

Clinical Support Guide | Inpatient blood glucose and ketone monitoring chart (MR59H)

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Approved by: BHF LHN – Clinic Governance Committee on 26/11/2019

EFN LHN - Pending approval

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Y&N LHN – Clinical Governance Committee on 03/03/2020

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Version control and change history

Version	Date	Amendment	Amended by:
1.0	01/05/2014	Original version	Jane Giles
2.0	05/10/2016	Minor wording about blood ketones	Jane Giles
2.0a	12/08/2019	This is an interim document until the 30 th December 2019. Amendments to aged care section, page 8.	Jane Giles
3.0	22/01/2020	Updated Template	Jane Giles

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Clinical Support Guide | Inpatient blood glucose and ketone monitoring chart (MR59H)

BLOOD GLUCOSE & BLOOD KETONE MONITORING CHART MR59H		<small>Atty patient identification label in this box</small>	
Hospital:		UR No:	Sex:
		<small>Do not hand write these details, except when adhesive barcode labels are unavailable</small>	
		Surname:	
		Given Name:	
		Second Given Name:	
		D.O.B:	
Blood glucose targets			
General Ward: 5.0 – 10.0 mmol/L OR Specify if Other: _____ - _____ mmol/L			
Blood glucose monitoring instructions		Blood ketone monitoring instructions	
<ul style="list-style-type: none"> Test blood glucose (BG) according to frequency instructions. Place a dot (•) in the centre of the box which refers to the BG level and connect dots with a straight line. Record BG number in line below the graph. Initiate actions according to colour zone. Treat all BG levels less than 4.0mmol/L using the Hypoglycaemia Protocol. 		<ul style="list-style-type: none"> Blood ketones are a sign of insulin deficiency and risk of DKA. Ketones can occur in low or 'in target' blood glucose levels. Test blood ketones according to frequency instruction. Record blood ketones result in line below the graph. Initiate actions according to colour zone. 	
Blood glucose (BG) monitoring frequency instruction			
Routine (QID) Test all patients with diabetes before meals and at 2100hrs review by medical practitioner.		Unstable (QID + 0200 hrs) Routine times plus 0200hrs if admission for hypoglycaemia or nocturnal hypoglycaemia suspected.	Stable (BD) If not at risk of hypoglycaemia and BG is between 5.0-10.0mmol/L, consider testing before breakfast and evening meal.
Blood ketone monitoring frequency instruction (for patients on insulin)			
Routine (Daily) If the patient is fasting.		Unstable If the BG greater than 15.0mmol/L.	Unwell If nausea or vomiting persist, recheck blood ketones as per the RDR Instruction.
Date			
Time			
Graph BG (mmol/L)	> 20.0		
	17.6 - 20.0		
	15.1 - 17.5		
	12.6 - 15.0		
	10.1 - 12.5		
	7.6 - 10.0		
	4.0 - 7.5		
	2.5 - 3.9		
0 - 2.4			
BG			
Ketones			
Hypo protocol (✓)			
Dr. Notified (✓)			
Intervention <small>See overleaf</small>			
Rapid Detection and Response Instruction			
A Senior Registered Nurse (RN) review must occur when a blood glucose (BG) or blood ketone result is in the yellow zone: <ul style="list-style-type: none"> BG is less than 4.0mmol/L (refer to Hypoglycaemia Protocol) BG between 10.1 - 20.0mmol/L Blood ketone is between 0.1 - 0.9mmol/L Review: Recheck BG and/or ketones in 2 hours.		A Multi-Disciplinary Team (MDT) review must occur when a blood glucose (BG) or blood ketone result is in the red zone: <ul style="list-style-type: none"> BG is less than 2.5mmol/L or greater than 20.0mmol/L Two consecutive BG results are greater than 15.0mmol/L Blood ketone is greater than 1.0mmol/L Review: Recheck BG and/or ketones in 1 hour or when medically ordered.	
A Medical Emergency Response (MER) review must occur when: <ul style="list-style-type: none"> Blood glucose (BG) is less than 4.0mmol/L and the patient is unconscious, unsafe to swallow or has not responded to the Hypoglycaemia Protocol oral treatment in 45 minutes. The patient is drowsy, confused, breathing rapidly or having difficulty breathing or complaining of severe abdominal pain. Review: Recheck BG and/or ketones when medically ordered.			
Interventions or Review			
Record intervention below and note corresponding letter in intervention row below graph.		Initial	Designation
A			
B			
C			
D			
E			
F			
G			
H			

