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PRESENTS
PACIFIC DIABETES MANAGEMENT COURSE
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with support & facilitation from
Aotearoa Diabetes Collective
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Welcome to the 2025
Pacific Diabetes Management Course

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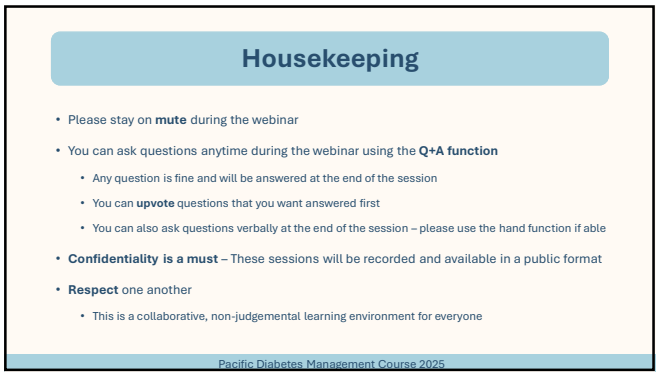
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Respect one another
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Pacific Diabetes Management Course 2025

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PACIFIC DIABETES MANAGEMENT COURSE
with support & facilitation from
Aotearoa Diabetes Collective
Webinar 7.
Management of diabetes in inpatients, prediabetes + type 2 diabetes in youth

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Management of prediabetes

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Prediabetes

- Predominantly defined as HbA1c 42 – 47 mmol/mol (42 – 47 mmol/mol worldwide)
  - Also encompasses impaired fasting glucose (6.1 – 6.9 mmol/L) and/or impaired glucose tolerance (7.8 – 11 mmol/L)
- Unlike diabetes may be diagnosed off a single blood test
- Common – affects > 26% of adults in Aotearoa New Zealand due to high prevalence of obesity
  - Prevalence is likely greater in Pacific
- Typically diagnosed at CVD risk assessment or on screening for diabetes

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Natural history of prediabetes

- Many people with prediabetes will develop type 2 diabetes within 10 years but many will not
- Can be difficult to identify who will progress to T2D especially at 1st visit

'Low risk' factors	'High risk' factors
HbA1c ≤ 42 mmol/mol	HbA1c ≥ 45 mmol/mol
Reduction or no change in interval HbA1c	Increase in interval HbA1c
Older age	Younger age
Few risk factors for diabetes	Multiple risk factors for diabetes
High levels of physical activity	Previous gestational diabetes or T2D
European ethnicity	Non-European ethnicity

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Risks of prediabetes

- Prediabetes is an independent risk factor for CVD but appears no benefit to decreasing HbA1c < 45 mmol/mol
- Risks of associated obesity likely much greater than prediabetes itself e.g.:
  - Obstructive sleep apnoea + asthma
  - Hypertension
  - Dyslipidaemia + metabolic liver disease
  - CVD
  - Osteoarthritis
  - Solid malignancies
  - PCOS

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Management of prediabetes

- **Weight loss is cornerstone of management to prevent progression to T2D + reduce other risks**
  - 5-10% total body weight loss leads to marked improvement in metabolic health
  - 10-15% total body weight loss often required for remission of prediabetes
- **May be achieved via:**
  - Healthy living interventions
  - Metformin
  - Interventions for weight loss
    - Very low calorie diet (VLCD) intervention e.g. DiRECT intervention
    - Pharmacotherapy for weight loss
    - Bariatric surgery
- Patients with prediabetes need repeat HbA1c or alternative at least yearly to determine whether progression to T2D

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Management of type 2 diabetes in youth + young adults

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Type 2 diabetes in youth + young adults

