Health
Hunter New England
Local Health District

Practice Nurse 2022

Learning Outcomes

- Discuss what is diabetes
- List prevalence of diabetes
- Identify major risk factors for development of diabetes
- Discuss diagnostic criteria for diabetes
- Discuss pathophysiology of diabetes
- Identify types of diabetes and common symptoms
- Discuss medication options
- Identify goals of diabetes management

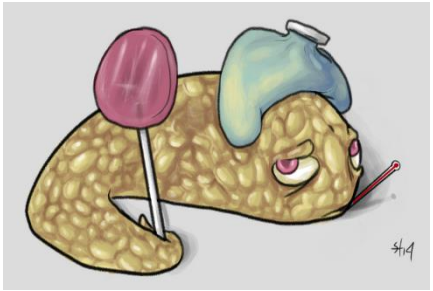
What is Diabetes?

A group of chronic metabolic disorders resulting in higher blood glucose levels (BGL's)

Diabetes occurs due to an absolute or relative lack of effective insulin hormone related to either:

1.The pancreas not producing enough insulin OR

2. Cells of the body not responding to the insulin that is produced



There is currently no cure for diabetes and the condition requires *lifelong management*

What are the 3 major types?

Normal carbohydrate metabolism

Carbohydrates come from starchy (complex) and simple (sugary) foods.

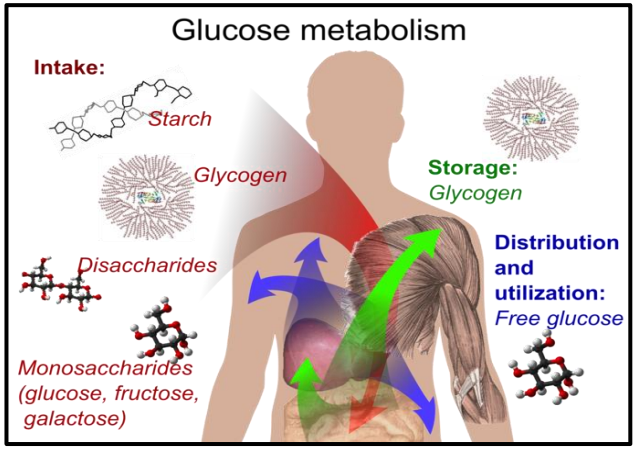
CHO are digested in the small intestines into monosaccharides such as glucose, and are absorbed into the blood stream.

As glucose levels increase insulin is secreted by the pancreas which stimulates the transfer of glucose into storage cells (liver, muscle).

In the liver and muscles, glucose is changed into glycogen by a process called **glycogenesis**.

Epinephrine and glucagon hormones convert glycogen back to glucose and releases it back into the blood stream, a process called **glycogenolysis**.

If the glycogen stores are full excess glucose is converted to fatty acids and stored in adipose tissue in a process called **lipogenesis**.



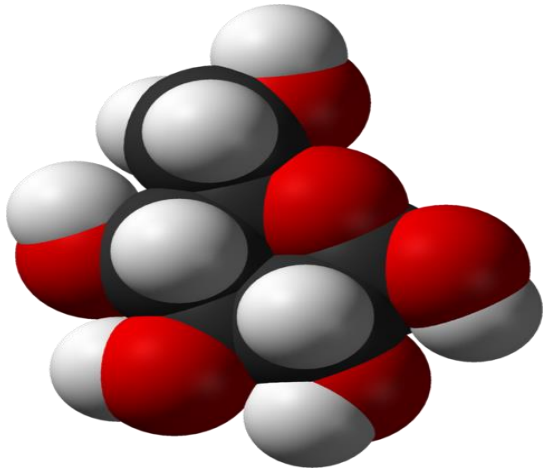
Role of Glucose

Glucose is the primary fuel use by the cells.

Sources of glucose include carbohydrate foods and also gluconeogenesis in the liver.

Blood Glucose Levels (BGL) for people without diabetes, are appropriately between 4 and 7.8 mmol/L.

Metabolism of fat and generally protein (unless in very large quantities) has NO DIRECT effect on BGLs.

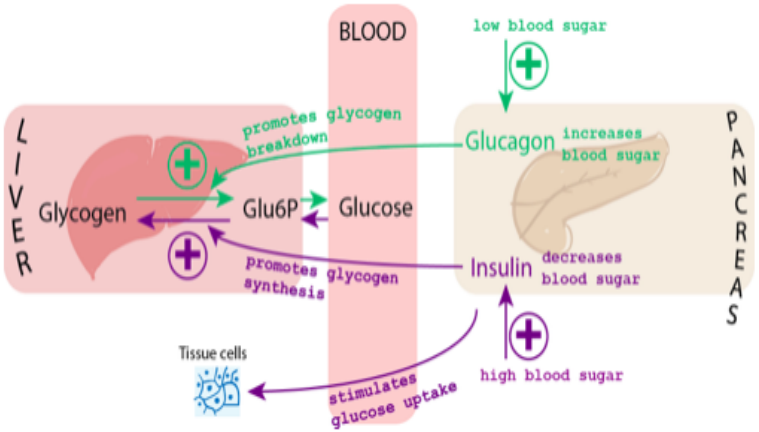


Role of Insulin

Insulin is a hormone produced in the beta cells in the pancreas

Insulin works to lower BGLs by facilitating the removal of glucose from the blood stream into the cells

Insulin controls production of glucose by the liver



Prevalence of Diabetes in Australia

Diabetes is the fastest growing chronic condition in Australia and the 7th leading cause of death.

280 people in Australia are diagnosed with diabetes every day – one every 5 minutes.

1.8 million Australians have been diagnosed with diabetes:

- 1.4 million known and NDSS registered, up to 500,000 undiagnosed
- ~ 10% with Type 1
- Gestational diabetes affects one in seven pregnancies

All types of diabetes are on the increase….

Data: diabetesaustralia.com.au accessed 20/4/22

Prevalence of Diabetes in Australia

Indigenous Australians are 3 times more likely to have type 2 diabetes compared with non-Indigenous Australians.

Up to 58% of cases of type 2 diabetes can be prevented in the high risk (pre-diabetes) population.

Risk Factors for Type 2 Diabetes

<u>Non modifiable</u>

- Family history of Type 2 diabetes
- Age over 40
- Aboriginality or other specific ethnic groups
- History of Gestational Diabetes
- Polycystic ovarian syndrome
- Anti- psychotic medications

Risk factors for Type 2

Modifiable risk factors

- Physical Activity- how much and what kind?
- Nutrition-" heart healthy" , fresh as much as is feasible, non- processed NUTRITIOUS
- Weight- 5-10% reduction
- Smoking(cellular oxidative stress, inflammation)
- Type 2 diabetes is PREVENTABLE and the progression of diabetes CAN BE DELAYED

Why is diabetes increasing?

- Type 2 diabetes is increasing at the fastest rate
- There are large numbers of people with silent, undiagnosed type 2 diabetes which may be damaging their bodies
- Obesity epidemic
- People are living longer
- Ethnicity - higher risk of type 2 diabetes in Chinese, South Asian, Indian, Pacific Islander and Aboriginal and Torres Strait Islander populations
- The combination of massive changes to diet and the food supply, with massive reduction in physical activity (more sedentary work and less activity)

Screening

People aged ≥ 55

People aged ≥ 45 with first degree relative or age ≥ 40 who have HTN/Obesity/both

People with aboriginal or other high risk ethnicities ≥ age 35

People with IFG or IGT (pre diabetes)

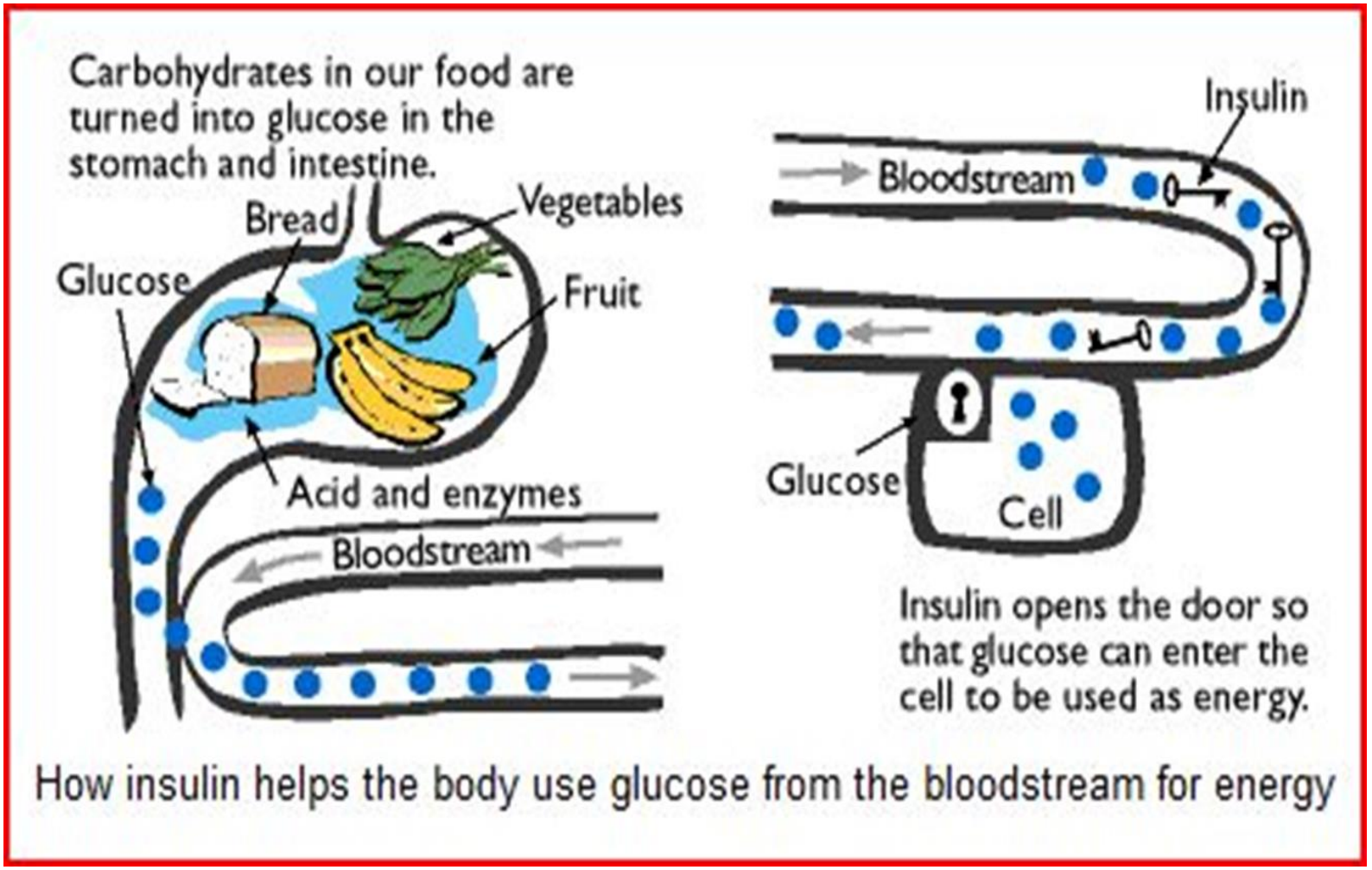
Women with history of GDM

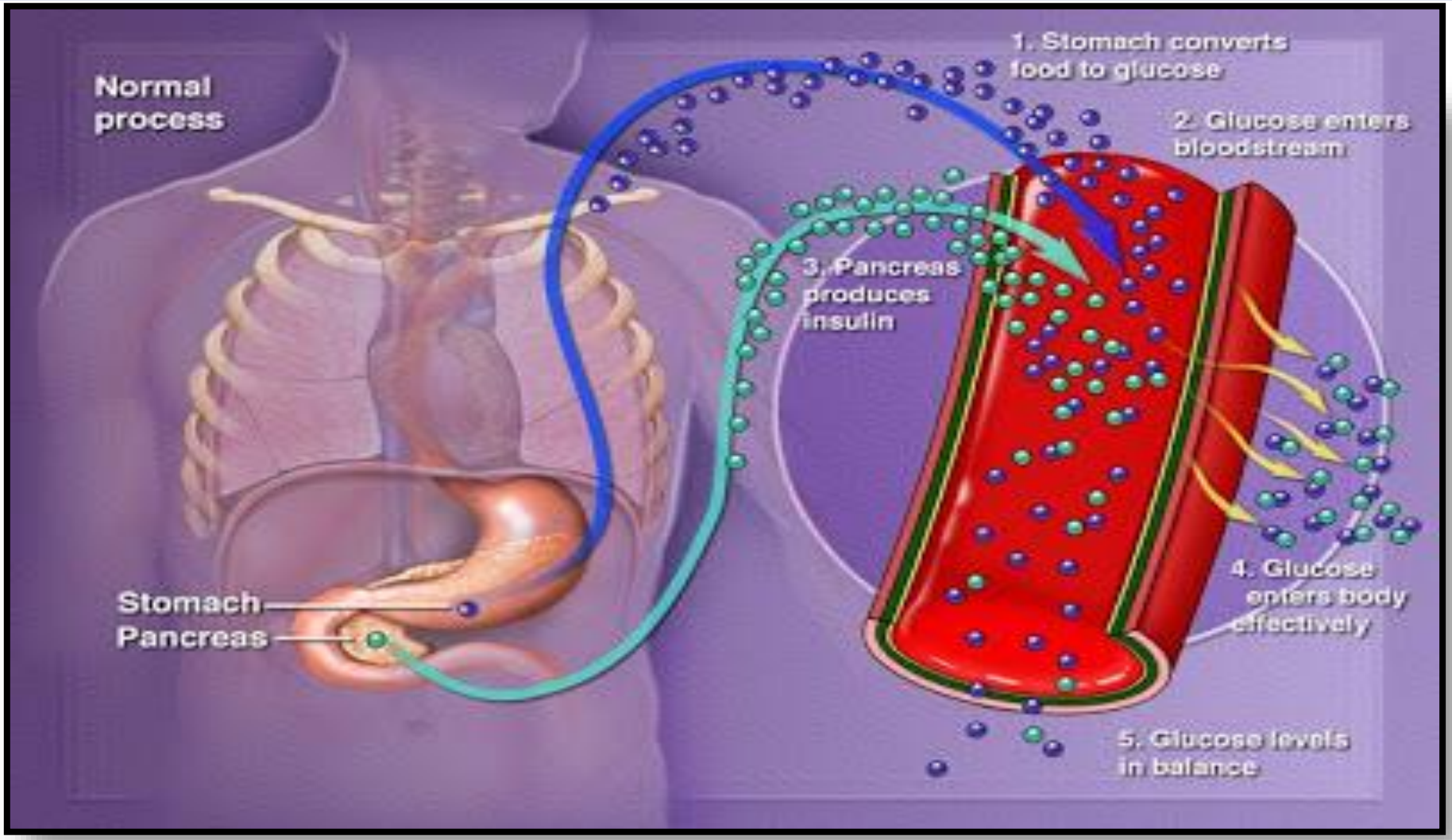
People on anti-psychotic medications

Medicare reimbursement for annual Hba1c screening test

Diagnostic criteria

- Fasting BG of ≥ 7 mmol/L- if asymptomatic -repeat
- HbA1c ≥ 6.5% (48 mmol/mol)- if asymptomatic -repeat
- Casual (random) BG of ≥ 11.1 mmol/L - if asymptomatic -repeat
- GTT fasting ≥ 7 2 h BG ≥ 11.1 mmol/L
- If asymptomatic- tests should be repeated on a subsequent day


Carbohydrates in our food are turned into glucose in the stomach and intestine.
Bread
Vegetables
Glucose
Fruit
Acid and enzymes
Bloodstream
Insulin
Bloodstream
Glucose
Cell
Insulin opens the door so that glucose can enter the cell to be used as energy.
How insulin helps the body use glucose from the bloodstream for energy


Normal process
1. Stomach converts food to glucose
2. Glucose enters bloodstream
3. Pancreas produces insulin
4. Glucose enters body effectively
5. Glucose levels in balance
Stomach
Pancreas

Types of Diabetes- Identify by cause

- Type 1 - Immune mediated
- Type 2 - Insulin resistance
- GDM – placental hormones
- LADA – Latent Autoimmune Diabetes Adult
- MODY-rare. Genetic
- Damage to the pancreas
- Atypical types

Type 1 Diabetes - NO Insulin Production

An *auto-immune condition* in which the immune system destroys the pancreatic beta cells, causing absolute insulin deficiency

- There is “ a trigger”.
- Positive GAD antibodies (glutamic acid decarboxylase) . to confirm diagnosis – GAD is an autoimmune marker of an attack on the cells that produce insulin.
- May present with Diabetic Ketoacidosis (DKA).
- Not linked to modifiable lifestyle factors.
- The onset of symptoms is generally sudden.
- Always need external insulin for survival.

