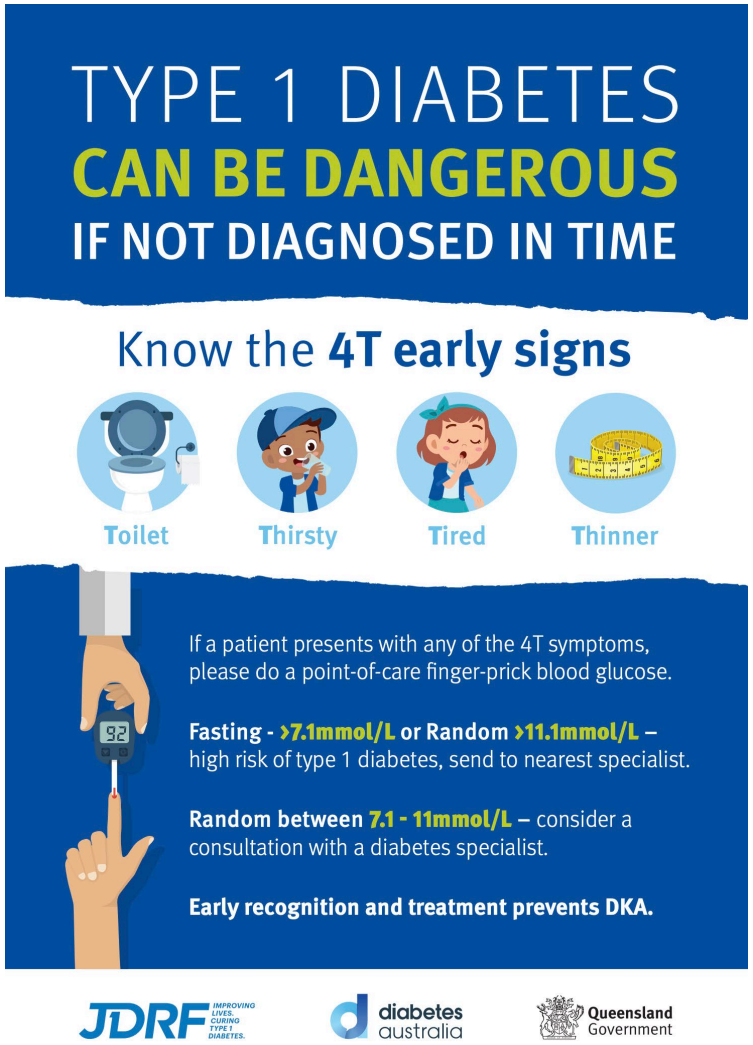
What's "New" in Type 1 Diabetes Mellitus (T1DM)

Associate Professor Gary Leong
Dr Jeffrey Yeung
Dept of Paediatrics
Nepean Hospital



phn Nepean Blue Mountains
Wentworth Healthcare
Blue Mountains | Hawkesbury | Lithgow | Penrith

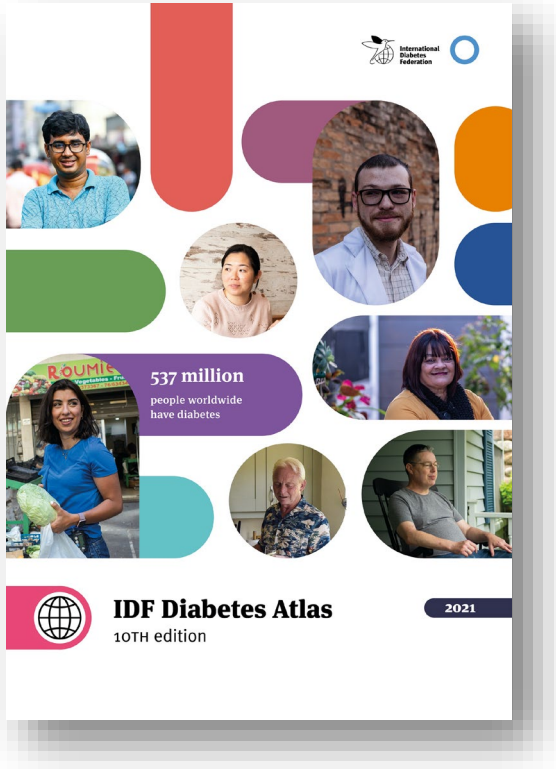
NSW GOVERNMENT
Health
Nepean Blue Mountains Local Health District

Overview of Talk

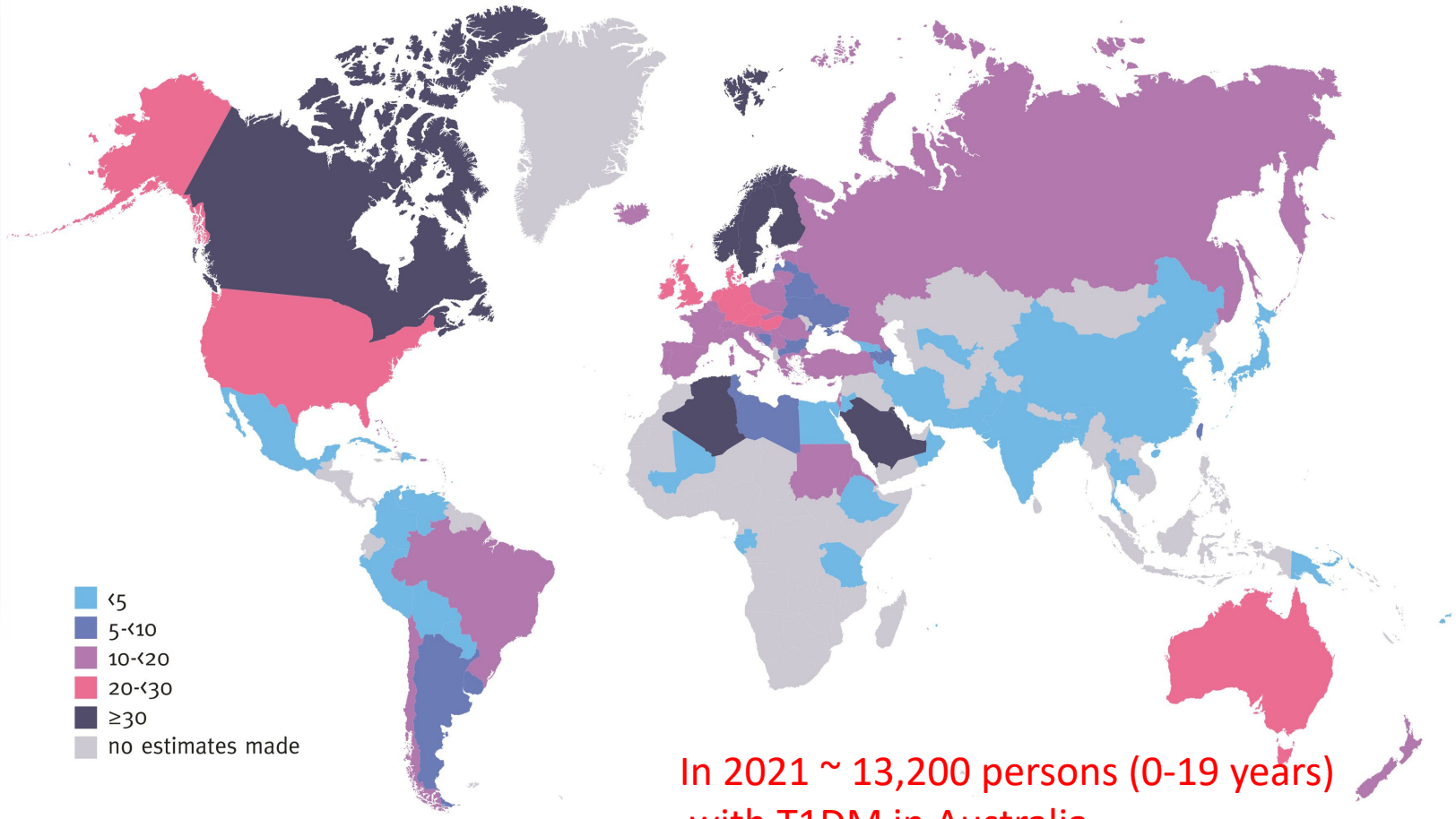
- Diabetes Technology Update – Smart pens and Pumps – CGMS –
  - Semi-closed loop systems – towards an “artificial” pancreas
- 2023 NSW Statewide Model of Care for Paediatric Diabetes
  - Important Role for Primary Care
  - EOI for Nepean Primary Care Paediatric Diabetes Education Program and Clinical/Education Partnership
- T1DM and DKA into the T1DM Prevention Millenium!
  - What should it entail and how can we increase our impact to prevent DKA a life-threatening complication
- 4T DKA Prevention Campaign
  - Highlighting our amazing Multicultural Unit led by Ms Una Turalic
  - Translated 4T DKA Posters
  - 4T Video with our Amazing Nepean Diabetes Families and Team

Age-sex standardised incidence rates of type 1 diabetes

Per 100,000 population per annum in children and adolescents aged 0–14 years



Map 3.4 Age-sex standardised incidence rates (per 100,000 population per annum) of type 1 diabetes in children and adolescents aged 0–14 years



In 2021 ~ 13,200 persons (0-19 years) with T1DM in Australia

THE UNITED NATIONS OF DIABETES

Highlights

In 2021, IDF estimates show that:

1 in 10

Adults (20-79 years) has diabetes
537 million people

149,500

More children and adolescents with type 1 diabetes

3 in 4

People with diabetes live in low and middle-income countries

1 in 2

Adults is undiagnosed
240 million people

1.2 million

Children and adolescents below 20 years have type 1 diabetes

NBMLHD Paediatric Diabetes Service

Annual number of children with newly diagnosed T1DM and now T2DM presenting is between 30-35 per year, so we now have ~ 220 children in our service.

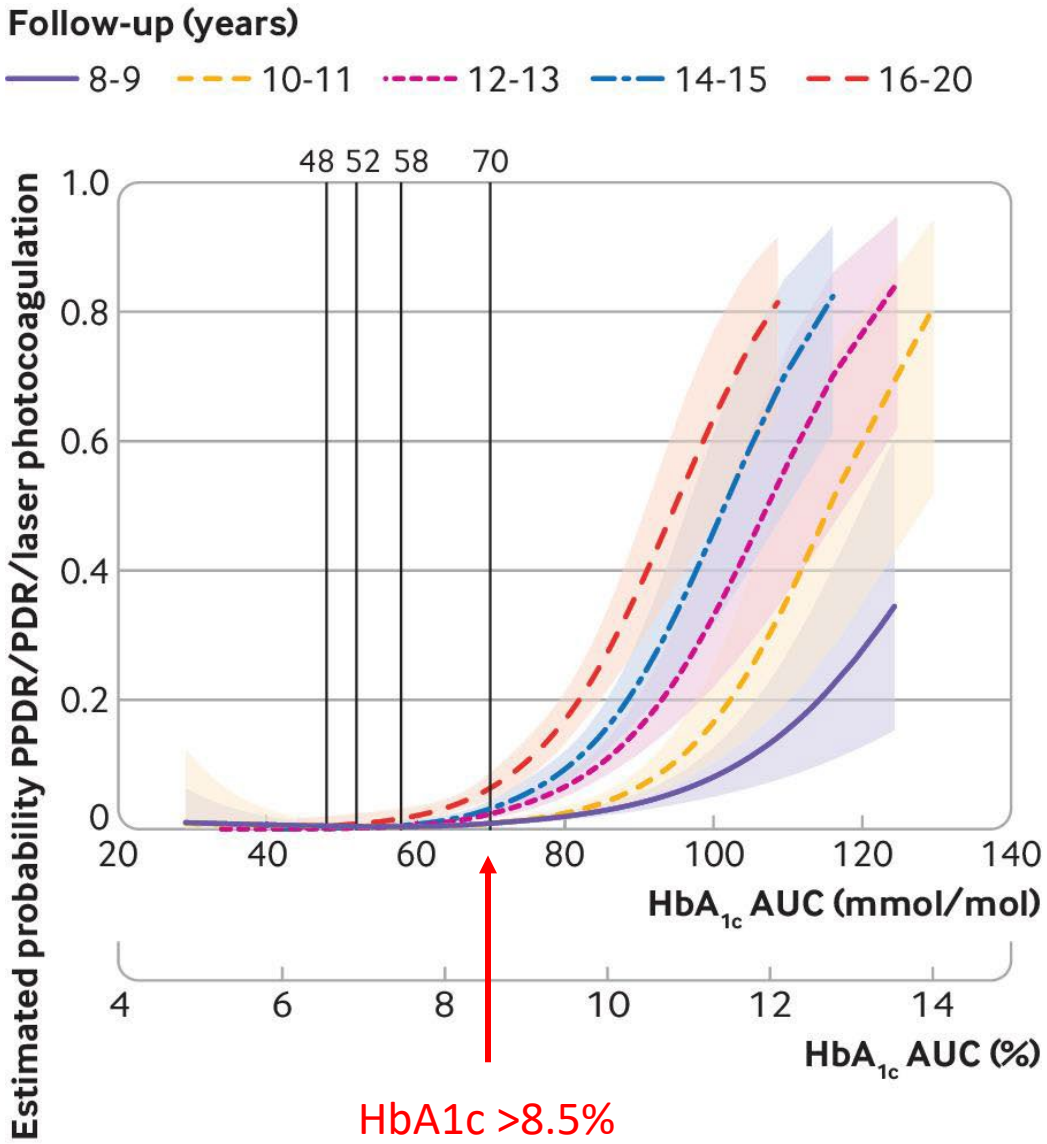
Every year in Australia ~ 3,000 children are diagnosed with T1DM and ~ 400 children and adolescents with T2DM.

