GOVERNMENT OF SAMOA

SAMOA DIABETES MANAGEMENT GUIDELINE

2024

Ministry of Health

Foreword

Samoa, like other middle-income countries, is experiencing the burden of illness from infectious diseases and lifestyle-related NCDs, including diabetes. The prevalence of diabetes in Samoa has increased steadily over the past 35 years, from 4.6% in 1978 to 24.3% (Samoa STEPs survey, 2013)[1]. In addition, many countries are now reporting the onset of type 2 DM at an increasingly young age. Factors that might explain the increasing prevalence of diabetes mellitus include the rising rates of obesity, while people are becoming less physically active, and both increase the risk of developing diabetes.

Pre-diabetes, such as impaired fasting and impaired glucose tolerance conditions, like diabetes, are at high risk for all-cause mortality and several cardio-metabolic illnesses. Asymptomatic diabetes can remain undetected for an extended period, and this means affected persons are not receiving the appropriate treatment to prevent complications.[3] The Samoa Data (STEPS SURVEY)[1,2] reported that one in five adults aged 18-64 years (25.8%) suffer from impaired fasting glycaemia, and almost half of adults (45.8%) were found to have raised blood glucose or had been previously diagnosed as diabetic. This also means the financial burden diabetes poses to individuals and society is more alarming than reported, and direct and indirect diabetes costs may be underestimated.[4, 5.]

There is robust evidence that better glycemic control improves overall health outcomes and prevents the development and progression of long-term complications of diabetes.

The Samoa MOH National Diabetes Guidelines, 2024, provides up-to-date, evidence-based guidance for preventing, diagnosing and managing the diabetes continuum. The overarching message of the Guidelines is that diabetes, primarily type 2, caused by unhealthy lifestyle factors, is essentially preventable.[6] The guidelines aim to prevent diabetes at all three levels, primary, secondary, and tertiary, by avoiding, detecting, and reversing diabetes and preventing or delaying complications. This necessitates multi-prong approaches at both individual and population levels.

As part of the Ministry of Health's effort to improve health care, this national DM guideline aims to standardise diabetes management and provide pragmatic guidance and best practices for health professionals to achieve the Guideline's aim to prevent and reduce the burden of diabetes in Samoa.

The recommendation is for all health professionals to use these guidelines to prevent and reduce the burden of diabetes in Samoa.

Fa'afetai

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Abbreviation and Acronyms

ABCD	Association of British Clinical Diabetologists
ACEi	Angiogensin-converting enzyme (ACE) inhibitor.
ARB	Angiotensin Receptor Blocker
BG	Blood Glucose
CBG	Capillary Blood Glucose
CCB	Calcium Channel Blocker
CGM	Continuous Glucose Monitoring
CVRA	Cardiovascular Risk Assessment
DPPIVi	Dipeptidyl Peptidase-IV inhibitors
DH	District Hospital
e-Guidelines	electronic Guidelines
EML	Essential Medicine List
GLP1RA	Glucagon-Like Peptide-1 Receptor Agonist
HbA1c	Hemoglobulin A1c
HC	Health Centre
MAF	Ministry of Agriculture and Fishery
MESC	Ministry of Education, Sports and Culture
MOH	Ministry of Health
MTII Hospital	Malietoa Tanumafili II Hospital
MWCSD	Ministry of Women, Community and Social Development
NCD	Non-Communicable Diseases
OHA	Oral Hypoglycemic Agents
PEN	Packing of Essential NCD
POCT	Point of Care Test
SGLT2	Sodiumm Glucose Cotransporter 2
SMBG	Self-Monitored Blood Glucose
SNAP	Smoking, Nutrition, Alcohol, Physical Activities
TIR	Target In Range
TTM Hospital	Tupua Tamasese Meaole Hospital
UACR	Urinary Albumin: Creatinine Ratio
VHW	Village Health Worker

Introduction

The Samoa MOH National Diabetes Guidelines, 2024, is the update of the Samoa MOH Diabetes Guideline 2004[7] plus input from the NCD Management Protocol in Primary Care Services, 2022.[2] The current Samoa MOH National Diabetes e-Guidelines, 2024, adapted and adopted the NSSD 2023 Guidelines[8].
The NZ Guidelines Group approved this but is not responsible for the content.

The management protocols for 'Hyperglycemia Emergencies' and Type 1 Diabetes from the Joint British Diabetes Society for Inpatient Care Guideline 2023 (ABCD)[9] and Starship Hospital Guideline,[10] respectively, were also adapted and adopted. The Samoa Guidelines Group adapted evidence-based medicine to the local contexts based on information, recommendations and limitations from previous local guidelines, plus the experience of the TTM Medical Team and the GPs in the Guidelines Group.

The Samoa MOH National Diabetes Guidelines, 2024, will be the first Samoa MOH National Diabetes Electronic Guidelines or e-Guidelines. It will be co-hosted on the NZSSD site, and the advantage is that this Guideline will be updated whenever the NZSSD is updated. The Samoa MOH can own its domain later if required.

Limitations of the 2024 Guidelines: The resource limitations highlighted in previous local guidelines are similar, including workforce shortages, unavailability, and inconsistent accessibility to diagnostic and monitoring devices and consumables. Although possible, prompt laboratory transportation of specimens from the District Hospitals and Health Centers to the central laboratory is not guaranteed, so results may be returned too late to impact patient care. Integrating technologies for Samoa's Diabetes service by deploying Point-Of-Care Tests (POCTs), remote access and the new e-Guidelines can narrow the gap. However, caution still applies as POCTs can be fraught with test result inaccuracies. Glucometers are not readily available, but these must be calibrated to laboratory standards.[6] Also, the newer, cost-effective diabetes medications are not on the Hospital's Essential Medicine List (EML).

The Samoa MOH National Guidelines Group considered these limitations to contextualise and design the 2024 Guidelines for safe practice.

Guidelines to Practices

The Guidelines ask the MOH to strengthen intersectoral collaborations and village innovations to deliver sustainable lifestyle interventions as everyday practices. We should adopt a mindset to foster healthy food environments and local organic food systems with a broader societal focus on improving health while maintaining traditional customs as the norm instead of Western food dependence cultivating obesogenic environments. The tasks require Samoa's collective effort. Only then will the 'Samoa MOH National Diabetes Guideline 2024 – Prevention and Management of Diabetes recommendations have the impetus and broader relevance for diabetic patients. A health professional's advice for healthier lifestyle changes calling for diabetes patient behaviour changes would be impractical and incognizant to effectively comply with competing church, socioeconomic and cultural priorities, notwithstanding the patient's efforts.

Although costly, accessing newer diabetes medications can be a cost-effective investment. Telehealth delivery with point-of-care testing supplements, e-guidelines, and training can standardise best practices in quality diabetes care.

The prevention, screening, and detection of diabetes by lifestyle changes are critical in the continuum of care for diabetes.[7] The current diabetes guidelines resonate with previous local guideline recommendations on lifestyle interventions. For the Samoa MOH National Diabetes Guidelines, 2024, to achieve good outcomes and reduce the burden of diabetes in Samoa, there are four key cost-effective intervention areas to invest in:

1. MOH intersectoral collaboration with relevant Government Agencies, Primary Health Care, Public Health/PEN – Fa'a-Samoa and Village Committees invigorating existing village-based programme to cultivate 'Healthy Environments' and well-being lifestyle choices as part of a Samoa Diabetes Prevention Programme (Samoa DPP).[2, 11.]
2. Healthcare resources - a consistent supply of standardised testing devices to remotely screen, diagnose, monitor, and treat, utilising newer cost-effective diabetes medications.[2]
3. Integration of technology to facilitate readily accessible national e-Health information to track NCD/diabetes interventions - guidelines, screening, prevention, and performance monitoring across the diabetes continuum.
4. Diabetes Workforce Capacity, Training and Expert Delivery.

What is new in the Guideline?

i. Changes in the diabetes screening age starting at a younger age

- Screening and early detection at ten years old instead of 15 yo.[2]
  - Screening tool using SNAP as appropriate.

- Primary Care Services Referral criteria, NCD Protocol[2]
  - Village Screening (Village Komiti and Village Health Worker)
  - Health Facility Screening
  - Primary School Screening
  - Ad hoc screening

[1]SNAP – Smoking, Nutrition, Alcohol, Physical Activities. [2]MOH & WORLD BANK GROUP, p6-15

ii. Emphasis on lifestyle management

- There is a new emphasis on individualized weight management plans, aiming for 10-15% weight loss in early disease to achieve T2D remission.
- The emphasis is on patient education and support to facilitate self-management.
- Emphasize the 'Green Prescriptions' and SNAP is the First Line Intervention
- Population-level approach. Multi-sectoral Interventions (MAF, MWCSD, MESC) and collaboration with public health
- Village Komiti and Public Health/ MOH -PEN Fa'a-Samoa Integrated Approaches
- New section on healthy sleep to improve glycaemic control and weight loss
- Cancer screening and influenza vaccination are to be included in the wrap-around care.

iii. Changes in guidance in glucose-lowering medicines

- New OHA as 2nd line treatment can delay the insulin regimen
- Metformin dosing should not be reduced unless the patient's eGFR <45mL/min.
- Sulfonylurea and/ or insulin can be reduced or withdrawn where appropriate when newer agents are introduced.
- SGLT2i - Empagliflozin proposed to be included in the EML.
- Empagliflozin (and/or GLP-1RA dulaglutide/ liraglutide, self-funded, if affordable) should be considered in patients aged 10-17 years based on safety and efficacy data. Empagliflozin is to be included in the EML.
- Linagliptin is redundant if a GLP-1RA is introduced and should be withdrawn.
- Dulaglutide[M] is unavailable in Samoa but can be used if the patient can afford it.

Dulaglutide in multiple weekly injections may be considered if the patient tolerates treatment and has not reached their HbA1c target – the max dose is 4.5mg per week. There is no evidence that either dulaglutide or liraglutide

iv. Management of hypoglycemia

- Simplified
- Hypoglycemia management in T2D has been simplified to prevent both under and over-treatment – it is body weight based:

If body weight ≥70kg, take 30g of rapid-acting or simple carbohydrate.

OR

If body weight <70kg, take 15g of rapid-acting or simple carbohydrate, repeat after 15 minutes if glucose levels <4mmol/L.

v. Other Changes

- Lipids - new LDL treatment target. The target LDL has been lowered from 1.8mmol/L to <1.4mmol/L

- Lipid-lowering therapy is important to reduce microvascular complications rosuvastatin is available if LDL cholesterol is above target.

- Continuous glucose monitoring (CGM) has been included with targets, e.g. TIR >70%

- Sulphonylureas are useful for steroid-induced hyperglycemia.

- Enhanced diabetes delivery services. The Guideline in the electronic form, e-guidelines can be accessed at the GP[N] surgery/ District Hospitals/ Health Centers.

- Vaccination and cancer screening as part of the diabetes care bundle

- The Green Prescriptions (GRx)

- Diagnostic testing - POCT (with calibrations) in the GPs, DHs, and HC.

- POCT and laboratory tests for screening and diagnosis:
  - POCT HbA1c and BG can be performed at the patient's GP, Outpatient Clinics, District Hospitals (DH) and Health Center (HC).
  - Laboratory HbA1c and BG blood samples can be collected at the GP practice, DH and HC and transported to the laboratory at TTM or MTII. The turnaround time could be the same day.
  - A simultaneous random HbA1c with a fasting plasma BG is efficient and can help facilitate the diagnosis of diabetes without requiring a second visit[12].
  - If a POCT finger prick (capillary) HbA1c > 6.5% and random BG >140mg/dL <180mg/dL, request a venous blood sample for a simultaneous HbA1c and FBG. POCT can test the sample and can send the remaining sample to the laboratory.

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is superior in glycaemic control. Liraglutide may be preferred if T2DM patients cannot obtain it or, are intolerant to Dulaglutide or prefer daily injections.

[M] GP - General Practitioner

Compare the results to check for consistency and calibrate the POCT if it is inconsistent.

- Ask the patient to fast overnight, return the next day, or wait until the 8-hour postprandial – see Diabetes Screening Algorithm p18.

Prevention of Diabetes

Lifestyle intervention programs promoting healthy diets, physical activity, and modest body weight reduction can prevent or delay the onset of diabetes among high-risk populations.[3, 13 – 15.] in Samoa. They may also help mitigate the effects of genetic diabetes risk. Preventing T2D in high-risk individuals results in a lower risk of cardiovascular disease (CVD) and microvascular complications.[8]

Although a population-based screening is ideal for preventing diabetes, it is expensive and not feasible for the Samoa MOH due to budget and workforce limitations.[16,17] However, '*opportunistic screening'* could be practicable and cost-effective if targeted to individuals with high-risk characteristics, obesity, and older age, using the lower cut points for pre-diabetes (A1c 6.0 – 6.4% (42-47mmol/mol) NICE[O] or 5.7% - 6.4% (39-47mmol/mol) ADA.[P,18.] Furthermore, opportunistic screening allows the Samoa MOH to simultaneously engage with other sectors to create collaborative approaches to modify the food environments[Q,19] like pricing strategies, food supply and availability improvement, discouraging dependence on imported processed food, education, and multi-media information. These holistic interventions sit mainly outside the jurisdiction of the MOH and require effective monitoring systems and high-level policies by key health stakeholders, for instance:

- A Government tax on fatty, salty and sugary foods and drinks and tobacco
- Enforce a smoking ban in all public areas, with designated smoking areas.
- Compulsory Food Technology curriculum starting at primary school (MESC) https://www.heartfoundation.org.nz/educators/#top
- Village Komiti, Public Health/PENfa'aSamoaa, MESC, MWCSD, MAF, Churches, NGOs - Home Economics and Media – Food Innovation Programme focusing on nutrition, school lunches, Green Prescription, Tobacco smoking cessation, and Physical activities, SNAP[R] - to integrate into existing diabetes screening, and prevention programmes, Appendix 1

Recommendations:[20]

1. To strengthen collaborative and multi-sectoral programmes, the 'Health' component must be mandated through Strategies, Policies, and Action Plans in the MESC, MAF, MWCSD, MOH-PEN-fa'aSamoaa, and Village Komiti/ Village Health Workers on diabetes prevention.

2. To assist the Screening Programme migrate to an e-Health Central Data Registry. Refer Appendix 3:[S]

O NICE = National Institute for Health and Care Excellence

P ADA = American Diabetes Association

Q Ministry of Agriculture and Fisheries, Samoa. Samoa Food Systems Pathway 2030 Report.