Cannot be prevented

Type 1 Diabetes

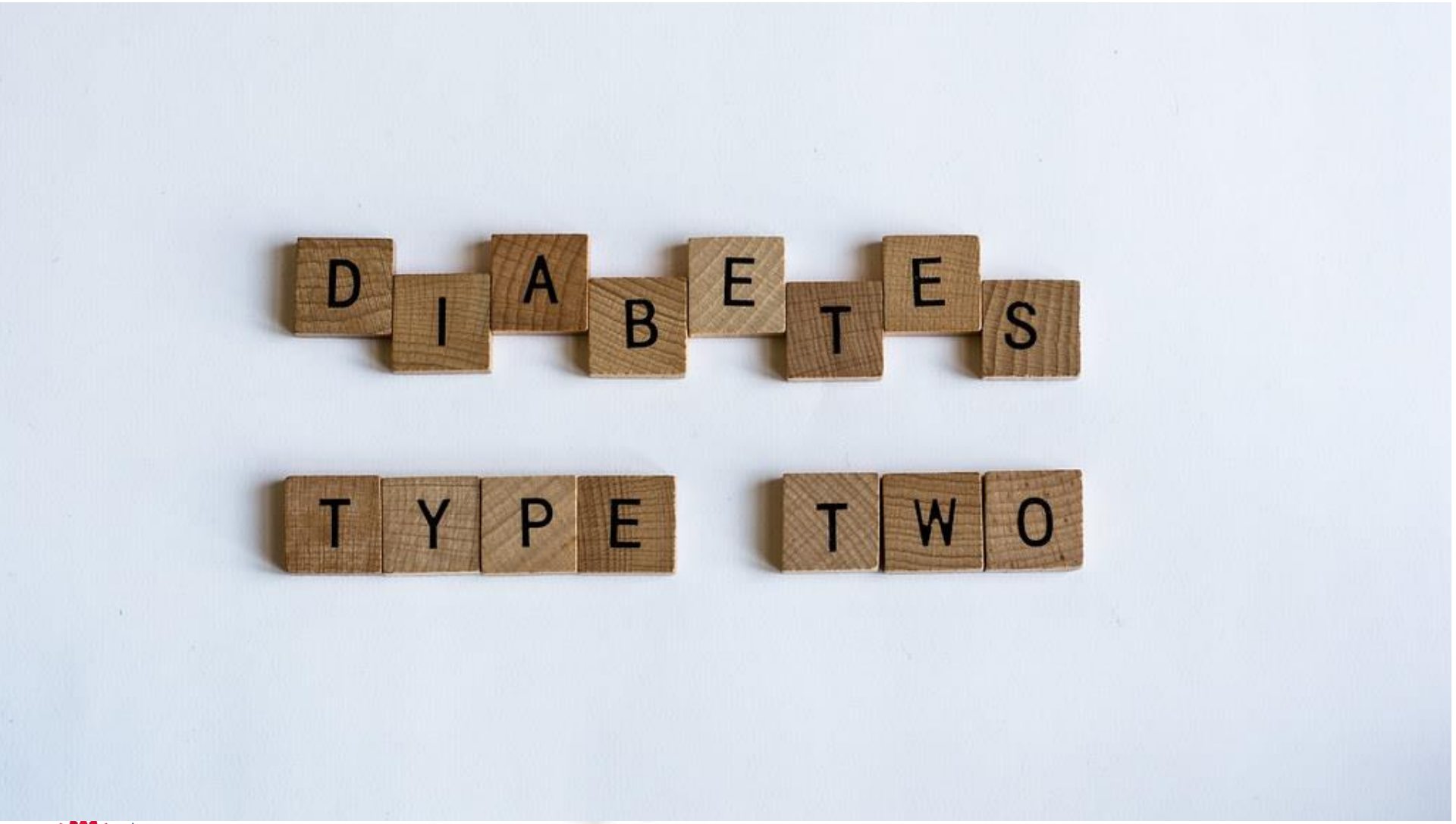
Type 1 diabetes can occur at any age - usually younger

- Typically presents with symptoms of diabetes such as polyuria, polydipsia and weight loss, however patients may present with minimal or no symptoms.
- If BGL >17mmol/L at presentation, please check serum ketones.
- If ketones +, likely indicative of insulin deficiency, requires urgent insulin initiation – even if obese phenotype.

Overlapping presentations

- Type 1 in the older person
- Type 2 in the younger person

If in doubt, assume type 1


DIABETES
TYPE TWO

TYPE 2 DIABETES

Chronic progressive condition

Insulin resistance → Insulin deficit

- Lifestyle changes (TLC)
- Oral glucose lowering medication
- May require insulin

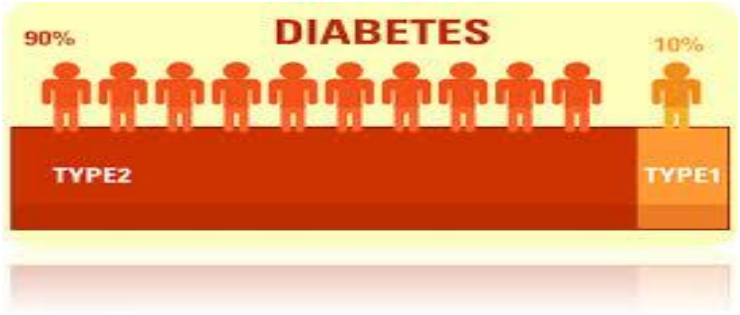
TYPE 2 REQUIRING INSULIN - *NOT IDDM*

Type 2 diabetes in children

- Type 2 diabetes is rapidly increasing in children and adolescents, accounting for approximately 5% of diabetes in this age group in Australia.
- Type 2 diabetes in children presents in a similar way as in adults - there is insulin deficiency and resistance.
- Strong family history (present in over 80% of cases) and predominately they are obese.
- Indigenous and some ethnic groups are at higher risk, such as Aboriginal and Torres Strait Islanders.

LADA – Latent Autoimmune Diabetes in Adults

- Slow progressing form of autoimmune diabetes.
- Despite the presence of islet antibodies at diagnosis of diabetes, the progression of autoimmune β-cell failure is slow.
- LADA patients may be managed at first by diet, weight reduction, exercise and possibly oral medications.
- May not need insulin injections for several months even years after diagnosis.



Other types of diabetes

There are other types of diabetes that account for about 3% of diabetes cases and can occur due to other conditions/syndromes, such as:

- Genetic defects of beta-cell function in pancreas and insulin action(MODY)
- Disorders of the pancreas (pancreatitis, cystic fibrosis, cancer of pancreas and other insults to pancreatic function)
- Endocrine disorders (acromegaly and Cushing`s syndrome)
- Drug or chemical induced diabetes (steroid-induced diabetes)
- Infections (congenital rubella)
- Uncommon but specific forms of immune-mediated diabetes mellitus
- Other genetic syndromes sometimes associated with diabetes

Cornerstones of Management

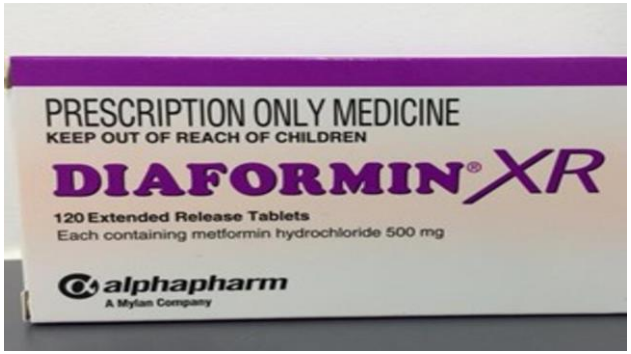
- Nutrition - for normal growth, development, activity, lifestyle and culture.
- Exercise - active lifestyle for all, incidental as well as planned, and weight loss for obese.
- Manage co-morbid risks- Optimal BP, cholesterol/lipid levels
- Oral Medication - if BGLs cannot be controlled by following a food plan and activity alone, 3 month trial often appropriate.
- Insulin Therapy - for all people with type 1 diabetes and in type 2 when diabetes no longer controlled by oral glucose lowering agents.
- Psycho-social support-
- Monitoring - either via 3–6 monthly HbA1c and/or self monitoring if appropriate.
- Education - for all people with diabetes and their carers to allow them to make informed decisions about their diabetes care. Encourage involvement in decision-making process regarding their care.
- Optimal Medical Management - involvement of the multidisciplinary diabetes team where appropriate, including regular assessment and complications screening.

Treatments

All of the knowledge we have does no good if…….

The patient does NOT take their medication or does NOT take it correctly……

Glucose Lowering Agents (GLA's)



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Glucose Lowering Agents (GLA's)

- Not a substitute for a healthy diet and physical activity.
- Type 2 diabetes is a progressive disease so GLA's are often required for treatment
- Important for the person with diabetes to understand that GLA's are not insulin
- SBGM becomes more beneficial to the client and the clinician when GLA treatment is commenced or adjusted

GLA's should be considered:

  - If target glycaemic control is not achieved after a 3-month period of healthy eating and regular exercise / activity
  - When severe symptoms are present such as polydipsia, polyuria, fatigue, blurred vision and infection.

Additional GLAs are added when current GLA has reached maximum prescribed or tolerated dose and target glycaemic control not achieved

As diabetes is progressive *medications needs regular review and adjustment*

DM 2- what's happening?

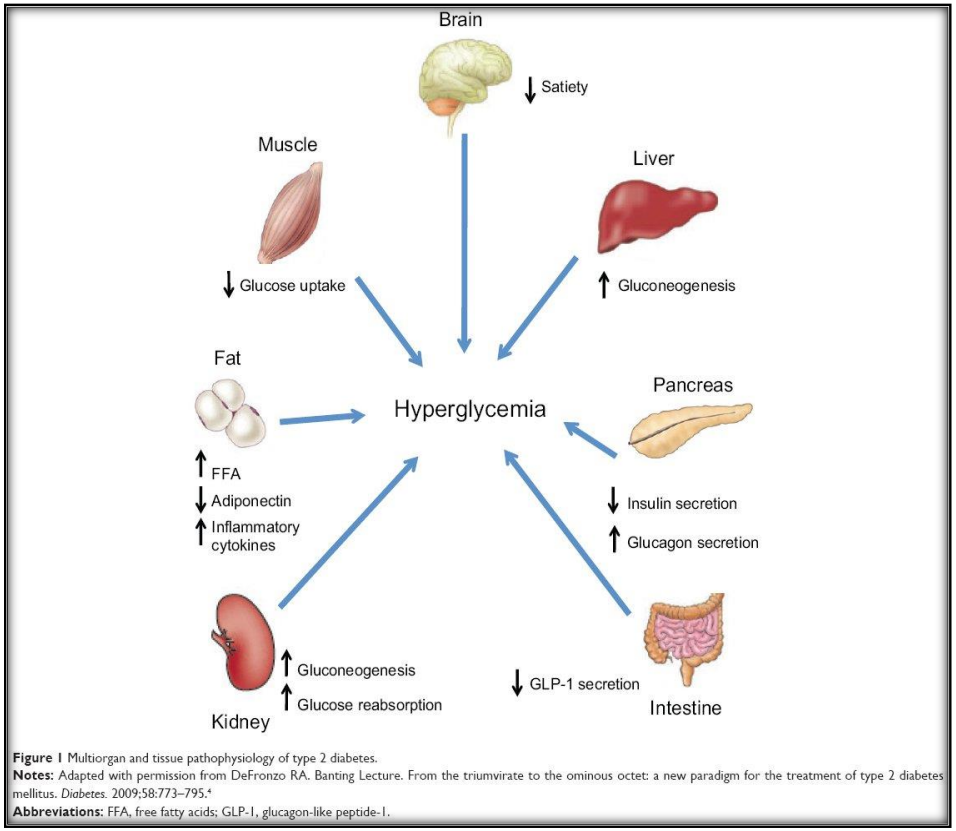


Figure 1 Multiorgan and tissue pathophysiology of type 2 diabetes.
Notes: Adapted with permission from DeFronzo RA. Banting Lecture. From the triumvirate to the ominous octet: a new paradigm for the treatment of type 2 diabetes mellitus. *Diabetes.* 2009;58:773–795.[4]
Abbreviations: FFA, free fatty acids; GLP-1, glucagon-like peptide-1.