Estimated cumulative probability for preproliferative diabetic retinopathy or worse (PPDR) for different area under the curve (AUC) glycated haemoglobin (HbA1c) values allowing for non-linear relation using spline functions for follow-up cohorts.

Swedish Paediatric T1DM Diabetes Registry

10,398 children and young adults followed for between 8-20 years for retinopathy and nephropathy

Mean age of cohort 14.7 years
43% female
Mean HbA1c 8.0%



HbA1c >8.5%

Marcus Lind et al. BMJ 2019;366:bmj.l4894

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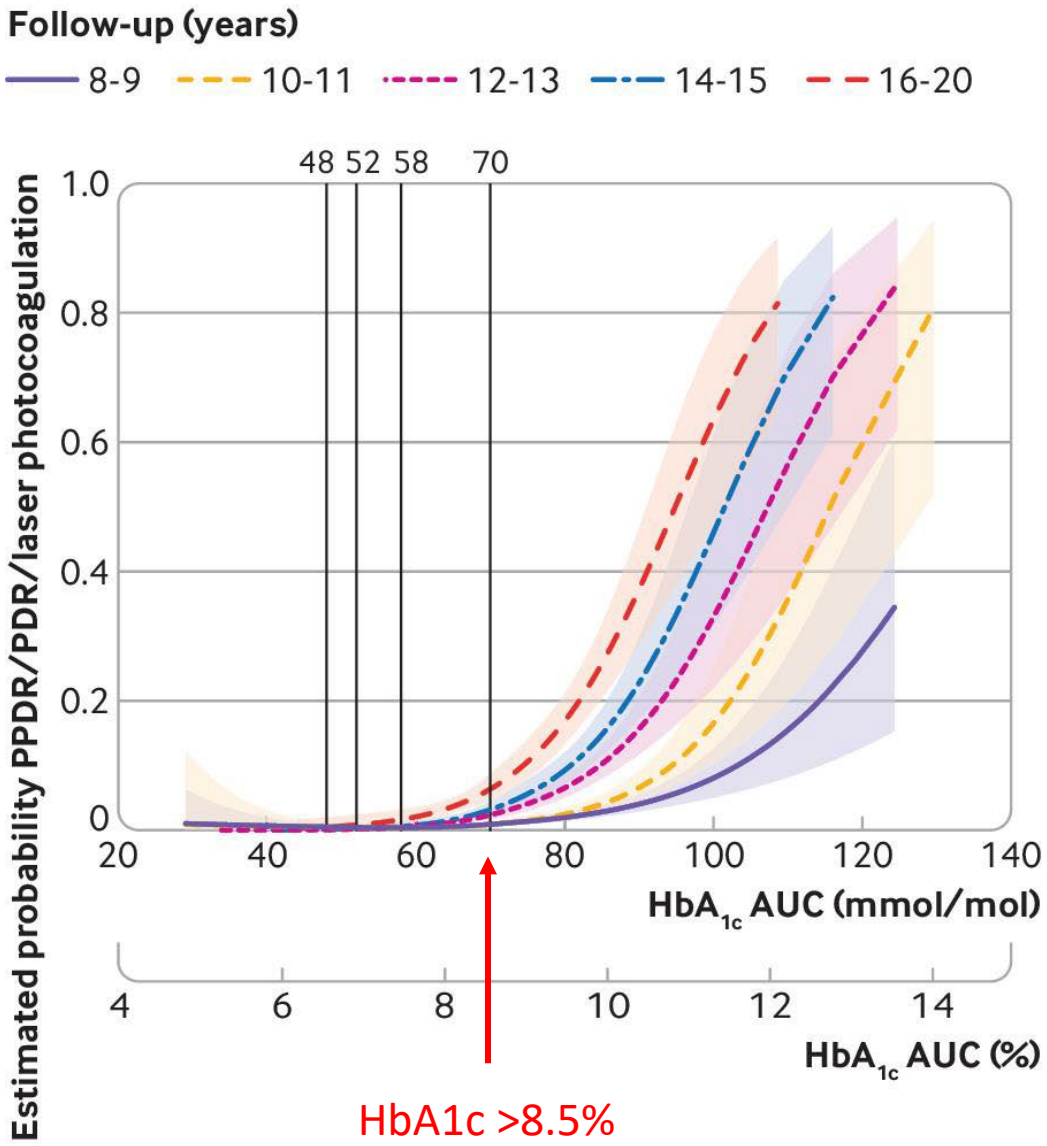


HbA1c Glycaemic Targets

T1DM < 7.0%

T2DM < 6.5%

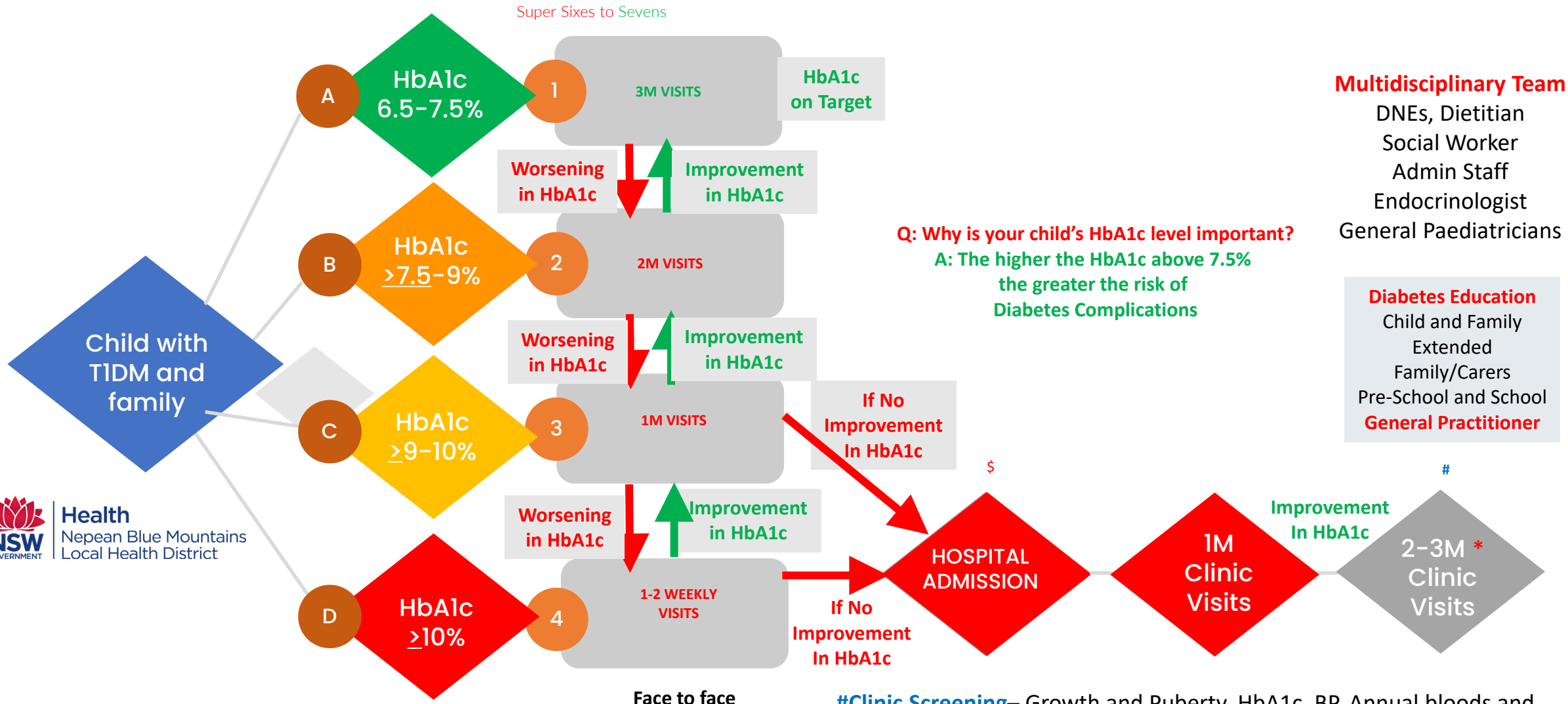
Marcus Lind et al. BMJ 2019;366:bmj.l4894

I am Brave, I am Strong, I am Happy, I am a Super 6 and 7s er


Thanks for becoming a
Valued Member
of the
Super 6 to 7s
HbA1c Club!
Name of Member
Date joined _____202___

Child with Type 1 Diabetes "Join the Super Six Sevens HbA1c Flyers Club"

The patient and family journey - Primary Goal: a healthy, thriving happy child/adolescent with good diabetes control with the best HbA1c as possible, ideally between 6.5-7.5%.



Health
Nepean Blue Mountains Local Health District

Q: Why is your child's HbA1c level important?
A: The higher the HbA1c above 7.5% the greater the risk of Diabetes Complications

Multidisciplinary Team
DNEs, Dietitian
Social Worker
Admin Staff
Endocrinologist
General Paediatricians

Diabetes Education
Child and Family
Extended Family/Carers
Pre-School and School
General Practitioner

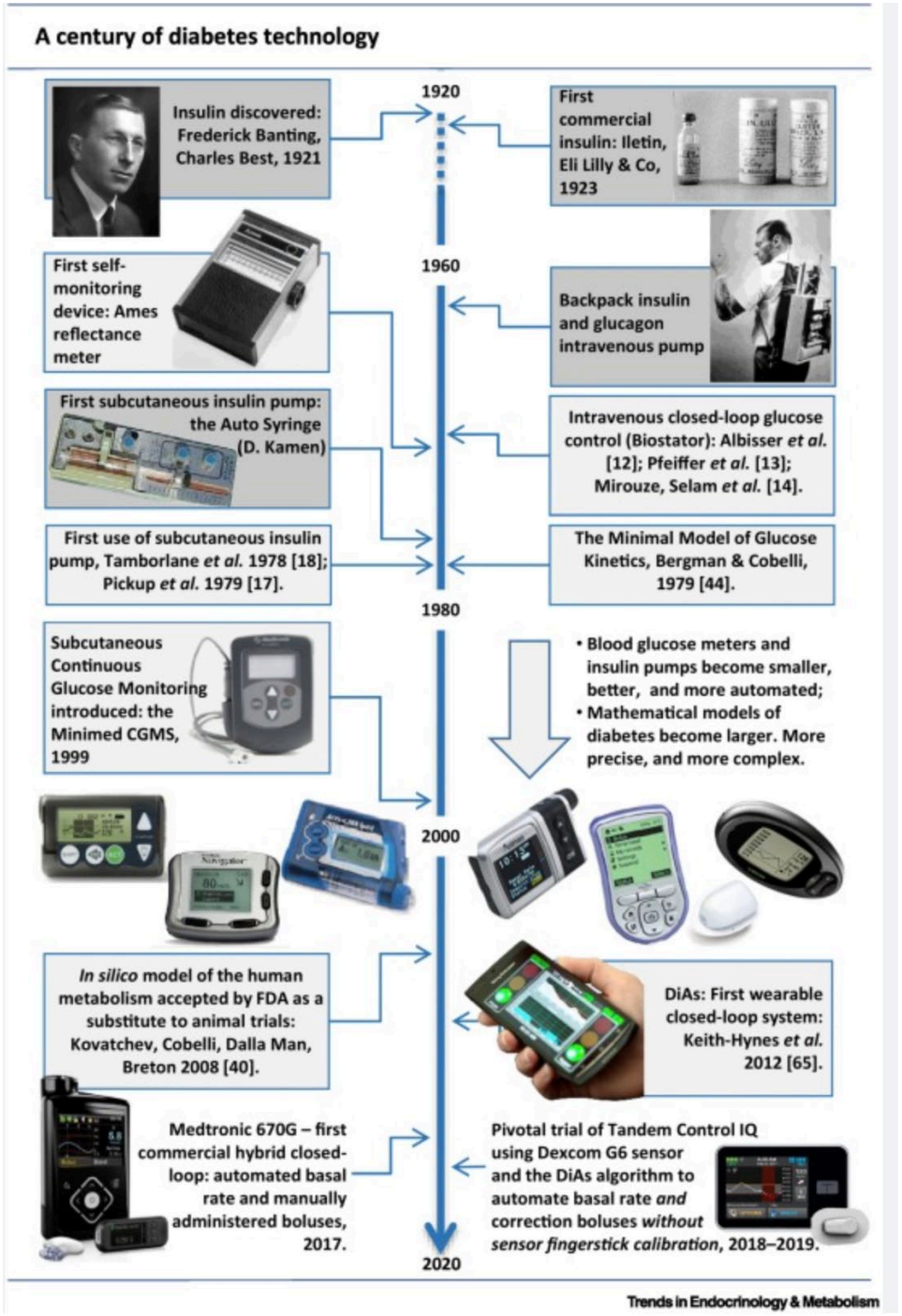
$ Prior to Hospital admission: Develop Goals and Expectations Contract between child, family and Diabetes Team to identify current psycho-social and other barriers to overcome to improving diabetes control.

