Type 2 Diabetes in Australian Indigenous Children & Adolescents living in rural and remote areas:

Recommendations for diagnosis, screening, management & prevention.

Pete Azzopardi, Alex Brown, Paul Zimmet

On behalf of the consensus working group
This presentation is based on the findings of a 2 day workshop in Alice Springs in 2011 which brought together key clinicians, policymakers and researchers to consider the actions that need to be taken to address type 2 diabetes mellitus (T2DM) in Australian Indigenous (Aboriginal or Torres Strait Islander) children and adolescents.

The main findings have been summarised in a publication in the Medical Journal of Australia, which is accessible online for free by clicking this link: https://www.mja.com.au/journal/2012/197/1/type-2-diabetes-young-indigenous-australians-rural-and-remote-areas-diagnosis
Aims

We had four main aims, and this presentation works through these in order.

- Review the literature on T2DM amongst Australian Indigenous children and adolescent.
- Identify the challenges and opportunities in providing care in rural & remote areas.
- Make recommendations on diagnosis, screening and therapeutic options.
- Consider opportunities for prevention.
The pattern of T2DM has been changing globally, and there has been an increase in the incidence (number of new cases) of T2DM in young people. This has coincided with an increase in obesity and diets high in animal fats and protein. There has also been an increase in the number of mothers with diabetes during pregnancy, which increases the risk of children developing diabetes later in life.
Indigenous Australians experience a high rate of T2DM, and the most striking features of this epidemic include the premature age of onset and the excess risk experienced by those living in rural and remote areas. There is however limited data on the prevalence of T2DM in adolescents (circled in red on the graph). We looked at all the available published data to try and better understand the burden of T2DM in young Indigenous Australians.
This review article provides an excellent summary of T2DM in Indigenous children and adolescents. In the following slides we present the 4 main studies which provide data for Indigenous young people.
Epidemiology of T2DM in Indigenous children & adolescents

- Retrospective hospital based, WA (McMahon MJA 2004)
  - Cases (< 17y) ascertained from hospital database

- Median age 13.6 y (8.8 – 16.7 y)
- Mean HbA1c at diagnosis 10%
- Acanthosis nigricans 72%, mean BMI Z score 1.94
- 5% DKA, 38% polyuria/dipsia, 57% asymptomatic
This graph from study 1 shows the increase in incidence of T2DM amongst Indigenous adolescents over time.
Epidemiology of T2DM in Indigenous children & adolescents

- Prospective population based, NSW *(Craig MJA 2007)*
  - Cases (< 19 y) ascertained from APEG database, secondary ascertainment from NDR (cases treated with insulin)
  - 128 incident cases of T2DM, 28 in Indigenous (2001- 2006)
  - Median age at diagnosis 13.7y (12.1–16.6)
  - Median BMI z-score 2.3
  - Family history T2DM 75%
This table from study 2 shows that Indigenous adolescents are at excess risk of type 2 compared to non-Indigenous adolescents.

<table>
<thead>
<tr>
<th></th>
<th>Indigenous (n=180,481)*</th>
<th>Non-Indigenous (n=4,902,872)*</th>
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<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Incidence</td>
</tr>
<tr>
<td>Type 2</td>
<td>23</td>
<td>12.7 (8.1–19.1)</td>
</tr>
<tr>
<td>Type 1</td>
<td>28</td>
<td>15.1 (10.3–22.4)</td>
</tr>
</tbody>
</table>

* Population at risk. † Incidence rate ratio (Indigenous v non-Indigenous).}

(Craig MJA 2007)
Study 3 is a case series from Darwin. Cases of T2DM in this study were mostly female, but this may be due to females being diagnosed as part of antenatal screening. Treatment data suggests co-morbidity and challenges to achieve normal blood sugar levels.

