

# Healthcare professional support: diabetic ketoacidosis avoidance and care

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## Abstract

Diabetic ketoacidosis is an acute, life-threatening diabetes-related emergency. Our study aimed to explore the support that key healthcare professionals desired around diabetic ketoacidosis avoidance and care within a low socio economic region of Australia. Participants were recruited from a community hospital using the following methods: direct contact of key hospital staff and use of snowballing, and posters placed in clinical and non-clinical areas. Audio-taped interview data were analysed using Gibbs's thematic framework, which entails transcription and familiarisation, code building, theme development, and data consolidation and interpretation. Interviews were conducted with 15 healthcare professionals from across allied health and medical professions. Describing factors relating to diabetic ketoacidosis presentations in people with type 1 diabetes, two themes emerged: a disparity in knowledge and health system opportunities. Findings complement the wealth of literature which details the problem of gaps in support for patient self-care to avoid diabetic ketoacidosis and prevent late presentation of this potentially fatal condition. There is a pressing need to ensure that healthcare professionals have the appropriate level of knowledge to prevent, recognise and treat diabetic ketoacidosis. Service reconfiguration can support care delivery.

## Introduction

Diabetic Ketoacidosis (DKA) is an acute, life-threatening diabetes-related emergency. Worldwide, the incidence of DKA among adults with Type 1 Diabetes (T1D) has increased to 56 per 1000 person-years,<sup>1</sup> as were hospital admissions; most notably, in persons aged less than 45 years.<sup>2</sup> Despite having a mortality rate of less than 1%, the acute complication remains a leading cause of death in people with T1D,<sup>3,4</sup> with higher rates seen among those with significant comorbidities or who are elderly.<sup>5</sup> Australia, a country that has one of the highest rates of T1D in the world, is not immune to the impact of DKA.<sup>6</sup>

Across Australia, DKA is the cause of a significant number of hospitalisations. For example, in 2014-15, nationally there were 7,132 hospitalisations with a primary diagnosis of DKA; most (84%) hospitalisations were for people with T1D, with half (54%) identified as children and young people aged less than 25 years.<sup>7</sup> Similarly, in Caboolture, an area of socio-economic disadvantage in Australia,<sup>8</sup> over half (n=165, 52.1%) of an estimated population of 317 people with T1D were reported to have had an index emergency department presentation for DKA between i.e. January

2015-December 2019. Over note, over half (n=92, 55.8%) of presentations occurred outside of note, regular business hours (9am-5pm).<sup>9</sup> Diabetes-related support in both Caboolture and local communities is provided through local diabetes education services, which operate during standard business hours only. This is a significant problem as, like many Australian diabetes-related support healthcare services, diabetes education services are provided during standard business hours only.

There has been much discussion in the literature around how hospital and community-based services should be reconfigured to promote care delivery for people with T1D around DKA prevention, deferral and management. Prior to implementing a reconfiguration of DKA services within our health service, an understanding of perspectives from local healthcare providers was essential. Our study aimed to explore the support that key healthcare professionals (HCP) within a community metropolitan hospital desire around DKA avoidance and care within a low socio-economic region of Queensland, Australia.

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## Materials and Methods

Data were collected by individual semi-structured face-to-face or telephone interviews, undertaken between i.e. October-December 2023 (by research assistant April Hatt). The interview schedule was developed through a review of available literature, discussion by research team members and then reviewed by expert clinicians involved in the care of people with T1D. The schedule was then piloted with HCPs external to the hospital; a process which resulted in modification of some questions. All interviews were held either face to face in a private office, via telephone or videoconferencing. Each interview commenced with an introduction and explanation of confidentiality principles. Consenting participants were recruited from a community hospital using the following methods: direct contact of key hospital staff and use of snowballing, and posters placed in clinical and non-clinical areas. At the end of the survey all participants were asked if they would like to be involved in an interview. Recruitment was undertaken until data saturation had been achieved. Ethical approval was obtained from the Children's Health Queensland Hospital and Health Service (HREC/22/QCHC/91105) and University of the Sunshine Coast (A231930) Human Research Ethics Committees, Australia. Site-specific approval was also obtained. Audio-taped interview data were transcribed verbatim into Microsoft Office Word™. Data were then deidentified, imported into NVivo™ software, and analysed using Gibbs's thematic<sup>12</sup> framework; a coding sheet was maintained in-relation to deidentification. Gibbs's framework entails transcription and familiarisation, code building, theme development, and data consolidation and interpretation. All comments and responses were treated confidentially. Data were analysed by an experienced qualitative research team member (Dr Steven James) who was independent of the interviews and not aware of the identity of participants. Findings were discussed amongst all research team members until consensus was reached.