Face to face
Telephone/email
Telehealth

#Clinic Screening– Growth and Puberty, HbA1c, BP, Annual bloods and Complications Screening (>11 years), Diabetes Knowledge, Psychosocial Well-being, Family Mental Health and Diabetes Distress and Transition Preparation.

2023 Diabetes Technology Update

Dr Jeffrey Yeung
Paediatric Endocrinologist
Paediatric Diabetes Service
Nepean Hospital



A century of diabetes technology

Insulin discovered: Frederick Banting, Charles Best, 1921

1920

First commercial insulin: Iletin, Eli Lilly & Co, 1923

First self-monitoring device: Ames reflectance meter

1960

Backpack insulin and glucagon intravenous pump

First subcutaneous insulin pump: the Auto Syringe (D. Kamen)

Intravenous closed-loop glucose control (Biostator): Albisser *et al.* [12]; Pfeiffer *et al.* [13]; Mirouze, Selam *et al.* [14].

First use of subcutaneous insulin pump, Tamborlane *et al.* 1978 [18]; Pickup *et al.* 1979 [17].

The Minimal Model of Glucose Kinetics, Bergman & Cobelli, 1979 [44].

1980

Subcutaneous Continuous Glucose Monitoring introduced: the Minimed CGMS, 1999

- Blood glucose meters and insulin pumps become smaller, better, and more automated;
- Mathematical models of diabetes become larger. More precise, and more complex.

2000

In silico model of the human metabolism accepted by FDA as a substitute to animal trials: Kovatchev, Cobelli, Dalla Man, Breton 2008 [40].

DiAs: First wearable closed-loop system: Keith-Hynes *et al.* 2012 [65].

Medtronic 670G – first commercial hybrid closed-loop: automated basal rate and manually administered boluses, 2017.

Pivotal trial of Tandem Control IQ using Dexcom G6 sensor and the DiAs algorithm to automate basal rate *and* correction boluses *without sensor fingerstick calibration*, 2018–2019.

2020

Trends in Endocrinology & Metabolism

MiniMed™ 780G SmartGuard

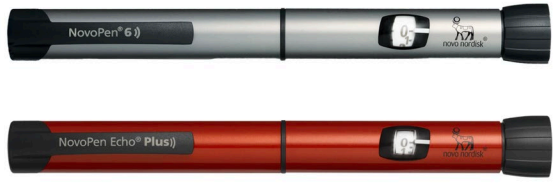
Automated Insulin Delivery System

Automated Insulin Delivery

CONTROL-IQ

OMNIPOD® 5

Automated Insulin Delivery System



Automated Insulin Delivery

iLet Bionic Pancreas

Available in USA only
FDA Approval 5/2023

Health
Nepean Blue Mountains
Local Health District

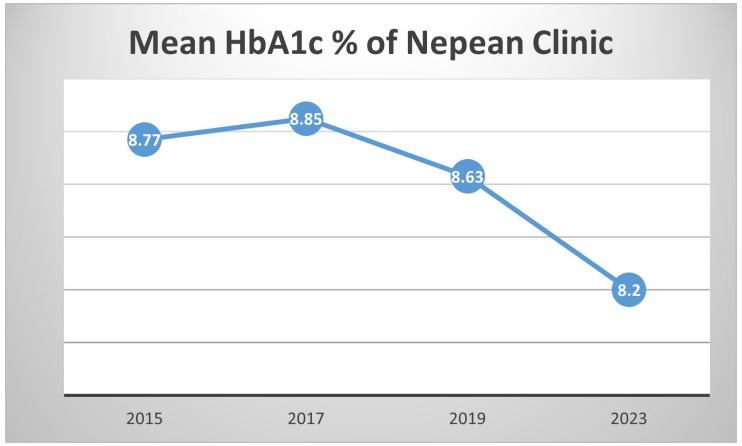
Paediatric Diabetes Service

- ~ 220 patients 2 to 16 years of age
- ~ 60% on an insulin pump system
- ~ 2/3 on Medtronic 770G/780G (JDRF Pump subsidised program) subsidised
- ~ 1/3 on Animas T-Slim
- Other: Omnipod, Ypsomed

- Main CGM systems:

- Libre freestyle, Dexcom G6, Guardian Link 3/4

Health
Nepean Blue Mountains
Local Health District



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Medtronic 780G pump G4 CGMS SmartGuard

Automatic Meal Detection Technology

No need for calibrations* with the new Guardian™ 4 Sensor & Guardian™ 4 Transmitter

No calibrations required

288 sensor glucose measurements per day without the need for calibrations.*

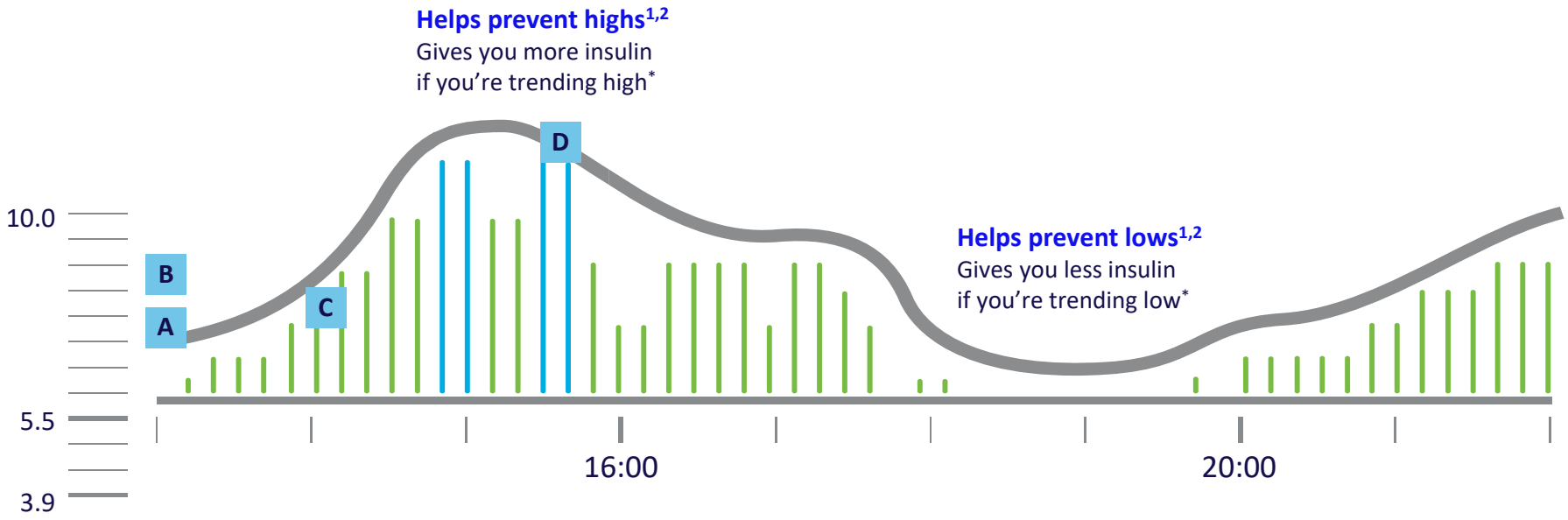
Sensor glucose can be used for treatment decisions*.

The MiniMed™ 780G system can be used in combination with the new Guardian™ 4 Sensor and Guardian™ 4 Transmitter.

More freedom with food

Automatically adjusts and corrects glucose levels every 5 minutes, as needed*

SmartGuard™ Technology helps prevent highs and lows[1, 2]



Auto corrects highs early, before they occur

Adjusted, small auto correction dosing, up to every 5 minutes*

Glucose levels mmol/L
Basal insulin
Auto correction bolus

A Choice of a basal target of 5.5 mmol/L (default setting), 6.1 mmol/L or 6.7 mmol/L

B The auto correction target is set at 6.7 mmol/L

C Basal insulin adjusts every 5 minutes based on SG values

D Auto corrections delivered if the algorithm determines they are needed, can be as frequent as every 5 minutes and up to 288 times a day:

- Max basal reached
- SG ≥ 6.7 mmol/L

No automatic corrections if Temp Target is set

For illustrative purposes only.
*Refer to System User Guide - SmartGuard™ feature. Some user interaction required

1. Carlson, AL. et al. Poster at the 80th International Conference of the American Diabetes Association, June 12-16. 2020, Chicago/Virtual
2. De Bock M. et al. Poster at the 80th International Conference of the American Diabetes Association, June 12-16. 2020, Chicago/Virtual

Medtronic 780G Pump: Initial real-world evidence (n=12,870): impact of recommended settings on TIR and GMI

	All users	Recommended settings users*
Number of users, *n*	**12,870**	**1,482**
Time in SmartGuard, *%*	92.3	94.9
Mean SG, mmol/L	8.0	7.6
GMI**, *%*	6.8	6.6

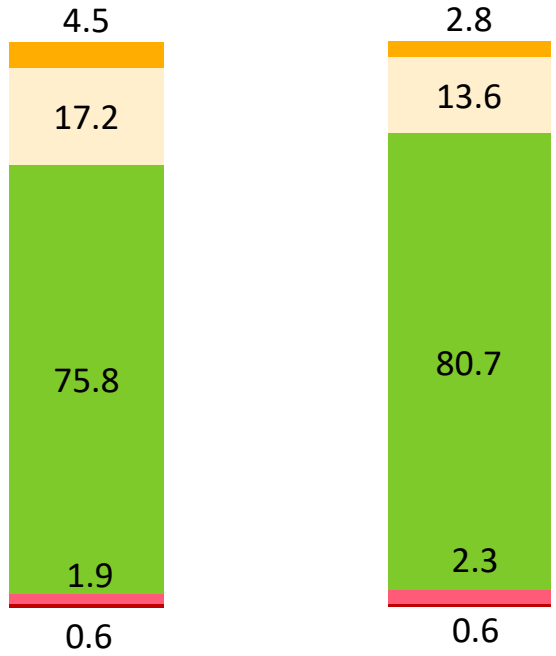
*Recommended SmartGuard™ Settings

5.5mmol/L — Glucose target

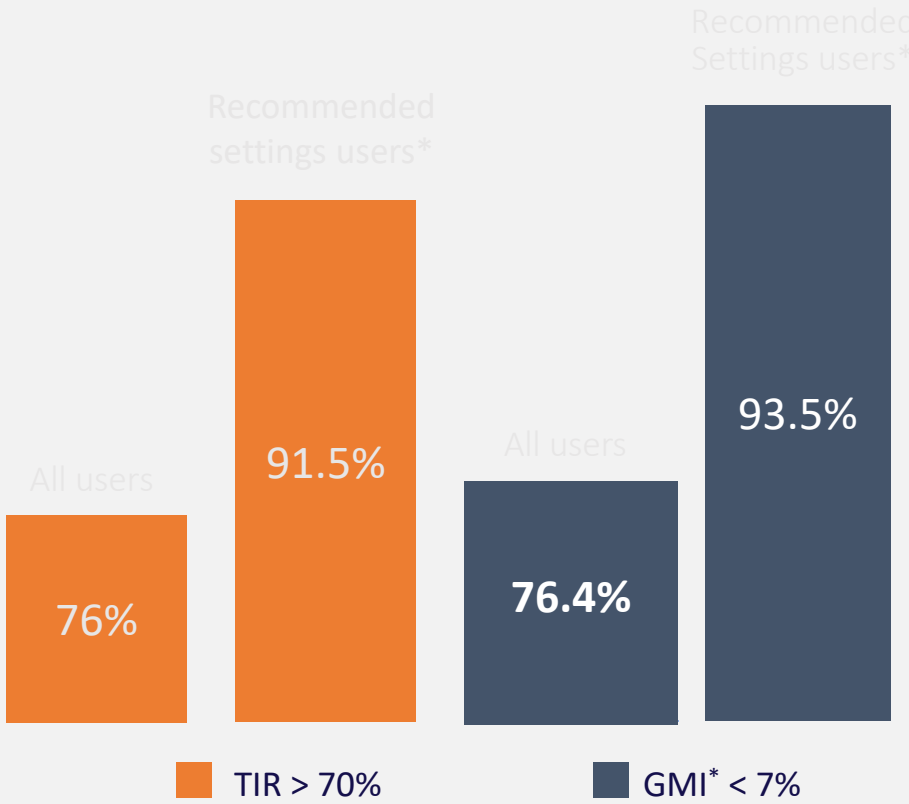
2 hours — AIT (Active Insulin Time)

Time in Ranges, %

<3.0mmol/L | 3.0-3.9mmol/L | 3.9-10mmol/L | 10-13.9mmol/L | >13.9mmol/L



Percentage of Users Achieving the Glycaemic Targets[1]



* Recommended setting users are the ones using the combination of glucose target setting at 100 mg/dL and Active Insulin Time (AIT) at 2 hours for at least 90% of the time. Recommended SmartGuard™ feature settings for each single patient must be defined by HCPs based on individual targets and specific needs. **Glucose Management Indicator (GMI) based on reported mean glucose values. Calculated using JAEB https://www.jaeb.org/gmi/.

