet Med* 2015; 32 : 1520 – 26

[18] Farmer AJ, Brookbank KJ, Keech ML, England EJ, Deakin CD. Incidence and costs of severe hypoglycaemia requiring attendance by the emergency medical services in South Central England. *Diabet. Med* 2012; 29: 1447 – 50

[19] Brackenridge A, Wallbank H, Lawrenson RA, Russell – Jones D. Emergency management of diabetes and hypoglycaemia. *Emerg. Med J* 2006; 23: 183 - 85

[20] Zaccardi F, Davies MJ, Dhalwani NNet al   Trends in hospital admissions for hypoglycaemia in England: aretrospective, observational study. Lancet Diabetes Endocrinol. 2016 4 677-85

Table 1 Estimated costs attributable to non – elective diabetes emergency admissions and ambulance attendances

	Episodes	Costs
Diabetic foot disease	37,308	£155.7 M
Diabetic ketoacidosis *	21,116	£43,583,421
Severe hypoglycaemia (SH) **	11,579	
Ambulance SH attendance	93,090	£12.69 M

* Based on 21,116 in HES data and estimated costs[21]

** Hospital admissions

*** Based on EAAT data (2013) adjusted for population of 50 million, 80% see and treat rate, tariff costs £92 or £314 for onward transport to A/E

- The costs associated with DFD have been well described[22] and activity and costs for inpatient care of DFD can be based on NDA data (Table 1) or from economic modelling on national datasets[23] for England in 2011. 8.8% of all diabetes recorded admissions recorded ulcer care or amputation. DFD was associated with a 2.51-fold (95% CI 2.43-2.59) increase in length of stay and a total estimated inpatient tariff costs of £274M

- The costs associated with DKA can be modelled on current activity (https://improvement.nhs.uk/resources/national-tariff-1719/).

Costs attributable to prolonged age adjusted length of stay in the diabetes inpatient population

- The costs associated with prolonged length of stay in the inpatient diabetes population in England have been estimated.[24] This modelling based on 2010 HES data suggests excess bed days per annum of 487,561 for non-elective admissions and 120,289 for elective admissions

- These excess bed days incurred an estimated tariff cost of £129.2M.

Costs associated with the elective and emergency inpatient population, admitted with other conditions, who have associated diabetes

- The tariff costs associated with elective admissions, non-elective admissions and a bias against day case surgery, for people with a diagnostic code of diabetes (2010) was estimated at £2,510M[25]

- The total excess estimated excess costs of inpatient diabetes care in terms of tariff associated with excess admissions, prolonged length of stay, and bias against day case surgery is estimated at between £573 and £681M per annum.[26] These data are almost 10 years old and are likely to have increased.

[21] Dhatariya KK et al Diab Med 2017 ; 34: 1361 - 1366

[22] https://diabetes-resources-production.s3-eu-west-1.amazonaws.com/diabetes-storage/migration/pdf/Diabetic%2520foot-care%2520in%2520England%2C%2520An%2520economic%2520case%2520study%2520%28January%25202017%29.pdf

[23] Kerr M et al Costs of diabetic foot disease in the National Health Service in England, Diab Med 2014 Dec, 13(12): 1498-1504

[24] Kerr M. Inpatient care for people with diabetes – the economic case for change. 2011 Insight Health Economics

[25] Kerr M. Inpatient care for people with diabetes – the economic case for change. 2011 Insight Health Economics

[26] Kerr M. Inpatient care for people with diabetes – the economic case for change. 2011 Insight Health Economics

How can commissioners and Acute Trusts reduce costs associated with inpatient diabetes care?

- There is a strong evidence base that a dedicated inpatient diabetes specialist nurse (DISN) reduces length of stay and excess bed occupancy for people with diabetes[27] and yet the NaDIA data (Chapter 2) suggests about 30% of UK Trusts have still not yet invested in this service model. This model is cost effective as an investment to save strategy in terms of reduced bed occupancy even apart from the quality and safety arguments

- An active systems wide admissions avoidance policy is summarised in this document (Chapter 4), and elsewhere.[28] The presence of specialist teams at critical points in the patient pathway (A/E, admissions units) reduced diabetes bed occupancy and is underused as a model

- An enhanced inpatient service and accurate discharge planning is associated with reduced bed occupancy through a reduced re admission rate[29 30 31]

- Acute Trusts and commissioners should examine local NaDIA data (Chapter 2) for local in hospital hypoglycaemia and hyperglycaemia prevalences. Inpatient hypoglycaemia is associated with significantly higher care costs and prolonged length of stay and enhanced inpatient services focussed on glycaemic extremes are associated with improved outcomes and reduced length of stay[32 33]

- The monetised tariffing arrangement for inpatient activity in England (less so in other UK nations) makes cost impact for activity in England easier to describe, but these data are likely to be matched by equivalent costs in Scotland and other UK nations.[34]

[27] Kerr M. Inpatient care for people with diabetes – the economic case for change. 2011 Insight Health Economics

[28] JBDS admissions avoidance: https://abcd.care/sites/abcd.care/files/resources/JBDS_IP_Admissions_Avoidance_Diabetes.pdf

[29] Healy SJ, Black D, Harris C et al. Inpatient Diabetes Education Is Associated With Less Frequent Hospital Readmission Among Patients With Poor Glycemic Control Diabetes Care. 2013 Oct; 36(10): 2960–2967.

[30] Joint British Diabetes Societies for Inpatient Care (JBDS) Discharge planning for adult inpatients with diabetes. https://abcd.care/sites/abcd.care/files/resources/JBDS_Discharge_Planning_amendment_RCN_2017.pdf

[31] McEwan P, Thorsted BL, Wolden M et al. Healthcare resource implications of hypoglycaemia related hospital admissions and inpatient hypoglycaemia. BMJ Open Diab. Res Care 2015 3: 000057

[32] Herring R, Russel – Jones DL, Pengilley C. et al Management of raised glucose, a clinical decision tool to reduce length of stay of patients with hyperglycaemia. Diabetic Med 2013 30(1) 81 - 87

[33] Govan L, Wu O, Briggs A et al. Inpatient costs for people with type 1 and type 2 diabetes in Scotland: a study from the Scottish Diabetes Research Network epidemiology group. Diabetologia
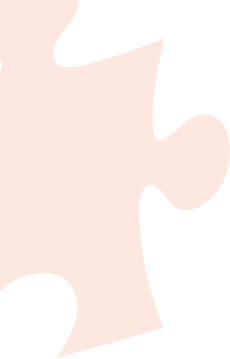
[34] Govan L, Wu O, Briggs A et al Inpatient costs for people with type 1 and type 2 diabetes in Scotland: a study from the Scottish Diabetes Research Network Epidemiology Group.Diabetologia. 2011 54: 2000-8.

4. Diabetes admissions avoidance

Belinda Allan

- JBDS guidance on admissions avoidance is published[35]

- The increasing demands on primary care to look after an ageing population with multi-morbidity and an unsustainable rise in Emergency Department attendances, means the NHS is being stretched to an unsustainable point

- There is also significant unacceptable variability in admission rates and readmission rates due to diabetes. We know that 17% of all Acute Beds in the UK are now occupied by someone with diabetes and that better models of care have the potential to reduce this variability and improve outcomes, and potentially reduce costs and improve bed capacity (Chapter 2)

- The JBDS admissions avoidance document contains examples of interventions that have had an impact on reducing hospital admissions due to diabetes throughout. It is aimed at commissioners and clinical teams involved in providing diabetes care, and makes the following recommendations that policy makers and commissioning teams can follow and includes:

  - Obtain data on overall diabetes admission rates, diabetes specific admission rates DKA, severe hypoglycaemia, hospital admission of care home residents with diabetes, and diabetic foot disease), and include data from regional Ambulance Trusts, against which to benchmark

  - Obtain data for their area on day case surgery listing rates, and readmission rates, for diabetes and non-diabetes patients to assess the extent to which improvements in care pathways could impact on surgical outcomes and length of stay

- Commission a whole systems review of diabetes admissions in collaboration with primary and secondary care, clinical commissioning groups (CCG), Ambulance Trusts, industry, and local clinical networks to determine local patterns and triggers for diabetes admissions

- Commission a modelled realistic estimate of what are truly avoidable diabetes admissions based on this data, and a diabetes service shown to reduce avoidable diabetes admissions

- Commission a service model based on adequate DISN numbers and diabetes specialist sessional time to develop and sustain an improved day case surgery pathway for people with diabetes that delivers a day case listing surgery rate the same as the non-diabetes population

- National Ambulance Service Medical Directors position statement on severe hypoglycaemia (July 2016) and patient consent

- All patients, of all ages, who have had an ambulance response to a hypoglycaemic episode or seizure, should automatically be referred for follow up. The issue was discussed at the UK Council of Caldicott Guardians on 4th May 2016. They recommended that, due to issues relating to wider public interest, patients should always be referred with or without consent

- Commission a diabetes service that identifies individuals who are frequently re-admitted with diabetes specific emergencies, or who make frequent 999

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[35] JBDS admissions https://abcd.care/sites/abcd.care/files/resources/JBDS_IP_Admissions_Avoidance_Diabetes.pdf

hypoglycaemia call outs, and support them with intensive education and access to the diabetes specialist team. The national Caldecott guardian and UK Ambulance Trust Medical Directors have confirmed that clinicians should, and are permitted, to let the patients normal clinical team know about a SH episode

- Commission a diabetes service that is associated with a lower DKA admission rate in adolescents and adults with Type 1 diabetes, as half of these admissions are avoidable

- Commission an adolescent and transitional diabetes service that identifies highest risk Type 1 patients such as those with co-existing psychiatric or behavioural disorders. This service should ensure structured follow up, a focus on missed appointments, appointment reminders by text or mobile phone, and meet the Best Practice Tariff criteria for paediatric and adolescent diabetes care

- Commission a diabetes foot care service, in line with NICE guidance NG19[36]

- In collaboration with Ambulance Trusts, commission a single point of contact model for the management of severe hypoglycaemia that employs a 'see and treat' policy with a low carry on rate to Emergency Departments. There should be a pathway for the duration of observation and safe discharge from emergency units, and a clear follow up plan involving the diabetes specialist team

- Commission a diabetes service that supports diabetes education, foot care and management in residential and nursing homes; identifying highest risk residents may reduce admissions by 50%. Good pre-discharge planning is essential for the frail elderly, as they are at high risk of re-admission.

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[36] https://www.nice.org.uk/guidance/ng19

5. Education and training of health care professionals in inpatient diabetes

Erwin Castro and Umesh Dashora

- Most inpatients with diabetes in UK hospitals are not under the care of the diabetes specialist team. Unfortunately, the majority of junior medical staff in UK hospitals lack confidence in the management of diabetes, feel uncertain about optimising inpatient glycaemic control, and recognise the need for further training.[37] There are similar shortfalls in the training, experience, and confidence in many inpatient nurse teams and midwives in managing diabetes[38]

- Often there is no service provision specific to education in the area of inpatient diabetes in many Trusts. Although there are often numerous initiatives from multiple diabetes teams to provide regular training, there is commonly a lack of engagement from Acute Trusts in making training in core areas of inpatient diabetes management part of mandatory training

- A structured competency assessment should be in place for all staff in Acute Trusts who have contact with inpatients with diabetes. Competency is defined as a level of performance demonstrating the effective application of knowledge, skill and judgement. A structured, skill based competency assessment, should be developed for managing hypoglycaemia and DKA, managing insulin infusions, managing diabetes and parenteral nutrition, and in patients treated with steroids. These core competencies must be established not just for physicians and nurses but also for dietitians, midwives, healthcare assistants, allied healthcare professionals and pharmacists as the primary providers of patient care and education[39]

- A proposed educational content of mandatory and competency training for health care professionals is summarised (Panel 1).

[37] George JT, Warriner D, McGrane DJ et al. Lack of confidence among trainee doctors in the management of diabetes: The Trainees own perception of delivery of care. QJMEd 2011; 9: 761 – 766

[38] Holmes C, Dyer P. Diabetes Training for nurses; the effectiveness of an inpatient diabetes half day workshop. Journal Diabetes Nursing 2013; 3 86 – 94

[39] International Council of Nurses: The scope of practice, standards and competencies of the advanced practice nurse. 2008. Geneva, Switzerland. Dashora U, Huw AD, Bennett S, Goodchild A, Hugason-Briem J, Johnson G, Kitt A, Schreiner A, Todd D, Yiallorous J. Findings of a nationwide survey of the diabetes education and training needs of midwives in the UK. British Journal of Diabetes. 2018 Dec 12;18(4):147-53.

Panel 1. The educational content of mandatory and competency training for health care professionals.

Nurses
- 1 hour mandatory training on acute diabetes emergencies as part of the induction programme for new nurses joining the Trust, with structured competency assessment to be completed within 3 months after attendance
- 1 hour mandatory training on the use of intravenous insulin as part of the Intravenous additives study day with structured competency assessment to be completed within 3 months after attendance
- 3 yearly half day mandatory diabetes study day
- Mandatory insulin safety training e-learning annually
- Annual 1 hours essential/mandatory Point of Care Testing (POCT) training for those who are involved in POCT.

Health care assistants
- Annual 1 hours essential/mandatory POCT training for those who are involved in POCT
- 2 hour mandatory training on diabetes as part of the induction programme for new HCAs with structured competency assessment to be completed within 3 months after attendance
- 3 yearly half day mandatory diabetes study day.

Doctors including registrars and pharmacists
- 1 hour diabetes prescribing training as part of the induction programme for new doctors and pharmacists joining the Trust
- 1 hour session for FY1, FY2 and CMTs on the management of inpatients with diabetes including acute diabetes emergencies
- 1 hour session on diabetes emergencies for the doctors in Accident and Emergency
- Mandatory insulin safety e=-learning annually.

Midwives
- 2 hour essential/mandatory training on Diabetes and Gestational Diabetes as part of the induction programme for new nurses joining the Trust, with structured competency assessment to be completed within 3 months after attendance
- 1 hour essential/mandatory training on the use of intravenous insulin as part of the Intravenous additives study day with structured competency assessment to be completed within 3 months after attendance
- 3 yearly whole day essential/mandatory diabetes study day
- Essential/mandatory safe use of insulin e-learning annually
- Annual 1 hour essential/mandatory POCT training for those who are involved in POCT.

Allied Healthcare Professionals (including dietitians):
- 1 hour essential/mandatory training on diabetes covering hypoglycaemia recognition and management as part of the induction programme for new staff joining the Trust.

The areas to be covered and key resources are summarised (Panel 2)

Panel 2.   Topics to be covered and key resources

- Types of diabetes
- Oral glucose lowering therapies, to include action, side effects, contraindications
- Insulin therapies, to include basal bolus subcutaneous insulin management, correction insulin doses, insulin action profile, timing, duration of action, storage and use of pen devices, vials and syringes
- Prescribing oral glucose lowering therapies
- Prescribing insulin
- Hospital management of hypoglycaemia in adults with diabetes
- The management of diabetic ketoacidosis (DKA) in adults
- Management of adults with diabetes undergoing surgery
- Self-management of diabetes in hospital
- Glycaemic management during enteral feeding in stroke
- Management of Hyperosmolar Hyperglycaemic State (HHS)
- Steroid use for inpatients with diabetes
- Variable rate insulin infusion (VRII) for medical inpatients with diabetes
- Management of adults with diabetes on the haemodialysis unit (as appropriate)
- Managing diabetes during and after delivery
- Diabetes in inpatients with mental health issues
- New diagnosis of diabetes in inpatients
- Insulin safety e-learning

Panel 3.   Key references/links

- http://www.e-lfh.org.uk/programmes/safe-use-of-insulin/
- http://www.healthcareea.co.uk/safe_use_of_insulin_online_training
- Joint British Diabetes Societies for inpatient care guidelines
  https://abcd.care/joint-british-diabetes-societies-jbds-inpatient-care-group
- TREND-UK: 2015. An Integrated Career and Competency Framework for Diabetes Nursing, 4th ed. Available at: https://trend-uk.org/resources/
- Dashora U, Huw AD, Bennett S, Goodchild A, Hugason-Briem J, Johnson G, Kitt A, Schreiner A, Todd D, Yiallorous J. Findings of a nationwide survey of the diabetes education and training needs of midwives in the UK. British Journal of Diabetes. 2018 Dec 12;18(4):147-53.

Others courses/ Links available for diabetes education for health professionals:
- An introductory diabetes course for health professionals accredited by the Royal college of Nursing can be completed online with a certificate at the end:
  https://www.diabetes.org.uk/Professionals/Training--competencies/Diabetes-in-Healthcare/?gclid=CjwKCAiAxarQBRAmEiwA6YcGKMcEyN1d9J7hjFAWOoansDg8ug IsNFT2KCbsbTH1-VlqJSHaGVo47BoCxCoQAvD_BwE
- https://rcni.com/hosted-content/rcn/diabetes/diabetes-essentials

6. Variable Rate Intravenous Insulin Infusions (VRIII) in medical inpatients

Stella George

The JBDS guidelines on VRIII in medical inpatients have been published[40] and the guideline is a practical guide to support the safe and effective use of VRIII by any healthcare professional who manages 'medical' inpatients with hyperglycaemia. Use of the guideline will help to harmonise the use of VRIII across the UK.

- Most acute trusts in the UK have VRIII guidelines but there is wide variation in the indications for its use, in rates of infusion, and in duration of use. This heterogeneity increases the risk of errors which can potentially lead to significant morbidity and mortality and also hinders study of the efficacy, optimisation and safety of VRIII

- Local and national audits have shown that VRIII (previously known as 'sliding scale' insulin) is frequently used in hospitals to manage hyperglycaemia, but often when not indicated, for too long, and with inappropriately managed subsequent transfer to other antidiabetic therapy[41]

- E learning modules are available to guide teams e.g. The NHS Diabetes e-learning module, 'Safe use of Intravenous insulin infusion'.[42]

Indications for VRIII in medical inpatients

- Most acutely unwell medical patients with diabetes or hyperglycaemia can be managed without a VRIII, including patients who are eating and drinking normally

- A VRIII is indicated for patients with diabetes or hospital-related hyperglycaemia who are unable to take oral food/fluid and for whom adjustment of their own insulin regime is not possible, where the patient is vomiting, nil by mouth (and missing more than one meal), or severely ill with the need to achieve good control (e.g. with sepsis).

Targets and threshold for starting a VRIII

- The consensus view, based on limited evidence, recommends initiation of VRIII if CBG is >10.0mmol/L. Target blood glucose levels have not been established in trials but there is a consensus for a range between 6.0–10.0mmol/L, which should avoid risks associated with hyperglycaemia and hypoglycaemia. However, a range of 4.0–12.0mmol/L is sometimes acceptable, and the JBDS guidelines summarise these arguments in detail.

Safe use of a VRIII

In general

- The patients normal basal insulin should be continued, as this may help control blood glucose during the use of the VRIII and avoid rebound hyperglycaemia

- All other diabetes medications should be discontinued during VRIII

- Restart VRIII within 20 min of treating a hypoglycaemic episode to prevent rebound hyperglycaemia and possible ketosis)

- Monitoring during the VRIII should include hourly CBG measurements and regular review of insulin infusion rates to achieve glucose levels within the target range[43]

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[40] George S, Dale J, Stanisstreet D; Joint British Diabetes Societies (JBDS) for Inpatient Care; JBDS Medical VRIII Writing Group. A guideline for the use of variable rate intravenous insulin infusion in medical inpatients. Diabet Med. 2015 32(6):706-13

[41] NaDIA 2015. https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2015

[42] The six steps module: https://www.diabetesonthenet.com/course/the-six-steps-to-insulin-safety/details

[43] Dashora U, Sampson M, Castro E, Stanisstreet D, Jones C, Hillson R. The best joint pharmacy and diabetes team initiative to improve insulin and prescribing safety in hospital. British Journal of Diabetes. 2018 Dec 12;18(4):163-6

- Each day should include review of the continued need for VRIII, the clinical status of the patient (including fluid balance) and urea and electrolyte levels (with appropriate actions taken).

Suggested Insulin infusion rates

- Three different rates are recommended depending on patients' likely insulin sensitivity or previous total daily dose of insulin (See Appendix 1 at the end of this chapter for a sample prescription and monitoring chart)

- Patients may move between scales depending on their response to treatment. For patients persistently out of range, first ensure proper functioning of the cannula and infusion equipment, and that the substrate infusion is running at the correct rate

- If CBG remains >12.0mmol/L and is not falling on at least two consecutive measurements, the insulin infusion rate can be increased to the next scale (if the patient is already on an increased scale, employ a customised infusion and seek immediate advice from the diabetes team)

- Conversely, CBG 4.0–6.0mmol/L (on at least two consecutive measurements) may be too low for some patients (e.g. after a stroke or acute coronary syndrome). Options here are to decrease the insulin infusion rate or, if this has been done, to increase the substrate to 10% glucose or to prescribe a customised insulin infusion rate and promptly seek advice from the diabetes team (including to ensure that a VRIII is needed).

Interpreting blood ketones during a VRIII

- Measure capillary blood ketones in patients with type 1 diabetes who are unwell or who develop persistent hyperglycaemia whilst in hospital (2 readings >12.0 mmol/L at least one hour apart) and in patients with type 2 diabetes who are acutely unwell

- Urinary ketones may be used where blood ketone testing is unavailable; check venous blood bicarbonate and pH if urine ketones are ≥2+. If the patient fulfils biochemical criteria for DKA then they should be managed according to the appropriate guideline rather than a VRIII.

Management of intravenous fluids during a VRIII

- We recommend the use of a balanced electrolyte solution containing 0.45% NaCl with 5%glucose and 0.15% KCl (20mmol/L) or 0.3% KCl (40mmol/L), depending on potassium requirement, at 125 ml/h in euvolaemic patients. However, as these fluids are not widely available, acceptable alternatives are:

    5% glucose with 20mmol/L or 40mmol/L KCl or

    0.18% NaCl with 4% glucose with 0.15% KCl (20mmol/L) or 0.3% KCl (40mmol/L)

- Patients who are vomiting, pyrexial or dehydrated will need additional fluid, usually 0.9% NaCl, run alongside the fluid used as the glucose substrate. Consider using 10% glucose for patients with heart failure or severe renal or hepatic impairment to minimise risk of fluid overload.

