Title:

Diabetic ketoacidosis in an adolescent and young adult population in the UK in 2014; national survey comparison of the management in adult and paediatric settings

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Novelty Statements

- Teenagers and young adults with DKA are treated largely according to national guidelines
- Monitoring during treatment is not always done according to guidelines, especially in young adults
- The incidence of hypoglycaemia is high in teenagers and young adults
- The incidence of hypokalaemia in young adults is high

Abstract

Objectives

Management of diabetic ketoacidosis (DKA) in young people differs in the UK between adult and paediatric services, but outcomes and extent of use of national guidelines are unknown.

Methods

A standardised questionnaire was sent to all paediatric[KD1] and adult diabetes services in England, requesting details of all DKA admissions in young people over the age of 14 years in Paediatric services ('paediatrics'), and in young adults up to the age of 22 years in Adult services ('adults').

Results

64 'adult' patients aged 22 or under were reported (mean 19.2yr); 7 were aged between 10 and 16yr. 71 'paediatric' patients were reported (mean 14.9yr; range 11-18). 85% paediatric and 69% adult patients [KD2]were treated according to national guidelines. 89% adult and 99% paediatric patients [KD3]were treated with 0.9% saline and fixed-rate insulin infusions; 16% adults had an insulin bolus. Insulin treatment was delayed in paediatric compared with adult patients (100min vs 39min, p<0.001).

23% of potassium levels in adult and 8.8% in paediatric patients were below 3.5mmol/l (p< 0.005). Lowest mean potassium levels were 3.8mmol/l in paediatric and 3.5mmol/l in adult patients (p<0.005). Hypoglycaemia occurred in 42.3% paediatric and 36% adult patients.

Time to resolution was similar in adult (18.2hr) and paediatric patients (16.0hr), as was duration of hospital stay (2.53 vs 2.35 days).

Conclusions

Young people are treated according to national guidelines, but the quality of monitoring was variable in both paediatric and adult settings. The incidence of hypoglycaemia and hypokalaemia was unacceptably high.

Diabetic ketoacidosis (DKA) is a common cause of hospital admission and a significant contributor to mortality and morbidity in people with type 1 diabetes [1,2]. Guidelines for the management of DKA in children have been available in the UK through the British Society of Paediatric Endocrinology and Diabetes (BSPED) since 1994 and are now widely used in paediatric departments [3]. Management guidelines have developed over the last 20 years to take into account emerging evidence for the prevention of cerebral oedema, which is the most serious complication of DKA in children and young people [4]. This includes reduced fluid volumes, delay in starting insulin infusion and emphasis on close monitoring [5,6,7].

The management of DKA in adults has historically involved giving significantly larger amounts of fluid in rehydration, and the use of variable insulin doses. In 2010 the UK Joint British Diabetes Societies (JBDS) published national guidance on the management of DKA [8,9], and revised this in 2013 [10]. These guidelines have become more similar to paediatric guidelines in that recommended fluid volumes have been reduced, and a weight based, fixed rate intravenous insulin infusion is advised. Guidance on fluid type and potassium replacement is also given [11].

Alongside a national survey of the management of DKA in adults against the standards in the JBDS guidelines, whose results have been reported elsewhere [12], we also conducted a survey of the management and outcomes of DKA in teenagers in paediatric services.

The aim of this joint survey was to examine the quality of management of young people (under the age of 22 years) against the JBDS guidelines [9[KD4]] in adult services, and the BSPED guidelines [3] for paediatric services, and study the differences in management and outcomes.

Research Design and Methods

A data collection questionnaire was developed using the 2013 JBDS guideline as a template [9][KD5]. The questionnaire was adapted slightly for paediatric services as some questions were not appropriate, although the majority remained the same [See online materials - Appendices 1 and 2].

Adult services were identified through the databases of Diabetes UK, the Association of British Diabetologists and the Diabetes Inpatient Specialist Nurse UK Group. Paediatric diabetes services were identified through the Regional Paediatric Diabetes Networks and the Association of Children's Diabetes Clinicians. The questionnaires were sent out by email to all 220 UK specialist adult diabetes teams and 185 paediatric diabetes services in England and Wales. One clinician from each service was asked to fill in a single form for each of the subsequent 5 patients at their institution (for paediatrics, those over the age of 14) with a diagnosis of DKA and return them between May and December 2014.

