

Primary care providers' experience in the management of paediatric type 1 diabetes in Western Sydney, New South Wales

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Background and objective

It is unknown to what degree general practitioners (GPs) are able to diagnose and assist in the management of children with type 1 diabetes (T1D). This study examined the experiences of GPs when faced with paediatric T1D.

Methods

A qualitative study using semistructured interviews was conducted with a sample of GPs in Western Sydney. Data were analysed thematically.

Results

Thirty GPs reported varied experiences with paediatric T1D. Two themes emerged: 'You don't think of T1D everyday' (GPs do not frequently encounter T1D) and 'We need to be equipped' (despite low patient numbers, GPs want to be able to recognise, refer and assist in the management of children with T1D).

Discussion

There is limited Australian research into GPs' ability to diagnose and manage children with T1D. This study highlights the current level of knowledge and referral practices of a sample of GPs.

TYPE 1 DIABETES (T1D) is a chronic metabolic disorder often diagnosed in childhood. T1D is characterised by insulin deficiency and an increasing prevalence worldwide, and is associated with a substantial disease burden, including long-term micro- and macrovascular complications.^{1,2} Diabetic ketoacidosis (DKA) is an acute, potentially life-threatening complication, especially at the time of initial diagnosis.

Evidence suggests that a large proportion (~ 30–40%) of children are diagnosed with T1D in a state of DKA.³ DKA at initial diagnosis is associated with worse long-term glycaemic control independent of demographic, socioeconomic and treatment-related factors.⁴ Typically, signs and symptoms of T1D occur over a period of weeks, and children may present to their general practitioner (GP) during this time with symptoms of unrecognised diabetes. The common presenting symptoms of unrecognised diabetes in children and adults have been described in the 4T DKA prevention campaign that was first launched in the UK.⁵ In summary, the 4Ts are thirst (polydipsia), toilet (polyuria), tiredness (due to metabolic acidosis) and thinner (weight loss).

In Australia, the role GPs play in supporting children and families with

T1D remains unclear beyond making an initial diagnosis or a referral to a specialist paediatric diabetes unit. This is important because earlier diagnosis may lead to a lower incidence of DKA and the prevention of this potentially life-threatening complication. In addition, it is well known that a multidisciplinary approach is required to help patients in achieve and maintain optimal glycaemic control.⁶

In 2021, our group launched the 4T DKA prevention campaign in our local health district; however, it was unclear what the current state of knowledge of GPs in our primary healthcare network was on childhood diabetes. To evaluate GPs' ability to recognise the signs and symptoms in children of new-onset T1D, it was necessary to determine what education and experience GPs have had, and their current education needs.

In addition, in the past 25 years there have been significant technological advancements in the treatment of T1D, including innovations improving insulin pump therapy and continuous glucose monitoring (CGM).⁷ There are limited data on how GPs have received and are engaging with these new technologies. The aim of this study was to establish how specialist diabetes centres can support GPs in diagnosing and assisting the specialist paediatric diabetes unit in the

management of children with T1D in the community. The study was conducted through semistructured interviews and thematic analysis. Specific areas of interest included awareness of early diabetes symptomatology and signs, GP referral decisions, educational resources currently available and lacking, and knowledge of new technology.

This study is part of a broader research project involving primary care clinicians in identifying and referring new T1D patients and outpatient and ambulatory stabilisation of patients with DKA.

Methods

A literature review was conducted to establish any gaps in the existing T1D literature. A research group was established comprising two general paediatricians with experience and interest in the management of T1D, a paediatric endocrinologist, a paediatric trainee and a diabetes educator. All members were involved in the formulation of the study design and ethics proposal.