Safe transfer to usual diabetes medication

- If the patient is on oral therapy only on admission and it is intended that they return to that on recovery, then return to usual oral therapy will only be appropriate when CBG targets on VRIII have been achieved and patient is eating and drinking reliably and is recovering from the precipitating illness/condition

- If the patient is on background insulin on admission (either in a premixed insulin or as part of a basal bolus regimen), background insulin should have been continued whilst on the VRIII or if it has been omitted for any reason it must be given at least 30 minutes prior to discontinuing the VRIII. Ideally this should be done at a meal time

- If the patient is insulin-naïve and the decision is made that a patient needs insulin going forward then, background insulin (mixed insulin or within a basal bolus regime) MUST be given prior to stopping the VRIII

- For any patient whose control on admission is suboptimal - seek advice from the diabetes team to optimise medication prior to discharge in Appendix 1.

For use for ALL medical in-patients receiving Variable Rate Intravenous Insulin Infusion (VRIII)
NEVER use an IV syringe to draw up insulin
NOT FOR USE IN CHILDREN
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard, Humulin I, Insuman basal
**Basal: Lantus (Glargine), Levemir (Detemir), Tresiba (Degludec), Toujeo
Hold off rapid or short acting insulin whilst on VRIII
Doctor: All prescriptions for insulin and fluids must be signed.
Nurse: All entries must be signed.

Ward	Consultant	Admission Date:
		Discharge Date:
Surname	First Name	
Hospital Number	Date of Birth / Age	
NHS Number		
Address		

	DOSING RATES (Please see the rate guide below)			
Rates ➔	**Standard Rate**	**Reduced Rate**	**Increased Rate**	**Customised Scale**
	Start on standard rate unless indicated	For use in insulin sensitive patients i.e. needing less than 24 units/day	For use in insulin resistant patients, i.e. needing more than 100 units/day	For use to bespoke rate
CBG Levels (mmol/L)⬇	Infusion Rate (units/hr = ml/hr)			
<4	Stop VRIII. Administer 100 ml IV 20% Glucose. Restart when CBG >4 mmol/L but at reduced rate			
	0	0	0	
4.1-8	1	0.5	2	
8.1-12	2	1	4	
12.1-16	4	2	6	
16.1-20.0	5	3	7	
20.1- 24.0	6	4	8	
>24.1	8	6	10	
Signed/Dated				
Print Name				

ENTRY CRITERIA:	RATE GUIDE
Start VRIII and fluids for: 1. NBM >1 missed meal 2. Type 1 diabetes with recurrent vomiting (exclude DKA) 3. Type 1 or 2 diabetes and severe illness with need to achieve good glycaemic control e.g. sepsis **Special circumstances:** For ACS, stroke, TPN/enteral feeding/steroids and pregnancy, follow local guidelines and seek advice from the diabetes team	**Standard Rate** Most patient will start here **Reduced Rate** Use this rate for insulin sensitive patients (i.e. needing <24 units/day) or when CBGs are persistently 4-6 mmol/L or dropping too fast **Increase Rate** Use this rate for patient who are likely to require more Insulin (on steroids; on >100 units of insulin prior to admission; or those not achieving target on Standard Rate) **Customised Rate** Use this to bespoke rate depending on co-morbidities If the patient is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 4 – 12 mmol/L
Check CBG every hour whilst on VRIII
Move to the increased rate if the CBG is > target and is not dropping over three consecutive hours by 3 mmol/L/hr or more
Move to the reduced rate if CBG falls below 4 mmol/L or is dropping too fast i.e. >3 mmol/L/hr

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date	SYRINGE PREPARATION			
							Prepared and administered by	**Date**	**Time started**	**Time stopped**
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per ml)	IV							

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION (caution with patients at risk of fluid overload)									
Date	Intravenous Fluid and Rate	Potassium See (K) guide	Alternative Rate	Prescriber's Signature	Nurse' Signature				
	500 ml 0.45% NaCl + 5% Dextrose to run at 125 ml/h								
	500 ml 0.45% NaCl + 5% Dextrose to run at 125 ml/h								

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA									
Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	100 ml	IV	15 min				

Potassium (K) Guide	Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
If K is >5.5 mmol/L- no K is to be added to the infusion fluid	Check U and E's on admission and at least once daily
If K is 3.5 – 5.5 mmol/L- use 0.30% (40 mmol/L) Potassium Chloride	
If K is <3.5 mmol/L- senior review needed as extra K needs to be given	

EXIT CRITERIA

STOP VRII when patient is able to eat and drink without nausea or vomiting. This should take place when the next meal-related subcutaneous insulin dose is due

Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

INTRAVENOUS INSULIN, CBG AND KETONES MONITORING RECORD SHEET

Guide:
Only use for patients on intravenous insulin regimen
(use different chart for patients on subcutaneous insulin)
Make sure the patient's hands are clean
Check CBG hourly
Check capillary blood ketone levels if CBG >20 mmol/L.
If DKA or HHS, follow DKA or HHS protocol

ADDRESSOGRAPH

LABEL

DATE	Time	CBG	Blood ketones	Hourly infusion rate (units/hr)	Volume left in syringe (ml)	Volume infused in one hour (ml)	Total volume infused (ml)	Signatures		KEY EVENTS/ NOTES

Our thanks to Dr Umesh Dashora and Erwin Castro for preparing examples of prescription charts here, and throughout this document.

7. The Management of Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycaemic Syndrome (HHS) in Adults

Ketan Dhatariya

Evolution of JBDS DKA guidelines

The original JBDS guideline came from the understanding that there was a variation in practice across the UK, and that this increased the risk of poor management. The initial version was created after many different DKA regimens from around the UK were examined and amalgamated. Where there were areas of consensus these were kept, and where there were areas of differences, we reached and agreed position on what was thought to be best practice. In 2013 the guidelines were updated to reflect new evidence and incorporate suggestions and comments made on the first edition. Most UK diabetes teams use them, and the incidence of hypoglycaemia and hypokalaemia with these guidelines have been described.[44][45] A condensed version for use 'at the front door' has also been developed.[46] Appendix 2 at the end of this chapter offers a sample prescription and monitoring chart for DKA and HHS.

The revised JBDS DKA guidelines suggest DKA diagnosis based on:

- Ketonaemia ≥3.0mmol/L OR significant ketonuria (2+ or greater on standard urine strips)

- Blood glucose >11.0mmol/L OR known to have diabetes mellitus

- Bicarbonate <15.0mmol/L OR venous pH of <7.3.

The key elements of DKA management

- Start intravenous 0.9% sodium chloride solution and a fixed rate intravenous insulin infusion (FRIII) at 0.1 units/kg/hour

- Only use a bolus dose of IV insulin if there is a delay in setting up the FRIII

- The rate of fluid replacement depends on the presenting systolic blood pressure
  - if it is <90mmHg, then 500ml 0.9% sodium chloride should be given over 15 minutes and repeated if necessary
  - If systolic BP is >90mmHg, then give 1 litre over 1 hour, then the next 2 litres over 2 hours each, then the next 2 litres over 4 hours each and then 6 hourly bags

- Symptoms, signs or biochemical evidence of increased severity should prompt urgent referral to a level 2 or 3 environment (HDU/ITU)

- Using only venous blood gases, aiming for:
  - a reduction of the blood ketone concentration by 0.5mmol/L/hour
  - an increase in the venous bicarbonate by 3.0mmol/L/hour
  - a reduction in capillary blood glucose by 3.0mmol/L/hour
  - maintaining potassium between 4.0 and 5.5mmol/L

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[44] Dhatariya KK, Nunney I, Higgins K, Sampson MJ, Iceton G. A national survey of the management of diabetic ketoacidosis in the UK in 2014. *Diabetic Med* 2016; **33**(2):252-260.

[45] Dhatariya K, Nunney I, Iceton G. Institutional factors in the management of adults with diabetic ketoacidosis in the UK: results of a national survey. *Diabetic Med* 2016; **33**(2):269-270.

[46] Joint British Diabetes Societies Inpatient Care Group. Abbreviated JBDS-IP DKA management guideline. http://www.diabetologists-abcd.org.uk/JBDS/Condensed_ADULT_DIABETIC_KETOACIDOSIS_(DKA)_MANAGEMENT_CHART_Aug_2017.pdf

- Where the patient has already been using a long acting basal insulin, this should be continued when a FRIII is being used

- Bicarbonate or phosphate replacement is not recommended

- Add 10% dextrose infusion once glucose concentrations drop to <14.0mmol/L

- Reliance on bicarbonate alone as a marker of resolution may be misleading due to hyperchloraemic metabolic acidosis due to high volumes of 0.9% sodium chloride administered

- Precipitating causes should be sought and treated

- If the expected rate of improvement of improvement is not achieved, then urgent senior advice should be sought

- Conversion to a VRIII should occur if the DKA has resolved but the patient is not eating and drinking normally

- Conversion to subcutaneous insulin should occur under the supervision of the diabetes team, and only when the patient is biochemically stable, and is eating and drinking normally - see section on VRIII

- Patients with DKA should be managed by a diabetes specialist team, and discharge planning (see Chapter 18) should include discussions of DKA avoidance, sick day rules, ketone testing, contact numbers and follow up arrangements.

The revised JBDS HHS guidelines suggest HHS diagnosis based on:

- Hypovolaemia – often severe

- Marked hyperglycaemia (>30mmol/L), without significant hyperketonaemia (<3.0mmol/L), or acidosis (pH>7.3, and bicarbonate>15.0mmol/L)

- Osmolality >320mosmol/kg [calculated as $2Na^+$ + glucose + urea].

Key elements of HHS management

- Use 0.9% sodium chloride solution as the fluid replacement of choice – the osmolality should fall (but sodium may initially rise). Only use 0.45% sodium chloride solution if the osmolality does not fall.

- Aim for a fall in serum sodium of no greater than 10mmol/L in 24 hours

- The glucose concentration should fall at no more than 5mmol/L per hour. Only start a low dose fixed rate intravenous insulin infusion (0.05 units/kg/hr) once the glucose concentration has stopped falling with intravenous fluids alone, OR if there is significant ketonaemia (>1.0mmol/L)

- Aim for positive fluid balance of 3-6 litres by 12 hours, with the remainder over the next 12 hours, although for those at risk of cardiovascular compromise slower fluid replacement may be appropriate

- Assessment for complications of treatment e.g. fluid overload, cerebral oedema or central pontine myelinosis (as indicated by a deteriorating conscious level) must be undertaken frequently (every 1-2 hours)

- Underlying precipitants must be identified and treated

- Prophylactic anticoagulation is required in most patients

- All patients should be assumed to be at high risk of foot ulceration if obtunded or uncooperative – the heels should be appropriately protected and daily foot checks undertaken (NICE 2015, NG19).

Appendix 2. An example of Intravenous Insulin and Fluid Protocol for DKA/HHS

<table>
<tr><td>For use for ALL ADULT (over 18 years) patients with a diagnosis of DKA
NOT FOR USE IN CHILDREN
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard®, Humulin I®, Insuman Basal®
**Basal: Lantus® (glargine), Levemir® (detemir), Tresiba® (degludec), Toujeo® (long acting glargine)
Doctor: All prescriptions for insulin and fluids must be signed
Nurse: All entries must be signed</td><td colspan="2">
Ward | **Consultant** | Admission Date:
Discharge Date:
Surname | First Name
Hospital Number | Date of Birth / Age
NHS Number
Address</td></tr>
</table>

ENTRY (diagnostic) CRITERIA (ALL must be ticked to establish diagnosis)

Established or new diagnosis of diabetes mellitus	☐
Capillary blood ketonaemia on Trust approved ketone meter of ≥ 3 mmol/L or ketonuria ++ or more on standard urine sticks	☐
Venous bicarbonate <15 mmol/L and/or venous pH <7.3	☐

If patient satisfies all ENTRY CRITERIA, commence insulin therapy (see BOX 1); intravenous fluid management (see BOX 2, BOX 3 and BOX 4); and intravenous fluid prescription (see BOX 5)

If patient has ketonaemia WITHOUT acidosis (pH>7.3 or HCO3>15 mmol/L, intravenous insulin therapy may not be required BUT intravenous fluid hydration and subcutaneous insulin dose correction may be necessary

BOX 1: INTRAVENOUS INSULIN THERAPY AND PRESCRIPTION | Weight/insulin dose reference Guide

A Fixed Rate Intravenous Insulin Infusion (FRIII) calculated on 0.1 units/kg body weight is recommended (see Weight/insulin dose Reference Guide)
It may be necessary to estimate the weight of the patient

Patient's Weight: _____ kg (Actual/Estimated)
Insulin dose per hour: _____ units   Date: _____
Print Name: _____   Signature: _____

Weight (in kg)	Insulin dose/hr (Units)	Weight (in kg)	Insulin dose/hr (Units)
*50-59	5	100-109	10
60-69	6	110-119	11
70-79	7	120-129	12
80-89	8	130-139	13
90-99	9	>140	*

If blood ketones not falling by at least 0.5 mmol/L/hr **OR** venous bicarbonate not rising by at least 3 mmol/L/hr **OR** CBG not falling by at least 3 mmol/L/hr- increase insulin infusion rate by 1.0 unit/hr until falling at target rates

*<50kg or >140kg: seek advice from the Diabetes Specialist Team

Date	Time	Adjusted dose (units/hr)	Prescriber Name	Prescriber Signature	Bleep

Drug (approved name)	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Actrapid®	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per mL)	IV			

BOX 2: INTRAVENOUS FLUID MANAGEMENT (Saline regime) CAUTION: Slower in young people aged 18-25 years, elderly, pregnant, heart or renal failure		BOX 3: INTRAVENOUS FLUID MANAGEMENT (Dextrose regime) Once CBG<14 mmol/L, or in the event of non-hyperglycaemic DKA presenting with CBG <14 mmol/L:
0.9% sodium chloride 1 litre (no KCl)	Over 1st hour	Give 10% Dextrose to run at 125 mls/hr AND
0.9% sodium chloride 1 litre (check K+)	Over next 2 hours	Continue saline as per Saline regime (see BOX 2)
0.9% sodium chloride 1 litre (check K+)	Over next 2 hours	Run through Saline and Dextrose regime in 2 separate lines at the SAME time
0.9% sodium chloride 1 litre (check K+)	Over next 4 hours	
0.9% sodium chloride 1 litre (check K+)	Over next 4 hours	Run Dextrose regime and insulin therapy in the same line via a three way non-return valve
Anticipate a fall in potassium and replace (see BOX 4)		

Re-assessment of cardio-vascular status at 12 hours is mandatory, further fluid may be required

SYRINGE PREPARATION | BOX 4: POTASSIUM REPLACEMENT

Add potassium as per guidance below
EXCEPT for the first Saline (1 hour) bag
ONLY use pre-prepared bags

Prepared and administered by	Date	Time started	Time stopped		
				>5.5 mmol/L	None
				3.5 – 5.5 mmol/L	40 mmol KCl per litre (see rate in Box 2)
				<3.5 mmol/L	40 mmol KCl per litre (senior review if additional potassium needs to be given- See rate in Box 2)

Intravenous Insulin Prescription and Fluid Protocol
FOR HYPEROSMOLAR HYPERGLYCAEMIC STATE (HHS)

For use for ALL ADULT (over 18 years) patients with a diagnosis of HHS NOT FOR USE IN CHILDREN NEVER use an IV syringe to draw up insulin ALWAYS draw up insulin using an insulin syringe ALWAYS continue subcutaneous intermediate* or basal insulin** *Intermediate: Insulatard®, Humulin I®, Insuman Basal® **Basal: Lantus® (glargine), Levemir® (detemir), Tresiba® (degludec), Toujeo® (long acting glargine) **Doctor:** All prescriptions for insulin and fluids must be signed **Nurse:** All entries must be signed		
Ward	**Consultant**	Admission Date: Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

ENTRY (diagnostic) CRITERIA (ALL must be ticked to establish diagnosis)

Hypovolaemia	☐
Marked hyperglycaemia (>30 mmol/L) without significant hyperketonaemia (<3.0 mmol/L) or acidosis (pH >7.3, bicarbonate >15 mmol/l	☐
Osmolality >320 mosmol/kg	☐

If patient satisfies all ENTRY CRITERIA, commence intravenous fluid management (**see BOX 2**)
ONLY commence intravenous insulin therapy IF patient has significant ketonaemia (blood ketones >1.0 mmol/L or ketonuria (urine ketones >++) (**see BOX 1**)

BOX 1: INTRAVENOUS INSULIN THERAPY AND PRESCRIPTION

A Fixed Rate Intravenous Insulin Infusion (FRIII) calculated on 0.05 units/kg body weight is recommended (see Weight/insulin dose Reference Guide)
It may be necessary to estimate the weight of the patient

Patient's Weight: _____ kg (Actual/Estimated)

Insulin dose per hour: _____ units   Date: _____

Print Name: _____   Signature: _____

Date	Time	Adjusted dose (units/hr)	Prescriber Name	Prescriber Signature	Bleep

Weight/insulin dose reference Guide

Weight (in kg)	Insulin dose/hr (Units)	Weight (in kg)	Insulin dose/hr (Units)
50-59*	2.5	100-109	5
60-69	3	110-119	5.5
70-79	3.5	120-129	6
80-89	4	130-139	6.5
90-99	4.5	>140	*

*<50kg or >140kg: seek advice from the Diabetes Specialist Team

Drug (approved name)	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Actrapid®	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per mL)	IV			

BOX 2: INTRAVENOUS FLUID MANAGEMENT (Saline regime)
CAUTION: Slower in young people aged 18-25 years, elderly, pregnant, heart or renal failure

BOX 3: INTRAVENOUS FLUID MANAGEMENT (Dextrose regime)
Once CBG<14 mmol/L

0.9% sodium chloride 1 litre (no KCl)	Over 1st hour	Give 10% Dextrose to run at 125 mls/hr AND
0.9% sodium chloride 1 litre (check K+)	Over next 2 hours	Continue Saline as per Saline regime (**see BOX 2**)
0.9% sodium chloride 1 litre (check K+)	Over next 2 hours	Run through Saline and Dextrose regime in 2 separate lines at the SAME time
0.9% sodium chloride 1 litre (check K+)	Over next 4 hours	Run Dextrose regime and insulin therapy in the same line via a three way non-return valve
0.9% sodium chloride 1 litre (check K+)	Over next 4 hours	
Anticipate a fall in potassium and replace (see BOX 4)		

Re-assessment of cardio-vascular status at 12 hours is mandatory, further fluid may be required

SYRINGE PREPARATION				BOX 4: POTASSIUM REPLACEMENT	
Prepared and administered by	Date	Time started	Time stopped	Add potassium as per guidance below EXCEPT for the first Saline (1 hour) bag ONLY use pre-prepared bags	
				>5.5 mmol/L	None
				3.5 – 5.5 mmol/L	40 mmol KCl per litre
				<3.5 mmol/L	40 mmol KCl per litre (senior review as additional potassium needs to be given)

BOX 5: INTRAVENOUS FLUID PRESCRIPTION

For information on dilutions, infusion rates, compatibilities and monitoring parameters, consult the:

Injectable Medicines Guide or contact Medicines Information

CAUTION: Slower in young people aged 18-25 years, elderly, pregnant, heart or renal failure

Date	Solution	Volume	Additives and dose Check potassium Refer to BOX 4		Rate	Duration	Route	Prescriber Signature & Bleep	Batch No.	Given by / 2nd check	Time started	Time stopped	Pharm and supply notes
	0.9% NaCl	1 litre	KCl	None	1000 mls/hr	1 hr	IV						
	0.9% NaCl	1 litre	KCl		500 mls/hr	2 hrs	IV						
	0.9% NaCl	1 litre	KCl		500 mls/hr	2 hrs	IV						
	0.9% NaCl	1 litre	KCl		250 mls/hr	4 hrs	IV						
	0.9% NaCl	1 litre	KCl		250 mls/hr	4 hrs	IV						
	0.9% NaCl	1 litre	KCl		166 mls/hr	6 hrs	IV						
	10% Dextrose	1 litre			125 mls/hr	8 hours	IV						

SWITCH FROM FIXED RATE INTRAVENOUS INSULIN INFUSION TO VARIABLE RATE INTRAVENOUS INSULIN INFUSION (VRIII) with 10% Dextrose with 0.15% KCl at 50 mls/hr IF:

DKA: CAPILLARY BLOOD KETONES < 0.6 mmol/L and HCO3 > 15 mmol/L and STILL not eating and drinking

HHS: Biochemical markers have normalised and STILL not eating and drinking

PRESCRIPTION

CBG mmol/L	Insulin units/hr	Insulin units/hr	Insulin units/hr
> 14	6		
12.1 – 14	4		
10.1 - 12	3		
7.1 – 10	2		
4 - 7	1		
< 4	0.5		
Signature			
Bleep No.			
Date			
Time			

Bedside and laboratory results

Check creatinine, electrolyte and venous bicarbonate and pH at 2 hours then 2 to 4 hourly until venous bicarbonate >15 mmol/L

Date	Time	Ketones	Na+	K+	Creatinine	HCO3	pH	Osmolality	Signature

EXIT CRITERIA (ALL must be ticked)

DKA:

Blood ketones <0.6 mmol/L **and** ☐

Venous bicarbonate >15 mmol/L **and** ☐

Eating and drinking ☐

HHS:

Osmolality normalised **and** ☐

Eating and drinking ☐

Transfer to subcutaneous insulin regime

Notes:

Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime- IV insulin has a 5 minute half-life

ALWAYS continue subcutaneous basal insulin

Refer to the Diabetes Specialist Team

Seek and treat precipitating factors

Consider prophylactic or full anticoagulation

Other issues:

INTRAVENOUS INSULIN, CBG AND KETONES MONITORING RECORD SHEET

Guide:
Only use for patients on intravenous insulin regimen (use different chart for patients on subcutaneous insulin)
Make sure the patient's hands are clean
Check CBG hourly
Check capillary blood ketone hourly until DKA resolved

ADDRESSOGRAPH
LABEL

DATE	Time	Blood glucose	Blood ketones	Hourly infusion rate (units/hr)	Volume left in syringe (ml)	Volume infused in one hour (ml)	Total volume infused (ml)	Signatures		KEY EVENTS / NOTES

8. Diabetic foot disease in inpatients

Gerry Rayman

- Diabetic foot disease is the most feared complication of diabetes and has a major impact on the patient's quality of life, socio-economic status and on their families. It is the most costly of all diabetes complications, largely due to the cost of inpatient care; it is the commonest diabetes specific reason for admission, is associated with excessive length of inpatient stay and accounts for more bed days than any of the other diabetes complications (Chapter 3)

- The National Diabetes Inpatient Audit (NaDIA) has provided valuable insights into the burden of diabetic foot disease and its management in English and Welsh hospitals.[47] In 2017 people with diabetes occupied 17.9% of hospital beds, but less than 10% were specifically for diabetes complications as the majority were for other conditions. In the 2010 NaDIA, diabetic foot complications accounted for 44% of diabetes specific admissions and each year this proportion has increased and in 2017 it accounted for half (51%) of all such admissions. This increase can be attributed to a change in practice with there being increasing recognition of the success of the multidisciplinary foot team and benefits of revascularisation in limb salvage, as well as the ageing population with its associated greater prevalence of peripheral arterial disease

- In terms of actual bed numbers, this was estimated as 96,497 inpatient admissions with diabetes and foot ulcer or amputation codes in 2014-15.[48] In 2017 the NaDIA, found that patients admitted for diabetic foot disease accounted for 4.3% of all diabetes related beds, 4.9% were admitted for other conditions but also had active foot disease, and another 3.1% did not have active foot disease but had a history of previous foot disease. Thus, over 13% of all the inpatients with diabetes have active foot disease or a history of previous foot disease and require either prompt input from specialists in diabetic foot disease and/or interventions to protect their feet from injury whilst in hospital.

