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Original Research

Diagnosis and management of type 2 diabetes in youth in North Queensland and the Northern Territory: A health professional survey

Kate Haigh, Endocrinology Advanced Trainee, MBBS (Hons),[1] Robyn McDermott, MBBS, MPH, PhD, FAFPHM,[2§] Ashim Sinha, MBBS, MD, FRACP, FACE,[1] and Anna McLean, MBBS, FRACP[1]

[1]Department Diabetes and Endocrinology, Cairns Hospital and [2]Centre for Chronic Disease Prevention, Australian Institute of Tropical Health and Medicine, James Cook University, Cairns, Queensland, Australia

Abstract

Objective: *To describe clinician practice regarding diagnosis, management and perceived barriers to the optimal management of youth-onset type 2 diabetes mellitus in North Queensland and the Northern Territory and to compare self-reported practice to guideline recommendations.*

Design: *A mailed questionnaire distributed between July and October 2017.*

Setting: *Clinicians practising in three tertiary hospitals and two primary care organisations in North Queensland and the Northern Territory.*

Participants: *Of the 72 participants, 42 (58%) who responded were endocrinologists, diabetes educators, GPs and paediatricians.*

Results: *Of the 42 clinicians, 23 referred to the guidelines. A diabetes educator, GP, endocrinologist and dietitian were the most commonly included clinicians in the multidisciplinary team. Half of the clinicians' screen the children if additional risk factors are present. The HbA1c is the most common test used for screening and diagnosis. At diagnosis, the clinicians' recommended lifestyle change in 86% of the patients, treatment with metformin in 48%, and, when indicated, treatment with insulin in up to 45%. All clinicians believe that non-adherence is a major factor limiting optimal care. Most commonly cited barriers to optimal care were poor patient or family health literacy and limited patient or family understanding of the condition.*

Conclusion: *This study demonstrates several aspects of diagnosis and management of type 2 diabetes mellitus in youth that deviate from the guidelines. Patients need improved access to social workers, psychologists and Indigenous health workers. Other key areas to address are evaluation of risk-based screening, supporting appropriate and early use of insulin and the management of youth with type 2 diabetes mellitus inclusive of their family through contextualised health care delivery.*

KEY WORDS: *community health programs and strategies, diabetes, Indigenous health, rural health, youth health.*

Background

Type 2 diabetes mellitus (T2DM), historically a disease of adulthood, is now a growing problem among the world's youth. Globally, the annual incidence of children with T2DM is increasing at a rate five times faster than that of childhood type 1 diabetes (T1DM), and even more among ethnic minority groups.[1,2] Indigenous children are disproportionately affected with T2DM, with the annual incidence of 6–20-fold higher among Australian Indigenous children compared to non-Indigenous.[3] Type 2 diabetes mellitus now comprises the majority of new cases with diabetes among Indigenous children in Australia.[4] It is likely that most youth with T2DM remain undiagnosed, with reports of up to 90% of youth with pre- or overt diabetes unaware of their disease.[5]

The development of T2DM is mediated by chronic nutrient surplus in genetically susceptible people exposed to specific environmental factors, particularly

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Correspondence: Dr Kate Haigh, Department Diabetes and Endocrinology, Cairns Hospital, Cairns, Queensland, 4870, Australia. Email: kate_jamilla@hotmail.com

[§]Robyn McDermott is also Professor of Public Health at the School of Population Health, University of South Australia.

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What is already known on this subject:

- *The prevalence of youth-onset type 2 diabetes mellitus is increasing worldwide, with the highest rates among Indigenous youth.*
- *Diagnosis and management of youth with type 2 diabetes mellitus by Australian clinicians have not been described previously.*

What this study adds:

- *Australian Aboriginal health workers, psychologists and social workers are underrepresented in multidisciplinary teams caring for youth with type 2 diabetes mellitus.*
- *Insulin is underused early in diagnosis.*
- *Diagnostic and management strategies that are informed by youth, their family and their psychosocial and cultural context are needed.*

those encountered during foetal and early childhood development.[2] The increasing prevalence of childhood obesity is speculated to be the main risk factor for the emergence of youth-onset T2DM, in addition to other risk factors, including ethnicity, T2DM in a first- or second-degree relative and intrauterine exposure to maternal diabetes and obesity.[6]

