

**Title:**

Institutional factors in the management of adults with diabetic ketoacidosis in the UK. Results of a national survey

**DME manuscript number:** DME-2015-00221

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Word Count: Main manuscript – 771

**Funding:** All of the authors are employees of the UK National Health Service

**Duality of Interest** The authors declare that there is no duality of interest associated with this manuscript.

**Keywords:** Diabetic ketoacidosis; management; survey; diabetes specialist team

Sir,

Determining what obstacles diabetes specialist teams face when providing services for patients with diabetic ketoacidosis (DKA) have not previously been determined on a national scale.

Between May and November 2014 a survey of all 220 UK diabetes specialist teams was conducted to assess their ability to provide comprehensive care for adult patients presenting with DKA [1]. [See online materials - Appendix 1].

67 hospitals returned the questionnaire. Appendix 2 (online) shows the list of contributors.

#### *Treatment pathways*

All hospitals had an up-to-date DKA treatment pathway, with just under 80% using the Joint British Diabetes Societies (JBDS) guideline. 62.5% of teams also had an integrated care pathway. Previous work has shown that the adoption of a management protocol is associated with improved outcomes, in particular reducing length of stay [2,3]. Further work needs to be done to see if there are differences in outcomes, amongst diabetes specialist teams who use an integrated care pathway, compared to those who do not.

#### *Meters*

76.1% of hospitals reported the ability to measure blood ketones at the bedside; however, 25.4% of teams did not have a healthcare professional

available 24 hours per day to perform point of care testing using a hand held ketone meter. 59.7% of hospitals said that their hand held blood glucose testing meters were centrally connected to their laboratory. 3% of institutions reported that they had no quality assurance scheme for their glucose meters, and 17.9% had none for their ketone meters.

The move to focussing on treating blood ketones rather than glucose has become more prevalent since the publication of the initial JBDS guideline [4]. With the advent of newer technology allowing point of care ketone testing, this move seems appropriate. The current data suggest that diabetes specialist teams regularly use them and they have become an integral part of DKA management [5]. However, the use of handheld point of care ketone monitors has been questioned recently, due to concerns about their accuracy, and a lack of data showing that their use is associated with clinical benefit [6]. Whilst no apparent harm has been reported as a result of using ketone monitors, the apparent lack of regular quality assurance in almost 1 in 5 institutions is of concern.

### *Staffing*

11.9% of teams had no clinical lead responsible for implementing and auditing local DKA guidelines.

Diabetes UK and others have previously suggested that an appropriate level of diabetes inpatient specialist nurse staffing should be one nurse per 300 beds [7,8]. However, only 49.3% of teams had a diabetes inpatient specialist

nurse staffing at this level. Of the remainder, mean staffing levels were 0.62 nurses ( $\pm$ SD0.26) per 300 beds.

Despite the evidence showing that input from the diabetes specialist teams is associated with shorter length of hospital stay [9], only 65.7% reported that patients admitted with DKA had access to a member of the team within 24 hours of admission.

#### *Audit and performance monitoring*

46.3% of diabetes specialist teams reported that they had audited their DKA outcomes in the previous year, with 52.2% saying that they used standard performance indicators. 44.8% of units reported not routinely discussing DKA cases at their departmental morbidity and mortality meetings.

#### *Staff education*

20.9% and 26.9% of teams did not offer any rolling education to junior medical or nursing staff respectively. However, 80.6% and 88.1% of teams reported giving feedback to junior medical and nursing staff. This inability to provide education may reflect the low number of specialist nurses, who often provide this.

#### *Patient self-management*

82.1% of diabetes specialist teams reported that their institution gave their patients the option to self-manage their diabetes.

### *Limitations*

There are several limitations to our data. We asked for voluntary contributions from teams across the UK, we have no way of knowing if the data that has been returned has been subject to some 'reporting bias'. In addition, only 67 out of 220 hospitals returned data, and this limits the degree to which these findings can be extrapolated to the rest of the UK. However, because we were asking about process issues and many similar themes emerged, the data are likely to be more widely applicable.

