

ADS-ADEA-APEG Consensus Statement: Management of Type 2 Diabetes in Young Adults (aged 18-30 years)

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Abbreviations and Acronyms

ACEI angiotensin converting enzyme inhibitor
ACR albumin-to-creatinine ratio
ARB angiotensin receptor blocker
AUSDRISK Australian type 2 diabetes risk assessment tool
BMI body mass index
BP blood pressure
CCB calcium channel blocker
CKD chronic kidney disease
CVD cardiovascular disease
DASH Dietary Approaches to Stop Hypertension
DiRECT Diabetes Remission Clinical Trial
DKA diabetic ketoacidosis
DPP-4i dipeptidyl peptidase-4 inhibitor
GAD glutamic acid decarboxylase
GCK glucokinase
HNF hepatic nuclear factor
GDM gestational diabetes mellitus
GI glycaemic index
GLP-1 RA glucagon-like peptide-1 receptor agonist
GP general practitioner
HbA1c glycated haemoglobin
HDL-C high-density lipoprotein-cholesterol
IA-2 insulinoma antigen-2
IFG impaired fasting glucose
IGT impaired glucose tolerance
IR Insulin resistance
ESRD End stage renal disease
LDL-C low-density lipoprotein cholesterol
MODY maturity-onset diabetes of the young
NAFLD Non-alcoholic fatty liver disease
NICE National Institute for Health and Care Excellence
OGTT oral glucose tolerance test
OSA obstructive sleep apnoea
PAID Problem Areas in Diabetes
PBS Pharmaceutical Benefits Scheme
PCOS polycystic ovary syndrome
PHQ Patient health questionnaire
RACGP Royal Australian College of General Practitioners
SGLT2i sodium glucose co-transporter 2 inhibitor
TZD thiazolidinedione
UACR urine albumin-to-creatinine ratio
VEGF vascular endothelial growth factor
VLED very low energy diet

Introduction

Type 2 diabetes, traditionally considered a condition of older age, is becoming more prevalent in younger age-groups in Australia and worldwide (1-3). It is increasingly clear that type 2 diabetes with onset in youth and young adulthood (nominally, 18-30 years of age) is a more aggressive condition than that seen in older age, with greater risks of major morbidity and early mortality (4, 5). It is estimated that onset in young adulthood comprises 16% of the adult type 2 diabetes population globally (1, 6). In the context of a still-limited evidence base, the objective of this Consensus Statement is to highlight the risks of this condition in young adults and to outline the specifics of management that may differ from later-onset type 2 diabetes. This Consensus Statement directly considers issues for young adults with type 2 diabetes (hereafter abbreviated as YT2D). Guidelines specifically for the management of type 2 diabetes in children and adolescents (<18 years of age) are available elsewhere (7). Special considerations with respect to Aboriginal and Torres Strait Islander Australians are highlighted separately.

Risk screening and diagnosis

Risk factors for YT2D appear to be similar to those for older adults with a particular emphasis on obesity. The increases seen in the incidence and prevalence of YT2D, are driven by the escalating rates of obesity in youth. A strong family history of type 2 diabetes is common, particularly a history of in-utero exposure to gestational hyperglycaemia or maternal obesity (8, 9). Additionally, type 2 diabetes in young adults is most prevalent in races/ethnicities with a high risk of type 2 diabetes overall and thus is relevant to multicultural Australia. Population screening is unlikely to be cost-effective (2), but risk-based screening criteria are recommended. Risk factors are chosen on the basis of their association with type 2 diabetes (see Table 1). This extends current general Australian guidance to testing young adults with obesity or overweight in the presence of additional risk factors, including a maternal history of type 2 diabetes or GDM during an individual's gestation. These recommendations do not preclude standard recommendations for diabetes testing in adults, although it is likely that the AUSDRISK score would lack accuracy for this age-group (10). In asymptomatic individuals, standard adult diagnostic criteria for diabetes apply (fasting glucose, 2hr post load glucose or HbA1c) and diagnosis requires two abnormal test results. If fasting glucose is in the range 5.6-6.9 mmol/L or HbA1c are 5.7-6.4% (39-46 mmol/mol), it is recommended to proceed to an OGTT, to identify post load hyperglycaemia defining IGT or diabetes. Thereafter, screening intervals are as for older adults; if IFG or IGT is found then screening for diabetes should be performed annually; if initial tests are within the normal range, screening should continue at a minimum of 3 yearly intervals or earlier if BMI is increasing. These recommendations are aligned with current guidance for paediatric and adolescent age-groups (2, 7). Specific guidance for Australian and Torres Strait Islander Australians are given below.

Table 1: Screening for type 2 diabetes and prediabetes is recommended in asymptomatic young adults with overweight or obesity (BMI \geq 25 kg/m²)* with one or more risk factor as listed

Maternal history of type 2 diabetes or GDM during an individual's gestation
Family history of type 2 diabetes in a first degree relative
High risk ethnicity Aboriginal, Torres Strait Islander **, S Asian, SE Asian, N African and Latino, Middle-Eastern, Māori or Pacific Islander. Includes individuals of mixed ethnicity
Clinical evidence of insulin resistance (PCOS, acanthosis nigricans, dyslipidaemia, hypertension) or existing macrovascular disease, IFG, IGT or history of GDM
Use of anti-psychotic medications

*Ethnic specific BMI cut-points recommended for S Asian and SE Asian [overweight BMI >23 kg/m² and obese as BMI >27.5 kg/m²] thresholds for public health action (11)

**See section below for screening and testing recommendations for Aboriginal and Torres Strait Islander Australians

Type 2 diabetes in young Aboriginal and Torres Strait Islander Australians

Aboriginal and Torres Strait Islander youth are disproportionately impacted by type 2 diabetes. Compared to non-Indigenous Australian youth, Aboriginal and Torres Strait Islander youth experience twenty-fold higher rates of type 2 diabetes and ten to twenty-fold higher hospitalisation rates (12, 13). They have an earlier age of type 2 diabetes onset than the general Australian population, with the condition reported in children as young as 5 years of age (14, 15).

Due to the high risk of type 2 diabetes among Aboriginal and Torres Strait Islander peoples, case-finding recommendations differ from those for the general population, such that annual screening is recommended from age 15 years as part of the MBS-funded well person's health check. Screening from age 10 years in those children with a risk factor is recommended in the Central Australian Rural Practitioner Guidelines for remote primary health care and this recommendation extends to the young adult onset population (16). Such risk factors include: overweight, family history of diabetes, mother with pre-existing or gestational diabetes during pregnancy, polycystic ovarian syndrome and acanthosis nigricans. An HbA1c is recommended for case-finding with a confirmation test of HbA1c, fasting glucose and/or 2 hour glucose on 75 gm OGTT with standard diagnostic criteria for diabetes applied. If the HbA1c is 5.7-6.4 % (39-46 mmol/mol), an OGTT is recommended in order to diagnose IGT (7), which is an important diagnosis to make, as dietary changes, physical activity changes, weight loss and/or metformin can then reduce the risk of progression to type 2 diabetes.

