THE NATIONAL GUIDELINES ON SAFE USE OF INFUSION PUMPS IN HEALTHCARE FACILITIES

2019

ACKNOWLEDGEMENTS

The 'National Guidelines on Safe Use of Infusion Pumps in Healthcare Facilities' was developed following extensive discussion and collaboration with stakeholders, and has been endorsed by the National Medication Safety Committee (see Table 1 for composition). We would like to thank all contributors with special mention to A/Prof Sophia Ang (Vice Chair Medical Board, Patient Safety and Operations, National University Health System) and A/Prof Tai Hwei Yee (Chief Quality Officer, National Healthcare Group) and nursing safety leads (listed in Table 2) for providing inputs to this document.

Table 1. Composition of the National Medication Safety Committee, July 2017 – June 2020

Name	Institution	Designation
Members		
Adj Assoc Prof Augustine Tee (Chairperson)	CGH	Chief, Medicine, Chief & Senior Consultant, Department of Respiratory & Critical Care Medicine
Mr Wu Tuck Seng	NUH	Deputy Director, Pharmacy Department
Dr Chua Mei Chien	KKH	Head and Senior Consultant, Department of Neonatology
Dr Loh Seow Siang	KTPH	Senior Consultant, Department of Acute and Emergency Medicine / Patient Safety Officer
Dr Kurumbian Chandran	NTFGH	Director of Endocrinology; Co-chair of the Medication safety committee
A/Prof Ng Heng Joo	SGH	Senior Consultant, Department of Haematology; Director of Patient Safety
Ms Angelina Tan Hui Min	SKGH	Head, Pharmacy
Dr Tan Sze-Chin	TTSH	Consultant, Department of Rheumatology, Allergy and Immunology; Chair of the Medication Safety Team
Ms Soh Lay Beng	IMH	Head, Pharmacy Department
Dr Ang Mei Kim	NCC	Senior Consultant, Division of Medical Oncology

Name	Institution	Designation
Prof Ding Zee Pin/	NHC	Senior Consultant, Department of Cardiology; Chairperson, Pharmacy & Therapeutics Committee
Mr Li Kaihui Benny	NSC	Manager (Pharmacy Quality & Safety)
Dr Marcus Ang	SNEC	Consultant, Corneal and External Eye Disease Department
Ms Chua Hui Min	NCIS	Senior Clinical Pharmacist
Asst. Prof Yeo Wee Tiong	NUHCS	Consultant, Department of Cardiology
Dr Peter Moey	SHP	Director, Pasir Ris Polyclinic; Chair Pharmaceutical & Therapeutics Committee, SHP
Dr Valerie Teo	NHGP	Associate Consultant Family Physician; Deputy Head, Ang Mo Kio Polyclinic; Chairperson, Medication Management and Usage Committee, NHGP
Dr Steven Chong Shih Tsze	NUP	Head, Clementi Polyclinic; Chair, Medication Management and Utilisation Committee, NUP
Ms Quek Hui Chen	JCH	Head of Pharmacy
Dr Colin Ngeow	YCH	Consultant, Medical Services
Dr Lou Huei-Xin	IHiS	Director, Clinical Safety, Governance and Measurements, Information System Division
A/Prof Lita Chew	MOH	Chief Pharmacist
Secretariat		
Dr Adelina Young	MOH	Deputy Director (Patient Safety & Quality Improvement Branch), Clinical Quality Performance & Technology Division
Dr Felicia Hong	MOH	Assistant Director (Patient Safety & Quality Improvement Branch, Clinical Quality Performance & Technology Division
Ms Liu Pei	MOH	Manager (Patient Safety & Quality Improvement Branch), Clinical Quality Performance & Technology Division
Ms Michelle Low	MOH	Manager (Patient Safety & Quality Improvement Branch), Clinical Quality Performance & Technology Division