- Given that approximately 1 million people with diabetes are admitted, each year there will be in the region of 130,000 diabetes admissions where there is need for specialist referral and /or specific foot interventions

- The total cost of hospital admissions for diabetic foot disease has been estimated at £322 million, and although amputation is high in the minds of patients and clinical staff, Kerr et al found that it only accounted one eight of the inpatient cost, £44 million; the predominant inpatient cost being for ulceration, £278 million[47]

- Given the extent of diabetic foot disease in hospital and recognising the rapidity at which diabetic foot disease can progress, the charity Diabetes UK in their 'Putting Feet First' document recommended that all patients admitted with diabetic foot disease be assessed within 24 hours of admission by a member of the Multi-disciplinary foot service (MDFS) and for a management plan to be promptly put in place.[49] The National Institute for Health and Care Excellence (NICE) in England endorsed this in their guideline document CG119 in 2012 and in a more comprehensive updated guideline NG19 in 2015.[50] The management plan should ensure that those needing one or more of a combination of rapid access to vascular services,

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[47] Kerr M. Inpatient care for people with diabetes – the economic case for change. 2011 Insight Health Economics

[48] Kerr M1, Rayman G, Jeffcoate WJ Diabetes UK. Cost of diabetic foot disease to the National Health Service in England. Diabet Med. 2014 Dec;31(12):1498-504.

[49] Putting Feet First. Commissioning specialist services for the management and prevention of diabetic foot disease in hospital. http://www.footindiabetes.org/media/FDUK/PuttingfeetfirstJun09FINAL.pdf

[50] NICE ng19 Diabetic Foot Problems: prevention and management https://www.nice.org.uk/guidance/ng19

immediate antibiotic treatment, and prompt surgical drainage and debridement are fast tracked to these services

- The 'Putting feet first' and NICE guidelines also recommend that every patient with diabetes admitted to hospital irrespective of the reason for admission should have a foot examination on admission, to detect new or existing foot lesions to ensure prompt referral to the MDFS, and to detect lesions that may be relevant to the presenting medical condition. For example, osteomyelitis in a toe as the initial focus for systemic spread resulting in a variety of clinical presentations such as septic shock, endocarditis, spinal and cerebral abscesses. A visual inspection is also essential in patients unable to give a foot history such as those who are confused, or those unaware that they have foot ulceration/infection as a result sensory loss and/or impaired vision to ensure are prompt attention

- In the 2010 NaDIA, 39% of acute hospitals had no MDFS, 34% did not even have a podiatrist for in patients with diabetic foot disease and only 50% of patients who should be seen by the MDFS were seen within 24 hours of admission. This led to a Diabetes UK initiative in which all trusts without a MDFS were written to, encourage provision of such services; this requirement was later supported by the NICE guidance. As a result there has be a significant improvement in provision. However, in 2017 20% of acute hospitals were still without a MDFS, 32% without an inpatient podiatric service and only 58% of patients with foot disease were seen by the MDFS within 24 hours of admission

- People with diabetes are at greater risk of hospital acquired foot lesions, mainly heel pressure ulcers; the relative risk ratio is 2.24 compared to those without diabetes.[51] The actual extent of this harm was for the first time fully appreciated in the 2010 NaDIA when it was found that 2.2% of patients had developed a foot lesion whilst in hospital but only 27% of all those with diabetes had had a foot examination during admission. The shock of the extent of this failure of care and the later guidance in the 'Putting feet First' and NICE guidelines has seen 86% of hospitals reporting introduction of some form of foot screening on admission; still only 37% of admissions were found to have had a foot examination in the 2017 NaDIA. Nevertheless, there has been a significant reduction in hospital acquired foot ulceration from 2.2% in 2010 to 1.0% in NaDIA 2017

- In summary, there has been a concerted national effort to improve the foot services and foot outcomes for people with diabetes in hospital. The NaDIA has been instrumental in driving this change; it allows hospitals to benchmark themselves against others as well as against themselves in the yearly audit cycle. Furthermore, it is only through such national audits that the success of nationwide programs can be evaluated. Although there have been significant improvements there remains a significant variation across the country. Recognising this, in 2017, NHS England released 'transformation' funds to support the staffing of MDFS in those hospitals without these services. Additionally, the Getting it Right First Time programme will be using 'foot data' from the NaDIA to promote service improvements in inpatient diabetic foot care.

[51] Wensley F, Kerry C, Rayman G. Increased risk of hospital-acquired foot ulcers in people with diabetes: large prospective study and implications for practice. BMJ Open Diabetes Res Care. 2018 Jul 9;6(1):e000510.

9. Perioperative Diabetes Care

Ketan Dhatariya

- In 2013/14, there were 4.7 million operations done in the UK. If one assumed the rate of surgery in people with diabetes is the same as those without, then with a prevalence of diabetes of ~ 6.5%, this equates to over 300,000 people with diabetes undergoing surgery each year[52] A recent survey of primary care referrals to all surgical specialities across 10 hospitals in the East of England for 1 week in 2014, showed that 8.8% of all referrals were for someone with diabetes[53] which implies nationally about 415,000 people with diabetes undergoing surgery per annum. It is probable that the true number of people lies between these figures.

- Previous data has suggested that people with diabetes are less likely to be offered day case surgery[54] contributing to data from 2007 that suggested that the length of stay for people with diabetes was about 1 day longer that those without diabetes, for the same condition[55] Systems should be in place that follow the recommendations of the 2018 report from the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD).[56] The recommendations associated with the patients perioperative diabetes care are summarised below and include:

[52] Royal College of Surgeons. Surgery and the NHS in numbers. https://www.rcseng.ac.uk/news-and-events/media-centre/media-background-briefings-and-statistics/surgery-and-the-nhs-in-numbers/ 2017

[53] 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.

[54] Kerr M. Inpatient care for people with diabetes: the economic case for change. http://webarchive.nationalarchives.gov.uk/20130513172211/http://www.diabetes.nhs.uk/document.php?o=3034 . 2013.

[55] Sampson MJ, Dozio N, Ferguson B, Dhatariya K. Total and excess bed occupancy by age, speciality and insulin use for nearly one million diabetes patients discharged from all English Acute Hospitals. *Diabetes Res Clin Pract* 2007; **77**(1):92-98.

[56] https://www.ncepod.org.uk/2018pd.html

Main Recommendations

- Careful planning and good communication between all healthcare teams involved in the peri-operative care of patients with diabetes, as well as the patient themselves, is key to ensuring that the patient has a smooth journey and comes to no harm
- Patients with diabetes should be identified as such by the GP at the time of referral
- Hospitals should have systems in place to identify all patients with diabetes on the patient administration system to highlight the need to prioritise them on the operating list, with minimal starvation times
- High-risk patients should be identified in surgical outpatients or at pre-operative assessment and plans should be put in place to manage the risk
- Early pre-operative assessment should be arranged to determine peri-operative diabetes management strategy and to identify and optimise other co-morbidities
- Day of surgery admission should be the 'default' position. Diabetes specific pre-admission should be avoided
- Review antidiabetic medications as per sick day rules
- Surgical and anaesthetic principles of the Enhanced Recovery Partnership Programme should be implemented to promote earlier mobilisation with resumption of normal diet and return to usual diabetes management
- Multi-modal analgesia should be combined with appropriate anti-emetics to enable an early return to normal diet and usual diabetes regimen.
- The patient should resume diabetes self-management as soon as possible where appropriate
- All hospitals should implement a Diabetes Inpatient Specialist Nurse (DISN) service to support the elective pathway
- Patients with a planned short starvation period (no more than one missed meal in total) should be managed by modification of their usual diabetes medication, avoiding a VRIII wherever possible
- Patients expected to miss more than one meal should have a VRIII. However, patients on lifestyle alone or on once daily metformin, should only start a VRIII if their capillary blood glucose levels are greater than 12mmol/L on 2 consecutive occasions. Appendix 3 found at the end of this chapter is an example of Intravenous Insulin Prescription and Fluid Protocol for Surgery
- The recommended first choice substrate solution for a VRIII is 5% dextrose in 0.45% sodium chloride and either 0.15% potassium chloride (KCl) or 0.3% KCl
- Capillary blood glucose (CBG) levels should be monitored and recorded at least hourly during the procedure and in the immediate postoperative period
- The target blood glucose in the pre-operative, anaesthetised or sedated patient should be 6-10mmol/L (up to 12.0mmol/L may be acceptable). The target of 6-10mmol/L is for those who are treated with glucose lowering agents – i.e. insulin, (either subcutaneously, or via an insulin infusion) or sulphonylurea therapy. In the **awake** patient on agents that do not produce hypoglycaemia, provided they have not been given insulin, lower blood glucose values down to 3.5mmol/L are safe and do not require IV glucose or other rescue treatment.

Goals of treatment

Primary care

- Provide the current HbA1c, blood pressure and weight measurements with details of relevant complications and medications in the referral letter

- Optimise glycaemic control, aiming for an HbA1c of less than 69mmol/mol (8.5%) before referral if possible, and if it is safe to do so

- Consider specialist support if the HbA1c is greater than 69mmol/mol (8.5%) and further optimisation is safely achievable

- Optimise other diabetes related co-morbidities.

Surgical outpatients

- Systems should be in place to allow early pre-operative assessment to identify people with suboptimal diabetes control

- Clear institutional plans based on British Association of Day Surgery Directory of Procedures should be in place to facilitate day of surgery[57]

- Hospital patient administration systems should be able to identify all patients with diabetes so they can be prioritised on the operating list

- Patients undergoing investigative procedures requiring a period of fasting should be identified and provided with written information about diabetes management

- The surgeon in the outpatient clinic should ensure that patients with diabetes are not scheduled for an evening list. This avoids prolonged fasting times, the use of a VRIII, and an unnecessary overnight stay.

Pre-operative assessment

- 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

- Pre-operative assessment clinic staff should:
  - Assess adequacy of glycaemic control. Balancing the risks of proceeding when control is suboptimal against the urgency of the procedure

  - Consider referral to the diabetes specialist team according to local policy

  - Identify other co-morbidities with referral to the appropriate team for optimisation where necessary

  - Plan inpatient admission including:
    - Timing of admission
    - Location
    - Timing of surgery
    - Pre-admission management of medications
    - Availability of usual insulin
    - Plans for Enhanced Recovery Partnership Programme in the context of diabetes

- Give the patient written instructions with the changes they need to make to their medication prior to admission explicitly highlighted

- Plan initial pre-operative management of diabetes

- Ensure that the patient's usual medication, as well as rescue medication is routinely prescribed to allow prompt treatment of hypo- or hyperglycaemia in the patient who is either unconscious or unable to cooperate

- Plan duration of stay and make preliminary discharge arrangements

- Ensure that admission ward staff are appraised of plans and able to activate them on the day of admission

- Consider the need for home support following discharge, and involve the primary care team in discharge planning.

Hospital Admission

- Provide written guidelines for hospital staff and patients for the modification of diabetes treatment regimens on the day prior to and day of surgery

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[57] Managing Diabetes in Patients having Day and Short Stay Surgery-4th Edition Ed Anna Lipp. Published by the British Association of Day Surgery. 2016

- Base management on Enhanced Recovery Partnership Programme principles

- Determine the treatment pathway in advance depending on the anticipated duration of starvation. Prioritise patients with diabetes on the list

- Use 0.45% sodium chloride and 5% glucose with either 0.15% or 0.3% potassium chloride (as appropriate) as the substrate fluid of choice if a VRIII is required

- Ensure that rescue medication is routinely prescribed to allow prompt treatment of hypo- or hyperglycaemia in the patient who is either unconscious or unable to cooperate. The target blood glucose in the pre-operative, anaesthetised or sedated patient should be 6.0-10.0mmol/L (up to 12.0mmol/L may be acceptable). The target of 6.0-10.0mmol/L is for those who are treated with glucose lowering agents – i.e. insulin, (either subcutaneously, or via an insulin infusion) or sulphonylurea therapy. In the **awake** patient on agents that do not produce hypoglycaemia, provided they have not been given insulin, lower blood glucose values down to 3.5mmol/L are safe and do not require IV glucose or other rescue treatment

- Monitor CBG regularly when the patient is under sedation. Hypoglycaemia sometimes manifests as drowsiness, which may be wrongly attributed to sedation

- For patients requiring a VRIII, the basal insulin should be continued alongside the VRIII during the peri-operative period.

Theatre and recovery
- Implement the WHO surgical safety checklist bundle with maintenance of intraoperative blood glucose levels between 6.0-10.0mmol/L where possible[58]

- Check the CBG prior to induction of anaesthesia and monitor the CBG regularly during the procedure (at least hourly – every half an hour during birth if readings outside the target range)

- **Avoid unnecessary use of VRIII, BUT NEVER STOP AN INSULIN INFUSION IN SOMEONE WITH TYPE 1 DIABETES UNLESS SUBCUTANEOUS INSULIN HAS BEEN GIVEN**

- Correct a high blood glucose using additional subcutaneous insulin or by introducing a VRIII

- Prescribe fluid regimen as required

- Implement surgical and anaesthetic principles of the Enhanced Recovery Partnership Programme to promote early return to normal diet and usual diabetes management[59]

- Use anaesthetic techniques to reduce the incidence of post-operative nausea and vomiting (PONV) and promote early return to normal diet and usual diabetes management.

Postoperative care
- Staff skilled in diabetes management should supervise surgical wards routinely and regularly

- Allow patients to self-manage their diabetes as soon as possible, where appropriate

- Provide written guidelines for the use of intravenous fluids and insulin

- Prescribe and administer insulin in line with NPSA guidance, in consultation with the patient wherever possible

- Ensure blood glucose levels are appropriately maintained. The acceptable post-operative range in the **awake** patient not on a VRIII is 4.0-12.0mmol/L, however if a VRIII is used, then the acceptable range remains 6.0-12.0mmol/L

- Monitor electrolytes and fluid balance daily and prescribe appropriate fluids

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[58] World Health Organisation Surgical Safety Checklist   https://www.who.int/patientsafety/safesurgery/tools_resources/SSSL_Checklist_finalJun08.pdf?ua=11

[59] UK Department of Health, Enhanced Recovery Partnership Programme, 2011, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/215511/dh_128707.pdf

- Treat post-operative nausea and vomiting to promote normal feeding

- Inspect foot and pressure areas regularly.

Discharge

- In consultation with the patient, decide the clinical criteria that the patient must meet before discharge. There are JBDS guidelines for effective discharge planning[60]

- Identify whether the patient has simple or complex discharge planning needs and plan accordingly

- Involve the diabetes specialist team if diabetes related delays in discharge are anticipated

- Provide patient education to ensure safe management of diabetes on discharge

- Discharge should not be delayed solely because of poor glucose control. The patient's or carer's ability to manage the diabetes should be taken into consideration. Discuss with the diabetes specialist team if necessary

- Systems should be in place to ensure effective communication with community teams, particularly if changes to the patients' pre-operative diabetes treatment have been made during the hospital stay.

[60] Discharging planning
https://abcd.care/sites/abcd.care/files/resources/JBDS_Discharge_Planning_amendment_RCN_2017.pdf

Appendix 3. An example of Intravenous Insulin Prescription and Fluid Protocol for Surgery

	Ward	Consultant	Admission Date:
For use for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII) for surgery/pre-operative/nil by mouth			Discharge Date:
NEVER use an IV syringe to draw up insulin NOT FOR USE IN CHILDREN	Surname	First Name	
ALWAYS draw up insulin using an insulin syringe ALWAYS continue subcutaneous intermediate* or basal insulin**	Hospital Number	Date of Birth / Age	
*Intermediate: Insulatard, Humulin I, Insuman basal **Basal: Lantus (Glargine), Levemir (Detemir), Tresiba (Degludec), Toujeo	NHS Number		
Hold off rapid or short acting insulin whilst on VRIII **Doctor:** All prescriptions for insulin and fluids must be signed. **Nurse:** All entries must be signed.	Address		

	DOSING RATES (Please see the rate guide below)						
Rates →	**Standard Rate**		**Reduced Rate**		**Increased Rate**		**Customised Scale**
	Start on standard rate unless indicated		For use in insulin sensitive patients i.e. needing less than 24 units/day		For use in insulin resistant patients, i.e. needing more than 100 units/day		For use to bespoke rate
CBG Levels (mmol/L)↓	Infusion Rate (units/hr = ml/hr)						
	If no basal insulin	If basal insulin continued	If no basal insulin	If basal insulin continued	If no basal insulin	If basal insulin continued	
<4	0.5 ml/hr	0 ml/hr	0.2 ml/hr	0 ml/hr	0.5 ml/hr	0 ml/hr	
	Administer 100 ml IV 20% Glucose						
4.1-6	0.5 ml/hr	0 ml/hr	0.2 ml/hr	0 ml/hr	0.5 ml/hr	0 ml/hr	
	Consider 50 ml IV 20% Glucose						
6.1-8	1.0		0.5		2.0		
8.1-12	2.0		1.0		4.0		
12.1-16	4.0		2.0		6.0		
16.1-20	5.0		3.0		7.0		
20.1-24	6.0		4.0		8.0		
>24.1	8.0		6.0		10.0		
Signed/Dated							
Print Name							

RATE GUIDE

ENTRY CRITERIA: Start VRIII and fluids if CBG is >12 mmol/L and/or patient is anticipating a long starvation period i.e. 2 or more missed meals

Standard Rate	Most patient will start here
Reduced Rate	Use this rate for patients when CBGs are persistently 4-6 mmol/L or dropping too fast
Increase Rate	Use this rate for patient who are likely to require more insulin (on steroids; on >80 units of insulin prior to admission; or those not achieving target on Standard Rate)
Customised Rate	Use this to bespoke rate depending on co-morbidities

If the patient is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 4 – 12 mmol/L

Check CBG every hour whilst on VRIII

Move to the increased rate if the CBG is > target and is not dropping over three consecutive hours by 3 mmol/L/hr or more

Move to the reduced rate if CBG falls below 4 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date	SYRINGE PREPARATION			
								Date	Time started	Time stopped
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per ml)	IV				Prepared and administered by			

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION									
Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse' Signature					
	1000 ml 0.45% NaCl + 5% Dextrose with 0.15%KCl to run at 100 mgs/hr								
	1000 ml 0.45% NaCl + 5% Dextrose with 0.15%KCl to run at 100 mgs/hr								

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA									
Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 ml**	**IV**	**15 min**				
		20% Dextrose	**50 ml**		**15 min**				

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team

EXIT CRITERIA

STOP VRII when patient is able to eat and drink without nausea or vomiting. This should take place when the next meal-related subcutaneous insulin dose is due

Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

10. The management of diabetes in the context of acute coronary syndrome

Stella George

- Poor blood glucose control in patients with an acute coronary syndrome is a strong independent risk factor for increased morbidity and mortality. The relationship between the level of admission blood glucose and the adjusted relative risk of death is almost linear and is more strongly associated with mortality than the diagnosis of diabetes per se[61][62][63]

- Improved glycaemic control has been associated with better survival in ACS, but the method of glucose lowering and the target range for glucose remain indeterminate. A US based retrospective study showed no benefit with insulin use over other glucose lowering therapies[64], and insulin may be more beneficial in some subgroups of ACS and not others[65]

- Two major RCTs (DIGAMI 1 and 2)[66][67] investigated the effects of insulin and glucose infusions in patients with diabetes or a blood glucose of >11.0mmol/L on admission. DIGAMI 1 aimed for a glucose concentration of 7.0-10.0 mmol/L and showed marked survival benefit at one year (18.6% vs 26.1%). DIGAMI 2 showed no additional benefit from long term insulin therapy in patients with Type 2 diabetes, although underpowered

- In the HI-5 trial blood glucose maintained at <8.0mmol/L was associated with a lower mortality than higher levels[68] although more aggressive glucose targets (4.7-6.1mmol/L) may be harmful [69]

- More recent data suggest that hypoglycaemia may be identifying patients at risk for other reasons such as heart failure, renal dysfunction or poor nutrition and when adjusting for such variables it no longer remains an independent risk factor.[70]

[61] Gholap NN, Mehta RL, Ng L, Davies MJ, Khunti K, Squire IB. Is admission blood glucose a more powerful predictor of mortality after myocardial infarction than diabetes diagnosis? A retrospective cohort study *BMJ Open* 2012 ; e:3001596

[62] Capes SE, Hunt D, Malmberg K, Gerstein HC. Stress hyperglycaemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. *Lancet.* 2000;355(9206):773-778.