Instructions on routine blood glucose and blood ketone monitoring

Blood glucose modification recorded

Instructions on frequency of blood glucose and blood ketone monitoring

Blood glucose and blood ketones as a number

Document hypoglycaemia, notification of Dr and intervention initiated

Escalation instructions for blood glucose and blood ketones

Intervention detail recorded

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1. Purpose

This clinical support guide supports clinical decision making by describing the best practice evidence based process for blood glucose (BG) and blood ketone (BK) monitoring in the inpatient setting. There is also a short section providing advice for aged and residential care facilities. The guide will assist nursing, midwifery and medical staff to determine appropriate health care for the management of BG and BK for inpatients and residents. The chart and associated escalation pathways are used in conjunction with the SA Health Rapid Detection and Response (RDR) Observation Chart.

There are variations for aged and residential care services and these are addressed in the section 'Aged Care' on page 8.

2. Areas of responsibility

2.1 Regional Local Health Network Executives are responsible for ensuring that all managers and staff are aware of the Regional Blood Glucose and Blood Ketones Monitoring Chart MR59H and their responsibilities in relation to leading, supporting and sustaining the BG and BK monitoring program and the appropriate escalation pathways.

2.2 Regional Local Health Network Directors of Nursing and Midwifery are responsible for ensuring that this chart is made known to all staff who are required to use it and that its use is part of clinical orientation. Training is available via the SA Health eLearning platform.

2.3 All hospital Nursing and Midwifery employees are responsible for referring to the recommendations in this guide when planning and monitoring care.

2.4 Non-employees eg Nursing and midwifery students are required to refer to this guide as stated under the supervision of a Registered or Enrolled Nurse and/or Registered Midwife.

3. Using the Blood Glucose and Ketone Monitoring Chart (MR59H)

Inpatient targets for blood glucose

The BG target range for inpatients on general wards is 5.0 – 10.0mmol/L. There may be circumstances in which BG targets need to be modified by the appropriate medical practitioner (eg if the patient is palliative care, aged care, diabetes in pregnancy). (Figure 1)

Figure 1: Modification of blood glucose targets

BLOOD GLUCOSE & BLOOD KETONE MONITORING CHART MR59H	Affix patient identification label in this box	
	UR No:	Do not hand write these details, except when adhesive barcode labels are unavailable
Hospital	Surname:	
	Given Name:	
	Second Given Name:	
	D.O.B:	Sex:
Blood glucose targets		
General Ward: 5.0 – 10.0 mmol/L OR Specify if Other: _____ - _____ mmol/L		

Blood glucose modification recorded

If an inpatient is experiencing low BG or hypoglycaemia (eg BG less than 4.0mmol/L), more frequent testing should be implemented (eg 0200 or more frequently as per the Hypoglycaemia Management Protocol).

Those inpatients not known to have diabetes, but who are at risk of hyperglycaemia (eg TPN, high dose corticosteroids), and who are not at risk of hypo, should have a daily BG measurement prior to lunch if eating or at 1200 hours.

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Modifying frequency of blood glucose monitoring

All inpatients with diabetes to have their BG tested within the first hour of presentation to hospital and thereafter, before meals and at 2100 (QID).

Stable patients (eg BG within target of 5.0 and 10.0mmol/L) not at risk of hypoglycaemia, can have their BG frequency decreased to BD by the medical practitioner. (Figure 2)