R SNAP - Smoking, Nutrition, Alcohol, Physical Activities

S MINISTRY OF HEALTH & WORLD BANK GROUP - NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES, 2022, P8 – 15, (Appendix 1)

- Village referral (pp8 – 11).
- Health facility screening (pp11 – 12).
- Primary school screening (pp13-14).
- Ad hoc screening (p15).

3. Integrating technology in Diabetes/ NCD service delivery by deploying POCT, well-calibrated by the Central laboratory system, for opportunistic community screening. Ensuring easy access to the Diabetes e-guidelines in Primary Health Care settings for doctors and nurses.

4. Regular upskilling and training, virtual or in person. Accredited certification of the Diabetes Workforce - GPs, Nurses, and Village Health Worker Assistants.

5. To assist existing diabetes programs, evaluate and improve screening activities, and optimize identifying diabetes patients via the GPs, MOH PEN Fa'a-Samoa and Village Komiti/ Village Health Workers.

6. To emphasize the 'Diabetes Prevention" component in existing Diabetes Specialist services. The services must extend beyond treatment goals to a specific Samoa Diabetes Prevention Programme (DPP), with a research arm to champion evidence-based lifelong change programs for people at risk of T2D/ NCD to adopt sustainable and healthy lifestyle choices.

Screening and Diagnosis of Type 2 Diabetes

Places: GP, Clinics, Health Centre, District Hospital, Churches, Villages[T]

- Village Referral (p8 – 11).
- Primary School Screening (p13-14).
- Health Facility Screening p11 – 12).
- Ad hoc Screening (p15).

Screening for **diabetes in people without symptoms.** As part of Cardiovascular risk assessment (CVRA) perform HbA1c in those who are/have:

• Overweight/obese (BMI >25 kg/m2)
  - All young people aged >10 yo with a BMI >25 kg/m2 with <u>at least one</u> other diabetes risk factor should have an HbA1c at least every 3 years.

• Risk factors for T2D
  - Samoan as Pacific People
  - Previous pre-diabetes or T2D in remission
  - Smoker
  - History of CV disease
  - Post-transplant
  - Current long-term corticosteroid or antipsychotic treatment
  - A 1st degree relative with T2D <40 years of age
  - Clinical features of insulin resistance, e.g. PCOS, acanthosis nigricans, hypertension and dyslipidemia

• HbA1c testing should routinely include all CV risk assessments, beginning at age 30 years for men and 40 years for women.

• Diagnosing T2D in an **asymptomatic** person requires two abnormal tests (HbA1c ≥ 50 mmol/mol or fasting glucose ≥7mmol/L) either on the same day or without delay.

• **Pre-diabetes** is defined as either HbA1c 41-49 mmol/mol (single measurement if the patient is otherwise well), fasting glucose 6.1-6.9 mmol/L or 2-hour glucose 7.8-11 mmol/L on 75g glucose tolerance test (GTT).

Testing **Symptomatic People**

• An HbA1c and fasting or random glucose test should be requested for all patients with symptoms of hyperglycaemia, i.e. polyuria, polydipsia, weight loss, recurrent fungal, skin or genitourinary infections.

[T] MINISTRY OF HEATH & WORLD BANK GROUP- NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES, pp8 – 15. Appendix 1. New Zealand Data: In 2013, the highest rate of diabetes in New Zealand was in the Indian ethnic group (11%), followed by Pacific peoples (9.6%).
• Type 2 diabetes is increasingly occurring in Māori and Pacific **children under the age of 15 years.**
• Māori are three times as likely to have type 2 diabetes as non-Māori, and are more likely to develop complications
• One in three Pacific adults aged 45 years or over has diabetes
• Pacific peoples develop diabetes earlier and experience more complications than New Zealand Europeans with the condition

• Diabetes in **symptomatic** patients is confirmed following a:
  - single HbA1c > 50 mmol/mol or
  - fasting glucose ≥ 7 mmol/L or
  - random glucose ≥ 11.1 mmol/L

Determining **the Type of Diabetes**

• At least 5% of adult-onset diabetes is not T2D.

• Consider other causes of diabetes (autoimmune disease screen) as it alters management – e.g. all pts with T1D require insulin and should be screened for other autoimmune diseases.

• T1D may develop at any age with an insidious onset and many patients are now overweight at diagnosis due to the prevalence of obesity in the general population.

• T1D antibodies are costly. Perform T1D antibodies if they have a high index of suspicion[1].

• Suspicion of T1D, diabetes due to pancreatic failure, or monogenic diabetes should be discussed with secondary care. Refer to the e-Guidelines for screening and diagnosis information.

Screening of **Pregnant Women for Diabetes**
- Refer to the e-Guidance menu for Diabetes in pregnancy.

For the **Management Algorithm,** go to the appropriate **e-Guidance** menu.
https://dm-mohsamoa.nzssd.org.nz/Home.html#subjects-list

[1]A positive anti-GAD, anti-IA2 or anti-ZnT8 antibody titre or low C-peptide, e.g. < 250 pmol/L fasting or < 600 pmol/L post meal if glucose is > 8 mmol/L at diagnosis is suggestive of T1D.

Primary Health Care Screening Referral Pathway

Screening and Referral Pathway – NCD Protocol, Appendix 1[2]

2.1 Community Screening (p8).
2.2 Health Facility Screening (p12)
2.3 Primary School Screening (p14)
2.4 Ad hoc Screening (p15)

Figure 1: Screening Sites HbA1c and Blood Glucose (BG) Testing

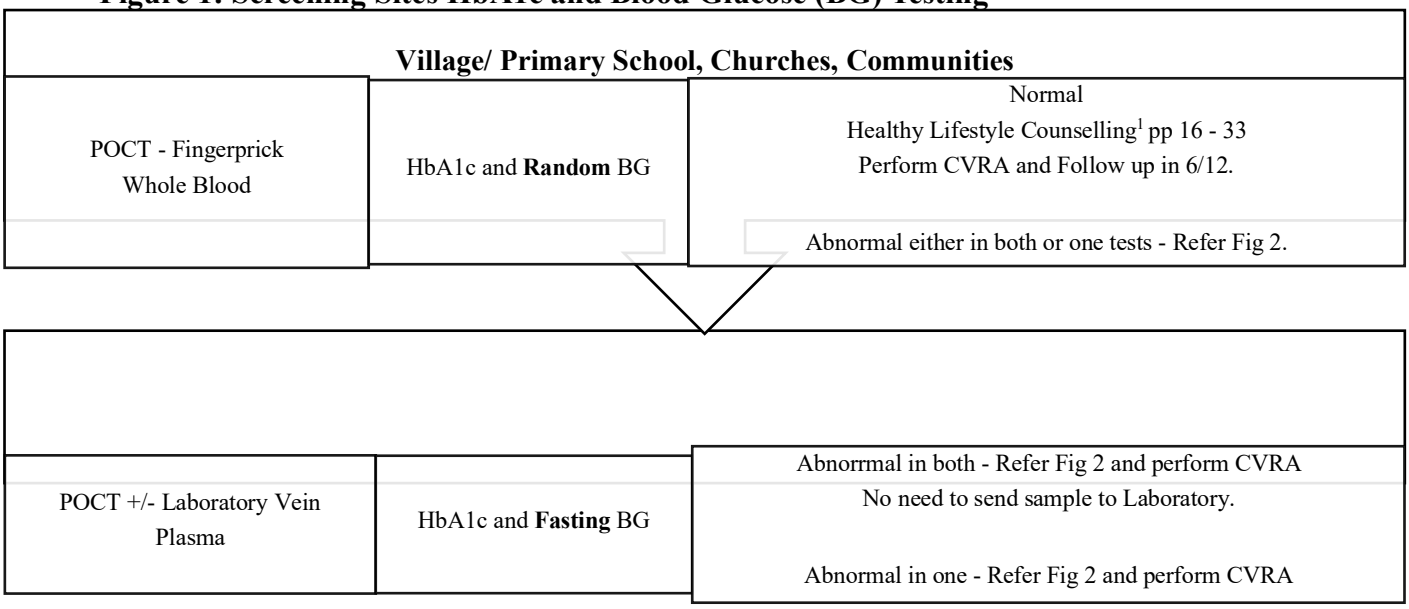
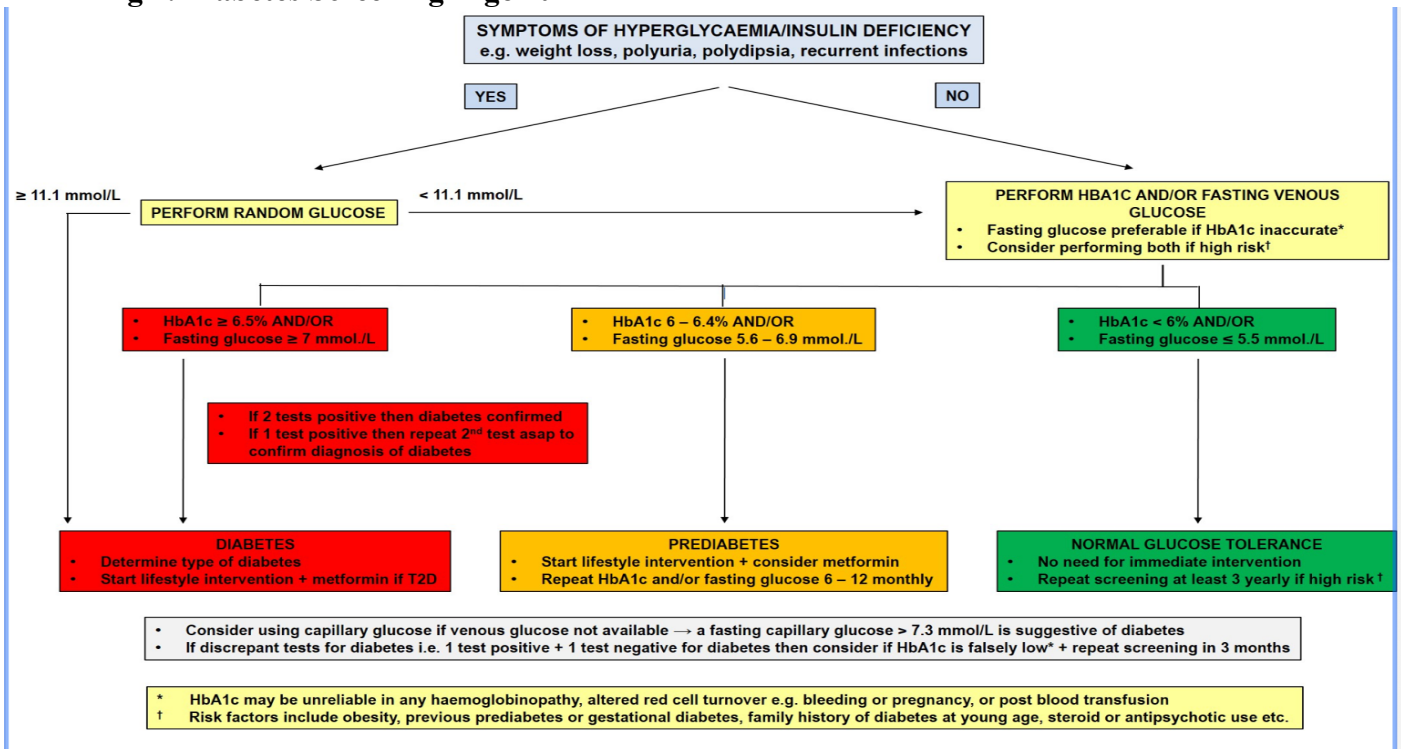


Fig 2. Diabetes Screening Algorithm



Once the diabetes diagnosis is confirmed, register the patient in the Diabetes Registry.

Glucose Level Metrics20

Harmonising HbA1c Testing – NGSP[1] IFCC[2] eAG[3]

[1]NGSP HbA1c (%)	[2]IFCC HbA1c (mmol/mol)	eAG (mg/dL)	[3]eAG (mmol/l)
5.0	31	97	5.4
6.0	42	126	7.0
7.0	53	154	8.6
8.0	64	183	10.2
9.0	75	212	11.8
10.0	86	240	13.3
11.0	97	269	14.9
12.0	108	298	16.6

[1]NGSP – National Glycohemoglobin Standard Programme certifies that markers of A1c tests, reported in percentage (%), provide consistent and comparable results with the DCCT (Diabetes Control and Complications Trial).
[2]IFCC – International Federation of Clinical Chemistry. The new mmol/mol values are the IFCC units.
[3]eAG – estimated average glucose levels (mg/dL) over the 2 to 3-month period, based on HbA1c results (%) by the American Diabetes Association (ADA). HbA1c in Samoa is in percentage (%), and NZ is in mmol/mol units.

Diabetes Diagnostic Values

CRITERIA – WHO and NICE		DIABETES		PRE-DIABETES HIGH RISK T2D	
		mol/mol	%	mol/mol	%
HbA1c		³ 48	³ 6.5	42 - 47	6.0 – 6.4
Blood Glucose (plasma)		mol/L	mg/dl	mol/L	mg/dl
	Random Plasma	³11.1	³ 200		
	Fasting Plasma	³7	³ 126	6.1 – 6.9	110 - 125
	2hr OGTT	³11.1	³ 200	7.8 - 11	140 - 199
Capillary Glucose		mol/L	mg/dl	mol/L	mg/dl
	Random Plasma	³11.1	³ 200		
	Fasting Plasma	³6.1	³ 110	6.1 – 6.9	110 - 125
	2hr OGTT	³11.1	³ 200	7.8 - 11	140 - 199

Monitoring Values

Goal for glycemic control	Fasting Plasma Glucose		HbA1c
	mmol/l	mg/dl	%
Fasting	< 7	< 126	< 7
Fasting (in patients with frequent severe hypoglycemia)	2-3hr postmeal <10 Relax if high risk	<180 Relax if high risk	< 8

Fasting Blood Glucose (FBG) - had been no calorie intake for at least 8 hours. FBG >126mg/dL suggests diabetes.

Random Plasma Glucose (RPG) non-fasting in the diabetes range in a patient with typical symptoms is diagnostic. A negative test does not rule it out. The RPG is the least accurate of the diagnostic tests.

OGTT - The 2-hour plasma, after a 75 oral glucose load (OGTT), is the most burdensome to the patient. It has the highest intraindividual variation to screen/ diagnose diabetes and is less practical and more costly.

HbA1c is the most convenient and practical test, requires no preparation, is analytically superior, and has the lowest intraindividual variation. It is more expensive than FPG but the same as the OGTT.

Always ask the patient when he/she last ate. BG should not be >140mg/dL 1-2 hours after a meal or post-prandial. A post-prandial BG > 180mg/dL suggest diabetes.