[63] Foo K, Cooper J, Deaner A, et al. A single serum glucose measurement predicts adverse outcomes across the whole range of acute coronary syndromes. *Heart.*2003;89(5):512-516.

[64] Kosiborod M, Inzucchi SE, Krumholts HM et al. Glucose normalisation and outcomes in patients with acute myocardial infarction. *Arch Intern Med* 2009;**169** (5); 438-446

[65] Birkhead J, Weston C, Timmis A, Chen R. The effects of intravenous insulin infusions on early mortality for patients with acute coronary syndromes who present with hyperglycaemia. A matched propensity analysis from the MINAP databases 2008-2012. *Eur Heart J Acute Cardiovasc Care*. 2015 Aug;**4**(4):344-352.

[66] Malmberg K, Ryden L, Efendic S, Herlitz J, Nicol P, Waldenstrom A, et al. Randomized trial of insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with acute myocardial infarction (DIGAMI study): effects on mortality at 1 year. J Am Coll Cardiol 1995;26(1):57-65.

[67] Malmberg K, Ryden L, Wedel H, Birkeland K, Bootsma A, DicksteinK, et al. Intense metabolic control by means of insulin in patients with diabetes mellitus and acute myocardial infarction (DIGAMI 2): effects on mortality and morbidity. Eur Heart J 2005;26(7):650-61

[68] Cheung NW, Wong VW, McLean M. The hyperglycemia: intensive insulin infusion in infarction (HI-5) study. Diabetes Care 2006;29:765-770

[69] de Mulder M, Umans VA, Cornel JH, van der Zant FM, Stam F, Oemrawsingh RM, et al. Intensive glucose regulation in hyperglycemic acute coronary syndrome: results of the randomized BIOMarker study to identify the acute risk of a coronary syndrome-2 (BIOMArCS-2) glucose trial. JAMA Intern Med 2013;173(20):1896- 904.

[70] Kosiborod M, Inzucchi SE, Goyal A, Krumholz HM, Masoudi FA, Xiao L, Spertus JA. Relationship between spontaneous and iatrogenic hypoglycemia and mortality inpatients hospitalized with acute myocardial infarction. *JAMA* 2009;**301**:1556–1564

International Recommendation Guidelines for the management of patients with ACS and diabetes have been published by several national societies as in the table below.

Society	Recommendations	Level of Recommendation where available
[71]AACE/ADA	Target 7.8-10.0 mmol/L most non critical patients	Evidence level C
[72]ACC/AHA	Treat hyperglycaemia if >10.0 mmol/L and avoid hypoglycaemia	Downgraded recommendation for use of insulin from Class 1 to Class II (evidence level B)
[73]Canadian Diabetes Association	Patients with acute MI and admission glucose >11.0 mmol/L may receive glycaemic control in the range of 7.0-10.0 mmol/L	Grade C level 2
	Insulin may be required to achieve this target	Grade D (consensus)
[74]ESC/EASD	Insulin based glycaemic control should be considered in ACS patients with significant hyperglycaemia (10.0 mmol/L) with the target adapted to possible co-morbidities	Recommendation Class IIa, Evidence Level C
[75]NICE	Keep blood glucose levels below 11.0 mmol/L. Consider intravenous insulin as a method to achieve target	
[76]SIGN	Patients with ACS and glucose >11.0 mmol/L should have immediate blood glucose control aiming for target of 7.0-10.9 mmol/L	

[71] Morghissi ES, Korytowski MT DiNardo M, et al American Association of Clinical Endocrinologists and American Diabetes Association Consensus statement on inpatient glycaemic control *Diabetes Care* 2009: **32**;1119-1131

[72] Kushner FG, Hand M, Smith Jr SC, et al. 2009 Focused Updates: ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction (updating the 2004 Guideline and 2007 Focused Update) *Circulation* 2009;**120**:2271e306.

[73] Tardif JC, L'Allier PL, Fitchett DH, Management of Acute Coronary Syndromes: Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. *Canadian J Diabetes* 2013; **37**: S119-S123

[74] Task Force on diabetes, pre-diabetes, and cardiovascular diseases of the European Society of Cardiology (ESC); European Association for the Study of Diabetes (EASD), Rydén L, Grant PJ, et al ESC guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. *European Heart Journal* (2013) **34**: 3035-3087

[75] NICE Clinical Guideline CG 130 Hyperglycaemia in acute coronary syndromes: updated 2013 available from URL https://www.nice.org.uk/guidance/cg130

[76] Scottish Intercollegiate Guidelines Network (SIGN). Acute coronary syndrome. Edinburgh: SIGN; 2016. (SIGN publication no. 148). [April 2016]. Available from URL: https://www.sign.ac.uk/sign-148-acute-coronary-syndrome.html

- **JBDS have not produced any guidelines on the glycaemic management of ACS in patients with diabetes. The above and these recommendations are intended to be a general discussion of this area with key materials and current international policy**

- It is clear that hyperglycaemia in the context of ACS is deleterious and it would seem logical to treat it in this context. What is less clear from the evidence is the target range for blood glucose, but the majority of the published guidelines suggest that the upper end of the range should be 10.0mmol/L

- Avoiding hypoglycaemia is self- evidently important, but the lower end of the target range for treatment is more contentious, with some guidelines not specifying a particular level. Where it is stated, the majority of guidelines suggest 7.0mmol/L

- The method of achieving this target is even less clear, but intravenous insulin is accepted to be the quickest way of achieving a target glucose. In patients who are unwell and likely not to be eating and drinking reliably in the first few hours of presenting with an acute coronary syndrome, it would seem that a variable rate intravenous insulin infusion with appropriate substrate fluids should be used. It essential that patients are monitored closely with point of care testing for glucose (and ketones if relevant) and that electrolytes are also monitored at least daily to ensure they are maintained in the normal range

- Of note, the JBDS suite of guidelines have suggested that for inpatients the target blood glucose be 6.0-10mmol/L with 4.0-12.0mmol/L being acceptable in some circumstances. However, these are for other patient populations and not specifically patients with ACS for which JBDS do not yet have specific published guidelines

11. Management of Hyperglycaemia and Steroid (Glucocorticoid) Therapy

Aled Roberts

- The challenge of maintaining glycaemic control in inpatients treated with short term high dose steroids is well recognised[77][78]

- The use of steroid treatment in people with pre-existing diabetes results in worsening glucose control, termed **steroid induced hyperglycaemia**, which will warrant temporary additional and more active glycaemic management

- A rise in plasma glucose related to steroid therapy in people without a known diagnosis of diabetes is termed **steroid induced diabetes**. This may or may not resolve when the steroids are withdrawn

- There is little evidence to guide how patients with hyperglycaemia related to steroid use should be managed. Short courses of steroids resulting in minimal periods of hyperglycaemia may not warrant intervention

- Higher dose steroids, for longer periods may result in significant symptomatic hyperglycaemia including fatigue, polyuria and polydipsia with the real potential for acute complications related to hyperglycaemia such as HHS or the need for urgent insulin initiation.

Steroid therapy – impact on blood glucose

- Steroids are given in various regimes and doses. A single or short course of steroid (e.g. prednisolone) in the morning may be the commonest mode of administration. This may result in a rise in blood glucose by late morning that continues into the evening. Overnight the blood glucose generally falls back, often to baseline levels the next morning, and treatment should be tailored to treating the hyperglycaemia, and avoiding nocturnal and early morning hypoglycaemia

- In pregnancy and other situations, a single dose or short course of steroid may be administered

- Many hospital inpatients receive multiple daily doses of steroids resulting in sustained 24 hour glucose elevation

- Glucose levels in most individuals can be predicted to rise approximately 4 to 8 hours following the administration of oral steroids and sooner following the administration of intravenous steroids.
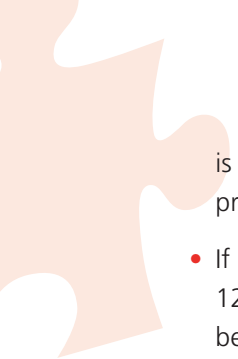
Target blood glucose

In line with other JBDS inpatient documents, the recommended target level for glucose in hospital inpatients is 6.0-10.0mmol/L, accepting a range of 4.0-12.0mmol/L. However, certain patient groups do not require such tight control, (e.g. those at the end of life) and those who may be severely disabled by a hypoglycaemic event (e.g. those with cognitive impairment).

Monitoring in people without a pre-existing diagnosis of diabetes:

- Monitoring should occur at least once daily – preferably prior to lunch or evening meal, or alternatively 1-2 hours post lunch or evening meal. If the initial capillary blood glucose (CBG)

[77] Donihi AC, Raval D, Saul M et al (2006) Prevalence and predictors of corticosteroid-related hyperglycaemia in hospitalised patients. *Endocrine Practice* **12**(4); 358-62.

[78] Swafe L, Narwani V, Stavraka C, Dhatariya K (2014): How frequently are bedside glucose levels measured in hospital inpatients on glucocorticoids? *Clinical Medicine* 14: 327-8

is less than 12.0mmol/L continue to test once prior to or following lunch or evening meal

- If a subsequent CBG is found to be greater than 12.0mmol/L, then frequency of testing should be increased to four times daily (before meals and before bed)

- If CBG is found to be consistently greater than 12.0mmol/L i.e. on two occasions in 24 hours, then the patient should enter the treatment algorithm.

In people with a pre-existing diagnosis of diabetes:

Test CBG four times a day, before or after meals, and before bed, irrespective of background diabetes control. If CBG is found to be consistently greater than 12.0mmol/L i.e. on two occasions during 24 hours, then the patient should enter the Steroid induced hyperglycaemia treatment algorithm.

Treatment of Steroid Induced Hyperglycaemia and Steroid Induced Diabetes

- Suggested algorithms for the management of steroid induced diabetes and steroid induced hyperglycaemia can be found within the JBDS document

- Principles include patient and carer education and monitoring for symptoms and signs of hyperglycaemia. Therapies include the use of Gliclazide or human intermediate acting insulin in steroid induced diabetes, and titration of existing therapies in steroid induced hyperglycaemia.

Further reading and key documents

- Link to guideline https://www.diabetes.org.uk/professionals/position-statements-reports/specialist-care-for-children-and-adults-and-complications/management-of-hyperglycaemia-and-steroid-glucocorticoid-therapy-october-2014
- Dashora UK, Taylor R (2004) Maintaining glycaemic control during high-dose prednisolone administration for hyperemesis gravidarum in Type 1 diabetes. Diabetic Medicine 21(3): 298-299
- Diabetes UK (2018) End Of Life Clinical Care document 3rd Edition https://www.diabetes.org.uk/About_us/What-we-say/Improving-diabetes-healthcare/End-of-Life-Care/
- Donihi AC, Raval D, Saul M et al (2006) Prevalence and predictors of corticosteroid-related hyperglycaemia in hospitalised patients. Endocrine Practice 12(4); 358-62.
- National Institute for Health and Care Excellence (2008) Diabetes in pregnancy http://www.nice.org.uk/nicemedia/live/11946/41320/41320.pdf (accessed 18/6/14)
- https://www.diabetes.org.uk/professionals/position-statements-reports/specialist-care-for-children-and-adults-and-complications/management-of-hyperglycaemia-and-steroid-glucocorticoid-therapy-october-2014
- Dashora U, Murphy HR, Temple RC, Stanley KP, Castro E, George S, Dhatariya K, Haq M, Sampson M; Joint British Diabetes Societies (JBDS) for Inpatient Care. Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes.
- Diabet Med. 2018 Aug;35(8):1005-1010
- Dashora U et al (2017) JBDS IP Management of glycaemic control in pregnant women with diabetes on obstetric wards and delivery units https://abcd.care/sites/abcd.care/files/resources/JBDS_Pregnancy_201017.pdf (accessed May 2019)
- Swafe L, Narwani V, Stavraka C, Dhatariya K (2014): How frequently are bedside glucose levels measured in hospital inpatients on glucocorticoids? Clinical Medicine 14: 327-8
- Umpierrez GE, Gianchandani R, Smiley D et al (2013) Safety and efficacy of sitagliptin therapy for the inpatient management of general medicine and surgery in patients with Type 2 Diabetes. Diabetes Care 36:3430-3435
- Willi SM, Kennedy A, Brant BP et al (2002). Effective use of thiazolidinediones for the treatment of glucocorticoid-induced diabetes. Diabetes Res Clinical Practice 58:87-96
- Yanai H, Masui Y, Yoshikawa R, Kunimatsu J, Kaneko H (2010). Dipeptidyl peptidase-4 inhibitor for steroid-induced diabetes. World J Diabetes; 1(3): 99-100
- Hwang JL, Weiss RE. (2014) Steroid-induced diabetes: a clinical and molecular approach to understanding and treatment. Diabetes Metab Res Rev. Feb; 30(2): 96–102.

12. Management of glycaemic control in pregnant women with diabetes on obstetric wards and delivery units

Umesh Dashora/Erwin Castro

- It is estimated that each year up to 5% (32,100) of women who become pregnant in the UK have either pre-existing diabetes or develop gestational diabetes during their pregnancy. Of these, 87.5%(28,100) have gestational diabetes, 7.5% (2,400) have Type 1, and 5.0% (1,600) have Type 2 diabetes.[79] The prevalence of diabetes and the incidence of gestational diabetes is increasing as a result of higher rates of obesity and more pregnancies in older women

- Many publications have highlighted suboptimal care, variable achievements and poor outcomes of pregnancy in patients with diabetes in the UK including poor preparation for pregnancy, high rates of ketoacidosis, maternal hypoglycaemia, stillbirths and neonatal hypoglycaemia, and worryingly, the outcomes have largely remained unchanged since previous audits[80 81 82 83 84 85]

- The National Institute for Health and Care Excellence (NICE) recommends that women with insulin-treated diabetes are given additional insulin when receiving steroids for prematurity according to an agreed protocol and are monitored closely. NICE also recommends keeping capillary glucose levels within a tight range of 4.0-7.0mmol/L during labour and birth to reduce the incidence of neonatal hypoglycaemia [86]

- This JBDS guideline is designed to offer a practical, consistent, consensus based approach to manage glycaemic control in pregnant women during steroid administration, labour and birth and when using Continuous Subcutaneous Insulin Infusion (CSII).

[79] National Collaborating Centre for Women's and Children's Health. Diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period. Feb 2015. http://www.nice.org.uk/guidance/ng3/evidence/full-guideline-3784285 (last accessed in July 2016)

[80] National Diabetes in Pregnancy Audit 2016. Available at https://digital.nhs.uk/data-and-information/publications/statistical/national-pregnancy-in-diabetes-audit/national-pregnancy-in-diabetes-annual-report-2016

[81] Dashora U, Rafique S, Tharayil G, Jones S, Castro E, Sathiskumar P. The feasibility and impact of implementing NICE guidance on diabetes control during delivery. British Journal of Diabetes. 2017 Aug 20;17:100-6

[82] Murphy, H.R., Bell, R., Cartwright, C. et al. Improved pregnancy outcomes in women with type 1 and type 2 diabetes but substantial clinic-to-clinic variations: a prospective nationwide study. Diabetologia (2017) 60: 1668. https://doi.org/10.1007/s00125-017-4314-3

[83] Feig DS, Donovan LE, Corcoy R et al. Continuous glucose monitoring in pregnant women with type 1 diabetes (CONCEPTT): a multicentre international randomised controlled trial. The Lancet. 2017 Sep 15.

[84] Metzger BE, Lowe LP, Dyer AR, et al.; HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med 2008;358:1991–2002

[85] CEMACH. Confidential enquiry into maternal and child health: pregnancy in women with type 1 and type 2 diabetes in 2002–03, England, Wales and Northern Ireland. London: CEMACH, 2005. https://elearning.rcog.org.uk//sites/default/files/Diabetes%20and%20other%20endocrinopathies/CEMACH_Pregnancy_type_1_2_diabetes.pdf

[86] National Collaborating Centre for Women's and Children's Health. Diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period. Feb 2015. http://www.nice.org.uk/guidance/ng3/evidence/full-guideline-3784285 (last accessed in June 2019)

During steroid administration for pre-maturity:

- The most effective way to control steroid-induced hyperglycaemia is by using VRIII (Appendix 4 at the end of this chapter provides an example chart for Intravenous Insulin Prescription and Fluid Protocol for the Management of Steroid Hyperglycaemia during Pregnancy 1)[87]

- CBG should be monitored hourly when mothers are administered steroids in pregnancy and VRIII is being used.

During Labour and birth

- All women with diabetes of any type should have hourly CBG monitoring in established labour or from the morning of elective caesarean section. If general anaesthesia is used, monitoring should be every half an hour until the baby is born and the mother is fully conscious

- Maintain CBG in labour in the target range according to the NICE guidelines (4.0-7.0mmol/L)

- All patients with type 1 diabetes and some patients with type 2 diabetes or GDM may require VRIII to keep the CBGs in this range. An example pre-printed prescription chart and guidance is attached with this guideline (see Appendix 5 at the end of this chapter which provides an example of a chart for Intravenous Insulin and Fluid Protocol Prescription for Pregnancy and Labour)

- Women who are on an insulin pump may choose to remain on CSII (in agreement with their treating physicians) unless they are not able or willing to continue pump therapy during labour

- Reduce the rate of VRIII (if and when used) by 50% (or change to the lowest scale) once placenta is delivered. Contact the diabetes teams to review the on-going insulin requirement in insulin treated patients with type 1 and type 2 diabetes. The insulin dose may be 25% less than the doses needed at the end of first trimester

- These mothers are at increased risk of hypoglycaemia especially when breast feeding and should have additional carbohydrate with meal or as a snack available during or before food

- Stop all antidiabetic medications at delivery in all patients with gestational diabetes. Continue monitoring CBG pre and 1 hour post meal for up to 24 hours to capture pre-existing diabetes, new onset diabetes and to avoid hypoglycaemia

- If breast feeding, women with pre-existing type 2 diabetes can take metformin and glibenclamide after birth, but should avoid other oral anti-diabetic treatments

- Breast feeding women should continue to withhold other medications that were stopped after conception.

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[87] Dashora U, Murphy HR, Temple RC, Stanley KP, Castro E, George S, Dhatariya K, Haq M, Sampson M, Joint British Diabetes Societies (JBDS) for Inpatient Care, Allan B. Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes. Diabetic Medicine. 2018 Aug;35(8):1005-10

Appendix 4. An example of Intravenous Insulin Prescription and Fluid Protocol for the Management of Steroid Hyperglycaemia during Pregnancy

For use for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII) for the management of steroid hyperglycaemia during pregnancy NEVER use an IV syringe to draw up insulin ALWAYS draw up insulin using an insulin syringe ALWAYS continue subcutaneous intermediate* or basal insulin** *Intermediate: Insulatard, Humulin I, Insuman basal **Basal: Lantus (Glargine), Levemir (Detemir), Tresiba (Degludec), Toujeo **Doctor:** All prescriptions for insulin and fluids must be signed. **Nurse:** All entries must be signed.		

Ward	Consultant	Admission Date:
		Discharge Date:

Surname		First Name	
Hospital Number		Date of Birth / Age	
NHS Number			
Address			

DOSING ALGORITHM (Please see the guide below)

Algorithm ➜	1	2	3
	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)
CBG Levels (mmol/L)⬇	Infusion Rate (units/hr = ml/hr)		
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check CBG in 10 minutes)		
4.0 – 5.5	0.2	0.5	1.0
5.6 – 7.0	0.5	1.0	2.0
7.1 – 8.5	1.0	1.5	3.0
8.6 -11.0	1.5	2.0	4.0
11.1 – 14.0	2.0	2.5	5.0
14.1 – 17.0	2.5	3.0	6.0
17.1 – 20.0	3.0	4.0	7.0
>20.1	4.0	6.0	8.0
Signed			
Print Name			
Date			

ALGORITHM GUIDE

- **ALL** women with diabetes should have Capillary Blood Glucose (CBG) testing hourly whilst on VRIII for the management of steroid hyperglycaemia during pregnancy
- Start VRIII and Fluids if CBG > target (see below) for 2 consecutive hours

Algorithm 1 Most women will start here

Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)

Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 4 – 7.8 mmol/L
Check CBG every hour whilst on VRIII

Move to the higher algorithm if the CBG is > target and is not dropping

Move to the lower algorithm if CBG falls below 4 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date	SYRINGE PREPARATION			
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per ml)	IV				**Prepared and administered by**	**Date**	**Time started**	**Time stopped**

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse' Signature				
	500 ml 0.9% NaCl + 5% Dextrose with 10 mmol KCl (0.15%) to run at 50 mgs/hr							
	500 ml 0.9% NaCl + 5% Dextrose with 10 mmol KCl (0.15%) to run at 50 mgs/hr							

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 ml**	**IV**	**15 min**				

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

INTRAVENOUS INSULIN, CBG AND KETONES MONITORING RECORD SHEET

Guide:

Only use for patients on intravenous insulin regimen. Use different chart for patients on subcutaneous insulin.

Make sure the patient's hands are clean.

Check CBG hourly for further 24 hours after the last dose of steroid OR as per advice from the Diabetes Team

ADDRESSOGRAPH

LABEL

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

Appendix 5. An example of Intravenous Insulin and Fluid Prescription for Pregnancy and Labour

For use during pregnancy and labour for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII)		
NEVER use an IV syringe to draw up insulin		
ALWAYS draw up insulin using an insulin syringe		
ALWAYS continue subcutaneous intermediate* or basal insulin**		
*Intermediate: Insulatard, Humulin I, Insuman basal		
**Basal: Lantus (Glargine), Levemir (Detemir), Tresiba (Degludec), Toujeo		
Doctor: All prescriptions for insulin and fluids must be signed.		
Nurse: All entries must be signed.		