1. Arrieta et al. *Diabetes Obes Metab. 2022;24:1370–1379.*

* Due to inherent analysis limitations, caution is advised when attempting to extrapolate these results to new patients. There could be significant differences.

Medtronic 780G pump: Initial real world evidence (n=12,870): Impact of 5.5 target

	Overall	>15 years		≤15 years		
	Overall	Overall	Target 5.5mmol/L AIT 2-hr[a]	Overall	Target 6.1mmol/L AIT 2-hr[a]	Target 5.5mmol/L AIT 2-hr[a]
Users[b], *n*	12,870	8,874	836	3,211	89	365
Time in AHCL, %	92.3 ± 13.0	92.3 ± 13.0	95.0 ± 8.0	92.7 ± 12.3	95.1 ± 7.6	94.6 ± 10.0
Mean SG, mmol/L	8.1 ± 0.84	8.1 ± 0.84	7.6 ± 0.63	8.1 ± 0.81	8.0 ± 0.72	7.6 ± 0.68
GMI, %	6.8 ± 0.4	6.8 ± 0.4	6.6 ± 0.3	6.8 ± 0.3	6.7 ± 0.3	6.6 ± 0.3
Time in Ranges, %						
>13.9mmol/L	4.5	4.1	2.6	5.4	4.8	3.3
10-13.9mmol/L	17.2	17.1	13.3	17.5	16.0	14.2
3.9-10mmol/L	75.8	76.5	81.3	73.9	76.5	78.9
3.0-3.9mmol/L	1.9	1.8	2.2	2.5	2.1	2.8
<3.0mmol/L	0.6	0.5	0.6	0.7	0.6	0.8

*Recommended initiation settings are: 5.5mmol/L auto basal target for adults, children ≤ 15 years old: 6.1mmol/L and reduce to 5.5mmol/L if no concern with hypoglycaemia.
[A] Individuals using the specified glucose target and Active Insulin Time ≥95% of the time; [b] Number of users with >10 days of sensor glucose data
Arrieta A, et al. *Diabetes Obes Metab*. 2022;10.1111/dom.14714
*Due to inherent analysis limitations, caution is advised when attempting to extrapolate these results to new patients. There could be significant differences.

Animas T Slim- Control and Basal IQ- Dexcom G6 CGMS Insulin Pump System

Control-IQ technology

THE EASY CHOICE TO HELP PREVENT HIGHS AND LOWS

Trying to keep your blood sugar in range can be stressful and time consuming. Our Control-IQ™ advanced hybrid closed-loop technology makes it easier by using Dexcom G6 CGM values to predict glucose levels 30 minutes ahead and automatically adjust insulin to help increase time in range.[2*]

PREDICTIVE TECHNOLOGY
Designed to help prevent highs and lows, to help increase time in range (3.9–10 mmol/L).*

CORRECTION BOLUS
Automatic correction boluses (up to one per hour) for added protection.

ZERO FINGERPRICKS^
When using Dexcom G6 CGM.

ACTIVITY SETTINGS
Dedicated Sleep ( ) and Exercise ( ) Activity settings for more targeted control.

^ If your glucose alerts and readings from the G6 do not match symptoms or expectations, use a blood glucose meter to make diabetes treatment decisions.

How Control-IQ technology works

The t:slim X2 insulin pump with Control-IQ technology is designed to help increase time in range (3.9-10 mmol/L)* using Dexcom G6 CGM values to predict glucose levels 30 minutes ahead and adjust insulin delivery accordingly.

10.0	**Delivers**	Delivers an automatic correction bolus if sensor glucose is predicted to be above 10 mmol/L**
8.9	**Increases**	Increases basal insulin delivery if sensor glucose is predicted to be above 8.9 mmoL/L
	Maintains	Maintains active Personal Profile settings
6.25	**Decreases**	Decreases basal insulin delivery if sensor glucose is predicted to be below 6.25 mmol/L
3.9 mmol/L	**Stops**	Stops basal insulin delivery if sensor glucose is predicted to be below 3.9 mmol/L

** Note: If glucose values are predicted to be above 10 mmol/L, Control-IQ technology calculates a correction bolus using the Personal Profile settings and a target of 6.1 mmol/L and delivers 60% of that value. It will do this up to once per hour asneeded.

Exercise Activity

Provides added control by enabling:
Options > Exercise > Start.

Delivers	Increases	Maintains	Decreases	Stops
10.0	8.9	7.8 - 8.9	7.8	4.4

Sleep Schedules

Helps to reduce the burden by allowing you to set up two sleep schedules to automatically turn on and off the Sleep Activity.

Delivers	Increases	Maintains	Decreases	Stops
--	6.7	6.25 – 6.7	6.25	3.9

BGL Target Flexibility with Physical Activity and Sleep

CLINICAL STUDY RESULTS

More time in range*

2.6 hours

Average additional time in range per day for study participants who used Control-IQ technology.[9]

Easy to use

97%

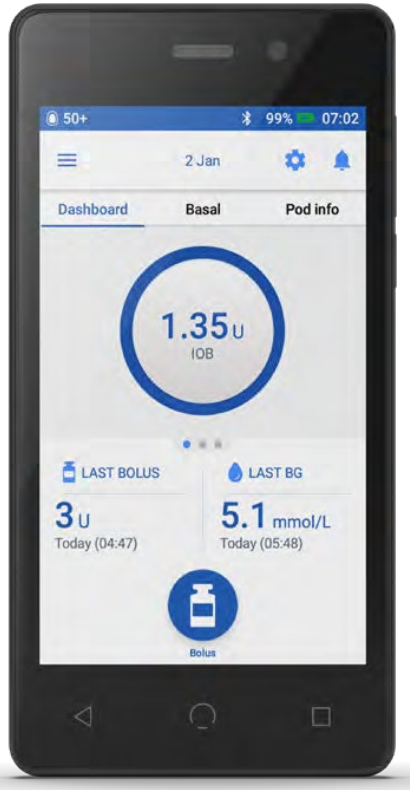
Percent of study participants who used Control-IQ technology and said it was easy to use.[9]

• Omnipod DASH® Insulin Management System

The PDM

Modern, touch-screen

Personal Diabetes Manager (PDM) — Insulin data and delivery control at your fingertips



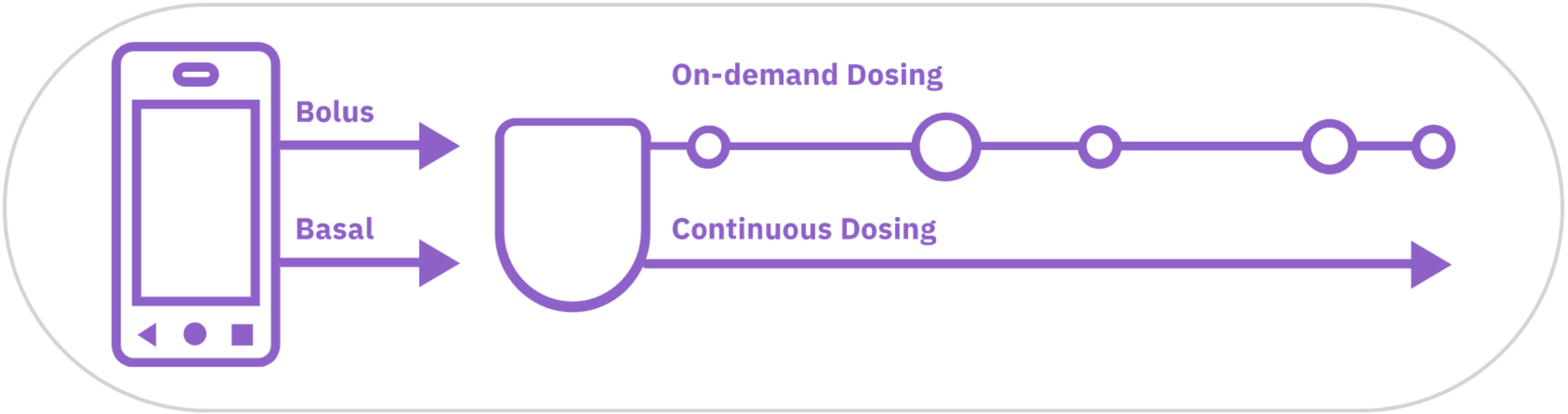
TWO SIMPLE PARTS

The Pod

Tubeless, wearable

Place almost anywhere you would give yourself an insulin injection for up to 3 days of nonstop insulin delivery

How does Pod Therapy work?

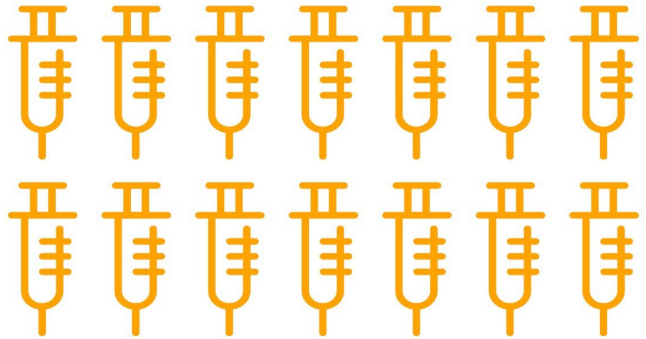


Simplify the Burden of Multiple Daily Injections

- Fewer injections*, fewer daily interruptions
- Consistent, hands-free insertion
- No need to see or touch the insertion needle

OMNIPOD DASH® SYSTEM
1 Auto-cannula insertion

VS

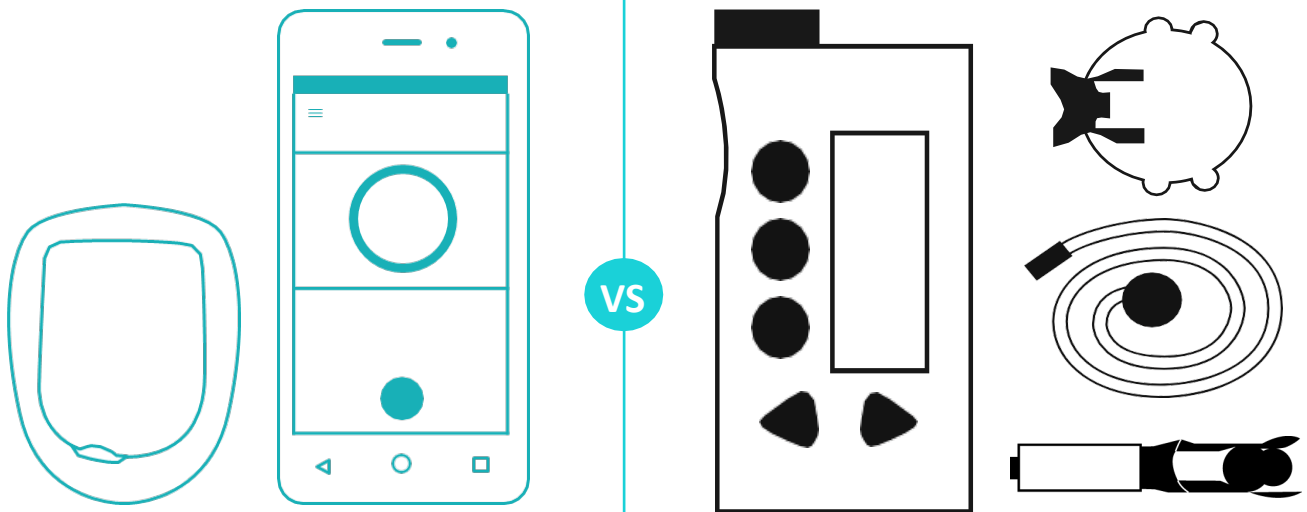


MDI
Approx. 14 Syringe/Pen Injections

*Based on average number of injections required every 3 days (MDI:~4.5/day)
**The Pod has an IP28 rating for up to 7.6 meters for 60 minutes. The Personal Diabetes Manager is not waterproof.

