REGIONAL LOCAL HEALTH NETWORKS

Protocol (clinical)

Title: Continuous Subcutaneous Insulin Infusion (CSII) in People with Diabetes in the Inpatient Setting

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Summary This protocol outlines responsibilities and actions required by medical staff, nurses and midwives to ensure the safety and quality of clinical care by appropriate assessment and care of inpatients using a continuous subcutaneous insulin infusion (CSII).

Policy/procedure reference This protocol supports the Controlled Substances Act 1984, SA Health Directive: High Risk Medicines Management, SA Health Directive: Clients' Own Medications, RSS Diabetes Service Plan and Diabetes Inpatient Model of Care.

Keywords Clinical, Protocol, RSS, Nursing, Midwifery, Safety, Blood Glucose, CSII, Pumps, Communication, Consumer Participation, Standards.

Document history Is this a new LHN protocol? **N**

Does this protocol *amend or update* an existing protocol? **Y**

Continuous Subcutaneous Insulin Infusion (CSII) Protocol 2016 [A329589 2016-07367]

Does this protocol *replace* an existing document? **N**

Applies to This protocol applies to all regional LHN hospital medical, nursing, midwifery and diabetes service staff.

Objective file number 2019-13020

Version control and change history

Version	Date	Amendment	Amended by:
1.0	Oct 2016	Original version	Jane Giles, Advanced Nurse Consultant
2.0	May 2020	New template and technology update	Jane Giles, Advanced Nurse Consultant
3.0	Oct 2021	New template and technology update	Jane Giles, Advanced Nurse Consultant

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Continuous Subcutaneous Insulin Infusion (CSII) in People with Diabetes in the Inpatient Setting – Flowchart

Person with diabetes with CSII (insulin pump) presents for hospital admission.

Nurse or midwife to:

- discuss with the person (and/or their carer) their preference in continuing CSII (insulin pump therapy) in the inpatient setting
- assess the persons' competency to self-manage CSII in the inpatient setting
- identify any absolute contraindications for use of CSII in the inpatient setting
- obtain a regional LHN CSII Inpatient Rate Record (MR-CIR)
- consult with admitting medical practitioner and discuss the persons' (and/or carer) preferences, competency assessment outcome and proposed diabetes management plan in the inpatient setting
- initiate referral to diabetes specialist nurse and/or dietitian.

If no contraindications are identified

Medical practitioner to:

- explain inpatient management which supports the maintenance of CSII
- prescribe the insulin used in CSII (insulin pump) on the National Inpatient Medication Chart (NIMC)
- on the regional LHN CSII Inpatient Rate Record (MR-CIR)
  - obtain consent
  - complete identifiers
  - record medical practitioner contact details and signature.

Nurse or midwife to:

- document on the regional LHN CSII Inpatient Rate Record (MR-CIR) :
  - carer's name and contact details (if applicable)
  - insulin pump model and insulin type
  - infusion set and catheter (reservoir) change date attended and due
  - blood glucose (BG) and blood ketone monitoring frequency
  - when the insulin cannula was inserted and when it is to be re-sited.

Person with diabetes and/or carer to:

- provide consent on the regional LHN CSII Inpatient Rate Record (MR-CIR)
- provide initial and ongoing details required on the regional LHN CSII Inpatient Rate Record (MR-CIR) including basal rates, meal boluses, correctional boluses, blood glucose and blood ketone test results, carbohydrate intake and physical activity level/s
- inform staff immediately of hypoglycaemia or hyperglycaemic events or CSII (insulin pump) failure
- inform staff of temporary disconnection from CSII (insulin pump) for hygiene or other circumstances.

If the above conditions cannot be met, CSII should be discontinued, and the person should be immediately provided with an alternative insulin order (e.g. IV insulin infusion or subcut insulin) prior to the removal of their insulin pump and maintained until the person and/or carer can resume their responsibilities.

If contraindications are identified

Medical practitioner to:

- explain alternate inpatient diabetes management
- prescribe the alternate insulin therapy:
  - intravenous (IV) infusion using the regional LHN IV Actrapid Infusion Chart Type 1 diabetes (MR-INF-A)

  OR
  - subcut injection/s using the Hyperglycaemia Protocol and Basal Bolus Chart (MR62A)

  OR
  - subcut injection/s using the National Inpatient Medication Chart (NIMC).

Nurse or midwife to:

- administer prescribed insulin
- monitor blood glucose (BG) and blood ketone as per the regional LHN IV Actrapid Infusion Chart Type 1 diabetes Chart (MR-INF-A) OR Hyperglycaemia Protocol and Basal Bolus Chart (MR62A) OR Blood Glucose and Blood Ketone Monitoring Chart (MR59H)
- take action in accordance with the Rapid Detection and Response Instructions
- store CSII (insulin pump) in a secure location.

Recommencement of CSII (insulin pump)

Medical practitioner to:

- review contraindications and determine if return to CSII (insulin pump) is appropriate
- follow requirements for switching from IV Actrapid Infusion to CSII.
- consider consultation with diabetes specialist and/or diabetes specialist nurse.

Nurse or midwife to:

- confirm the person and/or carer is ready to resume their CSII responsibilities
- on switching from IV Actrapid Infusion to CSII, monitor BG and blood ketone for at least 4 hours
- confirm if the person is tolerating food and fluid
- confirm the blood ketone is less than 0.3mmol/L
- confirm the person and/or carer is confident that they can continue their CSII responsibilities on discharge and if not, discuss concerns with medical practitioner and/or diabetes specialist nurse.

Discharge

Medical practitioner to:

- discuss discharge planning including referrals (e.g. diabetes specialist, diabetes specialist nurse and/or dietitian) and recommendations for CSII (insulin pump).

Nurse or midwife to:

- provide the person and/or carer with a copy of the regional LHN CSII Inpatient Rate Record (MR-CIR). Original to be retained in the hospital medical record.

1. Purpose and scope of use

This inpatient clinical protocol supports clinical decision making by describing the best practice evidence based process for managing continuous subcutaneous insulin infusion (CSII) in the inpatient care setting.