**Case-series from Darwin**

Retrospective hospital based, RDH *(Stone, Baker, Maple-Brown APEG 2012)*

- Cases (< 25 y) ascertained from RDH hospital ICD coding, Diabetes educators, Diabetes clinic


- Median age at diagnosis 18 y (10 – 25 y)
  - 8 cases < 14 y old, 89% female

- 5 had gestational diabetes prior to T2DM, 1 Rx risperidone

- 86% on oral hypoglycaemics
  - (22% on more than one agent)
- 20% on insulin
- 11% on ACEi
Case series from Far North Queensland

Retrospective case series, FNQ (Sinha, DRCP, 2000)

- 17 cases of T2DM amongst Indigenous young people (< 20y)
  - Mean age 12 years (6 – 16 y)
  - 95% Family history, 88% obese (mean BMI 32.8), 2 were lean
  - 60% Acanthosis nigricans
  - HbA1c 15% at diagnosis (HbA1c result available for 11 cases)
  - 2 presented with DKA, 88% asymptomatic

Study 4 is from FNQ. The very high HbA1c at diagnosis suggests that these children and adolescents must have had diabetes for a long time before being diagnosed. The majority were asymptomatic.
This table provides a summary of the clinical features of T2DM in Australian Indigenous children and adolescents

<table>
<thead>
<tr>
<th>Incidence</th>
<th>Significantly higher than in non-Indigenous Australians</th>
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<tbody>
<tr>
<td></td>
<td>Estimated incidence rate ratio 6.1 (95% CI 3.9 – 9.7).</td>
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<table>
<thead>
<tr>
<th>Age at onset</th>
<th>12-13 years (median)</th>
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<tr>
<td></td>
<td>Reported in children as young as 6 years.</td>
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<table>
<thead>
<tr>
<th>Gender</th>
<th>No gender difference</th>
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<tbody>
<tr>
<td></td>
<td>(maybe higher in females?)</td>
</tr>
<tr>
<td></td>
<td>The quality of data is limited</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Morphology</th>
<th>Obesity almost ubiquitous (~100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acanthosis nigricans common (~75%)</td>
</tr>
<tr>
<td></td>
<td>BUT not all Indigenous youth with T2DM are overweight (10% of FNQ series were lean)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical presentation</th>
<th>Most commonly asymptomatic</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Can present with symptoms related to hyperglycaemia</td>
</tr>
<tr>
<td></td>
<td>Ketoacidosis is uncommon but does occur</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>Hypertension, renal disease, dyslipidaemia are all common at diagnosis.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retinopathy an essential consideration given high incidence of vision threatening retinopathy in Indigenous Australians.</td>
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</table>

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Social determinants of health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Genetic - family history is frequently present</td>
</tr>
<tr>
<td></td>
<td>Gestational diabetes/ maternal diabetes</td>
</tr>
</tbody>
</table>

Depression from American data (TODAY study)
The pictures on the right demonstrate the hyperpigmentation (darkening) of the skin which is a common feature of T2DM in young people.

Data from America shows that acanthosis and obesity are common features of T2DM in adolescents.

**Treatment Options for type 2 Diabetes in Adolescents and Youth (TODAY) study, USA**

(Copeland, J Clin Endocrin Metab, 2011)

704 adolescents (10 – 17) with newly diagnosed T2DM recruited from 15 centres

-86% acanthosis present at the neck

-(clinical presentation not reported)

-BMI z-score 2.15 (0.44)

-Mean age 14 years
Most cases of T2DM amongst Indigenous young people are identified from hospital datasets, and because T2DM in young people is commonly asymptomatic, these data may only provide the ‘tip of the iceberg’ of the true burden of T2DM in Indigenous youth.
The increasing incidence of T2DM in Indigenous youth is significant because onset in childhood and adolescence has poor outcomes.

- T2DM in young people has significant implications
  - Psychosocial and socioeconomic implications for individuals, their families and communities
  - Early onset disease associated with rapid development and progression of complications. (Pinhas-Hamiel, Lancet 2007)
Of the 17 adolescents with T2DM
- 1 patient (now 19yrs) with ESRD on dialysis and legally blind
- 1 patient (now 27 years) coronary artery disease with CABG
Renal failure and T2DM in youth
Dart et al, Diab Care (2012)

This recent study compares a group of young people with T1DM (mean age 9 years at baseline) to T2DM (mean age 13 years at baseline) in Canada. The dotted line is for young people with T2DM and shows that 20 years after diagnosis (mean age 33y) the risk of renal failure was 45%.
Survival and T2DM in youth
Dart et al, Diab Care (2012)