Tubeless Flexibility

- Tubeless means fewer parts than tubed insulin pumps
- The Pod holds and delivers insulin, without any concern of tubes getting in the way



OMNIPOD DASH®
2 components

CONVENTIONAL PUMP
3+ components

+ The small, waterproof, tubeless Pod offers a truly differentiated experience compared to MDI and tubed pumps

TUBELESS

+ No need to make clothing choices to accommodate pumps, and no need to worry about tubes getting tangled or pulled

AUTO-CANNULA INSERTION

+ Your patients can initiate therapy without touching or seeing an insertion needle

BLUETOOTH® ENABLED

+ Communicates with the PDM via Bluetooth® wireless technology

WATERPROOF*

+ No need to disconnect for swimming or bathing* for up to 72 hours of continuous insulin delivery

Additional Specifications:

+ Insulin reservoir volume: 200 units
+ Cannula insertion depth: 6.5 mm
+ Operating temperature range: 4.4° C to 40° C

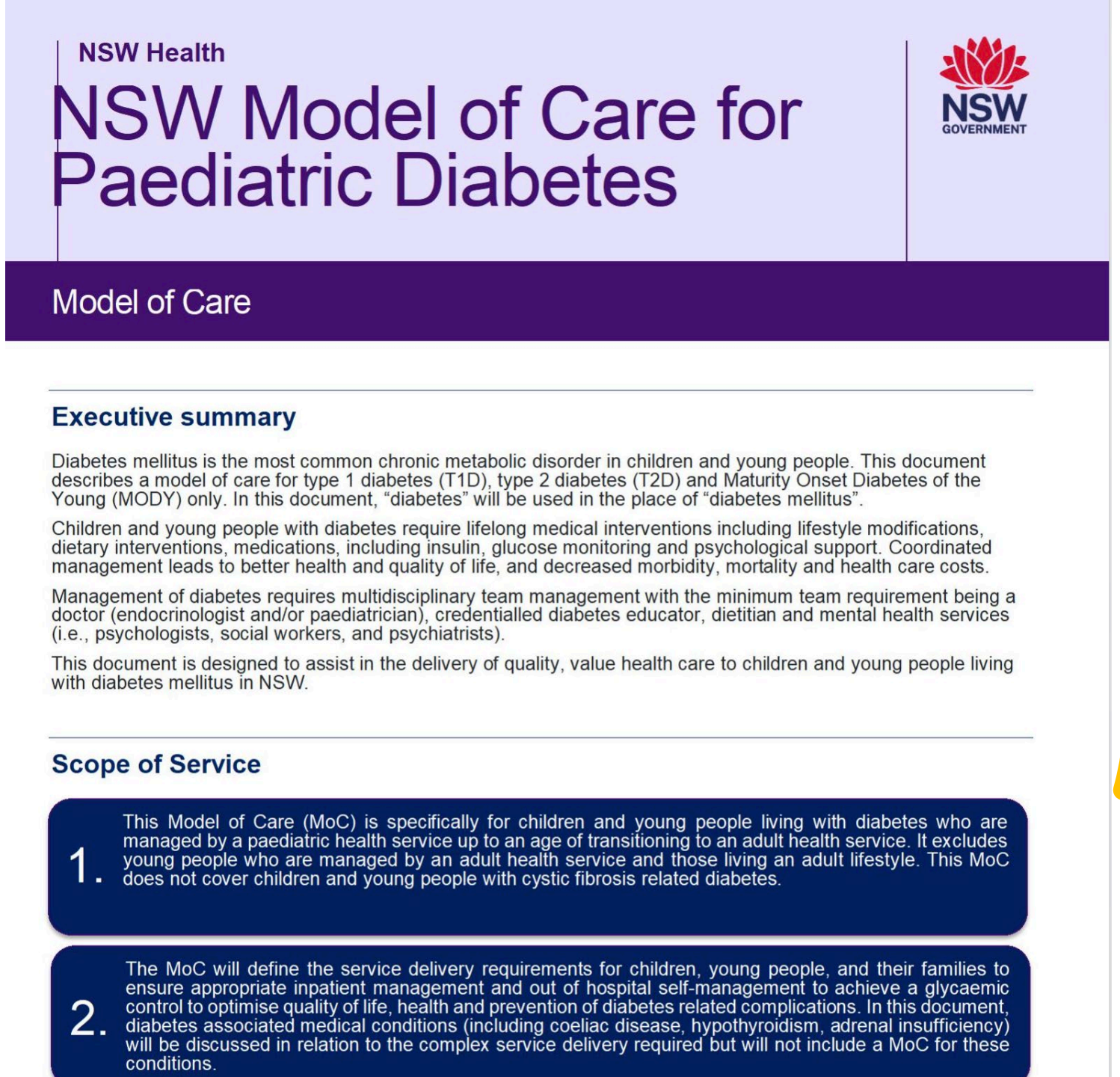
*The Pod has an IP28 rating for up to 7.6 meters for 60 minutes. The Personal Diabetes Manager is not waterproof.

Rapidly Evolving Diabetes Technologies

- Smart insulin pens and associated smartphone insulin dosing apps and log i.e. NovoPen 6, NovoPen Echo, Medtronic InPen
- Record dose/time +/- communicate with CGM
- Omnipod 5 – Dexcom G6 CGMS
  - semi-closed loop system
- Libre 3 – autoreadings of CGMS to phone app
- iLet Bionic Pancreas (full automated insulin-delivery system) – recently approved by USA Food and Drugs Administration (FDA) for over 6 years old with T1D in the USA

2023 NSW Model of Care for Paediatic Diabetes

A/Prof. Gary Leong
Paediatric Endocrinologist
Paediatric Diabetes Service
Nepean Hospital



NSW Health

NSW Model of Care for Paediatric Diabetes

NSW GOVERNMENT

Model of Care

Executive summary

Diabetes mellitus is the most common chronic metabolic disorder in children and young people. This document describes a model of care for type 1 diabetes (T1D), type 2 diabetes (T2D) and Maturity Onset Diabetes of the Young (MODY) only. In this document, “diabetes” will be used in the place of “diabetes mellitus”.

Children and young people with diabetes require lifelong medical interventions including lifestyle modifications, dietary interventions, medications, including insulin, glucose monitoring and psychological support. Coordinated management leads to better health and quality of life, and decreased morbidity, mortality and health care costs.

Management of diabetes requires multidisciplinary team management with the minimum team requirement being a doctor (endocrinologist and/or paediatrician), credentialled diabetes educator, dietitian and mental health services (i.e., psychologists, social workers, and psychiatrists).

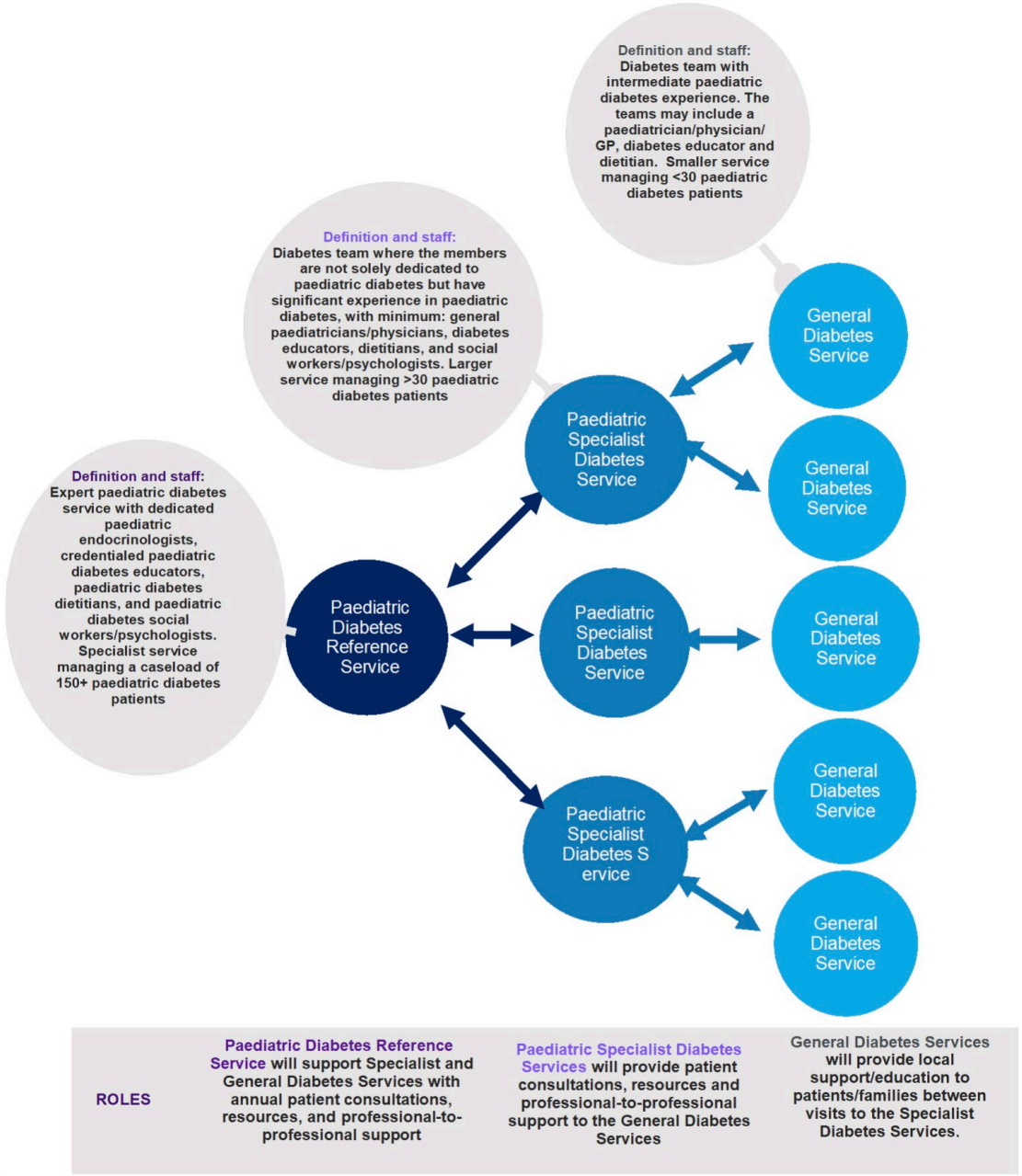
This document is designed to assist in the delivery of quality, value health care to children and young people living with diabetes mellitus in NSW.

Scope of Service

1. This Model of Care (MoC) is specifically for children and young people living with diabetes who are managed by a paediatric health service up to an age of transitioning to an adult health service. It excludes young people who are managed by an adult health service and those living an adult lifestyle. This MoC does not cover children and young people with cystic fibrosis related diabetes.

2. The MoC will define the service delivery requirements for children, young people, and their families to ensure appropriate inpatient management and out of hospital self-management to achieve a glycaemic control to optimise quality of life, health and prevention of diabetes related complications. In this document, diabetes associated medical conditions (including coeliac disease, hypothyroidism, adrenal insufficiency) will be discussed in relation to the complex service delivery required but will not include a MoC for these conditions.