Study sample and setting

Study participants were GPs and GP registrars from metropolitan Western Sydney, New South Wales, which has a population of approximately 2.5 million people. Twenty-one per cent of residents in Western Sydney have a Bachelor's or higher degree qualification, and 41% of the population earn a 'low' income (<\$500/week), compared with 28% and 36%, respectively, for Greater Sydney.⁸

Recruitment and data collection

Participants were recruited via the referring GP register of the paediatric diabetes service at Nepean Hospital and other GPs in the community using professional contact with the Nepean paediatric service. Data were collected using semistructured interview techniques from December 2020 to April 2021. Interview questions explored the exposure of GPs and GP registrars to managing children with T1D, their ability to diagnose, current referral pathways and their awareness of new technology (Appendix 1; available online only).

Interviews were conducted face to face, via telephone or via videoconference software. All interviews were conducted by one author (NH) who had no previous professional connection with the participants. The interviews were audio recorded and transcribed verbatim. Participants were interviewed until data saturation was achieved. This was evident when no new information arose from subsequent interviews.

Data analysis

A qualitative descriptive study methodology⁹ was used to explore current knowledge and exposure, previous and desired education and familiarity with new technology used in the treatment of T1D. This method was chosen to collect rich, descriptive data on GP experiences. Data were coded into descriptive codes, then grouped into broader interpretive codes and synthesised into overarching themes by two authors (NH, TP). All members of the research team were involved in the formulation of the final manuscript.

Ethics

This study was approved by the Nepean Blue Mountains Local Health District Human Research Ethics Committee (Study no. 2020/ETH03161). This study was conducted in accordance with the ethical standards of the institutional research ethics committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards, as well as the National Statement on Human Research of the National Health and Medical Research Council (NHMRC).¹⁰

Results

Thirty participants (28 GPs, 2 GP registrars) were interviewed. Forty per cent of participants had graduated from an Australian university, and the remainder had graduated from international universities. This was comparable to data obtained from the Nepean Blue Mountains Local Health District, showing that 51% of GPs are local graduates. Most participants had between 6 and 15 years of practice (77%), with most participants being aged 41–50 years (37%), followed by 51–60 years (20%). This

is younger than the local GP population (29% aged 55–64 years; 22% aged 45–54 years). Most participants (73%) rated their skill in recognising and managing T1D as average to good.

Themes

'You don't think of T1D everyday'

It was vague: Diagnosing T1D in the community

Codes and representative quotes for this subtheme are presented in Table 1.

In general, GPs were able to identify that a patient in a state of DKA would appear clinically unwell. Few were able to state the biochemical markers for the diagnosis of diabetes with fasting blood glucose >7.0 mmol/L or random blood glucose >11.1 mmol/L.¹¹ Although most participants could correctly name the key diagnostic features of diabetes, not all patients that presented to GPs had classic symptoms. Two participants acknowledged that they had missed diagnoses of T1D. In some cases where T1D was suspected, it turned out not to be the case.

Features of presentation that were more likely to result in a diagnosis of T1D included recurrent boils, family history and fatigue. Occasionally, diabetes was picked up during routine investigation of another condition.

Although some participants had diagnosed children with diabetes during their emergency department (ED) rotations, most stated that children had not presented to their GP practice with T1D. Children presenting to the ED were generally more acutely unwell with overt symptoms.

In summary, GPs do not frequently encounter children with T1D in their practices. When diabetes is overt, children are often severely unwell and present directly to the ED. However, such children may present to their GPs prior to the development of DKA with prodromal symptoms that were not recognised as diabetes or impending DKA.

Out of the loop: Working in a multidisciplinary team

Codes and representative quotes for this subtheme are presented in Table 2.

Most GPs identified that a team-based approach was beneficial for the management of children with T1D. As such, they often referred to a tertiary paediatric hospital for a multidisciplinary approach to treatment. However, one participant recognised that they had become 'complacent' due to their proximity to a tertiary children's hospital.

Some participants discussed how their referral practices were affected by parental anxiety. As a result, several participants had referred children to an ED, regardless of the patient's clinical condition. Framed around patient safety, long waiting times to see outpatient paediatricians was another reason to

refer directly to the ED, although one participant acknowledged that the public system was 'probably overburdened' and that 'if more of us are competent in the community, it probably would relieve some of that burden'. Although close communication between GPs and the endocrinologist was vital if the GP was expected to monitor the patient, in reality referral to a tertiary paediatric centre sometimes led to the exclusion of the GP from the treating team.