- T2D < 25 years of age is typically rapidly progressive with early severe complications
- Management should be aggressive to prevent + delay complication burden:
  - Target HbA1c < 48 mmol/mol (6.5%)
  - Target systolic BP < 125 mmHg particularly if any complications
  - Low threshold for starting statin therapy as CV risk calculators will always underestimate risk in this group
- Healthy living interventions + metformin remain 1st line management but:
  - Vildagliptin does not appear to be effective + sulfonylureas may increase β-cell burnout in this age group
  - Empagliflozin + GLP1Ra 2nd/3rd line agents + often need insulin early

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Special considerations in youth + young adults

- **Refer to Secondary Care asap if available**
  - Differentiating between the types of diabetes typically more difficult → all types of diabetes are becoming more common
  - Specialised multidisciplinary input important
- Aim for remission if possible → use local intervention programmes if available
- Utilise wrap-around support if available with all members of the team
- Discuss contraception, planning pregnancy + safety around alcohol etc.
- Ensure HbA1c at least 3-6 monthly + regular follow up

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Differentiating between the types of diabetes

- **Important as governs best care & access to CGM, automated insulin delivery + specialist services**
- **5-10% of adult onset diabetes is not T2D** – we have all likely missed other types of diabetes including:
  - Type 1 diabetes
  - Pancreatogenic diabetes (Type 3c)
  - Monogenic diabetes
  - **Secondary causes of diabetes** e.g. pregnancy, medications, Cushing's syndrome, acromegaly + thyrotoxicosis etc.

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Differentiating between the types of diabetes

- Differentiate via a careful history + examination & investigations including:
  - Anti-GAD, anti-IA2 + anti-ZnT8 antibodies
  - C-peptide + paired glucose levels → C peptide < 250 pmol/L with glucose > 8 mmol/L consistent with severe insulin deficiency
  - Beta-HCG, faecal elastase + others as appropriate
  - **Discuss with secondary care if suspicious of non-T2D diabetes AND/OR patient is < 25 years of age**

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Red flags for other types of diabetes

- Age < 25 years
- Phenotype inconsistent with type 2 diabetes
- Pancreatic exocrine insufficiency
- Strong direct family history of diabetes < 40 years of age especially type 1 diabetes
- Personal or direct family history of autoimmune disease
- Secondary causes of diabetes present

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Inpatient management of diabetes

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Inpatient management of diabetes

- Hyperglycaemic emergencies
- Hypoglycaemic emergencies
- General concepts of inpatient diabetes management
- Special situations

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Hyperglycaemic emergencies

- Diabetic ketoacidosis (DKA) + Hyperosmolar Hyperglycaemic State (HHS) are the 2 main hyperglycaemic emergencies
- Predominant feature of DKA is ketoacidosis with pH < 7.3 and/or $HCO3^-$ < 18 mmol/L
  - Blood ketones typically need to be > 4 mmol/L
  - **Glucose levels typically high but often normal or only mildly elevated if pregnant, on empagliflozin, or significant starvation or exercise (euglycaemic DKA)**
- Predominant feature of HHS is hyperosmolality with serum osmolality > 320 mOSm/kg
  - Glucose levels often > 50 mmol/L
- Significant overlap between DKA + HHS & people may present with both
  - DKA typically occurs in type 1 diabetes + HHS in type 2 diabetes but both may present in either type of diabetes

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Management of DKA

- Fluid resuscitation with normal saline
  - Typically 100 mL/kg in deficit at presentation
  - Consider 1 L stat, 1L over 1 hour, 1 L over 2 hours, 1 L over 4 hours and 1L over 8 hours if no fears of fluid overload + no significant Na^+ derangement
- Potassium replacement
  - Usually > 150 mmol in deficit at presentation
  - Start K^+ replacement at maximum 20 mmol/hour once K^+ < 5.5 mmol/L (may initially be high due to acidosis)
- Insulin
  - Start IV insulin infusion at 0.1 unit/kg/hour
  - Continue s/c basal insulin → may need to start weight-based Protaphane
  - Combine with IV dextrose once glucose levels ≤ 14 mmol/L → may need to start at outset if euglycaemic DKA