The protocol will assist medical, nursing and midwifery staff to determine appropriate health care for the management of people with diabetes using CSII. Together with the associated medication record *CSII (Insulin Pump) Inpatient Rate Record MR-CIR*, this material provides regional Local Health Network (LHN) clinicians with the clinical support to assess and provide care to people with diabetes self-managing CSII during a hospital admission.

The package also provides medical staff, credentialled diabetes educators (CDE) and dietitians with the outpatient medication records *CSII (Insulin Pump) Outpatient Rate Record MR-COR* to support ongoing medication management, clinical care and educational services to be provided following discharge in the community setting.

This protocol is not a complete or definitive resource but is designed to be used in conjunction with SA Health and SA Government regulatory documents regarding scope of practice, competencies and professional development frameworks.

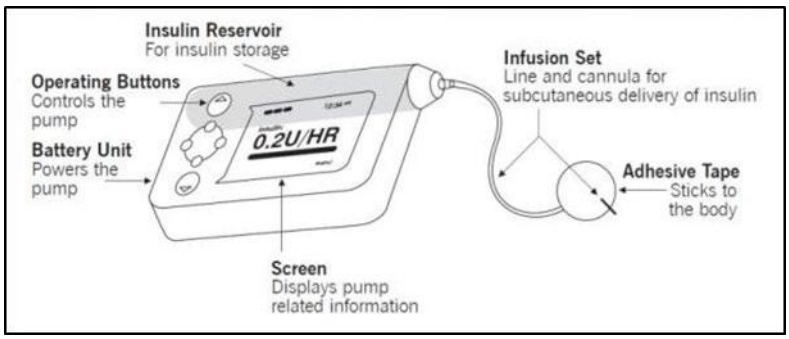
1.1 Assessing individual competency to self-manage CSII

CSII therapy can be continued in the hospital setting only if the person with diabetes or their carer can self-manage their insulin dosing and the pump (button pushing and set changes) safely.

All insulin pumps are worn 24 hours a day, although they can be removed for up to two hours for showering and other activities (page 7).

An insulin pump replaces the need for multiple injections by delivering rapid acting insulin continuously 24 hours a day. Some insulin pumps can connect (via Bluetooth wireless technology) to blood glucose meters, continuous glucose monitoring (CGM) systems and smart phone applications. The Hybrid Closed Loop insulin pumps use an algorithm and real-time CGM sensor glucose results to automatically adjust and correct insulin delivery to minimise glucose fluctuations (e.g. above and below glucose target/s). All pumps have similar components (Figure 1).

Figure 1: Components of Insulin Pumps



On admission to hospital, the person with diabetes must demonstrate to the satisfaction of the assessing health care professional that they can use their CSII and understand how to modify the settings.

It is acknowledged that the assessing health care professional may have limited exposure to the practical management of the specific insulin pump used. The role of the health care professional is to assess the competency of the person to use the insulin pump.

Competency assessment will involve asking the person to demonstrate that they:

> can open the pump menu

> can adjust the basal rate and adjust the bolus dose/s

- can re-site their pump cannula (e.g. this could involve discussing how it is done, rather than undertaking the activity at this initial assessment)
- can demonstrate technical competency regarding cannula sites / how they would manage infusion line obstructions / site leaks
- can undertake appropriate problem-solving actions if blood glucose (BG) is higher or lower than target
- have adequate supplies of infusion sets, spare batteries and the insulin used in the insulin pump available for the anticipated duration of the admission
- have been performing regular BG tests (e.g. four tests per day).

A CDE should be notified upon admission of a person with CSII. An urgent consultation is recommended if there is a concern about competency of the person to continue. The CDE can advise or rectify any issues or concerns, allowing the person to continue using their insulin pump or assist with recommendations for an alternative insulin treatment.

1.2 Inpatient management

People with diabetes established on CSII usually prefer to continue on their insulin pumps during hospital admissions.

The admitting medical practitioner will be responsible for:

- explaining inpatient management
- supporting the maintenance of CSII
- prescribe the insulin used in the insulin pump on the National Inpatient Medication Chart (NIMC) or
- prescribing alternative insulin therapy (e.g. intravenous infusion (IV) or subcutaneous (subcut) injection) where CSII is contraindicated.

Who to consult?

The following health professional should be consulted:

- the person's diabetes specialist (e.g. endocrinologist) or medical practitioner
- CDE trained in insulin pump management
- dietitian.

Contraindications for use of CSII in the inpatient setting

The use of the CSII is contraindicated in situations where the person's safety may be compromised by their physical illness or mental state.

Absolute contraindications for CSII using an insulin pump in the inpatient setting are;

- impaired level of consciousness
- critical illness requiring intensive care
- major psychiatric disturbance
- diabetic ketoacidosis (DKA)
- inability to demonstrate a basic level of competency in the operation of their insulin pump

- lack of infusion sets, spare batteries and other equipment required to maintain CSII therapy
- extensive skin infections or inflammation
- concerns regarding technical malfunction of the pump
- numerous radiological procedures (e.g. the pump should be suspended and disconnected prior to the person entering a CT or MRI scanner)
- lengthy or complicated surgery, or serious medical illness likely to be accompanied by significant metabolic disturbance
- any other medical circumstance deemed unsuitable by the supervising medical officer.

If the person with diabetes presents with any contraindication, the CSII must be discontinued and the device managed according to the hospital's policy for storage of valuables.

To minimise risk of diabetic ketoacidosis, the person should be immediately provided with an alternative insulin order (e.g. IV insulin infusion or subcut insulin) prior to the removal of their insulin pump.

Children and adolescents

The continuation of CSII in a child or adolescent needs to be considered carefully in consultation with the person with diabetes, their parent or carer and their specialist diabetes team.

- The parent or carer must be able to stay with the person with diabetes at all times during the admission so that adjustments to the insulin pump can be made at any time.
- The medical practitioner and a CDE must be satisfied that the responsible person can satisfy all essential requirements.