Hub and Spoke Model



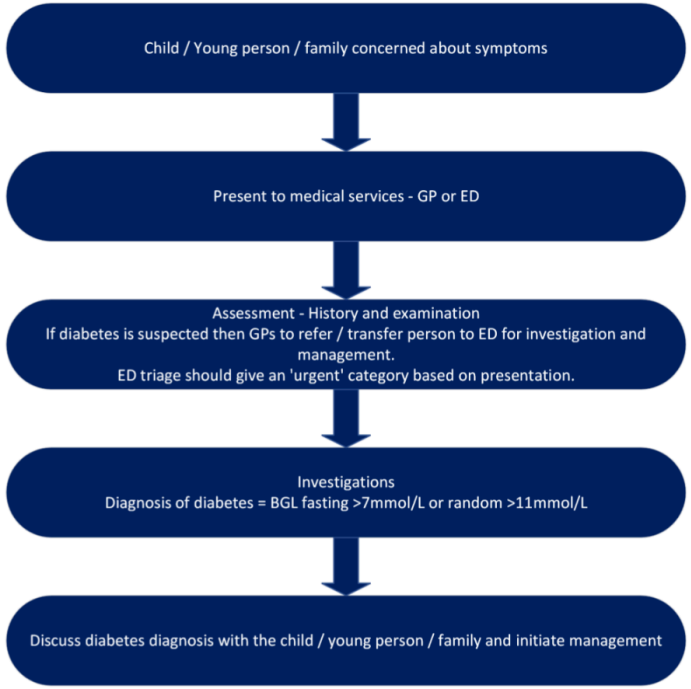
- Covers children Type 1 and 2 Diabetes Mellitus and Maturity-onset of Diabetes of the Young (MODY)
- Spoke and Hub Model
  - Reference Services - > 150+ patients –
    - SCHN Network- CHW and SCH Randwick and John Hunter Hospital, Newcastle
    - RNSH, NBMLHD,
    - Campbelltown/Liverpool
  - Paediatric Specialist Diabetes Service
    - > 30 patients – city or regional e.g. St.George, Gosford, Wollongong
  - General Diabetes Service
    - < 30 patients – regional- e.g. Wagga Wagga, Orange, Dubbo and others

Important Role for GP in Diagnosis Phase

Diagnosis Phase

The diagnosis phase needs to occur promptly, efficiently and with compassion/empathy.

Figure 1: Diagnosis Phase



Early recognition of the symptoms of diabetes:

- At initial diagnosis of type 1 diabetes, 36% of children and young adults have diabetic ketoacidosis (DKA). DKA is life threatening and dramatically increases treatment cost and has long term consequences.
- Community and health professional knowledge of the symptoms of diabetes leads to early diagnosis of diabetes and prevention of DKA.
- Displaying posters in places such as GP waiting rooms improves diagnosis and prevents DKA.

DKA Poster_FINAL_PR (clinicalexcellence.qld.gov.au)

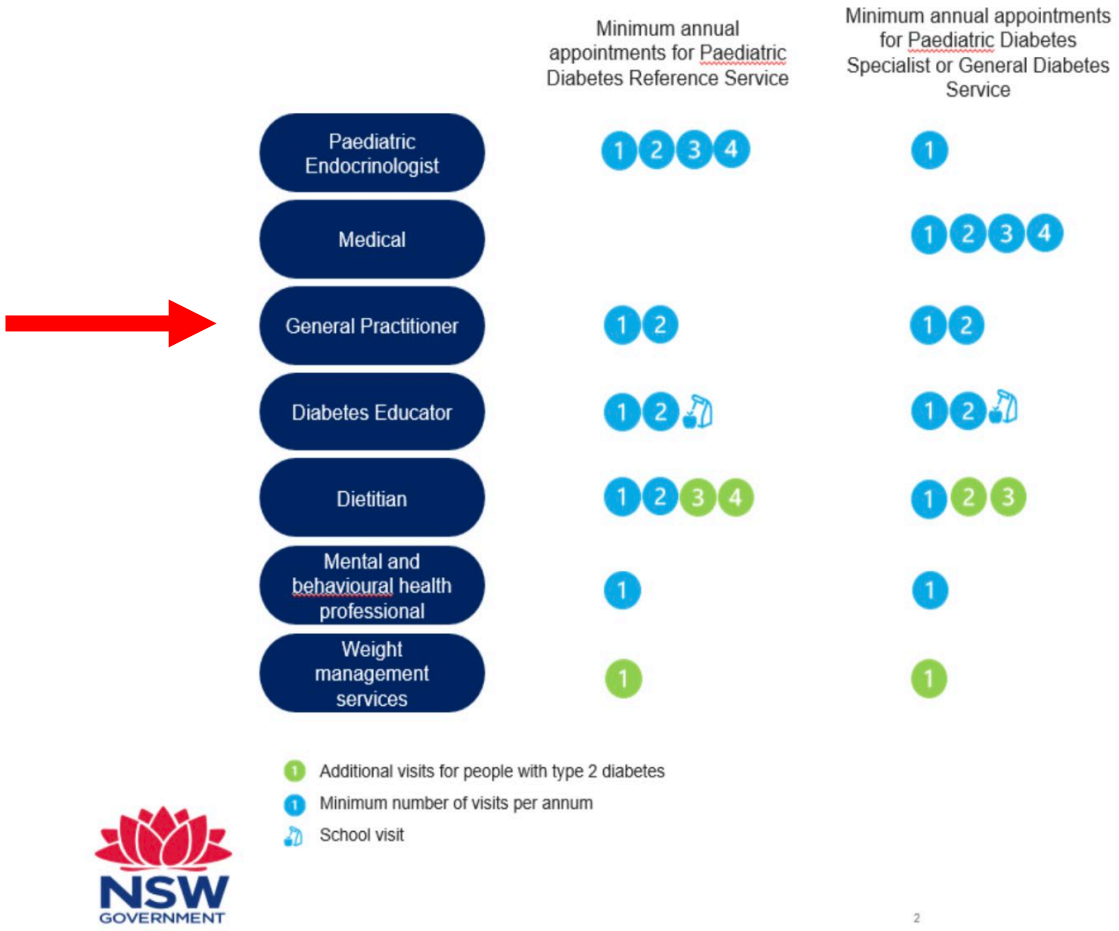
Child, young person, family concerned about symptoms:

- Typical symptoms of diabetes are excessive drinking, excessive urination, weight loss, lethargy, and increased appetite.
- If not treated early, then the person can develop nausea, vomiting, abdominal pain, rapid breathing, confusion/disorientation, pallor, shock, coma and death.
- The progression from a child/young person being well to being critically ill can occur over hours.

General Practitioner (GP) assessment:

- GPs are the first point of contact for families, so a response to family's concerns should occur promptly.
- If a GP suspects a child/young person has diabetes they should conduct a dipstick urine test or finger prick test, and if that suggests a diabetes diagnosis then refer the patient to the nearest emergency department for urgent assessment. If the tests do not indicate a diabetes diagnosis, the patient can be referred for blood tests at a future stage.

Role of GPs in Paediatric Diabetes Management



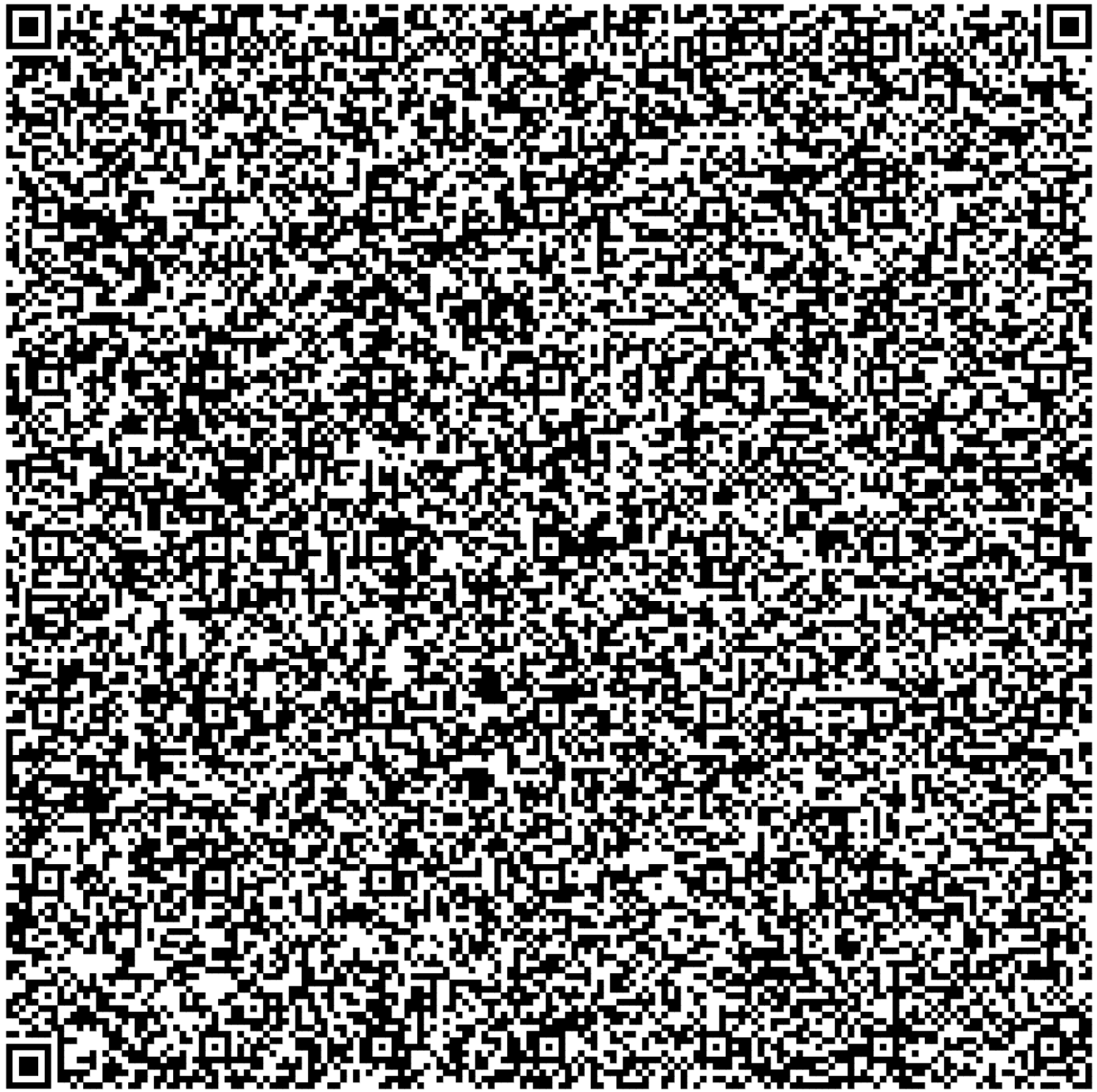
Primary Care providers' experience in the management of paediatric type 1 Diabetes in Western Sydney, New South Wales

Hardikar N, Power T, Leong GM, Liu A, Bhurawala H
AJGP 2023:52:7:464-471

Our qualitative study reported that GPs have little involvement in management of children with diabetes, but that many GPs want more education and up-skilling in a shared-care model of care.

This is critically important in the diagnosis phase for early diagnosis and DKA prevention,
but in on-going management of family and child diabetes distress and mental health.

Register your interest in participating in a Paediatric Diabetes Educational Program



DKA Prevention

Early Diagnosis and Recognition of the 4T symptoms in ANY child of any age is the key

TYPE 1 DIABETES CAN BE DANGEROUS IF NOT DIAGNOSED IN TIME

Know the 4T early signs

If a patient presents with any of the 4T symptoms, please do a point-of-care finger-prick blood glucose.

Fasting - >7.1mmol/L or Random >11.1mmol/L – high risk of type 1 diabetes, send to nearest specialist.

Random between 7.1 - 11mmol/L – consider a consultation with a diabetes specialist.

Early recognition and treatment prevents DKA.

JDRF IMPROVING LIVES. CURING TYPE 1 DIABETES. diabetes australia Queensland Government

Nepean Retrospective Review of Paediatric Diabetes presentations from 2010-2020

Shahzad Sarwar, Habib Bhurawala, Gary Leong & Anthony Liu
(manuscript in preparation)

196 presentations with T1DM – new or previously diagnosed

118/196 (60%)

newly diagnosed T1DM -

Mean Age 9.3 yrs +/- 4.0 yrs

54% female

38% of those with new T1DM had DKA

Ph < 7.30 and HCO3 < 15 mmol/L with BGL > 11 mmol/L

18/196 presentations for severe hypoglycaemia

6/18 – Seizures

(67% on MDI)

No mortalities, though no data on long-term diabetes control or ethnic background in this cohort

Nepean Retrospective Review of Paediatric Diabetes presentations from 2010-2020

Shahzad Sarwar, Habib Bhurawala, Gary Leong , Anthony Liu

Presenting symptoms in order of frequency

Feeling generally unwell

Polydipsia

Polyuria

Nausea/vomiting

Weight loss

i.e. 4Ts

Severe DKA (Ph<7.10)

< 5 years (n=12) 42%

5-10 years (n=2) (9%)

>10-16 years (n=20) (25%)

14 transferred to Tertiary Children's Hospital

For severe DKA = 7% (78% were newly diagnosed T1DM)

DKA recurrence rate 10% of cohort

In newly diagnosed T1DM DKA

Mean Ph 7.16+/-0.11

BGL 28.1 mmol/L +/-10.7

HbA1c 12.3%+/- 2.3

No cases of Hyperglycaemic Hyperosmolar State (HHS)

No presentations of T2DM

ISPAD 2022 Updated DKA guidelines

ISPAD GUIDELINES

ISPAD Clinical Practice Consensus Guidelines 2022: Diabetic ketoacidosis and hyperglycemic hyperosmolar state

Nicole Glaser[1] | Maria Fritsch[2] | Leena Priyambada[3] | Arleta Rewers[4] | Valentino Cherubini[5] | Sylvia Estrada[6] | Joseph I. Wolfsdorf[7] | Ethel Codner[8]

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[5]Department of Women's and Children's Health, G. Salesi Hospital, Ancona, Italy

[6]Department of Pediatrics, Division of Endocrinology and Metabolism, University of the Philippines, College of Medicine, Manila, Philippines

[7]Division of Endocrinology, Boston Children's Hospital, Boston, Massachusetts, USA

[8]Institute of Maternal and Child Research, School of Medicine, University of Chile, Santiago, Chile

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1 | SUMMARY OF WHAT IS NEW OR DIFFERENT

Changes to previous recommendations include:

- Biochemical criteria to diagnose diabetic ketoacidosis (DKA) include serum bicarbonate <18 mmol/L
- Infusion of initial fluid bolus(es) over 20–30 min
- Promoting a rise in serum sodium concentrations during DKA treatment is no longer considered necessary
- Increased emphasis on differences in treatment recommendation for HHS and mixed presentation of DKA and HHS (hyperosmolar DKA) compared to standard DKA treatment

symptoms of DKA are non-specific. Therefore, fingerstick blood glucose measurements should be considered for all children presenting with rapid breathing or with vomiting and abdominal pain without diarrhea.