Key management principles when working with Aboriginal and Torres Strait Islander youth with type 2 diabetes include: culturally-relevant and culturally-safe care, involvement of an Aboriginal Health Practitioner as a key member of the multi-disciplinary team, assessment and management of social and emotional well-being and shared care between primary care and multi-disciplinary diabetes teams (17). Development of strong patient-provider relationships are particularly important in this context; thus minimising change in the provider team is a priority. Pregnancy planning and contraception are important considerations among young Aboriginal and Torres Strait Islander women with type 2 diabetes, as rates of type 2 diabetes in pregnancy are ten-fold higher than in non-Indigenous Australian women, and type 2 diabetes is a key contributor to higher rates of adverse perinatal outcomes among Aboriginal women (18).

Aboriginal and Torres Strait Islander youth with type 2 diabetes experience very high rates of diabetes complications from a young age (12, 15). Of great concern is the report that among Canadian First Nations peoples with youth-onset type 2 diabetes, renal survival was only 55% at twenty years after diagnosis: that is, nearly half of those with youth-onset type 2 diabetes require dialysis by age 40 years (19).

Determining diabetes type

Diabetes type in young adults can be difficult to determine as background population obesity rates mean that obesity is present in a significant proportion of individuals with classical type 1 diabetes (20). Furthermore, type 2 diabetes in youth can present with ketosis or ketoacidosis, so that clinical overlap features are common in youth. The main decision points in young adults are to distinguish type 1 diabetes from type 2 diabetes and to recognise rarer monogenic forms of diabetes. It should be noted that at this time there are no agreed diagnostic criteria for YT2D.

To assist in identifying type 1 diabetes, it is recommended that clinicians have a low threshold for checking islet autoantibodies (insulin, GAD, IA2 and ZnT8) if possible, regardless of BMI at diagnosis. Extrapolating from evidence in adolescents with typical clinical features of type 2 diabetes, antibody positivity is associated with an intermediate phenotype and a faster progression to insulin therapy; such cases are likely to represent slowly evolving type 1 diabetes (21, 22). In terms of other biomarkers, a low C-peptide is consistent with type 1 diabetes but does not exclude type 2 diabetes, especially in the context of prevailing glucotoxicity. In addition, C-peptide may be preserved early in

the course of type 1 diabetes, particularly in the presence of insulin resistance, however persistent C-peptide beyond 5 years from diagnosis of type 1 diabetes should prompt re-consideration of type 2 diabetes or monogenic forms (23, 24). Nevertheless, measurement of C-peptide or insulin is not recommended as part of routine evaluation in this population as there is likely to be considerable overlap in insulin or C-peptide measurements between T1D and T2D at onset of diabetes, as seen in children and adolescents (2).

A detailed family history of diabetes, particularly early onset diabetes should be taken. Monogenic diabetes can account for up to 6% of diabetes in children and adolescents (23). Clinical clues to monogenic diabetes include: a family history of diabetes in one parent and first-degree relatives of that affected parent in young adults who lack the characteristics of type 1 diabetes, lack of marked obesity and other metabolic syndrome features, isolated mild fasting hyperglycaemia (GCK MODY), an extreme sensitivity to hypoglycaemia on sulfonylurea medications (HNF1 α -MODY / HNF4 α -MODY), or the presence of renal cysts (HNF1 β MODY). A MODY probability calculator is available online but this has not been validated in Australian multiethnic populations (25). If monogenic diabetes is suspected, genetic testing is available via clinical genetics services and should be considered, given therapy implications for a positive diagnosis of monogenic diabetes. Recommendations for determining diabetes type, based on guidelines for children and adolescents (2, 23) are shown in Table 2.

Table 2: Determining diabetes type	
Consider testing for islet cell autoantibodies to exclude autoimmune type 1 diabetes. GAD Ab and IA2 Ab are the most commonly available	
Consider monogenic forms of diabetes and take a detailed family history	
Clinical features suggestive of monogenic diabetes	A family history of diabetes may be present in one parent and first-degree relatives of that affected parent, in young adults who lack the characteristics of type 1 diabetes (no islet autoantibodies, low or no insulin requirements more than 5 years after diagnosis)
	Stable isolated fasting hyperglycaemia in the range of 5.5-8.5 mmol/L and a 2hr glucose rise of <3.5 mmol/L on OGTT (GCK MODY)
	Extreme sensitivity to sulfonylurea medications with large post load glucose rise > 5 mmol/l on OGTT (HNF1 α MODY / HNF4 α MODY)
	Lack of marked obesity and other metabolic syndrome features (e.g. acanthosis nigricans)
	Specific features such as genitourinary tract abnormalities or renal cysts, pancreatic atrophy, hyperuricaemia or gout (HNF1 β MODY)
	History of neonatal hyperglycaemia
	Maternal line inheritance and associated hearing loss (mitochondrial diabetes)

Dietary management and physical activity as first-line therapy

Intervention is recommended from diagnosis and needs to support three aims: i) to achieve adequate person-centred reduction in calorie/kilojoule consumption and portion control, as obesity is a common comorbidity in YT2D, ii) to increase physical activity and reduce sedentary time, and iii) to achieve recommended metabolic targets. Specific recommendations will need to be sensitive to individual resources, with consideration of the possibility of food insecurity, socioeconomic disadvantage and other social stressors, all often of specific relevance to this age-group.

Dietary management and medical nutrition therapy

The choice of nutrient-dense, culturally-appropriate wholefoods in the context of an individual's preferences, together with calorie/kilojoule and portion control for weight management is recommended. A first-line intervention needs to be elimination of 'empty calories' e.g. sugar-

sweetened beverages, including juices, and reduction of refined simple sugars, particularly in pre-packaged, processed food. Beyond this, there is little evidence for one specific macronutrient approach in YT2D. Eating patterns with some proven benefit on glucose levels and metabolic risk factors in older adults include the Mediterranean diet, a plant-based diet, and the DASH diet. For adolescents with obesity, modified 'traffic light' interventions whereby foods are assigned colours depending on their nutritional quality in the context of an overall calorie-restricted lifestyle intervention, showed benefit in cardio-metabolic indices (26). Of interest, the VLED approach has shown benefit among adolescents with obesity and newly diagnosed type 2 diabetes but evidence for long term effects is lacking at present (27, 28). Similarly, in adults with type 2 diabetes, utilising a weight management program incorporating a low energy formula diet, the DiRECT trial achieved remission of diabetes in almost half of the patients randomised to this intervention (29). Although young adults were not well represented in this trial and evidence for durability of effect is still limited, this approach merits further consideration given the potential pre-conceptual, occupational and other benefits of inducing remission in this age group. Further research is needed to identify the most effective nutritional approach for YT2D. Until then, it would seem reasonable to base dietary interventions on the evidence-based framework above. Given the complexities, all YT2D should be offered personalised advice from an Accredited Practising Dietitian with specialist expertise in this area.