If the above conditions cannot be met, CSII should be discontinued, and the person should be immediately provided with an alternative insulin order (e.g. IV insulin infusion or subcut insulin) prior to the removal of their insulin pump and maintained until the parent or carer can resume their responsibilities.

Obstetric and gynaecological

Labour and birth is not an absolute contradiction to the use of CSII, and may be used as determined by the endocrinologist, obstetrician and CDE.

Fasting procedures and surgery

The use of the CSII in operating theatres, procedure rooms, etc. is not contra-indicated. CSII must be considered carefully in consultation between the anaesthetist, surgeon, physician, medical practitioner, CDE, person with diabetes, parent or carer. (Figure 2)

Insulin administration via CSII can provide excellent peri-operative blood glucose control. In the basal infusion mode only, it can be considered 'equivalent' to long acting insulin.

The continuation of CSII in a child or adolescent needs to be considered carefully in consultation with the person with diabetes, their parent or carer and their specialist diabetes team.

Figure 2: Situations for Intra-Operative CSII and IV Insulin Infusion

Situations appropriate for Intra-Operative CSII	Indications for Intra-Operative Intravenous Insulin Infusion
> procedure of short duration (e.g. D&C) > medical and aesthetic staff that are familiar with pumps. > person is awake and alert intra-operatively > person is metabolically stable > person is alert and to resume eating shortly after completion of the procedure.	> prolonged and complicated procedure (e.g. abdominal procedure) > impaired conscious state > medical and anaesthetic staff unfamiliar with CSII > person is critically unwell and metabolically unstable (e.g. intubated or ventilated) > prolonged post-operative recovery period.

If the medical practitioner or anaesthetist is unable to manage CSII whilst the person with diabetes is premedicated or unconscious during an operation or procedure, CSII should be discontinued and the person should be immediately provided with an alternative insulin order (e.g. IV insulin infusion or subcut insulin) prior to the removal of their insulin pump and maintained until the person or carer can resume their self-care responsibilities.

The person with diabetes (or parent/carer) must consent to continue CSII peri-operatively.

> **CSII and IV insulin infusion should not run at the same time**

> the person should perform a set change on the morning or afternoon of the day prior to the procedure

> if the pump is to be used during surgery, the person must replace steel cannulas with plastic insertion cannulas before any surgical procedures where diathermy may be performed)

> the infusion site must be placed away from the operation site with consideration also given to where a diathermy pad may be placed (e.g. ensure the insertion cannula is plastic not steel)

> an identification tag must be attached to the person that states that they are using an insulin pump (e.g. this should be sited in a readily visible position appropriate for the procedure to be undertaken)

> the medical practitioner or anaesthetist must have access to the insulin pump during surgery to enable it to be disconnected if necessary

> use of a temporary basal rate during the procedure (rather than adjusting the usual basal rate)

> the person's BG must be monitored every hour peri-operatively until they have satisfactorily regained consciousness and the person (or parent/carer) is capable of making decisions regarding managing their CSII.

In the event of the BG increasing to an unsatisfactory level peri-operatively, an IV insulin / dextrose infusion should be commenced to prevent ketosis. Refer to the appropriate regional *Intravenous Actrapid Infusion Chart MR-INF-A*. The insulin pump should be turned off or disconnected.

In the event the BG level falls below 4.0mmol/L peri-operatively, the insulin pump must be temporarily disconnected (page 7). The hypoglycaemia should be treated with IV glucose. Once euglycaemia is restored, there are three options regarding recommencement of the CSII;

> leave the pump off and commence an IV insulin infusion to control the person's BG

> reconnect the pump at the usual basal rate with a higher IV glucose infusion rate to prevent further episodes of hypoglycaemia

> reconnect the pump at a lower basal rate (if the medical practitioner or anaesthetist can program the device).

The use of CSII in major procedures is not recommended. This is due to the increased probability that an adjustment to the person's insulin therapy will be required during the prolonged peri-operative period. Discontinuation of the insulin pump and commencement of IV insulin infusion is recommended in this situation.

Discontinuing CSII peri-operatively

People with diabetes whose CSII is to be discontinued prior to surgery WILL require either an IV insulin infusion or subcut insulin therapy. Considerations include;

- discontinuation of the insulin pump for even short periods of time with no alternative source of insulin will result in the rapid development of hyperglycaemia and risk of diabetic ketoacidosis
- CSII can be recommenced when the person has regained full consciousness and it is considered medically appropriate
- recommencing CSII is preferable in the morning using new consumables and when the cannula has been re-sited
- CSII should be recommenced prior to cessation of the IV insulin infusion. See Section 1.5 Switching from intravenous insulin (IV) to continuous subcutaneous insulin infusion (CSII).

Temporary disconnection

When the insulin pump is disconnected, all delivery (basal and bolus) of insulin is stopped. Do not disconnect while in the middle of delivering any bolus as it will NOT be resumed. Reasons to temporarily disconnect from the insulin pump include showering and those listed in Figure 3.

Figure 3: Temporary disconnection of CSII

Circumstances where the insulin pump needs to be temporarily disconnected include;
> any radiological investigation (pump must be removed)
> CT Scan (pump must be removed)
> MRI scan (pump must be removed, including steel cannula)
> physiotherapy (depending on the therapy)
> hydrotherapy (even if the pump is labelled as waterproof).

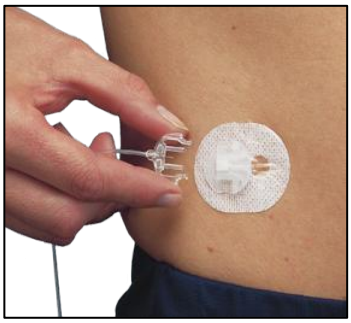
CSII can be discontinued for up to two hours at the discretion of the treating medical practitioner if the person is clinically stable and BG is being monitored regularly. However, discontinuation of the insulin pump for more than 30 minutes may result in significant hyperglycaemia.

If CSII needs to be discontinued for longer than one hour, considered short acting insulin subcut injection to cover the short-term insulin requirements. Alternatively, upon recommencement of CSII, the BG should be rechecked and if needed, a correction bolus can be given.