1. Insulin resistance- cells
2. Pancreatic insufficiency
3. Liver overproducing stored glucose
4. Lack of key gut hormone
5. Kidneys re-uptake of BG
6. Brain – hunger satiety centre

Oral GLA classes

- Biguanides
- Sulfonylureas
- Alpha Glucosidase Inhibitors
- Thiazolidinediones (‘glitazones’)
- DPP-4 inhibitor (‘gliptins’)
- Glucagon-like peptide-1 agonists
- SGLT-2 (‘flozins’)

AUSTRALIAN TYPE 2 DIABETES GLYCAEMIC MANAGEMENT ALGORITHM

Australian Diabetes Society

All patients should receive education regarding lifestyle measures: healthy diet, physical activity and weight management.

Determine the individual's HbA1c target – commonly ≤53 mmol/mol (7.0%) but should be appropriately individualised (refer to ADS position statement).

Effect of changes in therapy should be reviewed in 3 months.

Review treatment: if not at target HbA1c or if presence of cardiovascular/chronic kidney disease –

- Check patient understanding of self-management including drug treatment
- Ensure current therapies are clinically appropriate including comorbidities/ therapies impacting glycaemic control
- Review medication adherence
- Assess tolerability, adverse effects and risk of interactions

Consider intensive weight management. Weight loss of ≥10% may allow a reduction or cessation of glucose lowering medication. Options include:

- Low energy or very low energy diets with meal replacements
- Pharmacotherapy
- Bariatric surgery.

Click here for the Australian Obesity Management Algorithm

Review treatment in 3 months. **If HbA1c not at target:** Reinforce education regarding lifestyle measures, physical activity and weight control.

MONOTHERAPY: Metformin is the usual monotherapy unless contraindicated or not tolerated

Metformin | SU | Insulin

Less commonly used are PBS approved: acarbose or TGA approved (but not PBS approved for monotherapy) DPP-4 inhibitor, SGLT2 inhibitor GLP-1RA, or TZD

DUAL THERAPY: Choice of treatment – add on an oral agent or injectable therapy

Choice of dual therapy should be guided by clinical considerations (presence of, or high risk of, cardiovascular disease, heart failure, chronic kidney disease, hypoglycaemia risk, obesity), side effect profile, contraindications and cost.

SGLT2 inhibitor | DPP-4 inhibitor | GLP-1RA | SU | Insulin

Less commonly used are PBS approved: acarbose or TZD

MULTIPLE THERAPIES: Choice of treatment : include additional oral agent or GLP-1 RA or insulin

Choice of agents should be guided by clinical considerations as above. Note: combinations not approved by PBS include GLP-1RA with SGLT2i or GLP-1RA with insulin (#). Consider *stopping* any previous medication that has not reduced HbA1c by ≥0.5% after 3 months, unless indicated for non-glycaemic benefits.

SGLT2 inhibitor | DPP-4 inhibitor | GLP-1RA | SU | Insulin

Less commonly used are PBS approved: acarbose or TZD

THEN...

To intensify treatment to meet glycaemic targets:

- If on metformin+SU+DPP-4i, consider *adding* SGLT2i, or *switching* DPP-4i to a GLP-1RA, or an SGLT2i.
- If on metformin+DPP-4i+SGLT2i consider *adding* SU or *adding* insulin.
- If on GLP-1RA consider *adding* basal or premixed/coformulated insulin (#).
- If on basal insulin, consider *adding* SGLT2i or GLP-1RA# or bolus insulin with meals, or *change* to premixed/coformulated insulin.
- Consider *stopping* medication that has not reduced HbA1c by ≥0.5% after 3 months unless indicated for non-glycaemic benefits.

With increasing clinical complexity consider specialist endocrinology consultation

For patients with high risk/established CVD, studies have shown improved all cause and CV death and non-fatal MI when used with usual care.

For patients with high risk/established heart failure (HF)/HF hospitalisation, studies have shown improved outcomes when used with usual care.

For patients with CKD as defined by albuminuria and/or eGFR >30 ml/min/1.73m², studies have shown reductions in important major renal end points, when used with usual care.

Exenatide (Byetta) and dulaglutide (Trulicity) are the GLP-1RA approved on the PBS for use with insulin.

Dark blue boxes indicate usual therapeutic strategy (order is not meant to denote any specific preference); usual refers to commonly available, evidence based, cost effective therapy.

Light blue boxes denote alternate approaches (order is not meant to denote any specific preference).

White boxes indicate less commonly used approaches.

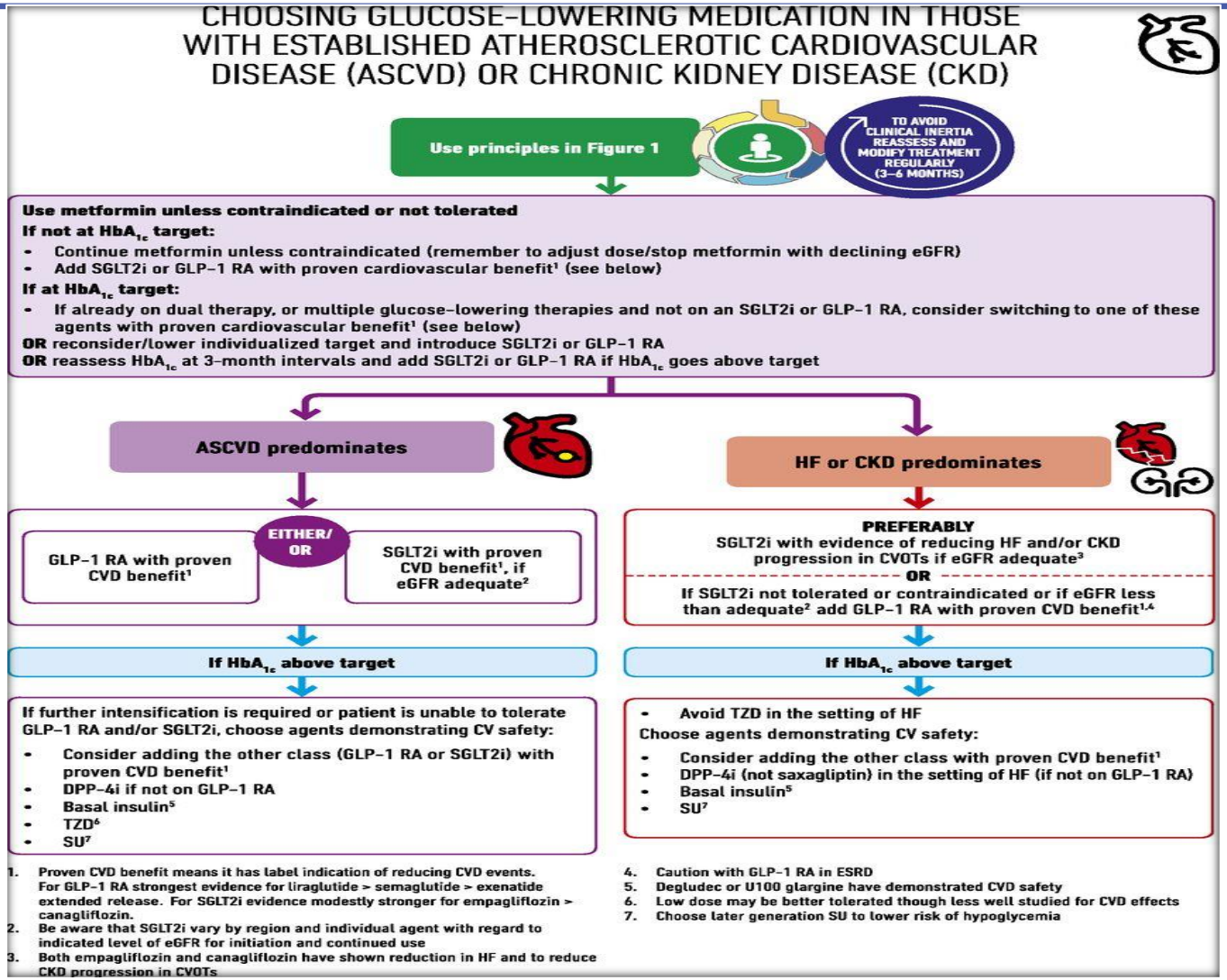
PBS = Pharmaceutical Benefits Scheme, HF = heart failure, CKD = chronic kidney disease, SU =sulfonylurea, TZD = thiazolidinedione, DPP-4i = dipeptidyl peptidase-4 inhibitor, GLP-1RA = glucagon like peptide-1 receptor agonist, SGLT2i = sodium glucose co-transporter inhibitor.

diabetes australia

NDSS National Diabetes Services Scheme An Australian Government Initiative

NSW GOVERNMENT Hea Hunt Loca

Choosing glucose-lowering medication in those with established ASCVD, HF, and CKD.



Melanie J. Davies et al. Dia Care 2018;41:2669-2701

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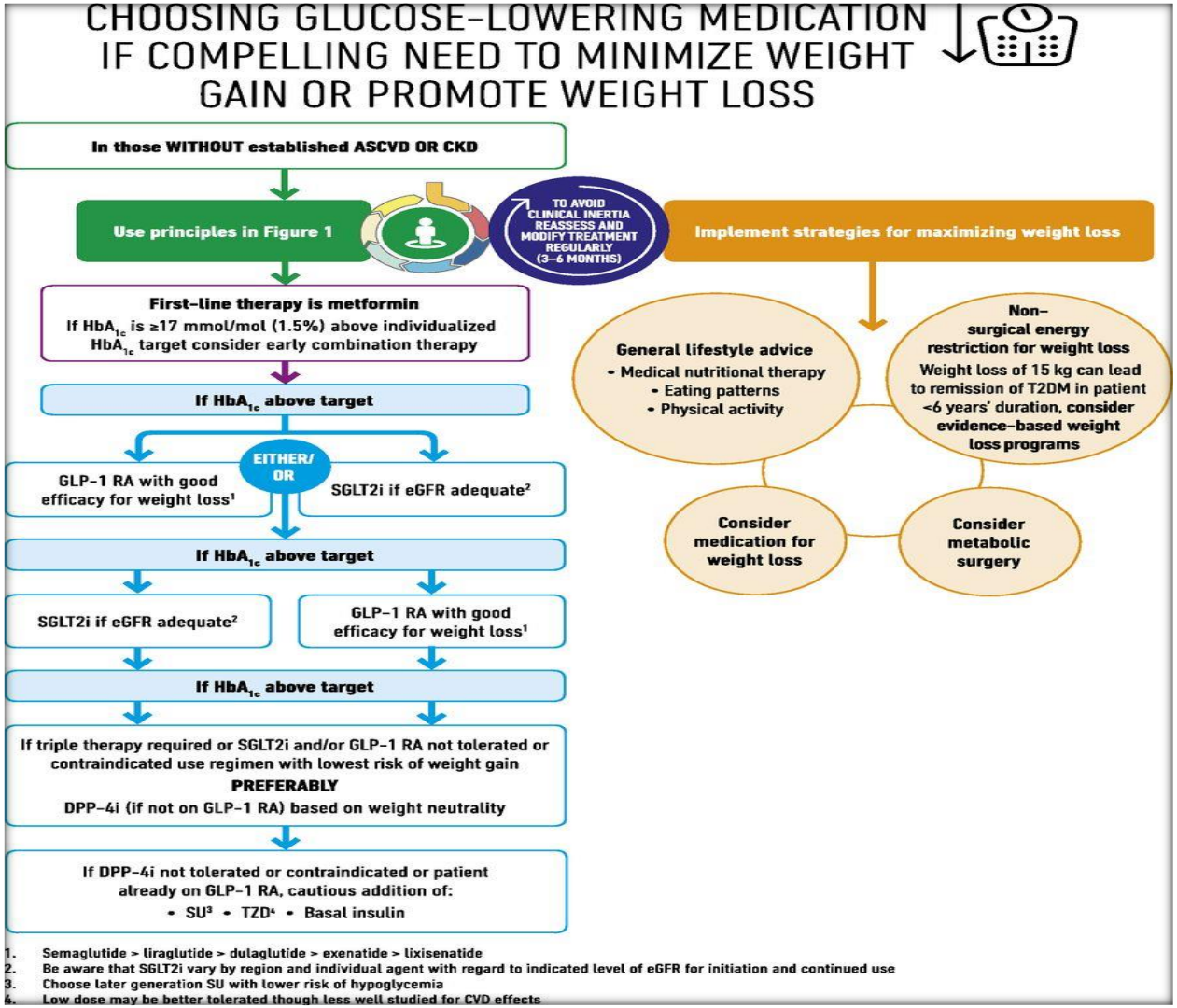
Choosing glucose-lowering medication if compelling need to minimize weight gain or promote weight loss.



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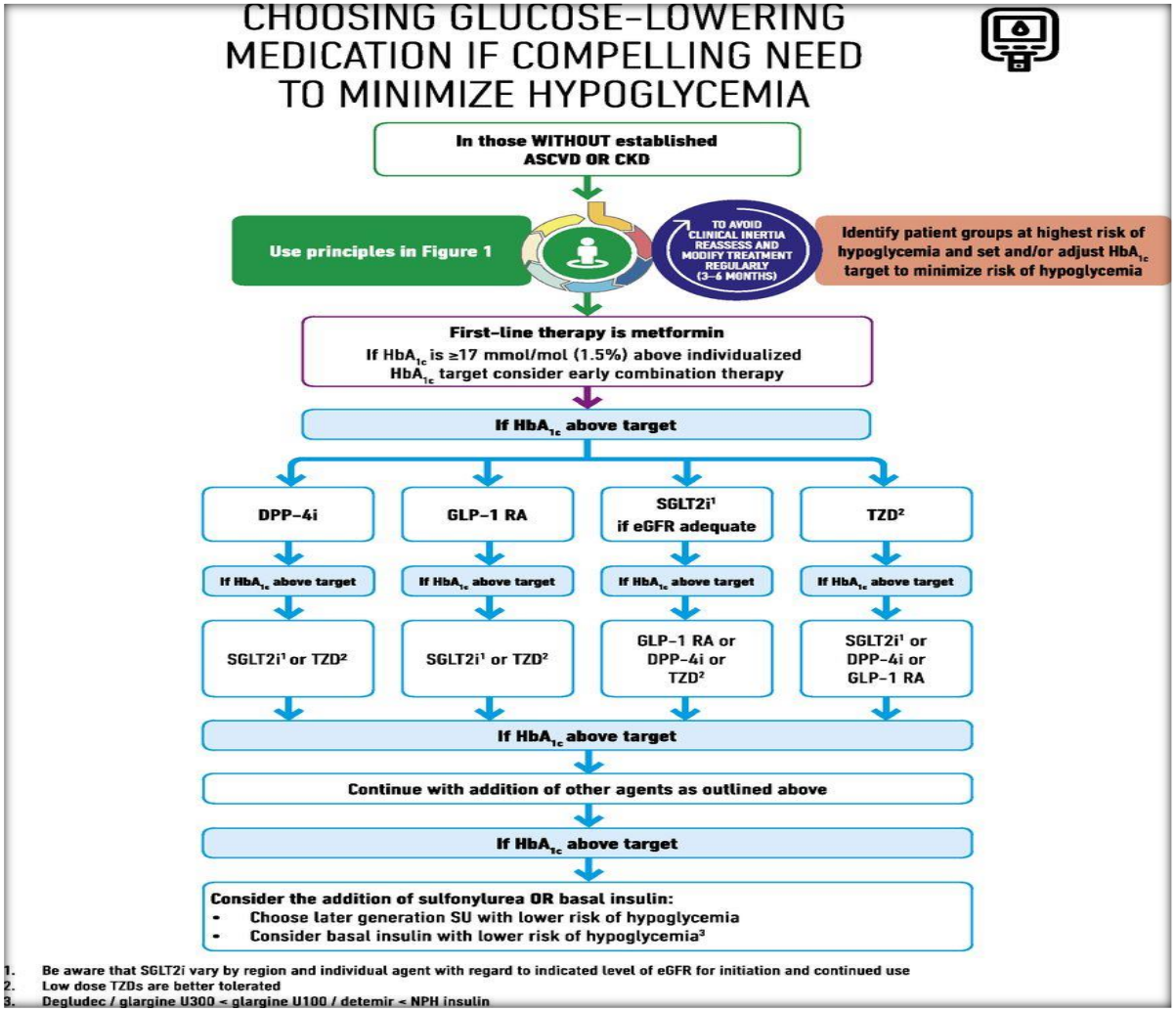
Choosing glucose-lowering medication if compelling need to minimize hypoglycaemia.



