Country Health SA Local Health Network

Protocol (Clinical)

Title: Continuous Subcutaneous Insulin Infusion (CSII)

Protocol developed by: CHSALHN Diabetes Service

Protocol Sponsor: CHSALHN, Chief Medical Advisor

Approved by: CHSALHN, Clinical Governance Committee on: 01/02/2017

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Summary	This procedure outlines responsibilities and actions required by nurses and midwives to ensure the safety and quality of patient care by appropriately recording continuous subcutaneous insulin infusion (CSII) rates.
Policy/Procedure reference	This protocol supports the Controlled Substances Act 1984, SA Health Directive: High Risk Medicines Management, SA Health Directive: Patients' Own Medications, CHSALHN Diabetes Service Plan and Diabetes Inpatient Model of Care.
Keywords	Clinical, Protocol, CHSA, Nursing, Midwifery, Safety, Blood Glucose, CSII, Pumps, Communication, Consumer Participation, Standards
Document history	Is this a new CHSA Protocol? **Y** Does this protocol amend or update an existing protocol? **N** Does this protocol replace an existing protocol? **N**
Applies to	This procedure applies to all hospital nursing, midwifery and medical staff and CHSA Diabetes Service staff.
Objective file number	A329589 2016-07367

Version control and change history

Version	Date	Amendment	Amended by:
1.0	October 2016	Original version	

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1. Purpose

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

The protocol will assist nursing, midwifery and medical staff to determine appropriate health care for the management of patients using CSII. The associated medication record charts and protocol provide CHSA LHN health care professionals with the clinical support so that people with type 1 diabetes (T1D) self-managing with a CSII at the time of hospital admission, can continue to do so during their hospitalisation. The protocol also provides credentialled diabetes educators and dietitians with approved medication records for the ongoing clinical and educational services provided by the CHSA Diabetes Service.

The admitting medical practitioner will be responsible for:

- explaining inpatient management
- supporting the maintenance of CSII and
- prescribing alternative insulin therapy (eg intravenous infusion or subcutaneous injection) where CSII is contraindicated.

Nurses have an important role in providing the applicable education to support safe CSII and self-management. It is recommended that the advice of a credentialled diabetes educator (CDE) be sought wherever possible to ensure a high standard of care for patients and the best opportunity for enhancing nursing knowledge and expertise.

This guide 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.

2. Areas of Responsibility

2.1 **CHSA Executive** is responsible to ensure that all hospital managers and staff are aware of the CHSALHN Continuous Subcutaneous Insulin Infusion Charts and their responsibilities in relation to leading, supporting and sustaining the protocol.

2.2 **Directors of Nursing and Midwifery and Managers** are responsible for ensuring that the charts are made known to all staff who are required to use it and that its use is part of clinical orientation.

2.3 **All hospital Nursing and Midwifery employees** are responsible for following the process identified in this protocol.

2.4 **Admitting Medical Practitioners** are responsible for following the process identified in this protocol.

2.5 **Non-employees** eg Nursing and Midwifery Students are required to follow the protocol as stated under the supervision of a Registered or Enrolled Nurse and/or Registered Midwife.

3. Glucose/insulin metabolism

The body needs glucose all the time. Glucose is supplied by carbohydrate (CHO) foods and via the liver, (in the absence of CHO intake eg overnight or fasting). Glucose needs to be available 24 hrs a day (measured as basal blood glucose).

Insulin is the hormone produced in the pancreas. Insulin enables glucose in the blood to be taken up by the body cells and also suppress liver glucose production. Figure 1 identifies the steady release of insulin 24 hours a day which is needed to maintain normal blood glucose levels (known as basal insulin). **Figure 2** identifies the burst of insulin released in response to meals (known as bolus insulin). Whenever glucose is released into the bloodstream from carbohydrate (CHO) digestion, bolus insulin is released to 'match' what is required to move the glucose into the cells and maintain homeostasis.

Figure 1: Normal basal insulin profile

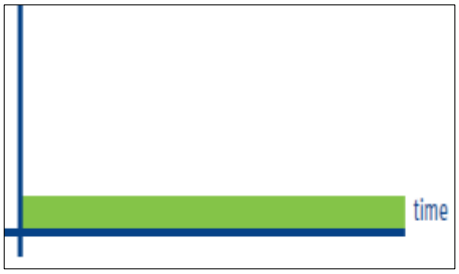
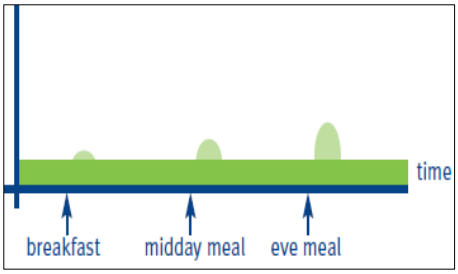


Figure 2: Normal meal time insulin profile



People with T1D don't produce any insulin and require CSII or multiple doses of injected insulin every day.

People with type 2 diabetes (T2D) will need injected insulin/GLP1 analogues, when nutritional modification, physical activity and oral hypoglycaemic agents (OHAs) are no longer sufficiently effective in maintaining their individual blood glucose targets.

Gestational diabetes (sometimes referred to as GDM) is diagnosed when higher than normal blood glucose levels first appear during pregnancy. In GDM, the pancreas makes some insulin but this is not produced in the amount the body needs and it does not work effectively. Women with GDM will need injected insulin, when nutritional modification and physical activity are not sufficiently effective in maintaining their individual blood glucose targets.

In Australia, CSII is approved for use in people with T1D, women with T2D during pregnancy and women with GDM. People with T2D can access CSII consumables but there is no rebate or subsidy available for the day to day running costs of the insulin pump. This guide will focus on people with T1D, women with T2D during pregnancy and women with GDM.

4. Understanding CSII

Benefits of CSII

Provided the suggested management guidelines are followed, CSII can;

- improve insulin absorption and promote efficiency and predictability of insulin action
- improve HbA1c
- allow greater flexibility with meal size, meal times, shift work, travel, regular/spasmodic sport or significant activity
- improve quality of life.

Disadvantages of CSII

As only rapid acting insulin is used, diabetic ketoacidosis can develop within 3-4 hours if the insulin is not administered correctly (eg pump removed for showering and not reconnected, catheter blocked, tubing kinked, pump dropped and damaged).

The insulin pump must be worn 24 hours a day and mechanical faults can occur.