People needing to be regularly disconnected from their insulin pump due to operations or procedures should be considered for basal bolus insulin or IV insulin infusion.

The quick disconnection device (Figure 4) allows the user to temporarily disconnect the pump and tubing without needing to take out the entire infusion set.

Figure 4: Examples of quick disconnection devices



The person with diabetes is responsible for all consumables and is required to replace the infusion set and cannula and rotate the insertion site every three (3) days.

Further information and specific insulin pump user guides are available via:

- Australasian Medical & Scientific Ltd (AMSL) Diabetes: www.amsl.com.au or Free Call: 1300 851 056
- Medtronic Australasia Pty Ltd: www.medtronic-diabetes.com.au or Free call: 1800 668 670.

1.3 Documentation

CSII (Insulin Pump) Inpatient Rate Record (MR-CIR)

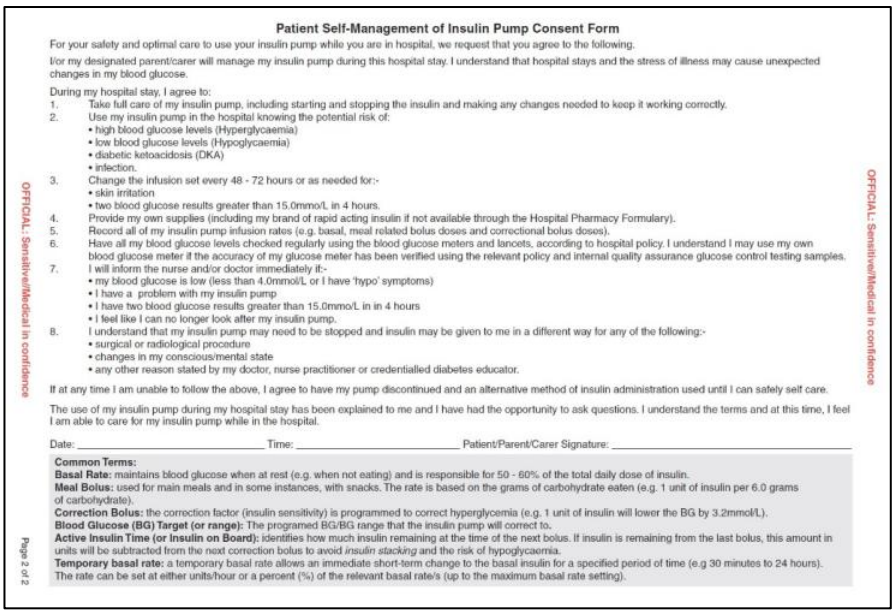
The CSII (Insulin Pump) Inpatient Rate Record (MR-CIR) includes a consent (Figure 5) that identifies the person's responsibilities related to the self-management of CSII while an inpatient.

A clearly written notation in the medical record and in the nursing care plan is required to identify that the person is to continue CSII during the admission. The following criteria on the MR-CIR must be discussed and consented to;

- the medical officers name, contact details and signature
- the brand name, model of the pump and duration of CSII must be written in the medical record
- that competency has been assessed and deemed satisfactory
- the type of rapid acting insulin used
- the current insulin delivery settings (e.g. temporary basal rates and bolus insulin doses including insulin: carbohydrate ratio/s, insulin sensitivity factor, duration of insulin action and glucose targets). Ideally the pump data would be downloaded, and the printout stored with the medication chart for reference
- any changes to the insulin delivery settings should be clearly documented at the time they are implemented
- documentation that these changes have been clearly conveyed to and confirmed by the person with diabetes or their carer are also needed
- BG monitoring frequency
- blood ketones (BK) monitoring frequency
- the person agrees to notify staff of any changes they make to their insulin pump settings and consumables used and when the insulin cannula was last re-sited.

The person is responsible for providing the dose parameters for the pump. The CSII (Insulin Pump) Inpatient Rate Record (MR-CIR) also provides a two day record for basal rates, meal boluses, correctional boluses, blood glucose, blood ketones, carbohydrate intake and physical activity level. (Figure 6)

Figure 5: CSII (Insulin Pump) Inpatient Rate Record (MR-CIR) Consent



Patient Self-Management of Insulin Pump Consent Form

For your safety and optimal care to use your insulin pump while you are in hospital, we request that you agree to the following.

I/or my designated parent/carer will manage my insulin pump during this hospital stay. I understand that hospital stays and the stress of illness may cause unexpected changes in my blood glucose.

During my hospital stay, I agree to:

1. Take full care of my insulin pump, including starting and stopping the insulin and making any changes needed to keep it working correctly.
2. Use my insulin pump in the hospital knowing the potential risk of:
   - high blood glucose levels (Hyperglycaemia)
   - low blood glucose levels (Hypoglycaemia)
   - diabetic ketoacidosis (DKA)
   - infection.
3. Change the infusion set every 48 - 72 hours or as needed for:-
   - skin irritation
   - two blood glucose results greater than 15.0mmo/L in 4 hours.
4. Provide my own supplies (including my brand of rapid acting insulin if not available through the Hospital Pharmacy Formulary).
5. Record all of my insulin pump infusion rates (e.g. basal, meal related bolus doses and correctional bolus doses).
6. Have all my blood glucose levels checked regularly using the blood glucose meters and lancets, according to hospital policy. I understand I may use my own blood glucose meter if the accuracy of my glucose meter has been verified using the relevant policy and internal quality assurance glucose control testing samples.
7. I will inform the nurse and/or doctor immediately if:-
   - my blood glucose is low (less than 4.0mmol/L or I have 'hypo' symptoms)
   - I have a problem with my insulin pump
   - I have two blood glucose results greater than 15.0mmo/L in in 4 hours
   - I feel like I can no longer look after my insulin pump.
8. I understand that my insulin pump may need to be stopped and insulin may be given to me in a different way for any of the following:-
   - surgical or radiological procedure
   - changes in my conscious/mental state
   - any other reason stated by my doctor, nurse practitioner or credentialled diabetes educator.

If at any time I am unable to follow the above, I agree to have my pump discontinued and an alternative method of insulin administration used until I can safely self care.