The following recommendations are based on currently available evidence and are intended to be a general guide to DKA management. Because there is considerable individual variability in presentation of DKA (ranging from mild to severe and life threatening), some children may require specific treatment that, in the judgment of the treating physician, may occasionally be outside the range of options presented here. Clinical judgment should be used to determine optimal treatment for the individual child, and timely adjustments to treatment should be based on ongoing clinical and biochemical monitoring of the response to treatment.

Prof Bruce King and Colleagues – John Hunter Children's Hospital

Community Diabetes Awareness Campaign in child care centres, schools and GP offices in Gosford area decreased DKA incidence by 64% c/w control regions who did not receive 4T DKA education posters.

During the 2-year awareness campaign period the rates of DKA decreased from 37.5% to 13.8% (64% decrease) in children with newly diagnosed T1DM.

PEDIATRICDIABETES ISPAD International Society for Pediatric and Adolescent Diabetes

Original Article

A diabetes awareness campaign prevents diabetic ketoacidosis in children at their initial presentation with type 1 diabetes

Bruce R King, Neville J Howard, Charles F Verge, Michelle M Jack, Natalie Govind, Karen Jameson, Angela Middlehurst, Lilian Jackson, Melinda Morrison, DM Wajira S Bandara

First published: 23 July 2012 | https://doi.org/10.1111/j.1399-5448.2012.00896.x | Citations: 71

Abstract

Objective

To evaluate the effect of a diabetes awareness campaign on the incidence of diabetic ketoacidosis (DKA) at the first presentation of type 1 diabetes in children (0–18 yr).

Methods

This study was a controlled population intervention study with a 2-yr baseline period and a 2-yr intervention period. Data were collected on all children presenting with their initial diagnosis of type 1 diabetes [pH, bicarbonate, base excess, blood glucose level (BGL), urea, and creatinine] at Gosford, Newcastle, and Sydney (Sydney Children's Hospital and Royal North Shore Hospital). During the intervention period, diabetes education occurred in the intervention region (Gosford). Child care centers, schools, and doctor's offices were offered education and posters about the symptoms of type 1 diabetes. Doctor's offices were given glucose and ketone testing equipment. The control regions (Newcastle and Sydney) did not receive any educational intervention or test equipment. DKA was defined as pH < 7.3 or bicarbonate < 15 mmol/L.

Results

In Gosford, the proportion of children presenting in DKA decreased from 37.5% (15/40) during the 2-yr baseline period to 13.8% (4/29) during the 2-yr intervention ($p < 0.03$). There was no significant change in the control regions during the same time periods, 37.4% (46/123) and 38.6% (49/127), respectively. In Gosford, the average BGL at presentation was 27.5 mmol/L during the baseline and 21.2 mmol/L during the intervention ($p < 0.01$).

Conclusion

During the diabetes awareness campaign, the rate of DKA at initial diagnosis of type 1 diabetes in children decreased by 64%.

THE UNITED NATIONS OF DIABETES

WELCOME TO
THE 4T DKA PREVENTION CAMPAIGN
VIDEO LAUNCH

Nepean Blue Mountains Local Health District

November 14

Wentworth Healthcare

Blue Mountains | Hawkesbury | Lithgow | Penrith

RACGP

Royal Australian College *of* General Practitioners

4T DKA Prevention Campaign

https://clinicalexcellence.qld.gov.au/resources/diabetes-resources/diabetic-ketoacidosis

Clinic Posters

Poster and fact sheets for families, community and primary care settings

The 4T's awareness poster is also available in the following languages:

- Arabic
- Bengali
- Hindi
- Indonesian
- Persian
- Simple Chinese
- Spanish
- Tamil
- Turkish
- Vietnamese

DKA Prevention Strategy Targets

General Community
Young Families
Schools
Primary Care GP Network
Community Nurses/Centres

Translated 4T DKA Posters – Multiple languages in collaboration with Una Turalic and the Nepean Multicultural Unit and QLD Health

English

Hindi

Vietnamese

Turkish

Will also be available in Samoan, Maori, Arabic, Farsi, Tamil, Greek, French, Italian, Chinese, Bengali, Spanish, Indonesian.

4T DKA Prevention Video
Multicultural Inclusion Grant Support

Sub-title
Translation in
4 languages to date:
Arabic
Turkish
Farsi
Samoan

With permission from families featured in the video

The Future in T1DM and DKA Prevention

- Focus on diagnosis of pre-symptomatic Autoimmune T1DM
- Screening of First-degree relatives affected by T1DM
- Screening of general population
- Immunotherapy for delaying islet cell immune-mediated destruction
- Identification of environmental risk factors has been elusive

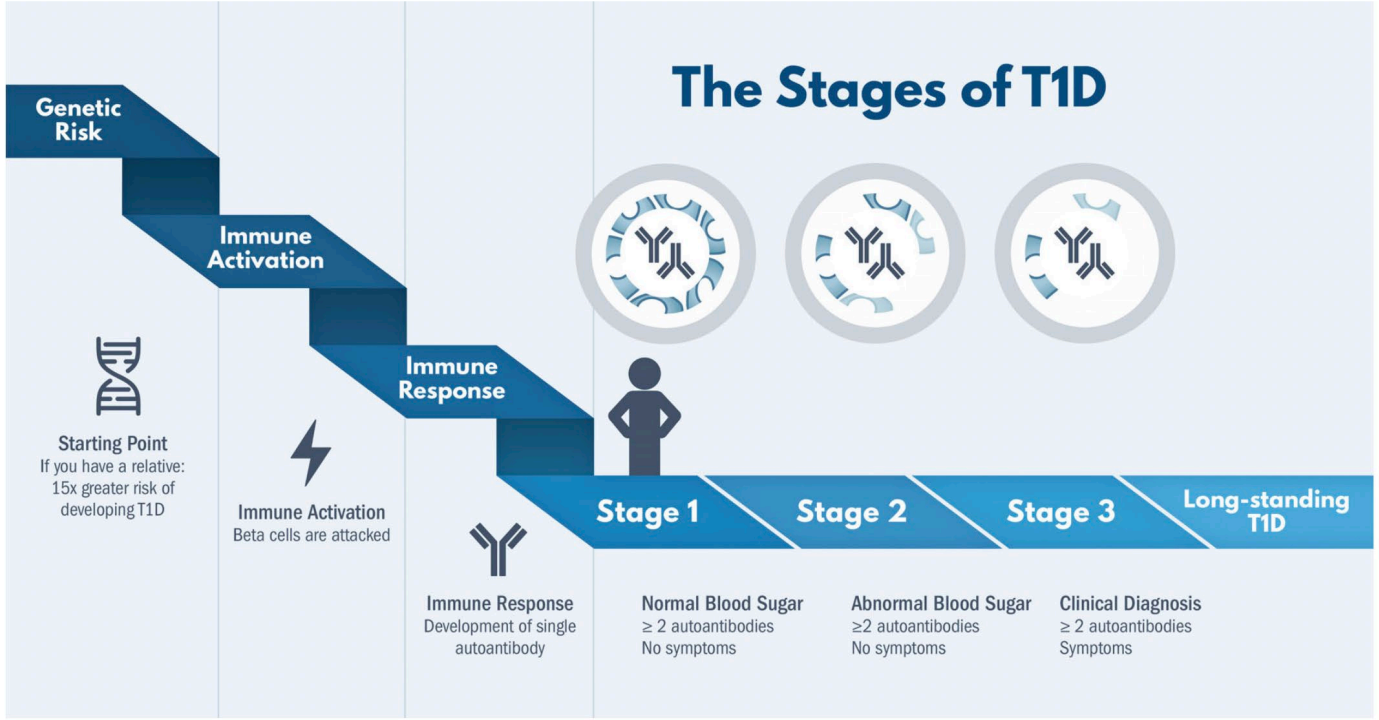


FIGURE 1 The stages of T1D (DiabetesTrialNet.org)

T1D is characterized by four stages as shown in Figure 1.
Stage 1 Multiple islet autoantibodies, normal blood glucose, presymptomatic.
Stage 2 Multiple islet autoantibodies, abnormal glucose tolerance, usually pre-symptomatic.
Stage 3 Blood glucose above ADA diagnostic thresholds.
Stage 4 Established T1D

An Anti-CD3 Antibody, Teplizumab, in Relatives at Risk for Type 1 Diabetes

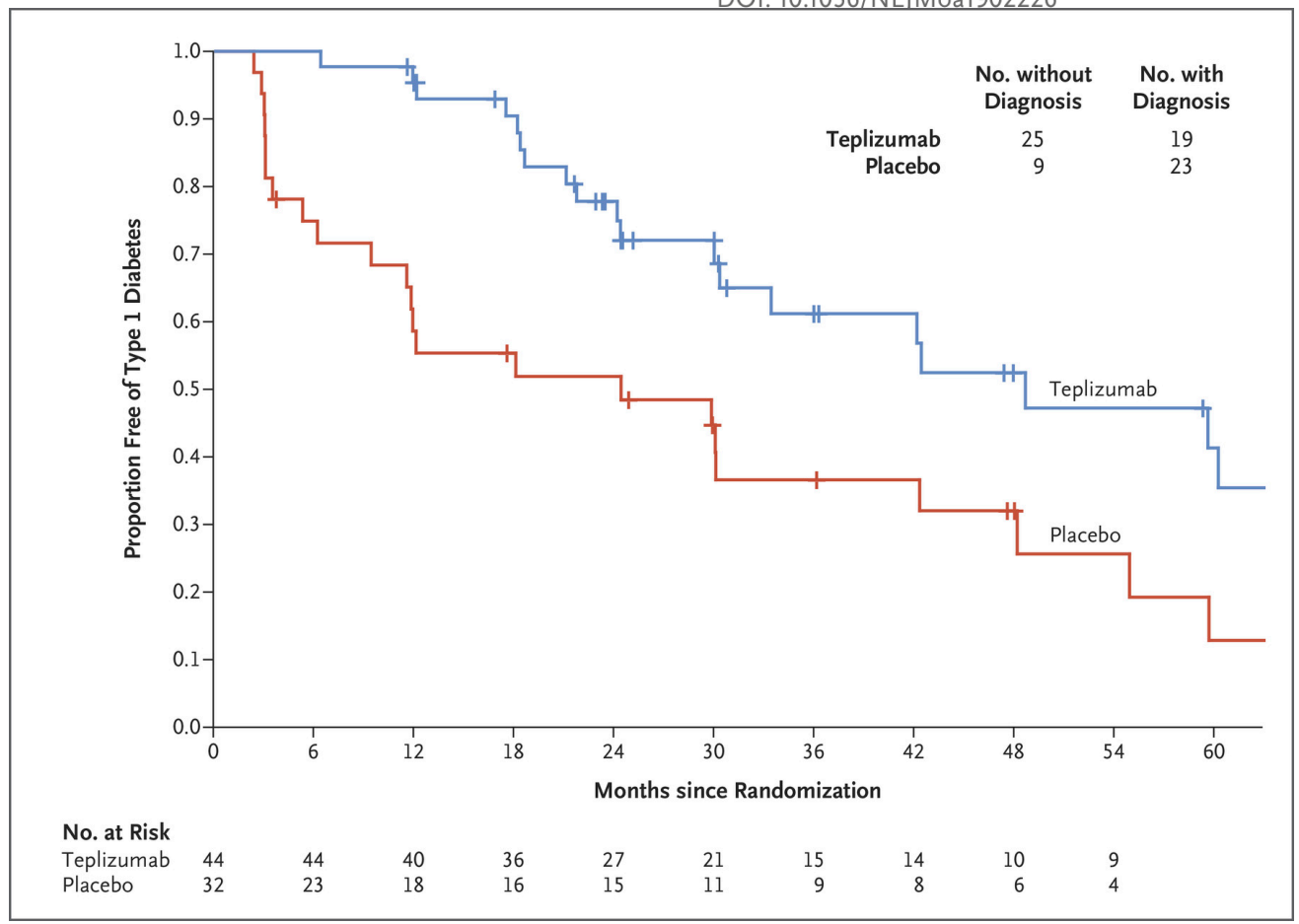
Kevan C. Herold, M.D., Brian N. Bundy, Ph.D., S. Alice Long, Ph.D., Jeffrey A. Bluestone, Ph.D., Linda A. DiMeglio, M.D., Matthew J. Dufort, Ph.D., Stephen E. Gitelman, M.D., Peter A. Gottlieb, M.D., Jeffrey P. Krischer, Ph.D., Peter S. Linsley, Ph.D., Jennifer B. Marks, M.D., Wayne Moore, M.D., Ph.D., et al., for the Type 1 Diabetes TrialNet Study Group*