In summary, participants identified that diabetes centres managed the bulk of care. EDs were often referred to in suspected cases of T1D. Participants also discussed the importance of developing strong lines

of communication between diabetes centres and GPs as essential for further GP involvement to become possible.

'We need to be equipped'

You learn on the job: Previous education on T1D

Codes and representative quotes for this subtheme are presented in Table 3.

Most participants had received no additional formal education on T1D since medical school. However, a handful had undertaken the Diploma of Child Health but could not recall specifically whether paediatric diabetes had been covered.

Learning 'on the job' and clinical experience appeared to be the mainstays

Table 1. Codes and representative quotes for the subtheme 'It was vague: Diagnosing T1D in the community'

Subtheme	Code	Representative quote
It was vague: Diagnosing T1D in the community	Biochemical markers	'Ok, well you would need ketonaemia. I don't know the exact levels, but I'm guessing blood ketone levels of 1.5. And hyperglycaemia, BSLs above, I don't know, I'm guessing something above 15. As well as acidosis. That would be my rough idea.' [Participant 3]
	Diagnostic features	'... polydipsia, polyuria, vague abdominal discomfort, tiredness.' [Participant 2]
	Missed diagnosis	'A child, she came here with shortness of breath, and initially I thought it was just an upper respiratory infection, and I just didn't do a finger prick test. No urine test was done ... a few days later I saw the parents and they told me it was type 1 diabetes. So yeah, I missed it ... It was vague ... You don't think of type 1 diabetes every day. I know we should be aware of it ... I thought it could be a viral infection or something.' [Participant 5]
	Incorrect diagnosis	'I had a child with polyuria and polydipsia and did blood tests, but they were all negative.' [Participant 20]
	Recurrent boils	'She was eight years of age, and she presented with recurrent boils. She saw a lot of doctors and they were all giving her antibiotics ... and then she came to see me ... and the Mum said "There is something else, she is weeing a lot, she's waking up a lot at night to go to the toilet". I said ... we're getting a sugar check right now. And of course, her sugar at that time was 27. So straight away to the emergency department ... She looked absolutely fine, and that was with a sugar of 27 ... I think if the mum did not mention that [polyuria, polydipsia] it could have potentially been missed by me.' [Participant 12]
	Family history	'So the mum was suspecting it already. I think the child was about eight or ten. Who was just not behaving right, was more lethargic, losing weight, unexplained weight. But she had an older sibling with type 1 diabetes, so it wasn't surprising to her.' [Participant 6]
	Urinary symptoms	'They come in with urinary symptoms, so you check whether it is a UTI and then you see the glucose and then you check the BSL, the finger prick one ... Because the first thing that came into your mind is not type 1 diabetes to be honest, its normally UTI you're looking for.' [Participant 29]
	Fatigue	'The patient presented with excessive fatigue all the time and the parents were complaining that the child goes to the toilet all the time ... fatigue is a very common presentation in general practice ... but this one was more than fatigue, his parents were telling me "drinking all the time, going to the toilet all the time", so it was more of a higher suspicion.' [Participant 28]
	Emergency department presentation	'Working in an emergency department before, I have made the diagnosis, because I think that's usually how the clinical presentations are ... suddenly they will present to [emergency] with ketoacidosis, then it's diagnosed.' [Participant 14]

BSL, blood sugar level.

of ongoing education. Some participants had gained knowledge of T1D prior to working as a GP, often during their residency. One participant discussed a colleague's experience of diagnosing T1D allowing for vicarious learning for a group

of GP registrars. Other education sources included workshops run by GP colleges, textbooks, journals, medical bulletins and information sessions from pharmaceutical representatives. One participant stated that resources were abundantly available

through The Royal Australian College of General Practitioners (RACGP).