This graph shows is also from the Canadian study and shows risk of all-cause mortality- young people with T2DM had a higher overall premature mortality compared to young people with T1DM- this may be explained by complications of T2DM or other causes of death related to socioeconomic disadvantage (which was more common for young people with T2DM compared to T1DM).
Co-morbidity at diagnosis

• Limited data for Indigenous young with T2DM
  – WA retrospective study: 59% hypertensive, 24% dyslipidaemia
  – Retrospective study of 33 children with T2DM (median age 13 years, included 3 Indigenous) (Ruhayel Pediatr Diabetes 2010)
    • 30% hypertensive, 56% dyslipidaemia
    • 45% microalbuminuria, 25% abnormal retinal findings
  – TODAY study (American data)
    • 15% had clinically significant depressive symptoms

While data are limited, it is suggestive of a high rate of co-morbidity at time of diagnosis
Pathogenesis and risk determinants

- Obesity
- 75% of NSW cohort and 100% FNQ case series had a family history
- Social determinants play a central role
  - 65% of NSW cohort from rural areas
  - TODAY study: Racial minority groups and those living in socioeconomic disadvantage over-represented
- Epigenetics
  - Indigenous mothers are at excess risk of diabetes during pregnancy
    - GDM incidence 2.5 times that of non-Indigenous (SA)
    - Prevalence of T2DM during pregnancy 15% (FNQ)
Metabolic syndrome in Indigenous children and adolescents

Common

- 14% of ABC cohort aged 9-14 years have MetS (Sellers J Peds 2008)

- School based, 158 aged 5-17y, Torres Strait (Valery Obesity reviews 2008)
  - 31% overweight, 27% obese
  - 27% hypertensive
  - 43% acanthosis

Metabolic syndrome is a cluster of risk factors for T2DM and cardiovascular disease, and is common in Indigenous children and adolescents.
Type 2 diabetes in Indigenous children and adolescents is a significant health issue!
Aims

• Review the literature on T2DM amongst Australian Indigenous children and adolescent

• Identify the challenges and opportunities in providing care in rural & remote areas

• Make recommendations on diagnosis, screening and therapeutic options

• Consider opportunities for prevention.
### Barriers to managing type 2 diabetes mellitus in Indigenous children and adolescents living in rural and remote settings

#### Health seeking (grade B evidence)
- Limited contact with health services, relating to:
  - perceived “health” despite significant morbidity\(^\text{21}\)
  - clinics not being adolescent friendly\(^\text{22}\)

#### Demographic (grade B evidence)
- Remoteness, limited telecommunication facilities, poor school attendance, poor socioeconomic health, no fixed address\(^\text{23}\)

#### Sociocultural (grade C evidence)
- Potential shame of diagnosis\(^\text{24}\)
- Acceptance of poor health status (by individuals and the health system)
- Many competing health needs

#### Physical resources (grade B evidence)
- Limited resources for lifestyle modification\(^\text{25}\)
- Food insecurity\(^\text{26}\)

#### Clinic resources – physical (grade C evidence)
- Inaccessibility of essential resources (such as glycated haemoglobin testing) in many remote clinics\(^\text{27}\)
- Misplaced or broken blood glucose meters
- Lack of infrastructure to start, maintain or safely store insulin

#### Clinic resources – staffing (grade C evidence)
- Understaffing and high staff turnover\(^\text{28}\)
- Overburdened clinic staff due to acute crisis care\(^\text{29}\)
- Limited and poorly coordinated visiting specialist services

We considered the barriers to addressing T2DM in Indigenous young people in rural and remote areas— we did this to ensure that our recommendations around diagnosis and management were feasible and practical.
Food insecurity

**Source:** arnhemweavers.com.au/mapuru.htm

**Relationship between cost and energy density in an Indigenous Island community**  
*Brimblecombe MJA 2009*

*Energy density (MJ/kg)*

*Energy cost ($/MJ)*

- Cereals
- Fats and oils
- Fruit
- Meat and meat products
- Sugar and confectionery
- Vegetables

*Scatter plot showing the relationship between cost and energy density of various food items.*

*Source: amhemweavers.com.au/mapuru.htm*
Difficult to implement lifestyle changes when quality of housing and social infrastructure is so poor

Housing for health survey

- 20% of homes in remote communities poorly constructed
- 70% failed because of poor maintenance

Source: Health Habitat
Physical inactivity

• **WAACHS** *(Blair MJA 2005)*
  - 21% male and 33% female Aboriginal 12-16 year olds hadn’t exercised in the week prior to the survey
  - compared to 6% of male and 11% of female non-Indigenous in WACHS.