The management of childhood T2DM remains a challenge worldwide and must address glycaemic control, risk of cardiovascular and microvascular complications, as well as the psychosocial impact of disease. Youth-onset T2DM has a more aggressive phenotype and is associated with early onset of complications, mortality and a worse cardiovascular risk profile than T1DM.[7]

Lifestyle modification is a key component of treatment, however, when used in isolation leads to metabolic control in <10% of patients.[8] Although almost all the youth with T2DM will require pharmacotherapy for glycaemic control, treatment options in Australia are limited to insulin and metformin. The TODAY trial demonstrated that approximately half of the patients initially managed with metformin and lifestyle modification will require insulin after 4 years.[7]

Treatment among Indigenous patients presents additional challenges, such as geographical isolation, limited access to health care and medications and medical staff perception of patient non-compliance, leading to restricted treatment decisions.[9] Stigmatisation, poor knowledge and fear of injection have been identified as barriers to insulin use among Torres Strait Islander adults with T2DM.[10] Improved health outcomes have been established in Indigenous communities through the involvement of multidisciplinary teams, including primary health care services, Indigenous health workers and specialist services, either remotely or through outreach clinics.[11]

International guidelines are available for diagnosis and management of T2DM in children. However, the authors' understanding of how this condition is being managed in Australia is limited. This study aims to describe the current management of youth with T2DM in communities with high prevalence among Aboriginal and Torres Strait Islander Australians and to compare this to guideline recommendations. The deviation from the recommended practice will be analysed to identify areas health care planning should be targeting.

Methods

Study and survey design

This cross-sectional study involved a survey of clinicians involved in the management of youth with T2DM in North Queensland and the Northern Territory. The involvement of clinicians in Western Australia was desired; however, difficulties in obtaining ethics approval within the study period prevented their inclusion in the study. Data were collected via a mail-out questionnaire specifically designed for this study. The questionnaire content was based on available guidelines and consisted of 40 questions divided into the following sections: (i) participant details; (ii) guideline use; (iii) health care team; (iv) screening; (v) diagnosis; (vi) glycaemic management; and (vii) complication management (see Appendix S1). The questionnaire content and design were peer-reviewed by the local clinicians prior to its initial mail-out.

Setting and participant selection

Clinicians involved in the study population included paediatric and adult endocrinologists, diabetes educators, GPs and general paediatricians who manage youth with T2DM. Physicians were identified from Cairns, Townsville and Royal Darwin Hospital clinician lists. Diabetes educators were identified by contacting local health services and a list of GPs was obtained from outreach organisations servicing the defined geographical areas.

Surveys were mailed in return-addressed, reply paid envelopes. Table 1 shows the clinicians in the study

TABLE 1: *Study population by type of clinician and location of practice*

	Queensland		Northern Territory	
Type of clinician	Respondents (*n*)	Total invited (*n*)	Respondents (*n*)	Total invited (*n*)
Paediatric endocrinologist	0	1	2	4
Adult endocrinologist	9	10	2	3
Diabetes educator	17	22	2	4
GP	8	26	0	0
General paediatrician	0	0	2	2

population by type and geographical location. Surveys were distributed between July and October 2017.

Ethics approval was granted by Townsville Hospital and Health Service (HREC/17/QTHS/79) and the Menzies Institute of Health (HREC 2017-2860). Participation in this study was voluntary and consent was implied by completion of the questionnaire.

Statistical methods

Data were entered into Epi Info 7 software (Centers for Disease Control and Prevention, Atlanta, GA, USA) and analysed using descriptive statistics. All variables were reported as counts or percentages. Associations between selected variables were examined using odds ratio (OR) with 95% confidence intervals (CIs).

Results

Participant demographics

Of the 72 clinicians, 39 (54%) returned a completed questionnaire, while three clinicians returned an incomplete questionnaire indicating they were not involved in the management of youth with T2DM. Table 1 shows the respondents by clinician type and geographical location. The majority of respondents were diabetes educators (44%), followed by adult endocrinologists (26%), GPs (18%), paediatricians (5%) and paediatric endocrinologists (3%). The majority practise in regional (51%) and remote (30%) centres. Respondents report that, of the children with T2DM that they manage, 81% on average are Indigenous and 88% have a first-degree relative with T2DM.

Guideline use

Of the 23 participants who referred to the guidelines, eight referred to the American Diabetes Association and six used the International Society of Paediatric and Adolescent Diabetes (ISPAD) guidelines. Guideline use was highest among adult endocrinologists (80%), followed by diabetes educators (59%) and lowest among GPs (33%). There was no significant association between guideline use and regional or metropolitan versus rural or remote location of practice (OR, 1.25; 95% CI, 0.32–4.78).