Testing Devices and Results Interpretations[U]

The relationship between BG levels in venous (laboratory) plasma glucose and whole capillary (finger-prick) whole blood glucose varies. A venous BG is high for a random and fasting sample. A capillary BG is high in a post-prandial or non-fasting sample. Capillary BG levels are ~20-25% higher than venous plasma glucose levels in the prandial state, whereas only 2-5mg/dl is higher in the fasting state. As a guide, a rough estimation of 15-20% calibration if BG >100mg/dl.[21] If in doubt, send for laboratory glucose testing and confirmation of an abnormal test with the same test is recommended.

POCT[23] - A finger prick (capillary blood) to test HbA1c and blood glucose (fasting or random) will be widely utilized in DH/ HC or Village Komiti, where laboratory service is not readily unavailable.

Glycaemic Monitoring and HbA1cTargets

- Glycaemic targets should be individualised and reassessed yearly for the annual diabetes review. HbA1c testing is preferred and repeat every three months until the patient is to target, then every six months once at target.
- Generally, the target HbA1c for most T2D patients is < 8% (a performance target for many GPs and Ministry of Health). However, the target HbA1c for most people with diabetes is <7% because microvascular complications exponentially increase from this point.
- More aggressive targets, e.g., HbA1c < 6.5 % (<48mmol/mol), are often appropriate for patients with a low risk of hypoglycaemia who are:

[U] Appendix 2: DIAGNOSTIC CRITERIA FOR DIABETES, IMPAIRED GLUCOSE TOLERANCE (IGT) & IMPAIRED FASTING GLYCEMIA (IFG) (MOH 2004 Diabetes National Guideline p (10-11).

  - Young
  - considering pregnancy or pregnant,
  - with microvascular complications, especially retinopathy and nephropathy.

- A more relaxed target, e.g. HbA1c 7.5% (54-70mmol/mol), is more appropriate if the risks of hypoglycaemia are more significant than the benefits of tight control, e.g.
  - Reduced life expectancy due to non-diabetic co-morbidities
  - History of severe hypoglycaemia
  - Significant hypoglycemic unawareness
  - Old age and frailty or cognitive impairment
  - Functional dependency.

- Practice point: Significant medication-induced hypoglycaemia only occurs in patients taking insulin and/or Sulphonylureas. T2D treated with metformin, vildagliptin, SGLT2i, GLP1RA and pioglitazone, alone or in combination, don't cause hypoglycaemia, so there is no need to routinely SMBG. An HbA1c < 6.5% (45 mmol/mol) is not concerning in these patients, but medications that do not reduce CV or renal disease, such as vildagliptin, may be stopped.

Reducing Cardiovascular and Renal Diseases

- Most of the morbidity and mortality associated with T2D is caused by cardiovascular (CV) and renal disease, especially Samoans being Pacific peoples. Therefore, the focus for T2D management now includes reducing CV and renal risk alongside glycaemic control.[25]

- All OHAs reduce CV and renal risk by improving glycemic control.

- Metformin, SGLT2i (and GLP1RA) are also likely to reduce CV and/or renal risk and body weight independently of their effect on glucose levels without causing hypoglycaemia unless combined with insulin and/or sulfonylureas. Metformin remains the first-line, and SGLT2i and GLP1RA are now the preferred second-line pharmacological intervention. The Samoa MOH National Guidelines Group proposes that the SGLT2i[29] be included in the EML.

- Practice point: The PREDICT calculator is currently the recommended CV risk calculator for T2D downloads.

- The benefits of metformin, SGLT2i, and GLP1RA in reducing body weight and progression of CV and renal disease are additive.[26, 27] Therefore, all T2D pts with either diabetic renal disease (UACR > 3 mg/mmol and/or eGFR < 60 mL/min) OR heart failure OR CV disease OR five-year CV risk > 15% should ideally be on metformin and SGLT2i (or GLP1RA if affordable) regardless of their glycaemic control or other OHAs.[28]

- The benefits of the newer agents, SGLT2i (and GLP1RA), in reducing CV disease and renal risk are additional to the benefits associated with statin and ACEi / ARB therapy.

- Unless contraindicated, all patients with T2D and renal disease and/or established macrovascular disease or a five-year CVD risk >15% should be taking a statin, and those with renal disease and/or heart failure should also be taking an ACEi/ARB unless contraindicated or not tolerated.

- Rosuvastatin should be considered for all patients who cannot reach the LDL target on maximally tolerated doses of atorvastatin or simvastatin.

- If renal disease is present, ACEi or ARB dosing (not in combination) should ideally be maximized before adding another antihypertensive.

- As it is now known that ACEi/ARBs do not prevent diabetic renal disease if a patient has a normal UACR and eGFR, either a CCB, thiazide or ACEi/ARB can be used to treat hypertension.

- In patients with no microvascular or macrovascular complications and a five-year CV risk < 15%, a target systolic BP < 140 mmHg and diastolic BP < 90 mmHg is reasonable.

- All patients with a previous vascular event should take aspirin for secondary prevention unless contraindicated. Aspirin is no longer generally used for primary prevention in

patients with diabetes because the benefits are reduced, and the bleeding risk increases compared to patients without diabetes.

- Smoking cessation is, as always, important.

- Practice point: The target LDL has been lowered to <1.4mmol/L (previously <1.8mmol/L). If tolerated, BP targets remain <130mmHg systolic and <80mmHg diastolic in this high-risk group. A BP target <125/75mmHg is likely beneficial for younger patients with a complicated disease burden.

Reducing Clinical Inertia

Clinical inertia is likely the most significant barrier to effective diabetes management worldwide, Samoa included.

In Auckland, NZ, despite suboptimal management being attributed mainly to patient barriers, pre-COVID data indicates that 99% of patients with diabetes were enrolled with a GP practice, and over 90% attended this practice at least twice a year.

In patients with the poorest glycaemic control (HbA1c > 9%), more than 75% attended their practice at least twice a year, and at least 85% attended their annual diabetes review and regularly received scripts for glucose-lowering therapy.[24]

Therefore, the key to reducing clinical inertia is to optimise diabetes management at every opportunity proactively.

Action is important as almost all patients with an HbA1c > 9% have an HbA1c test at least once yearly, but approximately two-thirds had a similar level for the past 12 months.

The most critical changes in the guidance aimed at reducing clinical inertia are:

- Confirm T2D diagnosis in asymptomatic patients as early as possible.

- Start lifestyle management and metformin together at diagnosis to delay the progression of T2D, reduce CV risk and assist in weight loss. Commencing metformin should not, however, diminish the importance of lifestyle management.

- Strongly consider starting a second-line agent with metformin at diagnosis if the patient's HbA1c > 8%, as most of these will not reach an HbA1c target <7% with metformin alone.

- Repeat HbA1c testing every three months with treatment intensification until the target is met; HbA1c testing is then every six months. Ideally, patients should have their blood pressure and lipids assessed at the same time, with the appropriate treatment escalating as required.

- Start weight-based basal insulin (rather than the traditional 6-10 unit starting dose) and add prandial insulin once basal insulin doses reach 0.5 units/kg/day.

- Recommend starting insulin immediately if the HbA1c is > 10% (90mmol/mol) at any time, as these patients typically will not reach their glycaemic targets despite lifestyle management and all other glucose-lowering therapies.

Clinical Inertia versus the Patient's Adherence

• A 5-item questionnaire by the TTM Medical Team was sent to District Hospital nurses regarding insulin and BSL review in the village/district hospital (DH). Generally, BSLs can be checked in the village by the women's committee or DH.

• Questions: ***Glucometer availability at home and patients self titration– Appendix 1.***

1. <50% of diabetic patients own and can afford a glucometer at home.

2. ***What is the general uptake of insulin therapy by most patients in the community?*** – Most patients are willing to take insulin if recommended for poor diabetes control instead of oral hypoglycemic medication.

3. ***A suggestion of giving glucometers to the village to the women's committee house. Asking about the feasibility of the diabetic patient's willingness to visit the women's committee house to check BSL twice daily. Is the women's committee willing to take responsibility for the glucometer and monitor patients' BSL?*** Yes, in some women's committees.

4. ***For insulin titration - will patients find it easier to go to the DH to check their BSLs twice daily if needed?*** All villages in a district have glucometers in the women's committee house, but some people find it easier to go to the hospital to have their BSL checked.

5. For optimal diabetes control, should a patient's HbA1c be tested every 3-6/12 as recommended? Most diabetic patients can have blood tested twice a year and some at once. Their blood tests are done at the district hospital, and the hospital transports them to the MTII Hospital lab.

Re-enforcing the New' Algorithm' for Managing T2D.

• The Samoa MOH National Diabetes Guidelines group has adopted the approach taken by the NSSD committee, leading to significant changes to T2D management. This is based on the availability of SGLT2i and GLP1RA and the shift towards reducing CV, renal, and obesity risk in addition to improving glycaemic control (Fig 1 - T2D Algorithm).

• In the T2D algorithm, lifestyle management and metformin remain the first-line interventions for all T2D patients.

Lifestyle Management

• Lifestyle changes: Green Prescriptions (GRx) with healthy eating, physical activity, healthy sleeping, education, and support continue to be the cornerstone of T2D management.

• Lifestyle modifications should target a 5-10% reduction in total body weight if the patient is >30kg/m2 OR a BMI>25kg/m2, or waist circumference > 88 cm for females or > 102 cm for males.

• Aim for a 10- 15% reduction in total body weight to achieve T2D remission, although this may not be possible for patients with long-standing T2D.

• Practice point: Explain to patients that a brisk 5-6-minute walk each day is associated with four additional years of life.[25]

BG Self-Monitoring.

• Self-monitoring of blood glucose levels is an important component of diabetes management. It helps patients understand how lifestyle changes and medicines affect their glycaemic control, such as glucometers and deliverables.

• Self-monitoring can be performed via CBG or CGM – Refer to Guidelines for the glucose targets.

• Practice point: Ideally, every patient with diabetes should be provided with a CareSens^{TM} N or N POP glucometer and CareSens^{TM} N glucose test strips to check CBG levels. However, because of resource constraints – only those on SU and/or insulin or who are pregnant would be eligible for subsidised devices.

• Self-monitoring is recommended if considering or taking a SU or insulin, or during preconception or pregnancy, for the acutely unwell or with hypoglycemia concerns and for patients unable to return reliable HbA1c results.

• CGM is potentially very beneficial when regular CBG cannot be obtained. Consider recommending CGM when insufficient CBG compromises patient safety and/or timely treatment decisions, e.g., in pregnant mothers or T1D with poor control or DKA (All CGM systems in NZ are unfunded and expensive).

Lifestyle Management – Must Be Pragmatic.

• Nutritional education from a registered dietitian is best practice at diagnosis and then annually for ongoing assessment when starting prandial insulin or at any time if required. In Samoa, there are only two local Nutritionists; perhaps online delivery with Village Komiti engagement should be considered.

• Recent evidence suggests that low-energy, low-GI, and modified macronutrient dietary approaches can be as effective as bariatric surgery in achieving weight loss and T2D remission.[25]

• No conclusive evidence exists that one dietary strategy is more effective than another in achieving sustained weight loss and improved glycaemic control. Meta-analyses of the sustainable benefits of ketogenic diets.[26]

• The choice of dietary strategy will depend on factors including patient preference, tolerance, income, co-morbidities, cultural suitability and nutritional needs. It is important to ensure healthy nutrition in young people, pregnant or lactating women or those considering pregnancy, and the elderly –
Multi-sectoral, especially at the village level.

• Dietary recommendations and activity guidelines are available from www.health.govt.nz/our-work/eating-and-activity-guidelines.

• The wrap-around care approach- SNAP, green prescriptions, sleep hygiene, annual influenza vaccinations, cancer screening, and checking for depression with appropriate referral as required – are all important components.

• Practice point: Discuss sleep with all T2D patients, as 50% of this population has OSA. Treatment of OSA can significantly improve blood glucose levels. The optimal sleep duration to benefit glucose and body weight appears to be 6-8 hours per night.

Lifestyle Changes - Nutrition and Physical Activities.

• Green Prescription (GRx) – The GRx Support Person encourages the patient to become active through:

- a monthly telephone call for 3-4 months or;
- face-to-face meetings for 3 – 4 months or;
- group support in the village setting for 3-6 months.

• Report the patient's healthier lifestyle progress to the referring health professional.

• Assess the weight and HbA1c and repeat the GRx as appropriate.

• Engage and encourage the patients in the MOH Healthy Lifestyle Programme[22].

Green Prescription (GRx).

• A Green Prescription (GRx) is a health professional's electronic or written advice to patients and families to encourage and support them in becoming more physically active and eating healthier as part of the management plan.

[22] Appendix 1 - Healthy Lifestyle Programme and SNAP - NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES, 2022.

"Green social prescribing' supports people in nature-based intervention and activities to improve patient's mental/ physical health. The aim is to improve the health and well-being of a diabetes patient through nutrition support and physical activity.

• The GRx colour is green for healthy food and nutrition support, which includes community gardening projects in schools, churches and villages.

1 https://www.england.nhs.uk/personalisedcare/social-prescribing/green-social-prescribing/

Exercise Prescription.
The burden of inactivity vs. smoking - One day of being inactive has roughly an equivalent health burden to smoking three cigarettes. So, being inactive for a whole week is an equivalent health burden to smoking a pack of cigarettes.[30]

• Knowledge: Duration, Frequency, Mode and Intensity.
Duration and Frequency:
Mode: aerobic, anaerobic, resistance or strength-training, cardiorespiratory etc.
Intensity[31] gentle, moderate, vigorous

a. Gentle activities: moving but may not notice or think of them as activities. E.g., showering, getting dressed, folding clothes, strolling around the house, park, or shops, playing musical instruments, and gentle movements in a pool.
b. Moderate activities: getting up and about, usually using the whole body, but not huffing and puffing or feeling sweaty. E.g., brisk walking, biking, skateboarding, dancing, handball, surfing, sweeping or vacuuming, mowing the lawn.
c. Vigorous activities make you "huff and puff." E.g., running, swimming laps, training for netball or soccer, heavy yard work.

• Reasons for exercise[32,-34] Losing weight or Maintaining weight or Keeping Fit or All

a. Losing weight: Integrate exercise into your usual routine.
b. For moderate weight loss: 150-250 mins/per week of moderate-intensity physical activity (American College of Sports Medicine – ACSM).
c. Maintaining weight: Needs to exercise even if has achieved weight loss goal.
d. Keeping fit: Both lose weight and prevent weight regain. ACSM and AHA[23] recommend 20 minutes of strength training/day, two days a week.