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## Results

Interviews were conducted with 15 HCPs from different professions (physician n=6 [of which n=2 consultant level; and n=4 registrar level]; nurse n=8 [of which n=2 were clinical facilitators; and n=1 was an enrolled nurse]; and a pharmacist n=1),

Participants had a wide variety of experience working with patients with T1D in DKA, and worked at differing levels of expertise and responsibility. Describing factors relating to DKA presentations in people with T1D, two themes emerged: a disparity in knowledge and health system opportunities.

### Disparity in knowledge

Participants highlighted a disparity in knowledge around T1D and DKA amongst consumers. While some people with T1D were regarded as having the skills to manage their condition appropriately and successfully, particularly those using diabetes-related technology to help self-manage their condition, the majority of people with T1D were thought to lack skills in the fundamentals of diabetes. Areas of knowledge deficiency included what the disease is, and aspects of management. When considering insulin dosages, for example, this Registered Nurse stated:

“They [the consumers] largely don't know how to manage their insulin dosages. When and how to manage it properly at home. Sometimes it's the case that they don't want to know .... and [they] just end up with complications because of that. Or they come in here [the emergency department].” (Healthcare professional: 11 - Registered Nurse)

This was particularly the case when considering troubleshooting and sick-day management. However, the disparity in knowledge around T1D at times also extended to the HCP themselves; particularly when considering diabetes-related technology, and around management of DKA itself. When considering the former, while some participants felt comfortable with the use of such technology and interpretation of related data, aided by having family members using this technology, many reported having limited knowledge in the area and even feeling overwhelmed when caring for such patients. There was a reliance on patients with T1D that use diabetes-related technology to continue with disease self-management when in the healthcare setting, as well as a thirst for education in this area. As this registrar physician stated:

“I think that, in general, most of the people that work in the emergency department would probably have less understanding of how the [insulin] pump works than the patients actually do. So, you're entirely relying on the patient, which can become a problem.” (Healthcare professional: 1 - Registrar physician)

Participants reported that select HCP should receive further education around diabetes-related technology; advocating that such education should not be widespread since many wouldn't be able to follow-through with the training in a practical sense on a consistent basis. As this consultant physician stated:

“It would be nice to be able to problem solve it then and there. And, I need to have some idea of how they're adjusted and programmed. More so I don't stuff them up than anything. And some basic information about the monitoring. So, at the moment, I only know as much as the patients tell me.” (Healthcare professional 14: Consultant physician)

However, there was widespread acknowledgement that all healthcare staff should receive training relating to DKA because of the acute and health-threatening nature of the complication. Despite this, getting time to have any training was considered to be problematic, and also the concern of not having the training can-

celled in view of unexpected competing demands that may occur in healthcare settings. Some participants were reluctant to undertake related training in their own time.

### Health system opportunities

There was wide-spread agreement that patients with T1D require more support than currently available to reduce DKA presentations. Participants highlighted that there were often multifactorial acute issues at play in the lives of people with T1D when they present to the emergency department in DKA. These may not always be able to be supported in the Emergency Department and there are some patients that will frequently present with DKA regardless of the support provided. Some participants advocated for a complete overhaul of diabetes-health care provision in all settings, whilst almost all identified the potential benefit of improving community-based support. This included nurse navigators for select patients, and increased access to diabetes educators in clinical settings. The limitations of existing pathways around referrals to community-based services, and the realities of lengthy waits for appointments were also identified. As this pharmacist stated:

“The ones that cycle through constantly should have nurse navigators attached to them. And, making sure that they have proper follow-ups with their endocrinologist and their diabetes educators .... Our complex care management for them needs to make sure that they don’t fall through the cracks.” (Healthcare professional: 12 - Pharmacist)

There was consistent agreement that advice relating to T1D management needs to be more readily available in the community. Suggestions included increased numbers of diabetes-related HCPs in current clinical settings, the formulation of specialised T1D related centres, potential centralised, or the use of diabetes support telephone lines. The potentially economic viability of these potential options was also noted by the participants.

Participants mostly advocated that such support should also be available to people with T1D after regular business hours, in community and Emergency Department settings; such as through a telephone support line. Highlighting the difficulty around having diabetes educators available to the Emergency Department only during week-day business hours, this registrar physician detailed:

“It would be good if we could have the diabetes nurses more available. You’ve got a lot of patients come in with DKA overnight. And, at this current moment in time, we’re having patients that stay in resus all night .... They’re actually at the point where they’re probably ready to go home.” (Healthcare professional: 2 - Registrar physician)