Barriers to exercise

• **Photovoice, Geraldton WA of Aboriginal 12-16 year olds** *(Edwards AIHWJ 2005)*
  - Lack of resources and facilities to exercise
    - Shelter, drink fountains, shade and equipment
  - ‘shame’ of exercising in front of others, particularly swimming for females
  - ‘hassled by authorities’ especially police
They (health staff) say that my diabetes will kill me if I do not take pills everyday and if I do not eat right. Sometimes I forget. I eat with my kin. I cannot be selfish and eat my food alone. I cannot do what they tell me to do. I have to decide for myself. They scared me! They told me that I will die if I do not listen. Well, I will die soon anyway.’

28 year old Indigenous woman with diabetes, 2007

Source: Dussart Hlth Prom J Aust 2009
Addressing diabetes in the asymptomatic young person in the context of many competing and acute health needs with limited resources is a real challenge

• for the young person

• their community

• the health system
Aims

• Review the literature on T2DM amongst Australian Indigenous children and adolescent

• Identify the challenges and opportunities in providing care in rural & remote areas

• Make recommendations on diagnosis, screening and therapeutic options

• Consider opportunities for prevention.
Diagnosis and Classification

- Random BGL $\geq 11.1$ mmol/L and symptomatic
- Fasting BGL $\geq 7$ mmol/L
- Random BGL $\geq 11.1$ mmol/L on two occasions

The table to the left details some clinical features that can help differentiate T1DM from T2DM.
Why HbA1c and OGTT should not be used routinely for diagnosis

- HbA1c $\geq 6.5\%$ acceptable for diagnosis in adults (C’Emden et al, MJA 2012)
  - Not currently funded for diagnosis of T2DM in Australia
    - Not available in all remote clinics
  - Poor screening test for dysglycaemia in children (Lee Diab Care 2011, Kester JAH 2012)
  - Caution needed in interpreting HbA1c in anaemia

- OGTT not practical in rural and remote settings
  - Not recommended when T2DM can be diagnosed using random or fasting BGL (ISPAD 2009 guidelines)
  - Where there is doubt of the diagnosis, the young person should be referred to a paediatrician or endocrinologist for an OGTT.
Point of care testing vs laboratory testing
(Marley, POC in exclusion and diagnosis of diabetes in remote Australia, MJA 2007)

POC $\geq 12.2$ mmol/L had sensitivity of 83.3%, specificity of 99.3% and PPV of 95.2% for laboratory measured $\geq 11.1$ mmol/L.
Screening recommendations

ADA (2000): recommended screening of obese adolescents for T2DM

ISPAD (2009 & 2011): evidence base limited and accumulating data indicate low yield of screening BUT may consider targeted screening in high prevalence settings awaiting evidence to inform screening strategy and timing

Maple-Brown (2010): recommended screening of T2DM of Indigenous adolescents

CDA (2008): recommend targeted screening of children > 10 y screened every 2 years if ≥ 2 of: obesity / high risk ethnic group / family history/ exposed to diabetes in utero/ signs of hyperinsulinism

Most of these recommended screening based on OGTT or fasting glucose.
Screening recommendations

The recommendations of our group

• Current documented burden of T2DM does not support population screening

• Recommend targeted screening of Indigenous young people > 10 years with an additional risk factor for T2DM

• Screening is based on random blood glucose in a clinical setting where adequate interpretation, management and follow-up will be provided
This algorithm provides a guide to screening for T2DM amongst Indigenous young people >10y living in rural and remote settings.

A printable version of this algorithm is available by clicking this link: <https://www.mja.com.au/sites/default/files/issues/197_01_020712/figure1.pdf>
Those who screen positive almost certainly have T2DM. The significance of this diagnosis and its impact should not be underestimated. Patients should be provided with the time to understand and question the diagnosis, the further testing and the required treatments. If appropriate, support from family and Indigenous health workers should be sought.

The initial management of T2DM is determined by symptoms, severity of hyperglycaemia and presence or absence of ketones: This is outlined in the management algorithm on the following slide.