Ward	Consultant	Admission Date:
		Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

DOSING ALGORITHM
(Please see the guide below)

Algorithm →	1	2	3
	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)
CBG Levels (mmol/L)↓	Infusion Rate (units/hr = ml/hr)		
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check CBG in 10 minutes)		
4.0 – 5.5	0.2	0.5	1.0
5.6 – 7.0	0.5	1.0	2.0
7.1 – 8.5	1.0	1.5	3.0
8.6 -11.0	1.5	2.0	4.0
11.1 – 14.0	2.0	2.5	5.0
14.1 – 17.0	2.5	3.0	6.0
17.1 – 20.0	3.0	4.0	7.0
>20.1	4.0	6.0	8.0
Signed			
Print Name			
Date			

ALGORITHM GUIDE
- **ALL** women with diabetes should have Capillary Blood Glucose (CBG) testing hourly in established labour or on admission for elective C-Section
- Start VRIII and Fluids if CBG > target (see below) or if the woman has type 1 diabetes

Algorithm 1 — Most women will start here
Algorithm 2 — Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
Algorithm 3 — Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target CBG level = 4 – 7 mmol/L
Check CBG every hour whilst on VRIII
Move to the higher algorithm if the CBG is > target and is not dropping
Move to the lower algorithm if CBG falls below 4 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50ml with NaCl 0.9% (1 UNIT per ml)	IV			

SYRINGE PREPARATION

Prepared and administered by	Date	Time started	Time stopped

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse' Signature
	500 ml 0.9% NaCl + 5% Dextrose with 10 mmol KCl (0.15%) to run at 50 mgs/hr			
	500 ml 0.9% NaCl + 5% Dextrose with 10 mmol KCl (0.15%) to run at 50 mgs/hr			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	100 ml	IV	15 min				

CAPILLARY BLOOD GLUCOSE MONITORING

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
CBG												
Insulin rate												
Blood ketones												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
CBG												
Insulin rate												
Blood ketones												
Initials												

GESTATIONAL DIABETES:
STOP VRIII and IV Substrate Fluid regime once placenta is delivered

TYPE 1 DM and INSULIN TREATED TYPE 2 DM
Reduce the rate of VRIII by HALF once placenta is delivered.
Contact diabetes team to review on-going insulin requirements

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

DIABETES CARE PLANNING DOCUMENT

For use to communicate care plans for **ALL** patients with diabetes during and after pregnancy
Please complete **ALL** required information
To be completed by the Diabetes Team

| Ward | Consultant | Admission Date: |
| | | Discharge Date: |

Surname		First Name	
Hospital Number		Date of Birth / Age	
NHS Number			
Address			

ANTENATAL INFORMATION

TYPE OF DIABETES

[ ] Type 1 DM	[ ] Type 2 DM	[ ] Gestational DM		
Age at diagnosis	Age at diagnosis	Diagnosed:	[ ] OGTT: Date:	[ ] OGTT: Date:
			Fasting: mmol/L	Fasting: mmol/L
		_____ weeks	2 hours: mmol/L	2 hours: mmol/L

PRE-PREGNANCY DIABETES MEDICATIONS

Medication	Dose	Time	HbA1c Record			
			Baseline	Date:	Value:	mmol/mol
			Additional HbA1c:	Date:	Value:	mmol/mol
			Notes:	Date:	Value:	mmol/mol
				Date:	Value:	mmol/mol
				Date:	Value:	mmol/mol
				Date:	Value:	mmol/mol

COMPLICATIONS DEVELOPED OR EXACERBATED BY PREGNANCY	DELIVERY DATES		
	Expected date of delivery	**Date for IOL**	**Date for C-section**

POST NATAL PLAN

PROPOSED POST-PREGNANCY DIABETES MEDICATIONS (FOR TYPE 1 OR TYPE 2 DM)			DISCUSSED WITH PATIENT:			
			Issues:	Yes	No	Date discussed:
Medications	Dose	Time	Contraception/plan for further pregnancy			
			Arrangement for on-going diabetes care			
			OGTT arrangement			
			Lifestyle modifications			
			Completed by:			
			Name:	Designation:		Sign:

POST NATAL CBG MONITORING
Pre-existing diabetes: as per usual practice
GDM: pre-meal and 1 hour post-meal for up to 24 hours
High levels (>7 mmol/L pre-meal and <11.1 mmol/L post-meal) may need a diagnostic test for diabetes

Date:	Pre-breakfast	1 hr after breakfast	Pre-lunch	1 hr after lunch	Pre-evening meal	1 hr after evening meal	Pre-bed

MATERNAL OUTCOMES				POST NATAL OUTCOMES (tick ALL that applies)			
Delivery	Tick that applies	Complications	Tick ALL that applies	Stillbirth		Neonatal jaundice	
Normal		Pre-eclampsia		Baby weight >4 kg		Hypocalcaemia	
Assisted/forceps		Inadequately controlled glycaemia		Neonatal hypoglycaemia		Hypomagnesaemia	
C-section		Post-delivery hypoglycaemia		Admission to NICU		RDS	
Other:		Other:		Shoulder dystopia		Birth defects	
				Other:		Other:	

13. Diabetes on the renal unit

Peter Winocour

- The JBDS guideline on managing diabetes in renal unit patients undergoing dialysis and on the renal unit has recently been published as a collaborative effort between the renal association and renal and diabetes clinicians[88]

- Diabetes is one of the commonest causes of end stage renal failure (ESRF) in the UK, with an estimated 1935 patients with diabetes requiring dialysis therapy in 2016 (UK Renal Registry aggregate data)

- The management of diabetes in patients undergoing haemodialysis (HD) is complex, with particular challenges posed by organisation of care, achieving safe and sensible glycaemic targets in patients on HD, with particular challenges posed by appropriate dietary advice and care, recognition of accelerated risk of adverse retinopathy and diabetic foot disease (DFD) outcomes.

Recommendations

- All people with diabetes undergoing maintenance haemodialysis (MHDx) should have a documented diabetes annual review which includes foot and eye screening through the GP diabetes register or secondary services. The responsibility for undertaking this rests with the diabetes service caring for the patient

- They should have regular access to a named Diabetes Specialist Nurse (DSN) responsible for providing support in relation to on-going care of diabetes and its complications and have specialist diabetes input for acute and/or chronic glycaemic instability

- All units treating patients with diabetes on MHDx should ensure they are aware of the method used to measure glycated haemoglobin (HbA1c) within their local laboratory and this should ideally be using an HPLC based assay to prevent the overestimation of HbA1c due to carbamylation of haemoglobin (Hb). Confounding issues in interpreting HbA1c in these patients are common, and are described in the full guidelines

- The target for HbA1c in patients with diabetes and on maintenance haemodialysis should be individualised but if the patient is on a hypoglycaemia inducing treatment, it should be aimed at between 58 to 68mmol/mol (7.5 to 8.5%). It is likely that HbA1c of >80 mmol/mol or 9.5% represents poor glycaemic control unless there is severe iron deficiency. Reduction in treatment should be considered for patients with HbA1c<58mmol/mol or 7.5% on potentially hypoglycaemia inducing agents

- Sulfonylureas are not licenced for patients on maintenance haemodialysis and should be avoided because of the increased incidence of hypoglycaemia in this setting

- Repaglinide can be considered in the haemodialysis patient. Dose reductions are to be expected and it should be noted that experience in this group is limited therefore increased monitoring required. Metformin is not licenced to be used in patients on maintenance haemodialysis and should be avoided because of the increased risk of lactic acidosis in this setting

- Acarbose is not licenced to be used in patients on maintenance haemodialysis. No dose adjustment of pioglitazone is necessary in patients with impaired renal function but issues with maculopathy, bone health and fluid overload may restrict use. There is insufficient experience of the use of any of the current GLP1

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88 Frankel AH, Kazempour-Ardebili S, Bedi R et al Management of adults with diabetes on the haemodialysis unit: summary of guidance from the Joint British Diabetes Societies and the Renal Association. Diabet Med. 2018 Aug;35(8):1018-1026

agents in patients on MHDx such that there use cannot be recommended.
Linagliptin, sitagliptin, vildagliptin and alogliptin are DPP4 inhibitors licensed in patients on MHDx, but dose reductions for sitagliptin, vildagliptin and alogliptin are required. SGLT2 inhibitors are to be avoided

- All people with diabetes on insulin should be dialysed against a dialysate containing glucose

- The aim of insulin therapy in diabetes patients on MHDx is to improve quality of life and avoid extremes of hypo- and hyperglycaemia. Most patients on dialysis would benefit from reduction of insulin doses during and immediately following dialysis (i.e. on the dialysis day, basal bolus regimes may be most flexible and best suited to the glycaemic variability seen in patients with diabetes on MHDx. In patients who are less likely to be able to comply with the requirements of a basal bolus regime consideration should be given to once daily regimes with longer acting insulins

- Each haemodialysis unit should have access to appropriate dietary expertise able to provide a holistic approach to the patient with diabetes. It is recommended that patients on haemodialysis achieve an energy intake of 30-40kcal/kg IBW and achieve a protein intake of >1.1g/kg IBW. If a patient is aiming to lose weight appropriate individualised advice should be provided on energy requirements

- In patients on treating their diabetes with insulin:
    - Where there is a pre-dialysis glucose of <7.0 mmol/L, 20 to 30g of a low glycaemic index carbohydrate is recommended at the beginning of the haemodialysis session to prevent further decline of blood glucose level Should have capillary glucose assessed pre and post dialysis
    - The unit should ensure a hypoglycaemia treatment is accessible to patient at all times including during travelling to and from the dialysis unit. (Grade 2D)

- Clinicians should ensure that patients on MHDx with diabetes are aware that they are more likely to be able to maintain IDWGs at less than 4.5% of dry weight or less than 2kg if they optimise their HbA1c

- Patients who are overweight/obese who are being considered for a kidney transplant should be encouraged to lose weight. Dietary counselling should be a calorie restrictive diet, making sure that the protein requirements for the patient are met, at least 1.1g/kg/IBW

- Dietary counselling should also ideally include behavioural change strategies and increased physical activity

- All patients with an elevated BMI who may not be considered for transplantation if unable to lose weight through diet, exercise and behavioural change should be considered for bariatric surgery or weight reducing medication

- In managing patients with diabetes on maintenance haemodialysis, clinicians should be aware of the significantly increased risk of hypoglycaemia. Clinicians should counsel patients with diabetes and on maintenance haemodialysis about risk of hypoglycaemia on dialysis days, and consider reducing anti-hyperglycaemic therapy on dialysis days

- The heels of all patients with diabetes on haemodialysis should be protected with a suitable pressure relieving device during haemodialysis. All patients with diabetes on dialysis should have their feet inspected at least weekly

- All patients with diabetes on dialysis should be considered high risk and should have regular review by the podiatry team. Patients should have their feet screened three monthly using a locally agreed tool and by competent staff on the dialysis unit. If the patient has an ulcer or there is any other concern the patient should be referred to the diabetic foot multidisciplinary team within one working day.

14. Glycaemic management and the inpatient enteral feeding of stroke patients with diabetes

Aled Roberts

- The JBDS guidelines on managing glycaemia in patients with diabetes undergoing enteral feeding has been published[89] and this remains a challenge for all clinical teams managing inpatients with diabetes and stroke

- Poor glycaemic control in people receiving enteral feeding following stroke may worsen patient recovery and the potential for rehabilitation. There is a need for pragmatic clinical guidance for multidisciplinary teams, on the inpatient management of people with stroke who have diabetes and who require a period of enteral feeding in order to improve patient outcomes and patient experience. This JBDS document was based on the limited available clinical evidence in this area but with a highly experienced clinical working group with expertise in diabetes, enteral feeding and stroke medicine.

Recommendations

- All patients who present with stroke should have a capillary blood glucose checked on admission to hospital, as hyperglycaemia in stroke patients is common, and associated with worse outcomes

- The focus in the management of hyperglycaemia should be the maintenance of capillary blood glucose (CBG) within an acceptable range (6.0-12.0mmol/l) whilst limiting the risk of hypoglycaemia

- The DISN or Diabetes Inpatient Team (DIT) should be available to plan the diabetes treatment once the enteral feed protocol is recommended

- Nursing staff need to have a good understanding of:
  - *Capillary glucose monitoring*
  - *The definition of hyperglycaemia and hypoglycaemia*
  - *The duration of action of different insulin products*
  - *Knowledge of the circumstances in which the DISN/DIT should be consulted*
  - *The ability to titrate and stop feed when required*
  - *Managing hypoglycaemia in an appropriate and timely manner*
  - *Risk of foot/heal ulceration*
  - *Undertake the NHS Diabetes e-learning packages – "Safe use of insulin" and "Intravenous Insulin Infusions" to acquire relevant knowledge*

- People with diabetes should receive standard feed preparations

- Blood Glucose Targets should be fasting or pre-feed 5.0-8.0mmol/L and feeding 6.0-12.0mmol/L

- Hypoglycaemia should be particularly avoided as patients with evolving cerebral damage may be particularly vulnerable to the central neurological effects of hypoglycaemia

- Monitor CBG pre-feed and then 4-6 hourly when patient receiving subcutaneous insulin and continuous feed

- If intermittent feeding, monitor CBG pre-feed, 4-6 hourly during feed, and 2 hour post-feed

- If bolus only feeding, then monitor CBG pre-feed, 2 hour post feed and 4-6 hourly during prolonged intervals between feeds

[89] Roberts AW, Penfold S; Joint British Diabetes Societies (JBDS) for Inpatient Care. Glycaemic management during the inpatient enteral feeding of people with stroke and diabetes. Diabet Med. 2018 Aug;35(8):1027-1036.

- Beware of risk of hypoglycaemia during fasted period between feeds, and hypoglycaemia as cause of drowsiness in patients with stroke

- Monitor blood glucose hourly if patient receiving VRIII, or if feed stopped and insulin.

Management of Hyperglycaemia

- Aim to keep CBG within target range 6.0-12.0mmol/L

- All patients with type 1 diabetes will require VRIII, with IV 10% glucose if feed off/not prescribed and nil by mouth

- Continue long acting analogue insulin if patient is already taking it

- Patients admitted with continuous subcutaneous insulin infusion (CSII) devices should be referred to the inpatient diabetes team for assessment. Unless the patient is fully competent and able to manage the insulin pump, CSII should be discontinued, and a subcutaneous insulin regimen be commenced, or a VRIII

- Treat the CBG if persistently >12.0mmol/L. Commence subcutaneous insulin aiming for a blood glucose 6.0-12.0mmol/L

- The titration of enteral feed may take at least 72 hours, and the use of a VRIII for the whole of this period will involve multiple capillary blood glucose checks for the patient. We advise minimising the use of the VRIII

- Metformin powder for re-suspension may be considered for mild hyperglycaemia (e.g. capillary blood glucose up to 12.0mmol/L) in people with type 2 diabetes. Crushing oral hypoglycaemic medications, such as sulphonylureas, to manage hyperglycaemia during enteral feeding is not advised given the unpredictable absorption and difficulties in administration associated with this action, as well as the risk of tube blockage with crushed debris.

Insulin options

- Pre-mixed (30/70) human insulin at the time of feed commencement, with the second dose at the midpoint of the feed. 50% of the required insulin can be administered with each dose

- Isophane insulin at the start of the feed - though a further dose of isophane may be required at the midpoint of the feed. Alternatively, bolus short-acting soluble insulin doses may be added during the feed period

- Continuation of basal bolus insulin regimen. The basal insulin should be administered at feed commencement and bolus doses of soluble or rapid-acting analogue insulin administered at 6 and 12 hours into the feed, if required – useful in those with type 1 diabetes

- Bolus feeding may be managed with single doses of soluble human insulin 20 minutes prior to the administration of the bolus feed. Basal insulin should be continued for those with type 1 diabetes or those with type 2 diabetes established on insulin.

Hypoglycaemia

- Patients with stroke requiring enteral feeding will have varying degrees of neurological injury, potentially masking the symptoms of hypoglycaemia. In the event of hypoglycaemia, rapid action is indicated to correct and maintain CBG to above 4.0mmol/L

- If severe or recurrent hypoglycaemia and patient has IV access, give 10% glucose at 100ml/hour

- If patient has no IV access give via NGT ONE of the following;
  - a) 2 tubes 40% glucose gel - not for use with fine bore NGT
  - b) 1 bottle (60ml) Glucojuice®
  - c) 150-200ml orange juice
  - d) 50-70ml Fortijuce® (NOT Fortisip) to give 15-20g carbohydrate
  - e) Re-start feed to rapidly deliver 15 – 20g carbohydrate

- Follow these treatments by FLUSHING THE NGT WITH WATER. Alternatively: Give IM Glucagon injection (providing no contraindication)

- When CBG greater than 4.0 mmol/L and the patient has recovered, give long-acting carbohydrate. For example, restart feed, if bolus feeding, calculate amount required to give 15-20g carbohydrate, or 10% IV dextrose saline at 100ml/hour. Volume should be determined by clinical circumstances.

Suggested further reading

- Link to guideline: https://www.diabetes.org.uk/professionals/position-statements-reports/specialist-care-for-children-and-adults-and-complications/glycaemic-management-during-the-inpatient-enteral-feeding-of-stroke-patients-with-diabetes
- Lee SH, Kim BJ Bae HJ et al. 2010 Effects of glucose level on early and long-term mortality after intracerebral haemorrhage: the Acute Brain Bleeding Analysis Study. Diabetologia Mar;53(3):429-34
- Gray C et al. The UK Glucose Insulin in Stroke Trial (GIST-UK). Lancet Neurology 2007
- Bruno A, Kent TA, Coull BM, Shankar RR, Saha C, Becker KJ, et al. Treatment of hyperglycemia in ischemic stroke (THIS): a randomized pilot trial. Stroke. 2008;39:384-9
- Kunjan R. Dave, John Tamariz, Kushal M. Desai, Frank J. Brand, Annie Liu, Isabel Saul, Sanjoy K. Bhattacharya, Antonello Pileggi. Recurrent Hypoglycemia Exacerbates Cerebral Ischemic Damage in Streptozotocin-Induced Diabetic Rats. Stroke. 2011;42:1404-1411
- Umpierrez G, Smiley D, Zisman A et al. Randomized Study of Basal-Bolus Insulin Therapy in the Inpatient Management of Patients With Type 2 Diabetes (RABBIT 2 Trial). Diabetes Care 2007;30(9):2181-86
- Charney P, Hertzler SR. Management of Blood Glucose and Diabetes in the Critically Ill Patient Receiving Enteral Feeding. Nutr Clin Practl 2004;19(2): 129-136
- The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee. Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008. Basel: The European Stroke Organization, 2009. https://www.karger.com/Article/FullText/131083
- Grant PS, Ali K. A prospective, observational study of the management of hyperglycaemia in acute stroke. What is the optimum level of blood glucose at which to intervene? British Journal of Diabetes & Vascular Disease November/December 2010;10(6):287-291
- Korytkowski MT, Salata RJ, Koerbel GL et al. Insulin Therapy and Glycemic Control in Hospitalized Patients With Diabetes During Enteral Nutrition Therapy. A randomized controlled clinical trial. Diabetes Care April 2009 vol 32(4) 594-596
- Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM, Kitabchi AE: Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. J Clin Endocrinol Metab 2002;87:978–982
- Poppe AY, Majumdar SR, Jeerakathil T et al. Admission Hyperglycemia Predicts a Worse Outcome in Stroke Patients Treated With Intravenous Thrombolysis. Diabetes Care 2009;32(4):617-22.

15. Inpatient Self-Management of diabetes

Daniel Flanagan

- The JBDS guidelines on self-managing diabetes in hospital has been published[90]

- The aim of this guideline is to improve the inpatient experience and safety for people with diabetes. It is primarily aimed at healthcare professionals working in hospitals, although some aspects are relevant to staff involved in pre-admission preparation. The guideline is designed to enable adaptation to local circumstances where required.

Key recommendations:

- Trusts should provide written information to explain the responsibilities of self-management to both patients and hospital staff
- The responsible nurse and the patient should agree, on admission, the circumstances in which the patient should self-manage. An agreement form should be signed by both the patient and a registered nurse
- For elective surgical admissions, a care plan should be agreed at the pre-operative assessment clinic to establish whether the patient wishes to self-manage and the circumstances in which this may not be possible
- During the admission, the clinical circumstances should be assessed regularly to ensure that the patient's ability to self-manage has not been compromised by their clinical condition
- The diabetes specialist team should be involved if there is disagreement about the patient's ability to self-manage or if there are difficulties with diabetes control. DISN staffing levels should be sufficient to support this role
- Patients should be able to self-monitor their blood glucose but should make the results available to hospital staff
- The insulin dose administered by the patient should be recorded on the prescription chart
- The hospital should ensure that the timing and content of meals are suitable for the patient with diabetes
- Facilities should be available for the safe storage of insulin in the ward environment.

[90] Flanagan D, Dhatariya K, Kilvert A; Joint British Diabetes Societies (JBDS) for Inpatient Care group and Guidelines writing group. Self-management of diabetes in hospital: a guideline from the Joint British Diabetes Societies (JBDS) for Inpatient Care group. Diabet Med. 2018 Aug;35(8):992-996

16. Avoiding and Managing Hypoglycaemia in Hospital

Esther Walden

- The JBDS guidelines on hypoglycaemia in hospital has been published[91]

- Hypoglycaemia remains one of the commonest and most feared challenges facing people with diabetes during an inpatient admission. Data from the National Diabetes Inpatient Audit (NaDIA) 2017[92] show that although there has been a slight decrease in the episodes of hypoglycaemia, nearly 1 in 5 patients still experienced at least one episode (18%). NaDIA 2015[93] data demonstrated that patients with medication errors were twice as likely to have a severe episode

- It is therefore essential that Trusts have a strategy for the recognition, treatment and avoidance of hypoglycaemia. There are many resources to help guide in the management and treatment of hypoglycaemia and useful patient education leaflets.