Although there is evidence for a lack of plasticity in modifying lifelong eating patterns in older adults, whether this is true for young adults is unclear. The inclusion of family members in diabetes management may still be important into early adulthood. It is particularly important to educate this vulnerable group given that lifelong eating behaviours are acquired during this period of life. For example, instructions on interpretation of nutrition labels and food preparation may be of particular benefit to young adults, and the use of mobile-phone-based apps may be of assistance in the understanding of calories/kilojoules, glycaemic index, and macronutrients (30). Clinicians should also be mindful that disordered eating may already exist in this age group and maintaining a healthy relationship with food is paramount (31).

Physical activity and exercise

Recommendations for exercise reduce in time and intensity with age; paediatric guidelines suggest 60 mins of moderate-intensity aerobic activity a day, whilst adult recommendations range from 150-300 mins a week depending on intensity and fitness, with the addition of 1-2 sessions of resistance training (32). Therefore, the 300 mins/week of moderate intensity aerobic activity could be considered a minimum recommendation for young adults. Shorter durations are recommended if high-intensity exercise is undertaken. A reduction in sedentary time is also indicated for its metabolic benefit (33). Such a reduction may also be helped by limiting electronic activities (e.g. computer use, texting and video games). Screen-time has been shown to be positively associated with HbA1c (34) and restricting recreational screen-time to less than 2 hours per day is recommended for adolescents (7, 35) which might also mitigate sleep deprivation (36, 37). It would seem reasonable to recommend similar if not more stringent limits for YT2D whose work or study-related screen-time exposure may be even greater. This recommendation is supported by evidence that increasing screen-time above 2 hr/day from adolescence to young adulthood is associated with adverse cardiovascular risk factors in young adulthood (38). Similar associations of increased TV viewing time, screen-time and adverse metabolic risk factors have been reported in college age students and older Australian adults without diabetes (38-40).

The efficacy of interventions in YT2D.

Extrapolation from studies in youth with obesity suggests that increased exercise and activity, coupled with nutritional intervention would promote weight loss, fitness, improved glucose control and improved cardiovascular risk factors. This has been challenging to prove in YT2D. One of the key learnings from the TODAY trial in young people with type 2 diabetes (up to age 17) (41) is that despite a comprehensive lifestyle approach in combination with pharmacotherapy and significant in-trial

support, there were only moderate improvements in cardio-metabolic indices. Interventions did not result in greater durability of optimal glucose levels, had a modest effect on BMI, and there were limited improvements in fitness measures (42-45). It is possible that the efficacy of lifestyle intervention in YT2D may be similarly blunted. Complex social and environmental factors are suggested to have contributed to these results. However, it is also possible that underlying physiological defects in response to an exercise stimulus exist for youth (35). It is notable that smaller studies examining exercise interventions in YT2D show a relative resistance to the effects of exercise, at least on fitness measures (46). Extrapolating the adolescent data to young adults, the practical application would be that clinicians should continue to promote dietary/physical activity management according to guidelines, but be aware that any suboptimal benefits for these interventions may not necessarily be a failure of personal action (or social environment) but may have a physiological background. Furthermore, the reliance on dietary/physical activity management for achieving optimal glucose levels should be realistic in this context. Therapeutic inertia towards initiating pharmacotherapy must be minimised and any psychological barriers experienced by the young adult need to be addressed. Further research is needed to identify the best methods for promoting and sustaining dietary/physical activity changes over time among YT2D.

Table 3: Recommendations for dietary/physical activity interventions in young adults with type 2 diabetes	
Obesity is a key modifiable risk factor. A sustained weight loss of 7-10% in those with excess weight is expected to provide benefits for blood glucose and CVD risk factors in young adults. See also Table 6.	
Culturally appropriate programs promoting healthy diet and increased physical activity need to be provided, and family involvement needs to be individualised as developmentally appropriate	
Current evidence suggests only a modest effect of dietary/physical activity intervention on weight loss and glycaemic control, which may in part have a physiological basis. Lack of efficacy should not be considered a failure of personal action. Intensifying pharmacologic intervention to improve glycaemia needs to be timely	
Specific recommendations will need to be sensitive to individual resources, with consideration of the possibility of food insecurity, socio-economic disadvantage and other social stressors, all often of specific relevance to this age-group	
In this age-group, disordered eating may already exist, and maintaining a healthy relationship with food is paramount	
Nutrition advice	No long-term data are available on the optimal eating pattern or in favour of a particular macronutrient approach. Emphasis is on nutrient-dense high-quality foods
	Reduce total energy intake and intake of low-nutrient energy-dense foods. Address snack frequency and portion control
	Eliminate sugar-sweetened beverages (e.g. soft drinks and fruit drinks)
	Ensure intake of adequate fruit (2 serves daily) and vegetables (5 serves daily)
	Reduce saturated fat and include mono-unsaturated and omega 3 poly unsaturated fats.
	Ensure adequate knowledge of carbohydrates including the appropriate intake of lower glycaemic index and high fibre foods
	Given the lifelong necessity for healthy eating, wherever possible and appropriate, young adults need to be offered education on shopping, healthy meal preparation and food labels to enable informed choice. Aim to promote healthy food choices, regular mealtimes and reduce reliance on processed, pre-prepared and takeaway foods. Encourage mindful eating behaviours
	Individualised advice for weight management and glucose control with involvement of an Accredited Practising Dietitian is recommended

Physical activity and exercise	Recommendations are as for a healthy young populations; a minimum of 300 min/week of moderate intensity exercise is recommended. An additional emphasis is on reducing sedentary time, limiting recreational screen time to <2hrs/day, and achieving adequate sleep in a sustainable way
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Psychosocial factors

The great influence of psychosocial factors on type 2 diabetes management and outcomes in diabetes is well recognised (47). In addition, it is evident that YT2D experience psychological burden comparable to young adults with type 1 diabetes and greater than older adults with type 2 diabetes (48). In Australia, YT2D often come from ethnic minority groups or from socially disadvantaged groups with multiple stressors including employment and housing insecurity. As a group, they experience lower engagement and follow-up than older onset type 2 diabetes (49). Clinical care needs to be individualised to address these challenges and facilitate access, engagement, and improved outcomes.