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Management of DKA

- Screen for + treat underlying cause
- Anticoagulation unless contraindicated
- Supportive care including at least hourly monitoring of glucose levels + 2 hourly monitoring of electrolytes initially
- Transition to s/c insulin once ketones cleared (ideally < 0.6 mmol/L)

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Management of HHS

- Very similar management to DKA but key differences due to greater insulin sensitivity + risk of fluid shifts
- Initially rehydrate with normal saline but subsequent fluids governed by close monitoring of Na^+
  - Switch to 0.45% saline if Na^+ is not reducing
  - Aim not to decrease Na^+ by more than 10-12 mmol/L in 24 hours
- Start insulin infusion at 0.05 units/kg/hour instead of 0.1 units/kg/hour
- Anticoagulation + supportive care important as mortality rates often > 10 – 20%

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Hypoglycaemic emergencies

- Prevention of hypoglycaemia is key because associated with significant morbidity + mortality in inpatients
- Treatment of hypoglycaemia in inpatients is similar to as in community if able to swallow
  - 30 g of glucose if T2D + > 70 kg
  - 15 g of glucose if T1D or T2D + < 70 kg
  - Repeat every 15 mins until glucose levels persistently > 4 mmol/L
- Best treatment of hypoglycaemia in inpatients who cannot swallow safely is IV or buccal glucose
  - Administer 50 mL of 50% dextrose IV if good venous access → can give 10% dextrose as alternative
  - I mg IM glucagon can be given if delay in IV access
- Need to reduce insulin by > 20% + sulfonylureas by > 50% to prevent further significant hypoglycaemia

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Key concepts in inpatient diabetes management

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Key concepts in inpatient diabetes management

- Target blood glucose range is 5 – 10 mmol/L
  - Principal aim is to avoid hypoglycaemia + severe hyperglycaemia
  - Evidence for tight glycaemia is only post cardiac surgery
- Glucose levels in inpatients are typically higher than in the community
  - Stress response of illness + reduced physical activity with alteration of diet
  - Glucose lowering therapies often withheld + medications (e.g. steroids) may further increase glucose levels
  - Hyperglycaemia is often problematic in people with normoglycaemia or prediabetes pre-admission
- Glucose levels in hospital are typically dynamic + frequent changes to glucose lowering therapies are often required
- People can typically return to their pre-admission glucose lowering therapies unless major changes in wellbeing

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Glucose lowering therapies that need to be stopped in the inpatient setting

- Empagliflozin needs to be stopped in all acute illnesses + not restarted until well & eating + drinking normally
  - Stop 3 days (including day of) an elective procedure or bowel prep/low carb diet
- Metformin needs to be withheld in the following situations:
  - Significant liver, kidney and/or heart failure
  - IV contrast + eGFR < 30 mL/min
  - Significant GI illness along with vildagliptin + GLP1Ra
- Sulfonylureas + meal time insulin often need to be stopped if reduced oral intake
- Basal + premixed insulin may need to be reduced by ~ 25% if nil by mouth or reduced oral intake
- **NB: Glucose levels are the best guide to alteration of insulin doses + be aware of changes in renal function**

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Insulin therapy in inpatients

- Insulin is often mainstay of treatment for inpatients with diabetes
- IV insulin infusion gold standard of treatment if dysglycaemia and/or significantly unwell
  - Best to continue basal insulin whilst on infusion or do not stop insulin infusion till > 3 hours after basal insulin administered
- Often need to start insulin for the first time
  - Weight-based dosing of basal insulin good starting point
    - 0.2 units/kg of Protaphane nocte if T2D → consider mane dosing if on prednisone and/or at risk of nocturnal hypoglycaemia
    - Consider splitting dose to twice daily if T1D or pancreatogenic diabetes + halving dose if at risk of hypoglycaemia
  - Bolus insulin typically best meal-time insulin due to unpredictable eating patterns → Actrapid best if rapid-acting insulin not available
    - Can match to carbohydrate intake & start with 4 units or 10% of basal insulin at largest meal
- 'Correction insulin' is invaluable in the inpatient setting → particularly if nil by mouth or minimal oral intake

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How do I use correction insulin?