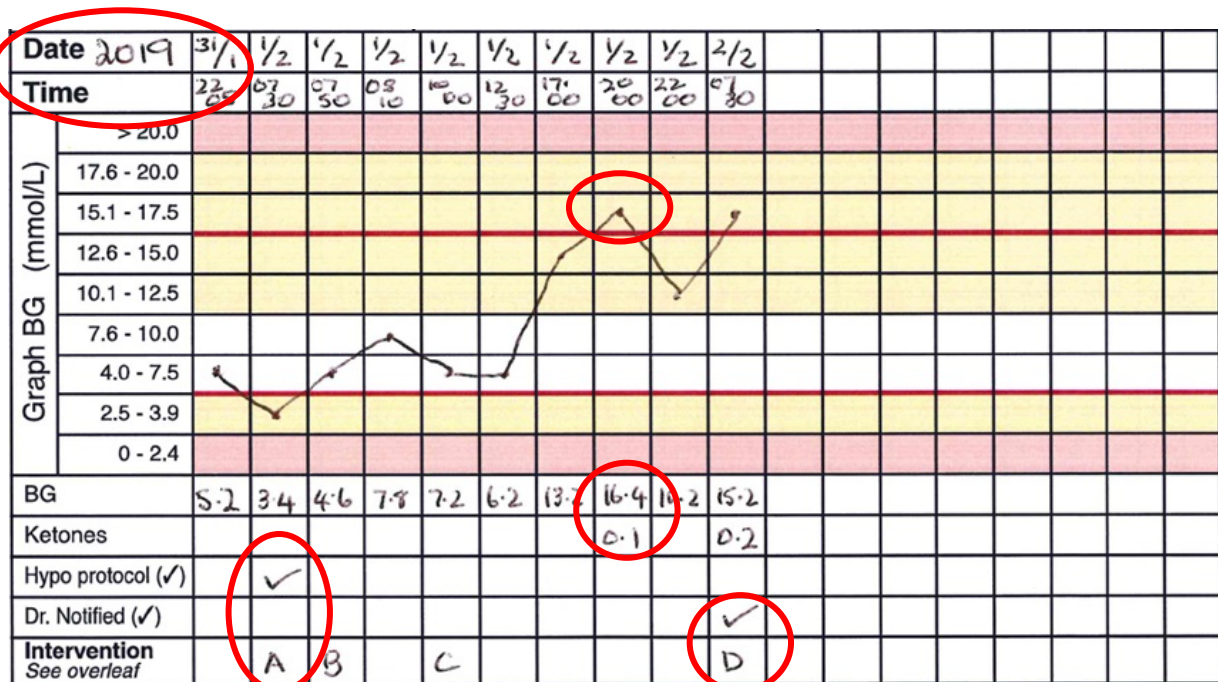
Figure 2: Modification of blood glucose monitoring frequency

Dr. Notified (✓)																			
Intervention <i>See overleaf</i>			A																
Interventions or Review																			
Record intervention below and note corresponding letter in intervention row below graph.																		Initial	Designation
A	Reduce BG testing to BD as not at risk of hypo																	FF	RN
B																			

Documenting on the chart (Figure 3)

- > The date and time should be documented in the top row.
 - > The BG should be graphed with a dot (.) in the centre of the square which coincides with the BG result, then connect to the previous dot with a straight line.
- > Numerical value of the BG documented in row below the graphed value. Ketone result in the row below BG.
- > If BG falls within a shaded area, initiate the actions required for that colour.
- > When the Hypoglycaemia Management Protocol is initiated or a medical practitioner is contacted, a tick is placed in the appropriate box on the chart.
- > A notation of any event should be documented in the Intervention section (Figure 4) and the corresponding letter (eg A) in the intervention row.

Figure 3: Example of how to chart the BG and ketone level



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The purpose of the Intervention/Review section is to visually highlight the actions/interventions have been initiated for corresponding abnormal result(s). A brief notation should be documented in this table (eg Hypoglycaemia Management Protocol initiated) with more detail given in patient case notes (eg safe to swallow, amount of glucose drink, amount of follow up complex carbohydrate). It is not necessary to duplicate information in this section with what is captured elsewhere (eg in case notes) or that is routine care (eg usual dose of insulin).