Current data in young adults are limited, but studies including adolescents suggest high rates of diabetes-distress, depression, psychiatric symptoms, and disordered eating, at least equivalent to or more prevalent than those seen in older type 2 diabetes or type 1 diabetes (48, 50-52). Diabetes distress is the emotional burden of living with diabetes. It is more common than and sometimes mistaken for depression (53). Clinicians need to be aware of, and ask about, depressive symptoms and diabetes distress to enable appropriate intervention where needed-practical guidance is available (53, 54). If standardised tools are used to assess and identify depressive symptoms, and diabetes specific distress, they need to be age appropriate. For monitoring purposes, the self-administered PHQ 9 can be applied routinely to assess depressive symptoms, and the PAID scale can be used to assess diabetes distress (55, 56). Additionally, there is considerable social stigma associated with T2D generally (49) and emerging evidence that shame can be a pervasive negative emotion in YT2D (57). Clinicians should also be vigilant for alcohol and substance abuse (58). Psychosocial assessments are recommended at the initial review and at any time when emotional health or self-care appears impaired. Common signs for psychosocial distress include: loss of interest or pleasure in usual activities; difficulties with concentration, sleep or relationships; ineffective coping strategies; multiple life stressors; appearing passive during consultations or not attending clinic appointments (53). If required, early referral to social work and mental health professionals with expertise in dealing with young adults is recommended.

Table 4: Recommendations regarding psychosocial care in young adults with type 2 diabetes
Emotional health problems, e.g. diabetes distress, depression, disordered eating, and psychiatric symptoms, are relatively common among young adults with diabetes. In addition, clinicians need to be mindful that young adults may be susceptible to, and internalise, the social stigma surrounding type 2 diabetes
Clinicians need to be aware of, and ask about, depressive symptoms and diabetes distress to enable appropriate intervention where needed
Screening tools such as the PHQ-9 and PAID can be used to identify those who may need additional support and intervention
Individualised strategies to assist engagement and follow-up are necessary for this group. This may include flexible appointment times, strong continuity of care with a single point of contact
Clinicians need to be vigilant for alcohol and substance abuse issues
Early referral to social work and mental health professionals with expertise in dealing with young adults is recommended

Glucose management and pharmacotherapy

Control of symptoms and prevention of acute and chronic complications are the treatment goals for YT2D (1). Glucose targets have not been specifically established for this age-group and extrapolations are made from data derived from those with older onset diabetes (1). The aggressive natural history of YT2D and the high prevalence of co-existing medical, psychiatric, and social issues need to be considered when individualising glucose targets (59). HbA1c should generally be measured every three months with a goal of ≤ 48 mmol/mol ($\leq 6.5\%$) for most people, if this can be achieved without undue hypoglycaemia risk or treatment burden.

As mentioned, dietary and exercise interventions alone are generally insufficient to maintain adequate glucose levels, with less than 20% achieving or maintaining adequate glucose management with lifestyle intervention alone (1). Less than half of young adults aged 18-39 (47%) with type 2 diabetes have optimal (>90%) medication-taking (60). To facilitate optimal treatment, it is critical that management is individualised, goal-setting is collaborative, culturally appropriate, and that necessary patient education and psychological support is provided.

Metformin is approved by the Australian Therapeutic Goods Administration for the management of type 2 diabetes in those >10 years of age (61). In the absence of contraindications, including reduced renal function ($\text{CrCl} < 30$ mL/min), metformin should be used as first line pharmacotherapy and should be initiated in most YT2D at diagnosis (62). Young adults with newly diagnosed type 2 diabetes may have an increased response to metformin compared with those with later onset diabetes (63).

Type 2 diabetes in young adults is thought to be caused by similar mechanisms to later onset T2DM, including pancreatic β -cell failure, insulin resistance, lipolysis, alterations in incretin and pancreatic α -cell function, and kidney glucose filtration (62). However, type 2 diabetes in youth is generally a more aggressive phenotype than later onset diabetes with a faster decline in β -cell function, up to 20-35% per year (62). Rapid decline in β -cell function with relatively stable insulin resistance may result in an early failure of metformin monotherapy and more rapid requirement of second line therapy (62, 64).

Insulin may be beneficial at the time of diagnosis to achieve rapid metabolic improvements. Although the specific effects in young adults is not known, one third of adolescents are able to subsequently cease basal insulin (65) and those who commence insulin at initial diagnosis have improved glucose and lipid profiles (66). However, the early use of metformin plus insulin has not been found to attenuate ongoing decline in β -cell function in adolescent type 2 diabetes (67).

Second-line and third-line treatment options of sulfonylureas, thiazolidinediones, SGLT2i, DPP-4i, and GLP-1RA, are licensed for use in individuals from 18 years of age, although have not all have been specifically studied in YT2D. Nevertheless, efficacy in young adults is supported by recent studies in children and adolescents; specifically liraglutide has been shown to be as efficacious in children and adolescents with type 2 diabetes (aged 10-17) as in adults and has been recommended as second-line therapy add onto metformin in paediatric guidelines (68, 69). Similarly, a single-dose study of sitagliptin in YT2D aged 10-17 has shown similar pharmacodynamics, pharmacokinetic and safety trends as for adults and it is expected that other agents in paediatric populations will report soon (70, 71). There have been too few young participants in the cardio-renal outcome trials to draw conclusions regarding non-glycaemia-mediated cardiac and reno-protective effects of specific therapies (SGLT2i and GLP-1 RA) in this age-group (72). Nevertheless, given the high cardio-renal risk in YT2D and the need to avoid iatrogenic weight gain and hypoglycaemia, GLP-1 RA and SGLT2i are the likely best second-line agents (73). The need for effective contraception is a requirement in women given unknown teratogenic effects of these newer agents.

Table 5: Recommendations regarding glucose management and pharmacotherapy in young adults with type 2 diabetes
Given high risk of complications, the HbA1c target should be $\leq 6.5\%$ ($\leq 48\text{mmol/mol}$) if it can be achieved without undue hypoglycaemia risk and management burden
Insulin may be beneficial at the time of diagnosis to achieve rapid metabolic improvements in the context of symptomatic hyperglycaemia, with a proportion likely to be able to subsequently cease insulin
Metformin remains first-line therapy but durability of achieving glucose targets may be less than for older adults
There is limited but emerging evidence for the use of newer agents GLP-1 RA, SGLT2i and DPP4i in YT2D. Given low hypoglycaemic risk and neutral or beneficial effects on weight, these should be considered early in the treatment algorithm. Consideration of effective contraception in women is essential as there is limited safety evidence for the use of these newer agents in pregnancy
Cardio-renal benefits are not yet proven for YT2D, however SGLT2i and GLP-1 RA could be considered preferentially in the context of persistent albuminuria/CKD or known CVD (see Table 7)
Caution recommended when using SGLT2i in ketosis-prone YT2D
Regular 3 monthly HbA1c monitoring is warranted given risk of therapy failure and progressive β -cell decline

Obesity management for the treatment of YT2D

Obesity is an important, modifiable risk factor and contributes to insulin resistance in YT2D. Studies from the USA show a strong inverse relationship between age of diabetes onset and BMI (74). However, there is considerable heterogeneity and, for some ethnicities, the relationship of obesity to age of onset of diabetes is less clear (2). In young adults with obesity and type 2 diabetes, early intervention is warranted and weight-loss can improve glucose control and obesity related conditions, although the evidence for diabetes remission specifically in YT2D is still limited (75). People with obesity face weight-based stigma and are subject to prejudice (weight-bias) in many aspects of their lives (76). In addition to the lifestyle interventions outlined in Table 3, available interventions for reducing energy intake include the use of VLCD and meal replacements under medical supervision. Pharmacotherapy, for obesity beyond that recommended for metabolic control is available for young adults. Metabolic Surgery in experienced units may also be considered as an option for treatment of type 2 diabetes in the context of inadequately controlled diabetes. See Table 6, for additional recommendations.