Key recommendations for all Trusts for the management of hypoglycaemia

- Trusts should have a local policy for the management of hypoglycaemia which should include managing patients from mild episodes with no swallowing difficulty, to managing those who are unconscious or 'Nil by Mouth' and those who are receiving enteral feeding

- 50% Intravenous glucose should no longer routinely be used for the treatment of hypoglycaemia

- Patients who have experienced a severe episode of hypoglycaemia or more than one mild episode should be reviewed by the Diabetes Specialist team

- Diabetes teams should review any serious untoward incidents where hypoglycaemia has been a factor and develop strategies for future prevention

- Trusts should consider and adopt strategies for avoiding hypoglycaemia such as access for patients to between meal snacks and routine diabetes specialist review of patients treated with insulin or sulphonylureas

- Trusts should have a blood glucose monitoring policy which includes guidance on the frequency of monitoring

- Trusts should have a policy for continued self-management of diabetes and ward nursing staff should encourage (where appropriate) patients to manage their own insulin

- All episodes of hypoglycaemia and the treatment given should be documented

- Where hypo boxes are being used, there should be a system in place for regular checking of the contents

- Episodes of hypoglycaemia should be audited on a regular basis and services adapted if required in light of the findings

- Education on the management of diabetes should be available to all nursing and medical staff with particular focus on insulin safety for those who are responsible for prescribing and administering insulin

- Nursing staff should be able to access regular education on the management of hypoglycaemia

- There should be a diabetes inpatient specialist nursing team to support all ward areas.

[91] https://abcd.care/sites/abcd.care/files/resources/20180508_JBDS_HypoGuideline_Revised_v2.pdf

[92] https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017

[93] https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2015

Useful hypoglycaemia resources

- The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus. April 2018 https://abcd.care/sites/abcd.care/files/resources/20180508_JBDS_HypoGuideline_Revise d_v2.pdf

- Hypoglycaemia in adults in the community: recognition, management and prevention December 2018 https://trend-uk.org/wp-content/uploads/2018/09/HCP_Hypo_TREND_FINAL.pdf

- Management of Diabetes (SIGN Guideline No 116) www.sign.ac.uk/pdf/sign116.pdf

- International Diabetes Federation. Managing Older People With Type 2 Diabetes Global Guideline https://www.idf.org/e-library/guidelines/78-global-guideline-for-managing-older-people-with-type-2-diabetes.html

- https://www.diabetes.org.uk/resources-s3/2019-05/Clinical%20Guideline%20for%20Type%20 1%20Diabetes%20for%20Older%20Adults%20-%20April%202019.pdf

- Diabetes UK information on hypoglycaemia https://www.diabetes.org.uk/guide-to-diabetes/complications/hypos

- TREND – Training, Research, Education for Nurses in Diabetes patient information leaflets available to download at https://trend-uk.org/resources/

- The Leicester diabetes team have produced a suite of short video animations for the management of diabetes, title IDEA (Inpatient Diabetes Education through Animation). The hypoglycaemia video is at : https://www.youtube.com/channel/UCEjm7Hzssu04snzzoxTD85A

- Dashora U, Sampson M, Castro E, Stanisstreet D, Hillson R, Diabetes OB. The best hypoglycaemia avoidance initiative in the UK. British Journal of Diabetes. 2017 Jun25;17(2):74-7.

17. Glycaemic Monitoring for inpatients with Diabetes

Anthony Lewis

Capillary blood glucose monitoring targets in particular patient groups are summarised in the relevant chapters throughout this document.

Quality Assurance

- Although laboratory measured glucose has less variability and interference, multiple daily phlebotomy is not practical in the clinical setting and POC CBG should be used

- Correlation of POC glucose readings with laboratory glucose levels is good and assuming normal haematocrit plasma glucose levels would be 12% higher than whole blood. Most POC glucose meters do not correct for haematocrit[94 95]

- As of May 2016, POC glucose meters should conform with accuracy standards (ISO:15197:2013) requiring that 95% of blood glucose results should be within ± 0.83mmol/L of laboratory results at concentrations of under 5.6 mmol/L and within ± 20% of laboratory results at concentrations of 5.6mmol/L

- POC glucose testing is subject to potential error in a variety of settings including improper storage conditions of meters and strips, failure to calibrate meters, failure to assess performance with quality assurance materials, operator error and through skin contamination

- POC glucose readings are affected by abnormal physiology with falsely low readings noted in hypotension (systolic BP <80mmHg), hypoxia, tissue oedema, polycythaemia and falsely high readings are noted in anaemia and low haematocrit

- Consideration should be given to the use of connected POC CBG meters for glycaemic monitoring to enable early identification of hypo- and hyperglycaemia by the inpatient diabetes team

- Consideration should be given to use of inpatient glucose metrics to establish baseline data and drive subsequent quality improvement in inpatient glycaemic control.[96 97]

Further Reading and Key Documents

AACE/ADA Consensus Statement on Inpatient Glycaemic Control

Klonoff DC. Point-of-care blood glucose meter accuracy in the hospital setting. *Diabetes Spectrum* 2014, **27**(3): 174–179

Kiechle FL. Blood Glucose: Measurement in the Point-of-care setting. *Laboratory medicine* 2000, **31**(5): 276-282

Kosiborod M, Inzucchi SE, Krumholz HM, et al. Glucometrics in patients hospitalized with acute myocardial infarction: defining the optimal outcomes-based measure of risk. *Circulation* 2008;**117**:1018-1027.

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[94] Klonoff DC. Point-of-care blood glucose meter accuracy in the hospital setting. Diabetes Spectrum 2014, 27(3): 174–179. 95

[95] Kiechle FL. Blood Glucose: Measurement in the Point-of-care setting. *Laboratory medicine* 2000, **31**(5): 276-282.

[96] ACE/ADA Task Force on Inpatient Diabetes. American College of Endocrinology and American Diabetes Association consensus statement on inpatient glycemic control. Endocrine Practice 2009, 15(4): 1-17.

[97] Kosiborod M, Inzucchi SE, Krumholz HM, et al. Glucometrics in patients hospitalized with acute myocardial infarction: defining the optimal outcomes-based measure of risk. Circulation 2008;117:1018-1027.

18. Discharge planning for patients with diabetes

Esther Walden

- The JBDS guideline on discharge planning for diabetes inpatients has been published[98]

- Effective discharge planning for patients with diabetes improves patient experience, reduces length of stay and readmission rates. Whilst there is a reasonable amount of information available on discharge planning, there are fewer patient resources available.

Key recommendations for discharge planning for adults with diabetes:

- Trusts should have clear discharge planning guidelines available for all wards which include information for early referral to the diabetes specialist team

- Discharge planning for inpatients with diabetes should begin at the time of admission to ensure a smooth, safe and documented transition from hospital to discharge destination

- All inpatients with diabetes, and/or their carers, should be involved in their diabetes care pathway and discharge planning

- A patient's ability to self-manage and their social support should be taken into account when choosing a glycaemic management plan on discharge

- Community support for glycaemic monitoring for patients unable to self-care, for whatever reason, should be arranged prior to discharge

- All medication, insulin passports, equipment and devices for glycaemic management and monitoring, as appropriate to individual needs and wishes, must be available for the patient or carer at the time of discharge

- All patients and their carers must be aware of their diabetes care provider following discharge as well as contact details to access emergency support for diabetes care if required

- On discharge all community services pertinent to the patient, including the GP, must be informed of changes made to the diabetes treatment and follow up plans in the care pathway

- Patients should be given a copy of their continuing diabetes care plan and discharge summary which should include the name of the medication, dosage, frequency of dosing, device for injections (GLP-1 and/or insulin), if appropriate, and follow-up arrangements post-discharge

- The discharge planning process should include all of the patient's needs, of which diabetes should be a part, not the sole focus

- Ensure the discharge planning for patients admitted primarily for another condition but also have active foot disease, does not overlook their specific foot care needs.

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[98] https://abcd.care/sites/abcd.care/files/resources/JBDS_Discharge_Planning_amendment_RCN_2017.pdf

Useful discharge planning resources

- Discharge planning for adults with Diabetes. October 2015. https://abcd.care/sites/abcd.care/files/resources/JBDS_Discharge_Planning_amen dment_RCN_2017.pdf

- The Royal pharmaceutical society. Ensuring the safe transfer of information about medicines when patients move care settings. https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20acces s/Publications/Keeping%20patients%20safe%20transfer%20of%20care%20report.pdf

- NHS England has produced an Improving Hospital Discharge into the care sector – Transforming urgent and emergency care services in England. https://www.england.nhs.uk/wp-content/uploads/2015/06/trans-uec.pdf

- Shepperd S et al (2013), Discharge planning from hospital to home. Cochrane Database of Systematic Reviews;1. https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD000313.pub4/epdf /full

- Department of Health (2010), Ready to go? Planning the discharge and transfer of patients from hospital and intermediate care. https://www.thinklocalactpersonal.org.uk/_assets/Resources/Personalisation/East Midlands/PandEI/Ready_to_Go_-_Hospital_Discharge_Planning.pdf.

19. The management of diabetes in adults and children with psychiatric disorders in inpatient settings

Hermione Price/Khalida Ismail

Why this is important?

- The JBDS guidelines on this area have been published and are a collaboration between the Royal College of Psychiatrists Liaison Faculty and JBDS[99]

- Comorbid mental illness and diabetes present a unique set of challenges both for the patient and for healthcare providers. The evidence for effective interventions is limited and there are no consensus treatment guidelines. Added to this are the inherent difficulties of delivering care across parallel organisational and operational boundaries and a recognition that individuals with psychiatric disorders often struggle to access routine physical healthcare and have other inequalities in health

- Nearly every category of ICD-10 Chapter F (mental disorders) is associated with diabetes In addition, many people with diabetes suffer from diabetes related worries, fears and distress such as fear of hypoglycaemia, complications, failing and the burden of the permanence of the condition, and have levels of 'diabetes distress'

- Individuals with schizophrenia and other mental illnesses are at an increased risk of developing type 2 diabetes. In addition, their life expectancy is reduced by approximately 20 years compared to the general population, with much of the excess mortality attributed to higher rates of cardiovascular disease (CVD). The risk of diabetes is observed regardless of whether individuals are receiving antipsychotic medication, although receiving such medications further increases the risk of diabetes and of premature CVD-related mortality. The reasons behind this increased risk of type 2 diabetes and premature CVD mortality are multifactorial and include increased rates of smoking, poor diet, obesity, lower levels of physical activity and antipsychotic medication in the context of institutionalisation even in the community

- In spite of this well-recognised increased risk, the quality of the diabetes care provided for people with SMI is poor and people are less likely to receive the full complement of recommended services and support. In addition, deaths from acute complications of diabetes in individuals with SMI but unrecognised diabetes have been reported.

Summary of key areas

Commissioners

- Ensure the needs of people with diabetes and SMI are specifically addressed in contracts with providers of in-patient care

- Avoid financial or other barriers to cross-organisational working, make specific targeted efforts to bring all relevant health care professionals together to scope and address obstacles to good care

- Ensure patient structured education is commissioned that meets the complex needs of people with diabetes and serious mental illness

- Consider incentivising good joint care for example through CQUINs.

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[99] Price HC, Ismail K; Joint British Diabetes Societies (JBDS) for Inpatient Care. Royal College of Psychiatrists Liaison Faculty & Joint British Diabetes Societies (JBDS): guidelines for the management of diabetes in adults and children with psychiatric disorders in inpatient settings. Diabet Med. 2018Aug;35(8):997-1004.

Acute trusts

- Develop joint pathways with mental health providers

- Facilitate MDT working with mental health professionals

- Screen for mental ill health in those admitted with acute complications of diabetes whose aetiology is unclear or not medically explained and ensure staff are appropriately trained to do this.

Mental health trusts

- Create a diabetes register particularly in units where individuals may have prolonged inpatient admissions (for example secure hospitals)

- Screen for diabetes particularly in those prescribed second generation antipsychotics

- Implement diabetes-related competencies as part of mandatory training with particular focus on managing and avoiding hypoglycaemia and safe use of insulin

- Audit current practices in diabetes care.

Clinical teams

- Ensure staff receive the basic skills in diabetes and in mental health that are in keeping with their job role to care for patients with comorbidity

- Develop and increase awareness of local pathways and policies for contacting diabetes or mental health services

- Ensure best practice tariff criteria are met for DKA and hypoglycaemia and for children and young people with diabetes.

Key documents

- World Health Organization. International Statistical Classification of Diseases and Related Health Problems - 10th Revision.Occupational Health 41, 1–201 (2004).

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- Newman, S. C. & Bland, R. C. Mortality in a cohort of patients with schizophrenia: A record linkage study. Can J Psychiatry 36 239–245 (1991)

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20. Safe and accurate insulin prescribing

Umesh Dashora/June James/Philip Newland-Jones

- Insulin errors are common in the hospital setting, may cause actual harm, and can significantly delay hospital discharge

- The NaDIA audit (2017) of 16010 inpatients showed 17.9% of inpatients had diabetes

- Data demonstrated that insulin errors continue to affect nearly 1 in 5 inpatients (18.4%) (Figure1) Common errors are shown in Table 2.

Figure 1 Percentage of inpatients with insulin errors (source NaDIA 2017)
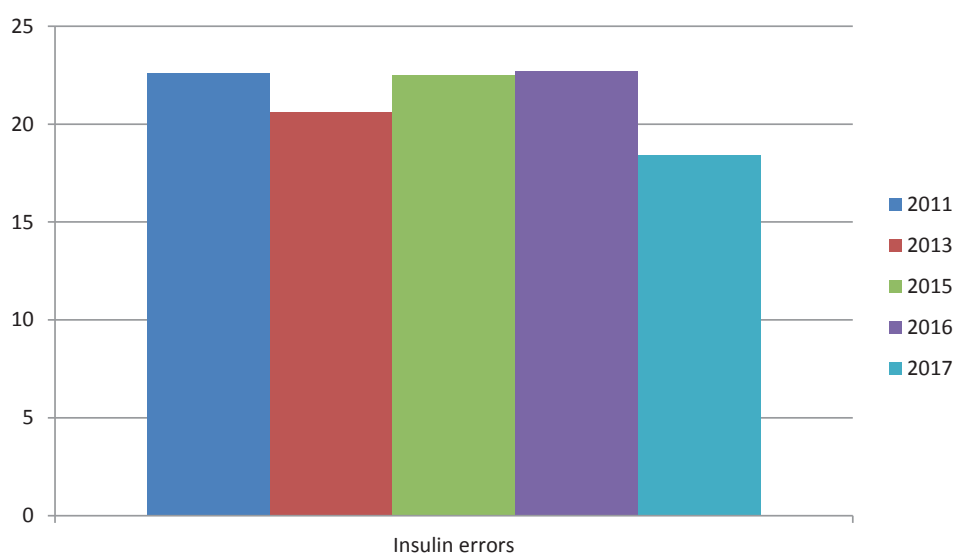
Table 2

Insulin Presription Errors (source NaDIA 2017)

Percentage of inpatient drug charts having one or more medication error in last 7 days, England and Wales, 2011-17.

Error Description	2011	2013	2015	2016	2017
Insulin not written up	2.1	1.7	2.2	1.9	2.0
Name of insulin incorrect	2.9	2.1	1.8	1.8	1.8
Number (dose) unclear	2.3	1.9	1.7	1.6	1.5
Unit abbreviated to 'U' or written unclearly	3.4	1.9	1.5	1.2	1.0
Insulin or prescription chart not signed	2.4	1.9	2.1	2.0	1.9
Insulin not signed as given	5.1	4.8	4.9	4.7	4.3
Insulin given/prescribed at the wrong time	3.1	3.1	3.7	4.2	3.7

- The audit revealed more medication errors (33.4 vs 30.6) and prescription errors (21.3 vs 18.4) on surgical wards compared to medical wards but there was no difference in glucose management or insulin errors

- The NaDIA report showed that although errors relating to insulin and management have reduced year by year, the situation still remains unacceptable and needs further innovations to improve safety

- It is clear that staff training is essential if hospital based prescribing and /or management errors are to reduce. The plethora of insulin types, different concentrations of insulin, and a variety of devices has added to the problem. In hospitals where electronic prescribing is the norm there has been shown some reduction in prescribing error rates (16.6 vs 20.3%)

- Appendix 6 found at the end of this chapter provides an example of an inpatient subcutaneous insulin prescription and monitoring chart.

Safe use of insulin means:

- Patients self-administering insulins should be assessed daily and this should be documented accordingly

- Never use abbreviations e.g. 'U' or 'IU'. Include administration method (e.g. Flexpen, Solostar, cartridges, vials) in 'Device' box. IV insulin should be prescribed on the separate IV insulin medication order and administration chart

- **ALWAYS** use FULL correct name and proprietary name of the insulin

- **ALWAYS** give rapid acting analogues (Humalog, Apidra, Novorapid), short acting human insulin (Humulin S, Human Actrapid) and human biphasic (Humulin M3) and analogue biphasic (Novomix 30, Humalog Mix 25 or Humalog Mix 50) with meals

- **ALWAYS** give Insulin Glargine (Lantus), Insulin Detemir (Levemir), Insulin Degludec (Tresiba) or insulin Toujeo or other BASAL and intermediate acting insulin at the same time each day, irrespective of meals and even if the patient is receiving intravenous insulin

- Confirm any single dose of intermediate/long acting insulin over 50 units and any dose over 25 units of short acting insulin and document

- **Insulin doses must never be omitted or delayed unless clearly outlined on the prescription and documented in the medical notes by the prescriber**

- Prescribe 'Insulin as per chart' on the patient's main inpatient prescription chart

- Prescribe and review insulin doses on a regular basis according to clinical need

- Cross off and re-write the prescription if changes are required

- If changes in the patient's insulin regimen are required, as a general rule, alter one insulin prescription at a time by roughly 10% of the dose

- Further dose adjustments should be made no less than 48 hourly

- All insulin doses must be measured and administered using either an insulin syringe or a commercial pen device. **NEVER** draw up insulin from a prefilled pen device or cartridge

- Whenever a patient is moved between clinical areas, all insulin stored in the patient's bedside locker and ward fridge **must be transferred** with the patient

- All insulin devices must be clearly labelled with the patient's name and expiry date

- Insulin devices in use must be stored in the patient's bedside locker and have a 4-week expiry from the date first used

- Insulin devices not in use by the patient should be stored in the ward fridge. The expiry date for unused insulin will be the manufacturer's

- Never discharge patients on insulin until you are sure that the patient/carer understands the regimen, type of insulin and injection device

- On discharge ensure all equipment is provided together with an insulin passport and information leaflet.

Medication Safety

- The NaDIA audit (2017) showed that there was a significant reduction in medication errors for trusts that used either electronic patient records or electronic prescribing. Data would suggest a reduction in overall prescribing errors, insulin errors and glucose management errors where electronic prescribing for insulin was used. Where trusts have access to electronic prescribing, data would suggest that all diabetes medicines including insulin should be prescribed using the electronic prescribing system. Where possible inpatient diabetes teams, pharmacy departments and IT departments should work together to fully utilise the possible digital technology support to further reduce diabetes medication errors

- Due to the common nature of diabetes medication errors, pharmacy departments within hospitals should have an ongoing strategy to reduce diabetes medication errors as part of a high risk medicines safety plan. Hospital Trusts should have a specialist pharmacist for diabetes that works within or closely alongside the inpatient diabetes service to ensure there is shared departmental responsibility for reducing diabetes medication errors and improving diabetes safety within hospital settings

- Areas of high risk for error such as transfer of patients either at admission or discharge should have standard operating procedures in place to ensure safe, correct information transfer across care settings. Patients on high risk medications such as insulin should have their medicines reconciliation prioritised by pharmacy staff, where brand name, insulin concentration, device type, dose (written in units and confirmed by patient or carer), and dose timing should be documented clearly. There are examples nationally where insulin self administration assessment can be undertaken at the point of medicines reconciliation by pharmacy technicians and pharmacists to support trusts in rolling out insulin self administration. (Making hospitals safe for people with diabetes DUK 2018)

- Ward pharmacists, doctors and nurses should work collaboratively to proactively review patients diabetes medications when there is a change in circumstances, such as acute kidney injury, peri-operatively, change in oral nutritional intake and initiation of total parenteral nutrition or feeds, to reduce risks of inpatient hypoglycaemia.

Medication errors

- Reporting of all near misses and no harm diabetes medication errors should be encouraged where data can be captured and collated. Regular review of near miss and no harm medication errors should be undertaken by the hospital diabetes team and designated members of the pharmacy department. This review should aim to learn from common types of medication error, and a bespoke education strategy developed for the ward areas, or members of staff that require support, avoiding errors that may eventually lead to harm. Where possible members of staff who have prescribed, screened or administered a medication in error should be supported in their learning by diabetes specialist nurses, pharmacists and doctors, or from ward diabetes link nurses

- Hospital trusts should have regular diabetes morbidity and mortality multidisciplinary meetings where time is given to discuss all moderate and high harm medication errors with route cause analysis undertaken as required, and necessary policy changes made to reduce risk of the event happening again

- Trusts are encouraged to partake in the NaDIA-Harms audit, reporting all inpatient episodes of severe hypoglycaemia requiring IV/ IM / SC intervention with glucagon or glucose, and occurrences of inpatient diabetic ketoacidosis (DKA), hyperosmolar hyperglycaemic state (HHS), or new foot ulceration. (NaDIA-Harms 2018)

- Those undertaking prescribing for diabetes medications which includes all doctors and non-medical prescribers should undertake safe use of insulin training or local equivalent. Non-medical prescribers should ensure that an appropriate level of education and development is undertaken prior to taking on prescribing of high-risk medication such as insulin. This should be signed off by divisional governance teams with centrally held records of scopes of prescribing practice updated for each individual.