Types of CSII available in Australia

There are many different insulin pumps available in Australia. Insulin pumps vary in price from $4000 to $9500, and come with a wide range of features. The following pharmaceutical companies provide insulin pumps;

- Australasian Medical & Scientific Ltd (AMSL) **Figure 3**
- Medtronic Diabetes Pty Ltd **Figure 4**
- Roche Diagnostics Australia **Figure 5**

Figure 3: Animas Vibe®

Figure 4: MedTronic G640®

Figure 5:Roche Aviva Combo®

5. Inpatient management

Reports suggest that patients established on CSII usually prefer to continue on their pumps during hospital admissions.

Health care professionals are increasingly faced with the issue of how to manage such inpatients. Whilst there are no data from randomised trials available, observational reports indicate that patients admitted to hospital continued on CSII who are managed with best-practice consensus protocols fare at least as well as those changed over to subcutaneous insulin injections and managed by the diabetes team.

The Blood Glucose Monitoring Chart (MR59H) continues to be completed by nurses or midwives who are trained and competent in the use of BG meters. Subsequent actions continue to be initiated according to the colour zone. The CSII Inpatient Rate Record is to be completed by the patient/carer and used in conjunction with the Blood Glucose Monitoring Chart (MR59H).

Who to consult

The following health professionals should be consulted:

- the patient's diabetes specialist (eg 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 contra-indicated in situations where the patient's safety may be compromised by their physical illness or mental state.

Absolute contra-indications for CSII using an insulin pump are;

- impaired level of consciousness
- critical illness requiring intensive care
- major psychiatric disturbance
- diabetic ketoacidosis (DKA)
- refusal or unwilling to participate in self-care
- 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 patient on CSII therapy
- extensive skin infections or inflammation
- concerns regarding technical malfunction of the pump
- numerous radiological procedures (eg the pump should be suspended and disconnected prior to the patient 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 patient presents with any contraindication, the CSII must be discontinued and the device managed according to the hospital's policy for storage of patient valuables. The patient should be provided alternative insulin administration (eg IV insulin infusion or basal bolus insulin) during their hospitalisation.

Assessing patient competency to self-manage CSII

On admission to hospital, either to a ward or emergency department, the patient must demonstrate to the satisfaction of the assessing health care professional that they have the ability to 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 patient to use CSII and the insulin pump.

Competency assessment will involve asking the patient to demonstrate that they;

- can open the pump menu
- are able to adjust the basal rate and adjust the bolus dose/s
- can re-site their pump cannula (eg this could involve discussing how it is done, rather than actually 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

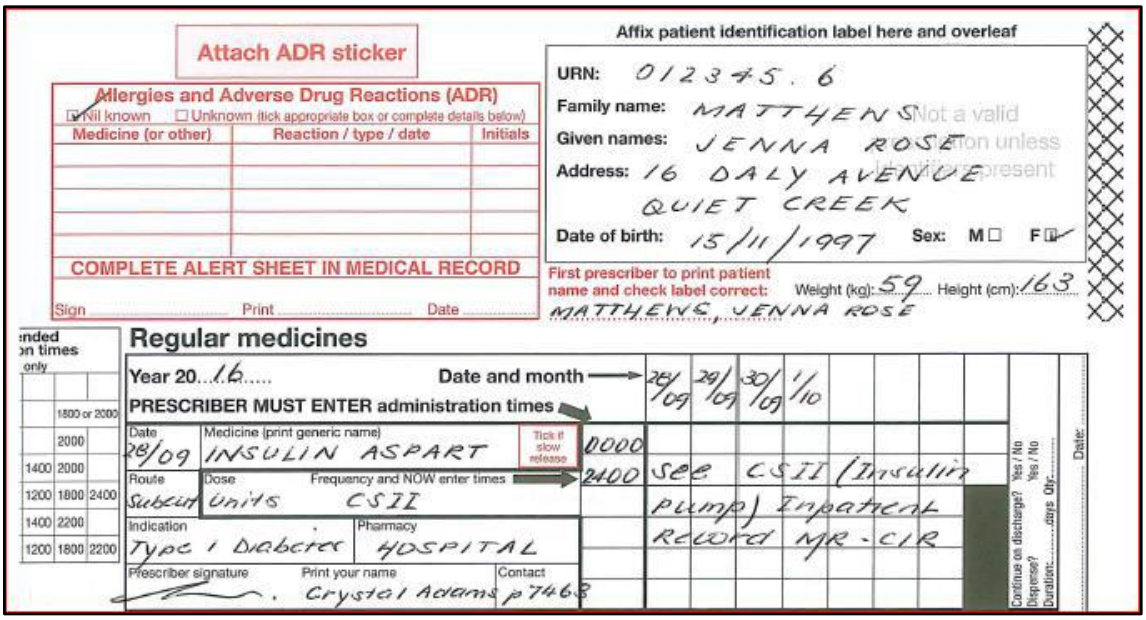
- have adequate supplies of infusion sets, spare batteries and the insulin used in the insulin pump available for the anticipated duration of the admission
- have been performing regular BG tests (eg four tests per day)

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

Documenting insulin rates and doses – the need to comply with medication documentation standards

The admitting medical practitioner is required to prescribe the insulin used in the insulin pump on the National Inpatient Mediction Chart (NIMC). **Figure 6**

Figure 6 National Inpatient Medication Order identifying insulin used in insulin pump.



The admitting medical practitioner is also required to make a notation within the order that hourly insulin rates and boluses will be record on the CSII Inpatient Rate Record MR-CIR.

The CSII Inpatient Rate Record MR-CIR and accompanying consent identifies the patient's responsibilities related to the self-management of CSII while an inpatient. If the patient is unable to follow these terms, the insulin pump is discontinued and the patient's diabetes will be managed by basal bolus insulin therapy and/or an intravenous insulin infusion until the patient is able to follow these terms and resume self-care and management or the patient is discharged.

To assist the patient to continue CSII during the admission, the following criteria must be documented;

- clearly written in the medical record and in the nursing care plan that the patient is on an insulin pump
- 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 insulin used

- the current insulin delivery settings (eg 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 print out stored with the medication chart for reference
- any changes to the insulin delivery settings should be clearly documented at the time they are implemented. It should also be documented that these changes have been clearly conveyed to and confirmed by the patient or their carer
- BG monitoring frequency
- blood ketones (BK) monitoring frequency
- the patient 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