### Conclusions

Describing factors relating to DKA presentations in people with T1D, interventions to support them and for prevention, participants highlighted a disparity in knowledge around T1D amongst consumers, particularly in the areas of troubleshooting and sick-day management. Findings are consistent with international data. For example, in a study undertaken in Western, Central and Greater Accra, Ghana, young people living with T1D and their caregivers were reported to possess limited scope of knowledge on T1D self management.<sup>10</sup> Similarly, in Hamilton, Canada, a significant proportion of patients were reported to have inadequate know-

ledge of diabetes.<sup>11</sup> With international consensus guidelines advocating the importance of T1D self-management, our study findings are concerning. Reduced diabetes knowledge in consumers can increase the risk for acute diabetes complications such as DKA, and chronic micro- and macro-vascular disease through sub-optimal management; multiple behaviours within three self-management cycles have been reported to be involved in sustained T1D self-management.<sup>12</sup> Diabetes education, like medical education, should be viewed as a life-long need rather than a discrete event. People with T1D need to be linked to an identified educator whom they would see regularly and who would be notified in the event of an emergency department presentation, like current practice when considering general practitioners.

It was interesting that the disparity in knowledge around T1D at times also extended to the HCP participants themselves; particularly when considering diabetes-related technology, and around management of DKA. Wide-spread serious and sustained deficiencies in nurses’ diabetes-related knowledge have been reported globally,<sup>13</sup> which has implications for people with T1D when they present to emergency departments or are hospitalized. Elsewhere internationally, in a study undertaken in Warsaw, Poland, which involved primary care facilities that employed school nurses, school nurses perception of their diabetes knowledge was better than their actual knowledge in six out of seven domains examined.<sup>14</sup> Further, in a study undertaken in the Guangxi Zhuang Autonomous Region of the People’s Republic of China,<sup>15</sup> diabetes-related knowledge of non-endocrinology nurses was reported to be low, particularly for diabetes monitoring. Maintaining up to date knowledge of diabetes-related technology is a fast-moving field, which poses challenges for HCP. The need for support to develop and maintain the expertise required by HCP to provide care for patients with specialist needs remains a gap in the literature.<sup>16</sup>

Consensus guidelines around Continuous Subcutaneous Insulin Infusion use highlight the need for involvement of a skilled multidisciplinary healthcare team.<sup>17-19</sup> However, there is no agreement on the necessary level of expertise or how it can be obtained.<sup>16</sup> Innovative approaches are required to upskill and maintain currency given known knowledge deficits, lack of competence and confidence in HCPs have been identified as barriers to accessing expert support.<sup>20</sup> Possible solutions may include rotating clinical placements across and between paediatric and adult diabetes care settings, and greater use of national professional associations for educational opportunities and advocacy.<sup>16,20</sup>

Participants disclosed that patients with T1D require more support than what is currently available to reduce DKA presentations, with an appetite for greater involvement of community-based care. This option is currently problematic in Australia due to ongoing general practitioner shortages, despite a record influx of general practitioners in primary care in Australia in recent times.<sup>21</sup> Many other countries world-wide also report shortages in general practitioners. A potential alternative option may be the use of nurse-led care, with a recent review having reported that nurse-led care had beneficial impacts on glycated haemoglobin values (from 0.03% to 2.0%);<sup>22</sup> evident when nurses received formal training, used treatment algorithms, had limited medical support, utilized technology and offered defined culturally sensitive and appropriate diabetes care. Nevertheless, further, more rigorously designed studies are required to support nurse-led models of care before widespread adoption into clinical practice.

Finally, alternative supports for the management of T1D may also be provided in the form of videoconferencing and telephone support lines.<sup>16,23</sup> When considering telephone support lines, numerous non-diabetes-specific after-hours telephone health support

services are available elsewhere in Australia, although these are not designed to specifically assist people with T1D. The Rural link service for example, provides after hours' mental health telephone support for people in rural communities in Western Australia.<sup>24</sup> The use of after-hours phone support specific to patients with T1D has been provided elsewhere in Australia and has been associated with reduced progression of ketosis to DKA.<sup>25</sup> There is a pressing need for alternative approaches to the emergency department for 24-hour care for people with T1D to be developed and evaluated.

### Limitations/Implications for nursing practice

There are limitations to our study that should be acknowledged. Findings may not be generalisable since they may not be representative of all HCPs; recruitment involved self-selection and therefore may have generated sampling bias. Further, HCPs were employed by a single public healthcare provider, and findings reflect their undefined experiences and perceptions at one time point. However, a strength of the study was the multi-disciplinary nature of the participants involved, which offered varying insights into the support that key HCPs need around DKA avoidance and care. This research provides important insights into the support that key HCPs, including nurses, need around DKA avoidance and care. They complement the literature, which details the problem of gaps in support for patient self-care for patients with T1D. There is also a pressing need to ensure that HCPs have the appropriate level of knowledge to prevent, recognise and treat DKA. Service realignment can support care delivery, possibly involving greater use of primary care in the form of nurse-led care, use of videoconferencing and/or telephone support lines.

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