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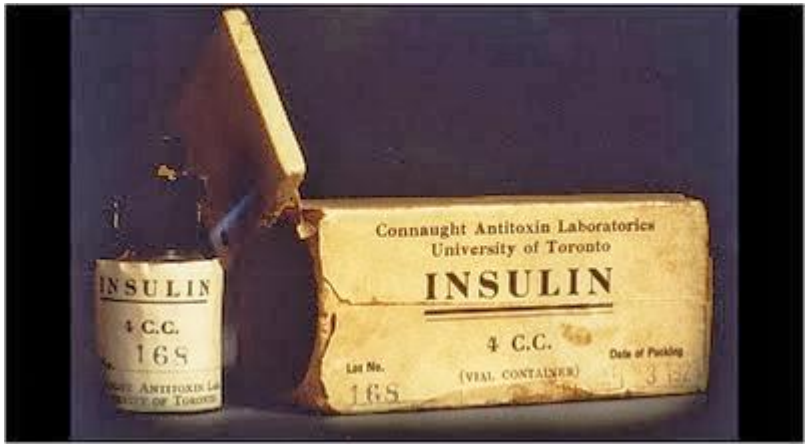
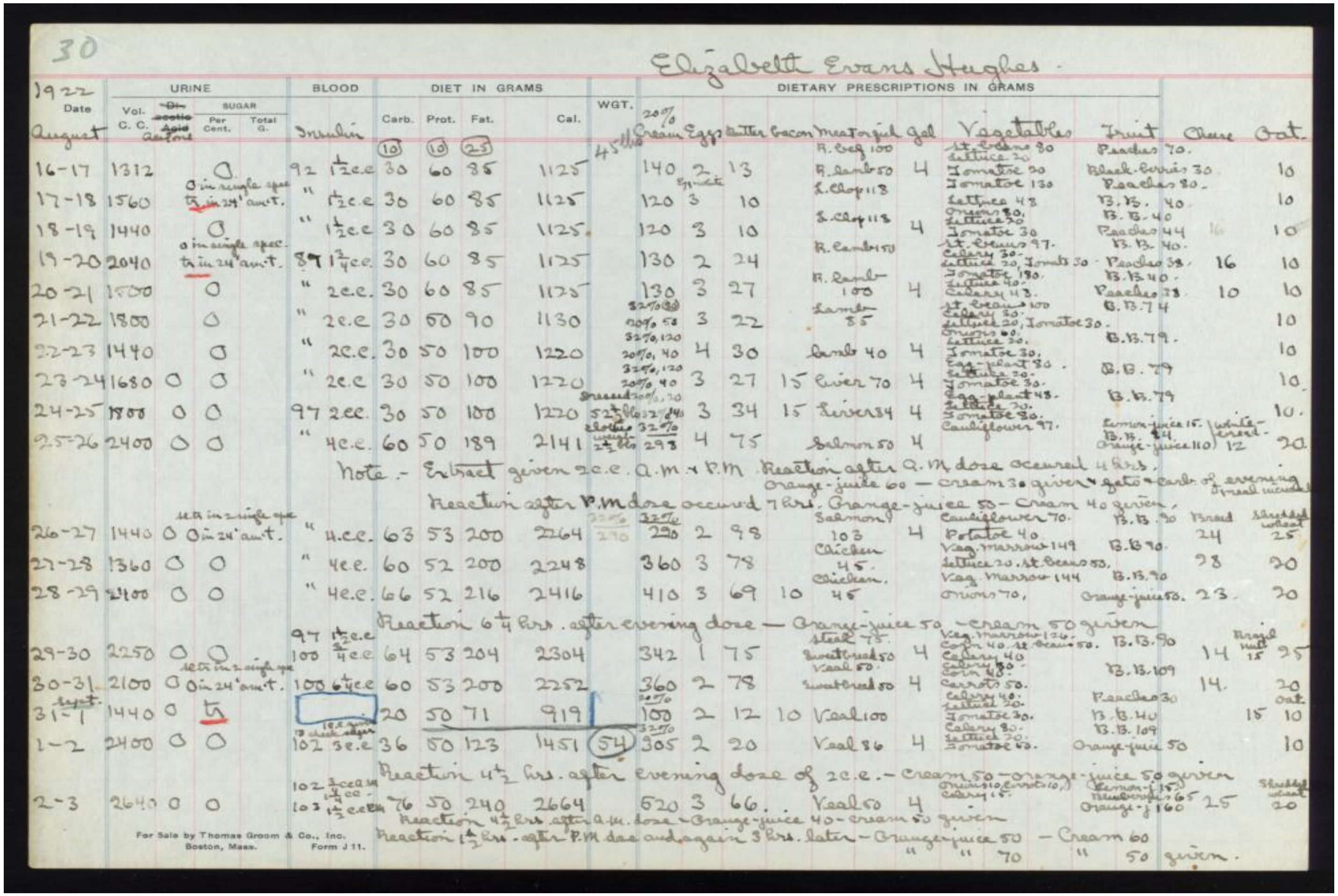


Insulin, food and glucose chart from 1922



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Elizabeth Evans Hughes

1922 Date August	Urine Vol. C.C.	Di-acetic Acid / Acetone	Sugar	Blood	Insulin	Carb.	Prot.	Fat.	Cal.	Wgt.	20% Cream	Eggs	Butter	Bacon	Meat or fish	Gel	Vegetables	Fruit	Chee	Oat.
						(10)	(10)	(25)												
16-17	1312		0 in single spec	92	1½ c.c.	30	60	85	1125		140	2	13		R. beef 100	4	St. beans 80, Lettuce 20, Tomatoe 20	Peaches 70, Black-berries 30		10
17-18	1560		tr in 24° amt.	"	1½ c.c.	30	60	85	1125		120	3	10		R. lamb 50, L. chop 118		Tomatoe 130	Peaches 80		10
18-19	1440		0 in single spec	"	1½ c.c.	30	60	85	1125		120	3	10		L. chop 118	4	Lettuce 48, Onions 30, Lettuce 30	B.B. 40, B.B. 40	16	10
19-20	2040		tr in 24° amt.	89	1¾ c.c.	30	60	85	1125		130	2	24		R. lamb 50		Tomatoe 30, St. beans 97, Celery 30, Lettuce 20, Tomato 30	Peaches 44, B.B. 40	16	10
20-21	1500		0	"	2 c.c.	30	60	85	1125		130	3	27		R. lamb 100	4	Tomatoe 180, Lettuce 40, Celery 43	Peaches 38, B.B. 40	10	10
21-22	1500		0	"	2 c.c.	30	50	90	1130		32% 60, 20% 58	3	22		Lamb 55		St. beans 100, Celery 30, Lettuce 20, Tomatoe 30	Peaches 38, B.B. 74		10
22-23	1440		0	"	2 c.c.	30	50	100	1220		32% 120, 20% 40	4	30		Lamb 40	4	Onions 60, Lettuce 30, Tomatoe 30	B.B. 79		10
23-24	1680	0	0	"	2 c.c.	30	50	100	1220		32% 120, 20% 40	3	27	15	Liver 70	4	Egg-plant 80, Lettuce 20, Tomatoe 30	B.B. 79		10
24-25	1800	0	0	97	2 c.c.	30	50	100	1220	52½ lbs	20% 70, 32% 40	3	34	15	Liver 34	4	Egg-plant 48, Lettuce 20, Tomatoe 30	B.B. 79		10
25-26	2400	0	0	"	4 c.c.	60	50	189	2141	clothes 52½ lbs	32% 293	4	75		Salmon 50	4	Cauliflower 97	Lemon-juice 15, B.B. 84, Orange-juice 110	white-bread 12	20

Note.- Extract given 2 c.c. a.m. & P.M. Reaction after a.m. dose occurred 4 hrs. Orange-juice 60 — cream 30 given & gets carb. of evening meal. Reaction after P.M. dose occurred 7 hrs. Orange-juice 50 — Cream 40 given.

1922 Date August	Urine Vol. C.C.	Di-acetic Acid / Acetone	Sugar	Blood	Insulin	Carb.	Prot.	Fat.	Cal.	Wgt.	20% Cream	Eggs	Butter	Bacon	Meat or fish	Gel	Vegetables	Fruit	Chee	Oat.
26-27	1440	0	0 in 24° amt. (sets in single spec)	"	4 c.c.	63	53	200	2264		32% 220	2	98		Salmon 103, Chicken	4	Cauliflower 70, Potatoe 40, Veg. marrow 149	B.B. 90, B.B. 90	Bread 24	Shredded wheat 25
27-28	1360	0	0	"	4 c.c.	60	52	200	2248		360	3	78		Chicken 45		Lettuce 20, St. beans 53	B.B. 90	28	20
28-29	2400	0	0	"	4 c.c.	66	52	216	2416		410	3	69	10	Chicken 45		Veg. marrow 144, Onions 70	Orange-juice 50	23	20

Reaction 6¼ hrs. after evening dose — Orange-juice 50 — cream 50 given.

1922 Date August	Urine Vol. C.C.	Di-acetic Acid / Acetone	Sugar	Blood	Insulin	Carb.	Prot.	Fat.	Cal.	Wgt.	20% Cream	Eggs	Butter	Bacon	Meat or fish	Gel	Vegetables	Fruit	Chee	Oat.
29-30	2250	0	0 (sets in single spec)	97, 100	1½ c.c., ¾ c.c.	64	53	204	2304		342	1	75		Steak 75, Sweetbread 50, Veal 50	4	Veg. marrow 126, Corn 40, St. beans 50, Celery 40, Corn 48	B.B. 90	14	Puffed wheat 15, 25
30-31	2100	0	0 in 24° amt.	100	6¼ c.c.	60	53	200	2252		360	2	78		Sweetbread 50	4	Carrots 50, Celery 40, Lettuce 20	B.B. 109	14	20
31-1 Sept.	1440	0	tr			20	50	71	919		32% 100	2	12	10	Veal 100		Tomatoe 30, Celery 30	Peaches 30, B.B. 40, B.B. 109	15	20 oat, 10
1-2	2400	0	0	102	3 c.c.	36	50	123	1451	(54)	32% 305	2	20		Veal 86	4	Lettuce 20, Tomatoe 60	Orange-juice 50		10

Reaction 4½ hrs. after evening dose of 2 c.c. — Cream 50 — orange-juice 50 given

1922 Date August	Urine Vol. C.C.	Di-acetic Acid / Acetone	Sugar	Blood	Insulin	Carb.	Prot.	Fat.	Cal.	Wgt.	20% Cream	Eggs	Butter	Bacon	Meat or fish	Gel	Vegetables	Fruit	Chee	Oat.
2-3	2640	0	0	102, 103	3 c.c., 1½ c.c.	76	50	240	2664		520	3	66		Veal 50	4	Onions 50, Carrots 10, Celery 15	Lemon-j 15, Blueberries 65, Orange-j 160	25	Shredded wheat 20

Reaction 4½ hrs after a.m. dose — Orange-juice 40 — cream 50 given

Reaction 1½ hrs. after P.M. dose and again 3 hrs. later — Orange-juice 50 — Cream 60 / " " 70 " 50 given.

For Sale by Thomas Groom & Co., Inc. Boston, Mass. Form J 11.