Figure 4: Example of how the intervention box can be used

Interventions or Review			
Record intervention below and note corresponding letter in intervention row below graph.		Initial	Designation
A	60mls GTT 75 glucose drink	SP	RN
B	2 biscuits	SP	RN
C	Reviewed by GP - medication adjusted	SP	RN
D	Ketones check - notified RN	BH	EN
E	GP advised of BG + BK	SP	RN
F			

Blood ketone monitoring for high risk patients

- > Ketones are a sign of severe insulin deficiency and pending diabetic ketoacidosis (DKA).
- > Adults and children with type 1 diabetes are most at risk.
- > Adults with type 2 diabetes requiring insulin or prescribed an oral medication know as a Sodium Glucose Co Transport 2 (SGLT2) Inhibitor (eg Empagliflozin or Dapagliflozin) are also at risk.
- > Ketone monitoring is used to avoid DKA by detecting insulin deficiency early and guiding insulin replacement. Ketones can be measured in two ways:
 1. beta-hydroxybutyrate (β -OHB) in capillary blood (recommended method in any health care facility)
 2. acetoacetic acid in urine.
- > Evidence shows that measuring BK is a more sensitive test for detecting ketosis as compared with urine ketones. BK is a SA Health benchmarked standard of care. However, if BK strips are not available urine ketone measurement is the alternative test. Ketones may be present even when BG is within target.

Guideline for blood ketone monitoring

Ketone testing is required for all patients and residents on insulin:

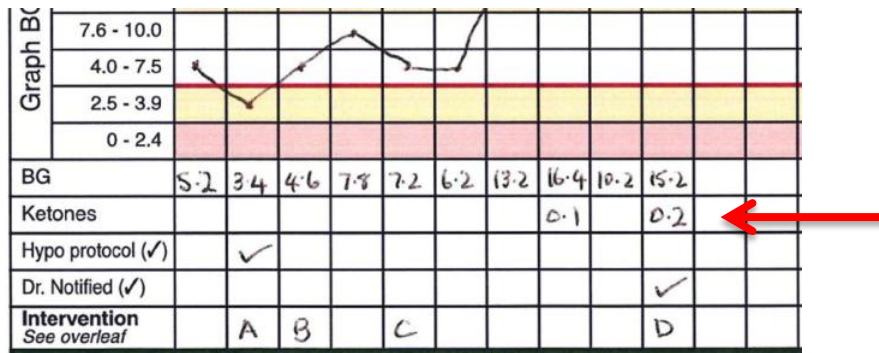
- > daily if patient fasting, or
- > BG is greater than 15.0mmol/L, or
- > if patient is unwell (eg systemic illness, infection, febrile, nausea, diarrhoea).

Patients on an SGLT2 need to be assessed by the admitting doctor for advice re management while in hospital. See [Australian Diabetes Society 2018 ALERT Severe Euglycaemic Ketoacidosis with SGLT2 Inhibitor Use in the Perioperative Period.](#)

Increased frequency of testing as per Rapid Detection and Response (RDR) instructions is required if blood ketones are noted. Greater frequency (eg before meals and at bedtime) may be instructed by the medical practitioner. Blood ketones to be documented as a number under the BG. (Figure 5)

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Figure 5: Recording ketones test results



Notifications and escalation

The table below explains how to escalate clinical care in diabetes management. When contacting a medical practitioner, clinicians should follow the pathway specified in their local Response Flowchart (developed for use with the RDR observation chart).

Telephone reviews can be utilised when the patient has responded well to a response flowchart such as the Hypoglycaemia Management Protocol. However, a diabetes treatment review by the medical practitioner should occur as soon as practicable. Avoidable causes of hypoglycaemia or hyperglycaemia should be identified and corrected. If the cause is not identified or cannot be corrected, the patient’s medication regimens should be adjusted.

Escalation of Care in the Management of Diabetes
A Senior Registered Nurse (RN) review must occur when a blood glucose (BG) or blood ketone result is in the yellow zone:
BG is less than 4.0mmol/L (refer to Hypo Protocol) BG between 10.1 – 20.0mmol/L Blood ketone between 0.1 – 0.9mmol/L Review: Recheck BG and/or ketones in 2 hours
A Multi-Disciplinary Team (MDT) review must occur when a blood glucose (BG) or blood ketone result is in the red zone:
BG is less than 2.5mmol/L or greater than 20.0mmol/L Two consecutive BG results are greater than 15.0mmol/L Blood ketone is greater than 1.0mmol/L Review: Recheck BG and/or ketones in 1 hour or when medically ordered
A Medical Emergency Response (MER) review must occur when:
BG is less than 4.0mmol/L and the patient is unconscious, unsafe to swallow or has not responded to the Hypoglycaemia Protocol oral treatment in 45 minutes. The patient is drowsy, confused, breathing rapidly, or having difficulty breathing or complaining of severe abdominal Review: Recheck BG and/or ketones when medically ordered.