Table 2. List of nursing safety leads from MOH and public hospitals

Name	Institution	Designation
Ms Tan Soh Chin	MOH	Chief Nursing Officer
Ms Joann Pang	MOH	Deputy Chief Nursing Officer
Ms Neo Soon Keow	CGH	Assistant Director Nursing
Ms Pang Nguk Lan	KKH	Director, Quality Service & Risk Management
Ms Ding Na	KKH	Assistant Director Nursing
Ms Rena Hooi	KKH	Senior Nurse Clinician
Ms Audrey Saw Guat Lin	KTPH	Deputy Director Nursing
Ms Eileen Cheah	KTPH	Senior Nurse Manager
Ms Lye Siew Lin	NTFGH	Assistant Director Nursing
Ms Teo Hui Sin	NTFGH	Nurse Clinician
Ms Katherine Leong	NUH	Acting Assistant Director of Nursing
Ms Nyeo Hui Qing	NUH	Senior Nurse Clinician
Ms Karen Perera	SGH	Deputy Director Nursing
Ms Norhayati Ahmad	SGH	Deputy Director Nursing
Ms Ng Woei Kian	TTSH	Senior Nurse Manager
Ms Tan Si Ling	TTSH	Senior Nurse Educator

INTRODUCTION

Smart pumps are infusion pumps that have dose error reduction systems that include defined drug libraries, dosing limits and other clinical advisories integrated into the systems. Even with smart pumps, medication errors could happen with incorrect setting or programming.

Internationally, the failed processes typically involved wrong item selection, wrong unit selection, wrong infusion rate setting, as well as mix-up of two pumps containing different medications.

This document ‘The National Guidelines on Safe Use of Infusion Pumps in Healthcare Facilities’ provides recommendations to guide the safe usage of infusion pumps and smart pumps, including purchasing considerations, risk assessments, workflow and drug protocols, as well as other preventive measures with the aim to mitigate risks and reduce the number of adverse incidents arising from their use.

All healthcare institutions should use the guidelines to review the existing or future policies, systems and processes for the safe use of all infusion pumps including smart pumps.

CONTENT

1. GENERAL RECOMMENDATIONS

1.1 Intent

This chapter provides recommendations on the general considerations for policies to be developed for safe use of infusion pumps and smart pumps.

1.2 Recommendations

1.2.1 Prior to instituting the use of any new type of smart pumps, institutions are encouraged to perform risk assessment such as Failure Mode Effects Analysis (FMEA) particularly for high-risk areas. This may be useful in identifying potential safety lapses or errors in programming the pump, accessing and using the drug library, or conditions that could lead practitioners to bypass safety features.

1.2.2 Institutions are encouraged to:

a) limit the number of models of pumps available to strengthen proficiency in the use of the pumps and prevent errors arising from use of varying models of pumps. Where possible, each institution should work towards having no more than two different models of normal infusion pumps or smart pumps;

b) consider specifically designated pumps for particular uses/delivery settings (e.g. for anaesthetists)

1.2.3 When setting up systems and policies for medication delivery by smart pumps, institutions should:

a) Have in place a specific policy for the use of smart pumps. The policy should describe when it is mandatory to use smart pumps.

b) Conduct periodic assessment, where possible, on the compliance with the use of drug library in smart pumps, and establish the underlying reason(s) when drug library is overridden to understand staff practices. Reason(s) for overriding drug library or specific medication settings should be reviewed

and followed-up with the appropriate preventive measures (e.g. to modify drug list, to re-educate staff);

c) Put in place a system(s) to ensure that infusion pump setting corresponds with the medication order i.e. both the medication order and pump setting reflect the same information

2. STANDARDISED DRUG PROTOCOLS WITHIN DRUG LIBRARY

2.1 Intent

This chapter provides recommendations related to drug library setting and standardised drug protocols within drug library.

2.2 Recommendations

2.2.1 Institutions are encouraged to have in place processes to create and review drug library of smart pumps, including when and how the drug library should be overridden.

2.2.2 Institutions are to standardise drug protocols in drug library of smart pumps, where possible or relevant to practice, to prevent errors from selection of incorrect drug dilution. This may include standardisation of the following:

a) Drug concentrations;
b) Maximum flow/dose rate;
c) Rates and/or duration of administration; and
d) Labelling and display of drug names on pump display screens (e.g. use of TALLMAN lettering).

2.2.3 Institutions are strongly advised to limit the concentrations of each drug in the smart pump drug library to prevent selection of the wrong concentration. Additional concentration of specific drugs should only be given if the drug is prescribed to different age groups of patients (e.g. paediatrics) or prescribed for conditions deemed to require varied drug concentrations (e.g. patient with fluid restriction). In such cases, guidance on dilution of drugs should be made easily accessible to staff and staff are aware of the guidance and how the guidance can be obtained when needed.

2.2.4 Institutions are advised to programme drug libraries in a manner that facilitates the search for the intended medication setting.

3. DOUBLE-CHECKING OF PUMP SETTING

3.1 Intent

This chapter provides recommendations related to independent double-checking of programming of pumps to prevent medication errors arising from incorrect programming of infusion pumps.

3.2 Recommendations

3.2.1 Institutions should identify and stipulate the essential drugs that require double-checking based on their institution-specific high-alert medication (HAM) list and medication formulary. The institution's list should be reviewed periodically to take into account new or emerging risks.

3.2.2 Institutions should specify the processes that require independent double-checking. The specifications should include the following considerations:

a) Different requirement in different clinical settings (e.g. Operating Theatre (OT), Intensive Care Units, General Wards and Accidents & Emergency Department);
b) Roles and responsibilities of the different healthcare professionals (i.e. nurses and doctors);
c) Specific processes for independent double-checking of drug dilution and pump programming;
d) Process for validation that a pump has restarted after an interruption (e.g. medication top up, alarm and patient transfer); and
e) Process for rechecking of pump settings during shift changes and handovers.

3.2.3 In the event that double-checking is not possible (e.g. frequent dosage change required to titrate according to patient's medical condition and in the OT setting), institutions should have mitigating measures in place to prevent medication error from incorrect programming of infusion pumps.

4. USER TRAINING AND COMPETENCY

4.1 Intent

This chapter provides recommendations on infusion pump user training and competency to ensure all users are competent to operate infusion pumps.

4.2 Recommendations

4.2.1 Institutions are recommended to have a competency framework in place to ensure that all infusion pump users are competent to operate infusion pumps. Healthcare staff should not be allowed to operate infusion pumps unless assessed to be competent. The competency framework should comprise training and assessment.

4.2.2 All infusion pump users should receive training to operate infusion pumps. Institutions should ensure the following for training:

a) The appropriate frequency of training to be conducted should be determined;
b) Simulation exercises should be incorporated into infusion pump training, including both routine and error prone practices (e.g. administration of secondary IV infusions, bolus dosing); and
c) The training should include de-identified case studies derived from actual events involving pumps, along with errors reported in literature.

4.2.3 All infusion pump users should undergo a competency assessment to be deemed competent to operate infusion pumps. The competency assessment may comprise assessment/ competency checklist. Institutions should ensure users are able to demonstrate competence in operating basic functions of the pump as well as response to alarms.

5. OTHER ERROR PREVENTION MEASURES

5.1 Intent

This chapter provides recommendations to ensure safety and reliability of infusion pumps used in institutions.

5.2 Recommendations

5.2.1 Institutions are recommended to carry out audits to ensure compliance to double-checking protocols and user competency.

5.2.2 Institutions are encouraged to conduct Root Cause Analyses for pump related errors, as well as multi-disciplinary quality improvement projects on safe use of infusion pumps.

5.2.3 All infusion pumps should be maintained and repaired in accordance with the manufacturer's instructions. Routine maintenance is necessary to ensure that the infusion pumps remain safe and reliable. Biomedical engineering inspection should be conducted as appropriate.

5.2.4 Institutions should have workflows to address the cleaning, storage and distribution of the infusion pumps.

5.2.5 Institutions are encouraged to evaluate safety, quality and compatibility of administration sets and tubings, alongside the evaluation of infusion pumps and to have systems in place to ensure use of compatible syringes, administration sets and tubings, including working with purchasing departments to ensure a reliable and constant supply.

5.2.6 Institutions may consider supporting smart pumps with wireless technology if resources allow, to provide for efficient periodic updates of drug libraries throughout the organisation. Wireless technology may also support timely review of smart pump data to identify at-risk behaviours exhibited by

practitioners that may compromise medication and patient safety, and identify necessary changes to drug libraries for the purpose of process improvement.

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