Some participants admitted to not seeking further education due to the low numbers of T1D patients seen in their practices. A lack of demand was

Table 2. Codes and representative quotes for the subtheme 'Out of the loop: Working in a multidisciplinary team'

Subtheme	Code	Representative quote
Out of the loop: Working in a multidisciplinary team	MDT	'Because they go there [public health system], they tend to get the whole caboodle, you know like they get the whole package there.' [Participant 6]
	'Complacent'	'The reason is that I've been quite complacent with it because we've got lots of services, I'm very close to Westmead Hospital, and there are lots of these diabetic educators, dieticians and so the patients are in direct contact with them.' [Participant 10]
	Perceived confidence	'Most parents, even if you felt confident dealing with the type 1 diabetes adequately until their clinic appointment, parents are still quite anxious ... So if they're not satisfied with the waiting time for the clinic appointment, even if the child is stable, or you offer a private paediatric endocrinologist ... sometimes they just rock up to the ED. Without a clinical need.' [Participant 6]
	Waiting times	'I guess I could send them to a paediatrician. But the problem with the paediatrician is the waiting list, and you also don't want to hesitate and something happens to the child.' [Participant 22]
	GP-specialist communication	'It's not about like or not like, it's about our job. So, if we need to be involved then we could. But then there has to be a connection between the paediatrician and the GP. If we're asked to monitor them, then we need to be in close contact with the paediatrician.' [Participant 22]
	'Pushed out'	'I think what's happened is once you link the patient with the hospital, then it's directly liaising between the patient, the diabetes educators, the hospital and parents, so we're sort of pushed out of the loop.' [Participant 12]

ED, emergency department; GP, general practitioner; MDT, multidisciplinary team.

Table 3. Codes and representative quotes for the subtheme 'You learn on the job: Existing education on T1D'

Subtheme	Code	Representative quote
You learn on the job: Existing education on T1D	Learning on the job	'Probably just education while being a GP. You learn on the job, and as you go.' [Participant 8]
	Vicarious learning	'One of my registrar friends diagnosed their patient with T1D. She diagnosed it and she told us all about it, then we all went through her notes.' [Participant 17]
	Abundant resources	'There was a GP workshop when they come all together, once a year, you can book yourself a couple of sessions. Plus we have lectures here. Reps come and show us new products. There are lots of places that you can increase your knowledge.' [Participant 22]
	Low T1D patient numbers	'I just haven't thought about it because it wasn't a patient group that I was addressing, so I haven't actually sought out what's in this area.' [Participant 30]
	Lack of resources	'I've seen a lot for T2D, because we have a lot of type 2s. I haven't come across very many for T1. There aren't very many paediatric workshops.' [Participant 25]
	In case of emergency	'I mean, although we don't have [the patients] but that is an area I think we need to be equipped. I mean, it's just like doing a CPR course.' [Participant 4]
	Health Pathways	'I am familiar with the Health Pathways, but I don't use them very much because I don't have the time. I wish I had the time, they are a very good resource.' [Participant 10]

CPR, cardiopulmonary resuscitation; T1D, type 1 diabetes; T2D, type 2 diabetes.

thought to impact the availability of education opportunities. However, one participant likened knowledge on T1D to a cardiopulmonary resuscitation course, in that even if the knowledge was only rarely required, it was useful in an emergency.

In summary, most participants had received minimal to no formal education other than from their medical school training, the Diploma of Child Health or through their clinical experience. Reasons for this were a lack of patients in this demographic and minimal educational opportunities.

Good to have a refresher: What do GPs want to know?

Codes and representative quotes for this subtheme are presented in Table 4.

Almost every participant interviewed expressed interest in further education regarding at least one element of T1D. Participants' topics of interest included subtle signs in diagnosis, early management, patient and parent education, commencing insulin, insulin pumps and sick day management. However, generally it was felt that further education was not vital due to most

patients being managed by the hospital system. Several participants expressed confidence in their ability to diagnose and did not believe further education was required.