• Exercise Prescription: Tailors to the patient's health and fitness goals.
Assesses current physical activity levels.

Brisk walk ~ 15 mins bd x 5d/wk or HIIT[35] ~ 10 mins tds x3d/wk + 3x resistance repetitions x10 of sit & stand, twice/wkly.

Aerobic: mod~15mins bd or HITT~10mins tds + 3 sets of resistance repetition x10 a day, twice a week.

Regular moderate-intensity aerobic and resistance exercise, 30 minutes 5-7 days a week or High-intensity interval Training (HIIT)[36-38]

[23] AHA – American Heart Association

Glucose Lowering Therapies or Oral Hypoglycaemia Agents

1st line treatment – Metformin[4, 27, 28]

Reduces CV risk independently of glycaemic control. HbA1c mean maximal reduction with metformin monotherapy is 16 mmol/mol, with modest weight loss and without hypoglycemia risk. Gastro s/e, but most will tolerate well when started at 250-500mg, OD/ BD, with food and titrated up weekly. Anecdotally, patients tolerate metformin much better in combination tablets with vildagliptin or empagliflozin compared to metformin alone. Metformin therapeutic benefit of > 2 g/day < S/E risk. Max recommended dose is 1g – twice daily.

2nd line treatment – SGLT2i, GLP-1RA, DPPIVi

- SGLT2i[28, 29, 39, 40] (giflozlin) – Empagliflozlin

For T2D and CVD, especially heart failure and renal disease, they reduce CV mortality and progression of established renal disease independently of glycaemic control. SGLT2i are associated with an average 6-13mmol/mol reduction in HbA1c. S/E empagliflozin includes polyuria (proportional to glucose levels and transient) volume depletion, a transient decrease in eGFR (up to 25% is acceptable), skin reactions and genitourinary infections, particularly vaginal thrush and balanitis. Very rare adverse S/E – euglycemic DKA and necrotising fasciitis of the perineum (Fournier's gangrene). It should not be prescribed to women who are pregnant or breastfeeding, patients aged <10 years*, patients with an eGFR < 20mL/min at the start of T1D and use with caution in those with recurrent genitourinary infections and/or are aged >75yo.

- GLP-1RA[41-45] (glutide) – Liraglutide, Dulaglutide, Semiglutide.

In T2D patients and CV and renal disease, they reduce CV outcomes and likely progression of diabetic renal disease, independently of glycaemic control. GLP1RA are associated with more significant reductions in glucose levels and weight than any other class of non-insulin glucose-lowering therapies, as well as reduced BP, without causing hypoglycaemia in monotherapy – as such, GLP1RA is a useful alternative to basal insulin

- DPPIVi [46-47] (gliptin) – Linagliptin, Vidagliptin.

It's currently the only glucose-lowering therapy shown to delay the need for insulin therapy in T2D when combined with metformin. Vildagliptin should be withdrawn if a GLP1RA is initiated due to redundancy and an increased risk of adverse effects associated with continued treatment.

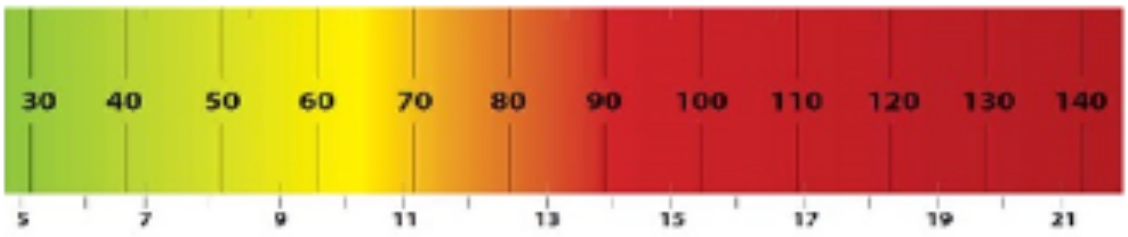
3rd line treatment – Pioglizatone, Sulfonylureas, Insulin

- Pioglitazone is a 3rd or 4th line medicine, likely to reduce CV disease independently of glycemic control and doesn't cause hypoglycemia alone.

S/E of weight gain and increased fractured risk limit its use. Its most significant benefit in obese patients with insulin resistance and fatty liver disease benefits increased in women.

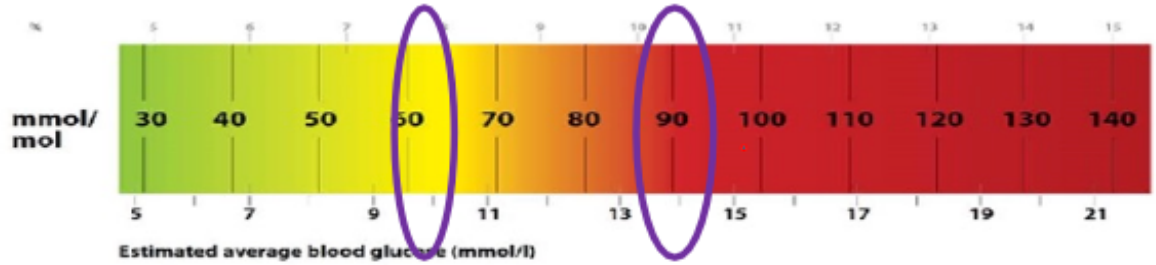
- Sulfonylureas (SU) are 3rd or 4th line medicine that may cause weight gain and hypoglycemia and do not reduce CV or renal disease independently of glycemic control. If appropriate, SU can be reduced or withdrawn when newer agents are introduced. SU remains useful in steroid-induced hyperglycemia. Patients taking SU would require SMBG and education about hypoglycemia and how it may affect driving and sick day management.

Medication Reduces HbA1c



Metformin ~10
SGLT2 6-13
GLP-1RA ~15
DPPIVi 5-10
Sulphonylureas ~15
Insulin Any

HbA1c as an indicator of Glycaemic Control



T2DM new diagnosis

Over 64 need 2 or more treatments
Over 90 or symptomatic consider insulin.

Escalation of Therapy

- The choice of a second-line agent depends on co-morbidities, primarily CV and renal disease.
- All patients with T2D with either diabetic renal disease OR heart failure OR CV disease OR five-year CV disease risk > 15% should ideally be on metformin, SGLT2i (and/or GLP1RA) regardless of their glycaemic control or other OHA.
- The choice between an SGLT2i or GLP1RA - SGLT2i is typically preferable if renal disease or heart failure predominates (GLP1RA is preferable if CVA predominates). If the HbA1c remains above target in this high-risk group, dual SGLT2i (and GLP1RA therapy is recommended but not funded in NZ).
- Prospective studies on the benefits of SGLT2i and GLP1RA in reducing CV and/or renal risk have largely been shown in patients with existing CV and/or renal disease.[28] Retrospective data suggest that SGLT2i regimens and combinations of SGLT2i and GLP1RA may primarily prevent cardiac and
- cerebrovascular events and heart failure in those with T2D.
- Obesity and its complications are also very common and major morbidity causes. SGLT2i (or GLP1RA) are still the likely preferred second-line agents when escalation of metformin therapy is required (including those aged 10-17 years)—patients without cardiovascular or renal disease who are overweight or obese[34, 39, 40].
- GLP1RA and SGLT2i both cause weight loss without hypoglycaemia.
- Vildagliptin is weight-neutral. GLP1RA typically reduces weight and glucose levels than SGLT2i, but patient preference is likely the greatest influencer on which agent is used.
- Vildagliptin is likely the preferred second-line agent when patients cannot afford to self-fund SGLT2i and/or GLP1RA therapy OR when escalation of metformin therapy is required in patients with T2D without CV or renal disease who are of normal weight. Vildagliptin is the only agent shown to delay the
- need for insulin when combined with metformin, and it does not cause weight gain or hypoglycaemia.

- Pioglitazone, SU, and insulin are now third- and fourth-line agents due to the associated weight gain, risk of hypoglycaemia, and need for SMBG with insulin and SU.

Take Home Messages for Type 2 Diabetes

- Screen for T2D in high-risk populations from age 10 years
- Confirm T2D diagnosis on the same or next day if possible; waiting three months is no longer advised.
- Target HbA1c for most patients with T2D is < 7%
- Start lifestyle management and metformin together at diagnosis, in combination with individualised self-management education and support, the Green and Exercise Prescriptions.
- Consider starting metformin and a second-line medicine at diagnosis if the HbA1c is 8%; SGLT2i (GLP1RA) is the preferred second-line medicine for most patients with T2D.
- Monitor HbA1c levels every three months and escalate treatment if the target is unmet.
- Prescribe an SGLT2i (and/or GLP1RA) to all T2D patients with diabetic renal disease and/or CV disease and/or five-year CV risk > 15%, regardless of their glycaemic control if no contraindications.
- Initiate insulin at any time if patients have symptoms of insulin deficiency, e.g. weight loss, polyuria, polydipsia, and consider starting insulin at any time if the HbA1c is > 10%.
- Initiate basal insulin with weight-based dosing; introduce prandial insulin if HbA1c is above target despite 0.5 units/kg/day doses.

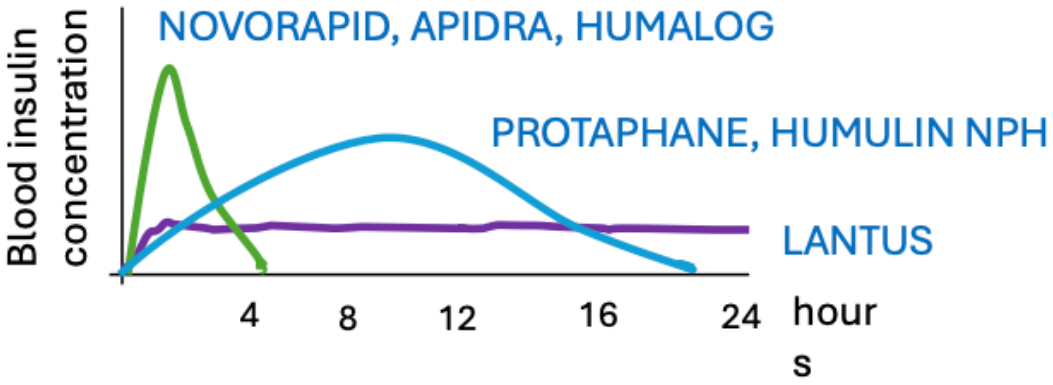
Insulin Profile

Insulin Brands and Duration of Action.

	BOLUS		**BASAL**		**PRE-MIXED**	
	Rapid Acting	Short Acting	Intermediate	Long Acting	Rapid + Intermediate	Short + Intermediate
Insulin Brand	Humalog	Actrapid	Isophane Wosulin N	Glargine Optisulin	Humalog Mix25	Penmix30 Penmix40 Penmix50
	Novorapid				Humalog Mix50	Humulin 30/70
	Apidra				Novomix30	
Onset	15 minutes	30 minutes	60 – 90 minutes	60 – 120 minutes	0 to 30 minutes	
Peak	1-3 hours	1-3 hours	4-12 hours	None	1 to 12 hours	
Duration	3 to 5 hours	5.5 to 8 hours	16-24 hours	Up to 24 hours	Up to 24 hours	

[1]No Rapid Acting is available in Samoa, only Short Acting.
Note the Correction insulin is a Bolus Rapid Acting

Insulin Profiles – Length and Strength of Action.



Insulin Regimen and Prescribing

- Insulin dose prescribing – weight-based (vs traditional dosing)

- Basal and Bolus insulin
  - Insulin available in Samoa: Basal - Glargine (Lantus), Isophane
    Bolus – Actrapid

- Safety and Regular BG Monitoring
  - Fasting BG level
  - Setting and by whom: Urban and Non-Urban

Basal insulin is indicated with any of the following:
- Likely or confirmed T1D
- Significant hyperglycemia at any time, e.g. HbA1c > 10% (including at diagnosis).
- Symptoms of insulin deficiency, e.g. weight loss, polyuria, polydipsia
- Unable to meet glycaemic targets after lifestyle management and maximal oral/GLP-1RA treatment
- Previous diabetic ketoacidosis or hyperosmolar hyperglycemic syndrome

Basal Insulin - Glargine (Lantus) for T1D and Isophane for T2D

- Weight-based dosing is safe and effective, resulting in faster glycaemic control than the traditional starting dose of 6 – 10 units.
- Basal insulin is most effective when taken at night to offset hepatic glucogenesis.

- The recommended starting doses for weight-based basal insulin are:
  - 0.1units/kg daily if there are concerns over hypoglycaemia, e.g. HbA1c < 8% or BMI < 18 kg/m2 or elderly or renal/liver failure; OR
  - 0.2 units/kg daily if HbA1c > 8% and BMI > 18 kg/m2

- Safety remains paramount regardless of the starting dose — regular dose titration results in most patients reaching their glycaemic target.

- Fasting Blood Glucose (FBG) monitoring while taking basal insulin and if 3 consecutive levels > 7 mmol/L occur, increase the dose by 10% or 2 units.
- The dose should not be increased if any hypoglycaemia occurs OR
the FBG < 7 mmol/L OR doses reach 0.5 units/kg/day.

• Doses of basal insulin above 0.5 units/kg/day typically do not reduce glucose levels further but lead to weight gain – Clinicians should confirm injection technique and adherence before adjusting insulin doses.

- If the glycaemic target of 0.5 units/ kg/day of basal insulin is not reached, prandial insulin with either premixed or bolus insulin would be required.

- The choice of bolus or premixed insulin is based on the patient's clinical characteristics and preference. Premixed insulin is only appropriate for patients who eat regular meals.

- Correction insulin involves adding doses of rapid-acting insulin to bolus insulin to correct pre-prandial hyperglycaemia. This is administered separately if the patient is taking basal or premixed insulin alone.

The progressive nature of T2D means many patients will require insulin in the advanced stages of the disease despite a maximal dose of other glucose-lowering therapies. However, many patients need help to reach glycemic targets on insulin therapy due to subtherapeutic dosing of ineffectual dose titration.

Patients starting on insulin need clear instructions on how to administer and self-titrate doses, how to SMBG levels, recognize and manage hypoglycaemia. Patients should receive a sick day management plan and be referred to a dietitian.