For this comparison of teenage and young adult DKA, all the paediatric responses were included as well as the adult responses relating to young people aged 22 and

under. These are termed ‘paediatric’ and ‘adult’ regardless of the age of the patient.

T-tests and analysis of variance (ANOVA) were used to compare groups.

The Clinical Audit and Improvement Department of the Norfolk and Norwich University Hospitals NHS Foundation Trust deemed this survey a service improvement exercise and confirmed that the project did not require multi-site ethical, research governance or audit approval.

Results:

Clinical details

Paediatric - 71 forms were received from 56 hospitals. Each form represented an individual admission for a unique patient. The mean age was 14.9 years (SD 1.4).

Adult – of the 283 forms received in the full adult survey, 64 patients were aged 22 or under. The mean age of this group was 19.2 years (SD 2.3). Adult physicians reported 7 younger teenagers aged 10 to 16 receiving DKA management from adult teams. These children and young people were cared for in adult environments using the adult guidelines.

The participating hospitals reporting these patients are listed in Appendix 3. The forms were completed by a mix of consultants, trainees and diabetes specialist nurses.

The median length of stay in the paediatric patients was 1.85 days (IQR 1.00, 2.74) with a mean of 2.35 days (SD 2.3), and in the adult patients was 2.0 days (IQR 1.12, 2.67) with a mean of 2.53 days (SD 2.4), p=0.3. One paediatric patient and 6 adult patients developed DKA as an existing in-patient. Table 1 shows the clinical site of care of the patients.

37.2% of paediatric patients and 42.2% of adult patients had had at least 1 previous admission for DKA in the preceding 12 months (median 2, range 1 - 7). Reasons for admission in DKA are given in Table 2. Only 1 paediatric patient (1.6%) and 3 adult patients (4.7%) in these cohorts had DKA as the new presentation of Type 1 diabetes.

Diagnosis criteria and adherence to guidelines

Admission mean pH (±SD) was 7.17 (±0.19) in paediatric and 7.15 (±0.20) in adult patients. Mean plasma glucose was 25.0mmol/l (±6.9) in paediatric and 26.8mmol/l (±8.5) in adult patients, and mean bicarbonate was 11.3mmol/l (±4.3) in paediatric and 11.0mmol/l (±4.7) in adult patients. Mean blood ketone level was 5.65 mmol/l (±1.15) in paediatric and 5.45 mmol/l (±1.44) in adult patients. There were no differences between the adult and paediatric patients in any of these criteria. 11 paediatric and 9 adult patients did not have blood ketone measurements.

Four paediatric patients and 7 adult patients had a pH of 7.3 or greater but only 1 adult patient did not have DKA on any criterion. One paediatric patient had a pH >7.3, bicarbonate of >15 but no blood ketone measurement although urine ketones

of 4+. These patients were still included in the analysis as their management was the same as the remainder.

Details of treatment given and investigations carried out during the first 24 hours are shown in Table 3.

87% adult units and 96% of paediatric units reported that they followed national guidelines. However only 60 paediatric patients (84.5%) were treated according to BSPED guidelines (7 were not and 4 missing), and only 49 adult patients (76.6%) were treated according to JBDS guidelines (9 were not and 6 missing).

Fluid

Intravenous 0.9% sodium chloride solution was first started a median of 34 minutes after admission (IQR 18, 78) in paediatric patients and 36 minutes after admission (IQR 15, 80) in adult patients. 45 of the paediatric patients were given a 0.9% sodium chloride bolus dose (their mean pH was 7.14 ± 0.15) and 23 were not (mean pH 7.23 ± 0.05, p=0.005). Table 3 shows issues surrounding the diagnosis and management of the patients during the first hour after admission. Senior review (i.e. registrar or consultant) occurred within the first 12 hours in 76% paediatric patients and 84% of adult patients.

Insulin

An insulin bolus was given to 11 (17%) adult patients; 2 of these had severe DKA with a pH of less than 7.1, and two were under the age of 18 years. Bolus doses were not used in paediatric care. Time from diagnosis to starting intravenous

insulin infusion was 39 minutes (IQR 19, 72) in adult patients and 100 minutes (IQR 84, 116) in paediatric patients ($p<0.001$). Of the paediatric patients, 61 started on an infusion rate of 0.1 Units/kg/hr, and 9 started at a rate of 0.05 Units/kg/hr. Although the mean pH of the two groups was no different (7.17 ± 0.02 vs 7.14 ± 0.04; $p=0.26$), those treated with 0.05 Units/kg/hr took significantly longer to reach DKA resolution (median 21.4 hours compared with 15.3 hours; $p=0.015$). The small group given the lower insulin dose were younger (13.9 ± 2.4 yr) than the larger group receiving the higher dose (15.0 ± 1.8 yr; $p<0.02$). As the majority of the adult patients were treated according to the JBDS guidelines, it was assumed that the insulin infusion was given at a rate of 0.1 Units/kg/hr. Their median time to resolution was 18.2 hours.