Insulin therapy may be initially required for stabilisation in the setting of significant hyperglycaemia and ketosis, even in the absence of ketoacidosis. Symptomatic patients, particularly those with vomiting and dehydration, should be monitored closely because their condition could deteriorate rapidly.
This algorithm provides a guide to management of T2DM amongst Indigenous young people >10y living in rural and remote settings.

A printable version of this algorithm is available by clicking this link: https://www.mja.com.au/sites/default/files/issues/197_01_020712/figure2.pdf

Figure 2: Treatment algorithm for T2DM in Indigenous children and adolescents. Adapted from IDF/ISPAD guideline 2011.
HbA1c levels should be tested quarterly

- International guidelines recommend an HbA1c target of < 7.5% for all paediatric age groups and < 7% for adolescents approaching adulthood. The Central Australian Rural Practitioners Association guidelines recommend, for adults, a target of < 7% for T2DM.
  - For simplicity, an HbA1c target of < 7% is recommended for Indigenous children and adolescents with T2DM
Psychosocial health: Routine psychosocial assessment promotes recognition of and response to psychosocial comorbidities, and provides appreciation of the context in which lifelong management will need to be established and maintained. Psychosocial health is a critical consideration in establishing a care plan (Box 4). Indigenous health workers play an essential role in the management team, especially in addressing psychosocial health, and should be engaged at all stages of management.

Lifestyle modification: When managing T2DM, the primary emphasis should be on lifestyle modification. It is essential to engage the family in lifestyle modification, respecting the right to confidential health care for older adolescents. Engaging the family increases the likelihood of the young person modifying his or her behaviour, and may also reduce the risk of diabetes and its complications within an at-risk family (grade C evidence).
## Addressing psychosocial health

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home &amp; family</strong></td>
<td>Where and who does the young person live with?</td>
</tr>
<tr>
<td></td>
<td>The patient’s home environment/s,</td>
</tr>
<tr>
<td></td>
<td>Family support for managing diabetes and behavioral modification</td>
</tr>
<tr>
<td></td>
<td>Physical resources: refrigeration, telephone, distance</td>
</tr>
<tr>
<td></td>
<td>to the nearest clinic, availability of emergency care.</td>
</tr>
<tr>
<td><strong>Education and employment</strong></td>
<td>Education, educational performance, literacy.</td>
</tr>
<tr>
<td></td>
<td>Future needs, Employment</td>
</tr>
<tr>
<td><strong>Activities</strong></td>
<td>Exercise and patterns of physical activity,</td>
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<tr>
<td></td>
<td>Eating practices and determinants of such,</td>
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<tr>
<td></td>
<td>Activities and interests,</td>
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<td></td>
<td>Peer support</td>
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<tr>
<td><strong>Drugs</strong></td>
<td>Substance use (peer and individual)</td>
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<tr>
<td><strong>Depression and self harm</strong></td>
<td>Depressive symptoms,</td>
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<td></td>
<td>Self harm, suicidal ideation</td>
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<tr>
<td><strong>Sexuality</strong></td>
<td>Opportunistic sexual health (if appropriate)</td>
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<tr>
<td><strong>Spirituality</strong></td>
<td>culture and spirituality</td>
</tr>
</tbody>
</table>
Engaging Indigenous young people: Engaging young people with clinical services to screen for, identify and manage T2DM is more likely if the services are accessible, demonstrate equity in service delivery, are acceptable and appropriate for the needs and cultural norms of the community, and are comprehensive and effective. Confidentiality is an essential component of providing health care to young people, particularly in small isolated communities. A young person who does not attend his or her clinic appointment may still care about their newly diagnosed diabetes, and non-attendance should therefore trigger further engagement with all necessary social and family support (grade C evidence).
A simple guide to adolescent consent and confidentiality
(Alice Baker, Peter Azzopardi, Susan Sawyer, Alex Brown)

Adolescents accessing health care
Key principles
> 16 year olds can generally access health services independently
< 14 year olds should be accompanied by a parent or guardian
Adolescents aged between 14 and 16 may be able to access health care and give consent to treatment if they are assessed to be a ‘competent minor’

For an adolescent aged 14-16 years to be ‘competent’, they must understand:
treatment options including side effects;
the health issue;
the consequences of no treatment.