Table 6: Recommendations for obesity management for the treatment of type 2 diabetes in young adults
As for all persons with diabetes, it is recommended to use non-judgmental people-first language (i.e. person with obesity rather than obese person), to avoid defining people by their condition
People with obesity or overweight face weight based-stigma and prejudice (weight-bias) in many aspects of their lives, which may impact the quality of health care received. Clinicians are encouraged to examine their own potential for weight-bias and to refrain from narratives that support negative weight-based stereotypes
As weight-gain is common in this age-range, annual weight/BMI assessment is recommended, or more frequently (if required) to assess weight trajectory. The need for privacy whilst weighing and any reluctance to be weighed, should be respected and accommodated
Relevant weight loss targets, dietary/ physical activity recommendations, and the potential for the co-occurrence of depression /presence of disordered eating, are outlined in Table 3 and 4
Interventions for reducing energy intake include the use of VLCD and meal replacements under medical supervision

Pharmacotherapy for obesity, beyond that recommended for glycaemic management, are available in Australia. These currently include phentermine, liraglutide 3mg, orlistat and naltrexone/bupropion (precaution/warning in persons younger than 25 years old with depression). Please refer to expert guidance for further information on their use *

Bariatric or metabolic surgery is effective for obesity and improving metabolic indices, although long term data in adolescents and YT2D are lacking. In experienced units, metabolic surgery may be considered as an option for young adults with obesity and persistent hyperglycaemia despite non-surgical therapy. Please refer to expert guidance for further information *

Assessment for obesity related complications including those that would benefit from weight loss is recommended (e.g. NASH, OSA, PCOS, fertility implications and hypertension) (See Table 7)

*Australian Obesity Management Algorithm

<https://diabetessociety.com.au/position-statements.asp>

Diabetes complications and comorbidities

Clinicians should be aware that some diabetes complications are more prevalent in YT2D in comparison to type 1 diabetes, with evidence for more rapid progression and a higher mortality (77-81). Furthermore, complications are occurring at a much earlier age, with a higher impact on mortality in comparison to later-onset type 2 diabetes (82-84). In general, guidance for complications management are as for older adults, however caveats for usual care of YT2D are discussed below.

Nephropathy and hypertension

Despite the young age, the prevalence of albuminuria is reported to be as high as 27% at diagnosis, and hyperfiltration (eGFR 120-150 mL/min/1.72m²) is also common (78). Obesity before the onset of diabetes is a potential contributor (85). These early changes indicate an increased risk of progression to diabetic kidney disease and an increased vascular risk. Current evidence suggests a more rapid progression to ESRD than that seen in type 1 diabetes with onset in this age-group (86). Thus, as for older adults, eGFR and urine ACR should be obtained at diagnosis and annually thereafter with albuminuria confirmed on repeat specimens. An elevated ACR (>30 mg/g or 3 mg/mmol) should be confirmed by repeat measure and represents an increased risk of progression of diabetic kidney disease (87).

The thresholds for treatment and targets for blood pressure (BP) continue to be debated for older adults and evidence for optimal thresholds are even less clear for YT2D. In adolescents younger than 18 years, pharmacological treatment of hypertension is recommended for persistent elevation of BP >130/80 following lifestyle intervention; BP targets are recommended to be <120/80 (7). Therefore, for YT2D (over 18 years of age), the recommended adult BP targets of <130/80 mmHg should be considered to be a minimum target. Recent recommendations for BP targets of 140/90 for adults are likely to be too high in this age-group and particularly so for women. Furthermore, current guidance for adults to utilise evidence-based CVD risk calculators to assess thresholds for blood pressure intervention, may not accurately quantify risk for this population and should not be used to influence therapeutic decisions.

ACEi or ARB remain as the first-line therapeutic option for hypertension, especially in the context of an elevated ACR; CCB are an alternative or may be added in combination. Use of ACEi in combination with ARB is not recommended. The effects of this approach are extrapolated from evidence of type 2 diabetes in older adults and remain unproven in YT2D. Nevertheless, the safety of ACEi over 4 years has been demonstrated by recent studies of CVD risk-factor management in children and adolescents with type 1 diabetes and safety is likely similar for YT2D (88).

Given the poor renal outcomes for YT2D and the evidence in older populations of the reno-protective

effects of SGLT2i and GLP-1RA (89), namely that i) both SGLT2i and GLP-1 RA reduce albuminuria and prevent macroalbuminuria and ii) SGLT2i reduce the risk of eGFR decline and end-stage kidney disease, these agents could be considered for YT2D. Although cardio-renal outcomes are not yet proven for YT2D, in the context of persistent albuminuria or CKD, the use of SGLT2i for glucose lowering should be considered with GLP-1RA as an alternative if not tolerated or contraindicated.

The potential teratogenic effects of SGLT2i, ACEi/ARB therapy should be noted and effective contraception offered where appropriate. In view of the often-aggressive progression seen, an early referral to nephrology specialists is recommended where there is concern regarding aetiology or there is worsening of UACR or there is eGFR decline. Further, one should consider non-diabetes aetiology in the presence of ACR > 30 mg/mmol or 300 mg/g.

Retinopathy

As for the other complications, YT2D are at high risk and a retinopathy prevalence of 42% of YT2D aged in their early 20s has been reported (90); the age-adjusted prevalence has been shown to be higher in YT2D than for comparable youth with type 1 diabetes (91). There is some evidence, albeit conflicting, to support a younger age of diabetes onset as an independent risk factor for retinopathy in type 2 diabetes (91-93). In this context, the current recommendations for screening in older adults apply with an added caveat that once retinopathy is detected there is the propensity for rapid progression. Thus, more frequent eye examinations, even if baseline examinations are clear (i.e. annually as opposed to two yearly which is currently recommended), may be considered for YT2D; this would be particularly important in the setting of sub-optimal glycaemic control or diabetes of long duration. Clinicians need to be mindful that YT2D experience many barriers to retinal screening including unrealistic optimism, concerns about the impact on time or family and misconceptions about the procedure. For prevention, and to reduce the risk of progression, optimising glycaemia is recommended as for older adults. In Australia, there is regulatory approval for the use of fenofibrate for the management of diabetic retinopathy. Again, the evidence base for this did not include YT2D and if used, potential teratogenicity should be considered. Similarly, in the setting of proliferative retinopathy, the use of anti-VEGF agents should consider pregnancy plans and effective contraception ensured for young women.