In patients already using long-acting insulin, this was more likely to be continued in adult patients (88%) than in paediatric patients (45%).

Biochemical changes during the first 24 hours

Glucose

44% of paediatric patients and 36% adult patients became hypoglycaemic (blood glucose (BG) levels less than 4.0mmol/l) during the first 24 hours of treatment. 18 of 57 adult patients (32%) became hypoglycaemic if the glucose concentration in the intravenous fluid was changed to 10% when the BG fell to 14 mmol/l, but 5 of 7 patients (71%) became hypoglycaemic if 10% glucose was not used. In paediatric patients, the glucose concentration was changed to 10% in 37 (of whom 16 (43%) became hypoglycaemic), but not in 27 patients (of whom 14 (52%) became

hypoglycaemic). None of the paediatric patients (n=9) starting on the lower insulin infusion rate (0.05 Units/kg/hour) became hypoglycaemic during the first 24 hours.

Potassium

The mean potassium on admission was 4.8mmol/l (±1.0) in paediatric patients and 4.8mmol/l (±0.8) in adult patients. Figures 1 and 2 show the changes in pH and potassium values during the course of the 24 hours following admission in both groups. Mean potassium levels gradually fell over the first 24 hours in both groups. The mean lowest recorded potassium during the admission was 3.8mmol/l (± 0.5) in paediatric patients, but 3.5mmol/l (± 0.6) in adult patients, p<0.005. 23.6% of all potassium levels measured over the first 24 hours in adult patients, but only 8.8% in paediatric patients were below 3.5 mmol/l (p<0.005). Those paediatric patients starting on the lower insulin rate (0.05 Units/kg/hour) had no less hypokalaemia than those starting at the higher rate (14.3% compared with 7.9% total potassium levels less than 3.5mmol/l). In adult patients, lowest potassium levels were no lower in those given a bolus dose of insulin (3.8 ± 0.4 mmol/l) than in those who were not (3.5 ± 0.6 mmol/l, p=0.2).

There was no difference in the risk of developing either hypokalaemia or hypoglycaemia between those respondents who followed the national guidelines and those who did not.

Monitoring during hospital admission

Table 4 shows the extent of monitoring in paediatric and adult patients; paediatric patients were more likely to receive appropriate monitoring during their DKA episode.

Resolution of DKA and discharge planning

The median length of time to resolution of DKA in the paediatric patients was 16.03 hours (IQR 10.0, 21.03) and in the adult patients was 18.18 hours (IQR 9.66, 34.12). Table 4 shows the steps involved at the resolution of DKA and transfer onto subcutaneous insulin. The majority of paediatric and adult patients had some educational input, but very few of either group had any psychology input before discharge.

Conclusions

This large study is the first to compare the management of DKA in young adults and adolescents on a national basis. The quality of care is generally good in both adult and paediatric services, and the majority of patients receive appropriate monitoring and treatment according to national guidelines. However there are still a minority of adults (14%) and adolescents in paediatric care (10%) who were not treated according to national guidelines. Furthermore it is of some concern that adult specialist diabetes services were managing DKA in a small number of children down to 10 years of age, using adult guidelines. In addition, a significant proportion of each group developed hypoglycaemia and /or hypokalaemia during treatment.

The identified precipitating causes were different between the groups, with non-adherence identified in around half of the paediatric patients, but only a quarter of the adult patients. The fact that 37% of the paediatric group and 42% of the adult

patients had had at least 1 episode of DKA in the previous 12 months (up to 7 admissions in one patient) suggest that many of the admissions are a result of non-adherence, even though adult patients are more likely to be recorded with 'gastroenteritis'. Investigation routinely includes a chest X-ray in the adult patients, although none were reported to have pneumonia or any other condition which would be identified on a chest X ray. In young adults under the age of 22 years, this could be removed from the guidelines as a routine investigation, but left to clinical discretion, as in children.