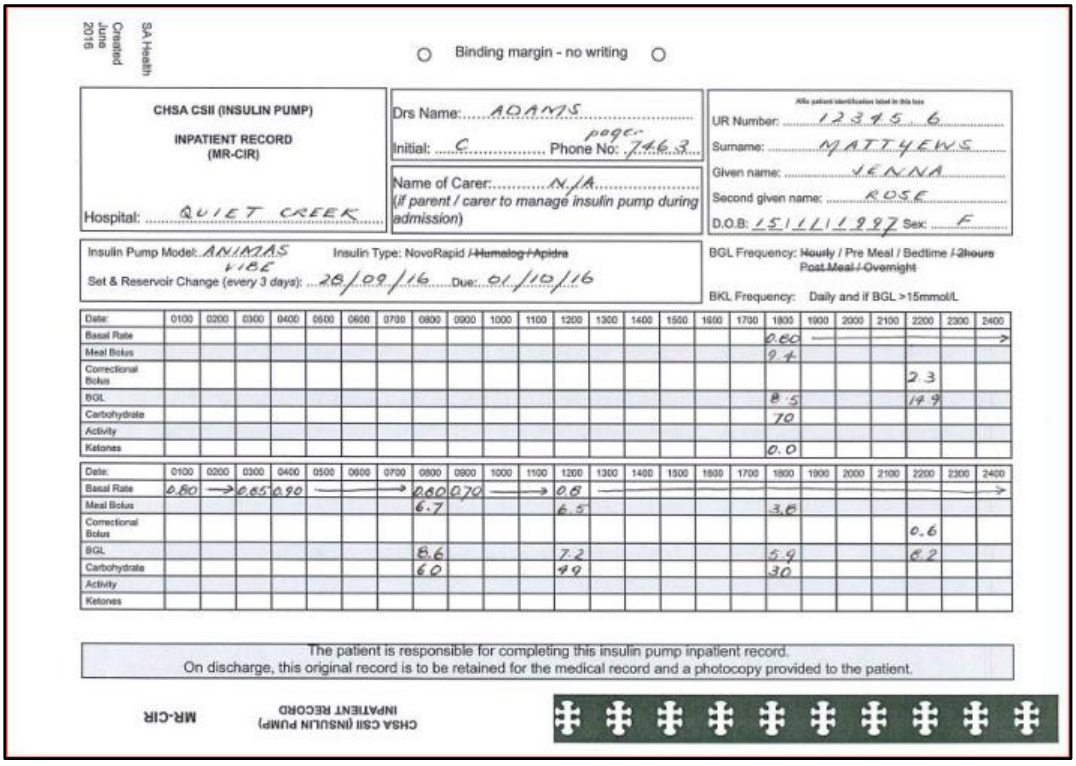
Using the inpatient rate record chart MR-CIR

The CSII Inpatient Rate Record provides a two day record for basal rates, meal boluses, correctional boluses, blood glucose, blood ketones, carbohydrate intake and physical activity level. It also requires the following information to be documented;

- the medical practitioner's contact details
- 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.

The CSII Inpatient Rate Record consent is to be completed by the patient or carer. The original rate record is to be retained in the medical record and a copy provided to the patient or carer on discharge. **Figure 7**

Figure 7 CSII Inpatient Rate Record MR-CIR



The Blood Glucose Monitoring Chart (MR59H) continues to be completed by nurses or midwives who are trained and competent in the use of BG meters. Subsequent actions continue to be initiated according to the colour zone. The CSII Inpatient Rate Record is to be completed by the patient/carer and used in conjunction with the Blood Glucose Monitoring Chart (MR59H).

Additional considerations based on expert consensus:

- **CSII should never be a substitute for an intravenous insulin infusion to treat patients with diabetic ketoacidosis**
- in a metabolically stable patient, who is able to eat, CSII may be more appropriate than an IV insulin infusion or a basal bolus insulin.
- regardless as to whether CSII is to be continued or ceased during the patient's hospitalisation, it is strongly recommended that a consultation with the patient's diabetes specialist team is obtained at the time of admission. If unavailable, the endocrinologist usually responsible for the care of the patient should be notified as soon as possible.
- CSII therapy is to be continued in hospital only in those situations where the patient or their carer have the ability to self-manage their insulin dosing and the pump (button pushing and set changes) safely.
- the patient will be responsible (in consultation with the diabetes team) for setting basal rates, determining bolus doses administered with meals or to correct elevated glucose levels and for set changes and for recording on the approved chart.
- CSII therapy should never be discontinued without first ensuring the provision of insulin via an alternative route (IV infusion or subcutaneous injection)

CSII therapy must be substituted with either a subcutaneous insulin regimen or an IV insulin infusion if;

- the patient or carer is not able to demonstrate that they are able to safely and reliably manage the insulin pump
- a severe acute illness is present
- a procedure or investigation is planned and the anaesthetic staff are not confident regarding the management of the insulin pump
- there are concerns regarding a malfunction in the insulin pump.

Children and adolescents

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

In the circumstances that the parent or carer is responsible for the management of the insulin pump, the medical practitioner must be satisfied that the responsible person can satisfy all essential requirements and that this decision may be made in consultation the patient's medical practitioner and CDE. Additionally, the parent or carer must be able to stay with the patient at all times during the admission so that adjustments to the insulin pump can be made at any time.

If the above conditions cannot be met, CSII should be discontinued and subcutaneous insulin injection should be used until as an alternative until the parent or carer can resume their responsibilities.

Obstetric and gynaecological patients

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.

Surgical procedures

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, patient, parent or carer. **Figure 8**

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

Figure 8 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 (eg D&C) > medical and anaesthetic staff that are familiar with pumps > patient awake and alert intraoperatively > patient metabolically stable > patient alert and to resume eating shortly after completion of the procedure.	> prolonged and complicated procedure (eg coronary bypass surgery) > impaired conscious state > medical and anaesthetic staff unfamiliar with CSII > patient critically unwell and metabolically unstable (eg intubated or ventilated) > prolonged post-operative recovery period.

If the medical practitioner or anaesthetist is reluctant to manage CSII whilst the patient is pre medicated or unconscious during an operation or procedure, CSII should be discontinued and an alternative insulin administration method used (eg subcutaneous insulin injection or IV insulin infusion) should be used until the patient or carer can resume their self-care responsibilities.

The patient (or parent/carer) must consent to continuing on CSII peri-operatively.

- **CSII and IV insulin therapy should not run at the same time**
- the patient 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 patient must replace metal cannulas with plastic insertion cannulas before any surgical procedures that may involve diathermy are performed)
- the infusion site must be placed away from the operation site with consideration also given to where a diathermy pad may be placed (eg ensure the insertion cannula is plastic not metal
- an identification tag must be attached to the patient that states that the patient is using an insulin pump (eg 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 turned off or disconnected if necessary

- the patient's BG must be monitored every hour peri-operatively until they have satisfactorily regained consciousness and the patient (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 dextrose infusion (eg 5% at 80ml/hr) and an IV insulin infusion should be commenced to prevent ketosis should be commenced. The insulin pump should be turned off, or disconnected.