Health care team

Participants were asked to report what other clinicians were involved in their multidisciplinary teams

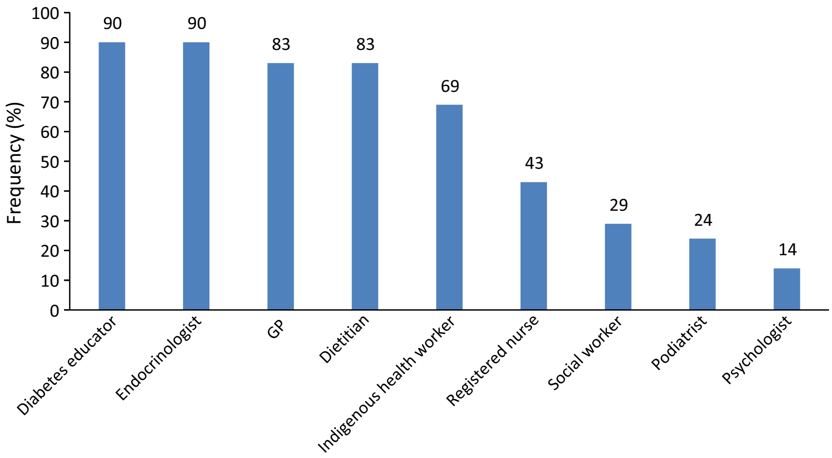

FIGURE 1: *Clinicians reported to be involved in multidisciplinary teams that manage youth with type 2 diabetes mellitus.*

caring for youth with T2DM and responses are shown in Figure 1. Most multidisciplinary teams include a diabetes educator (90%), an adult endocrinologist (90%) and a GP (83%), while an Indigenous health worker is involved in 69% of the teams, a social worker in 28% and a psychologist in 14%. The most common initial contacts in communities for youth with T2DM were GPs (40%) and diabetes educators (38%). There was no significant association between initial health care worker contact and geographical location.

Screening and diagnosis

Half of the clinicians screen asymptomatic youth for T2DM, and among those who screen, the most common indications for screening included overweight and obesity (67%), Indigenous status (60%) and family history of T2DM (55%). Uptake of screening was highest among community-based practitioners (65% of diabetes educators and 57% of GPs) and less commonly performed by hospital-based practitioners (31% of endocrinologists).

The most frequently described screening test was the HbA1c used by 45%, followed by random blood glucose level (BGL) used by 40%, fasting BGL used by 30% and oral glucose tolerance test (OGTT) used by 10%. The diagnosis of youth-onset T2DM was made using the HbA1c by 71% of the clinicians, fasting BGL by 50% and random BGL and OGTT were used by 37% of the clinicians. Type 1 diabetes mellitus was excluded by 36% of the clinicians who routinely test autoantibodies.

Glycaemic management

Of the 42 clinicians, glycaemic targets to guide treatment of youth with T2DM varied, with an HbA1c target of <6.5% utilised by 15 clinicians, <7% by 13 clinicians and 10 clinicians chose the glycaemic target based on the individual. While the clinicians' recommended lifestyle change in 86% of the patients at diagnosis, less than half (48%) recommended treatment with metformin at diagnosis. The factors that prompt the clinicians to initiate insulin at diagnosis are shown in Figure 2.

There was wide variation in responses to optimal BGL monitoring frequency. For patients not on insulin, recommended frequency of BGL monitoring ranged from 'not at all' (21%), 'twice weekly' (29%), 'weekly' (16%) to '3–4 times per day' (13%). For patients on insulin, the recommended frequency of BGL monitoring ranged from 'daily' (31%), 'twice daily' (26%) to '3–4 times per day' (44%).