In the National Paediatric Diabetes Audit, around a third of DKA episodes were at the diagnosis of diabetes [13]. However in our survey, only 4 patients (3.0%) were newly diagnosed. This is a very low number but may be because young people aged 14 and above are less likely to present in DKA at diagnosis than younger children (4-11% compared with 23-15% in children under the age of 4 years [13]). Seven patients (1 paediatric and 6 adult) developed DKA as an existing in-patient. This is clearly a major safety concern. This has been identified as a particular problem in the National Diabetes Inpatient Audit in adults [1] and is currently a focus of improved training of ward nurses and junior doctors in the importance of monitoring of diabetes, and adequate insulin replacement [14].

Fluid and Insulin management

Although a large paediatric randomised study of various fluid regimes is currently underway in the US [15], in the UK the use of 0.9% sodium chloride solution ('normal saline') is now almost universal in both adult and paediatric services. In the paediatric patients, those receiving a sodium chloride bolus had a lower pH.

A small number of adult patients (17%) received an insulin bolus, despite guidelines which do not recommend it, and two of these patients were under the age of 18 years. This is not appropriate treatment because in children under 18, the JBDS guideline recommends that the paediatric BSPED guideline is followed, which advises against a bolus dose of insulin because it is unnecessary and in this age-group it can increase the risk of cerebral oedema [7]. Furthermore paediatric guidelines recommend a delay in starting insulin for at least an hour after starting intravenous fluids, because early insulin has been shown to increase the risk of cerebral oedema [7]. This recommendation is being followed in the paediatric patients who started insulin 100 minutes after admission, compared to 39 minutes in the adult patients, but this is another concern for children who are being treated with adult guidelines.

Monitoring during management

Not all patients, either adult or paediatric, appear to have been seen by senior doctors during the early management. Only 69% responders felt that an appropriate monitoring strategy had been established in the adult patients (compared to 85% in the paediatric patients); lower rates of regular monitoring of capillary glucose, vital signs etc were recorded in adults. 90% of all patients had their blood ketone levels measured initially, but only 60% repeatedly through the episode.

One third of all patients, both adult and paediatric, developed hypoglycaemia. In adult patients hypoglycaemia has been shown to be a strong predictor for

increased length of hospital stay and mortality [16]. This suggests that either the insulin dose (fixed rate or bolus) was excessive. None of the paediatric patients started on the 0.05 Units/kg/hour insulin infusion developed hypoglycaemia, but in order to convincingly answer the question of which dose is safer, a randomised controlled trial of 0.1 Units/kg/hour compared with 0.05 Units/kg/hour needs to be carried out in both children and young adults [17,18]. Also a much smaller number of paediatric patients were changed to 10% glucose (52% compared with 80% adults) when their blood glucose level fell.

Hypokalaemia also occurred in large numbers of patients, but there was more than twice the incidence of hypokalaemia in the adult compared with the paediatric patients, although no[KD6] evidence of harm. Both JBDS and BSPED guidelines suggest adding 40 mmol potassium per litre of intravenous fluid, but the JBDS guidelines recommend that no potassium be prescribed if the serum potassium level remains above 5.5 mmol/l and it should only be added if the patient is passing urine [9]. Since most of the difference of the fall of blood potassium levels which we observed, occurred during the first 2 hours of treatment (figure 2), it is possible that the delay while waiting for urine to be produced may be important. The delay in starting the insulin infusion for at least an hour after the start of intravenous fluids may also help to prevent an early fall in potassium levels in the paediatric[KD7] patients.

Resolution of DKA and discharge

The majority of adult and paediatric patients (over 90%) were referred to and seen by the diabetes team before discharge. However, the vast majority of all children

and young people did not receive psychological support prior to discharge. The provision of this service is known to be lacking in many teams although generally advocated as an important part of a diabetes team. The higher rate of paediatric psychology input compared to the adult services (11.4% vs 5.6%) may be a reflection of the increased psychology provision through the Best Practice Tariff in England [19]. It would be very beneficial if this tariff could also be extended to adult services for young people up to the age of 25 years, especially as a high proportion of the episodes of DKA are related to adherence difficulties.

Limitations of the Study

We asked for voluntary contributions from teams across the UK, and for unselected sequential cases, but come case selection may have occurred. Despite this, we feel that the forms returned are likely to be a good representation of patients presenting daily to emergency adult teams and paediatric services across the UK and elsewhere, and this is the largest study of its kind reported. This survey was not designed to look at prevalence or risk factors of DKA, but rather at quality of management.