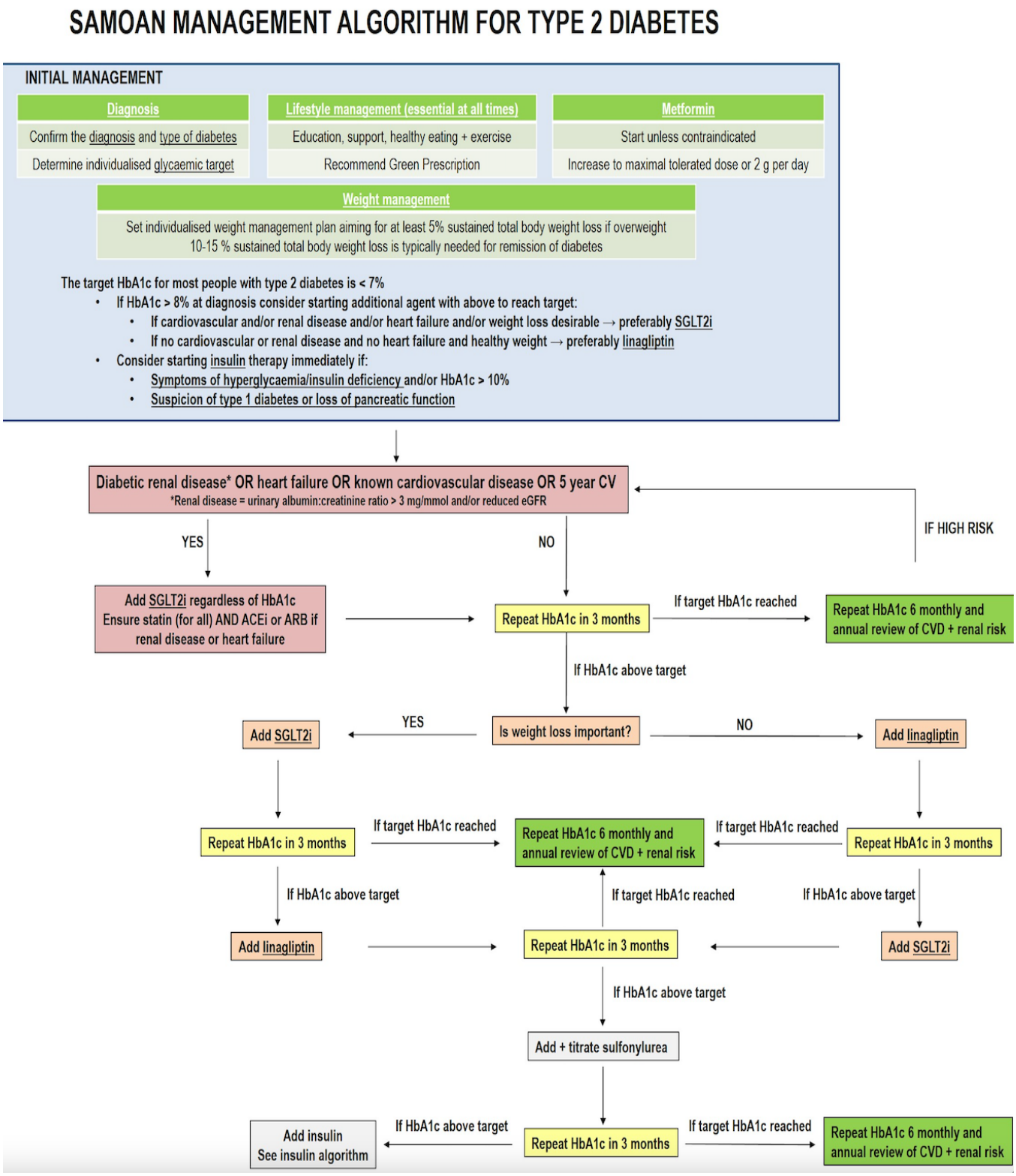
Insulin may be reduced or withdrawn, where appropriate, following initiation of newer agents.

Patients taking insulin need to understand their obligations if driving. Factors influencing fitness to drive include vision, peripheral vascular disease and neuropathy, risk of hypoglycaemia, cognitive impairment and other co-morbidities, e.g. obstructive sleep apnea.

Further information about diabetes and driving is available from
https://dm-mohsamoa.nzssd.org.nz/Home.html#subjects-list

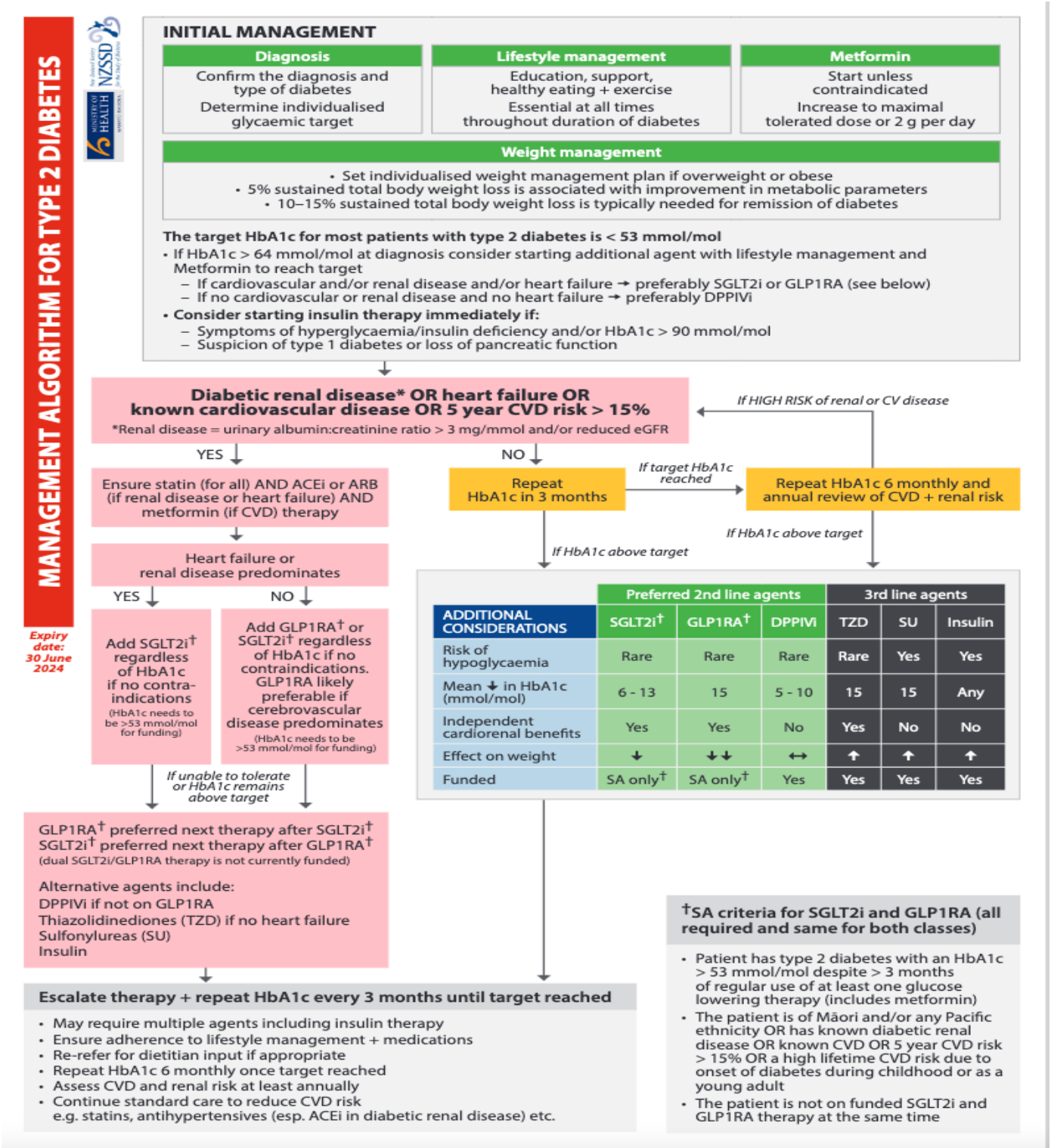
Management Algorithm for T2D without GLP-1RA

Fig. 3 Management Algorithm for T2D without GLP-1RA
(adapted from NZSSD)



Management Algorithm for T2D with GLP-1RA

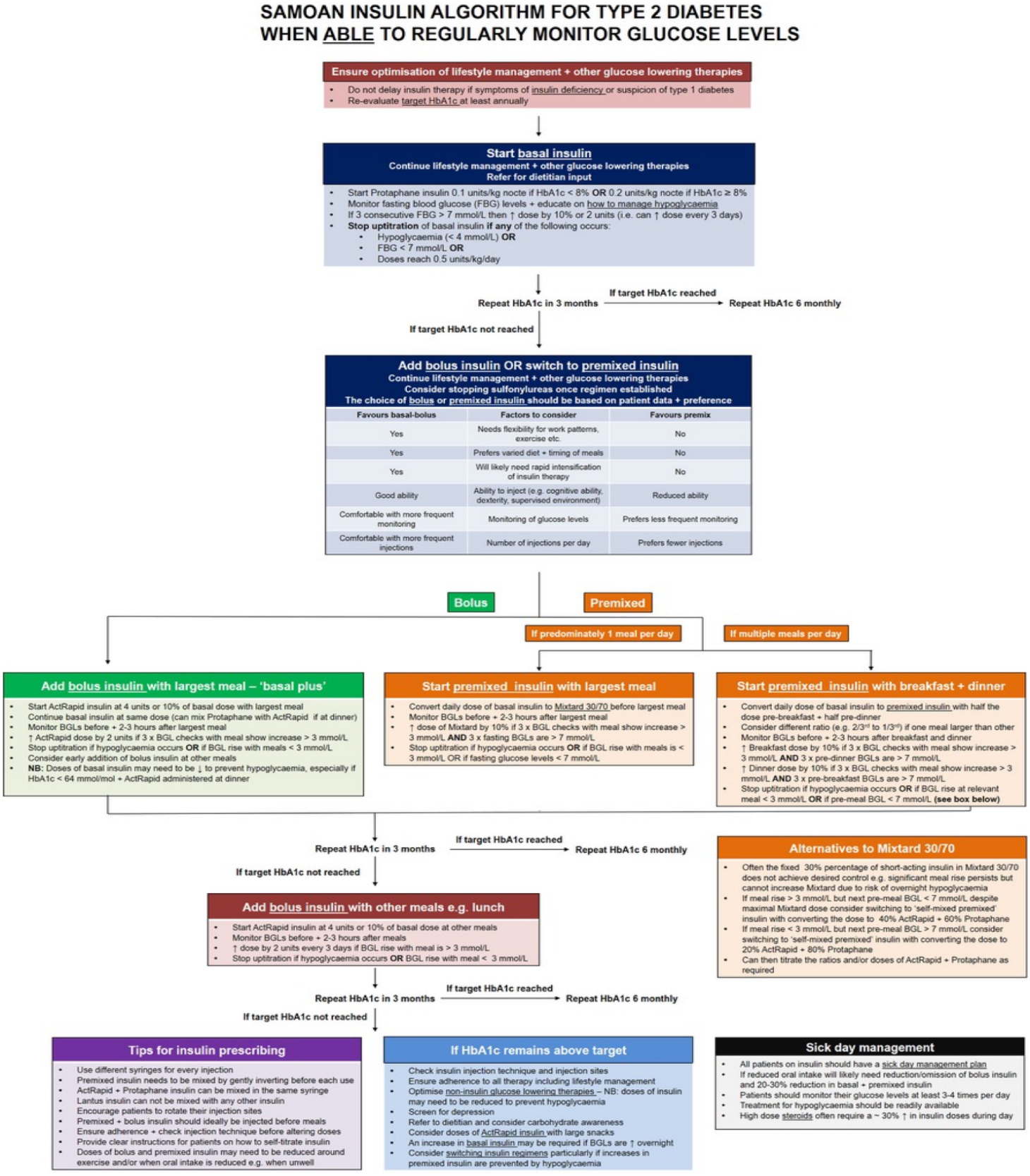
Figure 4: Management algorithm for T2D with GLP-1RA[24]
(adopted from NZSSD)



[24] GLP-1RA – not available in Samoa.

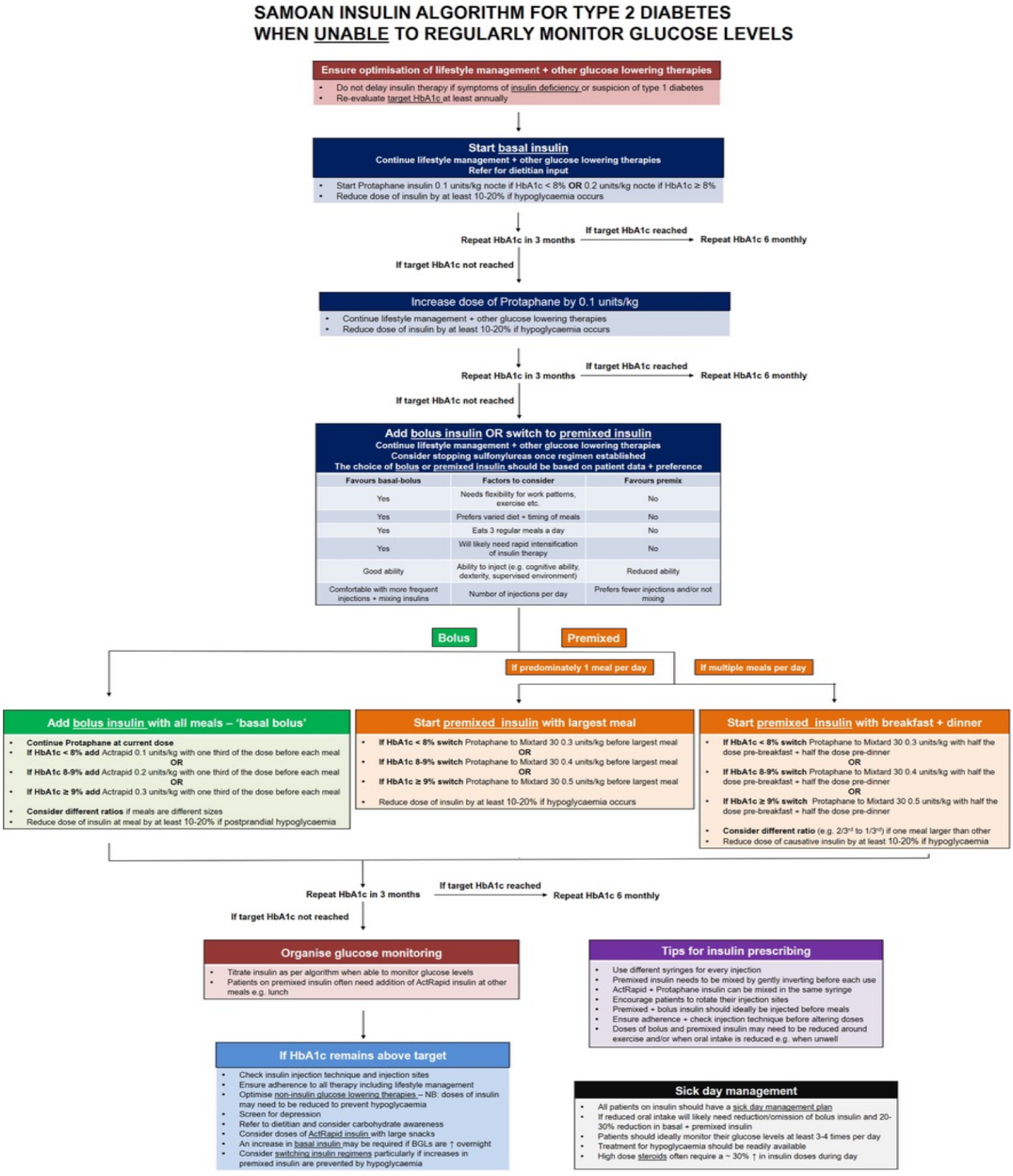
Insulin Regimen for T2D – When ABLE to SMBG Regularly