Sixty-two per cent of the clinicians indicated an optimal follow-up frequency of 2–4 months, while 23% indicated that a 1–2 monthly review was optimal. In contrast, around half (49%) of the clinicians

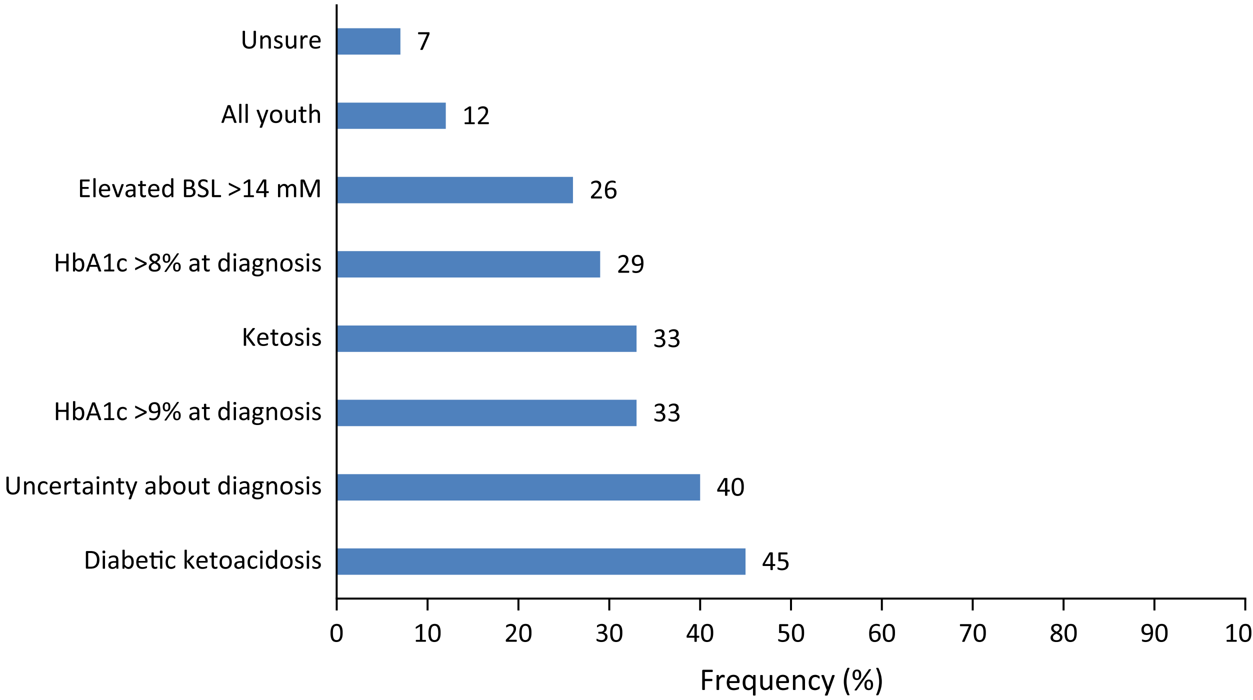

FIGURE 2: *Indications for clinician use of insulin at diagnosis. BSL, blood glucose level.*