Summary

These data represent the largest ever nationwide survey on the management of DKA. For the first time this has allowed a comparison of the management and outcomes in adolescents and young people from the age of 14 to 22, managed in paediatric and adult services. Although guidelines are largely followed in both groups, we have highlighted a small group of children being treated with adult guidelines, which is a concern. There is a significant risk of hypokalaemia in the

adult patients and of hypoglycaemia in both groups. This suggests that the potassium and glucose replacement regimens, and insulin replacement, need to be studied further in randomised trials in both paediatric and adult services. We feel that adult and paediatric teams need to work together to produce the safest guidelines for adolescents and young adults, who may have different requirements from older adults.

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Contribution Statement

KD designed the adult survey and JE adapted for the paediatric survey. JE, KD and IN analysed the data, and JE and KD prepared the paper.

Conflict of Interest Statement

None of the authors has any conflict of interest associated with this manuscript.

Legends

Table 1

Care setting in Paediatric patients compared with Adult patients. Shaded boxes show major differences.

Table 2

Precipitating cause for the episode of DKA in Paediatric patients compared with Adult patients (more than one cause in some patients). Shaded boxes show major differences.

Table 3

Management of the Paediatric and Adult patients in the first hour after diagnosis of DKA was made. The number and percentage of missing data for each variable is shown. Shaded boxes show major differences.

NA = not applicable
JBDS – Joint British Diabetes Societies for Inpatient Care Group
BSPED – British Society of Paediatric Endocrinology and Diabetes
ICU – Intensive Care Unit
ECG – Electrocardiogram
CXR – Chest X-Ray

Table 4

Ongoing DKA management, outcome and discharge. The number and percentage of missing data for each variable is shown. Shaded boxes show major differences.
NA = not applicable

Figure 1

Changes in plasma pH over time. Paediatric values in the dashed line and adult values in the solid line. Results are shown as mean of all values at each hour.

Figure 2

Changes in plasma potassium levels over time. Paediatric values in the dashed line and adult values in the solid line. Results are shown as mean and standard deviations of all values at each hour.

Online Appendices 1 and 2

Questionnaires sent to all adult and paediatric diabetes teams in all UK hospitals

Online Appendix 3

List of all contributing hospitals

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Table 1

		Paediatric (n=71)	Adult (n=64)
Gender	Male	53.5%	50%
	Female	46.5%	50%
Treatment Area	Level 1 (General ward)	21.4%	10.9%
	Level 2 (High dependency)	**41.4%**	12.5%
	Level 3 (Intensive care)	2.9%	12.5%
	Acute Medical Unit	5.7%	**43.8%**
	Accident and Emergency	18.6%	10.9%
	Combination	8.6%	9.4%
	Missing data	1.4%	0

Table 2

Precipitating cause of DKA identified	Paediatric (n=62)	Adult (n=50)
New diabetes diagnosis	1 (1.4%)	3 (4.5%)
Infection	9 (12.7%)	**14 (21.9%)**
Alcohol	2 (2.8%)	4 (6.3%)
Gastroenteritis	7 (9.9%)	9 (14.1%)
Non-adherence	**37 (52.1%)**	16 (25%)
Appendicitis/pancreatitis	0	2 (3.1%)
Insulin pump problems	5 (7.0%)	0
Psychological including anorexia	2 (2.8%)	3 (4.5%)
No precipitating cause identified	8 (11.3%)	13 (20.3%)

Table 3

	Paediatric Reports (n=71)			Adult Reports (n=64)		
Variable	**Yes (%)**	**No (%)**	**Missing / N/A (n (%))**	**Yes (%)**	**No (%)**	**Missing / N/A (n (%))**
Was the diagnosis made using JBDS criteria?	**77.5**	1.4	15 (21.1)	**59.4**	1.6	25 (39.0)
Seen by ICU or a senior within 12 hours of admission?	76.1	18.3	4 (5.6)	84.4	6.2	6 (9.3)
Was care given according to BSPED/JBDS guidelines?	84.5	9.6	4 (5.6)	76.6	14.1	6 (9.3)
Was the care given in an appropriate area?	100	0	0	93.4	3.1	2 (3.1)
Was a bolus insulin dose given?	n/a	n/a	n/a	17.2	78.1	3 (4.7)
Was a fixed rate insulin infusion used?	98.6	1.4	0	95.3	4.7	0
Was the insulin infusion started at 0.05 units/kg/hour?	12.9	87.1	0	n/a	n/a	n/a
Was the insulin infusion started at 0.1 units/kg/hour?	87.1	12.9	0	100	0	0
Was a bolus of 0.9% sodium chloride solution given?	63.4	32.4	3 (4.3)	n/a	n/a	n/a
Was intravenous 0.9% sodium chloride solution used?	98.6	1.4	0	98.4	1.6	0
Potassium replacement in accordance with local protocol?	93.0	4.2	2 (2.8)	82.8	9.4	5 (7.8)