In summary, this large national survey on the institutional factors that influence diabetes specialist teams' ability to provide care for people admitted with DKA has found that whilst many specialist teams have moved to using the national guidelines, there remain several areas for potential concern. These include inadequate staffing levels, or the inability to provide handheld ketone monitors to help patient management 24 hours per day. In addition, the lack of quality assurance for ketone meters is of concern. Given several questions remain unanswered, further work remains.

### **Acknowledgments**

I thank the steering committee of JBDS who helped develop the audit forms. I am very grateful for the invaluable help of Chris Jones, administrator for JBDS and the Diabetes Inpatient Specialist Nurse group for her tireless efforts in producing follow-up data for individual hospitals. I thank Chris Ratcliff and

Tony Waeland from the Norfolk and Norwich University Hospitals NHS Foundation Trust clinical audit and improvement department for stepping in when Gillian Iceton retired. I am also grateful to Diabetes UK and ABCD for their support and help promoting the survey. Finally, I would like to extend my deepest gratitude to all of those individuals who filled out the forms. They are listed in Appendix 2

## **Legends**

Appendix 1

Questionnaire sent to all adult diabetes teams in all UK hospitals

Appendix 2

List of institutions and individuals that returned forms

## References

- [1] Joint British Diabetes Societies Inpatient Care Group. Guidelines for the management of inpatient diabetes. <http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm>. 2014. [Last accessed 6th May 2015]
- [2] Thuzar M, Malabu UH, Tisdell B, Sangla KS. Use of a standardised diabetic ketoacidosis management protocol improved clinical outcomes. *Diabetes Res Clin Pract* 2014; **104**(1):e8-e11.
- [3] Bull SV, Douglas IS, Foster M, Albert RK. Mandatory protocol for treating adult patients with diabetic ketoacidosis decreases intensive care unit and hospital lengths of stay: Results of a nonrandomized trial. *Crit Care Med* 2007; **35**(1):41-46.
- [4] Savage MW, Dhatariya KK, Kilvert A *et al*. Joint British Diabetes Societies guideline for the management of diabetic ketoacidosis. *Diabetic Med* 2011; **28**(5):508-515.
- [5] Dhatariya K. The use of point-of-care blood ketone monitors in the management of diabetic ketoacidosis in adults. *Ann Clin Biochem* 2014; **51**(5):525-527.
- [6] Misra S, Oliver NS. Utility of ketone measurement in the prevention, diagnosis and management of diabetic ketoacidosis. *Diabetic Med* 2015; **32**(1):14-23.
- [7] Diabetes UK. Commissioning specialist diabetes services for adults with diabetes. A Diabetes UK Task and Finish Group Report .



[http://www.diabetes.org.uk/Documents/Reports/DefiningSpecialistDiabetesServiceforAdults\\_Consultation\\_Final\\_Mar\\_2010.pdf](http://www.diabetes.org.uk/Documents/Reports/DefiningSpecialistDiabetesServiceforAdults_Consultation_Final_Mar_2010.pdf). 2010. [Last accessed 6th May 2015]

[8] Diabetes UK, TREND-UK, Royal College of Nursing. Diabetes specialist nurses: Improving patient outcomes and reducing costs.

[http://www.diabetes.org.uk/Documents/Position%20statements/Diabetes-Specialist-Nurses\\_Improving-patient-outcomes-and-reducing-costs-position-statement-February2014.pdf](http://www.diabetes.org.uk/Documents/Position%20statements/Diabetes-Specialist-Nurses_Improving-patient-outcomes-and-reducing-costs-position-statement-February2014.pdf). 2014. [Last accessed 6th May 2015]

[9] Flanagan D, Moore E, Baker S, Wright D, Lynch P. Diabetes care in hospital - the impact of a dedicated inpatient care team. *Diabetic Med* 2008; **25**(2):147-151.