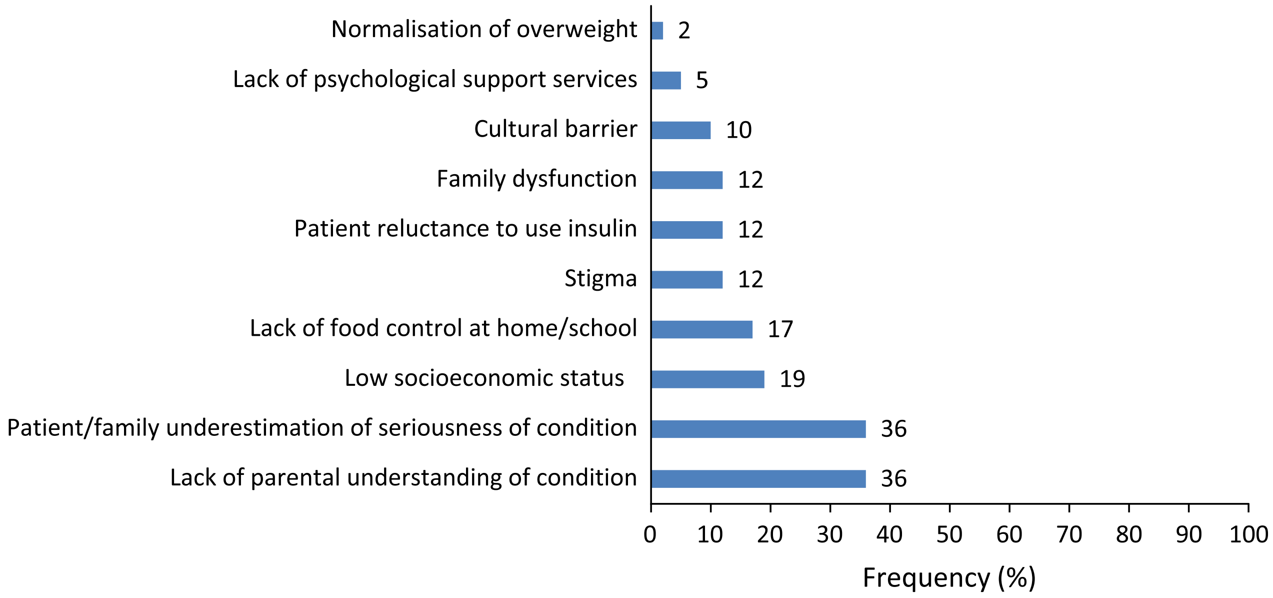

FIGURE 3: *Perceived causes of non-adherence.*

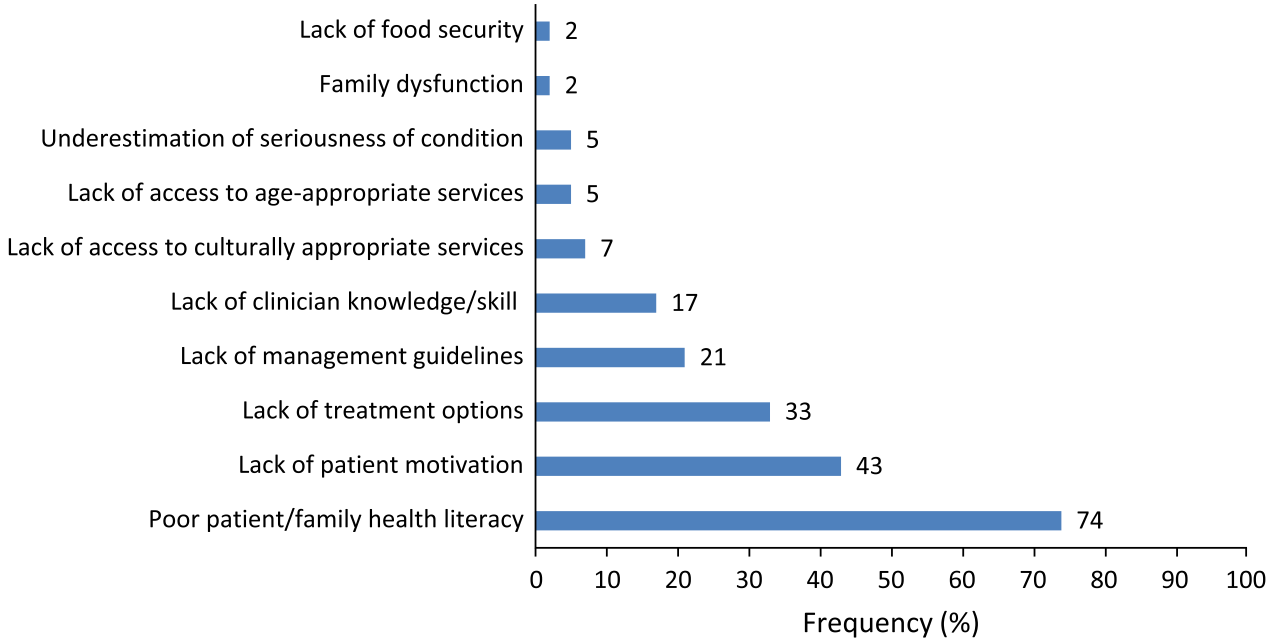

FIGURE 4: *Perceived barriers to optimal care.*

followed-up every 2–4 months and only 19% of the clinicians managed 1–2 monthly follow-ups.

All clinicians agreed that patient or family non-adherence was a major barrier to optimal care of youth with T2DM. The factor that was perceived to receive the least adherence was diet (81%), followed by insulin (62%) and appointment attendance (60%). The main causes of non-adherence identified by participants, based on multiple choice and opened-ended response, are shown in Figure 3. The main barriers to optimal care other than non-adherence, based on multiple choice and open-ended response, are shown in Figure 4.

Discussion

To the authors' nowledge, this is the first study to assess actual practice with regard to diagnosis and management of youth with T2DM in Australia.

Although over half of the clinicians refer to the guidelines when managing youth with T2DM, the authors identified several aspects of care that deviate from guideline recommendations.