The nature of the health issue also must be considered; an adolescent may be deemed competent to provide consent for a relatively minor issue (contraception) but not for a life threatening issue (surgical procedure).
Adolescents with intellectual disability or severe mental illness (eg acute psychosis) may not be competent, even if they are over 16 years old. Adolescents who cannot provide ‘consent’ can still provide ‘assent’ (agreement).
Confidentiality
Adolescents who are competent should receive confidential health care. This builds trust between the adolescent and health care provider and improves the quality of health care. An example of a confidentiality statement is: ‘Everything that we discuss will be confidential – that means it stays between you and me - however we will have to tell someone else if; someone is hurting you, you are hurting yourself, or you are hurting someone else. If I have to break confidentiality, we will do it together’.

It is mandatory to report an adolescent at risk of suicide, homicide, or serious harm to self or others, or at risk of sexual, physical or emotional abuse, neglect or exposure to violence. In the NT it is mandatory to report a 14-15 year old who is sexually active with someone when there is > 2 years age difference, regardless of consent.

While competent young people can access health care independently, there is great value in engaging an adult in the health care of young people. Respecting the young person’s right to confidential health care, young people should be supported to identify a competent adult that they can discuss their health with. At all times, finding the right support person should be sensitively, yet transparently negotiated – this may include a parent, other family member, Indigenous Health Worker or other trusted adult in the community.
Managing T2DM in young people can be complex—there is a lot to think about!

We have summarised the key issues to address, targets and actions if targets not met in the following care plan. We hope that this care plan provides a practical resource for practitioners and complements the screening and treatment algorithm.

http://jugglebox.wikia.com/wiki/Juggling_Clubs
### Care plan


<table>
<thead>
<tr>
<th>Issue to address</th>
<th>Initial visit</th>
<th>Quarterly visit</th>
<th>Annual visit</th>
<th>Target</th>
<th>Action if target not met</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lifestyle</strong></td>
<td></td>
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</tr>
<tr>
<td>Psychosocial health*</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Address Home &amp; family, Education &amp; Employment, Activities, Drugs, Depression &amp; Suicidality, Sexuality &amp; Spirituality *</td>
<td>Engage family, Indigenous health workers, social services and mental health services as required</td>
</tr>
<tr>
<td>Behavioural factors</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Address SNAP: Smoking, Nutrition, Alcohol, Physical activity³⁵</td>
<td></td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>✔️</td>
<td></td>
<td></td>
<td>Complete baseline investigations; Fasting blood glucose, autoantibodies (GAD, IA2, insulin), C-peptide.</td>
<td>Discuss with district medical officer</td>
</tr>
<tr>
<td><strong>Glycaemic control</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Blood glucose level</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Premeal BGL &lt; 7.2 mmol/L, Postmeal BGL &lt; 10 mmol/L</td>
<td>Refer treatment algorithm (figure 2). Consider compliance and need to escalate treatment.</td>
</tr>
<tr>
<td>HbA1c</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>&lt; 7 % (&lt;53 mmol/mol)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Reduce body weight</td>
<td>Continue to support healthy diet and exercise, engage family.</td>
</tr>
<tr>
<td>Height, BMI, Waist circumference</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td>BMI &lt; 95th centile (non-obese)</td>
<td></td>
</tr>
<tr>
<td><strong>Complications screening</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Blood Pressure</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Blood pressure &lt; 95th centile by age, sex and height.</td>
<td>Consider ACEi</td>
</tr>
<tr>
<td>Fasting lipids (total cholesterol, HDL, LDL, Triglycerides)</td>
<td>✔️</td>
<td>☐</td>
<td>✔️</td>
<td>LDL &lt; 2.6 mmol/L, Triglycerides &lt; 1.7 mmol/L</td>
<td>Diet, lifestyle, consider statins</td>
</tr>
<tr>
<td>Urea, Creatinine, electrolytes ACR, microalbuminuria if possible</td>
<td>✔️</td>
<td>☐</td>
<td>✔️</td>
<td>Refer to local laboratory range</td>
<td>Discuss with specialist. Treat Hypertension &amp; albuminuria with ACEi</td>
</tr>
<tr>
<td>Eyes: acuity &amp; dilated fundoscopy</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td>Monitor and treat retinopathy</td>
<td>Refer to Ophthalmologist</td>
</tr>
<tr>
<td>Feet: Pulses and neuropathy</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td>Monitor and treat neuropathy &amp; macrovascular complication</td>
<td>Refer to specialist and Podiatrist.</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>✔️</td>
<td>☐</td>
<td>✔️</td>
<td>Refer local laboratory</td>
<td>Maximize glycaemic control and weight loss for NAFLD, Refer specialist</td>
</tr>
<tr>
<td>Obstructive Sleep Apnoea (OSA)</td>
<td>✔️</td>
<td>☐</td>
<td>✔️</td>
<td>No obstructive symptoms</td>
<td>Refer for sleep study if OSA suspected</td>
</tr>
<tr>
<td>Opportunistic health screening</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Consider sexual health (STI, contraception, PCOS screening in oligomenorrhoea, acne or hirsutism), immunisation, mental health, nutrition (anaemia), other health needs (systems screen).</td>
<td></td>
</tr>
</tbody>
</table>