Neuropathy

Despite their young age, YT2D should be screened at diagnosis and annually thereafter for the presence of neuropathy and foot problems by foot inspection, evaluation of small fibre function (pin prick, or temperature sensation) and large fibre function (10 g monofilament and vibration perception and soft touch sensation), ankle and knee reflexes and pulses. Studies in adolescents have determined that the prevalence of peripheral neuropathy and autonomic neuropathy are higher than in their type 1 diabetes counterparts (91-95). Long term, this is likely to result in a higher prevalence of foot problems and a heightened amputation risk at a young age. Extrapolating from studies in youth with type 1 diabetes, attaining glucose goals is the primary management, and foot-care education should be emphasised early (96).

CVD and dyslipidaemia

The prevalence of CVD risk factors (hypertension, albuminuria, dyslipidaemia and abdominal obesity) is high in YT2D (97). It is evident that the atherosclerotic process can begin in adolescence with subclinical vascular disease such as elevated aortic pulse wave velocity and increased carotid intima media thickness being reported in YT2D (98, 99). Several lines of evidence suggest an increased prevalence of early CVD and death compared to type 1 diabetes, with deaths occurring in excess by the third decade of life (77, 100). Thus, if intervention is to be optimally effective, its early application is indicated.

BP and glucose management are discussed above. In the absence of direct longitudinal evidence for

prevention and treatment in YT2D in addition to lifestyle intervention, the issue of when to commence cholesterol-lowering therapy is relevant. A large evidence base supports the use of statins in older adults with type 2 diabetes, however intervention studies have not traditionally included this younger group. Furthermore, as mentioned before, absolute CVD risk calculators, which are predicated on age and 10-year risks as an arbiter for intervention, are not likely to be accurate given a sparse evidence base. Lifetime risk might be a better criterion for therapy decisions.

It is recommended that the risk/benefits of statin therapy should be discussed for YT2D with particularly high CVD risk, as in the following groups:

1. Aboriginal and Torres Strait Islander people with high CVD risk. Assessment of CVD risk is recommended from age 20 years. See (16) for further guidance
2. YT2D with established elevated ACR
3. YT2D with diabetes duration >10 years. This would be in accordance with guidance for type 1 diabetes and predicated on the increased risk for YT2D in comparison (101, 102)
4. YT2D with established CVD.

Additional guidance based on absolute lipid levels are as follows:

1. A statin should be considered in the context of YT2D and a total cholesterol level >7.5 mmol/L. At this level, a diagnosis of Familial Hypercholesterolaemia (FH) should be considered.
2. Paediatric/Adolescent guidelines recommend lipid lowering for LDL levels >3.4 mmol/L persisting after dietary and glucose management, with a target of 2.6 mmol/L, and this could be continued into later years or newly considered in YT2D noting that this specific approach is currently supported by the PBS for total cholesterol levels > 5.5 mmol/L.

Although long-term risks of statin use in YT2D have not been quantified, experience in familial hypercholesterolaemia has not identified any excess risk for youth (103). Recently, the four-year safety and lipid-lowering efficacy of statin therapy has been demonstrated in young type 1 diabetes which is reassuring for YT2D (88). If used, pregnancy and teratogenicity risks should be considered. In the context of diabetes-related dyslipidaemic profiles characterised by high triglyceride and low HDL, combination statin-fibrate treatment although promising, has not been definitely proven for primary prevention in older adults, and this approach cannot yet be recommended for YT2D (104). Fibrate therapy for severe hypertriglyceridemia to reduce pancreatitis risk is indicated as in older adults. Smoking habits should be ascertained at diagnosis and regularly thereafter. Aspirin is not recommended for YT2D for primary prevention of CVD and is generally contraindicated in those <21 years due to the risk of Reyes Syndrome.

Polycystic Ovary Syndrome, sleep disturbance and Non Alcoholic Fatty Liver Disease

PCOS and type 2 diabetes share the common risk factor of insulin resistance. Thus, in young women with type 2 diabetes, a menstrual history and assessment for hyperandrogenism should be undertaken. Lifestyle modification and metformin may improve the menstrual disorder and, if oral-contraceptive treatment is considered, lipid and insulin effects should be considered in agent selection.

Sleep disturbance and OSA are recognised to be associated with obesity and IR in adolescents and adults (105). In a large study of mainly older adults with diabetes, although treatment of OSA did not result in improvements in glycaemic control, improvements in diastolic blood pressure, sleepiness, and parameters of well-being were found (106). Further study on the benefits of intervention in youth are needed. Enquiry as to sleep disturbance, sleep duration and symptoms of OSA would seem reasonable in YT2D with obesity despite their young age.

In YT2D, the frequency of NAFLD has not been established. Nevertheless, compared to older type 2 diabetes there is an association with a greater histologic severity of liver disease that may signal an increased risk of progression of fibrosis and cirrhosis, leading to hepatic failure (107). In this context, clinicians are recommended to evaluate all young adults with type 2 diabetes for the potential for

NAFLD, with AST and ALT at diagnosis and then annually. The preferred non-invasive diagnostic imaging thereafter has not been standardised. Weight loss is currently the most beneficial treatment. Specialist gastroenterology consultation should be considered for persistent biochemical disturbances not responding to weight loss.

Table 7: Recommendations for the prevention and management of complications and comorbid conditions in young adults with type 2 diabetes

Complication Comorbidity	Summary Recommendation
Nephropathy and BP	The prevalence of albuminuria in YT2D, is high at diagnosis. eGFR and urine ACR should be obtained at diagnosis and annually thereafter with albuminuria confirmed on repeat specimens (preferably 3 early morning ACRs)
	Recommended BP targets of <130/80 mmHg regardless of the presence of albuminuria should be considered to be a minimum target. Recent recommendations for BP targets of ≤140/90 are too high in this age-group and particularly so for women
	ACEi or ARB are first line therapeutic options for hypertension, especially in the context of an elevated ACR; CCB are an alternative or may be added in combination
	In the context of persistent albuminuria/CKD, ACEi or ARB and glucose-lowering with SGLT2i therapy should be considered. A GLP-1 RA is an alternative if SGLT2i are not tolerated or are contraindicated
	Early referral to a nephrology specialist is recommended where there is concern regarding aetiology or there is worsening of ACR or there is eGFR decline
	Consider non-diabetes aetiology particularly in the presence of ACR > 30 mg/mmol or 300 mg/g
	Potential teratogenic effects of ACEi/ARB, SGLT2i, and GLP-1 RA therapy should be noted and effective contraception offered where appropriate
Retinopathy	Screening should begin at diagnosis
	Given propensity for rapid progression, even if baseline examinations are normal, screening should be annual as opposed to two-yearly
	Optimisation of glycaemia for prevention and to slow progression
	If fenofibrate or anti VEGF therapy is considered in the management of diabetic retinopathy, effective contraception should be offered given potential teratogenicity and adverse pregnancy outcomes
Peripheral Neuropathy	Screening for the presence of neuropathy and foot problems at diagnosis and annually thereafter
	Focus on attaining glucose goals is primary management
	Foot care should be emphasised early
CVD and Dyslipidaemia	Absolute CVD risk calculators are not likely to be accurate for YT2D. The following groups are considered as having particularly high lifetime risk and statin treatment should be considered with the aim to lower global CVD risk: 1. Aboriginal and Torres Strait Islander Australians 2. YT2D with established elevated ACR 3. Diabetes duration of >10 years 4. YT2D with established CVD
	Lipids should be checked once initial glucose levels have been as optimised as possible and annually thereafter.
	Statin should be considered in the context of a person aged <30 years and a total cholesterol level > 7.5 mmol/L and familial hypercholesterolemia considered
	Paediatric guidelines recommend lipid lowering for LDL levels >3.4 mmol/L with a target of 2.6 mmol/L and this could be continued or newly considered in YT2D, noting that this specific approach is currently supported by the PBS for total