In the event of the BG level falling below 4mmol/l peri-operatively, the insulin pump must be turned off and/or disconnected. 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 patient's BG
- recommence the pump at the usual basal rate with a higher IV glucose infusion rate to prevent further episodes of hypoglycaemia
- recommence the pump at a lower insulin infusion rate (if the medical practitioner or anaesthetist is able to program the device).

NB: use a temporary basal rate rather than adjusting the usual basal rate. This offers more flexibility and avoids confusion if basal settings are not restored to usual for discharge.

The use of CSII in major procedures is not recommended. This is due to the increased probability that an adjustment to the patient'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.

Patients NOT continuing CSII peri-operatively

Patients whose CSII is to be discontinued prior to surgery WILL require either an IV insulin infusion or subcutaneous therapy. Considerations include a;

- 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 diabetic ketoacidosis
- the CSII can be recommenced when the patient has regained full consciousness and it is considered medically appropriate
- recommencing CSII is preferable in the morning using new consumables and when the insertion site has been re-sited
- CSII should be recommenced immediately prior to cessation of the IV insulin infusion

Other circumstances

The CSII may need to be discontinued temporarily during hospitalisation. **Figure 9**

Figure 9 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 metal cannula)
> physiotherapy (depending on the therapy)
> hydrotherapy (even if the pump is labelled as water-proof).

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 injection to cover their short term requirements.

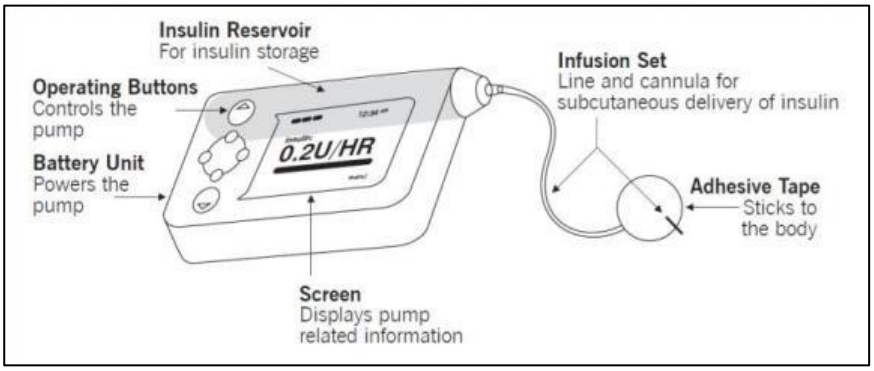
CSII can be discontinued for up to two hours at the discretion of the treating medical practitioner if the patient is clinically stable and BG is being monitored regularly. Upon recommencement of CSII, the BG should be rechecked and if needed a correction bolus can be given.

Patients 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.

6. Device management

All insulin pumps are worn 24 hours a day, although they can be removed for up to two hours for showering and other activities. All pumps have similar features. **Figures 10**

Figure 10 Components of Insulin Pumps



Consumables

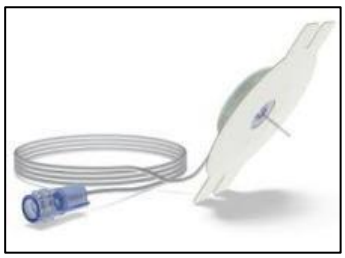
Patients will be required to provide the CSII consumables if they choose to self-manage their CSII in hospital. CSII consumables are subsidised by the NDSS for patients with T1D, women with T2D during pregnancy and women with GDM.

Cannulas

Teflon "soft" cannula (Figure 11) is a thin, flexible needle made of the synthetic substance teflon that is inserted into the subcutaneous tissue via a steel introducer needle. The introducer needle is then removed and only the soft cannula is left in place.

These sets are comfortable to wear and they can remain inserted for up to 72 hours. One disadvantage is that its flexibility can potentially lead to kinking, which disrupts the flow of insulin into the body. Users of soft cannulas need to troubleshoot and immediately change their infusion sets if kinking occurs.

Figure 11: Example of a teflon cannula



A **metal cannula** (Figure 12)is a thin metal needle that is inserted into the subcutaneous tissue; steel cannulas should stay in place for no longer than 48 hours.

One advantage is that it is durable and will not kink, assuring a continuous flow of insulin into the body. Metal cannulas are also very useful for people who are allergic to Teflon. The disadvantages of using a metal cannula are that it can cause discomfort during movement or physical activity and that it requires more frequent site changes.

If the insulin pump is to be used during surgery, the patient must remove the metal cannula before any surgical procedures that may involve diathermy are performed. In this instance, the metal cannula may be replaced with a telfon cannula or an alternative administration of insulin may be more appropriate (eg IV insulin infusion).

Figure 12: Example of a metal cannula

Insertion method

There are two options for inserting a cannula, either the manual insertion (eg the patient simply pushes the needle into the subcutaneous tissue as if giving themselves an injection) or the automatic insertion (eg the patient uses a spring-loaded insertion device that automatically inserts the needle into the tissue).

The manual method **(Figure 13)** is useful for people who like to control the speed of the insertion; it allows them to prepare themselves psychologically for the task and to achieve a gradual and less forceful insertion.

Figure 13: Example of a manual insertion method

Most people prefer using an insertion device **(Figure 14)** which also allows the person to insert a cannula more easily into harder-to-reach infusion site, such as the buttocks or the back of the arm. The disadvantages of using an insertion device include the added expense, additional education needed to learn to use it correctly and that the user cannot control the depth or the exact angle of insertion.

Figure 14: Example of automatic insertion aids



Angle of insertion

CSII Infusion sets come in two varieties with regard to the angle at which the cannula is inserted into the skin either straight (90°) or angled (10° to 45°).

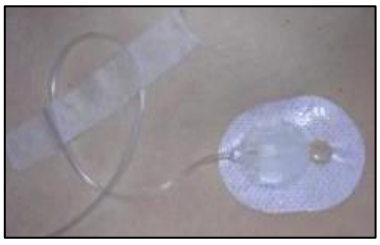
A 90° set is inserted at a right angle, or straight into the skin. This option allows for use of a shorter needle. The disadvantage, however, is that a shorter needle can become dislodged more easily and kinks in a soft cannula are more common.

“Angled” infusion sets allow a person to insert the needle into the subcutaneous tissue at different angles ranging from 10° to 45°. The major disadvantage with this type of set is that the introducer needle is longer and may therefore be less appealing for people with needle phobia.

Safety loop

A safety loop **(Figure 15)** is recommended to avoid the insertion site being tugged on during movement.

Figure 15: A safety loop reduces risk of tugging



Not securing the infusion set is a very common cause of increased scarring, skin irritation, site infections and tunnelling (eg when movement at the site occurs (eg due to tugging), the gap can become large enough that insulin begins to leak from the end of the cannula back to the surface of the skin).