4. Where else can BG and BK be charted?

If using the Hyperglycaemia Management Protocol and Basal Bolus Insulin Chart (MR62A) or the Intravenous Actrapid Infusion Charts (MR-INF-A and MR-INF-B), cease using the MR59H as in the example. (Figure 6)

Figure 6: Discontinuation of blood glucose and blood ketone monitoring chart (MR59H) with reference to alternative chart (eg IV insulin infusion chart)

Date	14/8	14/8	14/8	15/8													
Time	12:00	13:00	22:00	07:30													
Graph BG (mmol/L)	> 20.0																
	17.6 - 20.0																
	15.1 - 17.5																
	12.6 - 15.0																
	10.1 - 12.5																
	7.6 - 10.0																
	4.0 - 7.5																
	2.5 - 3.9																
0 - 2.4																	
BG	18.1	21.0	14.4	18.6													
Ketones	0.4	1.3	1.5	2.0													
Hypo protocol (✓)																	
Dr. Notified (✓)		✓		✓													
Intervention See overleaf				A													
Interventions or Review																	
Record intervention below and note corresponding letter in intervention row below graph.														Initial	Designation		
A	Transfer to IV Insulin Infusion Chart														gr	RN	
B																	

5. Suggested variations in blood glucose and ketone monitoring for aged care.

Care plans for older people with diabetes (including BG targets) should be tailored to the individual's needs, functional status, life expectancy and health status using a whole of life approach that encompasses end of life care. Each site will need to determine the form of documentation to be used. Some sites will use the Blood Glucose and Ketones Monitoring chart and some will have access to electronic records.

Blood glucose targets

Ketone testing is required for all patients and residents on insulin:

- > BG target – for most residents is 6.0 - 15.0mmol/L.
 - > Hypoglycaemia – generally less than 6.0mmol especially in frail older people.
 - > Hyperglycaemia – greater than 15.0mmol/L especially if consistently high.

Blood glucose monitoring frequency

- > Testing frequency should be individualised according to functional status and will change over time; thus should be assessed on a regular basis; at least as part of the annual cycle of care.
- > The McKellar Guidelines for Managing Older People with Diabetes in Residential and Other Care Settings (2014) provide guidelines to assist clinicians in determining best care for individuals with diabetes. A copy of the blood glucose monitoring suggested frequency recommendations are provided in Appendix 1.

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- > Frequency should be individualised for each resident taking into consideration their person's type of diabetes and co-morbidity status, BG targets, current medicine regime and life expectancy.
- > Self-monitoring should be encouraged where possible.
- > If the resident refuses a BG test (eg resident with dementia), delay the test unless the resident has signs of hypoglycaemia in which case treat as per the Hypoglycaemia Protocol and test BG when the resident settles.
- > Test BG more frequently during illness, if the resident is fasting, if there is a change in medication, dosage or if the residents condition changes.
- > Report to senior staff if;
 - > BG level is above or below the residents target range or if the residents behaviour/cognition alters.
 - > The resident consistently refuses BG tests.
- > Consult with the medical practitioner if blood or urine ketones are present.

Blood ketone monitoring frequency

- > Refer to blood ketone escalation as per the Inpatient blood glucose and ketone monitoring chart (MR59H).
- > Consult with the medical practitioner if blood or urine ketones are present.