	cholesterol levels > 5.5 mmol/L.
	Fibrate therapy reserved for severe hypertriglyceridemia (Tg >4 mmol/L) to reduce pancreatitis risk
	Smoking habits should be ascertained regularly and information provided for cessation programs
	Aspirin is not recommended for primary prevention in YT2D
	Screening for CVD in asymptomatic youth is not warranted
PCOS	Assessment for hyperandrogenism should be undertaken for all female YT2D
	Weight loss and metformin may improve the menstrual disorder. If hormonal contraception is commenced, lipid and insulin effects should be considered in agent-selection
NAFLD	YT2D should be assessed for the potential for NAFLD, with AST and ALT at diagnosis and then annually. Gastroenterology review recommended if persistent abnormality not responding to weight loss
OSA	Sleep disturbance and symptoms should be assessed at diagnosis
Psychological co-morbidity	See Table 4.

Pregnancy and pre-conceptual care

Pregnancies associated with pre-gestational diabetes have higher rates of adverse outcomes than pregnancies without diabetes, especially congenital anomalies, pre-eclampsia, pre-term birth, large-for-gestational-age babies, and pregnancy loss. In the TODAY study, around 30% of pregnancies in female adolescents with type 2 diabetes were complicated by pre-term birth or fetal malformation (108).

Adolescents and young women with type 2 diabetes have a similar or higher presence of hypertension and albuminuria compared to young women with type 1 diabetes. Nephropathy, when present, increases the likelihood of pre-eclampsia, pre-term delivery, low-birth-weight babies and caesarean-section (109,110). Further, the emotional, psychological and social burden of a pregnancy on adolescent girls and emerging adults may be greater than on older women.

There is evidence that diabetes begets early diabetes in offspring, not only via the inheritance of diabetes-susceptibility genes but also potentially via a mechanism of in-utero hyperglycaemia, subsequent fetal hyperinsulinaemia and adiposity, supporting the development of later obesity and insulin resistance in youth (111). Additionally, comorbid maternal obesity itself has a negative impact (112). Thus, diabetes in pregnancy is a likely contributor to intergenerational cycles of early-onset type 2 diabetes. Optimal peri-conceptual and antenatal glucose levels and avoidance of excessive gestational weight gain, may attenuate at least some of the risks mentioned above.

On this background, clinicians should emphasise the need for pre-pregnancy counselling for young women of childbearing potential with diabetes, which should be incorporated into routine clinic visits from puberty onwards. Effective contraception should be offered as necessary, and it should be recognised that young women may face unseen barriers to accessing contraception based on age, marital or financial status, and including the occasional professional with a lack of willingness to acknowledge sexual-health needs in youth. Long-acting reversible contraceptives (LARCs), which include hormonal and non-hormonal intra-uterine contraceptive devices (IUCDs) and subcutaneous progestogen implants, have been recommended as first-line contraceptive options for adolescents and young women (113,114). A proactive approach to contraception is recommended.

Practically, recommendations for pregnancy planning and management are as for older women (115); high dose periconceptual folate (2.5-5 mg inclusive of folate in other pregnancy supplements) should be commenced ideally three months prior to pregnancy. Ideally, the periconceptual HbA1c

should be $\leq 6.5\%$ (48 mmol/mol) while minimising risk of hypoglycaemia. During pregnancy, insulin and metformin are the pharmacological management options of choice for achieving glucose targets. All glucose lowering treatments other than insulin and metformin should be stopped prior to conception and glycaemia stabilised prior to conception. However, when pregnancy occurs outside an optimal pre- conceptual setting, sudden withdrawal of metformin and/or sulfonylureas may lead to rapid deterioration in glucose levels. It is then recommended that metformin and sulfonylureas be continued initially until specialist review. However, GLP-1 RA, SGLT2i and other oral agents should be discontinued immediately as there is limited safety evidence for their use in pregnancy. Breastfeeding should be encouraged as it may offer some protection against the development of early onset type 2 diabetes in the next generation (116).

Table 8: Recommendations regarding pregnancy in young adults with type 2 diabetes (115)
Pre-pregnancy counselling and contraception advice for young women with diabetes of childbearing potential should be incorporated into routine clinic visits from puberty onwards
High-dose periconceptual folate (2.5-5 mg daily inclusive of folate in other pregnancy supplements) should be commenced three months before pregnancy
Ideally the pre-conceptual and pregnancy HbA1c should be $\leq 6.5\%$ (48 mmol/mol) while minimising the risk of hypoglycaemia
All glucose lowering pharmacotherapy other than insulin and metformin should be stopped prior to conception, and glycaemic control optimised prior to conception
When pregnancy occurs outside an optimal pre-conceptual setting, sudden withdrawal of metformin and/or sulfonylureas in early pregnancy may lead to rapid deterioration in glucose levels. It is recommended that metformin and/or sulfonylureas be continued initially until specialist review.
GLP-1 RA, SGLT2i, and other oral agents (other than metformin or sulfonylurea) should be discontinued immediately, as there is limited safety evidence for their use in pregnancy

Education

Diabetes self-management through education is a cornerstone of diabetes therapy (117). Whilst it is well known that structured education in older people with type 2 diabetes is effective, there is a dearth of literature about appropriate approaches to educating those diagnosed with type 2 diabetes under the age of 30 years. Few educational resources are available directly targeted at this young adult group. It is likely that structured education programs designed for older adults will not meet the needs of younger people, and it is not appropriate to mix the age-groups. Moreover, the TODAY study suggests that the benefits of traditional lifestyle interventions in YT2D may be limited and this requires more detailed exploration. Key barriers to this may include being time-poor, a lack of motivation to undertake the rigours of diabetes self-management, and not understanding the serious nature of their condition resulting in a loss to follow-up (41). Bespoke structured education programs for young people that are person, not disease-focussed, could be effective and need to be developed and evaluated. Similar to type 1 diabetes in this age-group, there are some key factors around education that apply. These are outlined in Table 9 and expanded below.