Micropore tape or similar can be used to make a safety loop and is less expensive than replacing a infusion set due to site failure and/or resultant infection.

Insulin reservoir

The insulin reservoir **(Figure 16)**, also known as insulin cartridge size varies between insulin pumps. Depending on the daily dose of insulin, some insulin reservoir sizes will be more suitable than others.

Figure 16: Example of an insulin reservoir

Choosing an injection site

The abdomen is the recommended site as it offers the most even absorption rate, has adequate subcutaneous fat, and makes it easy to raise a skin fold. It is however important to avoid any abdominal wounds, injuries or scars.

If the abdomen is contra-indicated, alternative sites for CSII include:

- thighs – slower absorption, can be used for alternate site for long acting insulin; very little subcutaneous fat thus higher risk of intramuscular injection
- back of arms – medium to fast absorption, not recommended for self-injection
- buttocks – slowest absorption, can be used for alternate site for long acting insulin.

Rotating insertion sites

Like insulin injections, using the same spot for CSII administration will cause lumps (lipohypertrophy) **Figure 17** which hinder insulin absorption resulting in unstable BG levels. Lipohypertrophy is also unsightly and distressing.

Figure 17: Example of Lipohypertrophy

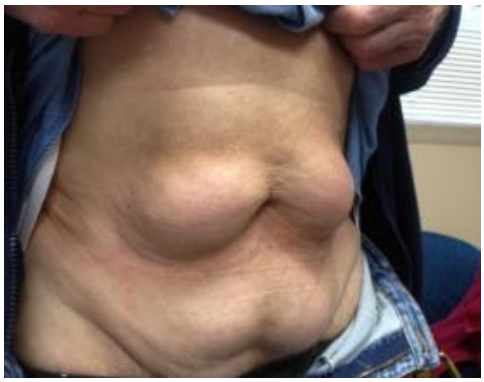
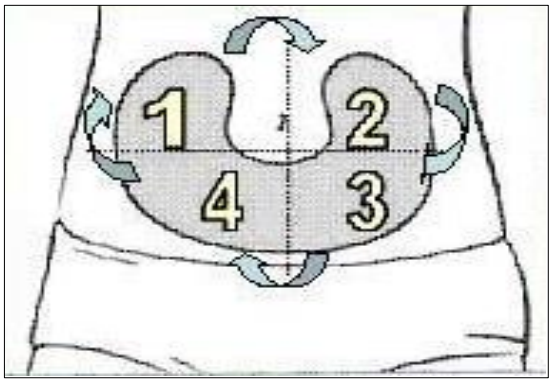


Figure 18: Rotation of sites



Each insertion site change should be at least a finger's breadth away from the last. Examination of sites used involves moving over the entire abdomen with the flat of the finger. If lipohypertrophy is found, the medical officer should be notified and the area should not be used for CSII. Lipohypertrophy may take weeks or even months to resolve, depending on the severity.

Patients are encouraged to rotate the cannula insertion sites around the abdomen and to check for lumps on a regular basis at home **(Figure 18)**. They are also advised to check the infusion site daily and look for swelling or redness around the infusion site or dampness of the dressing around the infusion site.

At the first sign of an infection, the cannula must be re-sited away from the site of the infection. The infection may require treatment with oral antibiotics. Repeated infections can result in scaring which will reduce the areas available to use for siting cannula.

Skin preparation products such as Cavilon™ or Skin Prep™ can form a protective barrier between the skin and the adhesive. These products can assist adhesion and minimise skin irritation.

Changing the infusion site

The patient should assemble new reservoir, infusion set, insulin and skin cleanser and independently;

- fill the reservoir to the desired amount with insulin
- disconnect the insulin pump from the insertion site
- remove the old reservoir from the insulin pump
- rewind the insulin pump (eg some pumps require the insulin pump to be suspended / stopped prior to changing the reservoir)
- load the new reservoir into the insulin pump according to the manufacturer's instructions. Some insulin pumps have a cap that is placed over the reservoir which needs to be in-place for the reservoir to load correctly. Other insulin pumps require the infusion line to be attached to the reservoir prior to placing it in the pump
- prime the infusion line making sure to expel all air bubbles
- choose and clean the site for the new cannula
- insert the cannula according to the manufacturer's instructions
- remove the insertion needle from the teflon cannula (metal cannula do not have a separate insertion needle)
- prime the cannula
- restart the insulin pump
- check the site for redness, bleeding or leakage
- remove the old cannula
- **check BG level 2 hours post change. If BG has elevated dramatically, suspect the cannula has kinked and change immediately.**

Disconnecting the insulin pump

When the insulin pump is disconnected, all delivery (basal and bolus) insulin pump is stopped.

Reasons to temporarily disconnect from the insulin pump include showering, ambulating or going for surgery and other procedures (eg CAT scan, MRI).

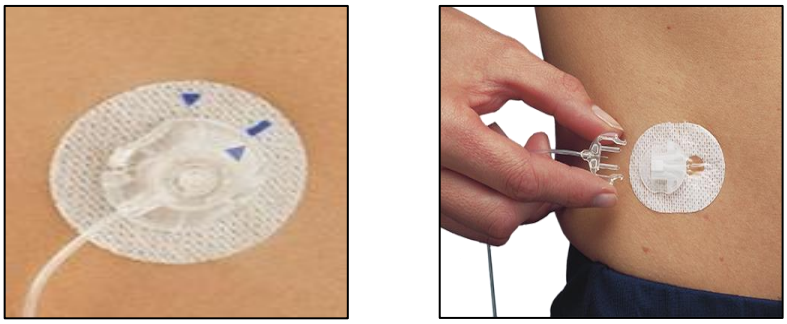
Temporary disconnection is recommended to be no longer than one to two hours. Do not disconnect while in the middle of delivering any bolus as it will NOT be resumed.

Generally it is better to leave the insulin pump "on" or in "run" when disconnecting briefly in order to prevent occlusions and to avoid having to remember to restart the insulin pump; only a very small amount of insulin is lost during the disconnect time.

To prevent gravity infusion, the insulin pump should never be disconnected where the infusion set connects to the insulin pump (eg leaving the infusion set and tubing are still connected to the body).

The quick disconnection device (**Figure 19**) allows the user to temporarily disconnect the pump and tubing, say for showering, without needing to take out the entire infusion set.

Figure 19: Examples of quick disconnection devices



Storage and handling of insulin

- insulin filled reservoir should be inserted into the insulin pump as required (eg they should not be pre-filled and stored)
- not in-use insulin should be kept in the fridge at between 4°C and 8°C
- the in-use insulin is kept at normal room temperature (below 25°C) for up to 30 days, and discard safely after 30 days
- discard or return to pharmacy any insulin which has passed it expiry date.