Suggested frequency of blood glucose monitoring as per the McKellar Guidelines (2014)

Individualise, but the minimum recommendation is:

1. Residents managed with diet only and if BG is stable: Daily BG at alternating times (eg alternating across fasting, pre meal or at bedtime).
2. Taking oral diabetes medications (eg sulphonylureas) and/or injectables (eg exanatide). Twice a day BG at alternating times (eg alternating across fasting, pre meal or at bedtime).
3. Taking insulin: Three times a day BG, before meals (add bedtime if history/concerned about hypoglycaemia).
4. During illness: Refer to Hyperglycaemia and Sick Day Care Guidelines (page 25).
5. Taking diabetogenic medications: Refer to Managing Corticosteroids (Steroids) and Antipsychotic Medicines Guideline (page 38).
6. At any time the resident's clinical condition (eg hypoglycaemia, during illness, resident fasting, medication changes, readings outside target range), behaviour and/or cognition changes.

pp. 23-24

Dunning T, Duggan N, Savage S. (2014) *The McKellar Guidelines for Managing Older People with Diabetes in Residential and Other Care Settings*. Centre for Nursing and Allied Health, Deakin University and Barwon Health, Geelong.

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Linked Documents

Document Name
National Safety and Quality Health Service Standards 9 - Recognising and Responding to Clinical Deterioration in Acute Health Care
CHSA Blood glucose monitoring chart - example
CHSA Blood glucose monitoring chart - 1 page instruction
SA Health eLearning Module for blood glucose monitoring

References

Document Name
Australian Diabetes Society (2012). <i>Guidelines for routine glucose control in hospital</i>. Sydney. ADS
Craig, M, S. Twigg, K. Donaghue, N. Cheung, F. Cameron, J. Conn, A. Jenkins and M. Silink (2011). <i>National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults</i>, Australasian Paediatric Endocrine Group and Australian Diabetes Society. Canberra, Australian Government Department of Health and Ageing.
Colagiuri, S, Dickinson, S, Girgis, S and Colagiuri, R (2009). <i>National evidence based guideline for blood glucose control in type 2 diabetes</i>. Canberra, Diabetes Australia and NHMRC.
Dunning, T, Duggan, N and Savage, S (2014). <i>The McKellar Guidelines for Managing Older People with Diabetes in Residential and Other Care Settings</i>. Geelong.

Accreditation Standards

[National Safety and Quality Health Service Standards \(NSQHSS\)](#)

1 <input checked="" type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input checked="" type="checkbox"/>	5 <input type="checkbox"/>	6 <input checked="" type="checkbox"/>	7 <input type="checkbox"/>	8 <input type="checkbox"/>	9 <input checked="" type="checkbox"/>	10 <input type="checkbox"/>
Governance for Safety and Quality in Healthcare	Partnering with Consumers	Preventing & Controlling Healthcare Associated Infections	Medication Safety	Patient Identification & Procedure Matching	Clinical Handover	Blood & Blood Products	Preventing & Managing Pressure Injuries	Recognising & Responding to Clinical Deterioration	Preventing Falls & Harm from Falls

[Evaluation and Quality Improvement Program \(EQIP\)](#)

11 <input type="checkbox"/>	12 <input checked="" type="checkbox"/>	13 <input type="checkbox"/>	14 <input type="checkbox"/>	15 <input type="checkbox"/>
Service Delivery	Provision of Care	Workforce Planning and Management	Information Management	Corporate Systems and Safety

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Australian Aged Care and Quality Agency (AACQA) – [Residential Aged Care Standards](#)

1 <input type="checkbox"/>	2 <input checked="" type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	<i>Specific criteria: (e.g. 1.1, 4.5)</i>
Management Systems, Staffing and Organisational Development	Health and Personal Care	Care Recipient Lifestyle	Physical Environment and Safe Systems	

Australian Aged Care and Quality Agency (AACQA) – [Home Care Common Standards](#)

1 <input checked="" type="checkbox"/>	2 <input checked="" type="checkbox"/>	3 <input type="checkbox"/>	<i>Specific criteria: (e.g. 1.5, 3.1)</i>
Effective Management	Appropriate Access and Service Delivery	Service User Rights and Responsibilities	

Consultation

Version	Consultation
1.0	CHSA Directors of Nursing & Midwifery Services, CHSA Directors of Medical Services, CHSA Diabetes Educator Network.
2.0	Medication Portfolio Nurses, Medication Safety Workgroup, CHSA Diabetes Educator Network.
2.0B	This is an interim document until the 30th December 2019 while the current version is being reviewed and updated. Modifications have been made to the Aged Care Section.
3.0	Medication Portfolio Nurses, Medication Safety workgroup, Regional Diabetes Specialist Nurse Network,