There was no clear consensus on the best format for delivery of further education. Some participants suggested half-day workshops or webinars, whereas others preferred self-paced online modules. A number suggested 'How to Treat' articles or quick reference guides due to their accessibility and frequent use. Expanding the T1D section in the Sydney Child Health Program was suggested. Incentivising educational sessions with continuing professional development (CPD) points and distributing information via primary health network liaison officers was also raised. All participants were asked about their knowledge and use of the Health Pathways. Most participants were aware of them but did not use them regularly, either due to preference for other sources or insufficient time.

One participant discussed being involved in a regular diabetes conference run through the local tertiary hospital, which they found very educational. Many

participants were interested in learning from various multidisciplinary team members, but most commonly wanted contact with paediatric endocrinologists.

In summary, most participants were interested in further education. However, they did not feel further education was urgent because of a lack of patients.

All these fancy things: GPs and diabetes technology

Codes and representative quotes for this subtheme are presented in Table 5.

None of the participants interviewed for this project had received any formal training on diabetes technology, such as insulin pumps and CGM or flash glucose monitoring, and relied on their patients' familiarity with these technologies and ability to troubleshoot. This was frustrating for many participants.

Although some participants expressed confidence in their general understanding of blood glucose monitoring, ability to interpret trends and adjust insulin doses, the major issue raised was how to access the data from glucose monitors. However, others felt they needed training in particular for paediatric dose adjustment.

Table 4. Codes and representative quotes for the subtheme 'Good to have a refresher: What do GPs want to know?'

Subtheme	Code	Representative quote
Good to have a refresher: What do GPs want to know?	A refresher	'Yes probably, with time, when you don't see it much, you lose a bit of the fine details. It's probably good to have a refresher.' [Participant 28]
	Need for further education	'So knowledge wise, of course there is no harm, as a doctor I want to improve my knowledge, but not desperately. I think there is no harm, but again it comes to the same point, even for the ongoing management, the hospital, they take care of everything, and the patients' have their [telephone] numbers.' [Participant 29]
	Areas of interest	'I would say more regarding the managing. Because in my practice and for my colleagues as well, we fairly accurately make the diagnosis.' [Participant 7]
	Format	'I think face to face is better, I don't do well with webinars and stuff like that, I think just meeting where we come that would be good.' [Participant 12]
	Sydney Child Health Program	'A lot of GPs do the Sydney Child Health Program ... Maybe if we have more information about type 1 diabetes on there because I think a lot of GP registrars enrol for that.' [Participant 3]
	Diabetes conference	'With type 2 diabetes, we've got a diabetes conference, with the endocrinologist at the hospital. So if we've got patients ... the endocrinologist - the staff specialist from Westmead Hospital, and we tell them what our problems are, and how we should be treating each patient. But they come and they sort it all out for us, and there is a lot of education there. We learn a lot. But that doesn't happen with type 1 ... Before it would be the patient, the diabetic educator, possibly the dietician and the endocrinologist, and me. We'd all sit down at the practice and discuss that person for 20 minutes.' [Participant 10]

GP, general practitioner.

In summary, although most participants were confident with the interpretation of blood glucose levels, most had no practical experience with pumps or monitors and had not previously had to titrate insulin pumps. In addition, many GPs expressed frustration about their lack of education on the new technology involved in the care of T1D.

Discussion

This qualitative study explored the current experience of managing T1D among GPs in metropolitan Western Sydney.

Existing literature has explored knowledge of diabetes management among GP trainees, acknowledging that knowledge gaps exist.^{12,13} It has also been established that delays in referral from GPs to specialist paediatric diabetes teams can result in increased rates of presentation with DKA.¹⁴ Our findings suggest that although most participants were able to identify typical presentations for T1D, it was often the more subtle presentations, such as those mimicking infective illness, that were missed. Participants appeared to have good levels of insight into this. However, parent reports of polyuria and polydipsia and a family history of T1D

were more likely to result in a higher index of suspicion and subsequently a blood glucose test. Two separate cases were diagnosed after presentation with recurrent boils, reflecting the increased risk for skin and other infections in unrecognised and poorly controlled diabetes.¹⁵