Disposing of sharps

Used cannulas and syringes must be disposed of in an Australian Safety Standards approved sharps container which is puncture proof and has a secure lid.

Procedures for disposing of sharps containers may vary and patients with T1D are encouraged to contact their local council for information. Sharps must never be disposed of in household or industrial waste.

Insulin pump failure

Every CSII supplier has a 24 hour emergency help line to assist patients / carers who experience difficulty. In most cases, these are free call numbers. It is recommended that the patient / carer have the emergency help line number in their phone in case of an emergency.

All insulin pumps in Australia have a 4 year warranty. In most cases, private health funds will provide a new pump each 4-5 years if there is supporting documentation that the pump requires replacement. If the fault occurs during the warranty period, the insulin pump is replaced free of charge. If the insulin pump is out of warranty, the company will often lend the patient an insulin pump until the health insurance agrees to fund a replacement. A replacement or loan insulin pump will be sent via express post to the patients address or admitting hospital on request.

CSII settings should be documented on the CHSA CSII Outpatient Rate Record MR-COR and a copy provided to the patient/carer. Whilst waiting for the replacement insulin pump, the patient should immediately revert to subcutaneous basal bolus insulin. The CHSA CSII Outpatient Rate Record MR-COR can be used by the medical practitioner to prescribe the appropriate temporary basal bolus doses.

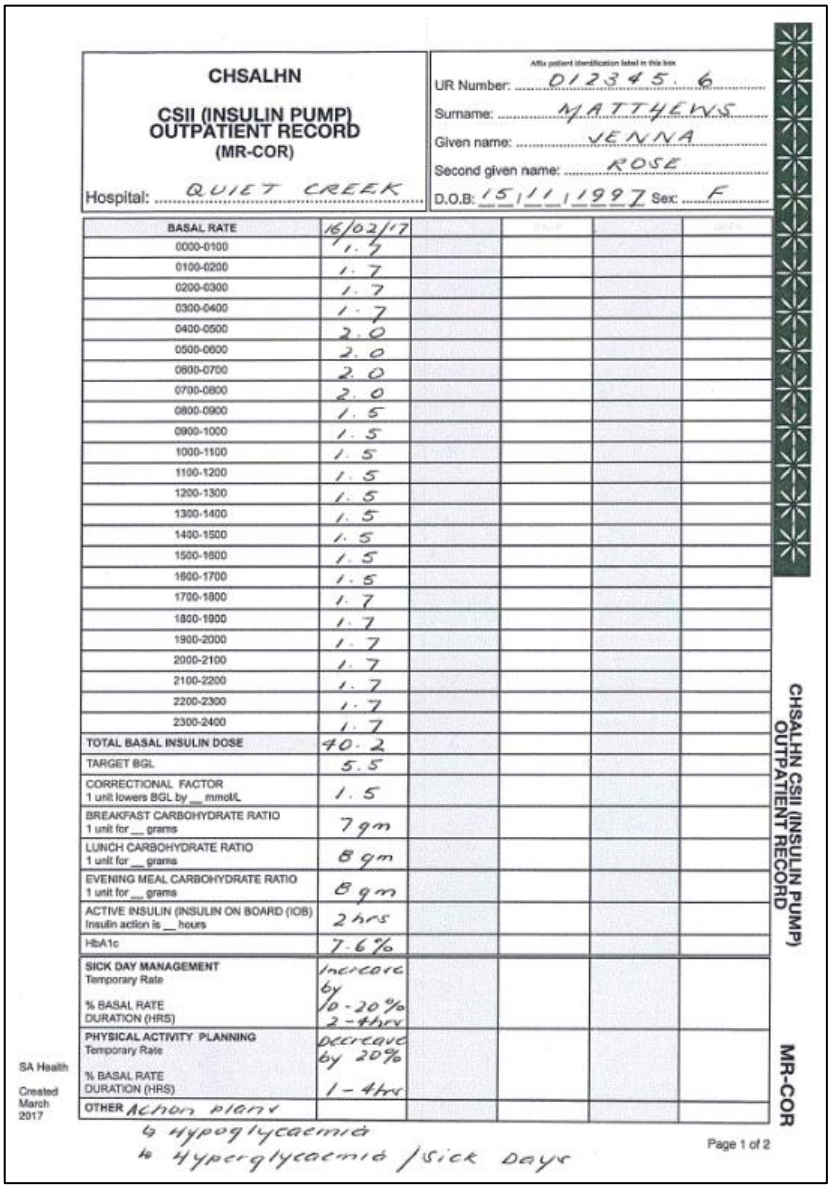
The CHSA CSII Outpatient Rate Record MR-COR will also assist the patient and CDE to program the replacement insulin pump when it is received.

7. Outpatient/ambulatory care rate record MR-COR

The CSII Outpatient Rate Record MR-COR is used by Community Health Services for use in the intermediatory/community health diabetes clinics and can be completed by the medical practitioner, nurse practitioner, CDE, patient or carer.

The CSII Outpatient Rate Record MR-COR provides an ongoing record of basal rates, bolus doses, target blood glucose, correctional factor, insulin: carbohydrate ratio/s and active insulin on-board time. Further information is 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. **Figure 20**

Figure 20 CSII Outpatient Rate Record MR-COR



CHSALHN

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

Hospital: QUIET CREEK

Affix patient identification label in this box

UR Number: 012345.6
Surname: MATTHEWS
Given name: JENNA
Second given name: ROSE
D.O.B: 15/11/1997 Sex: F

BASAL RATE	16/02/17					
0000-0100	1.7					
0100-0200	1.7					
0200-0300	1.7					
0300-0400	1.7					
0400-0500	2.0					
0500-0600	2.0					
0600-0700	2.0					
0700-0800	2.0					
0800-0900	1.5					
0900-1000	1.5					
1000-1100	1.5					
1100-1200	1.5					
1200-1300	1.5					
1300-1400	1.5					
1400-1500	1.5					
1500-1600	1.5					
1600-1700	1.5					
1700-1800	1.7					
1800-1900	1.7					
1900-2000	1.7					
2000-2100	1.7					
2100-2200	1.7					
2200-2300	1.7					
2300-2400	1.7					
TOTAL BASAL INSULIN DOSE	40.2					
TARGET BGL	5.5					
CORRECTIONAL FACTOR 1 unit lowers BGL by __ mmol/L	1.5					
BREAKFAST CARBOHYDRATE RATIO 1 unit for __ grams	7gm					
LUNCH CARBOHYDRATE RATIO 1 unit for __ grams	8gm					
EVENING MEAL CARBOHYDRATE RATIO 1 unit for __ grams	8gm					
ACTIVE INSULIN (INSULIN ON BOARD (IOB) Insulin action is __ hours	2hrs					
HbA1c	7.6%					
SICK DAY MANAGEMENT Temporary Rate % BASAL RATE DURATION (HRS)	increase by 10-20% 2-4hrs					
PHYSICAL ACTIVITY PLANNING Temporary Rate % BASAL RATE DURATION (HRS)	decrease by 20% 1-4hrs					
OTHER Action plans						

CHSALHN CSII (INSULIN PUMP) OUTPATIENT RECORD MR-COR

SA Health
Created March 2017

to Hypoglycaemia
to Hyperglycaemia / sick days

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In the event of insulin pump failure, the CSII Outpatient Rate Record MR-COR provides vital information to guide temporary basal insulin and rapid acting bolus insulin doses of subcutaneous insulin injections until such time that the insulin pump is repaired or replaced.