Insulin Treatment

Essential for type 1 diabetes; enables glucose uptake and metabolism

May be required in type 2 diabetes if lifestyle measures and GLAs do not achieve target glycaemic control or when GLAs unsuitable

GDM / type 2 during pregnancy (Metformin possibility during pregnancy but no other GLAs and insulin may be required if targets are not met)

50% type 2 require insulin 10 years post diagnosis

Insulin is an anaerobic steroid that encourages weight gain – now that alternatives like GLP-1 are available these should be considered initially

A person does not become type 1 when insulin treatment is required

The choice is determined to support normal physiological changes

Insulin Delivery Devices

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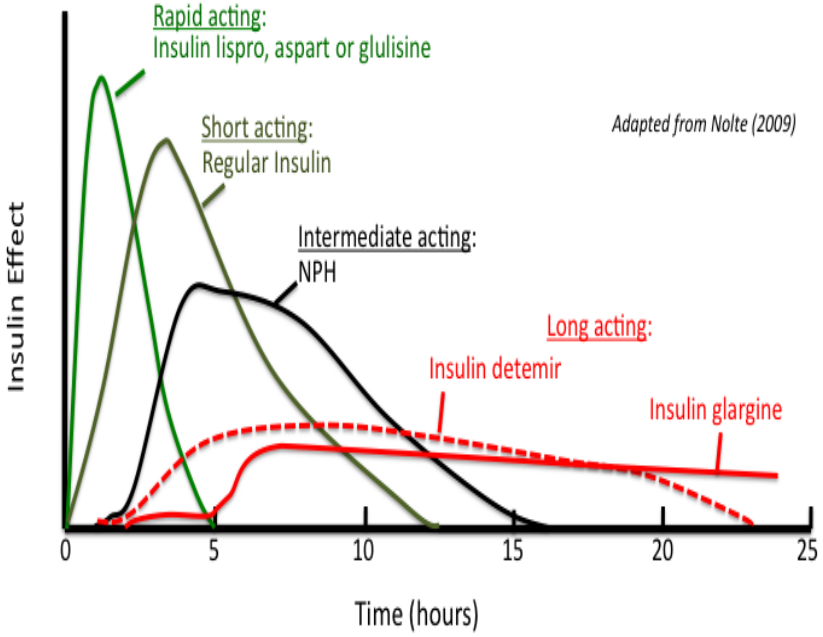
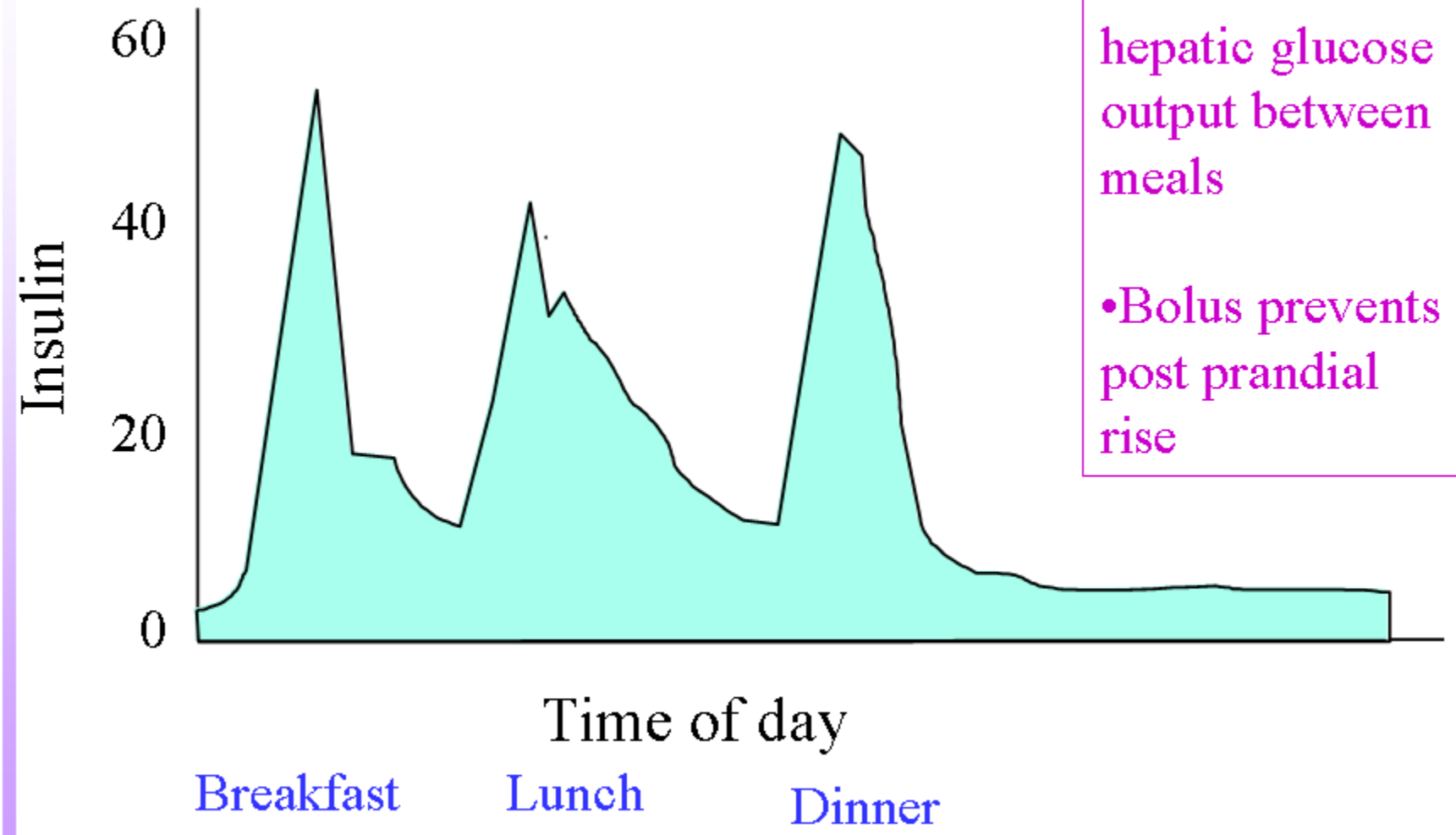
Insulin Types

- Quick or Ultra short-acting insulin
- Short-acting insulin
- Intermediate-acting insulin
- Long-acting insulin
- All preparations contain 100 U/mL and are suitable for SC injection
- Short-acting insulin can be given IV e.g. diabetic ketoacidosis

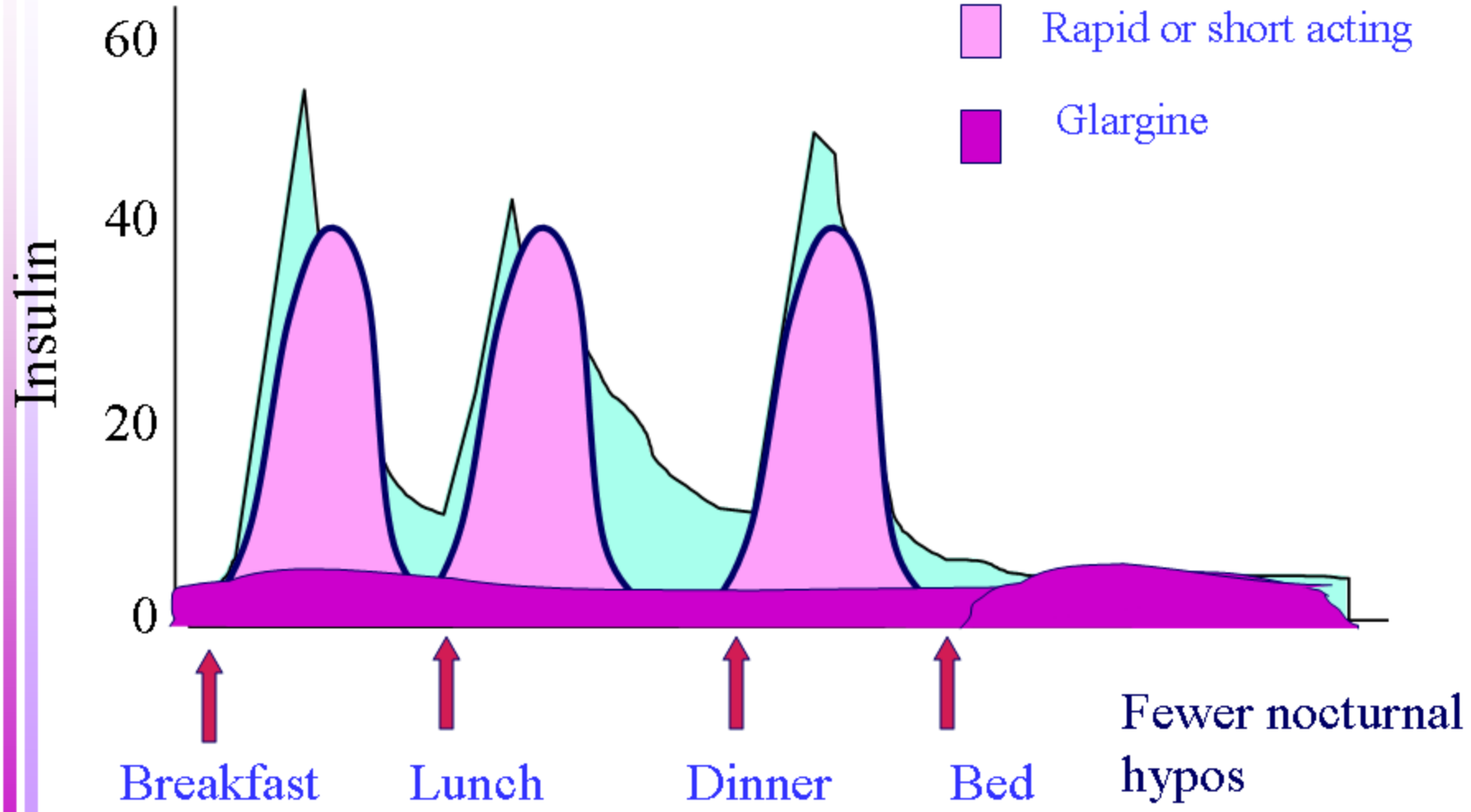


Normal insulin secretion



- Basal controls hepatic glucose output between meals
- Bolus prevents post prandial rise

Basal-bolus regimen using glargine



Rapid Acting Insulin

Onset: 5-15min

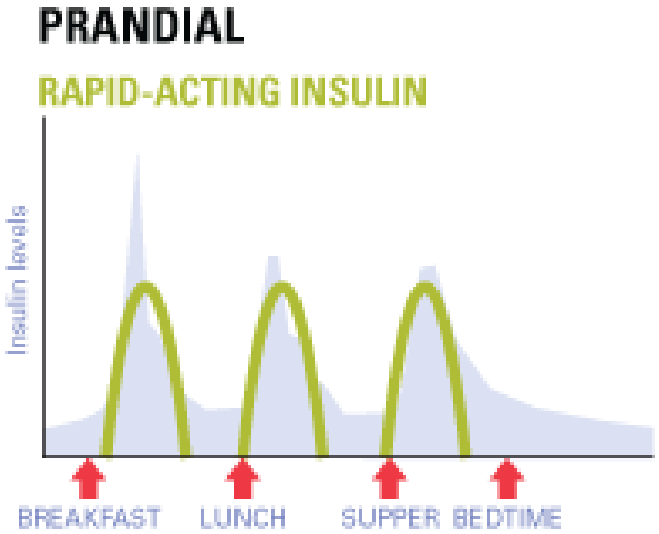
Peak: 1-3 hours

Duration: 3 – 5hours

To have 15 minutes to immediately prior meal or correct hyperglycaemia

Clear insulin

eg.**NovoRapid®** (insulin aspart) / **Humalog®** (insulin lispro) / **Apidra®** (insulin glulisine)



Long Acting insulin

Onset: 1-4 hours

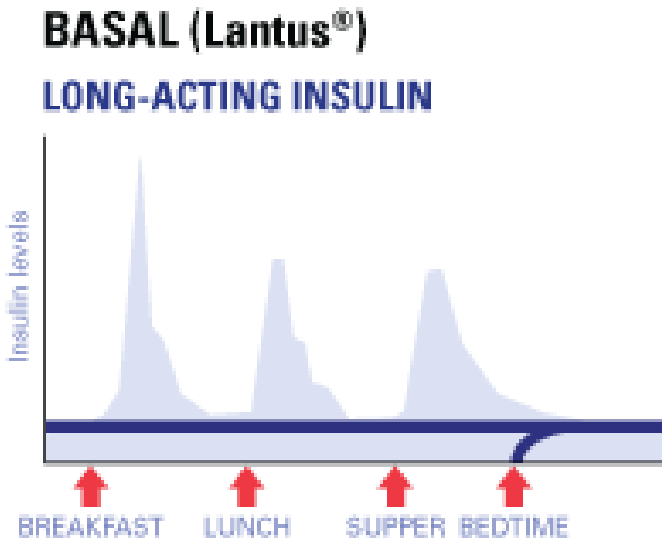
Peak: 0 – 8

Duration: 12-24 hours

Clear insulin

Given once or twice daily

e.g. **Detemir [Levemir®] Glargine [Lantus®]**



Premixed Insulin ; Rapid and Intermediate acting insulin

Onset:10 - 20 min

Peak:1-4 hours

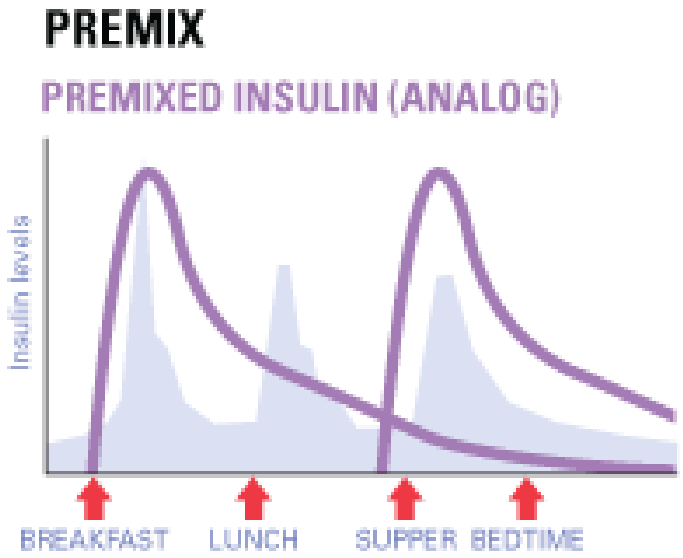
Duration: up to 24 hours

e.g. **NovoMix 30® / Humalog Mix 25® / Humalog Mix 50®**

Given once / twice / three times daily

Cloudy insulin (**gently rotate vials in hands before use to ensure resuspension)**

Have 15minutes to immediately prior meal



Ryzodeg

- Co-formulation of rapid (Aspart) acting insulin and basal (Degludec) insulin
- Can be once to twice daily- if once daily-with the largest CHO meal of the day. Timing of injection can be customized on patient's meal schedule-
- CLEAR- NO mixing

Frequent Problems with Insulin Therapy

- Not mixing pre-mixed insulin
- Injection site – lipohypertrophy
- Not changing needles
- Insulin outdated, left outside for too long in hot weather
- Not timing premixed insulin, prandial insulin with meals
- Inconsistent carbohydrate intake
- No regular BGL monitoring
- Wrong insulin dispensed (Humalog versus Humalog Mix insulin)
- Recurrent hypoglycaemia and defensive eating

PRECAUTIONS, CONTRAINDICATIONS, POTENTIAL INTERACTIONS & SIDE EFFECTS

Hypoglycaemia (over dosing)

Hyperglycaemia (under-dosing)

Insulin requirements can be affected by

- infection / illness
- exercise / diet
- stress / hormonal changes

Allergy (extremely rare)

Absorption of insulin can be accelerated by

- increase in body temperature
- increase in temperature at injection site (e.g. hot baths)
- exercising the area of injection
- massaging
- injecting intramuscularly

Insulin Storage

Store unopened insulin in fridge until opened (not freezer)

Open vials / pens in cool, dark place (4weeks)

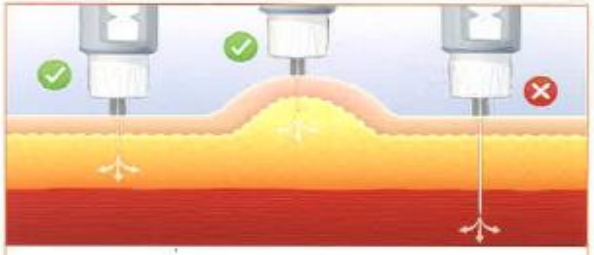
Discard insulin if:

- kept unrefrigerated > 4 weeks
- past expiry date
- insulin is discoloured
- clear insulin has turned cloudy
- lumps or flakes present
- has been frozen or exposed to high temps
- cannot achieve uniform suspension

Injection technique

General Recommendations on Injection Technique

Pen Needle length	Technique for most patients	Exceptions	% Risk of Intramuscular (IM) Injection^3
4mm		Very thin adults or children may require a skinfold	0.4%
5mm		Overweight or obese adults may not require a skinfold	1.8%
6mm		Overweight or obese adults may not require a skinfold	5.7%
8mm		Use of an 8mm pen needle is discouraged for children	15.3%



Accidental IM injection may result in [2,3]:

- Hypoglycaemia
- Pain
- Bruising
- Bleeding

Insulin should be injected into subcutaneous tissue for consistent absorption.[2]

Table adapted from reference 3.