Given that it is known that patients have poorer outcomes when diagnosis and referral are delayed, it is essential that all GPs are aware of and have access to regular education on the classical presentation of T1D. The 2022 edition of the RACGP curriculum, includes the ability of trainees to describe symptoms and emergency management of DKA, but does not address prodromal symptoms of T1D.¹⁶ Given the often vague and overlapping symptoms of paediatric patients (especially infants) with unrecognised diabetes, it could also be useful for GPs to increase their use of point-of-care diagnostic tools, such as urine dipsticks and glucometers, to prevent unnecessary delays caused by referrals for formal blood tests.¹⁷ Education programs¹⁸ and team-based learning modules¹⁹ targeted at GPs have proven effective. This includes the 4T campaign run by Diabetes Australia in discussion with

GPs and endocrinologists to educate the community about the early warning signs of T1D.²⁰ Easily accessible campaigns such as this may assist paediatric specialists in educating both parents and GPs. Furthermore, such campaigns can be used during consultation to prompt specific lines of questioning that may make a diagnosis of T1D clearer. The National Diabetes Service Scheme also has a number of resources available for health practitioners on its website, including patient fact sheets available through common GP practice software.²¹ The Western Sydney Health Pathways page on T1D has been updated and is another potential source of centralised education and referral information for local GPs. Organisations such as the Primary Care Diabetes Society of Australia have also published free educational material for primary care providers in the diagnosis of paediatric T1D that have been incentivised with CPD points.²²

This study also highlighted that the current status quo based on internationally recognised management guidelines is for paediatric T1D to be exclusively managed in tertiary paediatric centres, sometimes to the exclusion of GPs. Given

Table 5. Codes and representative quotes for the subtheme 'All these fancy things: GPs and diabetes technology'

Subtheme	Code	Representative quote
All these fancy things: GPs and diabetes technology	Frustration	'I am learning from my patients, all these fancy things ... It's not very nice. I think I should have better knowledge about them.' [Participant 29]
	Learning from patients	'I haven't had much exposure ... I just take it for granted that either the team or they themselves know how to manage.' [Participant 1]
	Interpreting tests	'I should be ok, because that's more working out what's normal, what's abnormal.' [Participant 30]
	Accessing data	'I've never had to, I probably wouldn't know how to access it.' [Participant 15]
	Dose adjustment	'I know their physiology would be a bit different to adults as well in terms of how sensitive they might be to food, and so I'm probably not as comfortable being able to adjust the dose based on their sugar levels, as much as I would a type 2 diabetic, an adult.' [Participant 2]
	GPs as education providers	'Like if they have questions. They've obviously been taught and given the information, but they always come back to their GP, and they do want to clarify things that they've heard. Because being their family doctor, sometimes they even question some of the things they've been told. They'll say "They've told me this, is that right?" and we're like "Well, if they've told you that, they're the right people to be giving that information." "Oh, but do you think it's right?" So if GPs were a bit more empowered with regarding to being confident and comfortable with how these devices work.' [Participant 6]

GP, general practitioner.

that collaborative care models have been shown to reduce medical errors and improve health outcomes,²³ this needs to be reconsidered. It has been previously established that role clarification and frequent effective modes of formal and informal communication are required to develop successful lines of communication between members of a diabetes team.²⁴ A centralised or formalised communication process may be mutually beneficial to all members of the multidisciplinary team. The Heart Foundation has released a Heart Failure Toolkit to assist in a multidisciplinary approach to heart failure.²⁵ A similar standardised toolkit could be produced for diabetes. In addition, effective leadership is required for functional healthcare teams.²⁶ This role could be performed by tertiary centres.