August 15, 2019
N Engl J Med 2019; 381:603-613
DOI: 10.1056/NEJMoa1902226

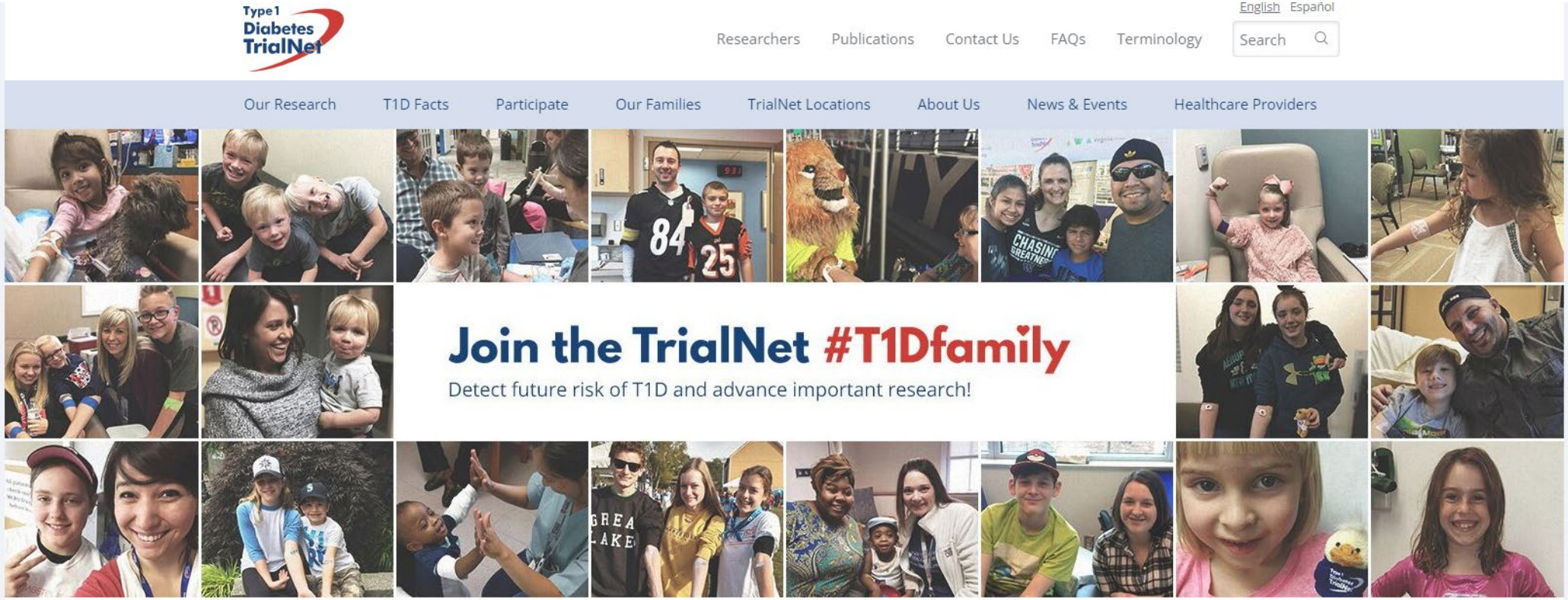
Table 1. Baseline Characteristics of the Participants.*

Characteristic	Teplizumab (N=44)	Placebo (N=32)
Age — yr		
Median (IQR)	14 (12–22)	13 (11–16)
Range	8.5–49.5	8.6–45.0
Age <18 yr — no. (%)	29 (66)	26 (81)
Male sex — %	57	53
Relationship to person with type 1 diabetes — no. (%)		
Sibling†	28 (64)	16 (50)
Offspring	6 (14)	6 (19)
Parent	6 (14)	3 (9)
Sibling and another first-degree relative	2 (5)	3 (9)
Second-degree relative	2 (5)	3 (9)
Third-degree relative or further removed	0	1 (3)
Autoantibodies — no. of participants positive (%)‡		
Anti-GAD65, harmonized	40 (91)	28 (88)
Micro insulin	20 (45)	11 (34)
Anti–IA-2, harmonized	27 (61)	24 (75)
ICA	29 (66)	28 (88)
Anti-ZnT8	32 (73)	24 (75)
Median glycated hemoglobin level (IQR) — %	5.2 (4.9–5.4)	5.3 (5.1–5.4)

* Percentages may not total 100 because of rounding. GAD65 denotes glutamic acid decarboxylase 65, IA-2 islet antigen 2, ICA islet-cell autoantibody, IQR interquartile range, and ZnT8 zinc transporter 8.
† Participants in this category may have had more than one sibling with type 1 diabetes.
‡ Shown are the autoantibodies for which participants were positive at the time of randomization. All participants were positive for at least two autoantibodies before randomization.



www.Trialnet.org https://jdrf.org.au/research/explore-research/

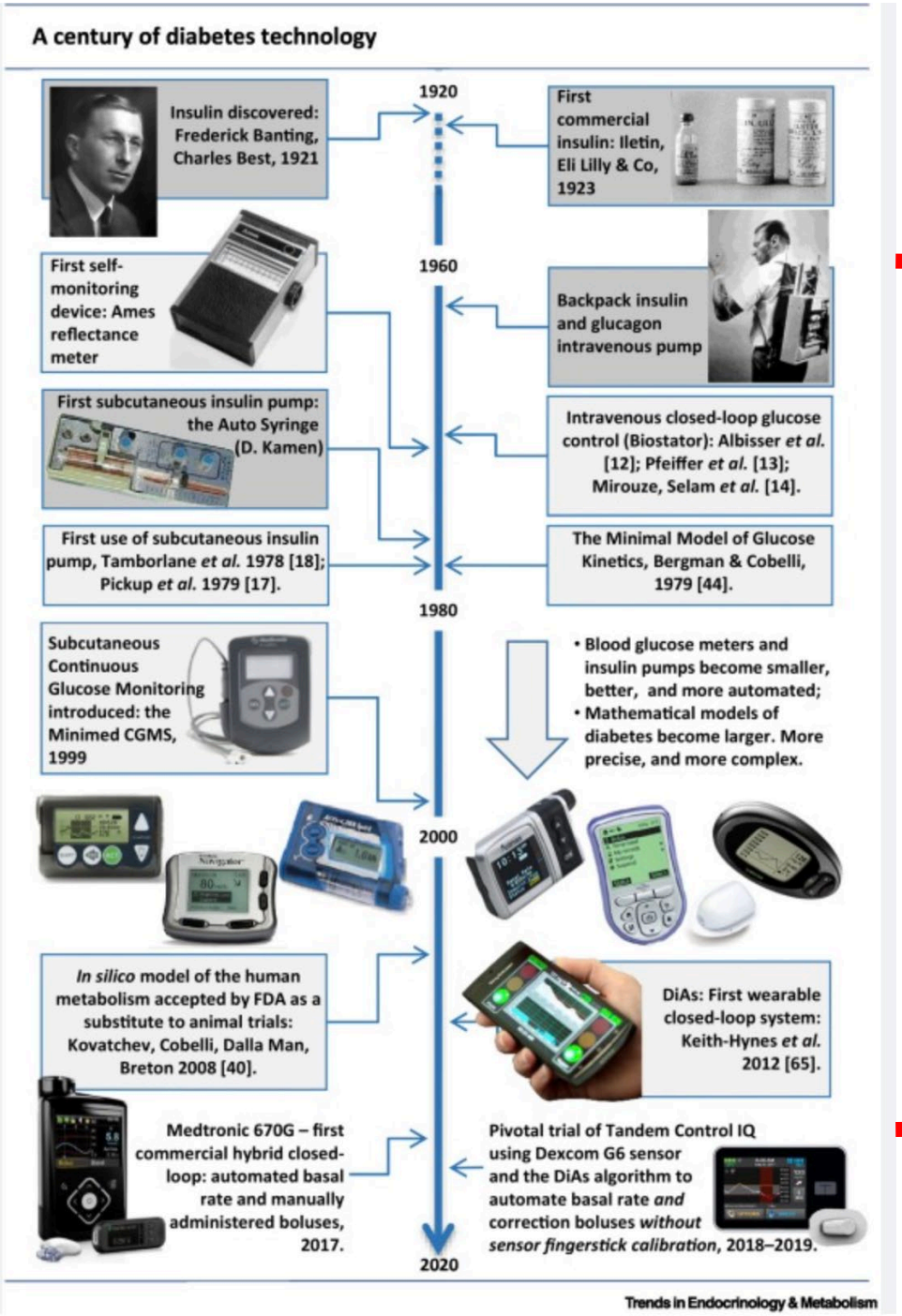


Reflections

- T1DM in children and adolescents is associated with significant long-term physical and mental health problems
- Diabetes Technology is advancing quickly to reduce the burden on child, family and the diabetes team alike!
- But there is still much to do to promote good mental and metabolic health in our patients and their families
- DKA incidence in our NMBLHD and in general remains unacceptably high in children newly diagnosed with T1DM
- Anecdotally DKA rates have been higher since COVID-19 pandemic
- DKA prevention campaigns using the 4T Diabetes Education Posters have successfully been undertaken in Australia and UK
- DKA prevention in the child with T1DM and his/her family reduces long-term anxiety/diabetes distress and we hypothesise improves long-term diabetes control and diagnosis acceptance/self-efficacy
- The effect of a multiculturally-sensitive DKA 4T prevention campaign in our ethnically diverse community remains to be tested
- There is a clear role for GPs in Primary Care to support families with T1DM but your skills are underutilised and your time limited!
- We would like to welcome the collaboration of GP Champions in the NBMLHD with interest in child health and diabetes (T1DM and the prevention and management of T2DM) to be involved in a proposed GP/PHN Nepean Education Partnership

Acknowledgments

- To all our Diabetes Families in our Nepean clinic for teaching us to be better clinicians and especially those who gave their time and inspiring stories for the video production
- To our Wonderful Paediatric Diabetes Team led by Senior DNE Julie Longson with Megan/Lisa/Lisseux, Kate/Renee, Katherine, Cass/Ramesha and Rosanna
- Ms Una Turalic and her wonderful Nepean Multicultural Unit
- Mark Santos and Elaine Lim from Nepean Video/Media Unit for video and poster editing
- To all the wonderful support of the General Paediatric Diabetes team, especially to Drs Sowmya Gandham and Drs Habib Bhurawala with Drs Tony Liu, Vishal Gupta and Ashu Aggarwal
- To Dr Jeff Yeung our younger Paediatric Endocrinologist for joining our team
- To Rachel De Bono our Paediatric Endocrine Fellow
- Collaborators in QLD Health, DA and JDRF on the DKA Prevention Campaign
- For sharing slides for this presentation
  - Medtronic: Alexandra Percival, NSW Field Trainer
  - T-Slim: Kristy Como, Territory Manager – NSW Sydney-West
  - Omnipod: Jessie Aoudi, ACT/NSW Territory & Clinical Services Manager



MiniMed™ 780G SmartGuard

Automated Insulin Delivery System

Automated Insulin Delivery

CONTROL-IQ

OMNIPOD® 5

Automated Insulin Delivery System

Nepean Hospital Paediatric Diabetes Service

Ms Julie Longson Senior DNE and Ms Lisa Fahey DNE are available in foyer at Morning Tea to demonstrate some of the currently available insulin pumps and CGMS devices

Register your interest in participating in a Paediatric Diabetes Educational Program