Pen needles are for single use only.

Needle re-use can result in lipohypertrophic (lipo) formation, pain, and needle deformation.[4,5]

Needle used 2 TIMES 

Needle used 3 TIMES 

Needle used 6+ TIMES 

Photographs from Dieter Look and Kenneth Strauss: "Nadeln mehrfach verwenden?" Diabetes Journal 1998, 10:S31-34.

Injection technique for BD AutoShield™ Duo may vary. Skin stabilisation may be required for loose or soft skin. ^Calculated risk into adult population, needle inserted at 90 degree angle without a skin fold.

1. Hirsch L, Gibney M, Berube J, *et al. J Diabetes Sci Technol.* 2012; 6(2): 328-335. 2. Frid AH, Kreugel G, Grassi G *et al*;*Mayo Clin Proc.* September 2016;91(9):1231-1255. 3. Gibney M, Arce C, Byron K, *et al. Curr Med Res Opin.* 2010; 26(6): 1519-1530. 4. Frid A, Hirsch L, Gaspar R, *et al. Diabetes Metab.* 2010; 36: S3-S18. 5. Mesnikova I, Dreval A, Gubkina V, *et al. Journal of Diabetology.* 2011; 1(1).

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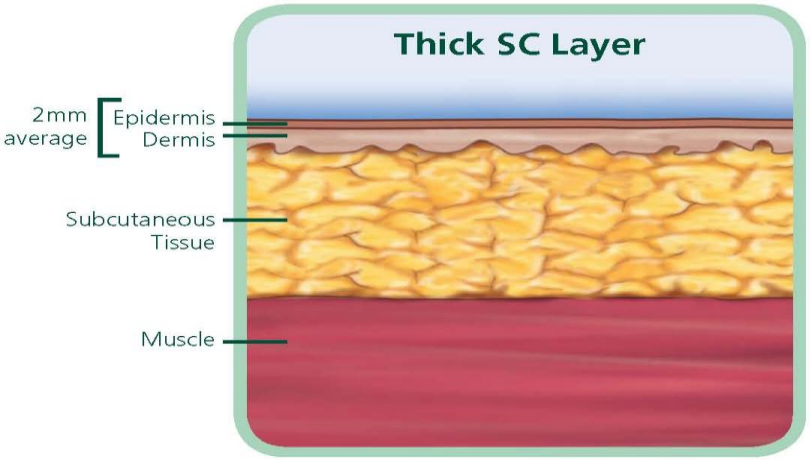
Targeting the Subcutaneous Tissue

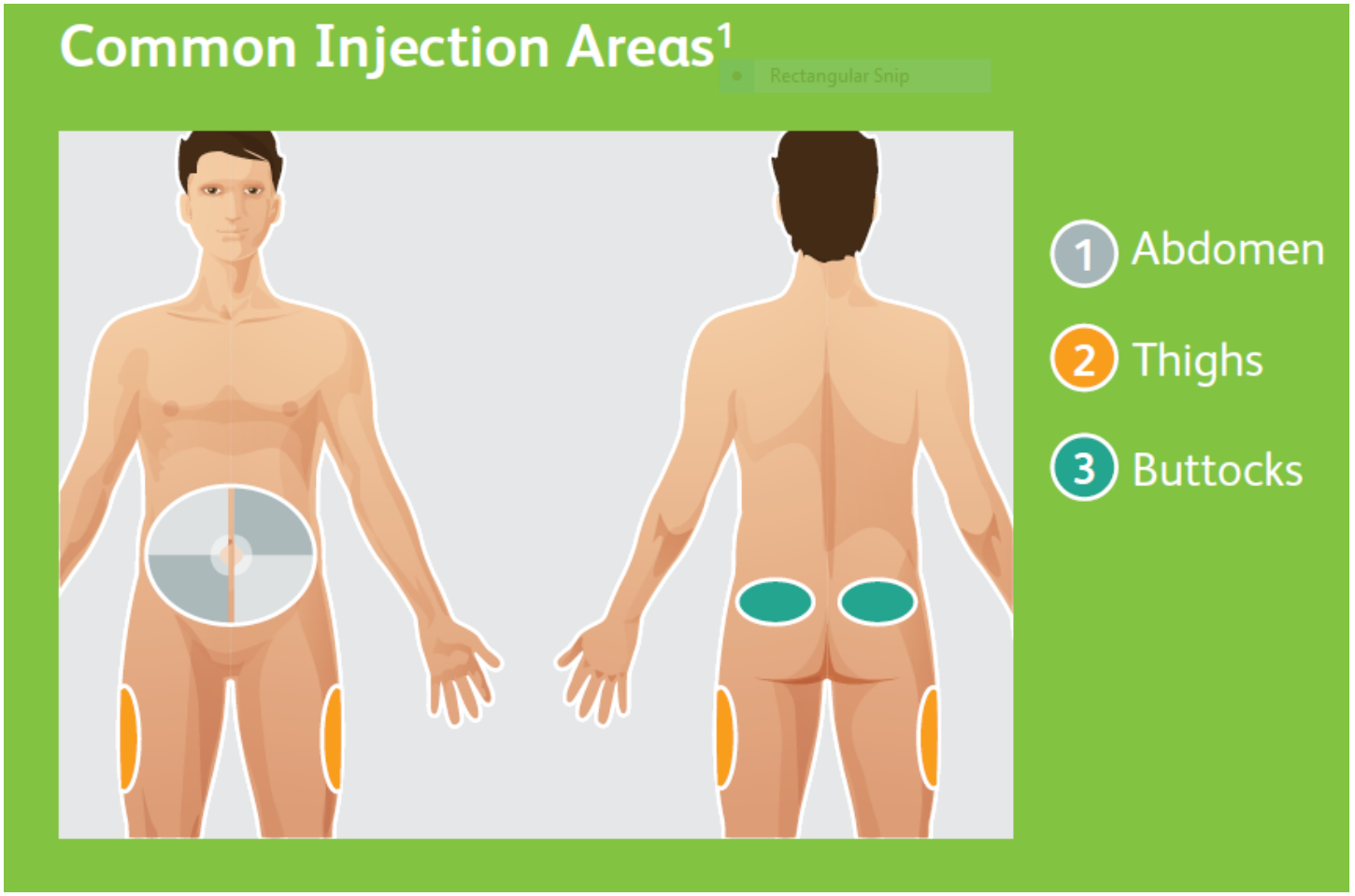


- Intradermal Tissue
  - Highly variable blood flow
- Muscle Layer
  - High general blood flow
  - Blood flow further increased with activity
- Subcutaneous Tissue
  - Stable, slow, reliable blood flow

fit

FIT Recommends
Use the correct needle length to ensure that the injectable therapy is delivered into the subcutaneous tissue

Where to inject



Detecting lipohypertrophy

Ideally the patient should stand with injection site to be examined exposed

Visual Check

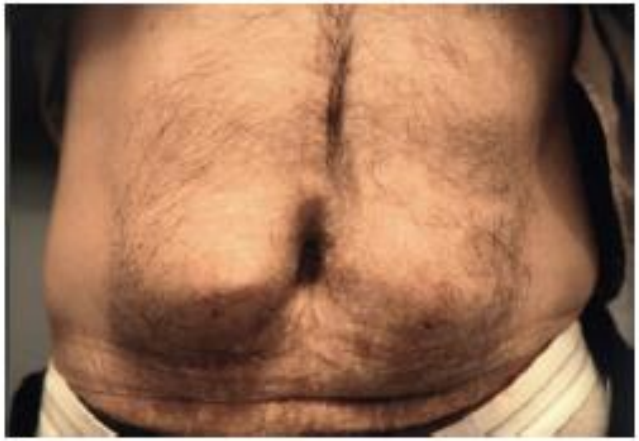
- At eye level of injection site being examined and look for:
  - Needle insertion points
  - Small subcutaneous bruises
  - Lipohypertrophy (swellings/fatty lumps or depressions)
  - Hair loss

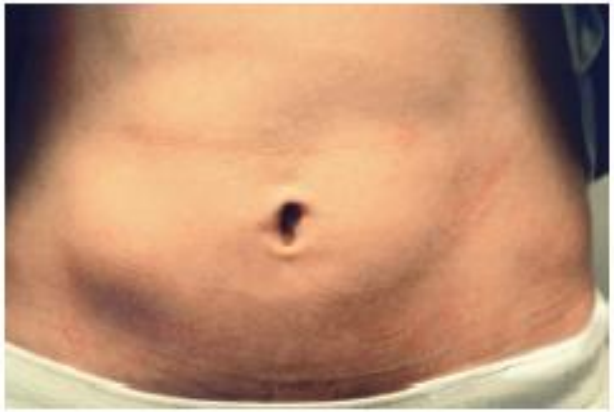
Palpation Check

- Move finger across the injection site (a light touch can often detect lipos more easily than a firmer one)
- Feel for an irregularity of the skin and underlying tissue (softer malleable tissue compared with harder rubbery tissue)

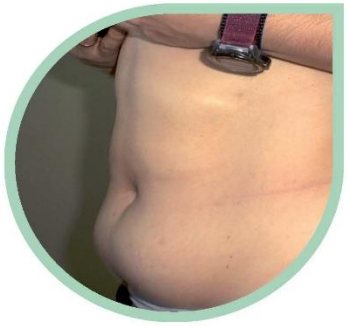
fit

FIT Recommends
Ideally inspect at every visit and teach self inspection of sites





Risk associated with lipohypertrophy



Implications of injecting into areas of lipohypertrophy

- Significant unpredictable and delayed absorption leading to possible hyperglycaemia and/or hypoglycaemia
- Malabsorption from lipohypertrophic sites may result in unnecessarily large doses fo insulin be used

ITQ Results*

- **54%** of the participants reported having lipohypertrophy at some time in their life
  - **47%** in the adult group
  - **71%** in the children and adolescent group
- **2.6%** always injected into lipos and **25%** inject into them sometimes
- Only **46%** of participants have their sites checked every visit

*Fried A. et al. (2010) The Third Injection Technique Workshop in Athens (TITAN). Diabetes & Metabolism 36: 519-529

fit

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Insulin commencement education

Need for comprehensive assessment, education and ongoing support.

Minimal education needs for urgent insulin initiation:

- Technique
- SBGM
- Recognition & treatment of hypoglycemia
- Safe sharps disposal
- 5 to drive
- NDSS upgrade

CONTINUOUS SUBCUTANEOUS INSULIN INFUSION

Research has shown that insulin pump therapy can reduce the frequency of severe Hypoglycaemia as well as improve the quality of life of pump users

Government subsidies for pump consumables via the National Diabetes Services Scheme (NDSS) have made it a more affordable option for many people.

Pumps are worn 24 hours a day, but can be detached as necessary for swimming, showering and other activities.

Use as per manufactures instructions

Clinical management goals

Treatment targets for people with type 2 diabetes include the following. For a comprehensive list of assessments and screening intervals, refer to the section 'Assessment of the patient with type 2 diabetes'.

HbA1c	Target needs individualisation according to patient circumstances Generally ≤7% (53 mmol/mol)
Lipids	Initiation of pharmacotherapy is dependent on the assessment of absolute CVD risk (refer to the Australian absolute cardiovascular disease risk calculator). This uses multiple risk factors, which is considered more accurate than the use of individual parameters Once therapy is initiated, the specified targets apply; however, these targets should be used as a guide to treatment and not as a mandatory target
Total cholesterol	<4.0 mmol/L
HDL-C	≥1.0 mmol/L
LDL-C	<2.0 mmol/L; <1.8 mmol/L if established CVD is present
Non–HDL-C	<2.5 mmol/L
Triglycerides	<2.0 mmol/L
Blood pressure	≤140/90 mmHg Lower blood pressure targets may be considered for younger people and for secondary prevention in those at high risk of stroke The target for people with diabetes and albuminuria/proteinuria remains <130/80 mmHg. As always, treatment targets should be individualised and monitored for side effects from medications used to lower blood pressure
Urine albumin excretion	UACR: • women: <3.5 mg/mmol • men: <2.5 mg/mmol Timed overnight collection: <20 µg/min; spot collection: <20 mg/L
Vaccination	Recommended immunisations: influenza, pneumococcus, diphtheria-tetanus-acellular pertussis (dTpa). Consider: hepatitis B (if travelling), herpes zoster

Individual goals	
Encourage all people with type 2 diabetes to approach/reach these goals.	
Diet	Advise eating according to the *Australian dietary guidelines*, with attention to quantity and type of food Advise individual dietary review for people with difficulty managing weight, difficulty maintaining glucose levels in target range, CVD risk, or if otherwise concerned
BMI	Advise a goal of 5–10% weight loss for people who are overweight or obese with type 2 diabetes For people with BMI >35 kg/m^2 and comorbidities, or BMI >40 kg/m^2, consider facilitating greater weight-loss measures
Physical activity	Children and adolescents: at least 60 min/day of moderate-to-vigorous physical activity, plus muscle- and bone-strengthening activities at least three days/week Adults: 150 minutes of aerobic activity, **plus** 2–3 sessions of resistance exercise (to a total ≥60 minutes) per week
Cigarette consumption	Zero per day
Alcohol consumption	Advise ≤2 standard drinks (20 g of alcohol) per day for men and women
Blood glucose monitoring	Advise 4–7 mmol/L fasting and 5–10 mmol/L postprandial SMBG is recommended for patients with type 2 diabetes who are using insulin. Education should be provided regarding frequency and timing of insulin dose For people not on insulin, the need for and frequency of SMBG should be individualised, depending on type of glucose-lowering medications, level of glycaemic control and risk of hypoglycaemia, as an aid to self-management SMBG is recommended in pregnancy complicated by diabetes or gestational diabetes SMBG is also recommended for people with hyperglycaemia arising from intercurrent illness. It may be helpful in haemoglobinopathies or other conditions where HbA1c measurements may be unreliable

Case Study 1

Samuel is aged 57 years of age. He has suffered from angina for the past 3 years and to date he has not been screened for diabetes.

Samuel's grandmother had type 2 diabetes and his mother had gestational diabetes. Samuel has put on a lot of weight since the angina started as he becomes short of breath quickly and is fearful of increasing the angina. He does very little exercise except for playing in his vegetable garden.