Figure 5: Insulin Regimen for T2D – When ABLE to SMBG Regularly



Insulin Regimen for T2D – When UNABLE to SMBG Regularly

Figure 6: Insulin Regimen for T2D – When UNABLE to SMBG Regularly



Type 1 Diabetes without Ketoacidosis

Type 1 Diabetes – new onset without Ketoacidosis

- Diabetes mellitus symptomatic (polyuria, polydipsia, weight loss)
- Random blood glucose >11.1mol/l (though not always the case)
- pH >7.3 HC03 >15mmol/l
- Ketonuria or ketonemia is usually present
- T1DM due to absolute or relative insulin deficiency

Background:

- Most newly diagnosed are well and without ketoacidosis (pH >7.3 and HC03>15mmol/l). They are only mildly dehydrated, though they may have had a lot of weight loss and are not vomiting or systemically unwell.
- This is not a medical emergency, BUT insulin is required to prevent DKA.
- Type 1 diabetes can present in any racial group and independent of BMI, so obese children are still most likely to have type 1 diabetes.
- Often, they have a trace or more urinary ketones or capillary ketones using POCT.
- Or capillary ketones if able to get a point-of-care measurement.

Differential diagnoses

- Stress-induced hyperglycemia
- T2DM
- Other types of Diabetes Mellitus.
- Risk factors for type 2 Diabetes:
  - BMI >+4 SD
  - Acanthosis nigricans
  - Family history of Type 2 diabetes
  - History of Gestational diabetes in mother and being of a High-risk ethnic group: Maori, Pacific Island or Asian. (If symptomatic, they will normally be started on insulin).

Laboratory Values for People with a New Diagnosis of T1D without KA

- **Diagnosis**
  - Blood glucose > 11 mmol/l
  - Ketoacidosis not present (pH>7.3, HCO3 >15 mmol/l)
  - Ketonuria is usually present.

Marked hyperglycaemia (especially if hyperosmolar) may require individualised therapy even if not in DKA (BG >40 mmol/l).

- **Investigations**
  - Blood glucose, urea, electrolytes, LFT, creatinine
  - Capillary or venous blood gas (arterial blood gas rarely required)
  - Urine - ketones, glucose and routine culture and capillary ketones, if available

- HbA1c (measure of 3 months glycaemia) – must be in the purple top tube
- Pre type 1 diabetes antibodies (GAD & IA2) - plain tube. Writ' 'pre-type 1 diabetes'. If negative, the lab will automatically check for ZnT8.
- Random blood lipids (to exclude severe hyperlipidaemia), TFTs, thyroid autoantibodies and coeliac antibodies.

• **Consider:**
- Check for precipitating causes if febrile or unwell.
- If considering type 2 diabetes (obesity, family history, acanthosis), check paired glucose/insulin level plus C-peptide and store DNA for potential future analysis.

Principles of Management

- All patients are initially admitted to stabilise and to start education and will have a three to five-day admission.

- To stabilise blood glucose and institute appropriate education for the family.

- Further education at the Specialist Diabetes Clinic at TTM or MT11 over the ensuing weeks.

- All patients should be started on insulin pens. Insulin pumps are not started during this phase of diabetes.

Insulin Regime

- All patients will start with 24-hour basal insulin (Lantus) on presentation, regardless of the time of day.

- High blood glucose can be corrected using short-acting analogue insulin such as Novorapid. Additional short-acting insulin will also be prescribed before each main meal.

- Note that no rapid-acting insulin is available in Samoa, only short-acting insulin. Therefore, caution is required when giving too much correction with short-acting insulin.

- Estimate total daily requirement of insulin (guide only)
  - 0-5 years: 0.5 – 0.6 Units/kg/24 hours (CAUTION: may be very sensitive to insulin)
  - 5 – 10 years: 0.7 Units/kg/24 hours (may need less if minimal symptoms and mild hyperglycemia)
  - >10 years: up to 1 Unit/kg/24 hours
- Dose Calculation
  - The daily calculated insulin dose is 50% basal insulin, and 50% short-acting insulin, given as three divided doses with meals. Any corrections for high blood sugars will be additional to the daily dose.

• For example
  - 10-year-old 50kg child receiving 1 Unit/kg/24-hour daily insulin dose
  - = 25 units of Lantus once daily
  - + 25 units Novorapid given as 8 units 3x daily before main meals

• Correction factor

- A correction factor is calculated by dividing 100 by the total daily dose of insulin (TDD). In the above example, 100 divided by 50 = 2, so the correction factor is 2. Refer to the insulin prescribing document.

- Implementing a correction factor and counting carbohydrates would be more challenging in Samoa as there are only two local dietitians, but we could still aim for this as a goal. The evidence is clear of the benefits of T1D in calculating, but for T2D, there is no evidence, and it is more about awareness than counting.

Insulin Dosing - Samoa MOH National Guideline Group note

A **weight-based** dose applies for basal insulin for a new T1D diagnosis at above 15 years old.

• Start a basal-bolus regimen with Lantus TDD
- 0.1 units/kg/nocte typical starting dose
- 0.05 units/kg/ nocte if very lean/concerns over hypoglycaemia
- 0.2 units/kg/ nocte if likely very insulin resistant

• Start a basal-bolus regimen with Protaphane TDD - if no Lantus
- 0.05 units/kg twice daily for most
- 0.025 units/kg twice daily if very lean
- 0.1 units/kg twice daily if relatively insulin-resistant

- For rapid-acting insulin, the doses would be based on insulin: carbohydrate ratios (see pre-calculated weight-based table for starting doses). The dietitian would calculate fixed doses based on the patient's typical diet.

- Start a Premixed insulin regimen (if basal-bolus is not the preferred option).
  - Typically, it starts at 0.5 units/kg/day, maximising the doses split with either a 50:50 split or a 2/3 morning 1/3 evening split if the mixtard is used. Titrate as for T2D, but more slowly. Use different ratios if there are marked differences in the size of meals.

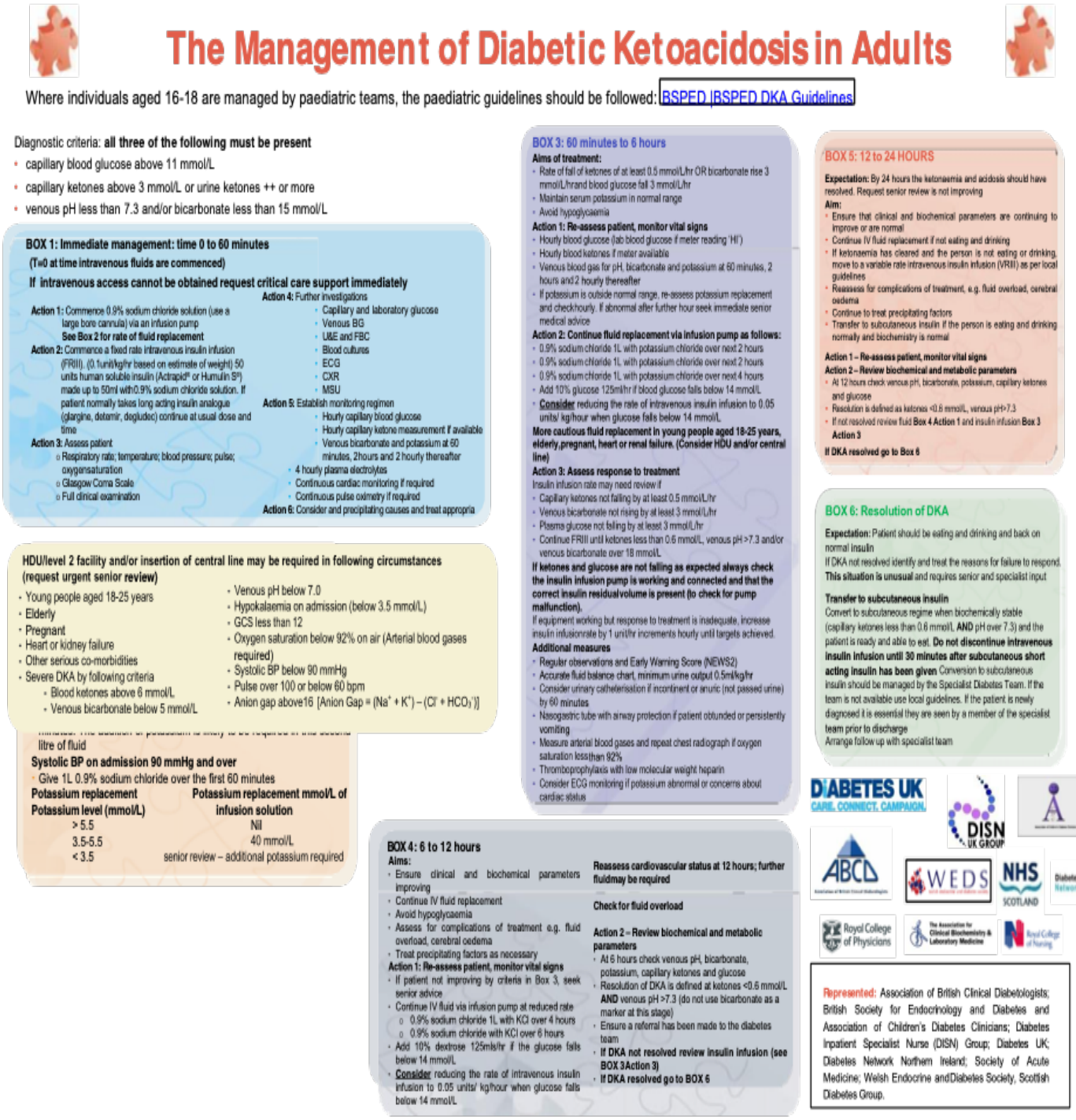
- Diabetes without Ketoacidosis (new onset Type I Diabetes)[36]
  https://starship.org.nz/guidelines/diabetes-without-ketoacidosis-new-onset-type-1-diabetes/

- Diabetic Ketoacidosis (DKA) management – Starship Type I Diabetes protocol
  https://starship.org.nz/guidelines/diabetic-ketoacidosis-dka-management/

- Use blood ketones and not urine ketones during the DKA phase. Urine ketones are unreliable as they can be increased due to causes other than DKA, such as dehydration, infection, and low carbohydrate diets. Capillary ketones can be measured if a venous sample is inaccessible.

Hyperglycemia Emergencies – Diabetic Ketoacidosis (DKA) in Adults

Figure 7: Hyperglycemia Emergencies - Diabetic Ketoacidosis (DKA) in Adults. **(**Adopted from the JBDS[25]_DKA protocol.pdf**)**



https://abcd.care/resource/current/jbds-02-management-diabetic-ketoacidosis-adults

[25] JBDS – Joint British Diabetes Societies

Hyperglycemia Emergencies – Hyperosmolar Hyperglycemia State (HSS)

Figure 8: Hyperglycemia Emergencies - Hyperosmolar Hyperglycemia State (HSS). (Adopted from the JBDS_HHS protocol.pdf) https://abcd.care/resource/jbds-06-management-hyperosmolar-hyperglycaemic-state-hhs-adults-diabetes

Hyperosmolar Hyperglycaemic State (HHS) care pathway in adults

JBDS-IP Joint British Diabetes Societies for inpatient care

Clinical features (all the below)	Aims of therapy	Criteria for resolution of HHS: Holistic assessment of the following:
1) Marked hypovolaemia	1) Improvement in clinical status and replacement of all estimated fluid losses by 24 hours	1) Clinical and cognitive status is back to the pre-morbid state
2) Osmolality ≥320 mOsm/kg	2) Gradual decline in osmolality: drop of 3-8 mOsm/kg/hr	
3) Marked hyperglycaemia (≥30 mmol/L)	3) Blood glucose: aim to keep to 10-15 mmol/L in the first 24 hours	2) Osmolality <300 mOsm/kg
4) Without significant ketonaemia (≤3.0 mmol/L)	4) Avoid hypoglycaemia and hypokalaemia	3) Hypovolaemia has been corrected (urine output ≥0.5 ml/kg/hr)
5) Without significant acidosis (pH ≥7.3) and bicarbonate ≥15 mmol/L	5) Prevent harm: VTE, osmotic demyelination, fluid overload, foot ulceration	4) Blood glucose <15 mmol/L