Early warning score recorded?	**74.7**	14.1	8 (11.3)	**90.6**	6.3	2 (3.1)
Respiratory rate recorded?	91.6	0	6 (8.4)	98.4	0	1 (1.6)
Temperature recorded?	91.6	0	6 (8.4)	98.4	0	1 (1.6)
Pulse rate recorded?	91.6	0	6 (8.4)	100	0	0
Oxygen saturations recorded?	91.6	0	6 (8.4)	100	0	0
Glasgow come scale recorded?	98.6	1.4	0	90.6	6.3	2 (3.1)
Full history recorded?	100	0	0	96.9	3.1	0
Full examination recorded?	100	0	0	89.1	4.7	4 (6.2)
Blood ketones recorded?	91.6	8.4	0	89.1	10.9	0
Capillary blood glucose recorded?	97.2	2.8	0	98.4	1.6	0
Venous plasma glucose recorded?	88.7	7.0	3 (4.2)	96.9	1.6	1 (1.6)
Urea and electrolytes recorded?	98.6	1.4	0	100	0	0
Venous blood gases recorded?	93.0	7.0	0	90.6	7.8	1 (1.6)
Full blood count performed?	97.2	1.4	1 (1.4)	90.6	3.1	4 (6.3)
ECG performed?	**23.9**	63.4	9 (12.7)	**73.4**	20.3	4 (6.3)
CXR performed?	**12.7**	77.5	7 (9.9)	**64.1**	28.1	5 (7.8)
Urinalysis performed?	78.9	18.3	2 (2.8)	67.2	20.3	8 (12.5)

Table 4

	Paediatric Reports (n=71)			Adult Reports (n=64)		
Variable	**Yes (%)**	**No (%)**	**Missing data / NA (n (%))**	**Yes (%)**	**No (%)**	**Missing data / NA (n (%))**
Was an appropriate monitoring regimen established?	**84.5**	11.3	3 (4.2)	**68.8**	28.1	2 (3.1)
Capillary glucose levels measured hourly?	95.8	4.2	0	84.4	14.1	1 (1.6)
Ketone levels measured hourly?	69.0	31.0	0	67.2	28.1	3 (4.7)
Observations of vital signs taken hourly?	**97.2**	2.8	0	**68.8**	26.6	3 (4.7)
Early warning score measured hourly?	77.5	19.7	2 (2.8)	62.5	32.8	3 (4.7)
Urine output documented?	71.8	25.4	2 (2.8)	68.8	26.6	3 (4.7)
If patient was already on long-acting insulin, was this continued?	**45.1** (n=53)	29.6	0	**88.4** (n=43)	11.6	0
Was 10% glucose started when the glucose dropped to <14mmol/l?	**52.1**	38.0	7 (9.9)	**82.8**	10.9	4 (6.3)
Review of fluid balance with the rate of normal saline amended if appropriate?	67.6	14.1	13 (18.3)	65.6	7.8	17 (26.6)
Did the patient ever develop hypoglycaemia?	43.7	56.3	0	35.9	62.5	1 (1.6)
If progress was not satisfactory, did a senior review occur?	100 (n=24)	0	0	100 (n=19)	0	0

Was the transition to subcutaneous insulin managed appropriately?	93.0	4.2	2 (2.8)	84.4	10.9	3 (4.7)
Was a referral to diabetes team made during admission?	85.9	5.6	6 (8.5)	90.6	3.1	4 (6.3)
After DKA resolution, were they reviewed by the diabetes team?	93.0	7.0	0	96.9	1.6	1 (1.6)
Did the patient receive education support before discharge?	84.5	12.7	2 (2.8)	89.1	1.6	6 (9.4)
Did the patient receive psychological support before discharge?	11.3	80.3	6 (8.5)	6.3	84.4	6 (9.4)