Glossary

Autoimmune Disease Disorder of the body's immune system in which the immune system mistakenly attacks and destroys body tissue that it believes to be foreign. T1D is an autoimmune disease because the immune system attacks and destroys the insulin producing beta cells of the pancreas.

Basal bolus insulin A basal bolus insulin regimen involves taking a longer acting form of insulin to keep blood glucose levels stable through periods of fasting as well as separate injections of shorter acting insulin to prevent rises in blood glucose levels resulting from meals.

Basal Insulin Background insulin required by the body at rest. Basal insulin is administered via injection or insulin pump at a low, steady rate for 24 hour coverage.

Blood Glucose The main sugar that the body makes from the three elements of food–proteins, fats, and carbohydrates–but mostly from carbohydrates. Glucose is the major source of energy for living cells, and is carried to each cell through the bloodstream. However, the cells cannot use glucose without the help of insulin.

Bolus Insulin Additional insulin required to cover meals or to correct high blood glucose levels. Bolus insulin doses are calculated on carbohydrate: insulin ratio, insulin sensitivity factor, target blood glucose levels and duration of insulin action.

Complications of Diabetes Harmful effects that may happen when a person has diabetes. Some effects, such as hypoglycaemia, can happen any time. Others develop when a person has had diabetes for a long time or poor glycaemic control. These include damage to the retina of the eye (retinopathy), the blood vessels (angiopathy), the nervous system (neuropathy), and the kidneys (nephropathy).

Continuous subcutaneous insulin infusion Also known as an 'insulin pump', refers to the constant, continuous infusion of a short acting insulin driven by mechanical force (a pump) and delivered via a needle or soft cannula under the skin.

Credentialled Diabetes Educator A Registered Nurse or Midwife who has completed a post graduate certificate in diabetes education and care that has been accredited by the Australian Diabetes Educator's Association (ADEA).

Diabetes Mellitus A disease that occurs when the body is not able to use sugar as it should. Diabetes occurs when the body cannot make use of the glucose in the blood for energy because either the pancreas is not able to make enough insulin or the insulin that is available is not effective.

Diabetic Ketoacidosis Severe high blood sugar that needs emergency treatment. DKA may be caused by illness, taking too little insulin, or getting too little exercise. If the person is not given fluids and insulin right away, ketoacidosis can lead to coma and even death.

Glucagon A hormone produced by the alpha cells in the islets of Langerhans in the pancreas. Glucagon stimulates the production of glucose from the liver (the conversion of liver glycogen to glucose). Injecting a manufactured preparation of glucagon (Glucagon hypo kit) is used to treat severe or unconscious hypoglycaemia.

HbA1c (Glycated haemoglobin) An indicator of glycaemic control during the previous six to eight weeks. The lowest risk of long-term diabetic complications is in people whose HbA1c is closest to the normal range (below 42mmol/mol or 6.0%). HbA1c targets will be modified to a high level for those at risk of hypoglycaemia.

Hyperglycaemia Too high a level of glucose (sugar) in the blood and occurs when the body does not have enough insulin or cannot use the insulin it does have to turn glucose into energy. For people with T1D, hyperglycemia may lead to diabetic ketoacidosis.

Hypoglycaemia Too low a level of glucose (sugar) in the blood. This occurs when a person with diabetes has injected too much insulin, eaten too little food, or has exercised without extra food.

Insulin A hormone that helps the body use glucose (sugar) for energy. The beta cells of the pancreas (in areas called the islets of Langerhans) make the insulin.

Insulin analogue A modern insulin preparation genetically engineered so that its action more closely resembles the normal physiological action of insulin in a person without diabetes.

Insulin Pump A device that delivers a continuous supply of insulin into the body. The insulin flows from the pump through a plastic/metal tube that is connected to a needle inserted into the body and taped in place. It is also known as Continuous Subcutaneous Insulin Infusion

Ketosis A state of severe insulin deficiency. Untreated, ketosis can lead to diabetic ketoacidosis, coma and death.

Smart Pump A insulin pump capable of calculating the amount of insulin required to cover the carbohydrate eaten and insulin dose required to correct higher than target blood glucose levels using rates set by the endocrinologist and credentialled diabetes educator. Smart pumps' have a feature that prevents stacking' or giving too much insulin by considering the insulin still active or 'on board' from a previous bolus dose before calculating the dose required.

Type 1 diabetes Is an autoimmune disorder characterised by raised blood glucose levels caused by absolute insulin deficiency. People with T1Ds require multiple dose insulin therapy or insulin pump therapy to survive.

Type 2 diabetes Raised blood glucose due to a combination of impaired insulin secretion and insulin resistance to the action of insulin at the cell level. T2D is a progressive disease, which frequently requires treatment with insulin to achieve glucose targets.

Gestational diabetes mellitus (sometimes referred to as GDM) is diagnosed when higher than normal blood glucose levels first appear during pregnancy when the amount of insulin needed for both the woman and her unborn child's requirements is increased. Hormones produced by the placenta that support the baby to grow and develop, reduces the effectiveness of insulin at the cellular receptor site.

Links you may find helpful

CHSA Diabetes Service: http://www.chsa-diabetes.org.au/

Australian Diabetes Educators Association: http://www.adea.com.au/

Diabetes Australia: http://www.diabetesaustralia.com.au/

National Prescribing Service: http://www.nps.org.au/

CSII Inpatient Rate Record MR-CIR

CHSA CSII (INSULIN PUMP)

INPATIENT RECORD
(MR-CIR)

Drs Name: .....

Initial: ..... Phone No: .....

Name of Carer: .....
(if parent / carer to manage insulin pump during admission)

Hospital: .....

Affix patient identification label in this box

UR Number: .....

Surname: .....

Given name: .....

Second given name: .....

D.O.B: __ __ / __ __ / __ __ __ __ Sex: .....