*perform test , ☐ only perform if abnormal on first visit.  
Aims

• Review the literature on T2DM amongst Australian Indigenous children and adolescent

• Identify the challenges and opportunities in providing care in rural & remote areas

• Make recommendations on diagnosis, screening and therapeutic options

• Consider opportunities for prevention.
Prevention

• T2DM in young people has a poor prognosis so effective prevention needs to play a dominant role

• Essential:
  – Consult and engage communities
  – Consult and engage those at the front line
  – Strategies need to be practical
  – Supported with appropriate funds and practical resources
Prevention
Improve the social determinants of health

• Improve daily living conditions

• Tackle the inequitable distribution of power, money, and resources – the structural drivers of those conditions of daily life

• Measuring and understand the problem and assess the impact of action.
Prevention
Tackling obesity

• Prevent obesity & treat children that are overweight or obese.

• Behavioural programs in children have limited effect
  – Need to tackle food security, improving opportunities for exercise, attitudes

• Lifestyle modification should not be overlooked
  – Health during pregnancy is an important target
**Prevention**

**Metabolic syndrome**

- High rates of Met S

- Some clinicians may treat young people with MetS (especially with IGT) with metformin *(Sabin, Pharmacol Res 2011)*
  - Limited outcome data to recommend this as a strategy

- In adults, metformin decreases progression from IGT to T2DM, but lifestyle modification (5.6 kg weigh loss) more effective *(Knowler, NEJM 2002)*
Summary & recommendations

• T2DM in Indigenous children and adolescents is a significant health issue
  – Increasing incidence
  – Poor outcome
Recommendations
epidemiology & public health

• There is a need to establish improved systems for monitoring the evolution of T2DM in Indigenous children and adolescents.

• In parallel, registers of diabetes in pregnancy should be established.
Recommendations

Screening

• Targeted screening for Indigenous Australian children and adolescents

• Every Indigenous Australian child should be screened for obesity.

• Opportunities to provide health screening for Indigenous children and adolescents should be maximised.

• Complications screening should be undertaken at the time of diagnosis and annually thereafter for children and adolescents with type 2 diabetes.

• Health systems should be adequately resourced to respond the demands of screening and follow up.
Recommendations

Treatment

- Standardise management of type 2 diabetes in children and adolescents across Indigenous communities

- All children and adolescents with newly diagnosed diabetes need to have blood ketones checked to assess whether they fit the type 1 or 2 diabetes form.

- Where available anti-GAD and C-peptide should be performed to ascertain whether type 1 or type 2 DM is the likely diagnosis

- Children and adolescents on insulin therapy should have access to 24 hour emergency care.

- Currently the only oral hypoglycaemic recommended for use in children is metformin. The safety and efficacy of oral hypoglycemic therapies in children need to be determined.
Recommendations

Prevention

• Strategies for the prevention of type 2 diabetes in children need to involve government and societal action, as well as individual change.

• Programs should focus on
  – prevention of obesity
  – promotion of attention to maternal and child health
  – treatment of diabetes in pregnancy.
THANK YOU

Thank you for reading this presentation!

Just a reminder that the full publication, screening and treatment algorithms and care plan are available through the link below: