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Syringe Driver Competency Programme

Participant Workbook

Acknowledgements

The syringe driver competency programme was first developed by the Hospice New Zealand Educational Advisory committee in 2005, it was reviewed and updated in 2008, 2011 and 2013.

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Introduction

Welcome to the Hospice New Zealand Syringe Driver Competency Programme.

This programme has been designed for registered nurses practising in a variety of settings, including hospital, aged residential care and community who may need to manage patients with a syringe driver and demonstrate competency in its use. Enrolled nurses are encouraged to complete the programme; however nurses are obliged to work within their scope of practice as outlined by the Nursing Council of New Zealand.

Initial certification involves completion of pre-reading, attendance at a workshop, demonstration of practical competence and completion of a written test. The written test may be completed prior to, or following the workshop. If completed prior to workshop attendance participants should bring it with them. The educator facilitating the programme will issue a certificate of attainment after successful completion of the workshop and the test.

This workbook contains rationales, guidelines, drug information, practice calculations and further reading suggestions. It is intended to provide approximately 2 hours background reading prior to workshop attendance. Everything will be covered again during the workshop and there will be plenty of time to practise setting up and managing syringe drivers.

Certification can be maintained by attending periodic updates. Hospice New Zealand currently recommends annual updates for nurses occasionally using syringe drivers and alternate years for nurses using syringe drivers routinely. Please check your organisations requirements for maintaining competence.

Hospice New Zealand is committed to ensuring that appropriate education and training is available and hopes that this programme provides skills and knowledge that are useful and relevant to your practice needs.

Programme aim

To assist Registered Nurses to obtain the theoretical and practical knowledge and skills they require to manage syringe drivers in their place of practice and for Enrolled Nurses to be competent in checking.

Learning Outcomes

On completion of this syringe driver competency package and workshop participants will be able to:

- State the rationale for use of a syringe driver in palliative care
- Educate the patient and family about the use of a syringe driver
- Explain management and safety principles when caring for patients with these devices
- Calculate conversions from oral opioids to subcutaneous opioids
- Identify medications commonly used in syringe drivers in palliative care and the rationale for their use
- Identify medications that should not be given subcutaneously
- Identify the equipment required to set up a syringe driver
- Identify suitable insertion sites for subcutaneous infusions
- Explain which sites are inappropriate for subcutaneous infusion
- Set up an infusion using the Niki T34 syringe driver
- State the observations that need to be made while the syringe driver is in use and their frequency
- Identify alerts and alarms and state corrective action to be taken
- Demonstrate the safe use of a syringe driver and show how to stop an infusion

National Guidelines for Syringe Driver Management in NZ

These guidelines are an additional resource that can be used as a reference and are located on:

http://www.moh.govt.nz/moh.nsf/indexmh/guidelines-syringe-driver-management-palliative-care-nz

The guidelines aim to standardise information about syringe driver management in palliative care, promote safe practice, avoid unnecessary duplication of information, and support both primary and specialist providers of palliative care.

Part I Rationale, Medications and Calculating Doses

Rationale

The subcutaneous administration of medications using a syringe driver is a common and accepted practice in palliative care for assisting with pain and symptom management when other routes are inappropriate or ineffective. The main advantages of a syringe driver are that it provides continuous delivery of medication, allows several medications to be administered simultaneously, and usually requires refilling only once a day. The use of syringe drivers, particularly in the last days of life, has made a significant contribution to ensuring patient comfort in palliative care (*bpac^{nz}, 2012; Dickman & Schneider, 2011*).

What is a syringe driver?

A syringe driver is a portable battery operated device that administers medications subcutaneously over a chosen period of time. A syringe containing the medication is attached to the driver, which pushes the plunger forward at an accurately controlled rate.

The syringe driver currently available and recommended for use in palliative care in New Zealand is the Niki T34. This device complies with the international safety standards for infusion devices.

What are the advantages of a syringe driver?

- It is inconspicuous and portable therefore assists with patient independence
- Can be managed in all care settings
- Provides a constant level of drugs, ensuring that plasma concentration remains at the optimum therapeutic level with no peaks or troughs
- Syringe driver administration is far more acceptable to the patient than intramuscular or intravenous medication routes
- Can be used intermittently and can be discontinued if symptoms can be managed appropriately and effectively by another route

PRACTICE POINTS

- What might having a subcutaneous infusion be like from the patients and family carer point of view?
- What is the potential impact on the patient, family/whanau/carer of having a subcutaneous infusion?

Responsibilities

All medications given via a syringe driver should be clearly and correctly prescribed by a doctor on a medication chart.

A syringe driver should only be operated by, or under the supervision of, appropriately trained personnel and in accordance with local guidelines and procedures. Before setting up or using a syringe driver, staff must familiarise themselves with locally developed clinical guidelines.

PRACTICE POINTS

- Familiarise yourself with the medication charts and delegated authorities used in your organisation / region
- These forms will be available at the workshop

Nursing responsibilities

- To identify the indications for syringe driver use
- To describe the purpose and action of all medications administered via a syringe driver
- To recognise adverse effects of any medications used in a syringe driver
- To correctly set up the syringe driver
- To appropriately assess subcutaneous sites at least four hourly in inpatient units and daily in the community and change according to policy
- To regularly assess symptom management and patient comfort
- To document commencement, changes of infusions, any site or line changes in patient notes and care plan
- To educate patient/carer (as appropriate) on the function of the syringe driver

Main indications for use

Oral administration of medication is inappropriate or ineffective due to:

- Unrelieved pain
- persistent nausea and vomiting
- dysphagia
- gastrointestinal obstruction
- poor absorption of oral medication
- weakness and/or alteration in a patient's level of consciousness (*bpac*^{nz}*, 2012,*)

Medications

In palliative care symptoms such as pain, nausea, vomiting, agitation, delirium and excessive secretions can be managed by continuous subcutaneous infusions.

Commonly, two to three (and occasionally up to four) medications may be mixed in a syringe for subcutaneous infusion. In New Zealand most palliative care services do not combine more than three medications in one syringe. An important safety consideration before mixing any medications together in a syringe is to check for compatibility information. The more medications that are mixed together, the greater the risk of precipitation, reduced efficacy and increased local toxicity. However, it has been reported that a wide variety of medications can be used in different combinations with no clinical evidence of loss of efficacy Stability problems can be minimised by diluting the mixture to maximum volume. The infusion should be delivered over a maximum time of 24 hours; stability and sterility cannot be guaranteed after this time. The contents of the syringe and infusion set should be protected from direct sunlight. If compatibility is an issue, the use of two syringe drivers can be considered (*Dickman & Schneider, 2011; MacLeod, Vella-Brincat & Macleod, 2016*).

Medications commonly used in syringe drivers

DRUG	DOSE	INDICATION
Morphine sulphate Morphine tartrate	½ oral daily dose	Pain
Haloperidol	1-5mg/24 hrs	Nausea/vomiting, Delerium, agitation, confusion
Cyclizine	75-150mg/24 hrs well diluted	Nausea/vomiting
Metoclopramide	30-60mg/24hrs	Nausea/vomiting
Levomepromazine	6.25-12.5mg/24 hrs	Nausea/vomiting
Levomepromazine	12.5-50mg/24 hrs	Agitation/confusion
Midazolam	5-60mg/24 hrs	Restlessness , Agitation, seizures
Hyoscine butylbromide	40-100mg/24 hrs	Excessive secretions
Dexamethasone	4-16mg/24 hrs	Cerebral oedema

Medications contraindicated for use in a syringe driver

Medications such as prochlorperazine, diazepam and chlorpromazine are specifically contraindicated for use in subcutaneous infusions due to severe localised reactions. *(MacLeod et al 2016)*.

Diluents

The choice between water for injection and normal saline (NaCl 0.9%) as a diluent is a matter of debate. The literature is divided, with some recommending water for injection as the preferred diluent, citing stability and solubility reasons, and others recommending normal saline as the diluent because it is isotonic and thought to be less likely to contribute to the development of site reactions.

The Palliative Care Handbook currently recommends water for injection for all infusions except ketamine, octreotide, ondansetron and levomepromazine which should be diluted with normal saline. However if these drugs are being used in combinations consider water. Normal saline can be used for most drugs, the main exception being cyclizine which should be diluted with water (*bpac^{nz}, 2012; MacLeod et al., 2016*).

PRACTICE POINT

- Find out the preferred diluent in your organisation / region

Compatibility of drugs for use in syringe drivers over 24 hours of subcutaneous infusions	clonazepam	cyclizine	dexamethasone	fentanyl	glycopyrolate	haloperidol	hyoscine butyl bromide (Buscopan™)	hyoscine hydrobromide	ketamine	methotrimeprazine/ levomepromazine (Nozinan™)	methadone	metoclopramide	midazolam	morphine sulphate (normal strengths)	morphine tartrate (high strengths)	octreotide	ondansetron	oxycodone	phenobarbitone
clonazepam	–	SI	Y	?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	?	Y	?
cyclizine	SI	–	SI	SI	Y	Y	SI	Y	?	Y	?	Y	SI	Y	Y	SI	Y	SI	?
dexamethasone	Y	SI	–	?	?	SI	Y	Y	Y	SI	Y	Y	SI	Y	Y	SI	Y	Y	?
fentanyl	?	SI	?	–	Y	Y	Y	Y	Y	Y	?	Y	Y	?	?	Y	Y	?	Y
glycopyrrolate	Y	Y	?	Y	–	Y	?	NA	Y	Y	Y	Y	Y	Y	?	Y	Y	Y	N
haloperidol	Y	Y	SI	Y	Y	–	Y	Y	Y	Y	Y	Y	Y	Y	SI	Y	Y	Y	?
hyoscine butyl bromide (Buscopan™)	Y	SI	Y	Y	?	Y	–	NA	Y	Y	?	Y	Y	Y	?	Y	Y	Y	?
hyoscine hydrobromide	Y	Y	Y	Y	NA	Y	NA	–	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	?
ketamine	Y	?	Y	Y	Y	Y	Y	Y	–	Y	?	Y	Y	Y	Y	Y	Y	Y	?
methotrimeprazine/levomepromazine (Nozinan™)	Y	Y	SI	Y	Y	Y	Y	Y	Y	–	Y	Y	Y	Y	Y	SI	Y	Y	?
methadone	Y	?	Y	?	Y	Y	?	Y	?	Y	–	Y	Y	?	?	?	?	?	N
metoclopramide	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	–	Y	Y	Y	Y	Y	Y	?
midazolam	Y	SI	SI	Y	Y	Y	Y	Y	Y	Y	Y	Y	–	Y	Y	Y	Y	Y	?
morphine sulphate (normal strengths)	Y	Y	Y	?	Y	Y	Y	Y	Y	Y	?	Y	Y	–	NA	Y	Y	NA	?
morphine tartrate (high strengths)	Y	Y	Y	?	?	SI	?	Y	Y	Y	?	Y	Y	NA	–	?	Y	NA	Y
octreotide	Y	SI	SI	Y	Y	Y	Y	Y	Y	SI	?	Y	Y	Y	?	–	Y	Y	?
ondansetron	?	Y	Y	Y	Y	Y	Y	Y	Y	Y	?	Y	Y	Y	Y	Y	–	Y	?
oxycodone	Y	SI	Y	?	Y	Y	Y	Y	Y	Y	?	Y	Y	NA	NA	Y	Y	–	?
phenobarbitone	?	?	?	Y	N	?	?	?	?	?	N	?	?	?	Y	?	?	?	–

Diluent: water is recommended for all infusions except ketamine, octreotide, ondansetron and levomepromazine where sodium chloride 0.9% should be used although in combinations consider water.

Y = compatible
N = incompatible
SI = sometimes incompatible (usually at higher concentrations)
NA = not usually used together
? = unknown

Combinations that have been used

morphine+clonazepam+cyclizine (morphine sulphate and tartrate)	morphine+cyclizine+dexamethasone (morphine sulphate and tartrate)	morphine+dexamethasone+haloperidol (morphine sulphate and tartrate)
morphine+clonazepam+dexamethasone (morphine sulphate and tartrate)	morphine+cyclizine+haloperidol (morphine sulphate and tartrate)	morphine+dexamethasone+hyoscine hydrobromide (morphine sulphate and tartrate)
morphine+clonazepam+haloperidol (morphine sulphate and tartrate)	morphine+cyclizine+hyoscine butyl bromide (morphine sulphate, tartrate SI)	morphine+dexamethasone+metoclopramide (morphine sulphate and tartrate)
morphine+clonazepam+ketamine (morphine sulphate and tartrate)	morphine+cyclizine+metoclopramide (morphine sulphate and tartrate)	morphine+dexamethasone+midazolam (morphine sulphate SI, tartrate SI)
morphine+clonazepam+metoclopramide (morphine sulphate Y, tartrate SI)	morphine+cyclizine+midazolam (morphine sulphate and tartrate)	morphine+dexamethasone+haloperidol (morphine sulphate and tartrate)

Info from: 1) The Palliative Care Handbook 8th Edition 2016 – 24 hour syringe driver compatibility for subcutaneous administration table. **2)** Palliative Medicine Handbook on line at http://book.pallcare.info/index.php **3)** Compatibility of syringe driver admixtures for continuous subcutaneous infusions, Department of Pharmacy, Auckland District Health Board 2002 **4)** Palliative Care Formulary on line at www.palliativedrugs.co.uk **5)** Gardiner P R Compatibility of an injectable oxycodone formulation with typical diluents, syringes, tubings, infusion bags and drugs for potential co-administration. Hospital Pharmacist 2003; 10: 354-61

Calculating the dose of morphine

Morphine is the most commonly used opioid in syringe drivers in New Zealand.

Patients who are not currently on any opioids

A suitable starting dose of morphine for a patient who has not previously been on any opioids would usually be 10mg subcutaneously over 24 hours (*Dickman & Schneider, 2011; MacLeod et al., 2016*).

PRACTICE POINTS

- **Avoid Confusion:** When documenting subcutaneous medications or prescribing them, always write subcut or subcutaneous rather than using the abbreviation SC as it can easily be confused with SL (sublingual)

Patients already on oral morphine

When transferring from oral morphine the 2:1 rule is a useful guide. First, work out the total daily dose equivalent of oral morphine from all routes the patient has had in the last 24 hours (include regular and prn doses). Then divide that dose by 2 to get the subcutaneous 24 hour dose (*MacLeod et al., 2016*).

EXAMPLE:
Suppose a patient is taking mEslon™ 30mg twice a day.

- The total daily dose of oral morphine is 60mg
- Divide the total daily dose by 2
- This gives a subcutaneous morphine dose of 30mg over 24 hours

Patients on other opioids

For those patients who are on opioids other than morphine, such as methadone, oxycodone or fentanyl, refer to the local palliative care guidelines and/or seek advice from:

- a specialist palliative care practitioner (e.g. a specialist pharmacist or nurse, or a palliative care doctor)
- a hospital pharmacy medicines information service
- The Palliative Care Handbook (*MacLeod et al 2016*)

Managing breakthrough symptoms

The most commonly reported symptoms at the end of life are pain, excessive secretions, restlessness, dyspnoea, and nausea and vomiting (*Ellershaw and Wilkinson 2003*). The prescription of prn medications to manage these symptoms is recommended. Anticipatory prescribing will ensure there is no delay in responding to a symptom if it occurs.

Pain

All patients should be prescribed breakthrough analgesia to have on a prn basis. If the patient is receiving morphine, the breakthrough dose should be approximately 1/6th of the current 24 hour morphine dose. Anything less may be ineffective (*MacLeod et al., 2016*).

EXAMPLE:

Suppose a patient is receiving 30mg of morphine subcutaneously over 24 hours.

- The prn dose for breakthrough pain would be 5mg subcutaneously – 30mg÷6 = 5mg
- If the breakthrough dose is to be given orally, the equivalent dose is 10mg orally 5mg subcutaneously x 2 = 10mg PO dose
- If the 24 hour dose increases or decreases, the breakthrough dose also alters accordingly (i.e. it should be 1/6th of the current 24 hour dose)

PRACTICE POINTS

- If the patient has any symptoms at the time of starting the syringe driver then consider giving a prn dose of medication prior to commencing the syringe driver, because medications from the syringe driver may take up to 4 hours to reach therapeutic concentrations (Dickman & Schneider, 2011).
- Insert a separate cannula for administering prn doses of medication
- Always assess, monitor and review patient's response to medication. Holistic assessment is vital as medication may not be the whole answer.

PART II Setting up a syringe driver

General management principles

- The standard delivery period for a continuous subcutaneous infusion in palliative care is 24 hours
- Luer-Lock® syringes should be used to prevent accidental disconnection of the tubing from the syringe
- To ensure adequate dilution of medications only 20 or 30mL Luer-Lock® syringes are recommended for 24 hour infusions, even though the Niki T34 syringe driver can accommodate a 2mL, 5mL, 10mL and 50mL syringe. However 50mL syringes will be used when larger volumes are required or greater dilution for irritant medications
- Medications should be drawn up accurately according to local protocol

Syringe volumes

- There is no definitive evidence to indicate how much diluent should be used. However, it is best practice to make the solution as dilute as possible to reduce the likelihood of drug incompatibility and minimise site irritation (*Dickman & Schneider 2011; MacLeod et al., 2012*).
- The Niki T34 syringe driver automatically detects the syringe brand, size and volume and sets the rate to deliver the infusion over the required time period. As a result there are no set syringe volume requirements. The maximum volume the Niki T34 syringe driver can accommodate is 34mL.
- However it is recommended that volumes be standardised locally to maintain clinical safety as patients move between care settings as suggested below:

SYRINGE	MAXIMUM FILL VOLUME
20mL	18mL
30mL	23mL
50mL	34mL

- High volume medications such as metoclopramide, oxycodone and fentanyl will often need to go into a 30mL or 50mL syringe. To reduce the need for more than one syringe change in a 24 hour period it may not be possible to add much diluent. Pharmacists have recommended a minimum of 5mL diluent should be used.
- Irritant medications such as methadone, cyclizine, ketamine and high doses of dexamethasone or oxycodone will need to go into a 30mL or 50mL syringe in order to ensure adequate dilution. **The recommended dilution is 50:50 medication to diluent solution**
- If there is doubt about appropriate syringe volume, check with a specialist palliative care practitioner or a hospital pharmacy medicines information service
- Syringes should be clearly labelled with ‘medication added’ labels completed as per the requirements of local guidelines.

Preparation of a Syringe Driver

Equipment required:

- Cannula such as Saf-T-Intima cannula and micro-bore extension line
- Prescribed medication/s and diluent
- Luer-Lock® syringe
- Syringe driver and battery
- Drug additive label
- Cleaning wipe
- Small clear adhesive dressing
- Lock Box if required

PRACTICE POINT

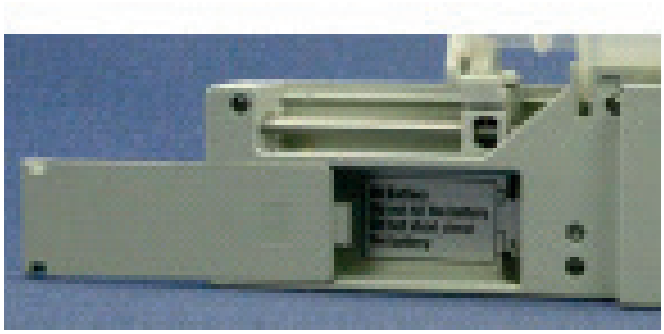
Careful explanation and education about how the device works, its advantages and disadvantages, for patient, family/whanau/carer is required. Provide information leaflet to reinforce information given.

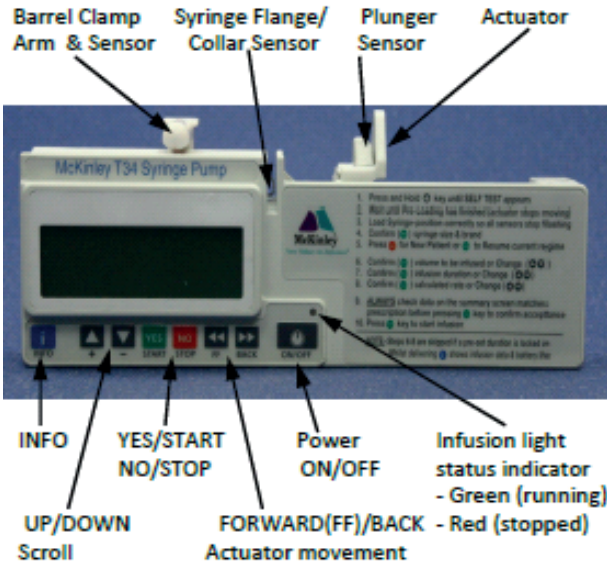
Procedure for starting a syringe driver for the first time:

1. Draw up medications accurately as prescribed.
2. Fill syringe to suggested standard volume with diluent.
3. Label the syringe clearly with completed medication added label. Ensure the label is flat when attached to the syringe, so it does not interfere with the barrel clamp arm of the Niki T34.
4. Attach syringe to extension line and cannula (unless already inserted), manually prime, apply the clamp.

Fitting the battery

1. Always use a 9V alkaline battery. These batteries can be easily identified by the international marking code 6LR61 (a recommended battery of this type is the Duracell plus MN1604).
2. Slide the compartment cover at the back of the syringe driver.
3. Push the battery into the compartment taking care to ensure that the +/- contacts are aligned as shown on the label inside the compartment.
4. Slide the cover back on.



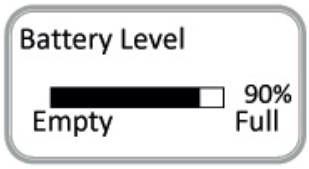


Loading the Syringe Driver

1. Ensure the syringe driver is turned off and the barrel clamp is down.

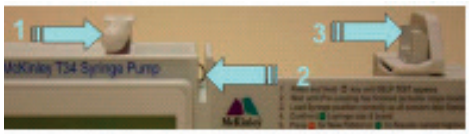
2. Press and hold the ON/OFF key to power the syringe driver up. The display will indicate PRE-LOADING and the actuator will start to move. Wait until it stops moving and the LOAD SYRINGE flashing screen appears.

3. **Battery test:** always check that there is enough charge in the battery to last 24 hours as follows:
   - Press the INFO key
   - Select BATTERY LEVEL from the menu and press YES to confirm
   - Verify sufficient battery charge is available to complete the infusion (approx 30% battery level is required to complete a 24 hour infusion). If not, change the battery



The Battery Level screen will return to the Load Syringe Screen after a few seconds.

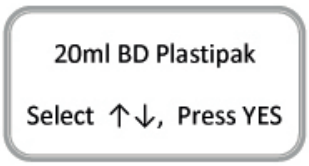
4. If the actuator is not in the required position to accommodate the syringe leave the barrel clamp arm down (1) and use the ◀◀FF| and keys |▶▶BACK| to move the actuator to the required position (3) (hold the syringe above the device to gauge the correct location). The |◀◀FF| key moves are limited so repeated presses may be necessary.



5. Lift the Barrel clamp arm and load the syringe into the syringe driver. Ensure the collar is sitting vertically in the collar sensor (2) and the plunger is centred in the actuator (3).

6. Lower the barrel clamp arm to sit on top of the syringe barrel. If the barrel clamp, collar and plunger of the syringe are loaded correctly the LOAD SYRINGE graphic will become solid (no flashing components).

7. The screen will display the Size and Brand of the syringe detected. If the syringe brand displayed is not correct use the UP (+) or DOWN (-) arrow keys to scroll between brands until the correct one is selected.



8. Press Yes/Start key to confirm the displayed syringe brand is correct.

PRACTICE POINT

Check brand carefully as the syringe driver sometimes detects the wrong brand of syringe.

9. The next screen displays an Infusion Summary screen.

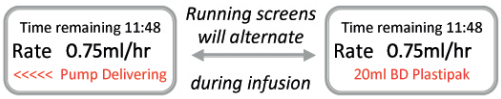
10. Check that all of the information on the screen is correct and matches the patient's prescription. Use a calculator to check the rate. Then press YES.

11. The screen will display – Start Infusion?

12. Select a site, insert and secure the cannula (see site selection)

13. Press YES/START to commence the infusion.

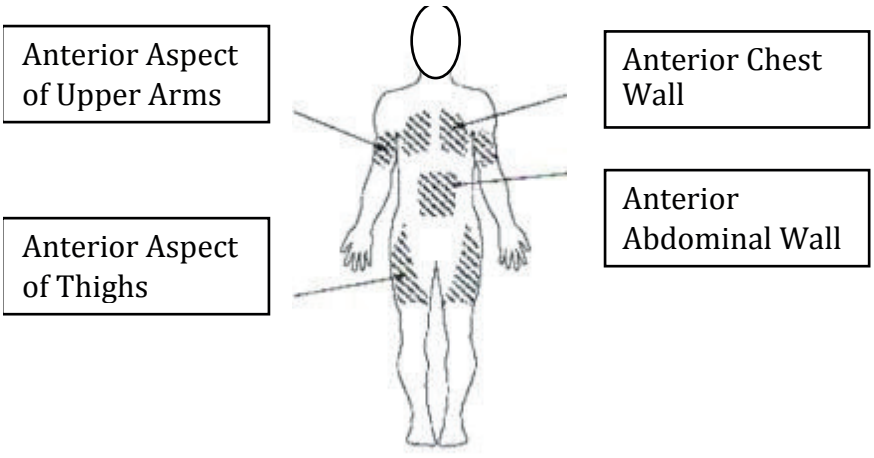
14. When infusing the LCD displays infusion time remaining (top line), Infusion rate (middle line) and the bottom line will alternate between syringe size and brand and '<<<<<<pump delivering' to confirm the syringe driver is running. The LED indicator on the ON/OFF key will intermittently flash green.



15. Support the Syringe driver in a carry bag or Lock-Box if needed.

Selection, preparation and maintenance of site

- Site selection will depend on whether the patient is ambulatory, agitated and/or distressed
- If possible, the patient should be involved in site selection
- The chest or abdomen is generally the preferred site, specifically the upper anterior chest wall above the breast but away from the axilla. This site is preferred because it is easily accessible, rarely oedematous, and permits easy inspection by the caregiver
- If the patient is cachectic, the abdomen may be a more appropriate site
- The upper arm can be used, but it makes it difficult for the patient to lie on their side
- If the patient is distressed or agitated, using the area around the scapula may be useful to minimise the risk of dislodgement
(*bpac*^{nz}*, 2012*)



Inappropriate sites include:

- lymphoedematous or ascitic areas
- areas where there is broken skin
- areas that have recently been irradiated
- areas with infection
- bony prominences
- in close proximity to a joint
- areas with tumours
- skin folds
- the anterior chest wall in cachetic patients
- areas of inflammation
- areas with extensive scarring (*Ministry of Health, 2009; bpac*^{nz}*, 2012*)

PRACTICE POINTS

- Use a site with good depth of subcutaneous fat
- Select and use sites on a rotating basis
- Meticulous checking of site to identify early and reduce risk of site related complications

Inserting the needle

- Recommended universal precautions
- Wash hands and dry well
- Swab site with a cleansing swab and leave to dry – follow local protocol
- To ensure subcutaneous placement of needle, lift a fold of skin between fingers and thumb and insert needle at approximately 30 degrees
- Secure needle/cannula with clear adhesive dressing, loop tubing (not for Saf-T-Intima as not long enough) and secure to prevent accidental displacement

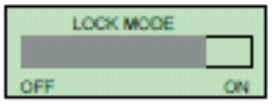
PRACTICE POINTS

- Follow local protocols re universal precautions or wearing of gloves and the cannula device used
- See instruction sheet for inserting Saf-T-Intima if using this device
- For useful video on how to insert inserting Saf-T-Intima see http://www.youtube.com/watch?v=BpMUPQ21eEo

Keypad Lock

When operating all of the keys on the Niki T34 keypad except the INFO, STOP and OFF keys are inactive.
The Keypad lock is an additional safety feature which prevents the syringe driver from being inadvertently turned off.
To activate the Keypad lock:

1. With the syringe driver infusing, press and hold the INFO key until a chart is displayed showing a bar moving from left to right.



2. Hold the key until the bar has moved completely across the screen and a beep is heard to confirm the lock has been activated.
3. To turn the lock off repeat this procedure. The bar will now move from right (ON) to left (OFF) and a beep will be heard to confirm the lock has been deactivated.

Note: The keypad lock does not affect the operation of the STOP and INFO keys.

Using the external lock box for the Niki T34

1. The Niki T34 lock boxes accommodates syringes <50mL.
2. Open the lockbox using the standard key that operates all T34 lockboxes.
3. Place the syringe driver into the lockbox so that the LCD display and keypad line up with the cut out opening.
4. Close the lockbox, guiding the administration set out the slot at the side of the top section of the box. Squeeze gently if necessary to ensure box closes securely.
5. Lock the box.

Note: The lock box prevents tampering with the syringe. The battery can be replaced without removing the syringe driver from the lockbox.

PRACTICE POINT

- Check your local clinical guideline to find out if the keypad lock and/or the lock box is routinely used in your area.

PART III Continuing care of a patient

Continuing care of a patient with a syringe driver

Assessment

- The infusion should be monitored at regular intervals. 4 hourly checks are recommended in inpatient units and daily or at each visit in the community
- Assess symptom management
- Meticulous site inspection is integral to early identification and prevention of site complications which can potentially cause patient discomfort and interfere with drug absorption which will lead to compromised symptom control. Check insertion site for: tenderness, hardness, redness, leakage
- Check the LCD screen for the infusion time remaining, infusion rate and pump delivering.
- Press info key once to check VTBI (volume to be infused) and VI (volume infused)
- Press info key twice to check battery remaining.
- Check tubing for kinks
- Check syringe for precipitation, crystallisation or discolouration

PRACTICE POINTS

- Identify the symptom assessment tools currently used in your service for assessing people receiving palliative care.
- If the medication needs increasing or altering, a new prescription needs to be ordered by the medical practitioner.
- DO NOT attempt to alter the rate of the syringe driver as this will increase the amount of all the drugs in the syringe at the same time.
- NEVER add an additional drug after the infusion has commenced.

Documentation

- Checklists should be available from specialist palliative care services
- Always ensure organisational policy is followed to maintain complete documentation

Change of Syringe Driver Infusion Site

The longevity of the site can vary considerably from 1 to 10 days. Many variables influence this, such as the type of medication and the cannula/needle used. Rather than relying on a time frame for resiting the infusion, the onset of a site reaction should dictate the timing (*bpac*^{nz}*, 2012; Ministry of Health, 2009*). Sites are ONLY changed when there is dislodgement of needle/cannula, evidence of skin problems, and crystallisation of medications or malfunctioning of syringe driver.

Reducing site irritation

Many factors contribute to site reactions, such as the tonicity and pH of the injectable medication, infection, and the presence of a foreign body. Specific medications used in palliative care that may cause site irritation include cyclizine, levomepromazine, methadone, oxycodone and ketamine. Techniques that are likely to minimise site irritation include:

- using a larger syringe to ensure a more dilute solution
- using normal saline (0.9%) if not contraindicated by the drug, instead of water, for injection
- adding 1mg of dexamethasone to the syringe if compatible with other medications
- using a Teflon™ or Vialon™ cannula

(bpac^{nz}, 2012; Dickman & Schneider, 2011)

Temporary interruption of infusion (e.g. for showering)

The syringe driver should not be immersed in water, or worn while showering or bathing.
Turn the syringe driver off as follows:

1. Press stop.
2. Press and hold "OFF" button until beep is heard. Screen will go blank.
3. Disconnect the line from cannula and cap the end of cannula with luer plug and protect line with luer plug (do not remove syringe from syringe driver).

Resume the infusion as follows:

1. Check prescription, syringe label and patient details match.
2. Remove luer plug and reconnect line using clean technique.
3. Press and hold ON button until beep is heard.
4. Press "YES" to confirm syringe brand and size.
5. The screen will now display "Press YES to Resume" or "NO for New Program".
6. Press "YES" to resume.

PRACTICE POINT

If you press "NO" the syringe driver interprets this as a completely new 24hr period. If this is done inadvertently the rate of the infusion will change. If the change is clinically significant you would need to set up a completely new syringe from the start.

7. Press "YES" to confirm "remaining volume, duration and rate of infusion".
8. Screen will then display "Start Infusion" Press "Yes" to confirm.

Alternative method for temporary interruption when showering.

1. Leave the syringe driver running
2. Disconnect the line from the cannula and cap the end of cannula with a luer plug
3. Place the line in a clean container such as medicine cup
4. After showering, reconnect the line to the cannula.

This method is simple particularly for patients and family in the community, reducing the risk of patients pressing the wrong buttons and inadvertently under-dosing themselves. Minimal wastage occurs – e.g. for a 10 minute shower, approx 0.1mL of the infusion will be wasted.

Changing the battery mid-infusion

1. Remove the old battery, this will automatically stop the infusion.
2. Replace with new battery.
3. Press and hold the ON/OFF key.
4. Press “YES” to confirm syringe brand and size.
5. The screen will now display “Press YES to Resume” or “NO for New Program”.
6. Press “YES” to resume.

PRACTICE POINT

If you press “NO” the syringe driver interprets this as a completely new 24hr infusion. If this is done inadvertently the rate of the infusion will change. If the change is clinically significant you would need to set up a completely new infusion.

7. Press “YES” to confirm “remaining volume, duration and rate of infusion”.
8. Screen will then display “Start Infusion” Press “Yes” to confirm.

Starting a new syringe

At completion of previous syringe:

1. The syringe driver will stop automatically when the syringe is empty and an alarm will sound.
2. Press the OFF key to turn the syringe driver off.
3. Remove the empty syringe.
4. Turn the syringe driver back on and load the new syringe.

Before completion of previous syringe (e.g. new prescription):

1. If the infusion is to be stopped before the syringe is empty press the STOP key to interrupt the infusion.
2. Press and Hold the OFF key.
3. Remove the syringe from the syringe driver.
4. Load the new syringe.

Changing an extension set only (e.g. set is occluded)

1. Stop the infusion – DO NOT TURN THE SYRINGE DRIVER OFF.
2. Clamp the extension set and remove the syringe from the syringe driver.
3. Place the barrel clamp arm in the down position.
4. Attach the new extension set to the syringe and prime the set manually. Clamp the line.
5. Use the FF key to reposition the actuator to fit the new volume in the syringe.
6. Place the syringe back into syringe driver.
7. Press “YES” to confirm syringe brand and size.
8. The screen will now display “Press YES to Resume” or “NO for New Program”.
9. Press “YES” to resume.

PRACTICE POINT

If you press “NO” the Syringe driver interprets this as a completely new 24hr infusion. If this is done inadvertently the rate of the infusion will change. If the change is clinically significant you would need to set up a completely new infusion.

10. Press “YES” to confirm “remaining volume, duration and rate of infusion”.
11. Screen will then display “Start Infusion”. Unclamp the set and Press “Yes” to confirm.

NOTE: The time remaining will adjust automatically to account for the volume removed from the syringe when priming the new line.

Cleaning/storage and maintenance

- Clean the unit using a lint-free cloth lightly dampened with warm water and a mild detergent, disinfectant or 10% bleach solution
- Always turn the syringe driver off and remove the battery before cleaning
- Do not clean the syringe driver with chemicals such as Xylene, Acetone or similar solvents
- Do not soak or immerse any part of the T34 in water or any other solution
- Once a month (or as required) clean the lead screw thread (beneath the actuator) and guiding rods with a small dry brush to remove debris or other particles
- If the syringe driver is to be stored for an extended period it should be cleaned and the battery removed
- The Niki T34 must be calibrated/serviced annually

Caution

- Don't use syringe driver near MRI scanner.
- Don't wet syringe driver.
- Syringe drivers require annual maintenance and calibration.

PART IV Troubleshooting

Alerts and Alarms

Alerts – an alarm will sound intermittently, the infusion will continue, a message appears on the display screen indicating the cause. This message then alternates with the normal “Infusion running” screen.

Alarms – an alarm will sound continuously, the infusion will stop, the LED turns to red, and a message appears on display screen indicating the cause.

ALARM	POSSIBLE CAUSE	ACTION
Occlusion or syringe empty	Patient access device blocked, kinked, clamped Tissuing/site inflammation, clouding/precipitation of solution Actuator has reached minimum travel position	Remove occlusion and restart
Syringe displaced	Syringe has been removed or displaced	Check and confirm syringe seated correctly and resume
Pump paused too long	Syringe driver left or no key presses detected for two minutes	Start infusion, continue programming or switch off
Near end (alert)	15 minutes from end of infusion	Prepare to change syringe or switch off
End programme	Infusion complete	Syringe driver will either default to KVO, await nurse, or it will alarm and switch off syringe driver
Low Battery (alert)	Battery almost depleted (30 minutes left)	Prepare for battery change
End battery	Battery depleted	Change battery

For advice and support contact your local hospice or specialist palliative care service.

Conclusion

The use of subcutaneous medications and syringe drivers in palliative care to achieve symptom control is standard and accepted practice. The use of syringe drivers allows patients and families the choice of being cared for at home by their family or friends or in Aged Residential Care facilities with the support of their general practitioner, community nurse and local specialist palliative care team.

Always be mindful that the patient/family/whanau/carers’ knowledge and understanding of syringe driver may be limited and this may cause them to be fearful of its use. Education and excellent communication about its use and benefits must precede use of the syringe driver in order to engage the patient/family/whanau/carer in the process.

These guidelines are intended to provide a standardised approach to clinical care and to minimise practice errors that can impact on patient safety. If you use syringe drivers intermittently ensure you feel competent or ask someone who is competent to help you.

Frequently asked questions:

1. **Should needles be inserted bevel up or bevel down?**

   Needles are bevelled to ease insertion; they should be inserted bevel up.

2. **My certificate is out of date; do I need to do the 2 hour workshop again?**

   No, the programme only requires you to complete the 2 hour workshop once unless you wish to repeat it. If your certificate is out of date you should attend an annual update session, where your practical skills will be reassessed, and complete a written test paper if necessary. If your certificate is more than two years out of date it may be necessary for you to attend the initial workshop again.

3. **Can I set up syringe drivers if my certificate is out of date?**

   This is not a compulsory programme although some organisations are choosing to make it mandatory as a way of demonstrating safe practice. Nurses are responsible for working within their scope of practice at all times as required by the Nursing Council.

4. **I haven't had to set up a syringe driver since I completed the programme and no longer feel confident, what should I do?**

   Some suggestions:

   - Re-read the workbook and have a practice session with a colleague who is competent
   - Discuss with a colleague or your manager
   - Contact your specialist palliative care service for advice, support or supervision
   - Remember syringes can be renewed early if necessary. Choose a time that best suits your setting when maximum clinical support is available.

PART V: Practice drug calculations for Niki T34

Practice drug calculations for Niki T34 syringe driver

Use these calculations as practice. Calculate volume of drugs and water required (based on local guidelines), state syringe size and show workings.

Calculators are allowed!

Formula: $\frac{\text{Dose required}}{\text{Dose in stock}} \times \frac{\text{Volume}}{1}$

Equipment:
20ml syringe
30ml syringe

Drugs:
Morphine Sulphate 10mg/1ml
Morphine Sulphate 30mg/1ml
Haloperidol 5mg/ml
Cyclizine 50mg/ml
Metoclopramide 10mg/2ml
Midazolam 15mg/3ml

1. **Patient charted:**
   10mg morphine
   2mg haloperidol

COVER ANSWERS:

$\frac{10}{10} \times \frac{1}{1} = 10 \div 10 = 1\text{ml}$

$\frac{2}{5} \times \frac{1}{-} = 2 \div 5 = 0.4\text{ml}$

1ml + 0.4ml = 1.4ml

Add 16.6ml H_20 to make up to 18ml in 20ml syringe

2. **Patient charted:**
   30mg morphine
   30mg metoclopramide

$\frac{30}{30} \times \frac{1}{1} = 30 \div 30 = 1\text{ml}$

$\frac{30}{10} \times \frac{2}{1} = 60 \div 10 = 6\text{ml}$

1ml + 6ml = 7ml

Add 11ml H_20 to make up to 18ml in 20ml syringe

3. **Patient charted:**
   100mg morphine
   20mg midazolam

$\frac{100}{30} \times \frac{1}{1} = 100 \div 30 = 3.3\text{ml}$

$\frac{20}{15} \times \frac{3}{1} = 60 \div 15 = 4\text{ml}$

3.3ml + 4ml = 7.3ml

Add 10.7ml H_20 to make up to 18 ml in 20 ml syringe

4. Patient charted:
15mg morphine
150mg cyclizine

$\frac{15}{30} \times \frac{1}{1} = 15 \div 30 = 0.5ml$

$\frac{150}{50} \times \frac{1}{1} = 150 \div 50 = 3ml$

0.5ml + 3ml = 3.5ml

Add 14.5ml H_20 to make up to 18ml in 20ml syringe

5. Patient charted:
45mg morphine
1mg haloperidol

$\frac{45}{30} \times \frac{1}{1} = 45 \div 30 = 1.5ml$

$\frac{1}{5} \times \frac{1}{1} = 1 \div 5 = 0.2ml$

1.5ml + 0.2ml = 1.7ml

Add 16.3ml H_20 to make up to18ml in 20ml syringe

6. Patient charted:
60mg morphine
150mg cyclizine
3mg haloperidol

$\frac{60}{30} \times \frac{1}{1} = 60 \div 30 = 2ml$

$\frac{150}{50} \times \frac{1}{1} = 150 \div 50 = 3ml$

$\frac{3}{5} \times \frac{1}{1} = 3 \div 5 = 0.6ml$

2ml + 3ml + 0.6 = 5.6ml

Add 12.4ml H_20 to make up to 18ml in 20ml syringe

PART VII

References and further reading

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Ministry of Health (2009). *Guidelines for syringe driver management in palliative care in New Zealand*. Retrieved from http://www.moh.govt.nz/moh.nsf/indexmh/guidelines-syringe-driver-management-palliative-care-nz

On-line training resource

Caesarea Medical Electronics has designed a free on-line education program for the Niki T34 syringe drivers. The education program is aimed at front line staff. For details on how to access his on-line education program please contact:
REM SYSTEMS Ltd
Freephone: 0508 654 258
And ask to speak to the Product Specialist in your region.

Websites

www.palliativedrugs.com

www.hospice.org.nz

www.health.qld.gov.au/cpcre

www.teomanga.org.nz – a research study done by Val Norton
Te Omanga Hospice – Syringe Driver use in Palliative Care
Patients and family caregivers understanding and experiences

PART VIII

Framework for reflection

The next section is designed to give you the opportunity to reflect on your learning so far and may be useful to include with your certificate in your portfolio.

Reflection is a good tool to use as it provides us with an opportunity to review and think about an experience within a certain context and link it to past experiences. We then have the opportunity to incorporate our learning into our current practice.

What have I learnt from this training that will help maintain and develop my professional knowledge and competence?

What else do I need to know to extend my professional development in this area?

Is there anything that I did not understand and wish to explore further, or read more about in order to clarify my learning/understanding?