A mixed picture of HHS and DKA occurs relatively frequently

Theme / Time	0-60 minutes	60 minutes - 6 hours	6-12 hours	12-24 hours	24-72 hours
Clinical assessment and monitoring					
Clinical status / NEWS	History/Examination, NEWS, cardiac monitoring, urine output Establish adequate intravenous lines (preferably 2 large bore IV cannulas) Discuss with outreach/ICU team early if there are markers of high severity **(see Table 1 overleaf)**			Check for continuing improvement	Expect steady recovery, patient eating and drinking, and biochemistry as it was prior to HHS Ongoing management of the precipitating cause(s) Replacement of all estimated fluid losses by 24 hours Individual BG target 6-10 mmol/L
Precipitating cause(s)	Assess for precipitating cause(s): sepsis, diabetic foot infection, treatment omissions, vulnerable adult, vascular event (myocardial infarction, stroke)			Ongoing management of the precipitating cause(s)	
Osmolality (VBG/blood) Measure/calculate (2xNa$^+$) + Glucose + Urea Aim for gradual decline of 3-8 mOsm/kg/hr	Check every hour for 6 hours Until the urea is available, calculate using (2 x Na$^+$ + glucose). Recalculate osmolality once urea is available, and then use (2 x Na$^+$ + glucose + urea)		Check every 2 hours	Check every 4 hours (if no clinical improvement then check every 2 hours)	
How to interpret osmolality results	**Check Figure 1 overleaf**	**Check Figure 1 overleaf**	**Check Figure 1 overleaf**	**Check Figure 1 overleaf**	
Blood glucose (BG) (Aim for 10-15 mmol/L in the first 24 hours)	Check every hour Fall in BG should be up to 5.0 mmol/L per hour **(check Figure 2 overleaf for details)**		**Check every hour (check Figure 2 overleaf for details)**	**Check every hour (check Figure 2 overleaf for details)**	
Interventions					
Intravenous fluids (0.9% saline) (In IV line 1) (caution in HF/CKD/BW <50 kg)	1 litre over 1 hour (caution in HF/CKD/BW <50 kg)	Aim for 2-3 litres positive balance by 6 hours	Aim for up to 6 litres positive balance by 12 hours	Reassess fluid balance to plan fluids replacement for the next 12 hours	Can be stopped if patient is eating and drinking
Insulin infusion (FRIII 0.05 units/kg/hr using Actrapid®) (In IV line 2)	Use DKA guidelines if ketonaemia (>3.0 mmol/L) or ketonuria (≥2+) Start FRIII if ketonaemia (>1.0 - ≤3.0 mmol/L) or ketonuria (<2+)	Only commence if positive fluid balance and BG plateaued on repeated measurements (>2 occasions)		Rate may need adjustment to 1 unit/hr to achieve BG target 10-15 mmol/L	VRIII if not eating and drinking Otherwise convert to subcutaneous insulin
Glucose infusion: 5% or 10% @ 125ml/hr (In IV line 2)	Not required at this stage	Only initiate if BG <14 mmol/L		Continue infusion at 125 ml/hr	Can be stopped if patient is eating and drinking
Potassium	Senior review / ICU outreach if potassium <3.5 or >6.0 mmol/L	**Check Table 2 overleaf for potassium replacement guidelines**	**Check Table 2 overleaf for potassium replacement guidelines**	**Check Table 2 overleaf for potassium replacement guidelines**	Check U&Es daily
Assessments and prevention					
Prevent harm	VTE prophylaxis (low molecular weight heparin) Assess for complications e.g. fluid overload, cerebral oedema, osmotic demyelination (deteriorating conscious level)				VTE prophylaxis until discharge Daily feet checks
Prevent hypoglycaemia	Glucose 5% or 10% at 125 ml/hr if BG <14 mmol/L				Target BG 6-10 mmol/L
Prevent foot ulceration	Daily foot checks				Daily foot checks
Refer to the inpatient diabetes team early. Escalate management if there is clinical deterioration.					Review by inpatient diabetes team before discharge

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Abbreviations: BG=blood glucose; BW=body weight; CKD=chronic kidney disease; FRIII=fixed rate intravenous insulin infusion; HF=heart failure; hr=hour; ICU=intensive care unit; IV=intravenous; kg=kilograms; NEWS=national early warning score; U&Es=urea and electrolytes; VBG=venous blood gas analysis; VRIII=variable rate intravenous insulin infusion; VTE=venous thromboembolism

@JBDSIP 2022

Hyperosmolar Hyperglycaemic State (HHS) care pathway in adults

JBDS-IP Joint British Diabetes Societies for inpatient care

Figure 1: Managing osmolality changes during treatment of HHS

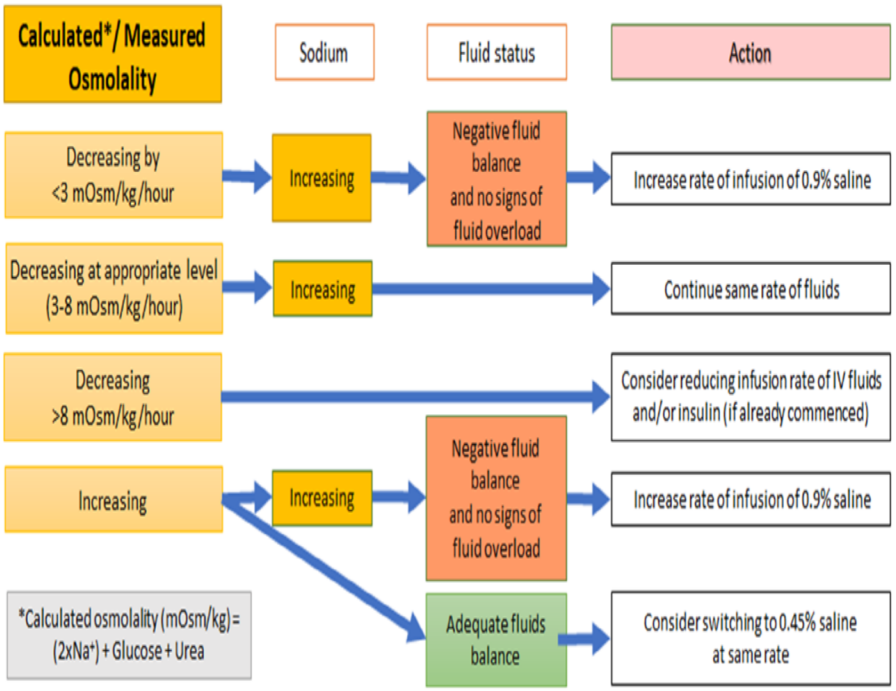
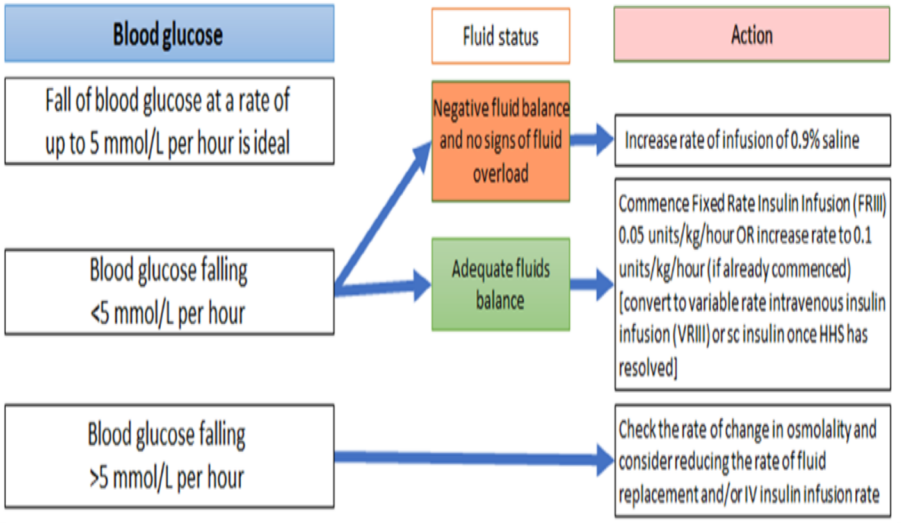


Figure 2: Managing glucose changes during treatment of HHS



If the parameters in Figures 1 and 2 above are not met, seek specialist input early to help tailor the management according to the individual's need

Table 1: Escalate to ICU/outreach if any of the following is present:

- Osmolality >350 mOsm/kg
- Sodium >160 mmol/L
- Venous/arterial pH <7.1
- Hypokalaemia (<3.5 mmol/L) or hyperkalaemia (>6 mmol/L) on admission
- Glasgow Coma Scale (GCS) <12 or abnormal AVPU (Alert, Voice, Pain, Unresponsive) scale
- Oxygen saturation <92% on air (assuming normal baseline respiratory function)
- Systolic blood pressure <90 mmHg
- Pulse >100 or <60 beats per minute
- Urine output <0.5 ml/kg/hour
- Serum creatinine >200 µmol/L and/or Acute kidney injury
- Hypothermia
- Macrovascular event such as myocardial infarction or stroke
- Other serious co-morbidity

Table 2: Potassium replacement guidelines

Potassium level in first 24 hours (mmol/L)	Potassium replacement in infusion solution
≥6.0	Senior review ICU/outreach
5.5-5.9	Nil
3.5-5.5	40 mmol/L
<3.5	Senior review ICU/Outreach. Additional potassium is required

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Referral and Management Pathway – navigating the e-Guidelines link.
Click on the blue text drop-down menu for the relevant topic
https://dm-mohsamoa.nzssd.org.nz/Home.html#subjects-list

- Screening and diagnosis of type 2 diabetes
- Glycemic monitoring and targets for type 2 diabetes
- Lifestyle management
- Non-insulin medications
- Screening and diagnosis of type 2 diabetes
- Management of cardiovascular risk factors in diabetes - (Hypertension, Dyslipidemia, Antiplatelet therapy)
- Management of hypoglycemia
- Sick day management
- Diabetes in pregnancy
- Diabetes and driving
- Pre-diabetes

References

1. World Health Organisation. Samoa STEPS Survey 2013, Ministry of Health. https://extranet.who.int/ncdsmicrodata/index.php/catalog/steps/?page=1&country%5B%5D=235&ps=15&repo=STEPS

2. Samoa Ministry of Health & World Bank Group. NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES (MINISTRY OF HEALTH & WORLD BANK GROUP, May 5, 2022. Version 1.2.

3. Galaviz KI, Narayan KMV, Lobelo F, Weber MB. Lifestyle and the Prevention of Type 2 Diabetes: A Status Report. Am J Lifestyle Med. 2015 Nov 24;12(1):4-20. doi: 10.1177/1559827615619159. PMID: 30202378; PMCID: PMC6125024.

4. Institute for Health Policy, Colombo, Sri Lanka. Centre for Health Information Policy and Systems Research, Fiji National University, Suva, Fiji. Samoa National NCD Cost Analysis Study. 19 December 2017. https://documents1.worldbank.org/curated/en/452191554307500821/pdf/Samoa-National-NCD-cost-analysis-study.pdf

5. Hou X, Anderson I, Burton-Mckenzie EJ. The value of lost output and cost of illness of non-communicable diseases in the Pacific. Health Policy Open. 2022 Jul 16;3:100073. doi: 10.1016/j.hpopen.2022.100073. PMID: 37383583; PMCID: PMC10297817.

6. Uusitupa M, Khan TA, Viguiliouk E, Kahleova H, Rivellese AA, Hermansen K, Pfeiffer A, Thanopoulou A, Salas-Salvadó J, Schwab U, Sievenpiper JL. Prevention of Type 2 Diabetes by Lifestyle Changes: A Systematic Review and Meta-Analysis. Nutrients. 2019 Nov 1;11(11):2611. doi: 10.3390/nu11112611. PMID: 31683759; PMCID: PMC6893436.

7. Viali S, Malaki M, Fiu L, Tupuola A, Quested C, World Health Organisation. NATIONAL GUIDELINE FOR THE PREVENTION AND MANAGEMENT OF DIABETES AND COMPLICATIONS IN SAMOA 2004 MINISTRY OF HEALTH SAMOA

8. The New Zealand Society for the Study of Diabetes (NZSSD) Group. Type 2 Diabetes Management Guidance. Updated 2023 Recommendations from the NZSSD. https://t2dm.nzssd.org.nz/

9. Joint British Diabetes Society for inpatient care. The Management of Hyperosmolar Hyperglycaemic State (HHS) in Adults. February 2022. https://abcd.care/sites/default/files/site_uploads/JBDS_Guidelines_Current/JBDS_06_The_Management_of_Hyperosmolar_Hyperglycaemic_State_HHS_%20in_Adults_FINAL_0.pdf

10. Starship Hospital. Diabetes Ketoacidosis (DKA) management. 20 Apr 2022. https://starship.org.nz/guidelines/diabetic-ketoacidosis-dka-management/

11. Lauren C. LaMonica, a Stephen T. McGarvey, Anna C. Rivara, Chl€oe A. Sweetman, Take Naseri, Muagatutia Sefuiva Reupena, Hemant Kadiamada, Erica Kocher, Alexa Rojas-Carroll, James P. DeLany and Nicola L. Hawley. Cascades of diabetes and hypertension care in Samoa: Identifying gaps in the diagnosis, treatment, and control continuum − a cross-sectional study. The Lancet Regional Health - Western Pacific, 2022;18: 100313. Published online November 24, 2021 https://doi.org/10.1016/j.lanwpc.2021.100313

12. Liyanage JH, Dissanayake HA, Gamage KKK, Keerthisena GSP, Ihalagama IRHS, Weeratunga PN, Wijesundara WA, Wijetunga WMUA, Subasinghe S, Tilakaratne TAD, Katulanda GW, Katulanda P. Evaluation of the accuracy and precision of glucometers currently used in Sri Lanka. Diabetes Metab Syndr. 2019 May-Jun;13(3):2184-2188. doi: 10.1016/j.dsx.2019.05.011. Epub 2019 May 22. PMID: 31235155.

13. Davies M.JD'Alessiosio D.A., Fradkin J., Kernan W.N., Mathieu C., Mingrone G., Rossing P., Tsapas A., Wexler D.J., Buse J.B. Management of hyperglycemia in type 2 diabetes, 2018. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD) Diabetologia. 2018;61:2461–2498. doi: 10.1007/s00125-018-4729-5.

14. Perreault L, Pan Q, Mather KJ, et al. Effect of regression from pre-diabetes to normal glucose regulation on long-term reduction in diabetes risk: results from the Diabetes Prevention Program Outcomes Study. Lancet 2021; 379:2243.

15. Schellenberg ES, Dryden DM, Vandermeer B, et al. Lifestyle interventions for patients with and at risk for type 2 diabetes: a systematic review and meta-analysis. Ann Intern Med 2013;159:543.

16. Olchanski N, van Klaveren D, Cohen JT, Wong JB, Ruthazer R, Kent DM. Targeting the diabetes prevention program leads to substantial benefits when capacity is constrained. Acta Diabetol. 2021 Jun;58(6):707-722. doi: 10.1007/s00592-021-01672-3. Epub 2021 Jan 30. PMID: 33517494; PMCID: PMC8276501.

17. Spigt M, Rikkers A, Doornbos M, Wouters E, Spitz I, Van Amelsvoort L, Zwietering P. The effect of screening on the prevalence of diagnosed type 2 diabetes in primary care. Scand J Prim Health Care. 2009;27(4):232-7. doi: 10.3109/02813430903226480. PMID: 19929181; PMCID: PMC3413915.