- Allows 'correction' of hyperglycaemia pre-meals or at times of reduced oral intake e.g. when unwell
- **Only use Actrapid insulin for correction insulin + do not typically repeat within 6 hours**
  - Needs to be administered separately if on basal or premixed insulin alone
- **Use 1 unit for every x mmol > 6 mmol/L based on the total daily dose (TDD) of insulin**
  - TDD **≤ 25** units → correction 1 unit for every **4** mmol > 6 mmol/L
  - TDD **26 – 40** units → correction 1 unit for every **3** mmol > 6 mmol/L
  - TDD **41 – 75** units → correction 1 unit for every **2** mmol > 6 mmol/L
  - TDD **≥ 76** units → correction 1 unit for every **1** mmol > 6 mmol/L
- **Often safer to limit initial correction to 6 – 10 units + correct to 8 mmol/L if risk of hypoglycaemia**

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How do I use correction insulin?

- E.g. if on basal insulin 40 units + bolus insulin 10 units with meals → total daily dose is 70 units
  - Correction factor is **1 unit for every 2 mmol > 6 mmol/L** provide clear instructions on what dose to administer at each meal

BGL (mmol/L)	Correction dose (units)
4.0 – 7.9	0
8 – 9.9	1
10 – 11.9	2
12 – 13.9	3
14 – 15.9	4
16 – 17.9	5
≥ 18.0	6

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How do I use correction insulin?

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BGL (mmol/L)	Correction dose (units)	Total dose with meal (units)
4.0 – 7.9	0	10
8 – 9.9	1	11
10 – 11.9	2	12
12 – 13.9	3	13
14 – 15.9	4	14
16 – 17.9	5	15
≥ 18.0	6	16

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Special situations in inpatient diabetes management

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Special situations in inpatient diabetes management

- Steroid induced-hyperglycaemia e.g. doses of prednisone > 10 – 20 mg per day + dexamethasone > 1-2 mg/day
  - Typically require ~ 30% increase in insulin doses
  - In insulin naïve patients → sulfonylureas may suffice in mild hyperglycaemia otherwise start weight-based morning doses of basal insulin
- Enteral feeding
  - Easiest to match continuous NG feeds with Protaphane insulin based on timing of feeds + correction insulin as required
  - Beware if NG tube dislodges and/or feeds stop
- Dialysis
  - Easiest to match peritoneal dialysis with Protaphane insulin based on timing of dialysis & correction + meal time insulin as required
  - People on haemodialysis typically need lower doses of dialysis on days of dialysis
- Special situations

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What are the take home messages?

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Take home messages

- Prediabetes is associated with increased CVD risk + warrants intervention if high-risk
  - Consider metformin and/or treatment for weight loss
- Remember not all diabetes is T2D → investigate and/or consider referral to specialist diabetes services if suspicious of other types
- Be aggressive in the management of T2D in youth as typically rapidly progressive disease
  - Metformin, empagliflozin, GLP1Ra + insulin key glucose lowering therapies in this age group
- Inpatient management of diabetes can be difficult + dynamic
  - Insulin typically mainstay of treatment
  - Can often return to pre-admission management post-discharge

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Case for discussion – Mrs F

- 22 year old woman with type 2 diabetes with HbA1c 53 mmol/mol (7%) admitted to ward with right lower lobe pneumonia
  - Glucose 16 mmol/L on admission despite no oral intake
  - Weight 150 kg
- Current medication regimen:
  - Metformin 1 g twice daily
  - Empagliflozin 10 mg daily
  - Gliclazide 80 mg twice daily
- Would you check for ketones and what will you do with her medications?
- If you start insulin, what doses will you start with + what target glucose range are you aiming for?
- What medication regimen will you discharge her on?

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Discussion

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