Key References

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- NHS Improvement (2016) Risk of severe harm and death due to withdrawing insulin from pen devices 16 November. https://improvement.nhs.uk/news-alerts/risk-severe-harm-and-death-withdrawing-insulin-pen-devices/
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Appendix 6. An example of Adult In-patient Subcutaneous Insulin Prescription and Capillary Blood Glucose Monitoring Chart

Allergies, Adverse Effects and Other Considerations for Medicines / Food / Other			Ward	Consultant	Admission Date:
					Discharge Date:
Name or Class Type	Nature of reaction and severity	Sign / Date /Designation	Surname		First Name
			Hospital Number		Date of Birth / Age
			NHS Number		
			Address		
Weight (kg) Date weighed:	Height (M)	BMI			

PRE-ADMISSION DIABETES REGIMEN			
Approved drug name	Form/insulin device	Dose	Frequency

Tick if the patient is also on an oral anti-diabetes medication (prescribed on the main chart)

Patient Self Administration of Insulin Assessment Log			
Refer to Policy for patient self administration of medicines (Policy code:)			Comments / concerns
Level 1	Nurse administration	Re-assess level when indicated	
Level 2	Supervised self-administration	Asked for medication at appropriate times Demonstrated they can select correct drug/dose Injected medication correctly	
Level 3	Independent self-administration	Holds the key to the medicines locker and it is kept in a secure place Has taken prescribed medication at the correct times	
Date			
Time			
Assessed Level			
Initials			

CHECK before you INJECT (5 R's)
Right Insulin   check the name, device and type of insulin   **Right Dose**   confirm the dose and ensure UNITS is written in full   **Right Time**   ensure appropriate timing i.e. mealtime / with food   **Right Route**   is it subcutaneous or intravenous?   **Right Patient**   check with the patient where possible and check identification band   **Right Device**   ensure insulin is administered using the appropriate delivery device

GUIDE ON SAFE PRESCRIBING, ADMINISTRATION, TRANSFER AND STORAGE OF INSULIN

- Never use abbreviations e.g. 'U' or 'IU'. Include administration method (e.g. Flexpen, Solostar, cartridges, vials) in 'Device' box. IV insulin should be prescribed on the separate IV insulin medication order and administration chart.
- Patients Self-administering insulins should be assessed daily and this should be documented accordingly.
- **ALWAYS** use FULL correct name and proprietary name of the insulin.
- **ALWAYS** give rapid acting analogues (Humalog, Apidra, Novorapid), short acting human insulin (Humulin S, Human Actrapid) and human biphasic (Humulin M3) and analogue biphasic (Novomix 30, Humalog Mix 25 or Humalog Mix 50) with meals.
- ALWAYS give Insulin Glargine (Lantus), Insulin Detemir (Levemir), Insulin Degludec (Tresiba) or insulin Toujeo or other BASAL and intermediate acting insulin at the same time each day, irrespective of meals and even if the patient is receiving intravenous insulin.
- Confirm any single dose of intermediate/long acting insulin over 50 units and any dose over 25 units of short acting insulin and document.
- Insulin doses must never be omitted or delayed unless clearly outlined on the prescription and documented in the medical notes by the prescriber.
- Prescribe 'Insulin as per chart' on the patient's main inpatient prescription chart.
- Prescribe and review insulin doses on a regular basis according to clinical need.
- Cross off and re-write the prescription if changes are required.
- If changes in the patient's insulin regimen are required, as a general rule, alter one insulin prescription at a time by roughly 10% of the dose.
- Further dose adjustments should be made no less than 48 hourly.
- All insulin doses must be measured and administered using either an insulin syringe or a commercial pen device. **NEVER** draw up insulin from a prefilled pen device or cartridge.
- Whenever a patient is moved between clinical areas, all insulin stored in the patient's bedside locker and ward fridge **must be transferred** with the patient.
- All insulin devices must be clearly labelled with the patient's name and expiry date.
- Insulin devices in use must be stored in the patient's bedside locker and have a 4-week expiry from the date first used.
- Insulin devices not in use by the patient should be stored in the ward fridge. The expiry date for unused insulin will be the manufacturers.
- Never discharge patients on insulin until you are sure that the patient/carer understands the regimen, type of insulin and injection device.
- On discharge ensure all equipment is provided together with an insulin passport and information leaflet.
- Communicate changes to the patient/carer/community nurse.

ONCE ONLY SUBCUTANEOUS PRESCRIPTIONS OF INSULIN

(For the correction of hyperglycaemia preferably use rapid acting insulin analogues for their insulin action profile and duration of action. A minimum of four hours should be left before repeating a dose of rapid acting insulin. Review cause and consider adjusting usual insulin regimen)

AVOID PRN insulin as much as possible

Date	Time to be given	Insulin (approved name)	Dose	Route	Prescriber's signature	Print name	Given by	Time given	Pharmacy
			Units	S/C					
			Units	S/C					
			Units	S/C					
			Units	S/C					
			Units	S/C					

HUMULIN R U500, INSULIN DEGLUDEC U200, INSULIN TOUJEO U300 AND HUMALOG 200: TAKE EXTREME CARE WHEN PRESCRIBING AND ADMINISTERING THESE INSULINS
These insulins are available in higher concentration to standard U100 preparations
REFER ALL patients to the Diabetes Inpatient team and INFORM Pharmacy

Insulin Types					
Rapid acting insulin analogues (Mealtime)	**Short acting human soluble insulins (Mealtime)**	**Biphasic insulin analogues (BD with meals)**	**Biphasic human insulins (BD with meals)**	**Intermediate acting human insulins (OD or BD)**	**Basal insulin analogues (OD or BD) *OD only**
Novorapid (aspart) Humalog (lispro) Apidra (glulisine)	Actrapid Humulin S Insuman Rapid	Novomix 30 Humalog Mix 25/ Humalog Mix 50	Humulin M3 Insuman Comb 15 or 25 or 50	Humulin I Insulatard Insuman Basal	Detemir (Levemir); Glargine (Lantus) Degludec (Tresiba)*; Toujeo*

REGULAR SUBCUTANEOUS INSULIN PRESCRIPTION
(Insulin must not be stopped or omitted in patients with Type 1 DM)

All insulin administration must be double-checked. This may be the patient if competent to do so.

Insulin (approved name) and device type (circle below) Pen cartridge / disposable pen / vial

To make a change, cross through previous doses

Administration
If patient second checks administration, record as "patient"
If patient is self-administering, document with relevant administration code, and countersign your initials

1	Nurse administration
2	Supervised self-administration
3	Independent self -administration

TIMES			Dose	Change 2 Date	Change 3	Change 4 Date	Change 5 Date	Date											
								Self-admin Level											
Breakfast	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											
	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											
Lunch	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											
Evening meal	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											
	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											
Bedtime	Type		Units	Units	Units	Units	Units	Dose given											
								Time given											
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1											
								Sign 2											

Insulin Types

Rapid acting insulin analogues (Mealtime)	Short acting human soluble insulins (Mealtime)	Biphasic insulin analogues (BD with meals)	Biphasic human insulins (BD with meals)	Intermediate acting human insulins (OD or BD)	Basal insulin analogues (OD or BD) *OD only
Novorapid (aspart) Humalog (lispro) Apidra (glulisine)	Actrapid Humulin S Insuman Rapid	Novomix 30 Humalog Mix 25/ Humalog Mix 50	Humulin M3 Insuman Comb 15 or 25 or 50	Humulin I Insulatard Insuman Basal	Detemir (Levemir); Glargine (Lantus) Degludec (Tresiba)*; Toujeo*

REGULAR SUBCUTANEOUS INSULIN PRESCRIPTION
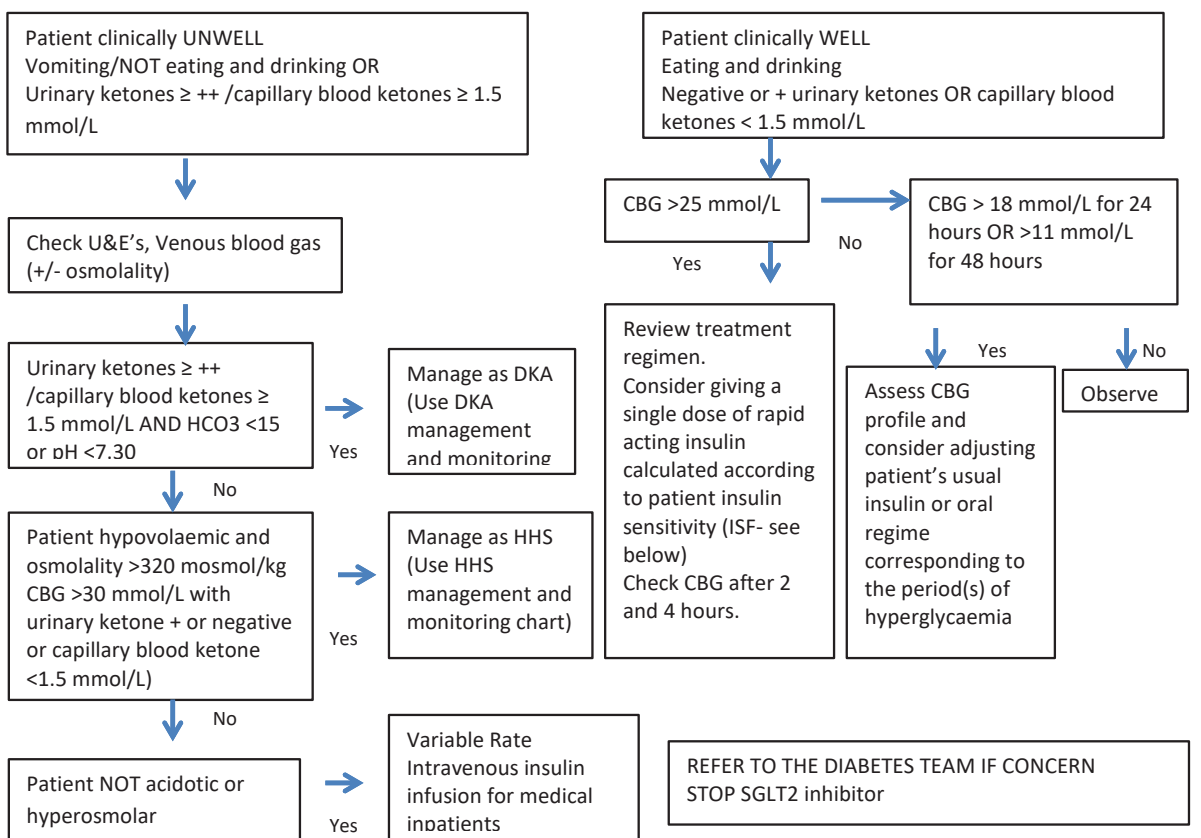(Insulin must not be stopped or omitted in patients with Type 1 DM)

All insulin administration must be double-checked. This may be the patient if competent to do so.

	Insulin (approved name) and device type (circle below) Pen cartridge / disposable pen / vial		To make a change, cross through previous doses			**Administration** If patient second checks administration, record as "patient" If patient is self-administering, document with relevant administration code, and countersign your initials						

1 Nurse administration
2 Supervised self-administration
3 Independent self-administration

TIMES			Dose	Change 2 Date	Change 3	Change 4 Date	Change 5 Date	Date												
								Self-admin Level												
Breakfast	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												
								Sign 2												
	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												
								Sign 2												
Lunch	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												
								Sign 2												
Evening meal	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												
								Sign 2												
	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												
								Sign 2												
Bedtime	Type		Units	Units	Units	Units	Units	Dose given												
								Time given												
	Sign	Date	Pharm	Pres. Sig	Pres. Sig	Pres. Sig	Pres. Sig	Sign 1												

CAPILLARY BLOOD GLUCOSE MONITORING CHART (in mmol/L)

Guide:

Only use for patients on subcutaneous insulin regimen. Use different chart for patients on intravenous insulin infusion.

Make sure the patient's hands are clean.

Basal only with oral glucose lowering therapy: Twice daily, at fasting and one at different time.

Biphasic insulin: Twice daily at different times.

Basal bolus: Four times daily

Monitor more frequently if CBG persistently >11 mmol/L and aiming for ideal glycaemic target

Monitor more frequently if patients are experiencing recurrent hypoglycaemia

Relax frequency of monitoring for patients with relaxed glycaemic target

DATE	Before breakfast	2 hours after breakfast	Other time	Before lunch	2 hours after lunch	Other time	Before dinner	2 hours after dinner	Other time	Before bed	During night	KEY EVENTS / NOTES Including Capillary blood ketone monitoring. Refer to Section: Management of Hyperglycaemia for adult inpatients with diabetes if blood ketones >1.5 mmol/L

MANAGEMENT OF HYPERGLYCAEMIA IN ADULT INPATIENTS WITH DIABETES

Increase frequency of CBG monitoring in patients with CBG's persistently >11 mmol/L

Assess cause(s) of hyperglycaemia, including concurrent illness, dietary intake, missed / omitted / incorrect dose of insulin or oral glucose lowering agent(s)

Check for ketones (capillary or urine) in unwell patients with Type 1 DM or if CBG >14 mmol/L, or patients with Type 2 DM admitted on SGLT2 inhibitors (Dapagliflozin, Canagliflozin, Empagliflozin, Ertugliflozin)

Patient clinically UNWELL
Vomiting/NOT eating and drinking OR
Urinary ketones ≥ ++ /capillary blood ketones ≥ 1.5 mmol/L

↓

Check U&E's, Venous blood gas (+/- osmolality)

↓

Urinary ketones ≥ ++ /capillary blood ketones ≥ 1.5 mmol/L AND HCO3 <15 or pH <7.30 → **Yes** → Manage as DKA (Use DKA management and monitoring

↓ **No**

Patient hypovolaemic and osmolality >320 mosmol/kg CBG >30 mmol/L with urinary ketone + or negative or capillary blood ketone <1.5 mmol/L) → **Yes** → Manage as HHS (Use HHS management and monitoring chart)

↓ **No**

Patient NOT acidotic or hyperosmolar → **Yes** → Variable Rate Intravenous insulin infusion for medical inpatients

---

Patient clinically WELL
Eating and drinking
Negative or + urinary ketones OR capillary blood ketones < 1.5 mmol/L

↓

CBG >25 mmol/L → **No** → CBG > 18 mmol/L for 24 hours OR >11 mmol/L for 48 hours

↓ **Yes**

Review treatment regimen.
Consider giving a single dose of rapid acting insulin calculated according to patient insulin sensitivity (ISF- see below)
Check CBG after 2 and 4 hours.

Yes → Assess CBG profile and consider adjusting patient's usual insulin or oral regime corresponding to the period(s) of hyperglycaemia

No → Observe

REFER TO THE DIABETES TEAM IF CONCERN
STOP SGLT2 inhibitor

Calculation of Insulin Sensitivity Factor (ISF) with example:
Total daily dose (TDD) = weight in kg/2 x 0.5 (Use 0.3 for renally impaired patients)
ISF = 100÷TDD
Example: A patient with CBG 25 mmol/L, weight of 70 kg
TDD= 70 x 0.5 = 35
ISF = 100 ÷ 35 = 3
The ISF = 3 means every unit of rapid acting insulin will lower CBG by 3 mmol/L
REMEMBER: Aim for target CBG of 7 mmol/L on correction
Answer: the patient will require 6 units of rapid acting insulin to bring CBG down to target
NOTE:
ISF calculation is only a guide. This may need adjustment according to response

---

DKA Entry Criteria (if all ticked- progress to DKA protocol)

Ketonaemia >3.0 mmol/L or significant ketonuria(≥++)	( )
CBG > 11 mmolL or known diabetes mellitus	( )
Venous bicarbonate (HCO3) <15 and/or venous pH <7.3	( )

HHS Entry Criteria (if all ticked- progress to HHS protocol)

Hypovolaemia +	( )
Marked hyperglycaemia (>30 mmol/L) without significant hyperketonaemia (<3.0 mmol/L) or acidosis (pH>7.3, bicarbonate >15 +	( )
Osmolality >320 mosmol/kg)	( )

MANAGEMENT OF HYPOGLYCAEMIA IN ADULT INPATIENTS WITH DIABETES

Definition: Any Capillary OR laboratory Blood Glucose less than 4 mmol/L

Patients who are conscious, orientated and able to swallow

STEP 1:
Give:
4-5 Glucose tablets OR
1 bottle Glucojuice OR2 tubes Glucogel OR
Other quick acting carbohydrates (15-20 g) of patient's choice

Repeat CBG check after 10-15 minutes

CBG ≥ 4 mmol/L and patient recovered

CBG < 4 mmol/L
Repeat step 1 up to 3 cycles
If still < 4 mmol/L contact doctor

STEP 2:
Give 20 g long acting carbohydrates e.g. 2 biscuits/ 1 slice of bread or a meal with carbohydrate if due
If patient had Glucagon give double carbohydrate portion

Patients who are conscious but confused, disorientated, unable to cooperate or aggressive but are able to swallow

Check ABCDE
Give 100 mls of IV 20% Dextrose over 10-15 minutes via volumetric pump OR
Glucagon 1 mg (if no IV access)
Arrange urgent medical review

Repeat CBG check after 10-15 minutes

CBG < 4 mmol/L give or repeat IV 20% Dextrose 100 mls up to 3 cycles
DO NOT repeat Glucagon

If CBG remains < 4 mmol/L contact the Diabetes Team or the on-call Medical Registrar

CBG > 4 mmol/L

STEP 3:
LOOK FOR THE CAUSE AND REVIEW THE USUAL DIABETES REGIMEN.
ALWAYS document the episode and increase frequency of CBG monitoring for 24-48 hours
DO NOT OMIT insulin if due. However, insulin regime review may be required
NEVER OMIT INSULIN IN PATIENTS WITH TYPE 1 DM
Give the patient hypoglycaemia education and/or refer to the DISNs

NOTE: Patients who are experiencing hypoglycaemia symptoms but have a blood glucose level greater than 4.0mmol/L – treat with a small carbohydrate snack only e.g. 1 medium banana, a slice of bread or normal meal if due.

ONCE ONLY PRESCRIPTION OF GLUCAGON

Date	Time	Drug	Dose	Route	Prescriber's Signature	Print Name	Given by:	Time given
		Glucagon	1 mg	IM				

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	100 mls	IV	15 mins				

DOCUMENTATION OF CAPILLARY BLOOD GLUCOSE (CBG) MONITORING

- After the hypoglycaemic episode has been treated record further CBG readings in the table below
- Repeat and record CBG again in 15 minutes after hypoglycaemia treatment is given
- Continue to check and record CBG reading every 15 minutes until 3 consecutive readings of >4 mmol/L are obtained. Regular monitoring is required for further 24-48 hours
- For recurrent hypoglycaemia refer to the Diabetes Team for review

Date	Time	Initials	CBG (mmol/L)	Date	Time	Initials	CBG (mmol/L)

21. Inpatient Care of the Frail Older Adult with Diabetes

Alan Sinclair, Umesh Dashora, Stella George

Introduction

- The main purpose of this timely guideline has been to highlight the importance of identifying and detecting frailty early in the inpatient course of someone with diabetes in order to have the best opportunity to enhance clinical outcome. The Writing Group has acknowledged that the evidence base for recommendations given requires to be more robust in the future but has pursued a strategy of evaluating all available evidence and then combining this process with expert consensus where possible. As such, this Inpatient Guideline is the first detailed attempt to provide an evidence-based and good clinical practice approach to diabetes care for a frail older inpatient with diabetes. JBDS has produced this guideline in order for its recommendations to be implemented within the NHS in the United Kingdom

- Frailty can be defined as a summary concept based on: (a) a vulnerability state that leads to a range of measurable adverse outcomes such as falls or a decline in physical performance; (b) a decline in physiological reserve and the inability to resist to physical or psychological stressors; (c) a pre-disability condition. It should be recognised that frailty is a common finding and may be present in 32-48% of adults aged 65 years and over with diabetes living in the community and that diabetes is one of five major comorbidities that is associated with the actual development of frailty. The guideline provides examples of frailty assessment tools that can be employed in routine clinical care and a series of appendices that support the evaluation process and provide a template pathway for the inpatient management of the frail older adult inpatient with diabetes.

Examples of Key Recommendations

- Health and social professionals engaged in direct patient care in hospital and community settings should acquire the basic skills to assess for functional status and frailty

- All older adult inpatients with diabetes should have Individualised care plans detailing co-morbidities, presence of frailty or functional loss (including cognition), individualised agreed goals of treatment plan, medications, frequency of monitoring, agreed target capillary blood glucose (CBG) when appropriate, with HbA1c, blood pressure and serum cholesterol levels measures as necessary

- Frail older patients may have nutritional deficits, and therefore ensure that nutritional status is assessed and that optimal nutritional support is provided

- Discharge planning preparation needs to ensure that the older person, their carers and the primary or community diabetes teams fully understand the ongoing care plan and any post-discharge medicines adjustments that may be required.

Examples of Key Topics for Multidisciplinary Clinical Audit

- Percentage of older inpatients with diabetes receiving an assessment for frailty in a single clinical unit or hospital ward in the past year

- Percentage of older inpatients with frailty and diabetes having received a community-based risk factor assessment prior to hospital admission in a single clinical unit or hospital ward in the past year

- Percentage of older inpatients with frailty and diabetes receiving a medicines review within 48h of their admission into a single clinical unit or hospital ward in the past year.

Supporting Information and Links to Resources

- Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al; the Cardiovascular Health Study Collaborative Research Group. *Frailty in older adults: evidence for a phenotype.* J Gerontol A Biol Sci Med Sci. 2001;56(3):M146-156

- Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, et al. *A global clinical measure of fitness and frailty in elderly people.* CMAJ. 2005;173(5):489-495

- Abellan van Kan G, Rolland Y, Bergman H, Morley JE, Kritchevsky SB, Vellas B. *The I. A.N.A Task Force on frailty assessment of older people in clinical practice.*J Nutr Health Aging. 2008;12(1): 29-37

- Sinclair AJ, Dunning T, Izquierdo M, Rodriguez Manas L, Bourdel-Marchasson I, Morley JE, et al. *An International Position Statement on the Management of Frailty in Diabetes Mellitus: Summary of Recommendations 2017*. J Frailty Aging. 2018;7(1):10-20

- **STOPPFRAIL** – a resource that lists explicit criteria for potentially inappropriate medication use in frail older adults with limited life expectancy: available at: https://www.semanticscholar.org/paper/ STOPPFrail-(Screening-Tool-of-Older-Persons-in-with-Lavan-Gallagher/7519e6463d66e69dc8c5e0c5 daad72fa7d0cf223

- **Acute Care Toolkit 3** – Royal College of Physicians – this provides guidance for NHS medical and nursing staff in acute medical units (AMUs) who are managing more and more numbers of older frail adults requiring access to acute care. Available at: https://www.rcplondon.ac.uk/guidelines-policy/acute-care-toolkit-3-acute-medical-care-frail-older-people.