Patients were occasionally referred to EDs regardless of their clinical condition to avoid long wait times and in response to parental anxiety over the diagnosis. Some patients also presented to the ED without first presenting to their GP. Given the difference in ability to access GPs compared with paediatric endocrinologists, this raises the question whether this model is sustainable and practical. It is, however, essential to recognise that in certain healthcare settings there are insufficient outpatient services for GPs to refer to, which potentially inflates figures of ED presentation. In addition, patients without regular access to tertiary paediatric centres, such as those who live rurally, would still need access to highly educated and confident healthcare partners. Furthermore, GPs have access to additional resources, such as chronic disease management and mental healthcare plans. Appropriate financial remuneration by the Medicare Benefits Schedule (MBS) may enable GPs to support their patients with T1D in accessing evolving diabetes technologies.²⁷ Given the known association of T1D with psychiatric comorbidities and risk of poor metabolic outcomes,²⁸ ensuring that GPs are involved in a multidisciplinary approach with the ability to facilitate further psychosocial support is essential, and is recommended by the Juvenile Diabetes Research Foundation (JDRF).²⁹

This study also examined the current educational opportunities for GPs to learn about T1D and diabetes technology. Most strikingly, the majority of GPs admitted to having limited knowledge of the latest diabetes technologies, with most having received no formal education. This is significant because GPs were approached to provide additional education to patients. O'Donovan et al have highlighted that primary care practitioners are usually hesitant to initiate or adjust insulin pump therapy; however, they recognise the advantages this treatment could offer.³⁰ Given that diabetes technologies such as insulin pumps and CGM are associated with better glycaemic control,³¹ and therefore better patient outcomes, it is imperative that GPs can troubleshoot and encourage adherence to such diabetes technologies. Pease et al identified the need to establish clear guidelines on the commencement and monitoring of diabetes technologies across all healthcare sectors, including the role of primary care providers and appropriate scope of practice, which is again highlighted here.²⁷ By upskilling GPs as an additional resource to patients, physical distance as a barrier in seeking appropriate treatment could be mitigated. This is particularly important in rural and remote areas, where physical distance is a significant barrier to access specialist care. Prentice and Elleri have established a guide to insulin pumps for general paediatricians, which may be useful in this setting.³² The findings of the present study are potentially transferable to similar local health districts within Australia.

Future considerations

Patient care could be improved by collaboration between professional bodies such as the RACGP, Australian Diabetes Association, JDRF, the Royal Australasian College of Physicians and other stakeholders to develop a standardised shared-care toolkit. This could incorporate the design of resources and pathways perhaps for a shared-care model of care between primary care and the multidisciplinary specialist paediatric diabetes service for paediatric T1D patients. The role of the GP could

incorporate appropriate psychological support, management of social stressors and the ability to troubleshoot issues with diabetes technology. One issue to address could include the use of glucose and ketone testing in unwell paediatric patients. In addition, further examination could be taken into how GP training could incorporate more T1D content, with additional multiplatform/medium educational opportunities for GPs. Examples of these include presentations that are recorded and distributed, quick reference guides and online modules. Access to practical demonstrations on using and interpreting CGM and insulin pumps could be established by the RACGP with assistance from tertiary centres. These resources could be distributed from a centralised location, such as Diabetes Australia or Health Pathways. In addition, review of existing MBS item numbers and the development of new MBS item numbers for the evolving landscape of diabetes management technologies could assist in appropriately supporting people with T1D and ensuring the optimal use of devices to achieve the best possible outcomes. Finally, community-based campaigns based on the 4Ts campaign for GPs, families and schools to educate about the early symptoms of T1D in children should be established and promoted. Further research is required into the expectations of patients with T1D and their carers of GP management and input into managing paediatric T1D.

Limitations

The sample size of this study of 30 participants in Western Sydney does not necessarily reflect the GP population of greater Sydney. The use of convenience sampling may not have captured the diversity of our local GP population. The varied experience between the research team and community-based GPs could have influenced the interpretation of the data, possibly resulting in a hospital-centric interpretation of the data.

Conclusion

There is limited Australian research into GPs' ability to diagnose and manage T1D. This study highlights the current level of

knowledge and referral practices of GPs and suggests further review into the educational opportunities available to GPs, with centralised and standardised approaches to education, communication and referral.

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