The use of my insulin pump during my hospital stay has been explained to me and I have had the opportunity to ask questions. I understand the terms and at this time, I feel I am able to care for my insulin pump while in the hospital.

Date: _____ Time: _____ Patient/Parent/Carer Signature: _____

Common Terms:

Basal Rate: maintains blood glucose when at rest (e.g. when not eating) and is responsible for 50 - 60% of the total daily dose of insulin.

Meal Bolus: used for main meals and in some instances, with snacks. The rate is based on the grams of carbohydrate eaten (e.g. 1 unit of insulin per 6.0 grams of carbohydrate).

Correction Bolus: the correction factor (insulin sensitivity) is programmed to correct hyperglycemia (e.g. 1 unit of insulin will lower the BG by 3.2mmol/L).

Blood Glucose (BG) Target (or range): The programed BG/BG range that the insulin pump will correct to.

Active Insulin Time (or Insulin on Board): identifies how much insulin remaining at the time of the next bolus. If insulin is remaining from the last bolus, this amount in units will be subtracted from the next correction bolus to avoid *insulin stacking* and the risk of hypoglycaemia.

Temporary basal rate: a temporary basal rate allows an immediate short-term change to the basal insulin for a specified period of time (e.g 30 minutes to 24 hours). The rate can be set at either units/hour or a percent (%) of the relevant basal rate/s (up to the maximum basal rate setting).

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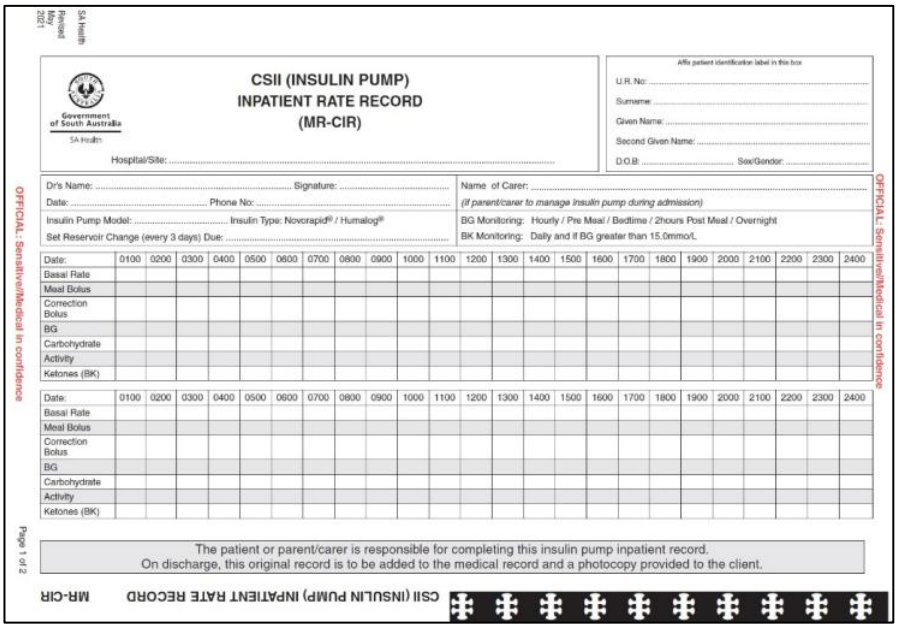
Figure 6: CSII (Insulin Pump) Inpatient Rate Record (MR-CIR) Dose Parameters



SA Health
Revised May 2021

Government of South Australia
SA Health

CSII (INSULIN PUMP) INPATIENT RATE RECORD (MR-CIR)

Hospital/Site: .....

Affix patient identification label in this box

U.R. No: .....
Surname: .....
Given Name: .....
Second Given Name: .....
D.O.B: ..... Sex/Gendor: .....

Dr's Name: ..... Signature: .....
Date: ..... Phone No: .....
Insulin Pump Model: ..... Insulin Type: Novorapid® / Humalog®
Set Reservoir Change (every 3 days) Due: .....

Name of Carer: .....
(if parent/carer to manage insulin pump during admission)
BG Monitoring: Hourly / Pre Meal / Bedtime / 2hours Post Meal / Overnight
BK Monitoring: Daily and if BG greater than 15.0mmo/L

Date:	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Basal Rate																								
Meal Bolus																								
Correction Bolus																								
BG																								
Carbohydrate																								
Activity																								
Ketones (BK)																								

Date:	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Basal Rate																								
Meal Bolus																								
Correction Bolus																								
BG																								
Carbohydrate																								
Activity																								
Ketones (BK)																								

The patient or parent/carer is responsible for completing this insulin pump inpatient record.
On discharge, this original record is to be added to the medical record and a photocopy provided to the client.

MR-CIR CSII (INSULIN PUMP) INPATIENT RATE RECORD

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It also requires the following information to be documented;

- the medical officers name, contact details and signature
- carer's name and contact details (if applicable)
- insulin pump model
- insulin type
- infusion set and catheter (reservoir) change date attended and due

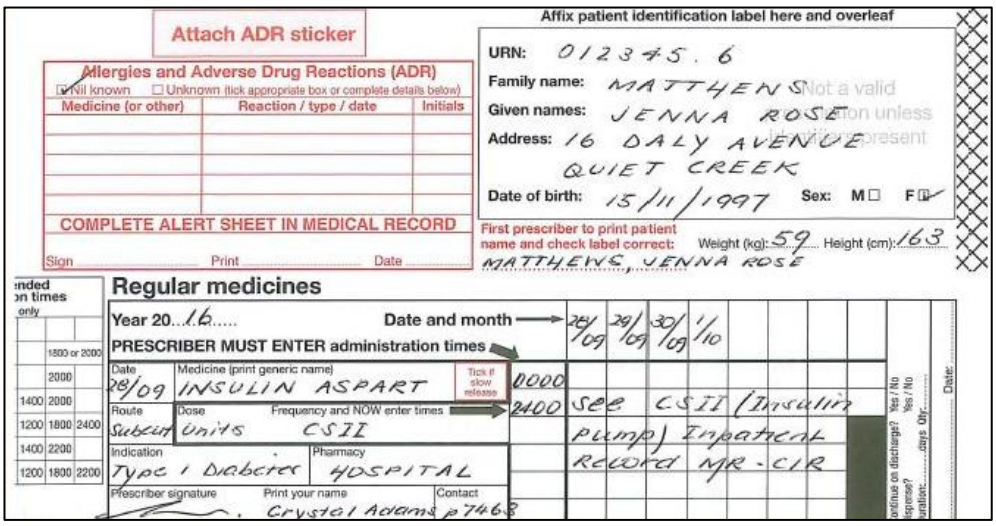
> BG monitoring frequency
> BK monitoring frequency
> when the insulin cannula was inserted and when it is to be re-sited.