22. End of life care

June James

- Each year in the UK around 550,000 people die (ONS 2008-10) and 54% die in hospital; of these approximately 75,000 will have diabetes. The numbers dying with diabetes are often underestimated as only 35-40% of recorded deaths list diabetes as the cause or a contributing cause of death[100]. Most people do not die as a direct result of having diabetes but of the co-morbidities associated with diabetes. It is important that healthcare professionals caring for inpatients with diabetes know how to address their needs at the end of life

- End of life" is a commonly used phrase, but what is "end of life" and when does it begin? The General Medical Council (2010) stated that: "Patients are 'approaching the end of life' when they are likely to die within the next 12 months. This includes patients whose death is imminent (expected within a few hours or days)" and those with:

  - Advanced, progressive, incurable conditions
  - General frailty and co-existing conditions that mean they are expected to die within 12 months
  - Existing conditions if they are at risk of dying from a sudden acute crisis in their condition
  - Life-threatening acute conditions caused by sudden catastrophic events.

The Gold Standard Framework (2011)[101] separates "end of life" into 4 stages:

A. Blue – individuals with a life expectancy of 12 months

B. Green – individuals with advanced disease and a life expectancy of months

C. Yellow – individuals whose condition is deteriorating and who may have a life expectancy of weeks

D. Red – individuals who are in the last few days of life

- However, inpatients are more likely to referred to diabetes teams when the patient has commenced treatments such as glucocorticosteroids resulting in hyperglycaemia, when they are experiencing recurrent hypoglycaemia and/or when they are in the last few weeks or days of life

- Guidance for healthcare professional is available from the Diabetes UK Consensus guidelines outlining treatment and care for individuals at each phase (2013). These recommendations have been adopted NHS England and by the International Diabetes Federation.

Treatment aims in end of life care

- The provision of a painless and symptom-free death

- The tailoring of glucose-lowering therapy to minimise diabetes related adverse treatment effects

- The avoidance of metabolic decompensation and diabetes-related emergencies: frequent and unnecessary hypoglycaemia, diabetic ketoacidosis, hyperosmolar hyperglycaemic state, persistent symptomatic hyperglycaemia

- The avoidance of foot complications in frail, bed-bound elderly patients with diabetes

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[100] (James J, McLeod J, Gregory R 2016). Diabetes at end of Life, https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118924853.ch63

[101] https://www.goldstandardsframework.org.uk/cd-content/uploads/files/General%20Files/GSF%20DH%20EOLC%20Programme%20Clarification%20Statement%20-%20Final.pdf

- The avoidance of symptomatic clinical dehydration

- The provision of an appropriate level of intervention according to stage of illness, symptom profile and respect for dignity

- The supporting and maintaining the empowerment of the individual patient (in their diabetes self-management) and carers to the last possible stage.

Diabetes Treatment options

- The guidance includes recommendations for insulin, non-insulin therapies and other diabetes-related medications linked to life expectancy and aligned where possible to the individual's perceived life expectancy, and following discussion with the patient, their family and the patient's advocate. Glycaemic targets given are dependent on the stage of the illness and patient preference

- There are no stated HbA1c recommendations as there is no evidence to support a specific target. Blood glucose targets are recommended and aim to reduce the risk of hypoglycaemia and hyperglycaemia and associated signs and symptoms:

    - Aim 1 is that there are no blood glucose readings less than 6.0mmol/L

    - Aim 2 is that there are no blood glucose readings higher than 15.0mmol/L

- Other recommendations for diabetes therapies including tailoring the medication to the clinical need of the patients and end of life stage (see algorithm 1)

- Fluid withdrawal is not recommended unless it is the express wish of the patient. There should be discussion on the withdrawal of any treatment and an acknowledgement that many factors may influence this process, which may include:

    - The patient's wishes: remember that individuals will probably have been encouraged to take all their medication and keep to tight glycaemic targets throughout their life with diabetes, and so a relaxing of glycaemic control may present real challenges

- Family concerns

- The type of diabetes: for example in type 1 diabetes, **insulin treatment should not be withdrawn**, but the number of blood glucose tests can be minimised in the last days

- The presence of an advance directive.

Treatment withdrawal

Treatment withdrawal may be considered when:

- The individual is entering the terminal phase of life

- When frequent treatment related hypoglycaemia is causing distress and management difficulties

- Where continued use of insulin poses an unacceptable risk of hypoglycaemia or the benefits of treatment cannot be justified

- Where the on-going use of blood pressure or lipid lowering therapies cannot be justified

- Where antibiotic therapy in unlikely to benefit the individual

- Where continued food or fluids is not the choice of the individual

- The development of advance directives complicated with an increasing older population some of whom will have appointed a "power of attorney" to aid decision making, make end of life care challenging. Therefore, it is vital that healthcare professionals, including those who work in diabetes, have the communication skills to have the "difficult discussion" and clinical skills to help the patient experience "as good a death" as possible.

Key references

- Diabetes UK (2018) End of life in diabetes:clinical care recommendations 3rd edition https://www.diabetes.org.uk/resources-s3/2018-03/EoL_Guidance_2018_Final.pdf

- General Medical Council (2010) Treatment and care towards the end of life: good practice in decision-making. GMC, London. Available from: https://www.gmc-uk.org/ethical-guidance/ethical-guidance-for-doctors/treatment-and-care-towards-the-end-of-life

- Gold Standards Framework Centre in End of Life Care (2011) Prognostic Indicator Guidance. Available from: https://www.goldstandardsframework.org.uk/cd-content/uploads/files/General%20 Files/GSF%20DH%20EOLC%20Programme%20Clarific ation%20Statement%20-%20Final.pdf

- James J, McLeod J, Gregory R, (2017) Textbook of Diabetes 5th edition chapter 63 Wiley Blackwell: West Sussex

- ONS 2008-2010 England and Wales General Register Office of Scotland (GRO) Northern Ireland.

23. Safe staffing levels for inpatient specialist nurses

Esther Walden/Debbie Stanisstreet

Position Statement: Diabetes Inpatient Specialist Nurse (DISN) requirements

Calculation of DISN WTE required

This calculation is for Trusts to work out how many DISNs are required for an inpatient service, it uses prevalence to ensure adequate future staffing with an increasing diabetes population

General calculation:

> **(Number of DM occupied beds* X 50 minutes) ÷ 60 = Hours per week**
>
> **Hours spent per week ÷ 25 hours = WTE DISN required**

Example calculation for a Trust with 180 beds occupied by people with diabetes

180 X 50 ÷ 60 = 150   **150 ÷ 25 = 6**   Thus 6 WTE DISN are required

180	(Occupied beds)
x 50	(Minutes)
÷ 60	(Hours spent per week)
150	=150 hours per week
150	(Hours per week)
÷ 25	
6	**= 6 WTE DISN REQUIREMENT**

Additions:
- This assumes half day working on Saturday, Sunday and bank holidays

- + 20% if running a 7 day service
  (e.g. 6 WTE + 20% = 7.2WTE)
  If you work 1 full day, or 2 half days at the weekend add 20%
  If working 1 half day add 10%

- + 5% if there is an expectation of national and/or international collaborations, national and/or international presentations (poster or oral) and manuscript publication.
  (e.g. 6 WTE + 5% = 6.3 WTE)

- Consideration should also be given if the team is expected to cover more than one site (although it is impossible to define a 'one size fits all' calculation in this instance as individual Trusts have significantly different distances between sites).

* worked out using NaDIA prevalence data for each Trust.

Supporting Information

- There have been many national initiatives, particularly in the last decade, to improve the care of people with diabetes whilst they are in hospital and there is now a great deal of evidence suggesting that a Diabetes Inpatient Specialist Nurse (DISN) service, leads to improved outcomes including reduced length of stay, reduced prescription errors, increased patient satisfaction and reduced admission rates. Specialist inpatient services were extremely rare at the turn of the 21st century, but by the first national diabetes inpatient audit (NaDIA) in 2010 (report 2011) two thirds of 188 audit sites that participated had a DISN service.

- Thus in that 10 year period there had been a need to define minimum staffing levels, and in 2010 the Diabetes UK tasks and finish group recommended a minimum of 1 whole time equivalent (WTE) DISN per 300 beds; a figure that was replicated in the DUK position statement in 2014. However, in the infancy of the service this figure was a consensus "best guess" among leading health care professionals at the time and in the intervening years has proved to be woefully inadequate for the complex service delivery that this role now encompasses.

- The NaDIA report 2017 demonstrated that average diabetes inpatient prevalence was 18%, but whilst the majority of hospitals now have a DISN service; one quarter of inpatients with diabetes were not seen by a member of the Diabetes Inpatient Team when it was deemed appropriate according to ThinkGlucose criteria. Of those patients seen, an average of 50 minutes was spent per patient, per week (NaDIA 2017). Whilst many patients may not need this amount of time, when considering the educational needs of this patient group (e.g. DKA, HHS, hypoglycaemia admission, 'new to insulin') or the complexity of some inpatients with diabetes (e.g. enteral feeding, surgery, end of life care) this figure is understandable and has been used as part of a more accurate calculation of DISN requirements.

- Consideration should be given to the structure of the service, particularly if it consists of several novice (less than 3 years diabetes nursing experience) staff members. However, allowance for annual and study leave has already been taking into consideration in the calculation.

- It is important to remember that in order for a DISN service to meet service delivery needs it is not possible for all their time to be spent on direct clinical care; indeed the Diabetes UK position statement 2014 suggested that clinical care should take up only 50-60% of a DSN's time. Thus the calculation that is being proposed takes into account the varied tasks of the DISN service and allows for one third of the time to be spent on activities other than direct patient care. Box1 categorises other activities such a service should include.

Box 1

- Admin (Clinical)
    - ✓ GP letters
    - ✓ MDT liaison
    - ✓ Discharge communication
- Admin (Non Clinical)
    - ✓ Electronic communications
    - ✓ Personnel management (assisting with)
    - ✓ Meetings (departmental, management, Trust, clinical governance, POCT etc.)
- Patient Safety
    - ✓ Investigating serious incidents
    - ✓ Datix management
    - ✓ Complaints (assisting with)
- Service improvement
    - ✓ Audit (preparation and participation)
    - ✓ Service development
    - ✓ Research
    - ✓ Raising awareness initiative
- Education
    - ✓ Training for other health care professionals (including mandatory and ad hoc)
    - ✓ Continued professional development

Key References

- Commissioning Specialist Diabetes Services for Adults with Diabetes: A Diabetes UK Task and Finish Group Report, October 2010
  https://www.diabetes.org.uk/professionals/position-statements-reports/healthcare-professional-staffing-competency/specialist-diabetes-team-role-and-members
- Courtney M, Carey N, James J, Hills M, Roland JM. An Evaluation of a Specialist Nurse Prescriber on Diabetes In-Patient Service Delivery. Diabetic Medicine 24(2) 69-
- DUK, TREND-UK and the RCN Position Statement Feb 2014. Diabetes Specialist Nurses: Improving Patient Outcomes and Reducing costs
  https://www.diabetes.org.uk/resources-s3/2017-11/diabetes-specialist-nurses_improving-patient-outcomes-and-reducing-costs-position-statement-february2014.pdf
- Sampson et al (2013) Determining in-patient diabetes treatment satisfaction in the UK – The DIPSat study. Diabetic medicine do1;10.1111/dme.12095
- National Diabetes Inpatient Audit (NaDIA) report– 2011 NHS digital
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24. What does a good inpatient service look like: what needs to be done to make hospitals a safe environment for inpatients with diabetes

JBDS/Diabetes UK

- All clinicians would accept that a system where people with diabetes do not feel safe in hospital, is unsatisfactory, and this subjective risk is reinforced by objective evidence of harm and at high cost clinically and financially (Chapters 2 - 18). This summary document has been written by practising NHS clinicians with an interest in improving inpatient diabetes care. The arguments in this document are well rehearsed and widely accepted – that about one in six acute beds in the UK are occupied by someone with diabetes, who commonly experience prolonged length of inpatient stay, poorer outcomes, higher morbidity, exposure to inpatient hypoglycaemia, and management errors related to staff inexperience and lack of confidence. Patients with diabetes commonly describe loss of control of their diabetes management, and high levels of dissatisfaction with key elements of inpatient care

- As practising clinicians we are well aware of the financial pressures and other constraints in UK Acute Trusts, but for commissioners, policy makers, and non-specialist teams, what should a good inpatient diabetes service look like? The goal of all hospital trusts should be to ensure that the outcomes for people with diabetes admitted to hospital are no different from those without diabetes by prevention of inpatient hyperglycaemia, hypoglycaemia and hospital acquired foot lesions, and ensuring early and safe discharge. Given the inexorable rise in prevalence and the frequent harms evidenced by the NaDIA, significant investment into planning future inpatient diabetes services will be needed if these goals are to be achieved and the high cost of poor inpatient care is to be addressed. A great deal can be achieved by addressing the significant deficiencies in diabetes specialist staffing and implementing care processes to reduce the variation in care revealed by the NaDIA

- The JBDS guidelines and other areas summarised here have been widely adopted into UK practice, have been well received, and have been seen as high quality by clinical teams[102], but the fact remains that people with diabetes in hospital are still being exposed to significant harms[103][104], and there is a need for continued structured effort to implement these guidelines and develop a wider offer for service improvement

- Diabetes UK, ABCD, the DISN UK Group and all diabetes clinicians are committed to improving hospital care for people with diabetes, but for real improvements to be seen there must be commitment across the whole inpatient community, from specialist teams to trust management, to improve care for people with diabetes in hospital.

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[102] Sampson M, Jones C; Joint British Diabetes Societies (JBDS) for Inpatient Care. Joint British Diabetes Societies for Inpatient Care: clinical guidelines and improving inpatient diabetes care. Diabet Med. 2018 Aug;35(8):988-991

[103] Holman N, Hillson R, Young RJ. Excess mortality during hospital stays among patients with recorded diabetes compared with those without diabetes. Diabetic Medicine 2013;30:1393-1402. Doi: 10.1111/dme.12282

[104] Health and Social Care Information Centre. National Diabetes Inpatient Audit 2017 – National Report

Diabetes UK Making hospitals safe for people with diabetes report

In October 2018 Diabetes UK released a report **'Making hospitals safe for people with diabetes'**[105] which was created by an alliance of groups and individuals striving to improve hospital care for people with diabetes. After a country wide consultation and many visits to hospitals across the country to find out what works they found that for people with diabetes to be safe in hospital we need:

- multidisciplinary diabetes inpatient teams in all hospitals
- strong clinical leadership from diabetes inpatient teams
- knowledgeable health care professionals who understand diabetes
- better support in hospitals for people to take ownership of their diabetes
- better access to systems and technology
- more support to help hospitals learn from mistakes

- The report outlines these points in more detail and highlights what needs to be in place in all acute hospitals across England to make sure every stay for someone with diabetes is safe. The report makes sound recommendations which if implemented in all hospitals will transform care across England and Wales

- The recommendations do not require substantial new investment, have evidence of cost benefit in many areas, and many could be delivered by any diabetes team. **We suggest these should be the key markers of a good inpatient diabetes service and be a guide to commissioning planning and service improvement for Acute Trusts.** These recommendations are based on models from across the UK which have been shown to improve care and can be found in the self-assessment checklist at the end of this chapter

- Partly driven by the concerns raised in the NaDIA and the work of the JBDS inpatient guideline group, over the last few years there has been considerable activity focused on inpatient diabetes care. In 2017-18, NHS England released 'transformation funds' to deliver more inpatient nurses and multidisciplinary foot services. NHS Improvement's 'Getting it Right First Time' (GIRFT) diabetes programme, has targeted reducing variation in inpatient diabetes care using outcome data derived from HES, the NaDIA, the National Diabetes Audit data and individual trust's self-reported data on staffing and service provision[106]

- Implementing all these recommendations is ambitious and will take time. However, with support, leadership and the coordinated efforts of NHS England, Diabetes UK, the GIRFT team, JBDS, the Association of British Clinical Diabetologists, the Diabetes Inpatient Specialist Nurse UK Group, Commissioning Groups, hospital management, diabetes teams and people with diabetes we can transform the care of people with diabetes.

To support you now

- Diabetes UK has a number of resources available for hospitals to access:

  - The Shared Practice Library is a bank of good practice examples in diabetes care with a specific page for hospital care: https://www.diabetes.org.uk/professionals/resources/shared-practice/inpatient-and-hospital-care
  - The Clinical Champions and Tomorrow's Leaders programmes give diabetes professionals the personal development and leadership skills to improve their local health systems: https://www.diabetes.org.uk/professionals/training--competencies/courses.

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[105] www.diabetes.org.uk/inpatientcare.

[106] GIRFT website https://gettingitrightfirsttime.co.uk/

Self-assessment checklist

	Recommendations	Who is responsible	Is it met/ Y/N/ Partially/ Planned	Comments (eg good practice or deficiencies identified)	Action required	Timescale
1	All hospitals should have a fully staffed diabetes inpatient team, made up of the following:[107] • Diabetes consultant • Sufficient DISNs to run a daily and weekend service • Access to a diabetes specialist podiatrist, pharmacist and dietitian and access to psychological support • A projects and implementation lead and admin support • The team should meet regularly, have access to shared office space and administrative support	Leadership of acute hospital trust				
2	Hospitals should have a perioperative diabetes team with representation from surgery, pre-admission, anaesthetic department, recovery nursing and analytic team. The responsibilities of the team to include: • Implementing and monitoring the perioperative pathway. • Meeting monthly to review reports, complaints, plan service improvements and audit the service	Leadership of acute hospital trust				

[107] Work is being done now to update the recommended numbers of staff per inpatient team

	Recommendations	Who is responsible	Is it met/ Y/N/ Partially/ Planned	Comments (eg good practice or deficiencies identified)	Action required	Timescale
3	All diabetes inpatient teams should host quarterly diabetes and insulin safety and strategy board meetings. Representation should include a member of the hospitals safety committee, the executive board and IT and analytic teams	Diabetes inpatient teams and leadership of acute hospital trust				
4	All diabetes inpatient teams should meet weekly to discuss: • Incident reports and complaints • Monthly and other audits • The service and innovations • Upcoming teaching	Diabetes inpatient teams				
5	Appropriate members of the diabetes inpatient team should be supported in getting leadership training. Information about Diabetes UK's leadership programmes, Tomorrow's Leaders and Clinical Champions is available online.[108]	Leadership of acute hospital trust and diabetes inpatient teams				
6	Guidelines recommended by the Joint British Diabetes Societies should be in place and easy to find	Diabetes inpatient teams				
7	All hospitals should support healthcare professionals to involve people with diabetes in their own care	Diabetes inpatient teams, leadership of acute hospital trust and healthcare professionals caring for people with diabetes				

[108] https://www.diabetes.org.uk/Professionals/Resources

	Recommendations	Who is responsible	Is it met/ Y/N/ Partially/ Planned	Comments (eg good practice or deficiencies identified)	Action required	Timescale
8	Basic training on the safe use of insulin and the main diabetes harms and how they can be prevented should be mandatory for all healthcare professionals caring for people with diabetes	Leadership of acute hospital trust				
9	Training should be provided to all undergraduate doctors and nurse trainees in the important aspects of inpatient diabetes care	Royal Colleges				
10	Training in the areas outlined in the table on pages 13 and 14 of the document' Making hospitals safe for people with diabetes' should be available for the listed healthcare professionals across all hospitals	Leadership of acute hospital trust and diabetes inpatient team				
11	All patients with a diagnosis of diabetes should be supported to self-manage their diabetes where appropriate. Hospitals should have systems and training in place that supports this	Leadership of acute hospital trust and diabetes inpatient teams				
12	All patients with a diagnosis of diabetes should benefit from a care plan - developed in collaboration between healthcare professionals and the patient - that is activated on admission to hospital	Diabetes inpatient teams and healthcare professionals caring for people with diabetes				
13	Diabetes teams should work with catering staff to make sure meal times and meal quantities are appropriate for people with a diagnosis of diabetes	Diabetes inpatient teams and healthcare professionals caring for people with diabetes				

	Recommendations	Who is responsible	Is it met/ Y/N/ Partially/ Planned	Comments (eg good practice or deficiencies identified)	Action required	Timescale
14	All hospital menus should have carbohydrate content available	Leadership of acute hospital trust and diabetes inpatient teams				
15	All patients with diabetes should have easy access to appropriate snacks and drinks throughout their inpatient stay	Diabetes inpatient teams and healthcare professionals caring for people with diabetes				
16	All hospitals should have systems in place that identify patients with a diagnosis of diabetes on admission. There should be electronic pathways to refer patients to the diabetes inpatient team which are audited for timeliness of review	Leadership of acute hospital trust and diabetes inpatient teams				
17	Effective electronic prescribing system for detecting, recording, and avoiding insulin and oral hypoglycaemic agent (OHA) prescribing errors should be used across hospitals	NHS England, leadership of acute hospital trust and diabetes inpatient teams				
18	Web-linked blood glucose and ketone meters should be actively used to alert the diabetes inpatient team to out of range glucose values and to monitor glucometrics across the trust and at ward level	Leadership of acute hospital trust and diabetes inpatient teams				
19	All hospitals should have an electronic safe discharge checklist that can be audited	Diabetes inpatient teams				
20	Systems should be in place to prevent readmissions due to unstable diabetes control	Diabetes inpatient teams				

	Recommendations	Who is responsible	Is it met/ Y/N/ Partially/ Planned	Comments (eg good practice or deficiencies identified)	Action required	Timescale
21	Hospitals should agree on local key indicators, like frequency of hypoglycaemia, hospital acquired foot ulceration and insulin errors to audit and have methods in place that ensure data collection is robust and the data is subjected to rigorous analysis	Diabetes inpatient teams with analytical support				
22	With audit and data analytic support, trusts should use their Hospital Episode Statistics to determine whether they are outliers with regards to length of stay, readmission rates and mortality	Diabetes inpatient teams with analytical support				
23	All hospitals should have reporting systems in place for collecting patient harms including hospital acquired foot lesions, DKA, HHS and severe hypoglycaemia requiring injectable therapy	Leadership of acute hospital trust and diabetes inpatient teams				
24	All hospitals should participate in the NaDIA and continuous monitoring of harms audits and report the results to the trust's Clinical Governance Committee	Diabetes inpatient teams				
25	All diabetes inpatient teams should host mortality and morbidity meetings	Diabetes inpatient teams				

These good practice examples are available on the Diabetes UK Shared practice library:
https://www.diabetes.org.uk/professionals/resources/shared-practice/inpatient-and-hospital-care