Screening high-risk children for T2DM is controversial and was not reported as routine in this survey. Screening has not been shown to be cost-effective and there is a lack of guideline consistency regarding whom, when and how to screen. Community-based screening of obese and overweight youth for T2DM has demonstrated low (<1%) detection rates.[1, 12] Among obese youth, the prevalence of impaired glucose tolerance is 10–30%; however, a direct link to youth-onset T2DM has not been well established.[13] Those organisations that recommend screening advise the use of fasting BGL or random BGL and focus on high-risk populations, including obese and overweight children over 10 years old with additional risk factors.[14, 15]

Fasting BGL and OGTT are the most widely accepted diagnostic tests by paediatric practitioners.[16] While HbA1c is more reproducible and less variable than fasting BGL or OGTT, its use among paediatric populations has not been extensively studied. This study demonstrates the preferential use of HbA1c for screening and diagnosis of youth with T2DM and this might be related to convenience of use, as HbA1c can be tested in the non-fasting state, at point of care and provide rapid results.[16] The ISPAD and American Academy of Paediatricians guidelines support the use of HbA1c for diagnosis of paediatric T2DM; however, further work is required to establish its role in both screening and diagnosis.[13] The diagnosis of T2DM in youth should routinely involve autoantibody testing to exclude type 1 diabetes mellitus; however, this was not widely performed by the clinicians and might reflect the lack of familiarity with this condition and of guideline recommendations.

Initial management of youth with T2DM is guided by clinical presentation. Lifestyle modification and metformin should be commenced at diagnosis in metabolically stable patients, as metformin has been shown to be superior to lifestyle change alone in paediatric populations.[17] Metformin was not routinely commenced at diagnosis by the clinicians, a practice that might reflect translation of adult-based management guidelines.

Indications for treatment with insulin at diagnosis are consistent across guidelines and include diabetic ketoacidosis, ketosis, elevated BGL >14 mmol L^{-1} and HbA1c >9%. Clinician reluctance to commence insulin, termed 'psychological insulin resistance' or 'treatment inertia', has been well described and was clearly evident in this study. The factors contributing to this reluctance include perceived patient resistance, education requirement, safety and the view that insulin is a treatment of 'last resort'.[10] Ethnic disparities in the treatment method and clinical outcomes have been described in youth with diabetes.[18] Even among insulin-treated patients, less than one-third achieve glycaemic targets.[19,20] The ISPAD guidelines recommend monthly review of youth with T2DM with an HbA1c >7% and 3 monthly review for those with an HbA1c <7%.[13] This recommendation is in contrast to the beliefs by most clinicians that optimal follow-up frequency is 3 months and is even further disparate to actual review frequency of these patients, indicating that ability to meet this recommendation is limited by community resources.

Managing youth with T2DM has many challenges; among them, the most significant is a patient's social and cultural context. Limited access to a regular health care provider, lack of culturally appropriate communication and lack of contextualised care have been identified as barriers to improve outcomes of ethnic minority youth with diabetes in the USA.[21] Furthermore, many patients live in remote communities with associated food insecurity, limited access to services and poorer mental health that challenge adherence to treatment plans.[22] All clinicians identified patient non-adherence as a major barrier to optimal treatment, suggesting that less importance is placed on the role of the health care team in enabling adherence to treatment. Staff, communication and medication choices that are sensitive to the culturally and socially diverse nature of Australian Aboriginal and Torres Strait Islanders are essential in improving the involvement in management strategies by youth with T2DM.[23] Another key barrier identified by the clinicians was the perception of parent and patient underestimation of the seriousness of this condition. This calls for novel patient-, and importantly, family-centred approaches to management.[24] Team members key to this change include Indigenous health workers, psychologists and social workers, all of whom were underrepresented in the management teams in this study.[23]

Australian Aboriginal and Torres Strait Islander youth are disproportionately affected by T2DM and the establishment of health care teams that cater to the cultural and psychosocial needs of the patient and family affected is critical. Adherence to a healthy diet and medications might be improved by involving the patient and family in treatment decisions, choosing available long-acting or combination preparations and improving cultural sensitivity, including use of locally resident Indigenous health workers. Aspects of diagnosis and management with wide variability in responses tended to correspond to areas that lack specific guideline recommendations, indicating the need for further research regarding best methods of screening and diagnosis. Early use of insulin should be encouraged. A shift towards management plans inclusive of patients, their family and their community, as well as sustainable novel interventions, are called for.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Management of children with type 2 diabetes in Northern and Western Australia.