National Inpatient Medication Chart

The admitting medical practitioner is required to prescribe the insulin used in the insulin pump on the National Inpatient Medication Chart (NIMC).

Reference to CSII (Insulin Pump) Inpatient Rate Record (MR-CIR) by the admitting medical practitioner is also required. To comply with medication documentation standards, the following NIMC prescription is recommended. (Figure 7)

Figure 7: National Inpatient Medication Order identifying insulin used in insulin pump.



Blood Glucose and Blood Ketone Monitoring Chart (MR59H)

People with diabetes using CSII require at least QID BG monitoring. As per hospital standards, these are recorded on the Blood Glucose and Blood Ketone Monitoring Chart (MR59H).

Escalation of care is initiated according to the colour zone.

1.4 Insulin pump failure

Every CSII supplier has a 24hour emergency help line to assist people with diabetes or their carers who experience difficulty.

In the event the person's insulin pump requires replacement during the hospitalisation, it is recommended that the person or carer notify staff immediately to facilitate transfer to an alternative insulin administration regimen e.g. basal bolus insulin therapy or an intravenous insulin infusion.

The person is to contact their CSII supplier to request a replacement insulin pump. If this request is supported, a replacement or loan insulin pump will be sent by the CSII supplier via express post to the person's address or admitting hospital.

A CDE should be notified of insulin pump failure. The CDE can advise or assist with programming of the replacement insulin pump basal and bolus settings during admission or assist with alternative insulin treatment until the replacement insulin pump is received and commenced following discharge.

1.5 Switching from intravenous insulin (IV) to continuous subcutaneous insulin infusion (CSII)

A person's endocrinologist should be consulted if transitioning to insulin pump therapy.

CSII is to be recommenced at the previous basal rate settings at least four hours before the IV insulin infusion. The IV insulin infusion can run concurrently with the insulin pump as the IV insulin infusion rate will be titrated down based on BG levels.

If a meal is due during the 4 hours of transition, the CSII's advanced settings are to be used to calculate the meal-related bolus.

- The CSII advanced settings consider the pre meal blood glucose test result, blood glucose target, insulin sensitivity factor, insulin:carbohydrate ratio and insulin action time (also known as 'insulin on board') to suggest a meal-related bolus dose to be delivered.
- The person can self-administer this suggested meal-related bolus dose or administer a reduction in the suggested dose if concerned about post prandial hypoglycaemia.
- The CSII Inpatient Rate Record (MR-CIR) is to be used by the person to document the meal-related bolus administered.

After at least 4 hours of basal insulin via the insulin pump **AND** if the person has tolerated food and fluid **AND** if the blood ketone is less than 0.3mmol/L, the IV insulin infusion can be discontinued.

After the IV insulin infusion is discontinued, maintain insulin pump therapy (using both basal and advanced settings at main mealtimes). Continue hourly blood glucose for 2-4 hours then if stable, reduce blood glucose monitoring frequency to QID. The blood ketone should be rechecked in 1 hour and then as instructed by the medical officer.

1.6 Discharge planning

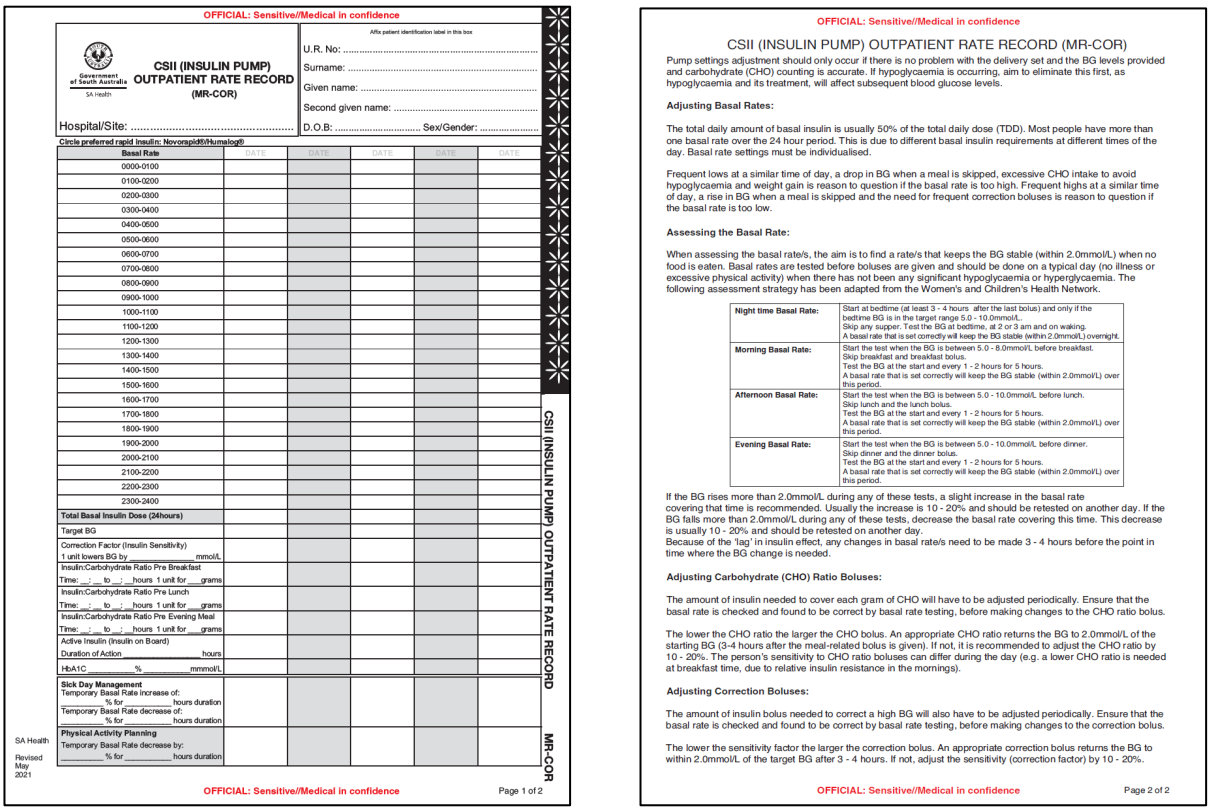
To assist the person and/or their family/carer to continue self-management and to ensure the ongoing medication support, clinical care and educational services provided following discharge in the community setting, the following health professionals should be consulted:

- the person's diabetes specialist (e.g. endocrinologist) or medical practitioner
- CDE trained in insulin pump management
- dietitian.

The CSII (Insulin Pump) Outpatient Rate Record (MR-COR) is used in the community setting and can be completed by the medical practitioner, nurse practitioner, CDE, person with diabetes or carer. It provides an ongoing record of basal rates, bolus doses, target blood glucose, correctional factor, insulin: carbohydrate ratio/s and active insulin on-board time. (Figure 8)

Further information is also provided to guide the adjustment of basal rates, correctional and insulin: carbohydrate ratio/s and consider temporary rates to accommodate sick day management and physical activity planning. In the event of insulin pump fails in the community setting, the record can provide vital information to guide temporary basal and rapid acting bolus insulin doses via of subcut injections until such time that the insulin pump is repaired or replaced.

Figure 8: CSII (Insulin Pump) Outpatient Rate Record (MR-COR)



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Government of South Australia — SA Health

CSII (INSULIN PUMP) OUTPATIENT RATE RECORD (MR-COR)

Affix patient identification label in this box

U.R. No: .....
Surname: .....
Given name: .....
Second given name: .....
D.O.B: ..... Sex/Gender: .....

Hospital/Site: .....

Circle preferred rapid insulin: Novorapid®/Humalog®

Basal Rate	DATE	DATE	DATE	DATE	DATE
0000-0100					
0100-0200					
0200-0300					
0300-0400					
0400-0500					
0500-0600					
0600-0700					
0700-0800					
0800-0900					
0900-1000					
1000-1100					
1100-1200					
1200-1300					
1300-1400					
1400-1500					
1500-1600					
1600-1700					
1700-1800					
1800-1900					
1900-2000					
2000-2100					
2100-2200					
2200-2300					
2300-2400					
Total Basal Insulin Dose (24hours)					
Target BG					
Correction Factor (Insulin Sensitivity) 1 unit lowers BG by _____ mmol/L					
Insulin:Carbohydrate Ratio Pre Breakfast Time: __:__ to __:__ hours 1 unit for ___grams					
Insulin:Carbohydrate Ratio Pre Lunch Time: __:__ to __:__ hours 1 unit for ___grams					
Insulin:Carbohydrate Ratio Pre Evening Meal Time: __:__ to __:__ hours 1 unit for ___grams					
Active Insulin (Insulin on Board) Duration of Action _____ hours					
HbA1C _____ % _____ mmmol/L					
Sick Day Management Temporary Basal Rate increase of: _____ % for _____ hours duration Temporary Basal Rate decrease of: _____ % for _____ hours duration					
Physical Activity Planning Temporary Basal Rate decrease by: _____ % for _____ hours duration					

CSII (INSULIN PUMP) OUTPATIENT RATE RECORD MR-COR

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CSII (INSULIN PUMP) OUTPATIENT RATE RECORD (MR-COR)

Pump settings adjustment should only occur if there is no problem with the delivery set and the BG levels provided and carbohydrate (CHO) counting is accurate. If hypoglycaemia is occurring, aim to eliminate this first, as hypoglycaemia and its treatment, will affect subsequent blood glucose levels.

Adjusting Basal Rates:

The total daily amount of basal insulin is usually 50% of the total daily dose (TDD). Most people have more than one basal rate over the 24 hour period. This is due to different basal insulin requirements at different times of the day. Basal rate settings must be individualised.

Frequent lows at a similar time of day, a drop in BG when a meal is skipped, excessive CHO intake to avoid hypoglycaemia and weight gain is reason to question if the basal rate is too high. Frequent highs at a similar time of day, a rise in BG when a meal is skipped and the need for frequent correction boluses is reason to question if the basal rate is too low.

Assessing the Basal Rate:

When assessing the basal rate/s, the aim is to find a rate/s that keeps the BG stable (within 2.0mmol/L) when no food is eaten. Basal rates are tested before boluses are given and should be done on a typical day (no illness or excessive physical activity) when there has not been any significant hypoglycaemia or hyperglycaemia. The following assessment strategy has been adapted from the Women's and Children's Health Network.

Night time Basal Rate:	Start at bedtime (at least 3 - 4 hours after the last bolus) and only if the bedtime BG is in the target range 5.0 - 10.0mmol/L. Skip any supper. Test the BG at bedtime, at 2 or 3 am and on waking. A basal rate that is set correctly will keep the BG stable (within 2.0mmol/L) overnight.
Morning Basal Rate:	Start the test when the BG is between 5.0 - 8.0mmol/L before breakfast. Skip breakfast and breakfast bolus. Test the BG at the start and every 1 - 2 hours for 5 hours. A basal rate that is set correctly will keep the BG stable (within 2.0mmol/L) over this period.
Afternoon Basal Rate:	Start the test when the BG is between 5.0 - 10.0mmol/L before lunch. Skip lunch and the lunch bolus. Test the BG at the start and every 1 - 2 hours for 5 hours. A basal rate that is set correctly will keep the BG stable (within 2.0mmol/L) over this period.
Evening Basal Rate:	Start the test when the BG is between 5.0 - 10.0mmol/L before dinner. Skip dinner and the dinner bolus. Test the BG at the start and every 1 - 2 hours for 5 hours. A basal rate that is set correctly will keep the BG stable (within 2.0mmol/L) over this period.