Health professionals delivering this education require specialised training in the principles of effective approaches to education and behaviour change. A multidisciplinary healthcare team (comprised ideally of physician, credentialed diabetes educator, dietitian, psychologist, and exercise physiologist) that provides a consistent message and is empathic, is critical to improving clinical outcomes (118). As loss to follow-up is a major concern, expert consultation, communication skills, and use of technology including telehealth to ensure ongoing engagement in the healthcare system, are essential.

Family history of diabetes is very common among YT2D and many live with an older adult with diabetes and obesity and diabetes-related complications. The experience of the young person to this

influence could be further explored. This shared family experience may lead to acceptance of complications as an inevitable course of diabetes (119). Thus, when designing programs, there is a need to be cognisant of and sensitive to family, social, and cultural beliefs. Some involvement of the family may be critical.

Use of interactive education tools such as the Conversation Map (120) can enhance effective interaction, peer support, and problem-solving skills. For some, drawing how they feel about their diabetes can be helpful. Written resources need to be targeted to an 11-year-old reading age, which is the age to which the tabloid newspapers are pitched. Apps that motivate through competition with self or others, in a process known as gamification, can add motivation and engagement with recording, monitoring, and achieving health goals (121, 122).

The format of delivering the education may need to differ from older adults' programs and may embrace technologies such as mobile-based apps or internet sites and programmes to enhance connections. Peer support groups, either face-to-face or via social media, appear to assist in improving healthy living and weight loss. Online groups and apps that combine social interaction, entertainment, and education could offer significant benefits toward their engagement and mastery of self-care practices. Reminder systems for appointments are often valuable, and text messaging is more popular than email in this age-group (123).

Quality-assured, structured education programs developed collaboratively between young people and skilled professionals should be made available in Australia to all under the age of 30 years with type 2 diabetes, irrespective of their ethnicity, geographic location, socio-economic status, and health literacy. Realistic and achievable goals need to be agreed upon and set.

Structured education and an assessment of the individual's learning needs and follow up education should be integrated into every clinical consultation. The availability of ongoing learning and support, vital in this high-risk group who often struggle to understand the complexities of the health and hospital system, is required. Structured discussion and education comprising several topic areas, designed to assist young people to become proactive in their diabetes management that could be addressed, are outlined in Table 9.

Table 9: Key principles for the delivery of diabetes education to young adults with type 2 diabetes
Multidisciplinary health professionals delivering this education require specialised training in the principles of effective approaches to education and behaviour change
A multidisciplinary healthcare team that provides a consistent message and are empathic is critical to improving clinical outcomes. Ideally this team will have skills in engaging young people
As loss to follow-up is a major concern, strategies involving expert consultation, communication skills, technology including telehealth, and text communication are recommended to ensure ongoing engagement in the healthcare system.
A shared family experience of diabetes should be explored as it may have a negative impact on disease perception and identify areas for specific education
Delivery of education should be in forums specific for young people alone, rather than in group settings with older adults
Structured education, an assessment of the individual's learning needs, and follow up education should be integrated into every clinical consultation
Education formats with interactive tools, including conversation maps, mobile apps, competition and gamification may be of specific benefit to assist in engagement of YT2D
Peer-peer interactions should be encouraged. Peer support groups and apps that combine social interaction, entertainment and education could offer significant benefits toward engagement and mastery of self-care practices for YT2D
The impact of co-existent depression, feelings of anxiety and shame should be considered

Table 10: Topic guidance for structured discussion within the consultation with young adults with type 2 diabetes
Dealing with the diagnosis of diabetes and its seriousness and impact on their health and wellbeing
Importance of nutrition and weight loss, adopting healthy choices, and an exploration of attitudes to food and eating behaviours
Recommendations for exercise, physical activity and limits on recreational screen time and how they may be achieved
Understanding that traditional lifestyle interventions while important, may be less effective for youth so as not promote feelings of failure or shame
Importance of early and intensive management with combination therapies to achieve tight glycaemic targets, which may be stricter than for older patients
Strategies to improve medication-adherence such as using a Webster-pak or smartphone type reminders
Practical skills such as how Medicare functions, how to fill a prescription, and the need for a referral if seeing a specialist
Discuss early the potential use of insulin therapy and identify cultural, recreational, and employment concerns or other barriers to insulin therapy
Discuss the higher complication-risk and importance of screening for micro and macrovascular complications from diagnosis and aggressive treatment of cardiovascular risk factors, despite a young age
Contraceptive advice and pregnancy planning
The changing needs of the person (e.g. leaving home, contraception, planning a pregnancy, recreational drugs, alcohol, transitioning from school to university/work, etc.)
Assessment and management of anxiety and depression
How to use technology-supports such as apps to record and monitor food, exercise, medication and blood glucose levels

Transition from paediatric services and models of care

The relatively recent recognition of the occurrence of type 2 diabetes in children and adolescents together with the rapid increase in rates, means that models of care for this age group and young adults are not yet well established. Although the majority of type 2 diabetes in adults is managed in primary care, we propose that additional support is required for YT2D. Current guidelines for children and adolescents with type 2 diabetes recommend that care be provided by a specialist team (7). Given all the challenges outlined, it is recommended that adolescents and emerging adults with type 2 diabetes also be referred to age-appropriate specialist care. Wherever possible, specialist endocrine teams that include an Endocrinologist and a Credentialed Diabetes Educator, who can coordinate multidisciplinary and interdisciplinary care to include dietetic, podiatric, psychological, and other specialist services as needed, are appropriate.

Transition is a period of vulnerability, as the health system does not engage well with YT2D and there is a high risk of being 'lost to follow up' for prolonged periods of time. Young adulthood is a time when long term complications become evident and regular screening and timely treatment is critical. If transitioning from paediatric services, there is a need for planning well before the actual transition care occurs with progressive familiarisation with adult service introduced over months. Although the empirical evidence does not exist for benefit, favourable outcomes using this approach can largely be extrapolated from those seen in young type 1 diabetes populations.

Conclusion

In response to the growing number of YT2D, this first Australian Consensus Statement on the management of type 2 diabetes in young adults provides advice for healthcare professionals in areas

where current guidance, focussed largely on older adults, may not be appropriate or relevant. Where relevant, recommendations are harmonised with current national guidance for those younger than 18 years of age (7). Despite a growing understanding of the excess risks and the more aggressive phenotype of T2D in young adults compared to older adults, there is still a great need to develop a rigorous evidence-base and systems to collect data on outcomes for YT2D. These will further inform management recommendations and models of care for this group at high risk, from which more definitive guidelines can be developed.

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