Case Study 2

Mr Brown is a 50 year old farmer with type 2 diabetes. He is on Metformin 1 gram TDS and a Diamicron twice daily. His HbA_1c is 9.0% and blood glucose levels are erratic. He feels hungry and shaky before meals especially in the middle of the afternoon and wakes up sweaty at night. He also reports weight gain. He finds it difficult to have regular meals and frequently misses lunch when out on his property.

Case Study 2

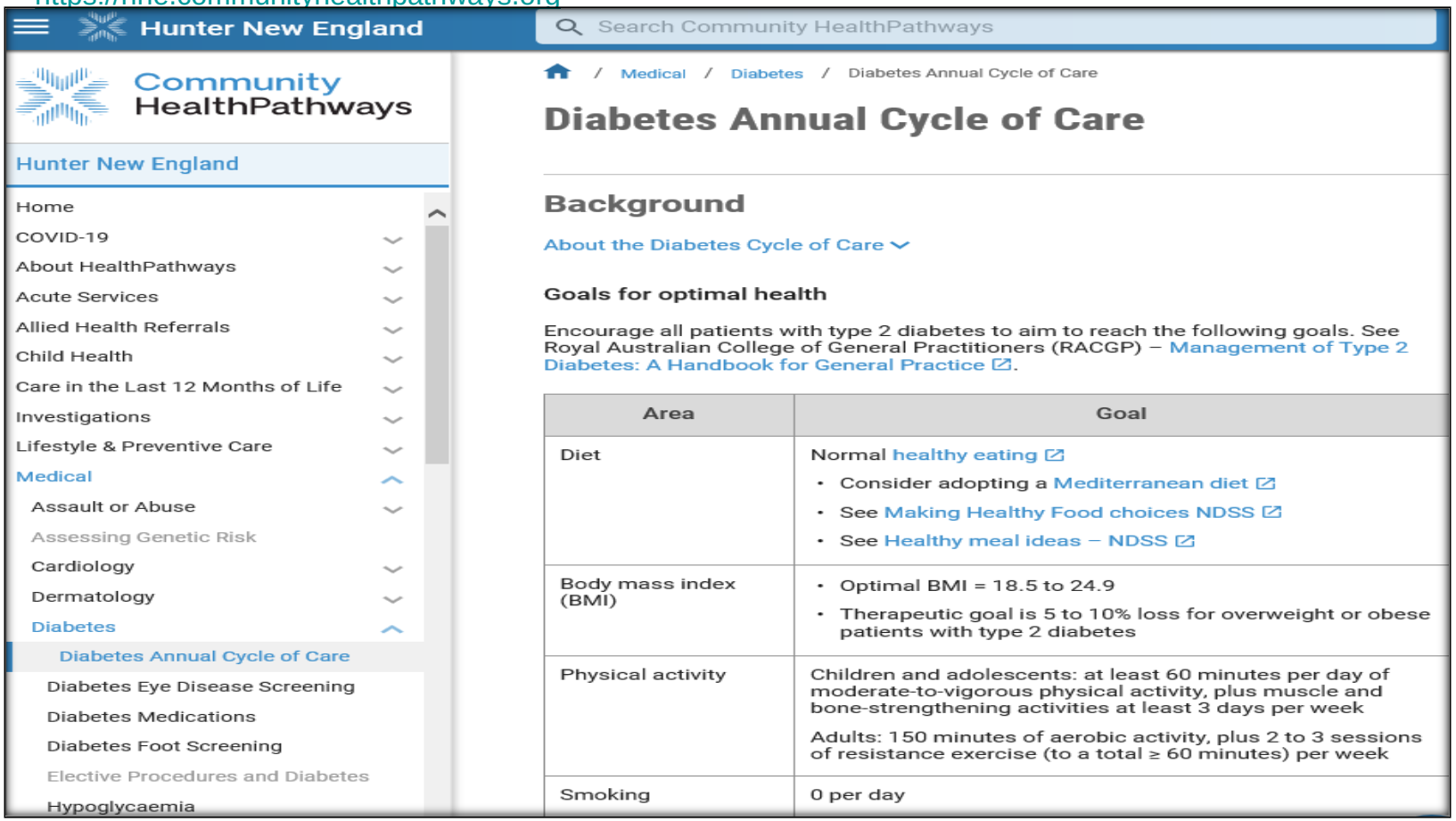
Despite trying to have regular meals Mr Brown still finds he is having episodes of low blood glucose levels. He consults his General Practitioner and he is recommended to commence on one Janumet 50/1000 BD with instructions to cease his Diamicron.

Outcome: HbA_1c 8.0%, sleeping better, less hungry, and missing lunch occasionally. Has lost 1.5kg in 3 months

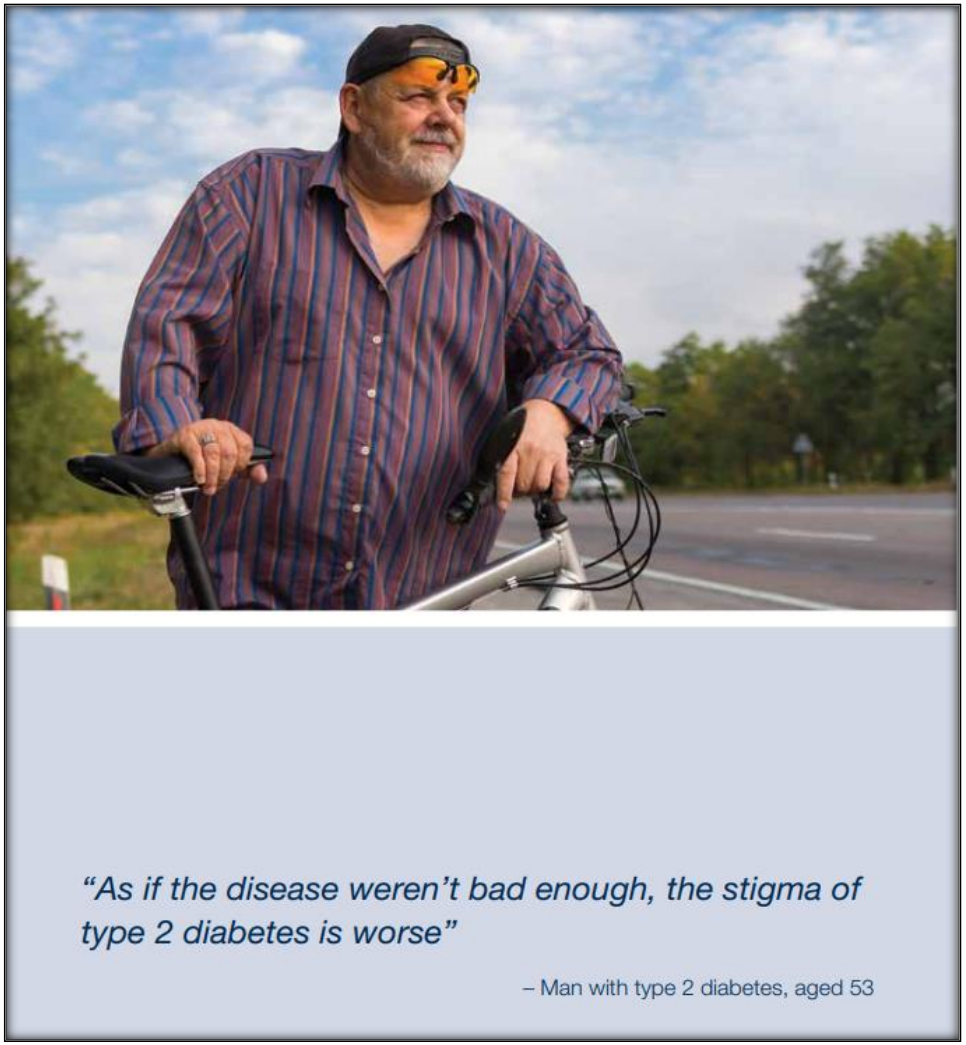
Resources- *patientinfo.org.au*

Resources-Community health pathways

https://hne.communityhealthpathways.org



Pyscho- social aspects of diabetes



"As if the disease weren't bad enough, the stigma of type 2 diabetes is worse"

– Man with type 2 diabetes, aged 53

Diabetes Distress

What is it?

Diabetes distress is a term to describe the common emotional distress from living with diabetes. Diabetes management is relentless, with multiple decisions and tasks for self-management each day, and concern about potential or current long-term complications. There may be increased financial burden, social concerns and stigma.

One in four people with type 1 diabetes experience severe diabetes distress, and rates of one in five people with insulin-treated type 2 diabetes, and one in ten people with non-insulin treated type 2 diabetes are seen. Diabetes distress can result in sub-optimal self-management of diabetes, HbA1c, and impaired emotional wellbeing. It is more common than depression yet if left untreated, diabetes distress can result in depression or diabetes burnout.

Diabetes Distress

Diabetes distress can be easily assessed during a routine consultation. The Problem Areas In Diabetes (PAID) questionnaire is one of the most common diabetes distress measures. The PAID questionnaire identifies concerns with diabetes management and most importantly, can open up conversations about barriers for optimal self-management

The level of diabetes distress can change during the course of the diabetes journey, so it is best to assess diabetes distress at key points in time;

1. At diagnosis

2. Annually

3. During significant changes in treatment and development or worsening of diabetes-related long- term complications.

Probem Areas in Diabetes scale-PAID

Problem Areas In Diabetes (PAID) scale

Instructions: Which of the following diabetes issues are **currently** a problem for you? Tick the box that gives the best answer for you. Please provide an answer for each question.

		Not a problem	Minor problem	Moderate problem	Somewhat serious problem	Serious problem
1	Not having clear and concrete goals for your diabetes care?	☐0	☐1	☐2	☐3	☐4
2	Feeling discouraged with your diabetes treatment plan?	☐0	☐1	☐2	☐3	☐4
3	Feeling scared when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
4	Uncomfortable social situations related to your diabetes care (e.g. people telling you what to eat)?	☐0	☐1	☐2	☐3	☐4
5	Feelings of deprivation regarding food and meals?	☐0	☐1	☐2	☐3	☐4
6	Feeling depressed when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
7	Not knowing if your mood or feelings are related to your diabetes?	☐0	☐1	☐2	☐3	☐4
8	Feeling overwhelmed by your diabetes?	☐0	☐1	☐2	☐3	☐4
9	Worrying about low blood glucose reactions?	☐0	☐1	☐2	☐3	☐4
10	Feeling angry when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
11	Feeling constantly concerned about food and eating?	☐0	☐1	☐2	☐3	☐4
12	Worrying about the future and the possibility of serious complications?	☐0	☐1	☐2	☐3	☐4
13	Feelings of guilt or anxiety when you get off track with your diabetes management?	☐0	☐1	☐2	☐3	☐4
14	Not 'accepting' your diabetes?	☐0	☐1	☐2	☐3	☐4
15	Feeling unsatisfied with your diabetes physician?	☐0	☐1	☐2	☐3	☐4
16	Feeling that diabetes is taking up too much of your mental and physical energy every day?	☐0	☐1	☐2	☐3	☐4

- The PAID questionnaire only takes 5 minutes to complete and it is easy to score. It has 20 questions and a five-scale rating for answers of 0-4 with 0 representing "no problem" and 4 "a serious problem". The scores are added up and multiplied by 1.25, to give the total score between 0 – 100. A score of 30 or higher indicates diabetes distress, and a of 40 or higher indicates severe diabetes distress. Individual answers that are rated either a 3 or 4, are worth discussing too.

Self Blood Glucose Monitoring (SBGM)

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SBGM

It is the quality use of SBGM (how the information is used and acted upon) rather than SBGM in HbA1c and well being. per se or the frequency of SBGM that is crucial for affecting improvements

For example: People with type 1 DM need to be able to:

1. Monitor and interpret their BGL's
2. Estimate CHO intake and administer insulin doses to achieve outcomes
3. Develop problem solving skills for making decisions

Benefits of SBGM

- Immediate results
- Relatively inexpensive
- Motivating
- Problem solving/supports self management
- 50-75 % of people with Type 2 DM will eventually require insulin, therefore effective self-management and understanding of the impact of food, physical activity and medication is crucial to minimising progression.

- Supports decision making to prevent complications:

Postmeal hyperglycaemia is associated with higher risk of these complications

- Macro vascular
- Increased risk of retinopathy
- Impaired cognitive function in elderly people with Type 2

TESTING in TYPE 2 DIABETES

- People who are diet controlled or on metformin alone can be provided with the option of blood glucose monitoring
- Frequency of SBGM is individualized
- To understand the impact of food and activity on the blood glucose profile, undertake a period of intensive testing-3-4 days is sufficient
- Specific times when testing is required
  - Insulin therapy
  - Sulfonylurea therapy
  - When HbA1c unreliable
  - Certain occupations
  - When unwell or symptomatic
  - When treatment decisions are being reviewed

BG monitoring - considerations

- Is it necessary?
- Has the patient been registered with the NDSS?

NDSS registration greatly reduces the costs of consumables.

- Can the products be easily obtained?
- How good is the patient's eyesight?
- How good is the patient's dexterity?
- Is the technology appropriate?
- Can they interpret the result?

BLOOD GLUCOSE TARGETS- individualize

RACGP guidelines for Type 2 diabetes advise

6 to 8 mmol/L fasting

8 to 10mmol/L post prandial

HYPER risk: consistently above 10.0 mmol/L

HYPO risk: low 4's

RAGP 2020 Type 2-goals for optimum management

Individual goals	
Encourage all people with type 2 diabetes to approach/reach these goals.	
Diet	Advise eating according to the *Australian dietary guidelines*, with attention to quantity and type of food Advise individual dietary review for people with difficulty managing weight, difficulty maintaining glucose levels in target range, CVD risk, or if otherwise concerned
BMI	Advise a goal of 5–10% weight loss for people who are overweight or obese with type 2 diabetes For people with BMI >35 kg/m^2 and comorbidities, or BMI >40 kg/m^2, consider facilitating greater weight-loss measures
Physical activity	Children and adolescents: at least 60 min/day of moderate-to-vigorous physical activity, plus muscle- and bone-strengthening activities at least three days/week Adults: 150 minutes of aerobic activity, **plus** 2–3 sessions of resistance exercise (to a total ≥60 minutes) per week
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GLUCOSE LEVELS – When to test

When?