Insulin Pump Model: ..... Insulin Type: NovoRapid / Humalog / Apidra

Set & Reservoir Change (*every 3 days*): ..... Due: .....

BGL Frequency: Hourly / Pre Meal / Bedtime / 2hours Post Meal / Overnight

BKL Frequency: Daily and if BGL >15mmol/L

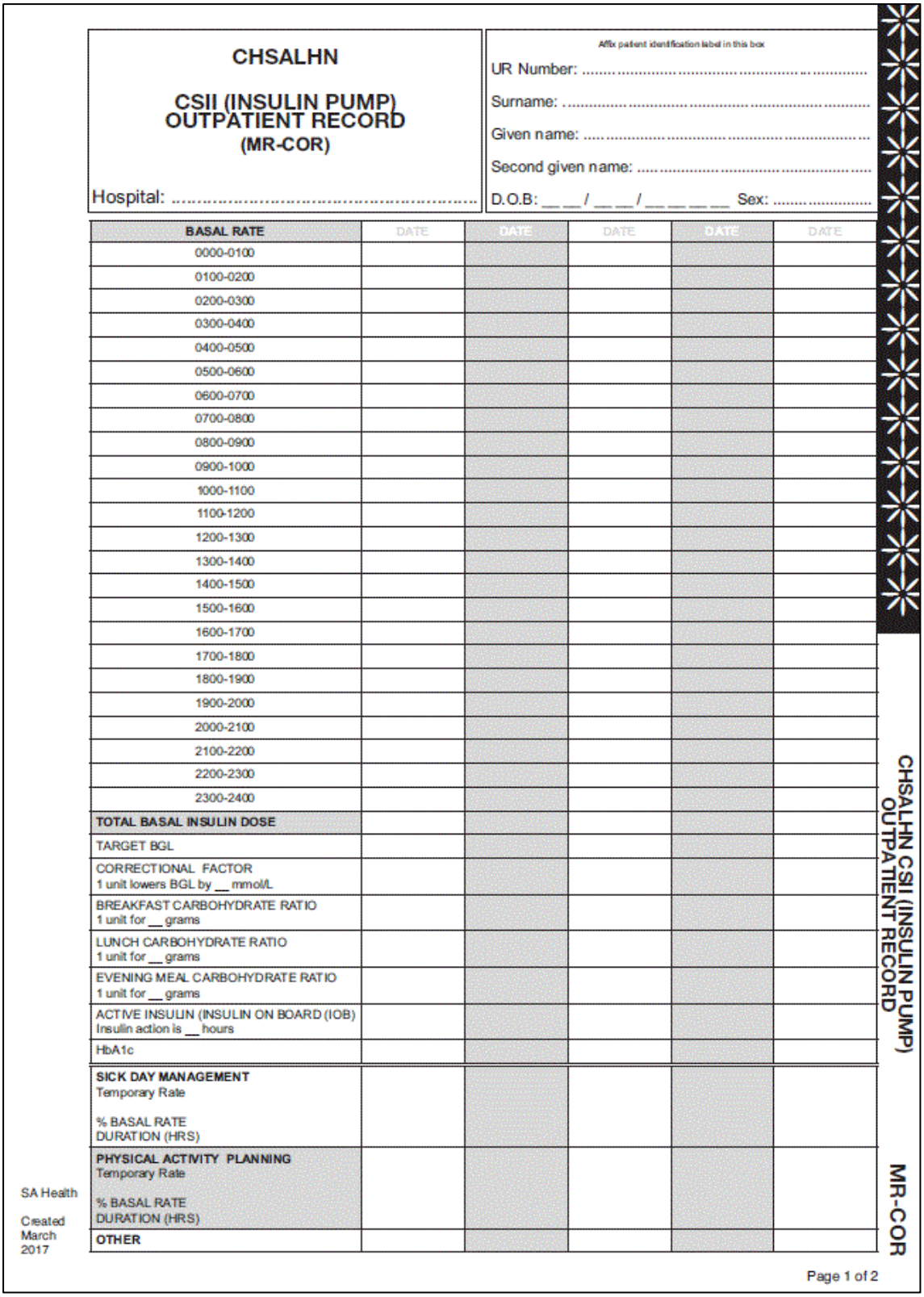
Date:	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Basal Rate																								
Meal Bolus																								
Correctional Bolus																								
BGL																								
Carbohydrate																					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

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																								
Correctional Bolus																								
BGL																								
Carbohydrate																								
Activity																								
Ketones																								

The patient is responsible for completing this insulin pump inpatient record.
On discharge, this original record is to be retained for the medical record and a photocopy provided to the patient.

CHSA CSII (INSULIN PUMP)
INPATIENT RECORD
MR-CIR

CSII Outpatients Rate Record MR-COR



CHSALHN

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

Hospital: .....

Affix patient identification label in this box

UR Number: .....

Surname: .....

Given name: .....

Second given name: .....

D.O.B: __ __ / __ __ / __ __ __ __ Sex: .....

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					
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1500-1600					
1600-1700					
1700-1800					
1800-1900					
1900-2000					
2000-2100					
2100-2200					
2200-2300					
2300-2400					
TOTAL BASAL INSULIN DOSE					
TARGET BGL					
CORRECTIONAL FACTOR 1 unit lowers BGL by __ mmol/L					
BREAKFAST CARBOHYDRATE RATIO 1 unit for __ grams					
LUNCH CARBOHYDRATE RATIO 1 unit for __ grams					
EVENING MEAL CARBOHYDRATE RATIO 1 unit for __ grams					
ACTIVE INSULIN (INSULIN ON BOARD (IOB) Insulin action is __ hours					
HbA1c					
SICK DAY MANAGEMENT Temporary Rate % BASAL RATE DURATION (HRS)					
PHYSICAL ACTIVITY PLANNING Temporary Rate % BASAL RATE DURATION (HRS)					
OTHER					

CHSALHN CSII (INSULIN PUMP) OUTPATIENT RECORD

MR-COR

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Linked Documents

Document Name
National Safety and Quality Health Service Standards 4 - Recognising and Responding to Clinical Deterioration in Acute Health Care
CHSA CSII Inpatient Rate Record MR-CIR
CHSA CSII Outpatients Rate Record MR-COR
CHSA Blood Glucose & Ketones Monitoring Chart and Protocol

References

Document Name
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Craig, M., S. Twigg, K. Donaghue, N. Cheung, F. Cameron, J. Conn, A. Jenkins and M. Silink (2011). *National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults,* Australasian Paediatric Endocrine Group and Australian Diabetes Society. Canberra, Australian Government Department of Health and Ageing.
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.
Queensland Health (2010). In-patient guidelines: Insulin infusion pump management. Brisbane, Queensland Health.

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