18. Genuth SM, Palmer JP, Nathan DM. Classification and Diagnosis of Diabetes. In: Cowie CC, Casagrande SS, Menke A, et al., editors. Diabetes in America. 3rd edition. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases (US); 2018 Aug. CHAPTER 1. Available from: https://www.ncbi.nlm.nih.gov/books/NBK568014/

19. Samoa Ministry of Agriculture and Fisheries Report. SAMOA FOOD SYSTEMS PATHWAY 2030. https://summitdialogues.org/wp-content/uploads/2021/12/Samoa-Food-Systems-Pathway-2030-Official-version.pdf

20. NGSP. Harmonizing Hemoglobin A1c Testing. A better A1C test means better diabetes care. https://ngsp.org/A1ceAG.asp

21. Kotwal N, Pandit A. Variability of capillary blood glucose monitoring measured on home glucose monitoring devices. Indian J Endocrinol Metab. 2012 Dec;16(Suppl 2): S248-51. doi: 10.4103/2230-8210.104052. PMID: 23565391; PMCID: PMC3603039.

22. Selvin E, Wang D, Matsushita K, Grams ME, Coresh J. Prognostic Implications of Single-Sample Confirmatory Testing for Undiagnosed Diabetes: A Prospective Cohort Study. Ann Intern Med. 2018 Aug 7;169(3):156-164. doi: 10.7326/M18-0091. Epub 2018 Jun 19. PMID: 29913486; PMCID: PMC6082697.

23. Ogunyemi G. How Accurate is POC Glucose Testing? More than half of commercially available glucometer need to meet recommended accuracy guidelines. Feg 05, 2019. https://www.clinicallab.com/trends/point-of-care-testing/how-accurate-is-poc-glucose-testing-169

24. Chan WC, Lee M (AW). Understanding the heterogeneity of the diabetes population in Metro Auckland in 2018. Published online 2020. https://countiesmanukau.health.nz/assets/About-CMH/Reports-and-planning/Diabetes/2020_Understanding_the_Heterogeneity_of_the_diabetes_pop.pdf (Accessed April 2021)

25. ElSayed N. A., et al. Standards of Care in Diabetes. Diabetes Care. 2023;46(S1)

26. New Zealand Manatu Hauora Ministry of Health. Nutrient Reference Values for Australia and New Zealand. May 2006. https://www.health.govt.nz/publication/nutrient-reference-values-australia-and-new-zealand

27. de Boer IH, et al. Diabetes Management in Chronic Kidney Disease: A Consensus Report by the American Diabetes Association (ADA) and Kidney Disease: Improving Global Outcomes (KDIGO). Diabetes Care. 2022;45(12):3075-3090

28. Sattar N, et al. Cardiovascular, mortality, and kidney outcomes with GLP-1 receptor agonists in patients with type 2 diabetes: a systematic review and meta-analysis and randomised trials. Lancet Diabetes Endocrinol. 2021;9(10):653-662.

29. Palmer SC, et al. Sodium-glucose cotransporter protein-2 (SGLT-2) inhibitors and glucagon-like peptide-1 (GLP-1) receptor agonists for type 2 diabetes: systematic review and network meta-analysis and randomised controlled trials. *BMJ.* 2021;372: m4573

30. Khan MK and Davis JC. A week of physical inactivity has similar health costs to smoking a packet of cigarettes. BJSM May 2010. 6:395

31. Centres for Disease Control and Prevention (.gov). General Physical Activities Defined by Level of Intensity. https://www.cdc.gov/nccdphp/dnpa/physical/pdf/pa_intensity_table_2_1.pdf

32. Mayo Clinic (2023 August 25). Exercise intensity: How to measure it. *Healthy Lifestyle Fitness*. https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/exercise-intensity/art-20046887

33. Robb B. (2022, November 17). How Much Exercise Do I Need? *EVERYDAY HEALTH*. https://www.everydayhealth.com/fitness/basics/how-much-exercise-do-i-need.aspx

34. Harvard T.H. Chan. Harvard T.H. Chan School of Public Health. Examples of Moderate to Vigorous Physical Activity. *Obesity Prevention Source.* https://www.hsph.harvard.edu/obesity-prevention-source/moderate-and-vigorous-physical-activity/

35. William L. Haskell, PhD, FAHA; I-Min Lee, MD, ScD; Russell R. Pate, PhD, FAHA; Kenneth E. Powell, MD, MPH; Steven N. Blair, PED, FACSM, FAHA; Barry A. Franklin, PhD, FAHA; Caroline A. Macera, PhD, FACSM; Gregory W. Heath, DSc, MPH, FAHA; Paul D. Thompson, MD; Adrian Bauman, PhD, MD (2007). Physical Activity and Public Health Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Circulation* 116 (1081-1093). https://www.sportmedicine.ru/recomendations/aha-acsm-physical_activity_and_public_health-2007.pdf. DOI:10.1161/CIRCULATIONAHA.107.185649

36. Horden, M. (19 Mar 2024). Exercise: The Forgotten Therapy: The Impact of exercise on cardiovascular health [PowerPoint].

37. Horden MD, Dunstan DW, Prins JB, Baker MK, Singh MA, Coombes JS. Exercise prescription for patients with type 2 diabetes and pre-diabetes: a position statement from Exercise and Sport Science Australia. *J Sci Med Sport.* 2012 Jan;15(1):25-31. doi: 10.1016/j.jsams.2011.04.005. Epub 2011 May 28. PMID: 21621458.

38. Amanda L Hannan[1] Wayne Hing[1] Vini Simas[1] Mike Climstein[2,3] Jeff S Coombes[4] Rohan Jayasinghe[5–7] Joshua Byrnes[8] James Furness[1] (2018). High-intensity interval training versus moderate-intensity continuous training within cardiac rehabilitation: a systematic review and meta-analysis. *Open Access Journal of Sports Medicine* 2018:9 1-17

39. Toyama T, et al. Effect of SGLT2 inhibitors on cardiovascular, renal and safety outcomes in patients with type 2 diabetes mellitus and chronic kidney disease: A systematic review and meta-analysis. *Diabetes Obes Metab.* 2019;21(5):1237-1250.

40. Zelniker TA, Wiviott SD, et al. SGLT2 inhibitors for primary and secondary prevention of cardiovascular and renal outcomes in type 2 diabetes: a systematic review and meta-analysis of cardiovascular outcome trials. Lancet. 2019;393(10166):31-39.

41. Boehringer Ingelheim (N.Z.) Limited. Jardiance datasheet. Published online 2021. www.medsafe.govt.nz/profs/Datasheet/j/jardiancetab.pdf

42. Wright AK, et al. Primary Prevention of Cardiovascular and Heart Failure Events with SGLT2 Inhibitors, GLP-1 Receptor Agonists, and Their Combination in Type 2 Diabetes. *Diabetes Care.* 2022;45(4):909-918

43. Laffel LM, et al. Efficacy and safety of the SGLT2 inhibitor empagliflozin versus placebo and the DPP-4 inhibitor linagliptin versus placebo in young people with type 2 diabetes (DINAMO): a multicentre, randomised, double-blind, double-blind, parallel group, phase 3 trial. Lancet Diabetes Endocrinol. 2023;11(3):169-181."

44. Giugliano D, et al. GLP-1 receptor agonists for prevention of cardiorenal outcomes in

type 2 diabetes: An updated meta-analysis including the REWIND and PIONEER 6 trials. *Diabetes Obes Metab.* 2019;21(11):2576-2580.

45. Hinnen D. Glucagon-Like Peptide 1 Receptor Agonists for Type 2 Diabetes. Diabetes Spectr. 2017;30(3):202-210.

46. Tanaka K, et al. Real-world effectiveness of liraglutide versus dulaglutide in Japanese patients with type 2 diabetes: a retrospective study. Sci Rep. 2022;12(1):154.

47. Matthews DR, et al. Glycaemic durability of an early combination therapy with vildagliptin and metformin versus sequential metformin monotherapy in newly diagnosed type 2 diabetes (VERIFY): a 5-year, multicentre, randomised, double-blind trial. Lancet. 2019;394(10208):1519-1529.

48. Tamborlane WV, et al. Liraglutide in Children and Adolescents with Type 2 Diabetes. N Engl J Med. 2019:381(7):637-646.

49. Arsalanian SA, et al. Once-Weekly Dulaglutide for the Treatment of Youths with Type 2 Diabetes. N Engl J Med. 2022:387(5):433-443.

50. Starship Hospital. Diabetes without Ketoacidosis (new onset Type 1 Diabetes). 12 May 2021. https://starship.org.nz/guidelines/diabetes-without-ketoacidosis-new-onset-type-1-diabetes/

Appendices

1. **NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES 2022**
    - Referral Criteria NCD 2022 p6 – 15
    - Nutrition and Physical Activities – NCD 2022 p16 - 31
    - Tobacco Cessation – NCD 2022 p32

2. **MOH Diabetes Guidelines 2004.**
    - Self-Care – MOH 2004 (p28)
    - General Care – MOH 2004 (p35)
    - Registration Form MOH 2004 (p43 – 44)

3. **TTM Medical Team Questionnaire on Insulin**

Appendix 1 – NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES 2022

MINISTRY OF HEALTH
MATAGALUEGA O SOIFUA MALOLOINA

WORLD BANK GROUP

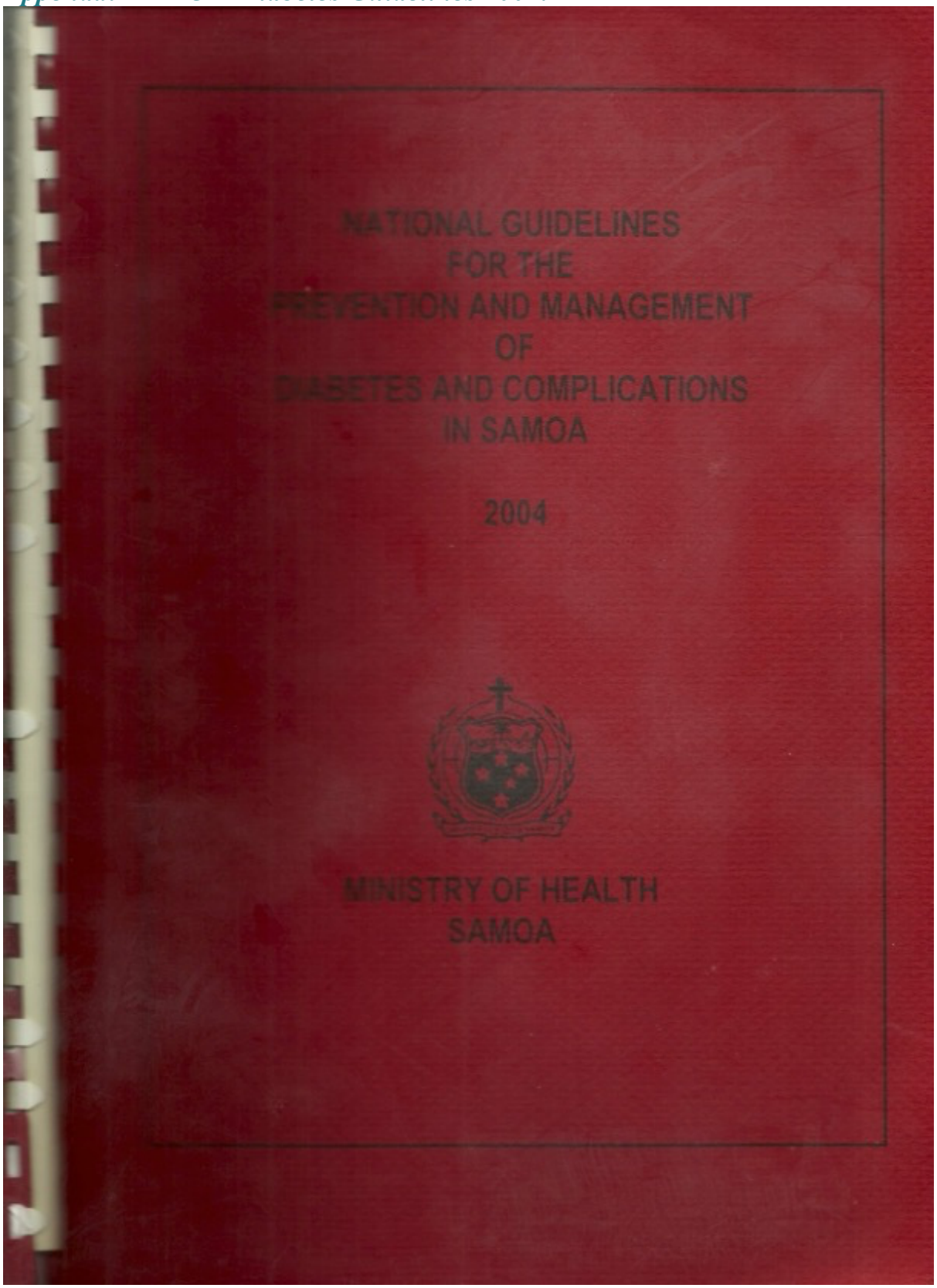
NCD MANAGEMENT PROTOCOL IN PRIMARY CARE SERVICES

Focusing on hypertension and diabetes mellitus screening, referral and treatment

NCD PEN

MAY 5, 2022
MINISTRY OF HEALTH
SAMOA
VERSION 1.2

Appendix 2 - MOH Diabetes Guidelines 2004.



Appendix 3 - Clinical Inertia versus Patient'snt's Adherence

• A 5-item questionnaire by the TTM Medical Team was sent to District Hospital nurses regarding insulin and BSL review in the village/district hospital (DH). Generally, BSLs can be checked in the village by women'sen's committee or DH.

• Questions – Glucometer availability at home and Insulin update by patients – see Appendix 1.

1. <50% of diabetic patients own a glucometer at home or can afford a glucometer at home

2. What is the general uptake of insulin therapy by most patients in the community? – Most patients are willing to take insulin if recommended for poor diabetes control instead of oral hypoglycemic medication.

3. If we suggest giving glucometers to the village, say women'sen's committee house (or any house in the village), do you think this is feasible? Will diabetic patients be willing to visit women'sen's committee house to have their BSL measured twice daily? Do you think women'sen's committee will be okay or willing to take this responsibility to take control of the glucometer and people who need BSL monitoring? Yes, some women's committees will be okay.

4. OR Will patients find it easier to go to the district hospital to check their BSLs twice daily if they need to titrate their daily insulin doses? All villages in a district have glucometers in women'sen's committee house, but some people find it easier to go to the hospital to have their BSL checked.

5. For optimal diabetes control, it is recommended that all diabetic patients need to have a blood test called HbA1c measured every 3-6 months. Can patients have their blood test done at the district hospital, then have the hospital transport deliver them to TTM Hospital/or MTII hospital labs? Yes, most diabetic patients have blood tested twice a year and some at once. Their blood tests are done at the district hospital, and the hospital transport delivers them to the MTII Hospital lab.