If the BG rises more than 2.0mmol/L during any of these tests, a slight increase in the basal rate covering that time is recommended. Usually the increase is 10 - 20% and should be retested on another day. If the BG falls more than 2.0mmol/L during any of these tests, decrease the basal rate covering this time. This decrease is usually 10 - 20% and should be retested on another day.
Because of the 'lag' in insulin effect, any changes in basal rate/s need to be made 3 - 4 hours before the point in time where the BG change is needed.

Adjusting Carbohydrate (CHO) Ratio Boluses:

The amount of insulin needed to cover each gram of CHO will have to be adjusted periodically. Ensure that the basal rate is checked and found to be correct by basal rate testing, before making changes to the CHO ratio bolus.

The lower the CHO ratio the larger the CHO bolus. An appropriate CHO ratio returns the BG to 2.0mmol/L of the starting BG (3-4 hours after the meal-related bolus is given). If not, it is recommended to adjust the CHO ratio by 10 - 20%. The person's sensitivity to CHO ratio boluses can differ during the day (e.g. a lower CHO ratio is needed at breakfast time, due to relative insulin resistance in the mornings).

Adjusting Correction Boluses:

The amount of insulin bolus needed to correct a high BG will also have to be adjusted periodically. Ensure that the basal rate is checked and found to be correct by basal rate testing, before making changes to the correction bolus.

The lower the sensitivity factor the larger the correction bolus. An appropriate correction bolus returns the BG to within 2.0mmol/L of the target BG after 3 - 4 hours. If not, adjust the sensitivity (correction factor) by 10 - 20%.

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1. Attached documents

National Safety and Quality Health Service Standards 4 - Recognising and Responding to Clinical Deterioration in Acute Health Care
CSII Inpatient Rate Record (MR-CIR) example
CSII Outpatient Rate Record (MR-COR) example
Blood Glucose & Blood Ketone Monitoring Chart (MR59H) and Protocol

2. References

Craig M, Twigg S, Donaghue K, Cheung N, Cameron F, Conn J, Jenkins A and Silink M (2011). *National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults*, Australian Paediatric Endocrine Group and Australian Diabetes Society. Canberra, Australian Government Department of Health and Ageing.

Umpierrez, GE, and Klonoff DC (2018) Diabetes Technology Update: Use of insulin pumps and continuous glucose monitoring in the hospital. *Diabetes Care*, Volume 41 (8) pages 1579-1589.

Marchand L, Kawasaki-Ogita Y, Place J, et al. (2017) Long-term effects of continuous subcutaneous insulin infusion on glucose control and microvascular complications in patients with type 1 diabetes. *Journal of Diabetes Science and Technology*, Volume 11. Pages 924-929.
Misso ML, Egberts KJ, Page M, et al (2010) Continuous subcutaneous insulin infusion (CSII) versus multiple insulin injections for type 1 diabetes mellitus. *Cochrane Database of Systematic Reviews*. Issue1. Article No CD005103.
Sora ND, Shashpal F, Bond EA and Jenkins AJ (2019). Insulin pumps: Review of technological advancement in diabetes management. *American Journal of the Medical Sciences*, Volume 358, Issue 5, Pages 326-331.
Scheiner G (2018) *New insulin pump comparisons and reviews.* Integrated Diabetes Services.
Sherr J, Tauschmann M, Battelino T, DeBock M, Forlenza G, Roman R, Hood K, and Maahs, DM (2018) *ISPAD guidelines - Diabetes Technologies Chapter*, International Society for Pediatric and Adolescent Diabetes, Berlin, Germany.
Australian Diabetes Society (2012). *Guidelines for routine glucose control in hospital.* Sydney, ADS.
Australian Institute of Health and Welfare (2012). *Insulin pump use in Australia.* Diabetes Series No. 18. Cat. No. CVD 58. Canberra, Australian Institute of Health and Welfare.

3. Accreditation standards

National Safety and Quality Health Service Standards ***(2nd edition)***

1	2	3	4	5	6	7	8
☐	☒	☐	☒	☒	☒	☐	☒
Clinical Governance	Partnering with Consumers	Preventing & Controlling Healthcare Associated Infection	Medication Safety	Comprehensive Care	Communicating for Safety	Blood Management	Recognising & Responding to Acute Deterioration

Aged Care Quality Standards ***(includes home care clients)***

1	2	3	4	5	6	7	8
☒	☒	☒	☐	☐	☐	☐	☐
Consumer Dignity & Choice	Ongoing Assessment & Planning with Consumers	Personal Care & Clinical Care	Services & Supports for Daily Living	Organisation's Service Envorinment	Feedback & Complaints	Human Resources	Organisational Governance

National Disability Insurance Scheme (NDIS) Practice Standards

CORE MODULE				SUPPLEMENTARY MODULES	
1 ☐	**2** ☐	**3** ☒	**4** ☐	**1** ☐	**2** ☐
Rights and Responsibilities	Governance and Operational Management	Provision of Supports (to participants)	Provision of Supports (environment)	High Intensity Daily Personal Activities Module	Early Childhood Supports Module

4. Consultation

Version	Consultation
1.0	SA Health Metropolitan Diabetes Services, Flinders University SA, NP-Diabetes - Mt Gambier, CHSA Diabetes Specialist Nurse Network, Clinical Pharmacists, CHSA Director of Endocrinology.
2.0	SA Health Metropolitan Diabetes Services, Flinders University SA, NP-Diabetes - Mt Gambier, RSS Diabetes Specialist Nurse Network, Clinical Pharmacists.
3.0	SA Health Metropolitan Diabetes Services, Flinders University SA, NP-Diabetes - Mt Gambier, RSS Diabetes Specialist Nurse Network, Clinical Pharmacists.