2 hours after meals (Post-prandial)

Target - 5 to 10 mmol/L (RACGP 2020)

Checks effectiveness of insulin and medication at that meal as well as CHO effect

2-3 mmol/L rise is ideal

Abbott Freestyle Optium Neo H™

Optium Neo H™ Blood Glucose and Ketone Meter:

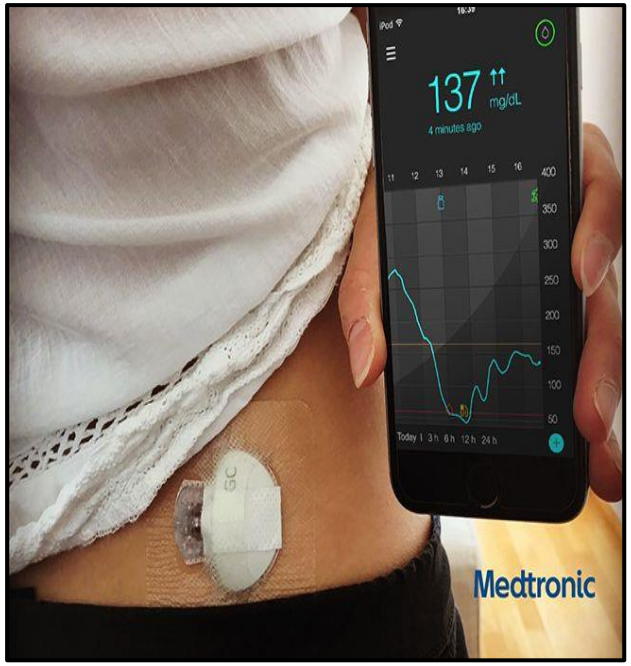
- accurately measures capillary blood glucose and ketone levels.
- is an earlier and more specific indicator of evolving ketosis and DKA than urinary ketone (acetoacetate) measurements.

FreeStyle Optium Blood Glucose Test Strips

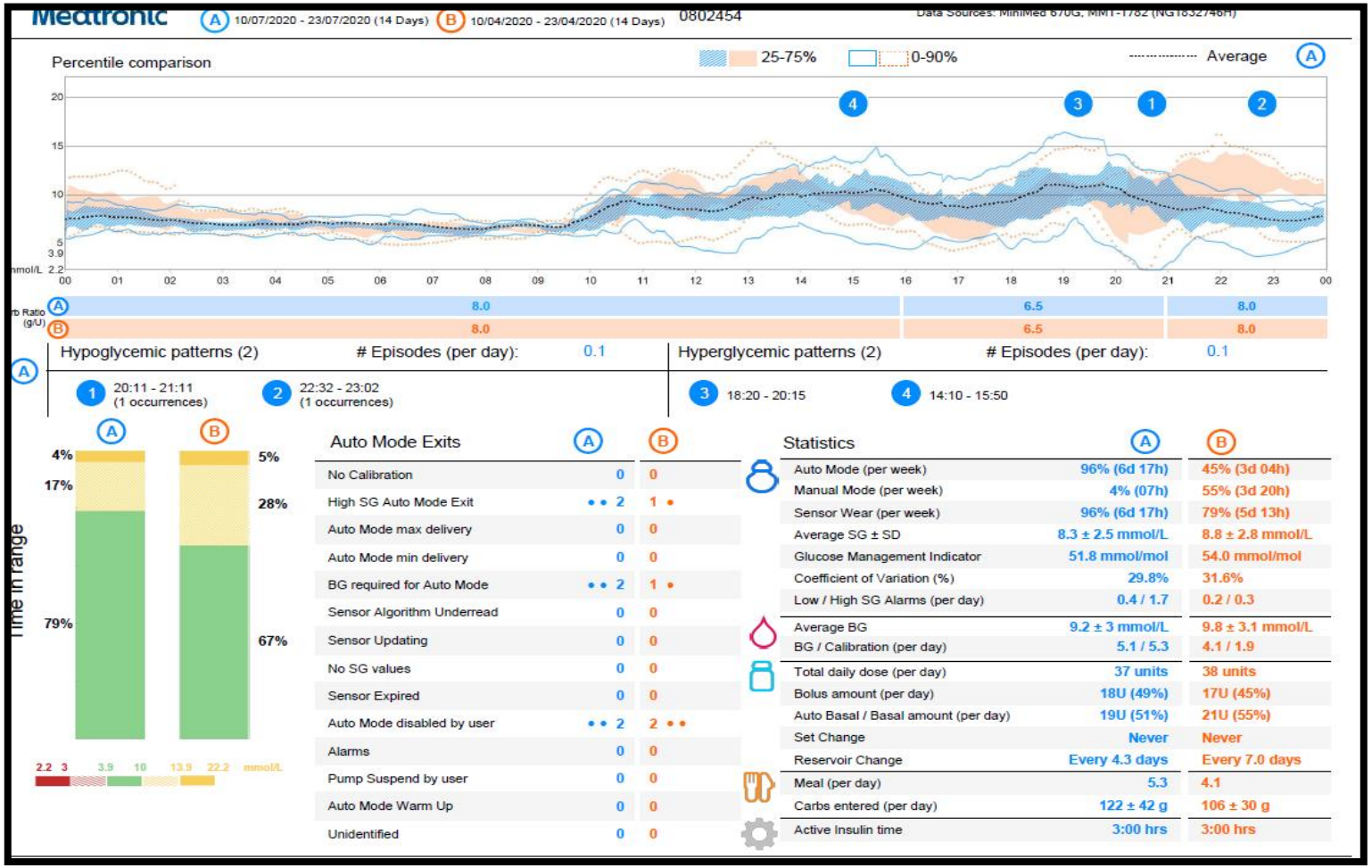
FreeStyle Optium Blood ß-Ketone Test Strips

CGM systems available in Australia

1. Medtronic –Guardian, Link 3
2. Dexcom - G6
3. Abbott- Libre 2 “Flash” GM



Ambulatory Glucose Profile (AGP)



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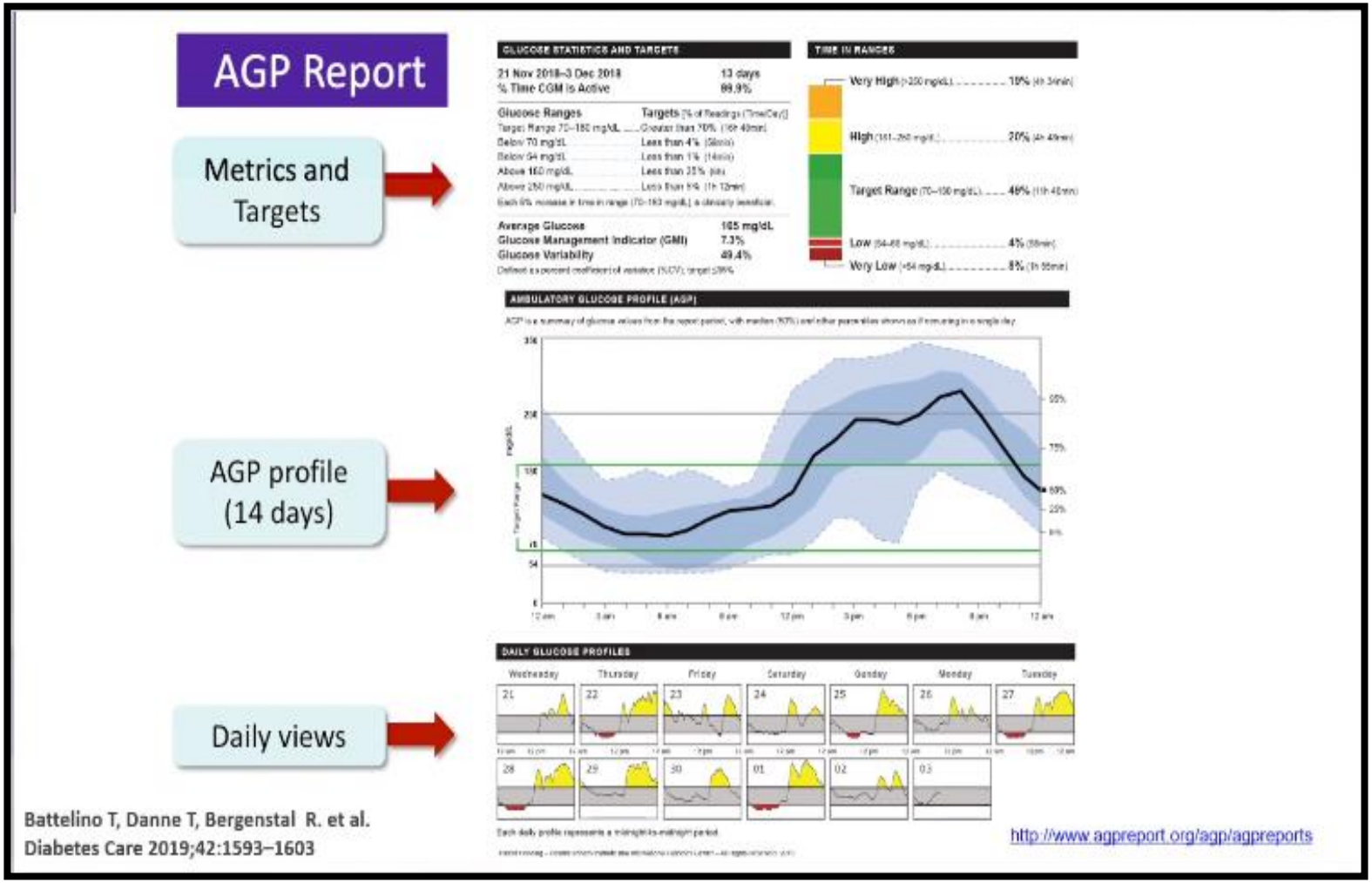
AGP Report Incorporates TIR and Other Metrics



AGP

AGP Report

7 May 2020 - 20 May 2020 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

7 May 2020 - 20 May 2020	**14 Days**
% Time Sensor is Active	**97%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	**7.3** mmol/L
Glucose Management Indicator (GMI)	**6.4% or 47 mmol/mol**
Glucose Variability	**30.1%**

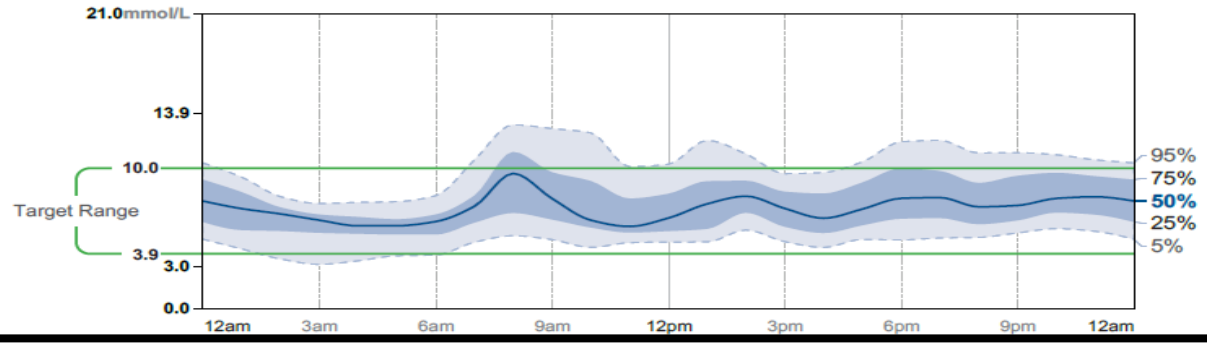
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High	>13.9 mmol/L	**1%**	(14min)
High	10.1 - 13.9 mmol/L	**11%**	(2h 38min)
Target Range	3.9 - 10.0 mmol/L	**86%**	(20h 39min)
Low	3.0 - 3.8 mmol/L	**2%**	(29min)
Very Low	<3.0 mmol/L	**0%**	(0min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



NSW GOVERNMENT Health
Hunter New England
Local Health District

AGP

Glucose

Average Glucose

10.6 mmol/L

Standard Deviation

5.1 mmol/L

Estimated A1C

8.3%

Time in Range

26% Very High

27% High

37% In Range

7% Low

3% Very Low

Target Range: 3.9-10.0 mmol/L

Sensor Usage

Days with CGM data

93%

13/14

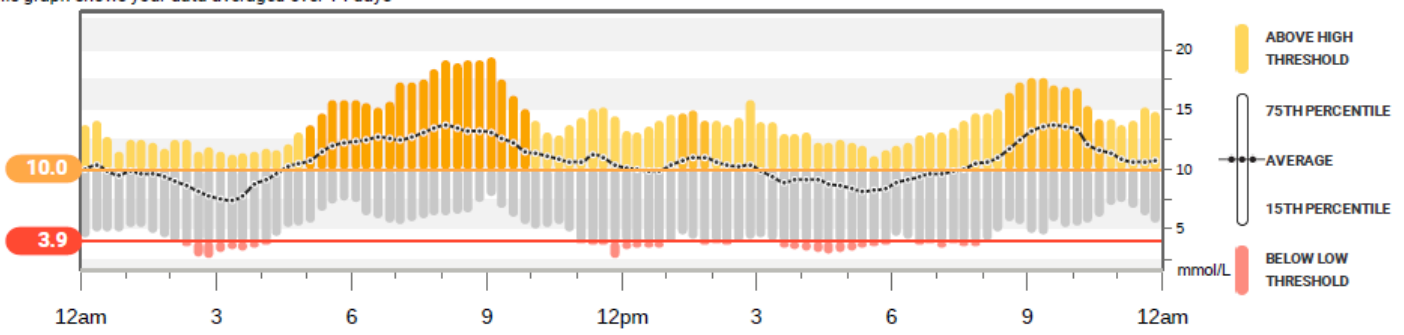
Avg. calibrations per day

2.6

Top Patterns

1. **Milan had a pattern of daytime highs**
   Milan had a pattern of significant highs between 5:15 AM and 9:45 AM.
2. **Milan's best glucose day was 25 July 2020**
   Milan's glucose data was in the target range about 54% of the day.

This graph shows your data averaged over 14 days

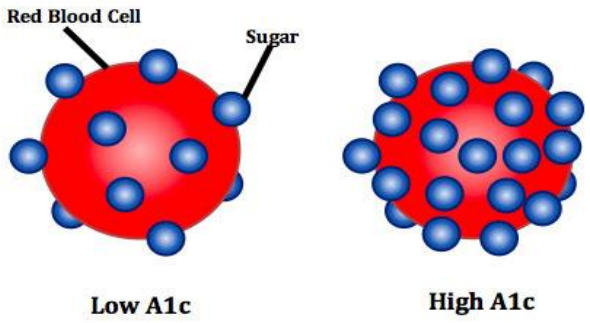


HbA1c - Glycated Haemoglobin Test

HbA1c or glycated haemoglobin is a test used to estimate blood glucose control.

- It reflects mean blood glucose over the entire 90-120 day life span of the red blood cell, but it correlates best with mean blood glucose over the previous 8 to 12 weeks.

HbA1c values ≥48mmol/mol (≥6.5%) can be used to diagnose diabetes.



QUESTIONS